The Indian Journal of Surgery

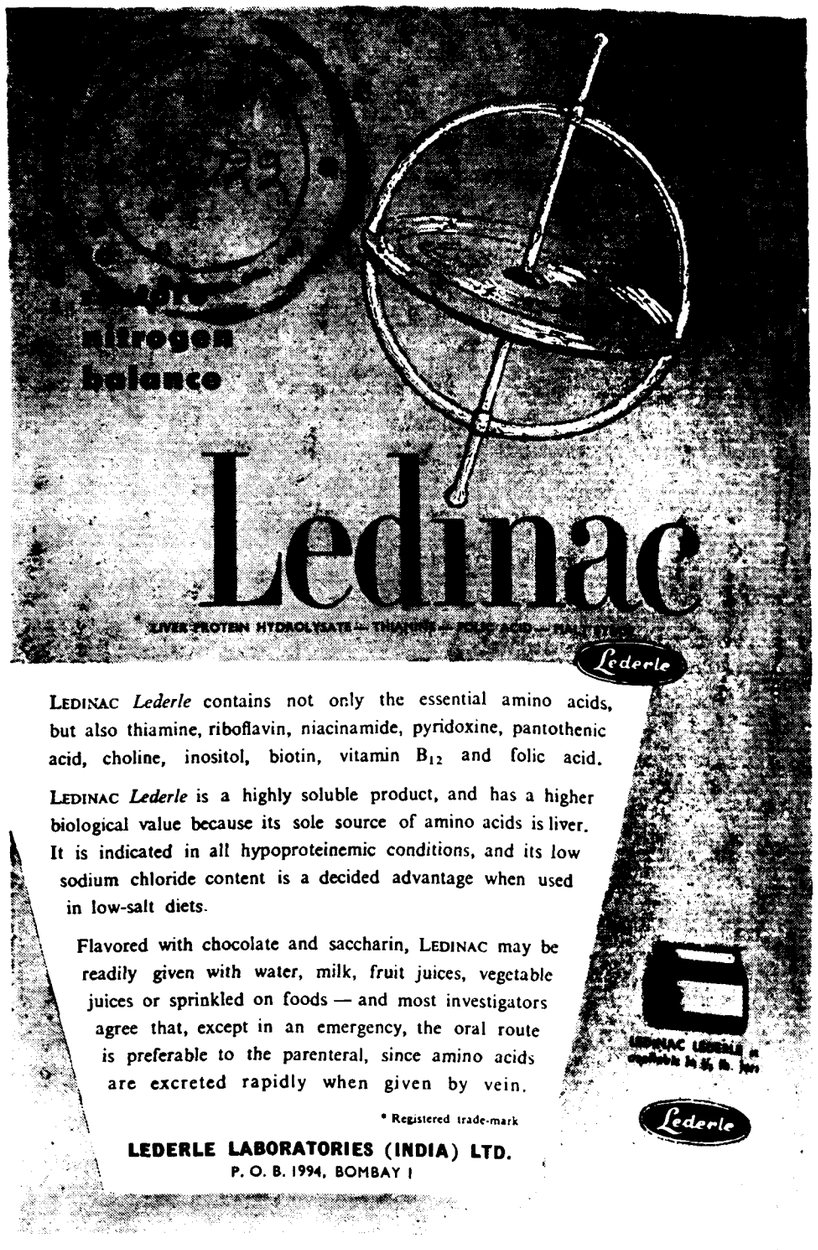
Vol. XVII] SEPTEMBER 1955 [No. 3

THE INDIAN JOURNAL OF SURGERY

SEPTEMBER, 1955

QUARTERLY

Annual Subscription Rs. 16 (Inland); Rs. 18 (Foreign)



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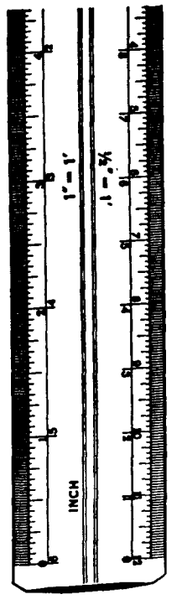

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1. Christopher, F.: Minor Surgery. 5th Edition, Philadelphia and London: W. B. Saunders Company, 1945, p. 348.
2. Beard, J. W., Taylor, A. R., Sharp, D. G. and Beard Dorothy.: The Nature of a Virus Associated with Carcinoma in Rabbits. Surg., Gynec., & Obst. 74: 509-513, 1942.

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THE

INDIAN JOURNAL OF SURGERY

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THE EARLY YEARS OF A THORACIC SURGICAL SERVICE*

by REEVE H. BETTS, Vellore.

During the past six years the Thoracic Surgical Service of the Christian Medical College and Hospital has been developed and more or less stabilized. It would seem worthwhile to review some of the problems, both past and present, in an attempt to help others who may be similarly engaged in the establishment of a surgical specialty service. What are the factors responsible for the development and growth of a service and why do some succeed and others do not? Usually the growth of a service is a reflection of the surrounding environment. Where the new service is valued and encouraged, growth is rapid and vigorous, and although a discouraging atmosphere may not prevent growth it is a markedly limiting factor. A spirit of friendly cooperation is of great significance and anything we may have achieved on our service has been largely due to that factor of mutual help and interest. A request had been made by the institution for the services of someone interested in thoracic surgery before our arrival and everyone was willing to contribute in any way possible. In fact, our initial service of 24 beds was developed by simply taking off 2 or 3 beds from every other service in the hospital. Everyone here knows the cry that usually is easily heard when anyone believes his service is to be reduced by even 2 or 3 beds!

Too often emphasis is placed on the physical surroundings and too little on the personnel and the psychological climate. I have not seen in this country, in any large hospital I have visited, operating rooms any smaller or less adequate from the physical standpoint than those in which Dr. Robert Gross has done his epochal work. The operating facilities of Dr. Charles Bailey who has made such outstanding contributions to cardiac surgery are surpassed by most hospitals in the larger centres in this country. Many of us learned during the war that the same operations could be done in a tent as in a regular hospital building. This is not to signify that proper physical plants are unnecessary, but it is to be remembered that they are not the prerequisite of good surgical work.

Although blood banks are quite common now they were much less so a few years ago and they are a strict necessity for any surgical hospital and even more so for those with thoracic surgical services. Securing adequate, safe blood was our biggest problem in the establishment of the service and although is as yet not perfect, is is functioning satisfactorily and to a large extent because there is a doctor in charge who is interested in that type of work and in the development of this important hospital service. Here proper equipment is essential but proper personnel far outweighs it. Due to the large number of workers in the lower income level there should be no difficulty in securing adequate donors at comparatively modest cost. We have not been able to keep our bank "solvent" though by purely voluntary donors or relatives. We made a valiant struggle toward this end but were not able to convince many relatives that they must

* From the Department of Thoracic Surgery, Christian Medical College and Hospital, Vellore, South India.

Paper read at the XVI Annual Conference of the Association of Surgeons of India at Hyderabad (Dn.), Dec. 1954.

give blood themselves if they wanted the patients to have the benefit of a transfusion. But by paying donors five rupees a pint at first, and later ten rupees, we have been able to obtain the necessary blood in spite of the rapidly increasing demands from all services in the hospital so that now over 500 pints are used per month.

Some of our early fatalities were traceable directly to the lack of adequate transfusion service. In some instances we did not have sufficient blood at the start of the operation and at other times there were severe pyrogenic reactions. These later reactions were largely eliminated by proper attention to preparation of the solutions used and the method of cleaning and sterilization of the equipment. The inadequate amount of blood on hand preoperatively was largely my responsibility as I made the mistake of thinking one could use the same amount of blood for the cases here as is the custom in the West. Many of the patients coming to surgery here have far more advanced lesions and their blood volume reserves are markedly diminished so that as this error was perceived we have increased the amount of blood deemed necessary and now require practically twice that routinely used in many centers in other countries. The usual pulmonary resection now has 3,000 cc. of blood made available preoperatively and although frequently some of this is returned to the bank that is far better than falling short. Patients with low circulating blood volumes and low protein reserves do not withstand shock readily and it is far better to maintain an adequate circulating blood volume than trying to overcome the shock syndrome later. It is true that some of the fluids used during operation may be electrolytes or one of the group of so-called plasma expanders, but in the usual type of case we have found that there is little danger of using too much blood and reserve the substitutes for those instances where blood cannot be given for some particular reason.

Proper anaesthesia is the other prerequisite for satisfactory thoracic surgery. Here again the problem is one of personnel as the properly qualified anaesthetist will be able to give a good anaesthesia with only a moderate amount of not too costly equipment, but certain things are absolutely necessary such as a good anaesthesia machine with CO_2 absorber, endotracheal tubes of proper caliber and fitted with inflatable cuffs and a reliable source of moderately strong suction. The surgeon and anaesthetist must work together as a team and the former should rember that it takes two to cooperate and should be willing to allow the anaesthetist considerable leeway in the selection of anaesthetic agents and methods of administration as progress is being made rapidly in anaesthesiology so that what the surgeon is used to may not be the best available.

What are the objectives of a surgical service, specialized or otherwise ? Basically there should be two. Firstly to treat and relieve patients of their abnormal or disease processes. Secondly the instruction and training of students or postgraduates who are interested in obtaining further experience and training in that particular branch of surgery. The physician or surgeon who does no teaching nor has any desire to do so classes himself with the other professions of different ethical standards than ours.

To revert to the first objective, the care of the patient, the greatest difficulty on a specialized service in this country is the selection of cases for treatment as it is completely impossible at the present time to admit and care for all cases who need it. I am sure this is a universal experience in all clinics and therefore a selection of cases is necessary. Should one select only those with early lesions for whom the outlook is best, or should one take those with more advanced lesions, knowing that unless rather prompt attention is given they will not survive for long ? For the teaching hospital the answer seems quite clear — a balanced selection of both early and late

cases is essential if the trainee is to get a clear appreciation of what can be accomplished for both types of individuals. If a proper balance is maintained between favourable and unfavourable cases it will be possible to demonstrate the right care of the early or favourable case, but one can also show that much can be done for some of the seemingly hopeless cases when ingenuity and diligence are exercised in an all-out effort to get the patient well. It is true that the selection of such cases for admission and treatment will be reflected in an increased mortality rate for that particular procedure, but that is of no consequence. In fact the surgeon who reports a large series of most types of thoracic cases without an appreciable mortality is denying many patients the one chance they have of being cured. Another factor that we believe to be of importance is to emphasize that once a case is admitted for treatment every effort should be made to provide that patient the very best possible treatment. If one is really persistent it is amazing how many ways there are of providing the necessities in a given case whether that be food, drugs, transfusions or consultative advice. As Johnson[1] has recently pointed out, it should be a standing rule that each case be treated and given the same consideration that one would exercise were that patient a member of one's immediate family.

A review of our experience on the basis of the pulmonary resection cases (Table I) indicates a gradual increase in cases during the first few years and then a levelling off

TABLE I

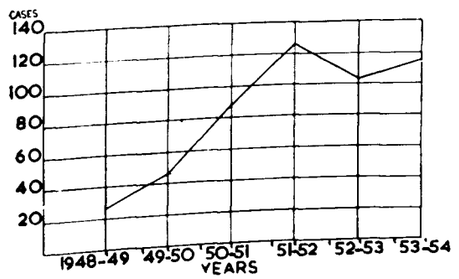
PULMONARY RESECTION: 1948—'54

	Cases	Mortality
Tuberculosis	165	11
Bronchiectasis	163	11
Lung Abscess	105	7
Hydatid	22	0
Carcinoma	11	4
Miscellaneous	33	4
Total	499	37 = 7.4%

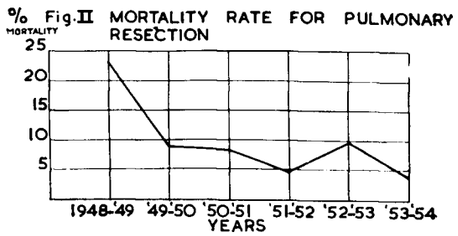
due to a limit on the number of beds that were allotted to the service (Fig. 1). One of the most distressing parts of a specialty surgical practice in this country at present is the necessity of constantly turning away for lack of beds, patients that you know could definitely be helped or cured if facilities were provided. The answer lies not so much in increasing the bed strength of the established services, but in training personnel who in turn can go out and start services of their own in other institutions and thus increase not only the number of beds available but also the number of centres so that the long distances that patients have to travel can be reduced.

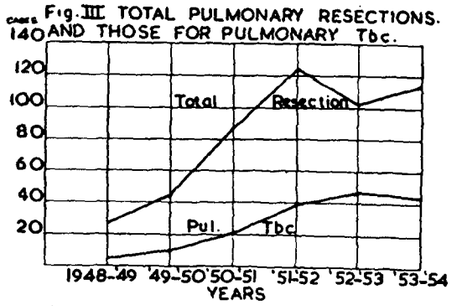
It will be noted that our mortality rate for pulmonary resection has been reduced over the years to a rather constant figure which we attributed to the selection of a proportion of advanced cases which might be deemed hopeless (Fig. 2). It is true

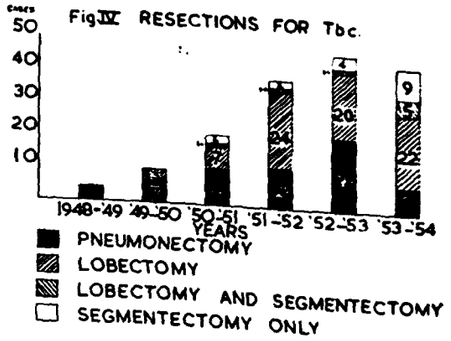
Fig.I NO.OF PULMONARY RESECTIONS



% Fig.II MORTALITY RATE FOR PULMONARY RESECTION

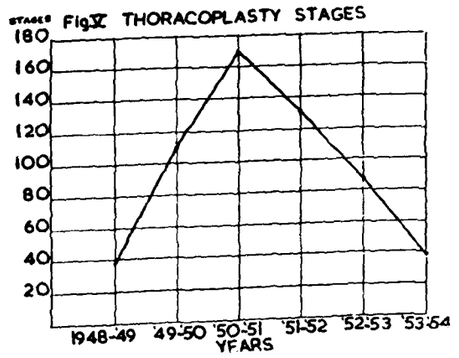


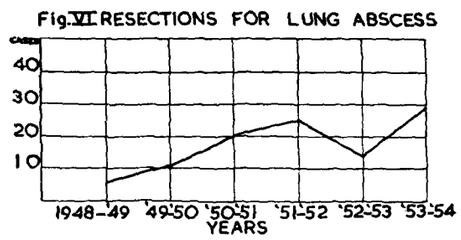




that perhaps one out of four or five of such cases will be lost but it must be remembered that without surgical help the mortality rate for the same cases would be practically 100%. The major attention should be directed toward detection and prevention of those deaths that could have been prevented by such things as better preoperative preparation, larger amounts of blood for transfusions, better selection of anaesthetic agents or more assiduous postoperative care and attention. Each failure should be dispassionately appraised and a serious attempt made to see if in some manner the outcome might have been avoided. This will only be possible or successful if postmortem examinations are done almost as a routine. There is no doubt that more is learned from a failure than from a success. Cases that are lost simply because the disease process was too far advanced are disheartening but the worst that can be said is that one has been guilty of misjudgement and that in favour of giving the patient the benefit of the doubt and attempting to provide relief. It should be noted that the mortality rate for pulmonary resection was lowest in 1953-54 the year I was away on furlough which is a tribute to Drs. T. Thomas and N. Gopinath who were in charge during that time. It may also reflect a more astute selection of cases.

In reviewing the results of the first 499 pulmonary resections on 500 patients done on our service it has been of interest to trace a few of the trends that have become apparent. One is the increasing number of patients with pulmonary tuberculosis which are referred for excisional surgery (Fig. 3). This is a reflection of the experience in other countries and largely due to the beneficial effects of chemotherapy. It will also be noted the number of limited resections (less than pneumonectomy) in the past year or two compared with the preceding years (Fig. 4). Here again the trend is easily discerned. As the operative procedures became standardized and the mortality lowered due both to improvement in technique and better preoperative preparation with the newer therapeutic agents, patients and doctors alike have accepted earlier surgical therapy and thus patients are coming at a stage when the disease is less advanced and therefore more are amenable to segmental or lobar resection compared to the far advanced cases of therapeutic failure that were the usual ones referred for surgical treatment a few years ago. A study of the number of thoracoplasties done on our service during the same period of time shows just the reverse of that for resections. Multi-stage thoracoplasties for tuberculosis were the most frequent operation for this disease when our service was started. Now it is infrequent and we have difficulty in getting enough cases of thoracoplasty for instructional purposes (Fig. 5). Also the adoption of the extraperiosteal plombage type of thoracoplasty has eliminated the multi-stage procedure and resulted in a still



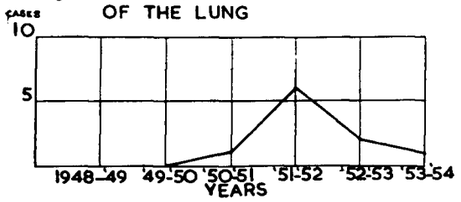


greater reduction in the number of thoracoplasty stages carried out.

The treatment of lung abscess has constituted a major portion of our surgical work in marked contrast to the present experience in countries of the West (Fig. 6). There the availability of early and adequate medical treatment has resulted in practically all of these cases being treated early in the course of the disease by vigorous chemotherapeutic and other measures so that surgical treatment is rarely needed. In this country by the time most patients seek medical aid, and especially by the time they reach the thoracic surgeon they have long since passed the stage when there is any hope of cure by non-surgical means. Many appear beyond surgical relief for that matter but here again with relatively large doses of the antibiotics, combined with postural drainage, bronchoscopic aspiration, and in some of our later cases with the use of the enzymes streptokinase and streptodornase by aerosol inhalation, most of these patients can be improved to the point of becoming acceptable surgical risks. Resection of the involved portion of the lung is far preferable to the older type of external drainage with its accompanying morbidity and complications such as persistent bronchial fistula, occasional empyema and the rather frequent persisting localized bronchiectasis. The only case we have treated by external drainage in the past four years was an elderly diabetic man with large bilateral cavities. These were both drained and then subsequently the right upper lobe and the basal segments of the left lower lobe were removed without difficulty. These patients often task the resources of the anaesthetist as it is sometimes impossible to get the sputum volume reduced to a reasonable level preoperatively in spite of all the efforts of the physiotherapist and others. We treated one of our recent cases for over four weeks in the hospital before operation and by all the methods we could but were unable to reduce the sputum volume to less than 200 cc. per day. In such instances we believe the prone position during the operation is of immense value as this position, combined with rotation of the table to the involved side, tends to keep the secretions from flowing into the opposite lung until the chest can be opened and the bronchus secured which is the first step in resection in these cases with excessive pulmonary secretions. In children too young to co-operate well in raising secretions postoperatively and where laryngeal trauma may result from repeated tracheal aspirations, we believe it is advisable to do a tracheotomy at the time of resection to provide ease of aspiration. The tube can be removed in four or five days when no longer needed.

It is our hope that in the near future it may be possible to study adequately the incidence of carcinoma of the lung in this country. From our experience the lesion

Fig VII RESECTION FOR CARCINOMA OF THE LUNG



is far less frequently seen than is true of the Western countries. There may be many factors responsible for this but it is our personal belief that heavy cigarette smoking is one of the major factors and such smoking is not the practice of a large proportion of the population in this country as it is in some others. It can be seen from the accompanying table (Fig. 7) that carcinoma of the lung is a very small proportion of the cases on our thoracic surgical service. Quite often when we have thought the patient had a carcinoma it has subsequently proven to be either an abscess without a tumour back of it or an aneurysm. One must not be any less assiduous in looking for the lesion as it is notorious as a masquerader of some other process. As is true of other tumours they are apt to be found in a younger age group here than in some other countries.

Successful results are not guaranteed by a technically superior operation but very largely depend on the postoperative care that is available. Here personnel is again the key factor. Both the nursing and surgical personnel to whose care much of the post-operative treatment is entrusted must have special training and experience and therefore must have sufficient stability to remain on the service for prolonged periods. Internes and house surgeons that rotate through the service for three to six months are not to be relied on for this important phase of the patient's treatment. Someone with at least one year's experience should be immediately available at all times. Of just as great importance is the nursing personnel, the senior ones of which should be permanently attached to the wards caring for such patients. It has been stated that "nothing makes a mediocre surgeon appear superior like having excellent assistants", and it is just as true that nothing produces good results like adequate postoperative surgical care. A principle that we have adhered to from the first and which has been of inestimable help is not to accept for training on our service anyone that will not agree to stay a minimum period of two years and thus it is possible to always have experienced people to supervise the pre and postoperative care.

Some may object that two years is too long to spend in a specialty but those who hold that it is not long enough will be more nearly correct. Theoretically those taking this training, or other special training like it, should already hold the M.S. or equivalent postgraduate degree in general surgery signifying that they have had considerable experience in general surgery which all will agree is a necessary prerequisite to specialized surgical training. Due to the varying requirements for an M.S. at present and the comparatively small number of holders of such degrees we have not thought it best to insist on this qualification for those entering training on our service. We would like our men to have had at least a year's internship and three years of general surgery but for the most part we have had to accept those with only two years of surgical experience. It is also recognized that there are many other factors of great importance besides the amount of formal training the man has had. We have endeavoured to select those candidates who are definitely interested in thoracic surgery and intend to limit their practice to that specialty on completion of their training. We deprecate the selection of a specialty on the basis of what positions happen to be open. The road ahead in any such special field is rough enough that the person should be completely convinced in his own mind that it is this field and nothing else to which he wants to devote his life. Also, we have tended to select those that are on the younger side even at

the sacrifice of some degree of experience as it is most difficult for the man who has been out in practice and become established or has had the advantages of having had assistants or students under him, to whom he can delegate the more mundane aspects of the patient's care, to reverse the process and again become the most junior member of the department, which is necessary under our setup as we have no internes on the service but all procedures are done by the trainees themselves. We are firm believers in learning by doing.

The main criticism that we hear from those who wish to secure specialized surgical training is that they are not able to get the required training in general surgery in order to enter the specialty of their choosing. They may be able to get one year of training on a general surgical service but from then on it is apt to be only in an honorary capacity and often without very much in the way of real patient responsibility and from the training standpoint is not of great help. If the standards of general surgery as well as specialty surgery are to be raised then some means must be found of providing opportunities for young doctors to obtain at least a three year progressive training in general surgery to fit them for that type of practice or as a basis for other specialties. This can only be done by changing the existing setup in most of our teaching institutions. The objective at present is apparently to give a limited amount of surgical training to as many as possible. This is a good ideal in itself but for the future of the medical profession and the provision of adequately trained special staff for future teaching positions or to staff certain centres that are being built or already in existence another type of training must be provided in addition.

One method of approaching this problem would be to select from those who are taking their first year of surgical training after their interneship approximately one out of three or four who would be kept on for an additional year in an increased responsibility capacity. Again the following year one or at the most two from each service would be selected who would have a third year of training and experience during which time they would have, if not responsibility for all the ward service cases, at least a certain number of beds for which they would be alone responsible under the guidance and consultative help of their chief. They should also help carry the load of the ward teaching as this would give them additional useful experience but often also improve the teaching of the students as I'm sure all will admit that quite often a younger person is a better teacher than the professor. The adoption of some such system as this is a powerful stimulus to the whole teaching programme and there is great benefit all the way from the student level to the head of the department and in the end results in far better care of the patient. Such a plan would no doubt eliminate a few from securing any training in surgery and it would also limit more than now the amount of responsibility and operating undertaken by certain of the honorary junior staff men but this is a necessary sacrifice if the goal of providing adequately trained young surgeons is to be achieved.

There are many who will say that this sort of plan cannot be adopted and accepted as the teaching institutions in which this must at least start and who must be the leaders in this movement will not change the older plan and the way they have been carrying on. That statement I am not willing to accept. We have here in this organization practically all the leading surgical teachers and professors of India and there is no doubt in my mind that if they really want to bring about such changes in their institutions they can do so. All that is needed is a real conviction among the members of this Association that such changes are in the best interests of medical education. Any other obstacle or objection can be overcome but until this membership sees it as their responsibility to initiate

such reforms and on an all-India basis there is little hope of success. True, it will mean sacrificing some of the prerogatives of the senior staff but any teacher should feel the same about his trainees as he does about his own children. He should want them to have privileges he did not have and should be willing to give up anything that will benefit them more. If we all go about it in this spirit of helpfulness instead of trying to use our trainees to better our own positions we will be able to turn out progressively better generations of surgeons. Any surgeon should be proud of having helped train a young surgeon who is a better surgeon than himself.

A worthy start was made by this Association two years ago in setting up certain standards of training. What now remains is to implement those recommendations by making it possible for qualified, interested, ambitious young men to secure the training they want and need right here in our own institutions. It is better done on a limited scale and can be done in all the larger institutions, but it will never be done unless each of us as members of this Association sees that it is done.

SUMMARY

1. The experience of the first six years of the thoracic surgical department of our institution has been reviewed. During this period 499 pulmonary resections were carried out on 500 patients with a mortality rate of 7.4%.

2. Pulmonary tuberculosis and bronchiectasis or cystic disease constitute the two main indications for pulmonary resection. Lung abscesses comprised 105 of the 500 cases.

3. Carcinoma of the lung continues to be rarely encountered and few of those seen are resectible.

4. It is believed that progress in setting up and staffing thoracic surgical centres in this country is largely dependent on proper facilities for surgical training. These can be provided by concerted efforts of the members of this Association.

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BEHAVIOUR OF THE URINARY BLADDER IN SPINAL PARAPLEGIA*

by PRITAM DAS, Lucknow.

INTRODUCTION

Golz and Ewald showed for the first time in 1896 experimentally that micturition in dogs returned even after the whole spinal cord had been removed. Since then it has become well established that the bladder recovers in human beings also even after complete trans-section of the cord. The clinicians before the first world war thought that the bladder might not recover after destruction of the lumbar enlargement or conus and cauda equina, but the experience gained during the war dispelled such apprehensions. Immediately after a lesion of the cord there is complete retention of urine followed by overflow incontinence if the bladder is not emptied at regular intervals. Then after a variable period the bladder recovers its activity. No matter what the level of lesion the sequence of these changes is essentially the same. If the lesion is incomplete or there is only a transient interruption, a state of voluntary micturition differing little from the normal may result, but if the lesion is complete the behaviour of the recovered bladder is far from normal. It differs from the normal in two fundamental respects, namely, the patient loses voluntary control of micturition, and the detrusor contractions are no longer inhibited by the cortical centres. The bladder activity is then regulated by the spinal centres if they are spared, and when even those centres or the nerves ensuing from them are damaged the bladder resumes its activity independent of the central nervous system.

It is again a more or less established fact that the sacral parasympathetics (S 2, 3, 4.) are the nerves which are mainly responsible for the motor activities of the bladder, both of its detrusor and of its sphincter. The detrusor muscle contracts in response to stimulation of these nerves and at the same time the internal sphincter relaxes reciprocally. Conversely the inhibition of these nerves causes relaxation of the bladder wall, and closure of the internal sphincter at the bladder neck. It may be mentioned here that the muscle at the bladder neck is also supplied by the parasympathetic nerves. The reciprocal action of the sphincter has been the subject of some discussion. Barrington (1913) thought it to be due to a reflex action, while Langworthy and his associates (1940) maintain that the contractions of the longitudinal fibres of the detrusor mechanically open out the bladder neck. Whatever the explanation the fact remains that the stimulation of the parasympathetic nerves causes contraction of the detrusor and relaxation of the bladder neck musculature.

The exact part played by the sympathetic nerves in the physiology of micturition is not yet clear. The sympathetic fibres reach the bladder from about the 9th dorsal to the second lumbar segments. It has long been believed that the stimulation of sympathetic nerves causes contraction of the internal sphincter and relaxation of the detrusor. However, recent writers on the subject have contradicted this belief and deny any significant part played by the sympathetic nerves in either filling or emptying the bladder.

Methods used and Clinical material :

Various methods have been employed to study the function of the bladder both in the lower animals and in human beings. In the animals these studies consist mostly of direct observations on the bladder after destroying or stimulating the various parts of the nerve components involved in the act of micturition. Such observations have the advantage of exactness but the animal physiology may not be entirely applicable to human beings. Again the animals cannot be observed for months or years, and,

* Paper read at the 16th Annual Conference of the Association of Surgeons of India held at Hyderabad (Dn.), Dec. 1954.

therefore, the long term effects cannot be studied. However, much valuable information has been obtained from such experiments. In the human subjects the difficulty is of being certain whether the lesion is complete or incomplete. In the partial lesions, the urinary bladder will not behave in a clear cut anticipated pattern, while in an apparently complete lesion a few fibres may escape damage and thus produce a variable picture.

In the human patients, besides clinical study, other methods employed have been the cystoscopic examination of the bladder, the cystography, the cystometry, the electrocystography (Slaters, 1953) and the electromyography (Boyce & Coworkers, 1953). Of the electrical methods of study I have no personal experience and it is also too early to comment on the extent of usefulness of these methods. However, they promise great hope to unravel the segmental or other contractions which are too weak to cause intravesical pressure changes.

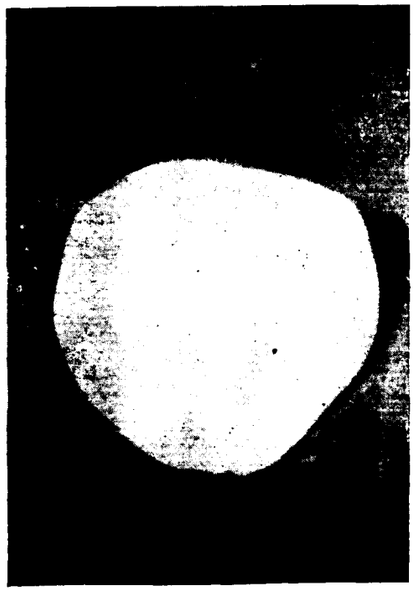

Fig. 1.
A normal Cystogram. The bladder has been filled with 300 c.c. of contrast medium.

The methods employed in the present study have been those of cystography and cystomyography. The cystography is done by filling the bladder with a contrast medium and taking a skiagram (Fig. 1). It gives a visible contour of the bladder wall. A crenated outline indicates contractions of the detrusor while a smooth one is taken to mean its inactivity. The region of the bladder neck and posterior urethra may also be visualised, and when it is so it means that the internal sphincter is open. We can also get an idea about the size of the bladder, whether it is small and contracted or large and dilated. I have used this method as a routine. The contrast medium used was 12½% sodium iodide, and two skiagrams were taken, one with 300 c.c. of this fluid in the bladder and the other with 150 c.c. only. This was done to note any difference made by the quantity of the fluid on the activity of the bladder or its sphincter. In some cases a few more skiagrams were taken after injecting 0.5 c.c. adrenaline 1 in 1,000 (M. & B.) subcutaneously, or carbachol (B.D.H.) 0.25 mg. intramuscularly or atropine (B.W.) 1 100 gr. intravenously. This was to note any difference that the sympathetic or parasympathetic stimulation or depression might make on the detrusor or the sphincter.

Cystomyography was another method employed as a routine in all cases. To perform cystomyography a rubber catheter (size 8'F) was passed into the bladder per urethra, the outer end of this catheter was attached to the cystometer. The cystometer used consisted of a glass tube of 123 cms. in length and of uniform bore of about 4 mm. internal diameter, vertically mounted on a stand graduated upwards and taking the level of the pubic crest as zero. By means of a T-tube the manometer could be connected to the catheter in the urethra. Most of the investigators have used cystometry for measuring the intravesical pressure after introducing measured amounts of fluid into the bladder, thus finding out the relationship between the amount of fluid present in the bladder and the tension produced therein by its presence. I have followed a different procedure. After having emptied the bladder completely at the beginning of the experiment it was allowed to fill in the normal physiological way by the urine coming down from the kidneys. As the bladder filled in gradually the pressure inside was reflected by the level of the fluid in the manometer. If there was a contraction of the detrusor at any time it led to an increase of pressure in the bladder, which in turn caused a rise of fluid in the manometer, and as the wave of contraction passed off the level of fluid in the manometer also fell. Thus the contractions of the bladder, their frequency and the force of individual contractions or the effects of their summation could be noted. The observations were made visually almost constantly and the results plotted on a graph, with time in minutes as the abscisea, and the pressure in centimeters as the ordinate. Thus the graph gives a picture of the contractions of the detrusor (Fig. 2). Thus having arrived at a method of visualising the contractions occurring in the bladder further observations were made to find the effect of sympathetic or parasympathetic stimulation or depression by drugs.

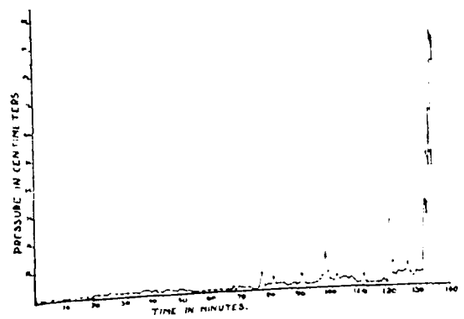

Fig. 2.
Normal Cystomyograph.

In some patients, at a variable stage of the procedure the urine leaked out by the side of the catheter, while in others it did not. It was taken to mean that when the internal sphincter opened out to a size wider than the catheter, the urine leaked out, while non-leakage meant that the sphincter had not relaxed widely enough. This method of cystomyography takes a long time and therefore to shorten the procedure the patient was given 1,000 c.c. of water by mouth at the beginning of the experiment to produce diuresis.

In this way 37 cases were studied, five of whom were normal and the rest had lesions as detailed in Table I.

TABLE I

SHOWING TOTAL NUMBER OF PATIENTS STUDIED AND THE LESIONS IN THEM.

1. Cauda Equina & conus lesions	
Fracture L 1 & 2 vertebrae ..	13
Fracture L 3 vertebrae ..	1
Injury Lumbar spine without fracture ..	2
Spina bifida occulta ..	1
Cauda equina tumour ..	1
Unidentified conus lesion ..	2
2. Lesions above the conus	
Fr. of vertebrae at various (from D 12 upwards) levels	7
Unidentified lesions ..	4
Caries spine ..	1
Total ..	32

The cases included under cauda equina lesions were those who had sensory loss and muscular paralysis in the distribution of sacral and the last one or two lumbar segments; the rest of the cases were put down as lesions above the conus.

These cases were studied at different phases of bladder activity. Fourteen of them were examined when they were in

the stage of complete retention of urine. Of these six were such who recovered during their stay in the hospital, while the other eight have not recovered yet or left the hospital before recovery took place. The other eighteen patients came under observations when they had already recovered and a few months to two years had passed since their initial lesion or injury.

The cases studied were under the treatment of different surgeons and physicians of the Gandhi Memorial and Associated Hospitals, Lucknow, during the year 1954.

THE STAGE OF COMPLETE RETENTION OF URINE

Immediately after injury there is complete retention of urine. This would occur irrespective of the level of lesion. The retention is discovered sometime next day when suprapubic distension becomes visible or it causes pain, and the patient is unable to pass urine. The pain is felt only in lesions of cauda equina or in incomplete lesions higher up. The interval between the initial lesion and the evacuation of bladder varies according to medical relief available. In this series most of the patients were catheterised within 24 hours, the maximum period being 12 days in one case. If left to themselves overflow incontinence starts in a day or two, and it is surprising that incontinence did not take place in the patient mentioned above for 12 days. This patient had a fracture of the twelfth dorsal vertebra and when he came to us four months after injury, he had an actively contracting bladder. Incidently this case points out that the bladder can remain distended for a number of days without undue harm to itself and without any prejudice towards the ultimate setting of an automatic function.

In this series 14 cases were studied during the stage of retention, 10 of them were due to conus or cauda equina lesions, one was a case of fracture of the dorsal 12 vertebra, one of caries spine, one of fracture of the dorsal 4 and another of a fracture of dorsal 10 vertebra.

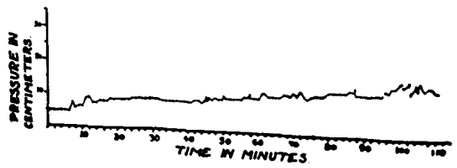

Fig. 3.
Cystomyograph in the inactive stage. The patient had a fracture of L 2 vertebra.

Fig. 4.
Cystogram of an inactive bladder. This patient has fracture of the First Lumbar Vertebra.

A cystomyograph of such a patient reveals no contraction of the detrusor (Fig. 3). There is a very gradual and slow rise of pressure which is due to mechanical filling of the bladder. On cystography a rather large bladder with a smooth outline is seen. The bladder neck is not open indicating a closure of the internal sphincter (Fig. 4). The best explanation for this state of affairs appears to be a total inhibition of stimuli along the sacral parasympathetic nerves. Such an inhibition would lead to an intense relaxation of the detrusor and reciprocal closure of the internal sphincter. That this is so, gets support from observations made after injection of carbachol. This caused a strong contraction of the detrusor and opening out of the internal sphincter. Fig. 5 represents a myograph after such stimulation and may usefully be compared with Fig. 3 which indicates inactivity of the bladder before the injection. It will be seen that the bladder is suddenly whipped into activity. At the same time a glance at Fig. 6 will show that the bladder neck is open and a continuous column of contrast medium is filling that region. It may be noted in passing that the action of carbachol starts within a minute and reaches its maximum in about 6 minutes time. The bladder appears to go into a spastic tonicity rather than exhibiting contractions followed by relaxation. During this period, there is also severe pain in the suprapubic region, which is apparently due to muscular contractions. This state of activity and pain gets completely annulled by atropine. The drop in manometric reading is sudden and dramatic and there is complete relief of pain. These experiments were tried in three males and one female having cauda equina lesion with the same results every time. Thus even in the stage of inhibition the bladder responds to the parasympathomimetic drugs and as such administration of carbachol may help establishment of bladder activity earlier than otherwise.

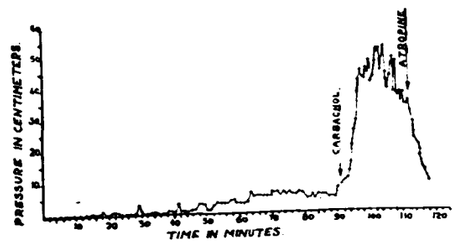

Fig. 5.
Cystomyograph of an inactive bladder after 0.25 mgm. injection of Carbachol. This is of the same patient as shown in Fig. 3.

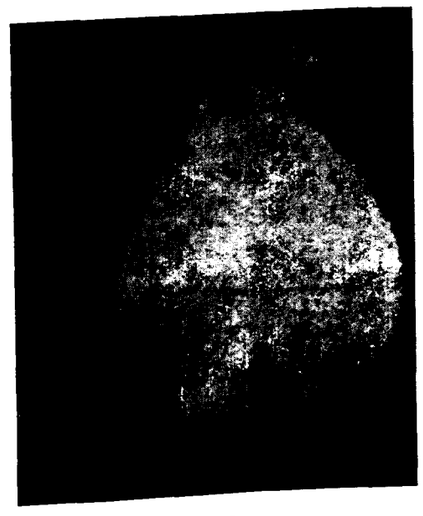

Fig. 6.
Cystogram of an inactive bladder after carbachol. The internal sphincter is now open.

THE STAGE OF RECOVERY

After a variable period the bladder starts recovery from its initial inactivity. In the beginning a few weak contractions of the detrusor are noted, gradually the contractions become stronger and enough to expel a few drops and subsequently a few ounces of urine at a time. The period after which recovery starts varies according to the level of lesion, the presence of infection and efficiency of treatment provided. In some cases it is a matter of a few days only while in others it may take a few months or may never recover at all. It has been said and rightly so that after lesions of cauda equina the bladder takes a longer time to recover than after lesions of the supralumbar region. In this series, however, some of these bladders were as quick to recover as others. The number of patients studied in the stage of recovery was 24, the minimum period taken for recovery was five days and the maximum five months. This excludes those cases who have not yet recovered.

It has already been stated that the recovered bladders behave differently according to the level at which the cord is involved. Usually two different types are described, the autonomous bladder developing after lesions of sacral segments or

their ensuing nerves and the reflex bladder resulting from lesions higher up. I may here add that the cystomyographic studies in this series have revealed a very distinct third type of bladder which results from a lesion immediately above the lumbar segments. I have preferred to call it "The midway bladder" because of its behaviour somewhere between the other two types. Table II shows the different types of bladders encountered in this study. It will be seen from the table that two cases of conus lesion developed reflex bladder. Apparently the bladder centres had escaped damage.

TABLE II

SHOWING DIFFERENT TYPES OF BLADDERS FOUND.

Level of lesion	Total No. cases	Total No. Recovered	No. of Autonomour Bladder	No. of Reflex Bladder	No. of Midway Bladder	Not yet recovered
Cauda equina and conus lesions	20	16	13	2	1	4
Higher lesions	12	8	Nil	3	5	4
Total	32	24	13	5	6	8

1. *The Autonomous bladder*: With this type of bladder the patient can feel the sensation of fullness. He asks for a bottle or walks down to the bathroom. If the matter is delayed the urine dribbles out into his clothes. The act having once started needs the effort of the patient to empty the bladder out. The patient takes a deep breath and strains with his abdominal muscles to expel the urine. The urine is passed in a stream of moderate force and as the patient stops to rebreathe the urinary stream also stops for a while. This straining is a necessary and important accompaniment of the act of micturition, although some patients strain less and some more. In this way the patient can pass upto 10 ounces of urine at a time, leaving a variable amount of residual urine of 150 c.c. or so. They perform micturition about four or five times during the day and about three times during the night and they keep reasonably dry. However, occasionally a few drops of urine dribble out on coughing or laughing or some times even on taking a turn in bed.

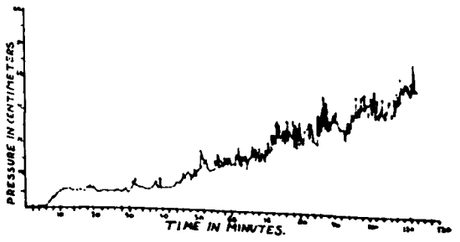

Fig. 7.

Cystomyograph of an autonomous bladder. The patient had fracture of first lumbar vertebra and a cauda equina lesion.

The cystomyographic studies of such bladders revealed a number of interesting points (Fig. 7). It will be seen that after about an hour when about a hundred and fifty c.c. of urine have accumulated in the bladder, contractions of the detrusor start and once started they continue, till the end of the experiment. They occur about twice or thrice a minute. The individual contraction is followed by relaxation and so on. Their magnitude on an average is 15 cms., at times reaching a maximum of 40 cms. Towards the end of the experiment when the bladder becomes more full, it will be noticed that the magnitude of individual contractions becomes less indicating that overdistention causes inefficiency. This is probably so because there is an optimum stretch stimulus to which the muscle fibres can respond best and beyond which the contractions are feebler. This also shows that the muscle fibres are contracting in response to the stimulus of stretch. As the bladder fills suprapubic discomfort makes it appearance and this usually coincides with the appearance of contractions of the detrusor. It is thus apparent from the graph that the detrusor is constantly active

after a certain amount of urine has collected in the bladder and its expelling force is about 30 cms. of water. When such a patient is asked to strain he can raise the pressure to 70 cms. or so, indicating that the abdominal muscles can help to raise the intravesical pressure to more than twice and in this way reinforce the expelling power. These figures may well be compared with the force of over 120 cms. of the normal bladder without the aid of abdominal muscles.

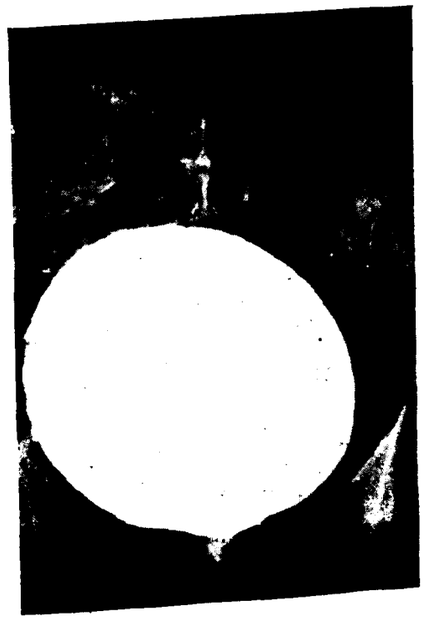

Fig. 8.

Cystogram of an autonomous bladder. The patient had fracture of first lumbar vertebra and a cauda equina lesion.

While the detrusor is actively though feebly contracting, the internal sphincter would be reciprocally relaxing causing the bladder neck to open. This can usually be observed on cystography (Fig. 8). Here the bladder is seen to be quite distended, there are some crenations on its outline indicating active contractions of the detrusor. The sphincter is seen to be open because the region of the neck and the posterior urethra is visualised. The visualisation of this region remains the same even when the amount of intravesical fluid is reduced to half. In the initial inactive stage of the bladder, the neck is not visualised while it is so now in a recovered bladder. We have but to draw the conclusion that the relaxation of the internal sphincter here is reciprocal to the continuous, almost rhythmic activity of the detrusor. It has been said that on cystoscopic examination of such a bladder the neck is funnel shaped due to paralysis of the sphincter. It is apparent from what has been said above that the funnel neck is not due to paralysis, but due to active reciprocal relaxation. The detrusor contractions being weak, it will be appreciated that the reciprocal opening of the internal sphincter will also be of a lower magnitude. In the cystomyographic studies no urinary leakage occurred by the side of the catheter in these cases. From this also it can be presumed that the bladder neck did not relax widely.

This answers the question as to why a patient with autonomous bladder has to strain such a lot to empty it out. This point has been widely discussed and it has been said that there is some soft tissue resistance in the region of the triangular ligament. It has also been suggested that it is due to a long and tortuous urethra in the male and so this difficulty did not arise in the female. But I found that the female patients had to strain as much as the male patients. As to the existence of an extraneous mechanical resistence, no such need be presumed. The resistence lies in the internal sphincter itself because it does not open widely enough. Any treatment which aims at resecting a segment of the bladder neck will thus make micturition easier for the patient and will allow a more complete evacuation of the bladder.

It may also be discussed profitably here as to how the activity of such a bladder is regulated. In these lesions the bladder is

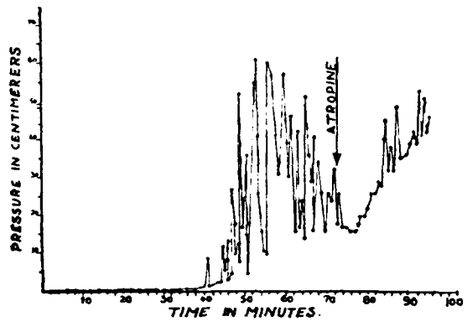

Fig. 9.

Cystomyograph of an autonomous bladder showing the effect of atropine on the detrusor contractions.

completely cut off from the spinal cord, and therefore no reflex activity through the spinal segments can take place. Evidently the activity should reside either in the inherent property of the muscle fibres or in such nerve elements as are still present. These nerve elements are the ganglia situated on the bladder and their post ganglionic fibres. It has been opined that axon reflexes take place via. these ganglia and their terminal fibres. Nothing has so far been offered to contradict this view. I have already shown that in the inactive stage of bladder, administration of carbachol causes intense activity of the detrusor which can be completely annulled by atropine. Now, I wish to draw attention to the fact that in an autonomous bladder the contraction of the detrusor can be annulled by atropine for a while. Fig. 9 demonstrates one such experiment. Atropine was given intravenously when the bladder reached its maximum activity. Within a minute there is a drop in the manometric reading and remains so for 6 minutes, thereafter the effect passes off gradually. From this one thing can be concluded positively, that the nerve elements do take part in the detrusor activity of the autonomous bladder. When the nerve endings on which the atropine acts are mediating in the activity it can safely be presumed that the ganglia are also contributing their share to it.

There were 13 cases in which an autonomous bladder had developed. They had the characters described above. Of these, two cases had only a sensory lesion in the distribution of the sacral segments, and there was weakness but no complete paralysis of the muscles supplied by these segments. One of them was a spinabifida occulta who had an autonomous bladder for the last ten years, the other was a case of injury of spine without fracture. These bladders showed features similar to those of an autonomous bladder except that the residual urine was much larger, about 200 c.c. This reminds us of the atonic bladders seen in tabes, but these cases differed so much from them.

2. *Reflx Bladder*: In higher lesions of the cord the bladder centres in the sacral segments and the nerves to and from them are intact and reflex activity can take place. As these centres have been cut off from inhibitory effect of the cortical centres the patient not only loses control over his micturition but also the subconscious inhibition of the detrusor muscle. Clinically the patient is not able to feel the distention of the bladder unless the lesion be incomplete, and thus he gets no warning of the impending micturition. When the bladder gets full to a certain extent, the reflex takes place and the bladder empties out. The urinary stream is of a strong force, and the residual urine if at all is small. One thing worthy of note in these patients is the frequency of micturition. It is not that the bladder is filled to its capacity before it gets emptied, but very often the reflex occurs with only a small quantity of urine in it. It is here that the lack of cortical inhibition is felt most. If cortical inhibition was present such premature reflex will not occur, and thus the bladder would fill to its capacity. Further the small filling of the bladder ultimately leads to a small capacity which aggravates the frequency of micturition.

In this series 6 cases were with a high lesion but none presented a typical reflex bladder. One had a fracture at D 4 vertebrae, but unfortunately he died a few days

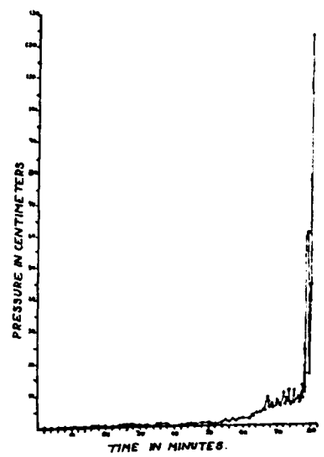

Fig. 10.

Cystomyograph of a reflex bladder. This patient had a fracture of first lumbar vertebra.

after admission in the stage of spinal shock. Another case had fracture at the cervico-dorsal region but he had a fracture of the lumbar region as well, so that an autonomous bladder developed. The other three patients had some ill defined medical disease causing a partial lesion of the cord at the level of D 5 to D 8 segments. However there were two cases of fracture of first lumbar vertebra, who had developed a typical reflex bladder.

Cystomyographic studies of such a case (Fig. 10), are more or less like those of a normal bladder. In the beginning while the bladder is filling there are no contractions, later a strong contraction takes place, the urine rises in the manometer to its full height and overflows it. About that time the urine leaks out per urethra by the side of the catheter in a good stream. This indicates that the internal sphincter is widely open.

3. *The Mid-way Bladder*: I have so named it because of its behaviour being different from an autonomous bladder as well as from a reflex bladder, yet it has some of the characteristics of both. It was found in lesions about the regions of dorsal 10 to lumbar 1 segments of the spinal cord, but this series is too small to localise the exact number of segments whose involvement will give rise to this type of bladder. Boyce and coworkers in 1953 described a similar bladder on electromyographic studies and called it hyper-active ineffectual bladder. There is also another slightly different type which has long been described as uninhibited neurogenic bladder resulting from lesions of the cerebral cortex and occasionally from partial lesions of the cord. At least some of these cases will be found to be of the mid-way type.

There were 6 such cases in this series, two had fracture of D 12, one had fracture of D 11 & 12, and one had fracture of the first lumbar vertebra, the remaining two had an unidentified partial lesion of the cord at D 10 & 12 segments respectively.

Clinically such bladders behaved some what like the autonomous ones except for greater urgency of micturition. The patient felt distension of the bladder or some sensation in the urethra when the bladder was full. The urine flowed out in good stream without much straining by the patients. They had then to strain or apply pressure on the suprapubic region to evacuate the bladder more completely. One of them said that he could increase the amount of urine passed at one time to almost double by straining and by pressing the abdomen. The urinary stream is more forceful than that of the autonomous bladder though it is also interrupted in the middle of the act twice or thrice. This type of bladder can be easily recognised and actually could have been differentiated only by myographic studies (Fig. 11). On an average after half an hour when only a small amount of urine has accumulated in the bladder, the detrusor is thrown into activity. There are continuous waves of contraction and relaxation till the end. The individual contractions are of the magnitude of 80 cms. or occasionally even more, that is, much stronger than those in the autonomous bladder, yet not strong enough to expel the urine out. At the height of

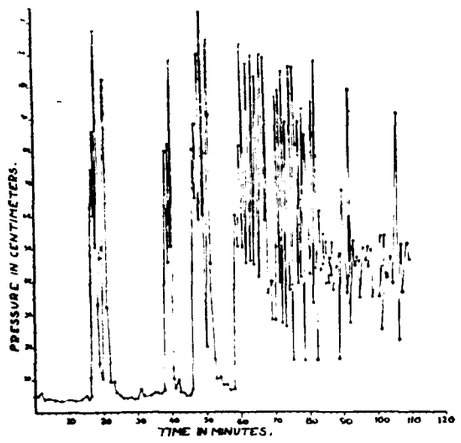

Fig. 11.

Cystomyograph of a midway bladder. This patient had fracture of dorsal 12 vertebra.

Fig. 12.

Cystogram of a midway bladder. This patient had a lesion at the 11th dorsal segment.

contractions a few drops of urine leak out by the side of the catheter indicating that the sphincter is open wider than that in the autonomous bladder but less than that seen in reflex bladders. The waves of contractions although stronger are slower than those in the autonomous bladder. They occurred in the beginning at a frequency of about one after five minutes or so, later as the bladder fills up, the frequency was about one or two per minute. A glance at Fig. 7, 10, 11 will show the striking difference between the three main types of bladders.

Cystographic examination reveals a bladder outline which is markedly crenated indicating an actively contracting bladder (Fig. 12). The bladder could be filled easily with 150 c.c. of the fluid, if more was added it got expelled out. The bladder neck is well open, being appreciably wider than seen in the autonomous bladder.

THE ROLE OF SYMPATHETIC NERVES.

The role of sympathetic nerves in the physiology of the bladder may now be discussed. There has been no unanimity on this subject and conflicting opinions have been expressed during the last 60 years. There has been the view that stimulation of presacral nerves causes relaxation of the detrusor and contraction of the internal sphincter (Langely 1890, Learmonth 1931). On the other hand Denny-Brown and G. Robertson (1933) found apparently normal bladder function in individuals following presacral neurectomy and in cases of cauda equina lesions they could find no evidence that the intact sympathetic nerves played any part of clinical importance in bladder activity. Quite a contrary view was expressed by many others, that sympathetic stimulation causes vesical contraction followed by relaxation (Stewart 1899, Wang and Harrison 1939, Kuntz and Saccomanno 1944). The last study on the subject has been reported by Ingersall and his collaborators (1954). They made direct observa-

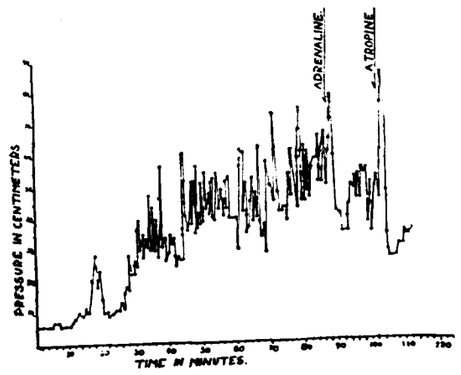

Fig. 13.

Cystomyograph after adrenaline injection. She had fracture of first lumbar vertebra and cauda equina lesion.

tions of the different parts of the bladder after stimulation of hypogastric nerves in cats, and came to the conclusion that there is a prompt contraction of all portions of the detrusor muscle which was followed immediately by relaxation in the same regions.

The evidence in the present study is in favour of the view that stimulation of sympathetic nerves causes relaxation of the detrusor. Cystomyography after such stimulation was carried out in four cases, two of autonomous bladder and two of midway bladder. In one case of autonomous bladder the effect was a momentary inhibition of contractions; in the other a female patient aged 16 years the contractions stopped for 6 minutes and it took another couple of minutes before they reappeared (Fig. 13). This was a striking effect and it coincided with a marked increase in the pulse rate (135 min.). There was no initial rise of pressure in the cystometer. In the other two patients with midway bladders no change was observed in the cystometric readings. However their cystograms showed a definite increase in the size of their bladders taken four minutes after adrenaline injection. Fig. 14 depicts the cystogram of one of these patients, the one taken after adrenaline injection is definitely larger than the one taken before it.

This leaves little doubt that sympathetic stimulation does cause relaxation of the bladder wall and in reciprocity we may expect the sphincter to contract. It may, however, be said that the effect of adrenaline is less than that of atropine, it is variable in different individuals, and it is perhaps not strong enough to make much difference clinically, particularly if the parasympathetic is intact. There is one more useful point that emerges if this role of sympathetic is accepted, i.e., the retention of urine in the initial stages after injury may be accentuated by sympathetic preponderence.

A NOTE ON TREATMENT.

Although this paper is primarily meant for discussing the function of the bladder, yet it will perhaps not be complete without a note on the treatment of such patients. The aims of the treatment are clear by now, and they are that the bladder should have a reasonable capacity to hold urine, it should leave the patient continent and should prevent serious infections. Most of the discussions centre round the treatment in the initial stage and the emphasis is laid on prevention of infection. Of course the initial treatment is important but the capacity of the recovered bladder cannot be lost sight of. Therefore, it will be briefly outlined here under two headings, the initial treatment and the subsequent treatment.

1. *The Initial Treatment*: No unanimity has yet been reached about the best treatment in the initial stage of retention. The various methods recommended have been, intermittent catheterization, indwelling catheter, indwelling catheter with tidal drainage, mechanical expression of urine by suprapubic pressure, suprapubic cystostomy, perineal or bulbar urethrostomy and lastly suprapubic catheterization.

The relative merits and demerits of each of these procedures will not be gone into,

Fig. 14.
Cystogram after adrenaline injection. The left hand side picture is before injection. Patient had fracture at D 12.

I will only emphasize my preference for the intermittent catheterization. This is said fully realizing the fact that in the first world war its results were so disastrous that the slogan 'the catheter kills' was raised by competent authorities. The catheter killed by carrying the infection with it, but it may be pointed out that in the second world war also when suprapubic cystostomy was the rule, all bladders were found infected (Guttmann 1943). The mortality was however less this time to which the sulphonamides and the speed of evacuation from the battle field materially contributed. It has been said that the infection of kidneys is more disastrous than that of the bladder and further that the kidneys get the infection from the urethra via. the perireteral lymphatics and this will not occur when suprapubic drainage is done. So much emphasis has been laid on this point that the chance of infection occurring via. the ureteric lumen is often ignored. Infection via. the lumen of the ureter does occur and I could not do better than to cite the example of a case of mine. This happened in a female patient who had fracture of the first lumbar vertebra and whose bladder had become grossly infected. A cystogram was done and it was found that the contrast medium had gone up the left ureter (Fig. 15). The same evening she had a rigor and a rise in temperature to 103° F. The catheter alone could not have been responsible for the reaction because it was already being passed three times a day. Moreover she was a female and the feature of urethritis was also absent. This

Fig. 15.
Cystogram showing reflux up the ureter.

is definitely a case where infection was carried via. the lumen of the ureter.

The intermittent catheterization is simple and is available easily, besides it has the added advantage that it keeps the bladder capacity to more or less normal which is just what an indwelling catheter or a suprapubic drainage can never achieve. It is also the nearest approach to the normal emptying of the bladder, and best for the recovery of a paralysed one. I would advocate its right use rather than of the more complicated and less efficiently performed methods. However there need be no hurry in emptying the bladder and it can be left safely upto 48 hours till clean surgical surroundings are available. The urethra should be irrigated before and after the catheterization and a bladder wash be carried out each time. The sulphonamides and antibiotics are given as a routine. It will also be worth while to administer small doses of Carbachol in the initial stages to hasten recovery.

The suprapubic catheterization advocated by Riches is really a commendable method, but I would reserve any suprapubic drainage for the grossly infected cases only. The tidal drainage of Munro has won wide appreciation, and rightly so but the difficulty is that the procedure has to be understood by everyone down to the juniormost nurse.

2. *The subsequent treatment*: The subsequent treatment has to be different in cases who have failed to recover from those who have recovered. In cases of failures the choice will be for a permanent suprapubic cystostomy. Those who have recovered and have an autonomous bladder the problem is to reduce the amount of exertion the patient has to put in. On theoretical grounds the most reasonable thing to do will be resection of a small segment of the bladder neck. A liberal excision is likely to cause constant dribbling. I may also emphasize here that recognition of midway bladder should be an essential feature before embarking on such an operation because resection in a bladder is likely to have the same effect as liberal excision in an autonomous bladder. The midway bladder cases should rather be given anticholinergic drugs to reduce the severity of contraction and make them behave more like an autonomous bladder.

In the reflex bladder the main difficulty of the patient is that he does not get a warning of the impending micturition and as time passes by, he develops frequency of micturition. The choice will be in wearing of a urinal and a permanent suprapubic cystostomy. The psychological satisfaction of a closed bladder is indeed great and will outweigh in favour of the former.

CONCLUSIONS AND SUMMARY

The behaviour of urinary bladder in spinal paraplegia has been studied in 32 patients. Conus or cauda equina lesion was present in 20 of them and a lesion at a higher level in 12. The methods employed to study these bladders were cystography and cystomyography. Cystomyography is a modification of cystometry which is already in routine use.

In the stage of complete retention of urine there is intense relaxation of the detrusor and closure of the bladder neck. It has been shown in this study that in the inactive stage the detrusor can be stimulated to activity and the bladder neck can be made to open by intramuscular injection of carbachol. This was demonstrated in four cases of cauda equina lesion.

In the phase of recovery 24 patients were studied, 13 were found to have an autonomous bladder and 5 a reflex bladder. A new type of bladder was found which has been termed the 'Midway Bladder'. There were three unusual cases of cauda equina lesion, of which two developed a reflex bladder and one a midway bladder.

The autonomous bladder showed constant and almost rhythmic contractions after about 150 c.c. of urine had accumulated in the bladder. These contractions could raise the intravesical tension by about 15 to 40 cms. of water. Straining raised this pressure to about 60 to 80 cms. Reciprocal to the activity of the detrusor, the internal sphincter gets relaxed. This has been put forward as an explanation for the visualization of the bladder neck and posterior urethra in a cystogram of these bladders. The relaxation of the sphincter is not complete and therefore the internal urethral meatus is not widely open. This has been put forward as the main reason to explain why a patient with an autonomous bladder has to strain such a lot to empty out his bladder. It has been shown that atropine abolishes the rhythmic contractions of the detrusor indicating that the remaining nerve elements regulate the activity of an autonomous bladder.

The midway bladder was found in lesions between Dorsal 10 and first lumbar segments and in partial lesions of the cord. It has characteristics common to both the autonomous and the reflex bladder. This bladder shows almost rhythmic contractions after about 50 c.c. of urine has accumulated in the bladder. The contractions are much stronger (80 cms.) than in the autonomous bladder and the bladder neck opens out more widely. There were 6 cases of this type.

The parasympathetic are the nerves which are responsible for the activity of the detrusor and of the internal sphincter. The role of the sympathetic nerves is not clear. It has been shown here that the sympathetic stimulation by adrenaline injection causes appreciable relaxation of the detrusor.

The treatment advocated in the initial stages is intermittent catheterization. Small doses of carbachol are also advocated on the basis of this study. In the subsequent treatment resection of a segment at the bladder neck is theoretically a sound operation for autonomous bladder. This should however not be performed in a midway bladder.

ACKNOWLEDGEMENT

I wish to thank the Physicians and Surgeons of the Gandhi Memorial Hospital, Lucknow, from whose wards the cases were taken for study. I also wish to thank my house surgeons who helped me such a lot. I am grateful to Dr. S. N. Mathur for suggesting the subject for study and his continual encouragement and helpful criticism. My thanks are also due to our Head of the Pathology Department and to Dr. R. M. L. Mehrotra for the excellent photography.

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Received for publication on 15-1-'55.

THORACOPLASTY

(A review of one hundred operations)

by R. NIGAM, Nagpur.

In this short paper I am presenting the experience we have gained at the Medical College Hospital, Nagpur in the treatment of pulmonary tuberculosis by thoracoplasty. The Medical College Hospital at Nagpur has a tuberculosis section in the department of medicine and for surgical treatment patients are referred to my unit. I am confining my observations to one hundred consecutive operations done on 40 patients in the last two years.

Of all collapse therapy procedures none has so completely established itself as a thoroughly satisfactory measure as has thoracoplasty. The results of this procedure are about five times as good as could be expected from conservative treatment alone. The selection of cases and the technic of the operation are standardised procedures today, and are being employed with increasing measures of success. Originally thoracoplasty was employed only in cases of unilateral disease, where all other measures had failed. It gradually became apparent, however, that it was unnecessary to defer thoracoplasty until an unsatisfactory pneumothorax had demonstrated its inefficiency, over a period of months or years. The results are better, and the mortality only half as severe, in cases where no pneumothorax had been present, as compared to those cases which had pneumothorax treatment. Thoracoplasty today is adopted as the primary method of collapse therapy, and at a much earlier stage of the disease.

The technic of the thoracoplasty operation has undergone many modifications, since it was introduced before the beginning of the century. The basic principles underlying the operation however remain unchanged, that is the provision of a permanent immobilisation to a part of the lung. The out standing advance in the operative procedure has been, the change over from the old type of complete thoracoplasty, as practised by the originators, to a selective thoracoplasty, collapsing only that part of the lung that needed rest.

Alexander's posterolateral thoracoplasty done in two or three stages is the operation of choice and has replaced most of the older operations. The dread of an obvious disfigurement, as a result of decostalisation of the chest wall, and the multiple stages requiring two or three operations, have been responsible for the introduction of several modifications in the technic. Some of these procedures have shown better cosmetic and functional results, but they require further follow up to establish their real value. In some of these procedures the development of untoward complications, or the inability to produce adequate collapse of the lung, have been responsible for their abandonment. Semb's apicolysis producing a concentric collapse of the lung has been widely employed. Recent observations however indicate, that apicolysis does not produce that degree of benefit, as it was originally described to achieve. Many surgeons have abandoned its routine employment (Fridmot Muller[3] and F. Hagn Meincke[2]).

Trans scapular thoracoplasty described by Coello[4] aims at collapsing the scapula with the chest wall in the first stage. This is achieved by removal of the lower half or two thirds of the scapula as the first step in the operation. Edwards[5] has described a periosteoplastic thoracoplasty where the intercostal bundles and periosteum of the excised ribs are sutured to the vertebrae to hold the lung down in a collapsed position and he maintains the position by refills as in an extrapleural pneumothorax. Wood Walker and Schmidt[6] have combined some of the advantages of an extra pleural

pneumothorax with thoracoplasty. They strip as many ribs as necessary in the first stage, thus mobilising the lung completely in one stage. The space between the lung and the denuded ribs, which are left in position, is filled with leucite spheres and the wound is closed. The spheres are left in position for 4 to 6 weeks after which they are removed, and at the same time, the divided ribs are taken out. In as much as the new ribs will have regenerated by the time the lung is kept in its collapsed position, there are no paradoxical movements of the chest wall. The costoversion thoracoplasty operation of Overholt is based on a similar principle. The mobilisation is done in one stage but the excised ribs are fixed back in an inverted position. In this way the inverted ribs are made to hold the lung in a collapsed position. A second operation is not required here, as when leucite balls are employed for the same purpose. The employment of leucite spheres in association with extra pleural pneumothorax is another collapse procedure, without damage to the thoracic cage. This operation produces good cosmetic results, but the frequent occurrence of secondary infection in the presence of a foreign body, and the inadequate quality of the collapse produced have been responsible for there being only a few followers of this technic.

The aim of all these procedures is to produce better cosmetic results with an intact thoracic cage, mobilisation of the lung in a one stage operation, and reduction of postoperative complications, especially paradoxical movements of the chest wall and atelectasis. Good results have been reported following these operations from some centres, but in general, the posterolateral thoracoplasty done in one or two stages is the standard procedure adopted today. With adequate physiotherapy in the form of regulated exercises in breathing and postural correction, begun before the operation and continued in the post operative period, good functional and cosmetic results are achieved.

The operation employed in the cases reviewed here has been the posterolateral thoracoplasty, done in two or three stages. Extrafascial apicolysis was employed in some cases. The anaesthesia used was local infiltration supplemented by intercostal block. A brachial plexus block was used in the first stage. For local infiltration along the line of incision and under the scapula ½% procaine with a few minims of adrenaline hydrochloride was employed. On an average 150 to 200 c.c. of procaine was used for this purpose. For intercostal block and for brachial plexus block a solution of 1% and 2% procaine respectively were employed. All patients were sedated with 3 grains of sodium amytal on the preceding night, and another 3 grains were given on the following morning, in two divided doses at an interval of one hour, about an hour prior to the commencement of the operation. The patients stood the operative procedure quite satisfactorily. In apprehensive patients and particularly in the second and third stages ½ gram sodium pentothal was administered by a slow drip as an additional sedative. A blood transfusion of 350 c.c. was given as a routine during the operation in the first or subsequent stages.

The patients selected for operation were unilateral cases or cases with minimal or controlled lesion on the opposite side. All cases for surgery had been hospitalised and were on general treatment for sometime. They were afebrile and the lesion was under control.

The operative approach was through a para scapular incision starting from the level of the vertebra prominens parallel to and to one side of the spinous processes of the vertebrae, skirting below the scapula, and extending anteriorly to the mid axillary line. The scapular muscles were divided along the line of the incision. The scapula was retracted forwards and the attachment of the serratus anterior was divided from the ribs. Diathermy was used as a routine for haemostasis, for the section

of muscles, and for cutting the periosteum. For the first stage the whole of the first rib, and wide segments of the 2nd and 3rd ribs were excised. The transverse processes of the thoracic vertebrae were excised along with the ribs with the exception, of the first dorsal vertebra. Apicolysis was done in some cases according to Semb's technic. An interval of about 3 weeks was given in between the stages, but this varied with the general condition of the patient.

The complications met with during the operation were an occasional damage to the pleura, and in a few cases, traction of the lower most trunk of the brachial plexus following an apicolysis. Damage to the larger vessels, or, an accidental opening up of a tuberculosis cavity was never observed. Infection of the wound, with a subcutaneous haematoma was observed in some cases. This cleared up after repeated aspirations and dressings. The post operative routine consisted of sedation with morphia and administration of penicillin and streptomycine for a period of 5 to 7 days. The use of streptomycine for a longer period was reserved for those cases who showed evidence of a flare up, or a contralateral spread of disease. This was however rarely seen. Early ambulation, movements of the scapula and the shoulder joints and breathing exercises, were started soon after the operation.

A review of the clinical observations is given below. Studies of respiratory function by broncho spirometry have been carried out in some of the cases and the results will be reported in another paper.

1. AGE & SEX

10–20 Years		21–25 Years		25–30 Years		30–35 Years		35–40 Years		Over 40	
M.	F.	M.	F.	M.	F.	M.	F	M.	F.	M.	F.
2	4	8	5	7	4	3	0	3	1	3	0

Male 27
Female 15

2. STAGE OF DISEASE AT OPERATION
(Radiological & clinical)

	No. of cases
1. Exudative with cavitation	5
2. Fibroplastic with cavitation	25
3. Tension cavity	2
4. Extensive fibroplastic without radiological evidence of cavitation	8
5. Thickened pluera with encysted fluid	2
6. Spontaneous pneumothorax with collapsed lung & with tension cavity	1

3. EXTENT OF LESION (Radiological)

1. Unilateral	37
2. Bilateral Minimal slight infiltration of other lung	5
3. Unilateral —Up to 3rd rib	2
—Up to 6th rib	33
—Whole lung	7

4. PREVIOUS TREATMENT

1. Previous A. P. Treatment	42 (all cases)
2. Previous P. P. Treatment	30
3. Previous antibiotics, streptomycine, P.A.S	do (all cases)
4. Phrenic avulsion	6 cases
5. Thoracoscopy with pneumonolysis (unsuccessful collapse)	6 cases

5. INDICATION FOR OPERATION

1. For cavity closure (A.P. & P.P. failed)	32
2. For sputum conversion	15
3. Thickened pleura with encysted fluid	2
4. Spontaneous pneumothorax with cavity and unexpanded lung	1
5. Tension cavity	2

6. TYPE & EXTENT OF OPERATION

Three rib thoracoplasty	11	
Six rib thoracoplasty	20	
Nine rib thoracoplasty	18	
With Monaldi suction drainage i.e. 3 stages	1	
Resection—Lobectomy	1	(Localised lesion right lobe)
—Pneumonectomy	1	(Extensive one side disease)
Semb's apicolysis with thoracoplasty	6	

7. COMPLICATIONS

(A) During operation		
Opening of plueral cavity	8	
Accidental opening of cavity	nil	
Paradoxical respiration	4	
(B) Post operative		
Pleural effusion	6	
Segmental atelectesis of lower basal segment opposite side	2	
Postoperative shock (severe)	3	
Respiratory distress	4	
Haematoma requiring aspiration	10	
Healing by second intention (Secondary suture)	20	
Frank Sepsis in wound	5	
Spont. pneumothorax	nil	
Deformity—obvious	2	
—Marked	3	
—No deformity	37	
—Restricted movements of scapula	3	
—Persistent pain operated side	2	

8. MORTALITY

Deaths in 102 operations	3
CAUSE OF DEATH	
Post operative shock	1
Paradoxical respiration (after the second stage)	1
Post operative flare up	1

9. RESULTS (A) Follow up

Follow up Period	No. of cases	Quiescent	Improved	Stationary	Worse	Dead
1 to 3 Months	12	—	7	2	Nil	3
3 to 6 Months	10	—	10	Nil	Nil	—
1 Year	14	8	4	2	Nil	Nil
1½ Years	4	4	Nil	Nil	Nil	Nil
2 Years	1	1	Nil	Nil	Nil	Nil

(B) Cavity closure 31 cases out of 34 cases

(C) Sputum conversion—15 cases had positive sputum of which 12 became negative after operation. One case became positive again due to tubercular tracheo bronchitis.

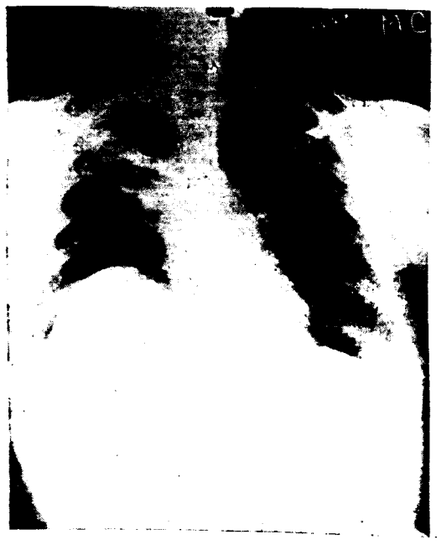

Fig. 1.

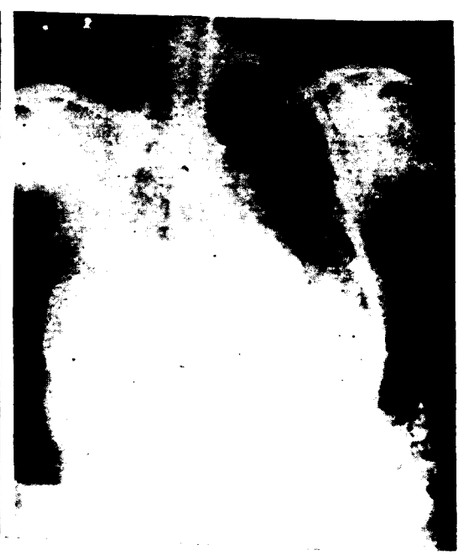

Fig. 2.

Figs. 1 & 2. Cavitary lesion right upper lobe.

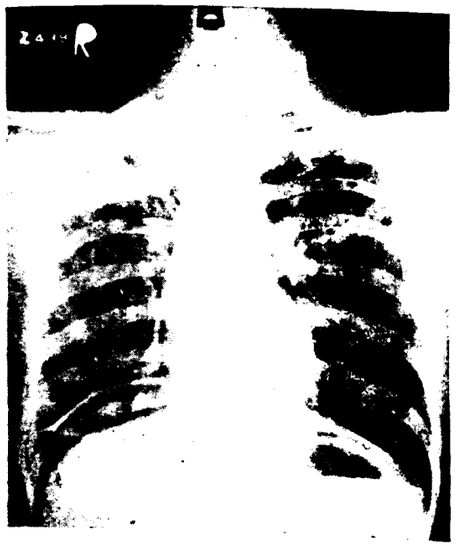

Fig. 3.

Fig. 4.

Figs. 3 & 4. Multiple cavities right upper lobe.

Fig. 5.

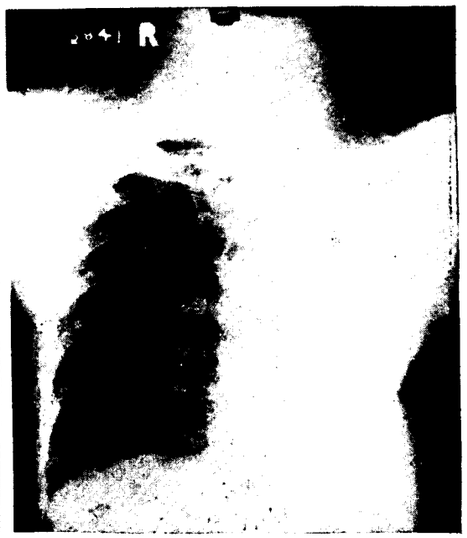

Fig. 6.

Figs. 5 & 6. Large tension cavity left upper lobe.

Fig. 7.

Fig. 8.

Figs. 7 & 8. Tension cavity left upper lobe.

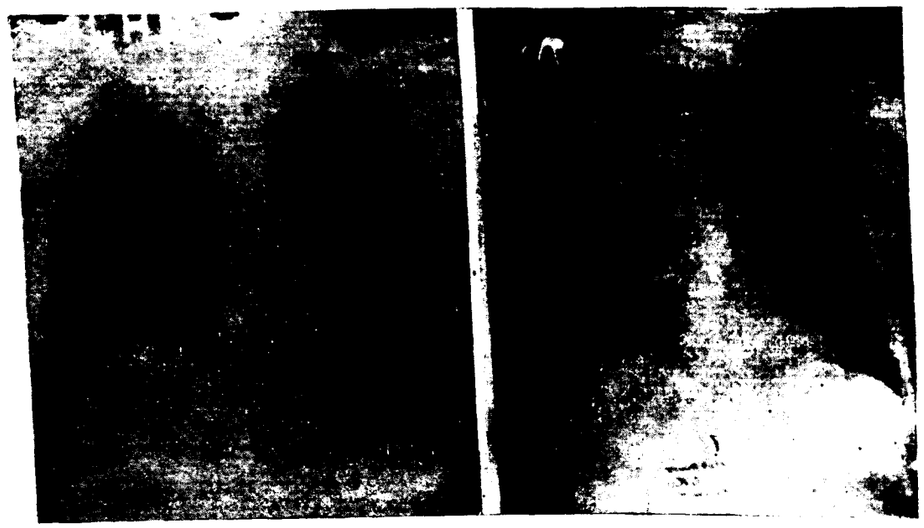

Fig. 9. Fig. 10.

Figs. 9 & 10. Fibroplastic lesion right upper lobe.

Fig. 11. Fig. 12.

Figs. 11 & 12. Pleural effusion (right) following failed A.P. treatment.

Fig. 13. Fig. 14.

Figs. 13 & 14. Extensive right sided fibrocaseous disease.

The results achieved in some of the cases are illustrated by their skiagrams before and after operation.

(A) *Cavitary lesion* :—Figs. 1 to 4.

(B) *Tension cavity* :—Figs. 5 to 8.

(C) *Fibro plastic lesion* :—Figs. 9 & 10.

(D) *Pleural effusion following failed A.P.* :—Figs. 11 & 12.

(E) *Extensive fibrocaseous disease* :—Figs. 13 & 14.

Conclusion

One hundred operations of thoracoplasty are reviewed in this paper. Modifications of the standard thoracoplasty operation have been introduced in recent years with the object of achieving better cosmetic results, and of completing the operation in one stage. These procedures have no particular advantages to commend them. All operations described in this paper were of the standard posterolateral thoracoplasty variety done under local anaesthesia.

I am grateful to the Dean, Medical College and Hospital, Nagpur for permission to publish these cases and to Dr. V. G. Gharpure, Tutor in Surgery, who has been working on this problem in my Unit. I am also grateful to Dr. B. K. Kapur, Medical Officer in charge of the Tuberculosis Section of the Medical College and Hospital, for help in collection of the clinical material, and in the follow up of the patients.

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Received for publication on 24-12-51.

SKIN GRAFTS IN THE TREATMENT OF EXTENSIVE DEFECTS

by B. PETROV, *Moscow.*

Skin grafts in cases of large defects is of great importance in modern surgery. This operation is very widely used in the Soviet Union. In cases of large defects of skin and in cases of extensive granulating surfaces it becomes sometimes the only means of saving the patient's life.

As is well known the father of free skin-grafting was the young French Surgeon, Reverdin, who first grafted some pieces of skin on an ulcerating surface in 1869. Russian Surgeons S. Shakliarevsky, A. Iatsenko, S. Ianovich-Tchaynsky and others contributed very much to this problem. One should have in view, that S. Ianovich-Tchaynsky first in the World published and introduced in practice just the same method, which was described in the same phrases 44 years later by Davis (1914) and which has been called in the literature since that time after the name of Davis (transplantation of small pieces from all the thickness of skin). It was just the same with the Russian Surgeon P. Piasetsky, who proposed in 1870 to graft small pieces of skin in the dimples, made in the granulation. However, this method was recognised in the literature only some tens of years later and got the name of Alglave (1901) and Brown (1920).

For covering large defects of skin, when there is, for instance, bare surface on thighs or shins, skull, belly or back of chest, the most rational method is that of grafting big strips of skin, pared with a razor, as was first done by Thiersch (1886). This method was well-known long ago, but the invention of the dermatome opened a new age in the evolution of free skin-grafting. This instrument made possible covering of spacious surfaces (1,000 to 1,500 Sq. cm.) what could be only a dream formerly.

The indication for free skin-grafting is a large defect which cannot epithelialise by itself. In times of peace, free skin-grafting is mainly needed for granulating surfaces left after burns or big traumatic flaying.

As is well known, in case of extensive burns, when 20, 30 or 40% of the skin surface is affected, the patients lapse into a very bad state. We have learnt very well to overcome first and second burn shocks by means of large transfusions of serum or blood plasma. In the last few years, in our Institute and after this in the Soviet Union for intravenous infusion the serum of big horned cattle is being widely used. Before the infusion the serum undergoes special cultivation, after which it looses anaphylactic properties and properties pertaining to the species. In the treatment of burns it is used in quantities of 2-3 litres at a time, the infusion being repeated on the next and the third day.

After the patient was saved from shock and had passed safely through the second toxic period, which lasts for 8-12 days, on comes the last, so-called Septic period, during which the extensive burned surface becomes free of scabs and is covered with granulation.

This period comes usually in 3-4 weeks. It goes on slowly, but it is very dangerous. The main danger is not only in the fact that the extensive granulating surface is an excellent place for the development and colonisation of pathogenetic micro-organisms, which quickly manifest their activity and intoxicate the patient, but is also a nidus of rather abundant suppuration. The incessant suppuration from the extensive surface cannot but harm the organism as a whole. It leads not only to dehydration, but also to a loss of protein. It may cause protein exhaustion, which we call "wound exhaustion". If the patient with such extensive granulating surfaces were let alone to the natural course of the illness, he would inevitably perish from exhaustion as a result of rising protein starvation and amiloidosis. Only covering the granulating surface with freely transplanted strips of skin may change the situation. But in this case it is necessary to perform the operation as soon as possible after the burned or wounded surface became free of scabs.

Such early covering of extensive granulating surfaces is of vital importance; firstly, because it covers spacious spots through which protein is incessantly lost, and secondly because it closes the gates of intoxication, in so far as the surface favourable to abundant vegetation of micro-organisms is liquidated. Of greatest importance is also the fact that the patient comes back to life with no ugly scars and ulcerous surfaces.

In order to succeed in grafting big strips of skin it is necessary to prepare the ground, on which transplantation is to be performed. Though this preliminary preparation is very important, much more important is preparation for operation of the patient himself. It is necessary to raise his vital energies by means of high quality nourishment, raise the quantity of haemoglobin and to achieve an increase in weight.

It is known, that in the first hours and days the extensive burns leads to a sharp increase of haemoglobin and of the number of erythrocytes, as well as to an increase of the haematocrite index. This regular reaction of the abundant perspiring of plasma from the vessels depends on the size of surface and depth of burn. We have already said that such coagulation of blood may be overcome by abundant infusion of serum. However, in a week, a reverse process takes place. Haemoglobin falls down, haematocrite index decreases, the number of erythrocytes diminishes and protein drops. Consequently anaemia, hydraemia and hypoproteinaemia develop. All this is a result of the loss of protein and intoxication. To successfully struggle for the patient's life it is necessary to seize the beginning of the process, start in time persistent and frequent transfusion of blood and have recourse to albumen nourishment of the patient.

In Moscow the Sklifosovsky Institute of Emergency Surgery widely uses donors' conserved blood. Besides, more than 20 years ago into our usual practice was introduced transfusion of cadaver blood which is obtained from people who have died suddenly. There were examples in our clinic, when in the period preparatory to skin-grafting we have transfused upto 20 litres of cadaver blood to some patients. In order to increase sharply the haemoglobin it is necessary to transfuse blood at least 1-2 times a week.

The second indispensable measure in preparing for skin-grafting in cases of extensive burns or traumatic defects of skin, is increasing the protein nourishment. The increased protein ration persues the object not only of making up for the natural loss of protein through the suppurating surfaces but of helping to an increase of epithelial integument regeneration as well.

The success of transplantation depends directly upon the preparedness of the patient for an operation and upon an increase of protein quantity in blood. The daily protein ration should be raised up to 150-200 grams of protein. The food should be tasty, diverse and rich in vitamins. It should include not more than 4,000 calories.

As far as the preparation for skin-grafting of the ground itself is concerned, there is a just conviction established long ago, that for successful skin-grafting granulations should be bright red and small-grained. It should not be inflated, hyaline hypertrophic and pale and it should not have traces of necrosis.

When the treatment of burned or wounded surfaces was done by an open method, the granulating surfaces crushed as a result of the drying of wound matter. There were many who thought that the scab is indispensable, as though under it epithelium grows better. But this opinion is wrong. Epithelialisation goes on better only on small spots. The growth of crust on extensive burned surfaces is not only unnecessary, but even harmful. The accu-

Fig. 1.

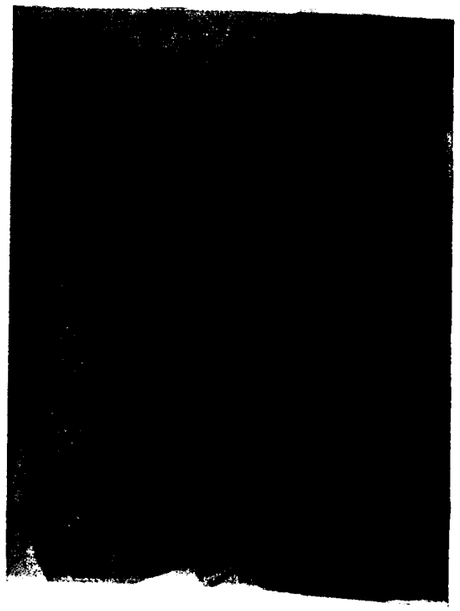


Fig. 2.

Figs. 1 & 2 show large granulating areas covered with skin strips.

mulated matter macerates the young epithelium and does not let it move to the middle of the surface. Therefore, in preparing for early skin-grafting one should avoid formation of crust. From this point of view the method of tanning, the method of open treatment under carcass, the sprinkling of chalk and of starch etc. should be harshly criticised.

Best of all, after the preliminary treatment of the burned or wounded surface, is to cover it with a bandage, oiled with neutral grease with penicillin paste. The bandage should be put on with a moderate pressure. Later on, in case of burns of the third degree, the main method of local treatment of the wound is the speeding up of removal of scabs. The necrotic tissues are dissected, hypertonic bandages, local and general baths are used. Good effects are received with quartz lamp raying.

In the treatment of extensive defects of skin a very great importance was always attached to micro-flora. It is known that the burn surface and the skin defects are the places where various micro-organisms vegetate in abundance. In the Soviet Union and in the other countries there were done many special scientific research works to discover the composition of these micro-organisms. It was established in our Institute, that these are streptococci, haemolytic and non-haemolytic, virulent and non-virulent, that always vegetate on the granulated surface. Sometimes it is coarse aerobe bacillus subtilis; in some cases bacillus pyoceaneus appears and almost always — proteus. In the course of time micro-flora changes as to its quality and quantity very little. It is true, with the improvement of the patient's general state the number of microbes diminishes, but the nidus never becomes sterile. And there is nothing curious about it, for even good skin is never deprived of microbes. Since long, surgeons strove to influence the bacterial flora, by every means reducing its quantity. But our investigations have shown that it is impossible to annihilate pathogenetic flora. On the other hand, it turned out that the flora does not harm the acclimatization of the graft, if after elaborate general preparation of the patient the level of haemoglobin and protein in the blood has been raised up to the normal. Provided that the patient has been well prepared, the graft acclimatizes itself notwithstanding the flora, as if it were absent or had died under the graft. Most significant is not the composition of flora, but the surrounding, the ground, the conditions, in which micro-organisms grow. Having favourably changed the surroundings, having elaborately prepared the patient by means of introduction of protein, blood, salts and vitamins, we set off resistance energies of the organism against the harmful activity of microbes. Of greatest importance is the general state of the patient's organism. It does not mean, that surgeons should neglect antibiotics and not use them in the preparatory period. But one should not overestimate the significance of micro-flora. It would be a profound error to postpone skin-grafting until the micro-flora has become less virulent or non-pathogenetic, because this purpose is unattainable. As was already mentioned, it is necessary to perform early skin-grafting. It has been proved that the earliest possible time for operation in case of extensive burns and traumatic defects is the end of the third week and the beginning of the fourth week after the incident.

Skin strips of 200 sq. cm. are taken by means of the dermatome. In some cases, to cover all the defect, it is necessary to take as many as 5-6 such strips. However, one should have in view, that the more extensive the granulating surface, the less is the area available for taking the grafts. The most convenient place for taking the graft is the front and outer surfaces of the thighs. Skin may be taken from the belly wall, from the back parts of the thighs, from the back, from the loins, from the calf of both legs. The record number of strips which we cut at a time, did not go beyond 8, what equals to 1,500 sq. cm.

To cover large defects we have to proceed with the operation of transplantation in stages. Sometimes it becomes necessary to use one and the same donor part, that is, to take skin from same place from which skin had been already taken 2-3 weeks ago.

The use of the dermatome is advantageous, as it makes possible the taking of strips of any given thickness.

Nowadays it is rather firmly established, that only autogenous grafts may lead to success. It is impossible to rely upon homo and still less on heterogenous grafts. Numerous works of Soviet and foreign authors unanimously confirm that success after homogenous graft belongs to the realm of "myth in surgery". At the same time we have repeatedly used fresh cadaver grafts, taken under sterile conditions soon after death. The blood-groups were not observed in such cases. The transplantation of corpse skin becomes indispensable in case of too spacious defects of skin, when the patient's own skin is not sufficient for the purpose. We alternated the transplantation of the patient's skin side by side with the cadaver's. The corpse skin acclimatizes itself very well and in the course 4-5 weeks it shows obvious signs of life. Later on it melts away and luxuriant granulations take its place. But it is important to gain time. It is necessary first of all to close the nidus of intoxication and of loss of protein. And for some time it is achieved by transplantation of corpse skin.

Several years ago we started using the dermatome with preliminary glueing on it of a gauze napkin. It affords a new advantage. The strip on the gauze does not contract and does not roll up. It may be easily spread on the granulating surface. It is

kept on the spot by means of the usual bandaging.

Using the foregoing principles we performed for the last 7 years, more than 100 operations of free skin-grafting for covering large defects (from 200 upto 3,200 sq. cms.).

Notwithstanding the strict system of general and local preparation, failures, though rare, have taken place; unfortunately in some cases we could not discover the reason for the necrosis of the graft. From the whole group of patients we had 10% of full failure. With the smaller group the grafts acclimatized themselves only partly. The most frequent reason for failure is exhaustion of patient in cases, where transplantation was performed too long after an incident.

To secure success it is necessary from the very day the patient arrives in the clinic with an extensive burn or a large skin defect, to see to preparing patient's organism by means of an increased protein nourishment and frequent transfusions of blood. It is necessary as early as possible, as soon as the general state of the patient permits it and as the granulating surface becomes free of scabs, to undertake free transplantation of skin by means of the dermatome.

In most cases the outcome is successful and the result is striking by its effect.

Received for publication on 1-1-'55.

CONSERVATIVE TREATMENT OF OBSTRUCTIVE LESIONS OF THE UPPER URINARY TRACT

by JOHN K. ORMOND, Miraj.

By conservative treatment is meant that form of treatment which in the existing circumstances is best calculated to conserve renal function, comfort, life expectancy and earning capacity. As will be shown later there are more factors to be considered than the pathological condition.

The upper urinary tract consists of the renal pelvis and the ureter, and obstructive lesions may be found any where along this tract though most frequently in the region where the ureter leaves the pelvis, and with the exceptions of tumours and stones and their sequelae, are usually of congenital origin.

No matter what the cause or where it is located, obstruction results in distension and dilatation above it and a predisposition to infection. Four stages can be recognized: (1) pyelectasis, dilatation largely confined to the pelvis with very little damage to the parenchyma; (2) hydronephrosis, with further dilatation of the pelvis and calyces resulting in varying degrees of atrophy of the parenchyma; (3) secondarily infected hydronephrosis and (4) pyonephrosis, with complete destruction of the renal functioning tissue from pressure and infection. This is more likely to be associated with stone and tuberculosis than with simple obstructive lesions, and I believe it is important to make this distinction between infected hydronephrosis and pyonephrosis.

Obstruction, even uncomplicated with infection, usually causes discomfort. The classical symptoms of hydronephrosis, intermittent polyuria, are not often seen. Much more frequent, especially in the early and more amenable cases, is constant or recurring discomfort in the flank or upper abdominal quadrant, of various grades, and frequently associated with gastrointestinal disturbances, and often treated as being of gastrointestinal origin. Recurrent attacks of pyuria and fever may be seen in the lesser grades of pyelectasis especially in children but also in adults. I might cite one case of this, seen recently. A lady who gave a history of over forty attacks of "cystitis" associated with fever, pyuria and pain in the right flank, was found to have a mild obstruction at the right uretero-pelvic junction, probably due to an aberrant vessel or band.

Obstruction may occur in the infundibulum of a major calyx causing dilatation of one calyx alone, but this is rare. Very common is obstruction at or near the uretero-pelvic junction, caused by stricture, aberrant vessel, fibrous band (the remains of an embryonic vessel), stone, nephroptosis and tumour. Obstruction in the mid-ureter is not common apart from stone and tumour, but obstruction at the lower end is not infrequent, due to congenital or acquired stricture, as well as to stone and tumour.

Diagnosis should include the following: (1) the position of the obstruction; (2) the nature of the obstruction; (3) the degree of the dilatation above; and (4) the presence or absence of infection; (5) condition of opposite kidney. And the requirements for an accurate diagnosis include a careful history and physical examination; examination of the urine; the determination of the nitrogen content of the blood in certain cases; a plain X-ray; intravenous urogram; and finally a cystoscopic examination with retrograde pyeloureterography.

The history is especially important in children, where a story of recurrent attacks of fever, pyuria, flank pain, vague abdominal discomfort, unexplained gastrointestinal upsets, and even malnutrition in a wisely fed infant, may give a lead and indicate further investigation of the urinary tract. In the physical examination I would

emphasize the importance of the presence or absence of pain on percussion at the costo-vertebral angles. The presence of pain on gentle percussion on this region throws the burden of proof on the man who says it is not due to a renal condition.

In the examination of the urine, particularly important are the specific gravity, the presence or absence of albuminuria and of pus and blood cells. It is important to examine a drop of the uncentrifuged urine, for the report of cells found in the centrifuged sediment is deceptive; and in the case of a girl or woman, a catheter specimen is essential.

Stones will usually show in the plain X-ray, and in some instances an unusually small or large kidney shadow may give a lead. The intravenous urogram may give the diagnosis. It may show the absence of function of a kidney, or the presence and degree of obstruction and dilatation.

The greatest amount of information and the most accurate information is given by cystoscopy and pyeloureterography. By passing a wax-tipped catheter up the ureter the presence of a non-opaque stone can be demonstrated, and by distending the pelvis and causing discomfort in the kidney, which may or may not reproduce the pain complained of, information of great importance in border line cases may be obtained. Both forms of urography are desirable but if expense is important or there is a history of allergy, it is best to omit the intravenous form.

Treatment varies according to various factors: (1) Type and location of the obstruction; (2) Degree of dilatation and extent of destruction of function; (3) Presence or absence of infection; (4) Condition of the opposite kidney; (5) Nature and intensity of symptoms; (6) Age of the patient; and (7) Financial condition of the patient.

In case of complete or almost complete destruction of the kidney, if the other kidney is reasonably good, nephrectomy is indicated no matter what or where the obstruction. If stone is the cause and the destruction has not gone too far, removal of the stone is obviously the remedy. Tumour of the kidney or ureter almost invariably necessitates nephrectomy. Strictures of the lower ureter are usually amenable to dilatation through the cystoscope, by means of bulb bougies. Long continued infection usually indicates nephrectomy. Absence of function of great diminution of function in the opposite kidney contraindicates nephrectomy usually, though not always for the removal of a pyonephrosis may cause the function of the opposite kidney to improve.

But congenital obstruction at or near the uretero-pelvic junction is the cause of by far the greater number of cases of pyelectasis or hydronephrosis, and this condition is likely to go unrecognized for long periods. When it is discovered late, after renal function has been greatly damaged or entirely destroyed, nephrectomy is almost inevitable. But if the condition is discovered before the damage is too great, plastic operation offers a means of saving the kidney; with halting of the destructive process; relief of symptoms; and restoration of health to the patient. And it is to this that I wish to direct particular attention.

Obstructions in the region of the uretero-pelvic junction are of two kinds, frequently combined, and often complicated by two factors. The two kinds of obstruction are (1) stricture, and (2) aberrant vessel; and the two complicating factors are, undue mobility of the kidney; and valve formation caused by change in position of the ureteral orifice due to the enlargement of the pelvis.

Strictures of the upper ureter do not respond well to dilatation, as do those at the lower end. If the stricture is in the upper ureter but does not involve the uretero-pelvic junction, there are two ways of treating it; simple incision, with insertion of a catheter F 12 or 14 for two weeks or more, around which it is allowed to heal; or simple excision of the strictured area and end to end suture about a catheter. I personally favour excision, but there are many who like the other method. If the stricture involves the uretero-pelvic junction, excision and reimplantation may be done, or use may be made of a simple plastic operation devised by Schwyzer and modified by Foley, which has been invariably successful in my hands. It consists in making a V incision in the pelvis down to the obstruction; changing the V into a Y by incising through the obstruction to normal ureter; then bringing the point of the V down to the lower end of the vertical incision and suturing it and the wings so formed. This enlarges the outlet and eliminates the obstruction.

When a band or aberrant vessel is responsible for the obstruction it may either press on the ureter or the ureter may wind about it. If the vessel supplies only a small portion of the kidney it may be sectioned with impunity. This can be determined by compressing the vessel and observing how much of the kidney changes colour. If it supplies a large portion of the kidney, it is best to section the ureter and repair it on the other side of the vessel. I had an interesting experience with a vessel which I sectioned. Necrosis of a small part of the kidney resulted and a urinary fistula appeared which closed in a couple of weeks. An important feature to remember is that pressure from a band or vessel is often associated with a stricture also, and it is good practice in every case to incise the uretero-pelvic junction and allow it to heal about a catheter.

Now a few points about the technique of the operation. The splinting catheter should be brought out through the lower calyx of the kidney, through the wound and should be sutured to the ureter with a fine, loosely tied catgut suture through the ureteral walls. This will absorb and free the ureter in about ten days. It is also a good plan to cut a hole in the catheter wall where it lies in the pelvis. In addition to this catheter, a small self-retaining catheter should be passed from the lower calyx, making a nephrostomy. This is even more important than the splinting catheter. Both may be removed after two weeks.

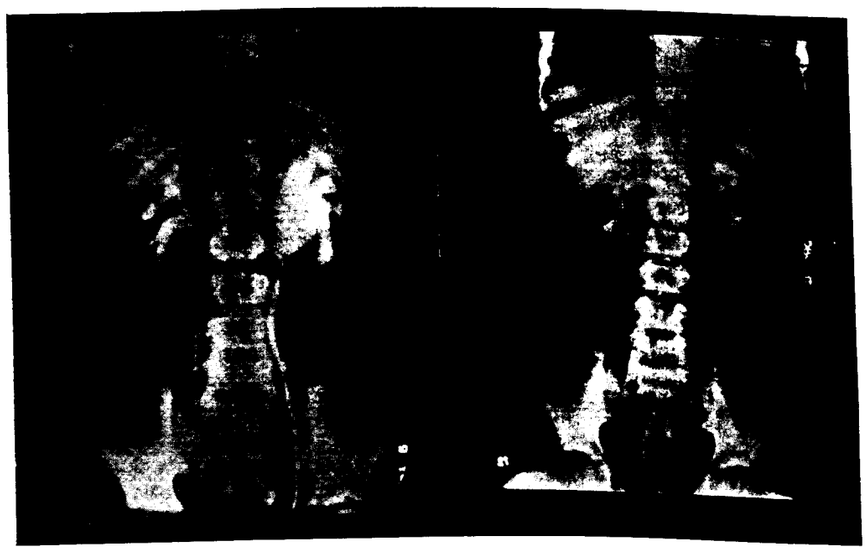
The sutures used in the repair of the ureter and pelvis should be the finest available. I have always used 5 zero on an atraumatic needle. Fixation of the kidney should always be done if the kidney is unduly mobile.

So much for the discussion of the pathological condition and the methods of treatment available. It is in order now to discuss briefly some of the other factors influencing choice of method of treatment. The condition of the opposite kidney is important. In some cases in which nephrectomy would ordinarily be done, if the condition of the other kidney is bad, it may be advisable to attempt a plastic operation. Also the age of the patient is of interest, for the younger the patient the more important is conservation, and an attempt to save a badly damaged kidney may be justified when the same kidney in an older individual would be removed without question. The financial status of the patient may be a factor. It has to be remembered that an attempt at conservative treatment may fail and that a second operation for nephrectomy may be necessary. This means another operation, loss of working hours, and further expense for the patient, and if he cannot afford to take the chance, primary nephrectomy may be the treatment of choice.

A few illustrative case-reports follow.

CASE I.

A young woman entered the hospital with anuria of several days duration, with bilateral soft masses in the flanks, closed hydronephroses. The renal function was severely damaged, but showed some improvement after several days of nephrostomy drainage, and plastic operations were done on both uretero-pelvic junctions, which were failures and had to be repeated. After the second operations the nephrostomy wounds closed and she was able to void without any trouble. These operations were successful but her kidneys had been irreparably damaged and she returned to the



CASE II

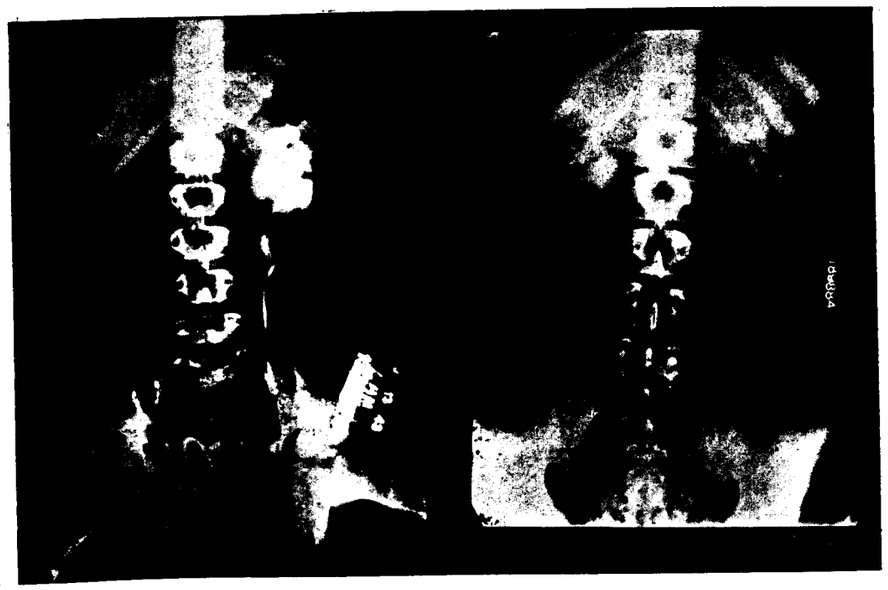
Fig. 1. Before operation.

Fig. 2. After operation.

CASE III

Fig. 3. Before operation.

Fig. 4. After operation.



CASE IV

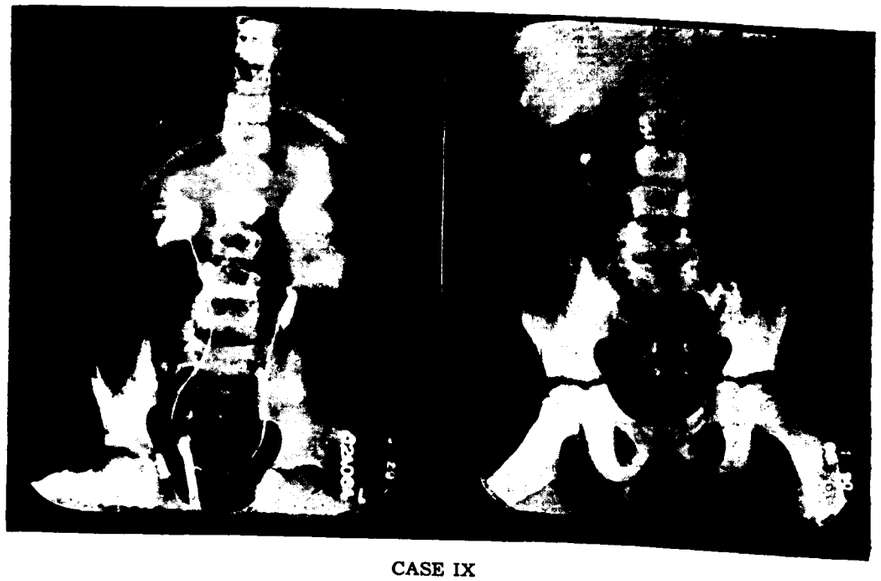
Fig. 5. Before operation.

Fig. 6. After operation.

CASE VIII

Fig. 7. Before operation.

Fig. 8. After operation.



CASE IX

Fig. 9. Before operation.

Fig. 10. After operation.

hospital a few years later and died of renal insufficiency.

CASE II.

An eight year old boy had recurring attacks of left flank pain for four years, with occasional vomiting but no urinary symptoms. Pyelograms showed a fairly large hydronephrosis on the left side. At operation a congenital stricture was found about an inch and a half below the ureteropelvic junction, and this was treated by intubated ureterotomy with splinting catheter and nephrostomy drainage. There has been no recurrence of the abdominal pain, his urine has remained clear, and intravenous urography six months post operative, though showing persisting pelvic enlargement, showed fair function (Figs. 1 and 2).

CASE III.

A ten year old boy was admitted to the hospital because of low grade fever, easy fatigue, and slow weight gain, and with a history of recurring periumbilical and left flank pain for three years. He was a poorly nourished boy and appeared chronically ill. Intravenous and retrograde pyelograms showed mild hydronephrosis on the left. A Foley plastic operation was done on the uretero-pelvic junction, using a splinting catheter and nephrostomy drainage. One month post operative he was free from symptoms, his urine was clear, and from then on, his energy and appetite improved. This improvement continued and he became very active. Excretory urograms three years after operation showed some persisting pelvic enlargement, with good drainage and normal calyces (Figs. 3 and 4).

CASE IV.

A nine year old boy had recurring attacks of fever accompanied by pyuria, failure to gain properly and slower development than his twin brother. Pyelograms showed marked hydronephrosis on the left. Plastic operation was done on the uretero-pelvic junction. Pyuria persisted for four months and then cleared permanently, and he began gaining weight and energy. Eight years later he was a tall, strong boy, was in his school track team, and had never had any further urinary trouble (Figs. 5 and 6).

CASE V.

A poorly nourished four and a half month old boy, had failed to gain in spite of good feeding schedule, and had recurrent spells of vomiting. On cystoscopy the right ureter could not be located and the catheter could be passed only two centimeters up the left. A congenital narrowing was found involving the upper two centimeters of the right ureter with consequent hydronephrosis. This was excised and the ureter reimplanted into the pelvis. Two weeks after, the left flank was explored and a rudimentary kidney found and removed. After a few weeks he began to gain satisfactorily. Four months after operation the phenol-sulphonphthalein test showed only 12 per cent out put in two hours. Two years later the urine showed no pus and the phthalein output had in increased to 25 per cent in two hours.

CASE VI.

A two and a half year old girl had for a year and a half attacks of fever, pyuria and pain on urination. Pyelogram showed moderate hydronephrosis with obstruction at the uretero-pelvic junction on the left, and slight similar obstruction on the right but without pyelectasis. At operation an aberrant vessel was found crossing the left uretero-pelvic junction. This stricture was excised and the ureter repaired on the other side of the vessel, which was not sectioned. Pyuris persisted for a while and then cleared permanently. She was followed for three years, had perfect health and grew and developed normally. Pyelograms six months after operation showed little anatomic change in the pelvis or function.

CASE VII.

A middle aged woman complained of persistent pain in the upper right quadrant of the abdomen. She was found to have a moderate hydronephrosis. At operation a long stricture of the upper ureter was found, apparently congenital, and about two inches long, too long to excise. It was incised and repaired with peritoneum about a catheter. She had relief for a few months but returned a year later for nephrectomy.

CASE VIII.

A nine year old boy gave a two years history of recurrent abdominal pain, nausea and vomiting, with no urinary symptoms. Excretory urography showed delay in the appearance of the medium and marked dilatation of the calyces on the left, and some pyelectasis on the right. Stricture of the left uretero-pelvic junction was treated by a Foley plastic operation. The abdominal pain disappeared but urinary infection persisted for four months. Five years after operation there is persistent hydronephrosis on the left but no increase over the previous state. There may be a little advance in the pyelectasis on the other side (Figs. 7 and 8).

CASE IX.

A seven and a half year old boy had for two years recurring bouts of fever, nausea and vomiting, left upper quadrant pain, progressive nervousness and enuresis. Clear urine came from the right ureter and there was pyuria on the left. Pyelogram showed bilateral ureteropelvic obstruction with mild pyelectasis on the right and fairly advanced hydronephrosis on the left. A Foley plastic operation was done on the left side. Five months after the operation his urine was clear, he had had no attacks of pain, nausea, etc., and had gained twenty pounds in weight. Excretory pyelogram, however showed no shadow on the left. There is probably no restoration of function, but the operation was certainly successful. The other side should be carefully followed (Figs. 9 and 10).

This series of cases illustrates the possibilities of conservative treatment of hydronephrosis. They also illustrate the facts that very little anatomic change can be expected after relief of obstruction and that improvement in function is limited. An operation is satisfactory if it preserves function, relieves symptoms and restores general health.

Not all these operations are successful, but the rate of success in cases of upper ureteral obstruction is high. I have not considered here obstructions at the lower end of the ureter. They present a different problem. Most strictures of the lower ureter can be treated by dilatation, but those conditions associated with reflux from the bladder are difficult to treat with any prospect of permanent improvement. Congenital megalo-ureter is an example.

Summary

Hydronephrosis due to upper ureteral obstruction, if diagnosed early, before complete destruction of function, can often be treated conservatively. A plastic operation is described.

Obstruction in the lower ureter usually yields to dilatation; but conditions involving ureteral reflux are difficult to treat successfully.

Received for publication on 18-2-'55.

RECONSTRUCTIVE SURGERY OF THE OESOPHAGUS

by B. A. PETROV, Moscow.

In case of a scar impassability of the oesophagus as a result of its burn with caustic alkali or an acid, the patient is doomed to taking food exclusively by means of gastrostomy. That is why the problem of restoration of taking food per mouth is of a very grave importance.

Treatment by dilatation is far from being successful for all the cases. There is a large group of patients, for whom the only way out is creation of an artificial oesophagus.

In the Soviet Union such an alternative is creation of an antethoracic oesophagus of small intestine. As is known, the first complete operation of this kind in the World was done in 1907 by our compatriot, the famous P. A. Herzen. He used the proposal of his teacher — Roux (Losanne). who had begun such an operation on a boy in 1906, but succeeded in accomplishing it only 5 years later.

The outstanding success of P. A. Herzen for many years was unique. Great surgeons of Europe oftentimes failed. Later on Russian Surgeons took a very active part in working out methods of the operation.

From 1928 the Sklifosovsky Institute started making artificial gullets. In the course of time the Institute became a concentration place for patients needing artificial gullets. For operations of this kind in the Institute are gathered the patients from all the regions of the country. And upto 1948, that is, in a period of 20 years, Professor S. S. Udin performed 313 such operations. During the last 5 years we have done 321 more operations. It should be mentioned that we have succeeded in considerably improving the technique of the operation.

Thus the experience of our clinic surpasses all the published statistics.

At present we recognise three types of operations.

1. In most cases an ante-thoracic subcutaneous oesophagus of small intestine is made.

2. Since 1949 small intestine is led through the thoracic cavity, and here we have intrapleural artificial oesophagus.

3. Finally since 1952 there appeared a third method conducting small intestine in the anterior mediastinum, behind the sternum. Here we have a retrosternal oesophagus.

Let me now estimate the advantages and disadvantages, indications and contra-indications of each type of operation and mention some of the results.

As I have already said, the first type is antethoracic subcutaneous artificial oesophagus. In such an operation preference should be given to the oesophagus of small intestine.

We never use the dermal tube. We have only once transplanted under the skin a section of large intestine and have never used the stomach for the purpose.

When mobilising small intestine, there arises a peril of necrosis of the loop taken out. Therefore the operation needs experience and careful and skillful ligation of main vessels. As it was proposed by Roux and Herzen, for an artificial oesophagus the initial loops of jejunum are taken. After trying 2—3 direct mesenteric vessels, the intestine is cut across at a distance of 12—15 cm. from the plica duodeno-jejunalis and transposed upwards. The afferent section is sutured into the side of the loop taken out. At this stage the intestine is not connected with the stomach, this anastomosis is performed several weeks after creation of the artificial gullet.

The aim of the surgeon is always directed towards leading out the intestine as high as possible in order to connect it with the neck part of the oesophagus. But just here lies a danger of necrosis. To get a long

loop it is necessary to ligate a large number of mesenteric vessels and this aggravates the danger of necrosis. In previous years we, like other clinics, led out intestine not high up, beneath the collar bone, but up to the level of the 2nd or 3rd rib. Above, between the intestine and oesophagus we made a dermal tube, so called dermal lengthening. This operation is painstaking, capricious and unpleasant both for patient and for surgeon. It leads sometimes to formation of fistulas, scar contractions, etc.

That is why, to avoid the dermal lengthening, we proposed in 1949 to perform at the first stage of the operation additional mobilization of the root of the small intestine mesentery.

It is performed in this way: when 2—3 mesenteric vessels are tied and it becomes evident that the intestine cannot be conducted over the collar-bone, the cupola of blind gut (caecum) is lifted a little up and the parietal peritoneum is cut under it. The cut is made well to the left, under the root of the small intestine mesentery. This method makes possible the sharp shifting upwards of the whole mass of small intestines and the loop taken out can be lifted much higher.

The operation was first performed by us in April, 1949. The data concerning the operation were published in 1950. Half an year later, C. Dubost and R. Bernier made a report of such an operation but did not refer to our article.

This operation has been performed by us 120 times during the last 5 years. There were no complications. At each operation we observed that the intestine was led out higher by 10—20 cm.

The above mentioned method enabled us in many cases to do without dermal lengthening and in most cases to perform the ideal operation, where the oesophagus from neck to stomach was entirely made of small intestine and at one sitting.

For the last few years we have introduced one more innovation. If, notwithstanding additional mobilization of the mesentery, the intestine cannot be lifted up high enough, it is left under the collar-bone. In 4—6 weeks, having no recourse to dermal lengthening one cuts open the dermal canal from top to bottom and frees the intestinal loop from it. This is sometimes sufficient to lift the intestine higher up. If it is followed by laparotomy and the intestinal loops are freed from adhesions in the abdomen, the surgeon will be surprised to see how high the intestine can be taken up though at the first stage he had exhausted all possibilities for achieving the same purpose.

We call such operations "reconstructive" and have performed them 82 times on 70 patients during the last 5 years. They are surely more difficult than the initial mobilization of the intestine. They need great pains. But these pains are wholly made up for. Thanks to this we have almost completely got rid of dermal lengthening and make the oesophagus wholly of intestine.

Besides, the reconstructive operation is quite indispensable in those cases referred from other medical institutions which have been failures due to necrosis of the intestine taken out and have had many plastic operations. During the last 5 years we have received and operated on 58 such patients. Some of them have undergone 20—30 and more previous operations.

During the last 5 years (1949—1953) antethoracic artificial gullets were made by us under spinal anaesthesia in 252 patients of whom 11, i.e. 4.3 per cent died.

During the same years antethoracic gullets were made in 27 patients who had previously undergone an operation for removal of cancer. We deem it more expedient to remove an invaded Oesophagus first of all, take out its end to the neck and then to make a new gullet of small intestine. In this group 5 died.

In this short report it is not possible to touch on many details of technique. For instance, there are cases, where the patients

are received with a burn of high degree and with a scarring of the pharynx. They have tracheotomy tubes and in order to make an artificial oesophagus it is necessary not only to lead out the intestine very high, upto "the lobe of the ear", but to make a pharynx stoma at the angle of the lower jaw; of small danger, though rather painstaking, this operation should be sometimes repeated so as to get a good orifice into the gullet because it tends to contract. However, the neck part of the Oesophagus is left in most cases unharmed, and then the intestine is connected with the Oesophagus end to side or side to side.

In the second type of operation the intrapleural artificial oesophagus is also made of small intestine. The antethoracic Oesophagus answered its purpose well and many hundreds live like healthy people.

According to a communication from Dr. Hase of Switzerland, the first patient operated on by Roux in 1906, a boy of 11 years old, lived 53 years to become a father and a grandfather and died in 1948 of bronchopneumonia. All his life he took food by means of an artificial antethoracic oesophagus and such examples are numerous.

The antethoracic oesophagus, however has its own drawbacks. It is not only esthetics that are concerned especially in young men and maidens. The intestine lying for long periods under the skin swells up and shows a decrease in peristalsis, so that one had sometimes to push a lump of food through with the hand.

The antethoracic oesophagus is especially disadvantageous in cases of stricture of the lower part of the oesophagus, where the upper part retains accumulated food above the stricture and this causes trouble. As a result of the great developments in thoracic surgery, it is now possible in the treatment of such patients to conduct the intestine into the pleural cavity and anastomose it to the oesophagus above the site of the scar contraction.

During the last 5 years we have performed 27 such operations with a mortality, however, of 30%. The danger in this procedure is that in case necrosis of the intestine takes place within the thorax, there is a grave danger to life. When the loop lies under the skin, it can be removed, but it is not so from the thorax. The place where the intestine is most likely to be subjected to pressure is the orifice in the diaphragm.

Under intratracheal necrosis, we perform a midline laparotomy and mobilize a jejunal loop of sufficient length in the usual manner. Then we cut the diaphragm in sagital direction dissect the right crus of the diaphragm and open the right pleural cavity from below and place the intestinal loop inside. The abdomen is closed and the patient is turned over on his left side. We make a right-side thoracotomy because through the right pleural cavity it is much easier to approach the oesophagus over its middle. The anastamosis is made here, a thick metallic olive having been previously led into the oesophagus.

This new intrathoracic gullet functions well because the intestine is left in a cavity. Peristalsis occurs normally, and the anastamosis being made immediately above the stricture, stagnation of food is avoided.

For such an operation, only patients who have a stricture which is not above the 4th Thoracic vertebra should be chosen. Among a large group of patients, not more than 10% are received with such a low stricture. Most patients have contracture along the whole length of the oesophagus from the neck down to the cardia. For them, another method should be chosen by conducting the intestine behind the sternum through the anterior mediastinum.

In 1946 our compatriot (Dr. N. I. Eremiev, City of Omsk) proposed this new original way of conducting the small intestine from the abdominal cavity to the neck, substernally through the anterior mediastinum. For this purpose the canal is opened by blunt dissection behind the sternum in front of the heart and main vessels and between the two pleural cavities. In Canada such an operation was performed much later by Robertson.

Soviet surgeon Eremiev has been working out his method for a long time and published his data in 1951. We started using it in the Clinic in 1952 and now we have an experience of 25 such operations. Out of the whole group, we have lost 3 patients. The operation was performed under intratracheal narcosis. The small intestine is taken out as usual by means of a laparotomy and the diaphragm is crosscut immediately under the xyphoid. Carefully moving on from beneath, between the pleural folds, one keeps close to the bone behind the sternum. From above the passage is made between the origins of the two sternomastoids and thus the way to the neck is opened. The danger of this operation lies in a possible wounding of the pleurae. Only in one-third of the cases did we succeed in avoiding injury to the pleura; in the other cases the pleura was wounded and in 7 patients on both sides. Under intratracheal narcosis this complication is a small danger. We have lost no patients from pneumothorax. Another danger is necrosis of the intestine taken out into the retrosternal canal. The fatal cases we had were those where we did not remove the necrotic intestine in time and that led to mediastinitis. To avoid such danger it is necessary to be sure of a good blood supply to the loop of intestine that is taken out. Also while opening up the canal in the anterior mediastinum, it may constrict the intestine. Of the series of 25 patients 3 were children of 5 years. The operation on these children proceeded very well because the canal was laid down the breast-bone in friable cellular tissue without any difficulty and the intestine was easily conducted on to the neck.

The advantage of the method consists in the fact that it can be used for a great majority of patients with strictures of the oesophagus. The intestine is hidden in the depths where it finds better conditions for functioning than under the skin.

Numerous examinations of cardiac function by means of electro-cardiography have shown that the close vicinity of the intestine has no influence on the activity of the heart. Patients can take any kind of food by mouth like ordinary people.

Apart from these 3 main methods of using small intestine for an artificial oesophagus, I would like to refer to an original way of intensification of the mesenteric blood circulation. In the Soviet Union, a group of Engineers has constructed a special apparatus* by means of which a circular vascular suture is mechanically applied. It sutures vessels of the smallest gauge down to 1—2 mm. in diameter.

In our Clinic, Dr. Androsov has successfully used the apparatus on 11 patients and sutured one of the mesenteric branches of the small intestine to the art-mammaria interna. In 6 other cases, he has succeeded in making an anastamosis between the mesenteric artery and the art-gastroepiploica sinistra. In almost all the cases, the results were good.

Such is a general summary of the work of the Surgeons of the Sklifosovsky Institute during the last 5 years in the creation of an artificial oesophagus.

It is interesting to compare them with the data in the literature. In 1931 Dr. B. V. Vexner found in the literature 205 attempts to make an artificial oesophagus. 74 of them were made in the Soviet Union and 131 abroad. The operation was accomplished only in 55% of the cases, the mortality being 18.2%.

In 1945 Dr. Clerk gathered new data. It turned out that an artificial oesophagus was successfully made in 50% of the patients. The general mortality rose to 30%, possibly because of the fact that some of these cases were for restoration of the oesophagus after

* The Editor has been in correspondence with Prof. Petrov with regard to this apparatus. Dr. Petrov informs me that it is still in an experimental stage. He has sent me a booklet describing the apparatus. It is written in Russia.

removal of cancer. 2 years ago, we collected data from a questionnaire sent to the Surgeons of the Soviet Union. There were altogether 172 cases where an artificial oesophagus was made, with a mortality of 11%.

In July, 1954 Dr. Mekie (Malaya) reported 10 operations for making an intrapleural oesophagus. The results were good in 5 patients. The other cases failed and 2 died.

We in this Sklifosovsky Institute have succeeded in considerably reducing the mortality (to 4.3%). In addition, all the patients were discharged with a functioning gullet.

On the basis of our experience we have come to the conclusion that the main method of making an artificial gullet at the present moment is by the use of small intestine. The taking out of the intestine has considerably been facilitated by mobilisation of the root of the mesentery and by reconstructive operations. The most progressive is the method of making intrathoracic and retrosternal gullets.

Received for publication on 1-1-'55.

PATHOGENESIS AND MEDICAL TREATMENT OF OBLITERATING ENDARTERITIS

by Prof. N. N. ELANSKY, Moscow.

Five years ago (in 1949) for treatment of obliterating endarteritis we proposed for the first time a blockade of the vaso-receptive apparatus by means of intraarterial injections of novocaine on the invaded extremities.

For a basis of this method of treatment we took the supposition that obliterating endarteritis is one of the manifestations of disorder of vaso-motive functions, and this disorder is connected with disorder of the functions of the central and peripheral nervous systems.

This supposition is confirmed by the clinical picture of obliterating endarteritis, by its progressive evolution, and by special investigations of the functions of the sympathetic system of the patients suffering from obliterating endarteritis.

Thus, one of the early symptoms of the illness — "claudicatio intermittens" is nothing but a manifestation of vessel spasm, connected with muscular exertion. Coolness of extremities, cyanosis or, on the contrary, crude pallor of the extremities and the appearance of a white speck, which does not disappear for a long time after the toes or foot were pressed, also bear witness to the existence of spasm of vessels.

Capillaroscopy and oscillography in cases of endarteritis confirm the existence of blood-circulation disorders, more or less clearly expressed.

Clinical observations show that endarteritis of extremities goes often together with stenocardia and infarct of myocardium, with spasms of intestinal vessels, which are often regarded as angina abdominales or colitis spastica, and with spasms of cerebral vessels.

All this gives reason to regard endarteritis not only as a local, but as a general illness, connected with disorders of vascular reactions in the whole organism with dominent manifestation of vascular disorders in separate organs — in extremities, intestines, heart, brain, etc.

Analysis of the clinical evolution and of the anamnestic data of patients suffering with obliterating endarteritis shows, that this illness develops gradually under the influence of various unfavourable external factors, affecting the organism. Mostly the patients link it to having got frozen or cold for a long period of time. The influence of low temperatures on the organism was recorded in 34 percent of the small number of the patients who suffered with endarteritis; nervous experience and psychical trauma — in 19.5%, smoking — 98%, contusion, wounding and infection — in 30% of the patients.

The Clinical course of the illness in the beginning manifests itself only during quick walking by pain in the calves, shins or toes, this is the so-called symptom "claudicatio intermittens". Then the pain follows every movement and at last the pain remains in repose. Along with it disappearance of pulse in the extremities, coolness of the extremities, dryness of the skin, change in the growth of the nails, darkening of the skin or painful chaps on the toes are observed. Here spasmodic phenomena are clearly accompanied by disorders of tissue trophics, which in its turn lead to necrotic changes.

As it is seen in the case of obliterative endarteritis, functional disorders, connected with disorders of vascular reaction on extremely strong unfavourable external irritations, develop gradually into anatomic changes.

To the external factors unfavourably affecting the organism and causing changes of vascular reactions, we refer various nervous shocks and psychical experiences, influence of low temperatures, which give rise to prolonged spasm of peripheral

vessels, lasting and regular influence of nicotine, which maintains constant rise of vascular tonicity in the organism and forms the background for other irritating factors causing vascular spasms.

The lasting influence of the above-mentioned unfavourable external factors leads to exhaustion of the cells of the cerebral cortex and to disturbance of its regulating accommodations, in consequence of which even normal irritations provoke perverse vascular reaction after the pattern of pathological conditioned reflexes.

Just as there is a variety of irritants, affecting the organism and causing vasomotor disorders, and quite a few points of their application, so there are various clinical manifestations of vascular disorders — on the extremities, in the tracts of the heart, brain, stomach or intestines. On the other hand, there are also recorded combinations of various forms of vascular disorders — endarteritis and stenocardia, endarteritis and ulcerous illness, etc.

In investigating the problem of the pathogenesis of the manifold vascular affections of the extremities it would be wrong to take into consideration only neuro-reflex processes, which undoubtedly play the leading part. It is necessary as well to take into consideration humoral and metabolistic functions of the organism, also connected with functions of the nervous system.

Thus, for the explanation of the juvenile or purely angio-spastic forms of obliterating endarteritis, the spasmogenetic factors are dominant. But as to the explanation of vaso-motor disorders in old age one should also take into consideration athero-sclerotic changes in the vessels, which are connected with disorders of metabolic functions of the organism. Therefore, in clinical practice it is necessary to distinguish sclerotic forms of obliterating endarteritis.

Besides, the evolution of vaso-motor disorders in juvenile and senile ages is influenced by the changes of an humoral order. Accompanying endarteritis, in some cases and sometimes coming forward into the foreground, a high susceptibility to thrombogenesis in vessels and mainly in the venous system, makes it necessary to distinguish an independent form of vascular disorder, known to clinicians as obliterating thrombangeitis or migrating thrombophlebitis. Our observations show, that in this form spasmodic processes in the vessels can also take place, but they usually recede before the thrombotic ones. In the latter form we usually find an increase of prothrombin in the blood.

Thus, the analysis of vaso-motor disorders which were observed in the clinic and which are included in the term "obliterating endarteritis", shows multiformity of these disorders and diversity in their pathogenesis.

Therefore, it is impossible to speak of a uniform method of treatment of obliterating endarteritis based on pathology. It is indispensable to individualize methods of treatment in accordance with the peculiarities of the pathogenesis of the illness, and to use complex methods of treatment.

Apart from the form of endarteritis (spasmodic, thrombangiitic or sclerotic) in solving the problem of its treatment one should take into consideration the stages of the process as well. We distinguish three stages: the first stage — presence of functional disorders only, the second, — presence of ulcers and trophic disorders and the third, — presence of tissue necrosis. The first two stages may be reversible, the third is mostly irreversible. Besides, the reverse process may take place only in the angiospastic and the thrombangiitic forms and in the first and the second stages. In the sclerotic forms of endarteritis, we may speak only of symptomatic treatment, because measures attacking atherosclerosis are unknown to us. It is not possible, either, to cherish hopes on fully curing endarteritis in the stage of necrosis with full embolism of main vessels, even in the angiospastic and thrombangiitic forms of endarteritis.

Coming to the problem of treatment of obliterating endarteritis we should first of all take into consideration functional disorders in the organism and try to remove them.

Having taken for a basis the neuro-reflex theory of pathogenesis, summarized above, we have worked out a complex method of treatment of obliterating endarteritis of the angiospastic type. The essence of it is as follows.

First of all we remove all the external and internal irritations, coming to extero- and intero-receptors and causing spasms of vessels. This is achieved by strict observance of bed regimen in stationary conditions. The patient is forbidden to walk, as even the slightest muscular exertion may cause spasms of vessels in the stage of exacerbation. Forbidden also is smoking, which raises vascular tonicity and furthers spasms of vessels. To the patient should be secured peace of mind. All the unfavourable factors, which lead to emotion and psychical experiences, should be removed. Besides, we try to affect directly the vaso-receptive and effectoral apparatus, using for this purpose intraarterial novocaine blockade on the invaded extremities.

This is effected by an injection in arteria femoralis of 10 millilitres of 1% solution of novocaine. After this the artery is pressed tightly for 5—10 minutes in order to have lasting influence on the vaso-receptive apparatus.

After the injection of novocaine there appears reddening of the integument, rise of dermal temperature by 2—4 degrees and disappearance of pain. The pain calms down for some hours after the intraarterial blockade and with each new injection of novocaine the pain becomes all the calmer.

In the beginning we make intraarterial injections daily, and then as the pain abates the intervals between injections are increased.

One course of treatment requires 15—25 intraarterial injections. The injections of novocaine do not result in habit formation or toxic reaction.

Our task consists in removal of the pain for a more or less protracted term and in demolition of the pathological conditioned-reflex ties. This is rather easily achieved in cases of the first and the second stages of endarteritis.

In the third stage, when there is no pulse in the arteria-femoralis, the method of intraarterial blockade is inapplicable.

When there is a necrosis or an infection, intraarterial blockade helps only a little. In these cases we have recourse to intra-arterial injection of novocaine with penicillin and to removal of necrotic tissues by means of surgical interference. In case of passability of main vessels and in the third stage it is possible sometimes to abate the pain, to remove the necrotic tissue and cure the ulcer.

Novocaine has considerable advantages over narcotics, as it removes spasm of vessels and the pain connected with it. Whereas narcotics do not remove spasm and lead to habit formation.

Injections of novocaine in patients with the spasmodic form of endarteritis were never followed by local or general complications.

In the sclerotic form of the illness intra-arterial novocaine blockade is contra-indicated, because in cases of general sclerosis of vessels intraarterial injection of novocaine causes sometimes brain disturbance in the form of vertigo, weakness and sometimes vomiting. These patients are treated with preparation of iodine, with methyltestosterone and rest in bed.

In treating the thrombangiitic forms we strove — apart from intraarterial injections of novocaine, to affect prothrombine index by administering anticoagulation preparations (dicumarine and pelentan).

During the five years beginning from 1949, 318 patients who suffered with various forms of obliterating endarteritis were treated.

The distribution according to the forms and stages of the illness is shown in the following table :

FORMS	STAGES			
	1st st. of functional disorders	2nd st. of trophic changes and ulcers	3rd st. of necrosis	Total
Angiospastic ...	31	64	29	124
Thrombangiitic ...	24	76	32	132
Sclerotic ...	18	29	15	62
Total ...	73	169	76	318

In the group of 169 patients of the second stage 56 patients had ulcers on one, two and more toes.

Before they were received in the clinic, 39 patients had undergone an operation of removal of sympathetic ganglions, and 34 — amputation of one of the extremities.

76 patients came in the clinic in a state of neglect, in the third stage of the illness with infection and with more or less extensive phenomena of necrosis and inflammation. As to the duration of the illness our patients are distributed as follows : — up to 1 year — 32, up to 3 years — 54, up to 5 years — 75, up to 10 years — 98 patients, and above 10 years — 59.

This shows that we have treated patients who were in a bad state and had tried many methods of treatment.

The results of the treatment of obliterating endarteritis by complex methods with the use of intraarterial blockade is the following :

86.7% — improvement, 9.4% — no changes, 3.9% — change for the worse.

From the group of 56 patients the ulcers of 44 were healed.

Disarticulation of toes was performed in 28 cases, amputation in 11 cases.

The majority of the patients (228) spent in the clinic from 1 to 2 months, 74 — from two to three months, and 16 — from three to six months.

Remote results were traced with 196 patients in the course of 1—5 years. Estimation of their state was done on a basis of general clinical examination : thermometry of skin, capillaroscopy and oscillography. From this group of 196 patients recovery and significant improvement took place in 79.6% cases. The pain remained with no changes in 13.3% cases. And the change for the worse took place in 7.1% cases. The best results were received with the patients of the first and second stages. From 46 patients of the third group of the illness 24 improved, 14 remained with no changes, and of 8, changed for the worse. Of all these patients, from the point of view of long term results, 62.3% returned to their former jobs, 26% changed their jobs for others, not connected with cooling and long walking, and 11.7% got certificate of invalidity.

The treatment of obliterating endarteritis with intraarterial novocaine blockade is widely and successfully used in many surgical institutions of the Soviet Union.

Positive results from the treatment confirm the justness of the neuro-reflex theory of the genesis of obliterating endarteritis and the important role of functional disorders in its pathogenesis.

Received for publication on 1-1-'55.

COMMISSUROTOMY IN MITRAL STENOSIS*

(A preliminary report on 7 cases)

by AJIT K. BASU and AMALANANDA DAS, Calcutta.

Introduction.

The purpose of this report is to present the findings and results on 7 cases of Mitral Stenosis in which commissurotomy was performed during the course of the last 12 months. Surgical correction of this mechanical burden on the heart may be said to be yet in its infancy, being about 6 years old and it was therefore felt that the few centres in this country, where this specialised type of surgery is being performed systematically, should present their data and their material early, enabling each to learn from the experiences of others. It is with this idea that this short communication is being made. The long term results of this series of cases will have to be assessed at a much later date but even so, an early review have taught us a few worthwhile lessons which we can fruitfully share with others.

Selection of cases for operation.

All cases of Mitral Stenosis are not suitable for operation. The criteria which were taken into consideration in selecting a suitable type of case in this series were as follows : —

(1) *Symptoms* : — Symptoms in all the cases were severe enough to incapacitate the patients in their every day ordinary activities. All were unable to walk more than a few yards without experiencing dyspnoea — many of them suffered from occasional acute paroxysmal dyspnoea. Some had recurrent attacks of haemoptysis.

(2) *Signs* : —All the cases had well developed signs of mitral stenosis, that is, slapping localised apical impulse, a diastolic thrill, a short sharp 1st sound in the mitral area with an opening snap in most cases, a rumbling diastolic murmur with presystolic accentuation. No case had significant evidence of mitral incompetence. Evidence of pulmonary hypertension as exemplified in an accentuated and split second sound in the pulmonary area and a parasternal right ventricular thrust (indicating right ventricular hypertrophy) was present in all cases. Two cases had evidence of early aortic incompetence. This was not considered a contraindication to correction of the mitral stenosis. Two cases had auricular fibrillation prior to the operation.

(3) *E.C.G.* : — The important findings in the electro-cardiograms were those of left auricular and right ventricular hypertrophy. In no case in this series was there any evidence of left ventricular hypertrophy.

(4) *Radiology* : — Here the significant findings were, —

(a) double contour of the left auricular shadow in the P.A. view and impression of the enlarged left auricle on the Ba-filled oesophagus in the R.A.O. view.

(b) mitralisation of the left border of the heart with straightening and prominence of the pulmonary bay.

(c) significant enlargement of the left ventricle was not present in any case.

(5) *Cardiac Catheterisation* : — This was done in one case and the findings indicated very high rise in the right ventricular, pulmonary artery and pulmonary capillary pressures.

In selecting cases for this initial series, we have deliberately adhered to a rigid set of criteria and have avoided accepting any

* Paper read at the 16th Annual Conference of the Association of Surgeons of India at Hyderabad (Dn.), December 1954.

case which presented features considered usually as relative contraindications for this operation. For example, — the cases in our series were in the acceptable age group; they had no significant mitral incompetence; except for slight aortic incompetence in two cases, no other valvular lesion was present.

Pre-Operative preparation.

All the cases were treated pre-operatively for correction of anaemia when present and improvement of congestive cardiac failure. They were put on a low sodium diet, digitalis and mercurial diuretics according to indications. Quinidine sensitivity was tested for in each case before operation.

Operative procedures.

The operation was done in all the cases in the right lateral position with the usual para-vertebral incision, and resection of nearly the whole length of either the 4th or 5th rib. This incision is probably little more traumatizing and takes slightly more time than the antero-lateral incision through an intercostal space as advocated by some authorities (Brock 1952), but it gives better exposure and in cases of emergency would certainly be more advantageous. The method of control of the auricular appendix was routine. After steadying the tip of the appendix with a suitable non-crushing clamp, a purse string suture was applied close to the base of the appendix. In two cases, the comparative stunted height of the auricle and consequent closeness of the left branch of the coronary artery, made it hazardous to apply this suture as deep as would have been desirable. In consequence, the amount of tissue that was available after the application of the Satinsky clamp was too little for easy introduction of the finger through the incised tip of the auricle. This was so particularly in the 7th case in this series, where the appendix was of a peculiar hour glass shape. The projecting part of the hour glass was too narrow for the introduction of the finger and the deeper portion of the hour glass was first of all very deeply situated and secondly was much too stunted.

Once inside the auricle, the eccentric situation of the mitral orifice and its very smallness in all the cases were often very elusive and sometimes there was difficulty for a few seconds in actually locating the orifice and in making sure that the orifice of the pulmonary vein was not mistaken for the real mitral orifice.

Dilatation of the mitral orifice and splitting of the commissures required usually more than one effort. Sometimes the extremely narrow orifice would dilate, enabling the finger to go through but the commissures would not be split satisfactorily. On other occasions, repeated trials would be rewarded with sudden wide splitting of the commissure and the resultant orifice would be quite large.

This happened in the last two cases and when this happens and the orifice is satisfactorily split well up to the mitral ring, the patients usually do remarkably well in the post-operative period. It has also been noted that the patient tolerates the intra-auricular finger quite well for a long time but the mitral orifice should never be obstructed for more than 2 to 3 seconds at a time and that repeated attempts at splitting is better than sustained and forcible manipulation.

It is during the process of introduction of the finger through the appendix inside the auricle and also during the process of extrusion of the finger that major haemorrhage is likely to take place. During introduction of the finger, the lips of the incision in the auricle must be clearly separated and the surgeon's finger must find a clear pathway to the interior of the auricle as the Satinsky clamp is slowly and gradually released and the purse string suture tightened. Often there are numerous criss-cross tabeculae inside the appendix which must be seen and deliberately divided. During the process of extrusion of the finger, reliance has been placed on the Satinsky clamp to control the auricle rather than on the purse string suture which is really for the final ligature of the auricular stump.

All the cases in the series had their commissures split by the finger. The mitral knife was not used. Judging by the results and on retrospective thinking, it appears that a knife could have been profitably used in at least one case in the series. It is true, however, that in the large majority of cases, finger fracture commissurotomy is sufficient and the additional hazard of introduction and the use of the knife should be reserved for the rare and occasional case, where the commissure would not split even after the Bailey manouever of applying simultaneous counter pressure from the outer surface of the ventricle (Bailey 1952).

The circulation into the head vessels (the left common carotid and the right innominate) was not controlled except in two cases who had pre-operative fibrillation and in whom there was reasonable apprehension of the presence of clot in the appendage. Bailey (1952) uses it routinely and according to him this manouever has considerably brought down the serious and almost fatal complication of cerebral embolism in his cases. However, other authorities have not completely accepted this view and up to now, there has been no cause for regret for not doing this manouever routinely in this series.

Post-operative care and complications.

Large gaps have been deliberately left during the pericardial closure in order to allow for the blood and expected reactionary pericardial effusion to drain away into the pleural cavity and thence to the water-seal suction bottle. Even so, most of the cases developed transient post-operative pericarditis and in at least 1 case effusion of considerable extent. Fortunately both the pericarditis as well as the effusion subsided on their own with the help of antibiotics and except for pyrexial reactions for some days did not cause any other complication.

In our experience, in addition to the routine care in the post-operative period, these patients require additional attention from 3 important aspects.

(1) *Control of restlessness*:— This appears to us to be most important and has considerably worried us on some occasions. Instead of massive doses of powerful sedative drugs, we have learnt to rely on pethidine hydrochloride given in smaller doses of 25 to 50 mgms. at repeated and frequent intervals and often alternating with and reinforced by 3 to 5 c.c. intramuscular injections of paraldehyde. This regime enables us to carry over our patients during the critical initial 48 hours in a state of comparative calmness, which we think, is very important.

(2) *Control of pulmonary congestion and right heart strain*:— This is another major hazard in the post-operative state. Our first patient died a few hours after the operation from development of acute pulmonary oedema and right heart failure which we were not able to tackle adequately. Another patient (case 5) developed signs of right heart strain with prominence of the jugular veins in the neck and congestion of lung bases. He was promptly treated by venesection and improved after 200 c.c. of blood had been let out. Another patient (case 3) developed signs and symptoms of considerable lung congestion which was controlled with digitalis and other ancillary measures.

(3) *Control of cardiac irregularities*:— Digitalis has not been used pre-operatively as a routine in this series of cases although it has been necessary to use this valuable drug in many of the cases, especially during the post-operative period.

Quinidine was successfully used in one case for control of paroxysmal auricular tachycardia.

A trial dose of quinidine is administered routinely in all cases before operation to test for adverse sensitiveness to this drug.

Post-Operative Improvement.

We have carefully analysed all the patients with regard to their present status from the clinical, radiological and electrocardiographic points of view. Of the 6 cases that survived, there has been overall improvement in all which is particularly marked in 4 cases compared to their pre-operative state. This improvement is most noticeable with regard to their capacity for ordinary exertion without experiencing dyspnoea and relief from attacks of acute paroxysmal dyspnoea and haemoptysis. Physical signs of mitral stenosis have lessened but the murmur has not completely disappeared in all the cases. There has also been significant improvement in the E.C.G. patterns in all cases and in roentgenograms in most.

Summary

This paper presents a review of 7 cases of mitral stenosis treated surgically. The criteria for selection of cases, the pre-operative preparation, the operative procedure and findings, the post-operative complications and their management and the overall results are described.

ACKNOWLEDGEMENT

Much of the success in this series of cases was due to the capable way in which our anaesthesiologist, Dr. S. Chatterjee, not only administered anaesthesia at the time of operation but also looked after the cases in the post-operative period. His energy and enthusiasm have been stimulating. We must also express our indebtedness to the house men of the Thoracic Surgery Unit particularly to Dr. Asraf who has been ever alert and tireless in looking after the cases in his charge. 2 cases in this series were initially under the care of Prof. N. R. Konar, Associate Professor of Medicine, Nilratan Sircar Medical College, who has also taken keen and active interest in this work. Another was kindly referred to us by Dr. A. B. Mukherjee, M.R.C.P., who has also co-operated with us in following up the case. Prof. S. N. De, Professor of Pathology looked over the histological sections of the auricular and lingular biopsis. Prof. S. Bose, Professor of Radiology has helped us in Fluoroscopy and in interpreting the skiagrams.

We wish also to express our thanks to Dr. A. K. Dutta Gupta, Principal, Nilratan Sircar Medical College, for allowing us to use the case records for this paper.

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Received for publication on 28-2-'55.

THE USEFULNESS OF TRACHEOSTOMY IN THORACIC SURGERY

by TIMOTHY TAKARO, Miraj.

Most surgeons, when they think of doing a tracheostomy, think in terms of relieving obstruction of the upper respiratory tract. However, the thoracic surgeon occasionally faces problems which, although they do not involve obstruction of the air passages, nevertheless may be solved, or at least mitigated, by resorting to the simple procedure of tracheostomy. The presence of a tracheostomy not only facilitates the removal of excessive secretions from the tracheo-bronchial tree, but also has important secondary effects on the physiology of respiration.

In 1951, Carter and Guiseffi[3], discussing the treatment of crushing injuries of the thorax, demonstrated from clinical, pathological, and experimental evidence, that tracheostomy not only reduces considerably the amount of dead space in the respiratory tree (Fig. 1), resulting in an increase in ventilatory efficiency (Fig. 2), but also reduces the resistance to breathing imposed by the baffles of the naso-pharyngeal air path, and the upper respiratory tract. In instances of "flail chest" or injuries characterized by non-penetrating chest wall damage with multiple rib fractures and consequent paradoxical movements of the chest wall, the ventilatory effort may become so ineffective, these authors pointed out, as to seriously threaten the patient's life. When, to paradoxical movement, diminished respiratory excursion due to pain is added, and the effective pulmonary air space is lessened by excessive secretions and ineffective cough, the resulting anoxia may prove fatal. In a later paper, Carter and Guiseffi[4], described eleven cases of crushing injuries of the chest, in which these principles were dramatically underlined by clinical course of the patients. The applicability of these principles in non-traumatic conditions following or during the preparation for elective thoracic surgical procedures was mentioned by the authors, and illustrated by one case report.

We would like to describe three cases in which tracheostomy was either helpful or life-saving, in elective thoracic surgical procedures in our own experience.

CASE REPORTS

CASE 1.

R.E.F., a 34 year old white male was admitted to the V. A. Hospital, Oteen, N.C., U.S.A., with a six month history of right tuberculous empyema due to rupture of a cavity in the right upper lobe. He had been treated prior to admission by closed and open thoracotomies, and presented himself with two broncho-pleuro-cutaneous fistulous openings on the right chest wall, and a destroyed right lung. On 10 October 1952, a right extrapleural pneumonectomy was done, with excision of the two fistulous tracts. The patient made a good recovery. Three and a half weeks later, an eight-rib post-resection thoracoplasty to obliterate the space was carried out. The mediastinum was assumed to have been fixed due to the chronic disease process. The following day the patient's condition was serious. He was markedly dyspnoeic, with gasping respirations and cyanosis, and gurgling rhonchi were heard in his left lung, and in the trachea. He was unable to raise these secretions by coughing. There were obvious paradoxical respiratory movements of the softened

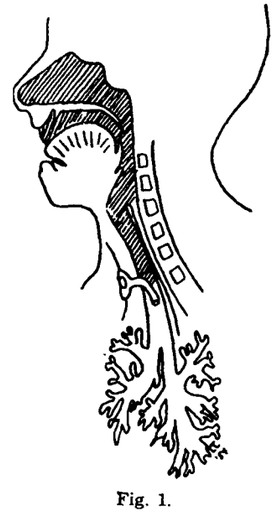

Fig. 1.

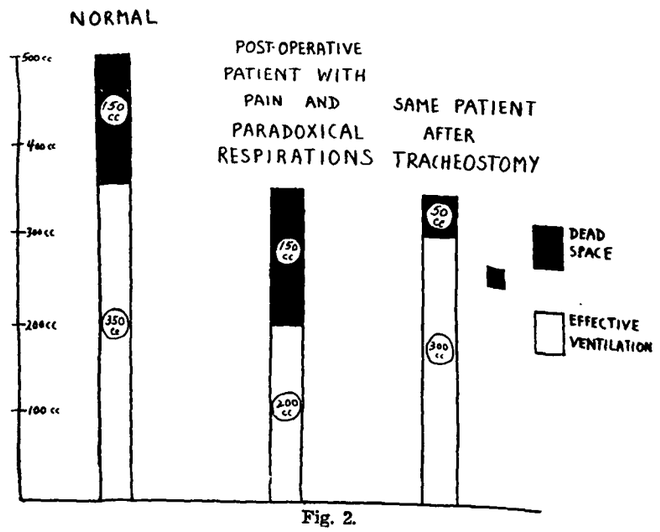

Fig. 2.

right chest wall. Direct aspiration of the trachea by a transnasally passed catheter gave him only partial relief lasting for about an hour. Bronchoscopy was promptly carried out, with thorough aspiration of the left lung. The right bronchial stump was intact. Again the lung filled up rapidly, and his condition began to deteriorate. An emergency tracheostomy under local anaesthesia was done within 24 hours of the time of completion of the thoracoplasty, with dramatic results. The patient's laboured breathing was immediately relieved, and the secretions were easily removed as often as necessary by catheter through the tracheostomy tube. The paradoxical respiratory movements of the right chest wall diminished markedly. He began to improve rapidly. One month later, the tracheostomy tube was removed and the neck wound allowed to close spontaneously soon after. He ultimately developed a small bronchopleural fistula and a small empyema on the right, from which he slowly recovered.

CASE 2.

Y., an Arabian male aged 33, was admitted to the Wanless Sanatorium in 1951 with far-advanced pulmonary tuberculosis. He had had a 5-rib thoracoplasty on the right in September 1952, and his sputum remained positive, with a residual cavity under the thoracoplasty. On 12 March 1954, a right upper and middle lobectomy, and segmental resection of the superior segment of the right lower lobe were carried out. The post-operative course was stormy, with hypotension, abdominal distension, moderate paradoxical respiratory movements of the right chest wall, and rhonchi in both lungs, with ineffectual cough. On the third post-operative day the patient was bronchoscoped because the basal segments of the remaining right lower lobe seemed to be atelectatic on the roentgenogram. A large amount of mucopurulent secretions were aspirated from the tracheobronchial tree, and the right lower lobe re-expanded promptly. Four hours later the same situation recurred, and the patient adamantly refused trans-tracheal suction and bronchoscopy. Accordingly, a tracheostomy was carried out in the patient's bed. This enabled repeated suctioning of the tracheobronchial tree to be carried out as often as necessary by the nursing staff, and markedly reduced the paradoxical movements of the right chest. He improved, and the right lobe re-expanded. The neck wound healed promptly. This patient also developed an empyema and a bronchopleural fistula, and required a modified Schede thoracoplasty. He is at present still a patient at the Sanatorium.

CASE 3.

S.P.L., a nine year old Hindu boy was admitted to the Wanless Sanatorium on 2 July 1954 with a one year history of chronic lung abscess of the left lung, with copious foul-smelling sputum, which was repeatedly negative for acid-fast bacilli

on smears and cultures. On the day following admission, he was bronchoscoped, on the assumption that he might have aspirated a foreign body. None was seen, but copious bloody, purulent secretions were aspirated from the region of the orifice of the left upper lobe bronchus. Although a 5 mm. Jackson bronchoscope had been used, and the procedure had been completed without difficulty, that night the patient's breathing became stridorous, and it became increasingly difficult for him to raise the large amounts of foul-smelling pus from his left lung by coughing. It soon became apparent that a combination of excessive secretions and glottic edema were producing increasing respiratory difficulty for the boy, with increasing stridor, and retraction of the intercostal muscles and increasing use of the accessory muscles of respiration. Accordingly, a tracheostomy was performed at 3 a.m. the next day, to relieve his dyspnoea. This route provided a ready means of improving the tracheo-bronchial toilet by repeated aspirations of secretions as often as necessary. After one week of preparation with antibiotics and aspirations of the trachea, his temperature dropped to normal and the secretions became much cleaner. Four weeks after admission, a left upper lobectomy was done. The patient made an uneventful recovery. The post-operative care was simplified by the presence of the tracheostomy tube, which was removed one week after surgery. Two weeks after the lobectomy, the patient was discharged, asymptomatic, and afebrile, with complete expansion of the left lower lobe to fill up the left pleural space. He has remained well during the past three months since his surgery.

Discussion

Many of the problems posed by the patient who has sustained a serious chest wall injury are encountered in whole or in part by patients who are candidates for, or who have undergone major thoracic surgical procedures. The respiratory passages may be filled with secretions or blood which the patient may be unable to expel because of ineffective cough. The cough mechanism may be impaired or rendered ineffectual because of pain, or because of depression from anaesthesia, or narcotics, or because of the paradoxical motion of the chest wall. The increasing respiratory effort needed to achieve adequate oxygenation under these circumstances leads to more paradoxical respirations, more pain, and further respiratory distress. The vicious circle can be broken if the secretions can be effectively removed by tracheal aspiration, or bronchoscopy; or by improving the patient's ability to cough by a combination of percussion of the chest and broncho-dilator drugs by aerosol (Palmer, et al[8]). Secretions may be loosened by such drugs as ammonium chloride, by intravenous sodium iodide (Baker, et al[1]), or by the newer detergents such as Alevaire (Wyeth) by aerosol inhalation. Pain can be combated by suitable drugs which do not depress the cough reflex, such as pethidine; or by intercostal nerve block (Davidson, J[5], Deaton, Wr.[6], Graham, F. M., et al[7], and Samson, P. C.[9]). The ingenious method of Blades and Ford[2], using fine polythene tubes at the inferior borders of several ribs above and below the intercostal incision into which procaine solution can be injected postoperatively, is also useful but rather time-consuming. Nalline, a morphine antagonist, helps combat depression due to over-narcosis with morphine, which, of course, should be guarded against at all times. Light anaesthesia and alert nursing, to re-establish an active cough reflex promptly after surgery are very important. If none of these methods prevent or relieve the patient's distress, tracheostomy must be done. This procedure should be carried out before the situation becomes desperate, as an elective rather than a rushed emergency operation. By one stroke, the respiratory dead space and the resistance to air flow are markedly reduced. Thus, each breath that the patient takes will be more efficient because more of it will be used for oxygenation rather than for filling dead space, and less effort will be required for each breath. This will result in diminished paradoxical movement of the chest wall, lessened pain, and more effective oxygenation of the blood. Secretions or blood can be repeatedly aspirated through the tracheostomy tube with no effort on the part of the patient, by any nurse, using a simple suction machine. After several weeks, when the patient's condition has improved, and his cough reflex has become effective again, the tube can be removed and the wound

allowed to close. No permanent difficulty will result, if the tracheostomy has been made well below the cricoid cartilage.

In our three cases, only one had actual partial obstruction of the airway. This was immediately relieved by the tracheostomy, with the added tremendous advantage of providing a ready means of removing the copious purulent secretions from his lung abscess. His preparation for surgery was thus facilitated, and his post-operative care rendered easier, by the tracheostomy. The other two patients were complicated cases due to extensive disease requiring extensive surgery. In these patients the procedure was life-saving in relieving marked dyspnoea and anoxia due to paradoxical motion of the chest wall, in one and probably life-saving in the other also, although he is not yet well due to further complications of his pulmonary tuberculosis.

Summary

Three patients in whom elective thoracic surgical procedures were carried out and in whom tracheostomy proved to be either life-saving or very helpful during their course of treatment, have been described. Tracheostomy is an useful tool for the thoracic surgeon not only for relieving obstruction of the upper respiratory airway but also by cutting down on the amount of respiratory dead space, and reducing the resistance to air flow. This results in more efficient breathing, diminishes the demand for oxygen. Post-operative pain is also reduced. In patients with an ineffectual cough mechanism due to excessive pain or to flail chest with paradoxical respirations and with blood and secretions in the tracheo-bronchial tree, dramatic improvement in the respiratory status can be quickly achieved by the simple procedure of tracheostomy.

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Received for publication on 6-12-'54.

CASES & COMMENTS

PARATHYROID CYST

by S. P. SRIVASTAVA and G. K. TIAGI, Agra.

Parathyroid cyst is a very rare clinical entity. The literature contains very few cases of surgical removal of such cysts. In 1906 Goris described the first case and 11 cases have been reported so far. In the John Hopkins hospital Cooley Mcgoon (1951) reported three cases while prior to January 1950 there were none on record. Cysts of microscopic size or slightly bigger have been detected on serial sections of the parathyroid gland in cadavers.

These cysts are common in the inferior parathyroid glands. Gilmour in 428 autopsies found 111 cysts which were visible to the naked eye in the lower glands. Table I, describes the previous records of parathyroid cysts reported, which indicate their predilection for the inferior parathyroids. The cysts have been found to vary from 1 to 5 c.m. in diameter and loosely attached to the lower thyroid pole. The three atypical positions reported are in the right superior parathyroid, anterior part of superior mediastinum and between the sternomastoid muscle and angle of the mandible.

TABLE I (Cooley and Mcgoon)

The eleven cases of Parathyroid cysts on record in the literature.

Author	Sex	Age	Location of Cysts	Size	Indication of Operation
1. Goris (1906)	M	22	Left lower pole of thyroid	Three closely applied cysts	Lump in neck Goitre
2. Anzilotti (1909)	M	25	Right inferior Parathyroid gland	Egg sized	suspected branchial cyst.
3. de Quervain (1925)	F	55	Left side of anterior superior mediastinum		Fund along with substernal thyroid adenoma
4. Nylander (1929)	M	16	Between sternomastoid and right angle of mandible	Goose egg size	Cervical cyst Branchial cleft origin
5 Welti (1946)	F	53	Left inferior Parathyroid		Goitre
6. Mc knight (1946)	M	17	Lateral aspect of left lower thyroid lobe	Golf ball	Goitre
7. Black and Watts (1949)	F	32	Behind and distal to left inferior pole of thyroid lobe	4 c.m. Diameter	Goitre
8. Black and Watts (1949)	M	30	Region of right superior Parathyroid	1 c.m. Diameter	Hyper parathyroidism. Adenoma removed from left superior parathyroid
9. Cooley and Mcgoon (1951)	M	66	Right inferior parathyroid	2×2 c.m.	Hyperthyroidism with adenoma left lobe of thyroid
10 Cooley and Mcgoon (1951)	F	49	Right inferior parathyroid	5 c.m. Diameter	Goitre. Adenoma right thyroid lobe
11. Cooley and Mcgoon (1951)	F	43	Left inferior parathyroid region	3×4 c.m.	Goitre. Adenoma of left lobe

Fig. 1.
Parathyroid cyst on the right side in connection with right inferior parathyroid.

Fig. 3.
Photo-micrograph of the cyst wall (low power).

Fig. 2.
Photo-micrograph (high power) of the cyst wall showing parathyroid tissue.

Fig. 4.
Case of parathyroid cyst after excision.

There are no specific symptoms associated with parathyroid cyst except that it gives rise to swelling in the neck. It is a space occupying lesion and may rarely press on the recurrent laryngeal nerve and Welti has called attention to the possibility of vocal cord palsy. In the case reported here, the hoarseness of voice was considered to be due to nerve palsy ; but after removal of the cyst it did not disappear. The cause of hoarseness was chronic laryngitis probably tubercular in origin.

There is no known correlation between the cyst and functional activity of the parathyroid gland. In one patient with hyperparathyroidism along with the cyst reported by Black and Watts (1949), the symptoms were due to a parathyroid adenoma of 200 mgm. removed from the opposite parathyroid gland.

Microscopic Structure :

In majority of the cases the cyst space is said to be lined by cuboidal or flattened cuboidal epithelium with parathyroid tissue embedded in the capsule. The same finding has been noticed in the section of the cyst-wall reported in this paper.

It is interesting to note the observations of Gilmour with regard to the histology of the cysts found at autopsy. There may be columnar celled alveoli filled with colloid which when distended gives rise to true colloid vesicle ; still larger sizes give rise to cystic vesicles which are irregular in shape with flattened lining epithelium. Haemorrage may occur in these cysts and it was due to this fact that the case reported here came for consultation due to sudden enlargement of the parathyroid cyst.

Etiology :

There are two explanations given as to the origin of these cysts — one, that the cyst develops due to retention of secretions. The second one is that these are developmental in origin, arising from the third or fourth pharyngeal pouch. The cyst later incorporates the parathyroid gland within its wall. The removal of cysts in the region of the parathyroid gland has been reported which resemble parathyroid cysts but which have no parathyroid tissue in its wall. Black and Watts have reported two cases and Welti three cases. It is due to the situation of the cyst on the back of the lobe of thyroid gland and its close relationship to the parathyroid tissue that the name of Parathyroid cyst is given to it. The name has a descriptive value and denotes a distinct entity with a characteristic location and involving the Parathyroid gland. Its origin strictly from the Parathyroid tissue is doubtful. The case reported here developed the cyst suddenly, due to haemorrage occurring in its cavity. It was purely a space occupying lesion extending in the retrosternal space. The cyst wall was in close relationship to the inferior parathyroid gland, the histological structure of which was found in the cyst wall. The other complaints, e.g. hoarseness and chronic cough were due to infiltration of the lungs, by chronic fibroid tuberculosis, and had no relationship with the cyst or its pressure on the surrounding structures. In the majority of cases reported by other writers in Table I and specially those by Cooley-Mcgoon, the indication for operation was goitre and adenoma of the thyroid gland. In the case reported here the thyroid gland was perfectly normal and by the situation of the cyst, there was no indication that its origin could be from a branchial cyst. It was closely adherent to the right lobe of thyroid gland and involving the right inferior parathyroid gland.

CASE REPORT

Patient named Hasan Khan aged 70 years, Muslim male was admitted with the complaint of swelling and pain on the right side of the neck of six days duration. He developed hoarseness of voice after increase in the size of the swelling. The swelling might have been present for a long time but the patient noticed it when suddenly it started increasing in size and became painful.

On examination the patient was an old man having a chronic cough and hoarseness of voice. He had normal temperature and pulse rate. The swelling was in connection with the right lobe of the thyroid gland $3\frac{1}{2}$" x $2\frac{1}{2}$" in size moving on deglutition. It was cystic, smooth on the surface

and well defined in outline. There were no signs of toxicity.

Respiratory System :

There were rhonchi and crepitations on both sides of the lungs.

Circulatory System :

Nothing abnormal detected.

Laryngoscopy :

Showed chronic congestion indicating chronic laryngitis. No growth or paralysis of vocal cords was detected.

Blood Picture :

Total white blood cells — 6200 per c.mm. Differential white cells — Polymorphs 61%, Lymphocytes 33%, Eosinophils 6%. Total red blood cells — 4,120,000 per c.mm. Haemoglobin — 12 gm. per 100 ml. General blood picture did not show any abnormality.

Operation Notes :

Under local anaesthesia a collar incision was made in the lower part of the neck. The strap muscles were divided on the right side and the cyst was exposed after retracting the right sternomastoid muscle. The cyst was found to be lying behind the right lobe of the thyroid gland which was displaced medially and forwards. The cyst was found to be extending from the superior cornu of the thyroid cartilage to behind the middle of sternum.

It was aspirated and about 60 c.c. of blood stained fluid was taken out. The enucleation was made easy after aspiration. The descending branch of ansa-hypoglossi was found to be stretched over the cyst and it was separated. The right recurrent laryngeal nerve was found behind the right lobe of thyroid gland and was cleanly dissected off the cyst. The right superior parathyroid gland was safely preserved while the right inferior parathyroid was found to be lying stretched on the wall of the cyst. It had to be taken out along with the whole cyst.

The strap muscles were stitched and the skin wound was closed with a drainage tube in the retrosternal space. The latter was removed after 24 hours.

The patient made an uneventful recovery. His hoarseness improved a little but it did not disappear completely. There was no fever but his cough with expectoration persisted. Later X-ray of the lungs was done about a month after the operation and it revealed infiltration of the right upper zone and also of the left side. Sputum examination did not show any acid-fast bacilli. Probably the hoarseness of voice was due to chronic tubercular-laryngitis. He was put on antitubercular line of treatment. He was apyrexial before and after the operation.

Biopsy Report of the Cyst :

Cyst with haemorrage, showing involvement more of the parathyroid gland than the thyroid gland.

Diagnosis :

Parathyroid Cyst.

Summary

1. The literature regarding Parathyroid cysts has been reviewed.

2. The etiology and histology of the cyst has been discussed.

3. A case of parathyroid cyst in a man aged 70 years has been described.

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Received for publication on 28-2-'55.

TUBERCULOSIS OF THE STOMACH

(With a report of two cases)

by SUBIR K. CHATTERJEE and A. K. DUTT, Calcutta.

Introduction

The volume of literature that has accumulated on the subject of Tuberculosis of the stomach since it was first mentioned by Buckhausen in 1824 and fully described by Litten in 1876 appears to be out of all proportion to the incidence of the disease. The relative immunity of the stomach to tuberculous infection has stimulated research along three distinct lines :—

(a) a study of individual cases with reference to clinical features, results of special investigations, gross operative and autopsy findings, and morbid histology ;

(b) a study of the gastric status of patients suffering from tuberculosis elsewhere, particularly in the lungs ;

(c) the experimental production of tuberculous lesions in the stomach.

There have been excellent reviews of the subject from time to time — the more important of these being those of Broders (1917), Biernath (1921), Good (1931), Rodriguez Olleros and de la Viesia (1935), Clagett and Walters (1938), Binder, Ruby and Sherman (1945), Palmer (1950), and Gaines, Steinbach and Lowerhauft (1952). A detailed consideration of these papers is not within the scope of this communication ; we shall merely summarise the conclusions reached, and try to focus attention on the problems associated with this disease, particularly as presented by our two cases. The first of these has intrigued us greatly by the development of a fatal postoperative complication, the like of which we have not previously been aware of. The second case has been included here by kind permission of Professor K. K. Ghosh, F.R.C.S. (Eng.), of the Calcutta Medical College and Hospitals.

Review of the literature

A. Incidence.

Tuberculosis of the stomach is undoubtedly a rare disease ; Palmer could not find more than 400 cases with any pathological validity. Its incidence has been computed as follows :

1 case in 21000 admissions in a General hospital (Windwer, 1946)

30 cases in 23279 admissions in the tuberculosis service (Bowne et al., 1942)

19 cases out of 17542 undergoing gastric operations (compiled by Palmer)

159 cases out of 96251 general autopsies (compiled by Palmer)

117 cases out of 20585 autopsies on patients with pulmonary tuberculosis (compiled by Palmer).

B. Diagnosis.

Most workers have failed to find anything specific in the clinical condition that would distinguish this disease from the commoner Gastric lesions — Gastric ulcer, Gastric carcinoma, and Gastritis either primary or secondary to a tuberculous lesion elsewhere, specially in the lungs. However, systemic manifestations of tuberculosis elsewhere in a young subject with a demonstrable gastric lesion should arouse suspicion about the nature of the latter. The presence of acid-fast bacilli in the gastric contents might conceivably aid the diagnosis, but while on the one hand these are sometimes found in uncomplicated pulmonary tuberculosis, on the other, they are not usually present in large numbers in gastric tuberculosis and are rapidly destroyed in the gastric secretions.

Evidently confirmation of the diagnosis could only come from a study of the gross appearance of the stomach lesion by one of the two available means — Radiology and Gastroscopy. Unfortunately, Radiological appearances are quite non-distinctive; a number of observers have, however, mentioned certain features of the Barium meal examination, such as the smooth rounded appearance at the site of obstruction, the presence of good peristaltic waves through an area of apparently extensive malignant infiltration, the presence of both gastric and duodenal lesions, or the demonstration of fistulous or sinous tracts, as characteristic of tuberculosis. Gaines et al (1952) divided their collected and personal cases into predominantly hyperplastic and predominantly ulcerative types. Of their 49 cases, 38 belonged to the former and 11 to the latter group.

The following Gastroscopic features have been considered helpful in the diagnosis:

(a) the undermined edge of the tuberculous gastric ulcer,

(b) the serpiginous outline of the ulcer with numerous fistulous and sinous tracts, and

(c) the presence of superficial tubercles in the neighbourhood of the main lesion.

Palmer states that in spite of the above, the correct diagnosis was made prior to pathological study in less than a dozen cases, and adds that the chief deterrent to a more enthusiastic search was the fact that the treatment of gastric tuberculosis was the same as for carcinoma, namely surgical resection. Now, however, in the era of good anti-tuberculous drugs, it is being realised that the treatment of gastric tuberculosis is not necessarily always surgery; Gaines et al. accordingly suggest a therapeutic test with streptomycin in adequate doses for three weeks. A retrogression in size of the gastric lesion, demonstrated by radiology or gastroscopy, would be almost diagnostic of tuberculosis.

C. *Pathology.*

Distribution. Although no part of the stomach is immune, tuberculous lesions are usually found in the pyloric antrum and pylorus, and less frequently along the lesser curvature.

Gross pathological types. According to the majority of observers, the ulcer type is the commonest, in fact Binder et al (1945) found 85% of their cases to be of this type. The ulcer is the result of caseation and fistula formation from a submucous focus, it is irregular and often multiple, and expands by further breakdown of tuberculous nodules. It is usually shallow, though it can extend to any depth. Occasionally, multiple small mucosal erosions are found, and these are considered to belong to a separate class by some observers.

The infiltrative or hypertrophic type is the other major variety of gastric tuberculosis and is considered to be commoner by Logeais (1945). It is characterised by submucous infiltration, resulting in an annular indurated thickening, which may extend for a variable distance. A more circumscribed variety of this has been designated as the tumour type by some; while a more acute variety has been delineated as the inflammatory type by others. It has been pointed out also that the predominantly hypertrophied type can be ulcerated as well and that a hard and fast distinction is not possible in gastric tuberculosis.

Route of infection. Four routes have been postulated by Broders. The haematogenous route has been considered the most probable, particularly in view of the submucous origin of the lesions, and has been substantiated experimentally. Direct extension from neighbouring organs and retrograde lymphatic spread are rarely demonstrable. The possibility of infection by direct contact of the bacilli with the gastric mucosa, intact or ulcerated has given rise to debate, but is considered rather remote by the majority of workers, on the basis of both clinical and experimental evidence.

Predisposing factors. Gastric tuberculosis is obviously due to the breakdown of the normal protective mechanism of the stomach, but what this is and which specific barrier gives way in any particular case has been a matter for considerable speculation. Factors which have been suggested are loss of mucosal integrity, failure of a local immune reaction, gastric stasis, increase in the amount of gastric lymphoid tissue which is normally scanty, and diminishing effect of the gastric secretions on the bacilli.

CASE REPORTS

CASE 1.

S.D., a Bengali male aged 35, was admitted under the Professor of Medicine, Nilratan Sarkar Medical College Hospital, on 1-10-1954. His history extended over a period of eight years. His initial complaints were acidity and heaviness in the abdomen after meals and epigastric pain, reaching its peak three to four hours after food. Vomiting was sometimes induced to relieve pain. During the last five years, there had been progressively increasing abdominal distension and vomiting after meals and latterly he could notice a mass moving in the upper abdomen from left to right. The number of vomits prior to admission had been on an average, one per day. He also suffered from a low-grade of pyrexia, and mild diarrhoea, and was becoming weaker and thinner.

On examination, he was a thin man, weighing 84 pounds, mildly anaemic; and visible gastric peristalsis was demonstrated fairly easily. There was tenderness and some slight muscle guard in the epigastrium, and in addition there was a certain amount of diffuse tenderness over the rest of the abdomen. His blood pressure was 120|95 mm. Hg.

Blood examination revealed the following:— Haemoglobin 60%; Red Blood cells 3.0 million| c.mm. and White cells 10,500; Neutrophiles were 80%, Lymphocytes 16%, Monocytes 2% and Eosinophiles 2%; Sedimentation rate was 71 mm. per hour. The Wasserman reaction was negative. Total proteins were 6.56 gms%, albumin being 2.87 and globulin 3.69. Urea was 44 mgs%.

A fractional test meal revealed a fairly high acid curve.

Barium meal examination confirmed the diagnosis of pyloric obstruction, there being however no filling defect (Fig. 1).

After the standard preoperative treatment the patient was transferred to the surgical unit and laparotomy performed on 11-11-1954 (S.K.C.). On

Fig. 1.
Case I. X-Ray — Barium meal.

exploration, the stomach was very large, as expected. The pyloric antrum was the site of a firm fusiform mass about 1½ inches in diameter, fairly mobile and obviously occluding the lumen. There were multiple hard white plaques on its peritoneal surface. The regional lymph nodes, specially the left gastric, gastro-epiploic, and pyloric were all enlarged and firm and matted; the mesenteric nodes were similarly affected. There were multiple nodules varying in diameter from ⅛ to ¾ inch on the peritoneal surface of the hepatic flexure and body of the stomach and in the greater omentum. The liver was apparently healthy. A clinical diagnosis of Carcinoma of the pyloric antrum with multiple lymphatic and peritoneal secondaries was made, though the affection of the mesenteric nodes was difficult to explain. A lymph node from the subpyloric group was taken for biopsy. A Devine type of exclusion gastro-jejunostomy was performed in the hope of securing the maximum palliation; the anastomosis was antecolic and iso-peristaltic and the selected loop of jejunum was apparently normal. The pyloric segment was closed and the laparotomy wound sutured.

The immediate postoperative course was uneventful. Penicillin and Streptomycin were administered, the dosage of the latter was one gram per day. Soft solids were begun on 19-11-1954. The biopsy result came in about this time. It read as follows:—

Macroscopic — specimen of lymph node, size of a pea, consistency firm, external surface congested, cut surface—homogenous pale white with caseous areas.

Fig. 2.
Case I. Photomicrograph — Section of subpyloric lymph node (low power).

Microscopic — extensive caseation and necrosis with giant cells both of foreign body and Langhan's type with epithelioid cells and lymphocytes ; no fibrosis (Fig. 2).

As a result of this the dose of Streptomycin was doubled and a skiagram of the chest taken ; this revealed no abnormality.

On the morning of 20-11-1954 the patient complained of upper abdominal pain of a colicky nature ; it started the previous evening and was increasing progressively. He had no appetite and looked ill. His temperature was 100°F, pulse was 120 and respiration rate 30 per minute. The wound was soundly healed, and the abdomen was soft, but there was some epigastric tenderness and bowel sounds were exaggerated. An enema was given with effect, but during the night pain was very severe and there were several vomits. On the next day he was very low indeed ; marked dehydration had set in, the Blood pressure was 80|40 mm. Hg., the pulse rate was 140 per minute. There was generalised tenderness and rigidity in the abdomen, some dulness in the flanks but no obliteration of Liver dulness. A diagnosis of diffuse peritonitis was made and it was decided that laparotomy be performed as soon as his general condition improved with transfusion and gastric suction — very little fluid was aspirated from the latter. At 9-30 p.m. the abdomen was opened under local anaesthesia. There was a large amount of free fluid, fairly thin and bilestained ; this was aspirated. Fibrinous adhesions were separated gently to reveal the state of things. The stcma was twisted but otherwise soundly healed. There were two jejunal perforations, clean-cut, with cedematous margins, pale surroundings and no evidence of congestion or strangulation or gangrene. The larger one was on the afferent loop ½" away from the upper end of the stoma and the smaller one on the efferent loop 2" from the lower end of the stoma. These were repaired with two layers of catgut. After making sure that no element of obstruction existed and that the pyloric stump was soundly healed, the wound was closed leaving a drain. The cause of the perforations remained a mystery.

The patient stood the operation fairly well and improved somewhat the next day. After that however the manifestations of dehydration and peritonitis set in again and he went rapidly downhill in spite of treatment. He died at 9-40 p.m. on 25-11-1954. A limited post-mortem examination was possible. There was gross peritonitis and fresh perforations of the jejunum ; one of the original rents too had given way. The stoma remained quite healthy. The pyloric segment and the affected portion of the jejunum were removed for histological examination.

Pathological examination of the pylorus yielded the following information :—

Macroscopically — the mucous surface showed congestion at places with no definite ulceration ; the peritoneal surface showed no definite tubercle or congestion.

Microscopically — the mucous membrane of the stomach showed evidence of breaking at places with round cell infiltration in the mucous coats. In the submucous coat there were round cell infiltration with giant-cells of Langhan's type with extension into circular muscle fibres (Fig. 3).

The fragments of jejunum sent were too small to allow macroscopic comment.

Microscopically the epithelium of jejunal fragment examined was more or less intact except at places where there was definite breakdown of the muscularis mucosa and infiltration with round cells extending up to the peritoneal surface. A tubercle was present in the peritoneal coat.

CASE 2.

R.M., a Bengali female aged 28 was admitted on 29-6-1953 as an emergency in the Calcutta Medical College Hospital complaining of acute epigastric pain, colicky in nature, and vomiting for the last 24 hours. She gave a history of heartburn and acidity for five years, but not of any real pain after meals.

Fig. 3.
Case I. Photomicrograph — Section of stomach wall (high power).

Fig. 4.
Case II. X-Ray — Barium meal.

Examination revealed a rather thin wasted young woman, her respiration was hurried but her temperature was normal. There was tenderness in the epigastrium. A provisional diagnosis of diaphragmatic pleurisy was made ; this was confirmed by a skiagram of the chest on 3-7-1953 which was reported upon as "Adhesions in the left costophrenic angle, irregular opacities at left base, findings suggest unresolved pneumonia left base." Blood examination on 20-6-1953 was as follows :—

Haemoglobin 65%, White blood cells 18600 per c.mm.; neutrophiles 93% and lymphocytes 7% Sedimentation rate was 59.5 mm. per hour. She was treated with antibiotics for pneumonia but the abdominal pain continued almost daily and had to be relieved by antispasmodics and hypnotics. A fractional test meal on 6-7-1953 revealed a complete absence of free acid ; the maximum total acid was 0.2%. A Barium meal examination was done on 10-7-1953 and reported upon as follows :— 'Evidence of malignant new growth in the pylorus giving rise to a constant filling defect, as evident from the series of films, involving the mucous membrane of the greater curvature. This region is completely aperistaltic. The pyloric canal is narrow and rigid, allowing free passage of the meal. The Duodenal cap looks inverted' (Fig. 4). A later blood examination showed haemoglobin to be 70%, White cells 5700 per c.mm., with Neutrophiles 56%, Lymphocytes 35%, Eosinophiles 6% and Monocytes 3%. An X-ray of the chest on 31-7-1953 still showed the remnants of unresolved pneumonia.

On 4-8-1953, Laparotomy was performed (K.K.G.). On exploration the posterior surface of the stomach was found to be adherent to enlarged matted coeliac lymph nodes and to the pancreas. The splenic and pyloric group of nodes were also enlarged. A diagnosis of Carcinoma of the stomach was made and a palliative, partial gastrectomy was performed (polya, antecolic); the affected coeliac group of nodes was cut through during the dissection. The specimen removed showed a shallow ulcer in the pyloric region extending up to the muscle coat, with induration of the margins and base ; it was 1½" in diameter.

She did well for the first few postoperative days; but later signs of peritonitis and a flare-up of the pulmonary condition manifested themselves. There was temperature of 101°F and a serous discharge from the wound; the latter was tested for pancreatic ferments but none were found. Despite treatment she continued to deteriorate and died on 16-8-1953.

The histology of the lesion in the stomach was as follows:— There was extensive denudation of the epithelium with caseous necrosis in the submucous coat associated with typical tubercle formation consisting of caseation, round and epithelioid cell infiltration and Langhan's type of giant cells. Many foci of such lesions were present in all the coats of the stomach affecting a wide area.

Discussion

Clinical.

Apart from the fact that both these cases occurred in young adults, and that both terminated fatally after an operation, there is very little clinical similarity between the two cases.

The first case had a long chronic history strongly resembling that of peptic ulcer followed by pyloric stenosis; fractional test meal and radiology confirmed the diagnosis. There were however a few puzzling features which tended to point to some other condition — the history of low-grade pyrexia, the generalised abdominal tenderness and resistance on palpation, the emaciation which was out of proportion to his vomiting and finally the markedly elevated sedimentation rate. In actual fact these findings were thought by the Professor of Medicine to add up to a diagnosis of tuberculous peritonitis coexisting with pyloric stenosis, but unfortunately the matter was not pursued further.

At the first operation of course there was no evidence of peritonitis, but again although most of the operative findings were those of Carcinoma of the pyloric antrum, there was one striking anomaly — the enlarged mesenteric lymph nodes. Retrograde involvement of these in Gastric carcinoma though not impossible, was certainly unlikely, especially such extensive involvement from a relatively small and mobile pyloric mass. Nevertheless the lesion was treated on the assumption of its being malignant, and the biopsy report eagerly awaited. When the lymph node was reported upon as tuberculous, two possibilities had to be considered — was it tuberculosis of the stomach or merely non-specific pyloric stenosis with tabes mesenterica? We were contemplating ways and means of determining the actual nature of the gastric lesion when the patient suddenly took a turn for the worse and presented us with diffuse peritonitis and acute jejunal perforations at the second laparotomy. In the absence of any evidence of strangulation or gangrene the pathogenesis of the above defied clarification at that time. The distance of the perforations from the stoma ruled out the possibility of their being due to trauma of the jejunal clamps, since the anastomosis had been performed flush on the clamps. However, three days later the patient's demise made possible a more detailed study of the stomach and affected jejunum and the tuberculous nature of both convincingly revealed.

The second case on the other hand was admitted as an emergency and at the outset it was difficult to decide whether this emergency was thoracic or abdominal. However she did admit of gastric symptoms over a period of five years and the subsequent course of events and investigations left no doubt about the seriousness of the abdominal condition. The radiologist confidently reported on the Barium meal examination as carcinoma of the pyloric part without obstruction; moreover the fractional test meal showed an absence of free acid. However the sedimentation rate was again considerably raised, and there was evidence of unresolved pneumonia in the lower zone of the left lung. At laparotomy in this case there was no reason to doubt the diagnosis of Carcinoma, and although it was considered incurable, a palliative resection was attempted and involved nodes were cut through during this procedure. As postmortem examination was not permitted, it is difficult to name the exact cause of death, but miliary dissemination and acute tuberculous peritonitis are the most likely.

Particularly in view of the fatal termination of these two cases we have pondered deeply over the question of earlier diagnosis to enable a more rational treatment to be carried out. Radiology has not helped us much, but recourse to gastroscopy and to a therapeutic test would have probably yielded results; unfortunately the former was not available to us at that time, and the value of the latter had not been adequately realised.Facilities for frozen section and biopsy at the time of laparotomy might also have been of help.

Pathology.

It is fortunate that our two cases illustrate the two main types of gastric tuberculosis. The first belonged to the hyperplastic or infiltrative type, the submucous layer being extensively involved and the mucosa macroscopically intact; the predominant feature being luminal obstruction. The second case was ulcerative in character with involvement of all coats of the stomach and spread beyond to the structures of the posterior abdominal wall. The characteristic undermined edge of a tuberculous ulcer was however not obvious, and there was induration.

In neither case was it possible to examine the lungs postmortem and this is particularly unfortunate in the second case as radiological evidence of disease was present and it could not be determined whether it was tuberculous or otherwise.

The microscopic appearance of the stomach call for little comment — they are the classical lesions of a rather acute form of tuberculosis. Our efforts to demonstrate the tubercle bacilli by Zeihl-Neilsen stain have been unsuccessful. This according to Broders, would relegate our cases of Gastric tuberculosis from 'positive' to 'probable', but other authors do not attack the same significance to the bacilli, as these are likely to be destroyed in an acute necrotic lesion. In any case the difficulty of suggesting an alternative diagnosis for these histological appearances is almost insurmountable. The only other lesions that we can possibly bring to mind are Boeck's sacroidosis, atypical Hodgkin's disease and syphilis. In the first two caseation and necrosis are not found and the lesions are well-defined, while the Langhan's type of giant cells exclude syphilis.

Examination of the jejunum in our first case likewise established without doubt the tuberculous nature of the acute ulcerations and perforations. The problem that arises in this connection is whether the tuberculous lesion in the jejunum was entirely the result of the first operation or whether the region of the jejunum utilised for the anastomosis was already affected with tuberculosis at this time, the lesions merely becoming active as a result of the anastomosis. All that one can say is that the jejunum was macroscopically normal at the time of the first operation, but the extensive mesenteric lymph node involvement certainly points towards a primary intestinal lesion. Moreover it is not at all clear how the anastomosis could help in the production of the perforations. Possibly the gastric lesion which was previously submucous was cut through during the transection required for the Devine anastomosis and this allowed the rapid spread of infection into the upper jejunum. Again the site of transection was macroscopically normal and the stoma was quite healthy at the second operation and at autopsy.

Extensive lymph node involvement was a conspicuous feature of both these cases — particularly the first. The significance of this in assessing the mode of infection and spread of the tuberculous process is a matter for debate, but there is certainly a strong suggestion of a 'primary complex'. It is possible for the gastric lesion to be secondary to an intestinal lesion in the first case and a pulmonary lesion in the second, but it could on the other hand be the primary focus of tuberculous disease, with spread by direct extension and via. the lymphatics to adjacent nodes. The actual route by which the bacilli reached the wall

of the stomach and what factors predisposed the stomachs of these individuals to tuberculous infection are matters for pure speculation and we would rather not hazard a guess.

ACKNOWLEDGMENT

We would like to express our thanks to the Principal-Superintendents, Nilratan Sarkar Medical College Hospital and the Calcutta Medical College Hospital, for permission to publish these cases, to Professor A. K. Basu, Professor A. Das Professor K. K. Ghosh and Dr. K. Sen Gupta, for their help in preparing the paper and to Mr. M Majumder for the illustrations.

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Received for publication on 23-3-'55.

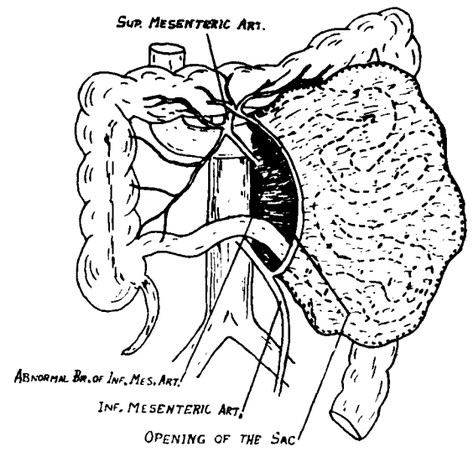
A CASE OF INTERNAL HERNIA OF SMALL INTESTINE

by R. P. KOPPIKAR and HARISH CHANDRA, Jaipur.

During the course of routine dissection of an adult male body in the Anatomy Department, S. M. S. Medical College, Jaipur, it was found, on opening the abdomen, that the small intestine was in a lump, encaged in a peritoneal sac having a narrow orifice. An abnormal branch of the inferior mesenteric artery supplying the left half of the transverse colon and the splenic flexure was away from the posterior abdominal wall and bordering the opening of the peritoneal sac. The upper left colic branch of the inferior mesenteric artery supplying the descending colon was going posterior to this sac. The small intestine was attached to the posterior abdominal wall by a small mesentery and the maximum width of the mesentery was 3 inches. The superior mesenteric artery before entering into the sac was giving middle colic and iliocolic branches. The opening of the sac was 1½ inches wide and the sac was 6½ inches long, 5 inches broad, and 4 inches high. Caecum and appendix were in the right lumbar region.

The history of this dead body was not available but it appeared that this internal hernia was not the cause of death as the herniated intestine showed no signs of obstruction, strangulation or gangrene.

It seems to be a congenital internal hernia which must have occurred at the time of withdrawal of the gut from the extra embryonic coelom. The returning coils of the intestine were pushed down and to the left into a sac formed by gradual pushing of the mesentery of this abnormal branch of the inferior mesenteric artery.



SUMMARY

A case of internal hernia of small intestine in the mesentery of the abnormal branch of the inferior mesenteric artery is reported.

Received for publication on 25-2-'55.

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THE XVII ANNUAL CONFERENCE

The XVII Annual Conference of the Association of Surgeons of India will be held on the 29th, 30th and 31st December, 1955 at Amritsar. The General Body meeting will be held on the last day of the Conference, i.e. 31st December, 1955. The meetings of the Editorial Board and the Governing Body will be held in the evening on the 28th December, 1955. All members are requested to attend. Details regarding arrangements for the Conference and accommodation at Amritsar during the Conference can be had from the Local Secretary, Dr. S. S. Anand, F.R.C.S., F.A.C.S., F.C.C.P., 35, The Mall, Amritsar.

At the Conference the following subjects will be discussed :—

1. *Surgery of the heart and great vessels*—
   Opener : Dr. P. K. Sen, Bombay.
   Seconders : Dr. S. S. Anand, Amritsar.
   Dr. A. K. Basu, Calcutta.
2. *Tuberculous disease of the Spine*—
   Opener : Dr. B. Mukopadhaya, Patna.
   Seconder : Dr. K. S. Grewal, Amritsar.
3. *Urinary Calculii*—
   Opener : Dr. L. B. Joshi, Poona.
   Seconder : Dr. M. Krishnamurthi, Madras.

Besides these, a few "Short Papers" will be read at the Conference.

Subjects for discussion at future meetings

18th Meeting :

1. *Cancer of the Lung*—
   Opener : Dr. A. K. Basu, Calcutta.
2. *Hypospadias*—
   Opener : Dr. R. N. Sinha, Patna.
   Seconder : Dr. R. N. Sharma, Lucknow.
3. *Spinal injuries particularly of the cervical region*—
   Opener : Dr. H. K. Sarkar, Calcutta.
   Seconder : Dr. A. K. Saha, Calcutta.

19th Meeting :

1. *Non-malignant Stricture of Oesophagus*
   by Dr. Subrata Banerjee, Calcutta.
2. *Surgery of Intracranial Vascular Lesions*
   by Dr. B. Ramamurthi, Madras.
3. *Genito-Urinary Testis*
   by Dr. E. J. Borges, Bombay.

NOTICES

RAILWAY CONCESSION TO ATTEND THE 17TH ANNUAL CONFERENCE OF THE ASSOCIATION OF SURGEONS OF INDIA

Concession of Return tickets in 1st, 2nd and 3rd classes on payment of single fare (Mail fares being charged in case of 2nd and 3rd classes) to persons attending the 17th Annual Conference of our Association, has been granted.

The grant of this concession is subject to the condition that each member produces a certificate from the Hony. Secretary of the Association of Surgeons of India to the effect that he is a bonafide member of the Asscciation travelling to attend the annual meeting of the Association of Surgeons of India and that his travelling expenses will not be borne by Central or State Govt. or Local Body or a Statutory Authority.

Members who are attending our ensuing Conference, are, therefore, requested to obtain a Certificate from the Hony. Secretary before purchasing their tickets.

A. VENUGOPAL,
Hony. Secretary.

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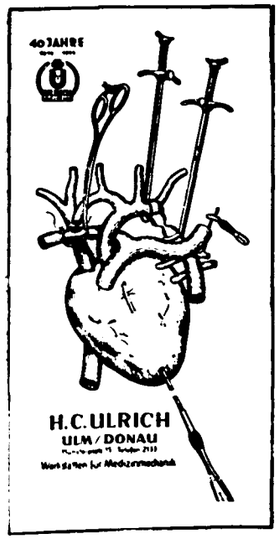

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Printed by Mr. G. Raghavan at The Huxley Press, 114, Armenian St., G.T., Madras, and Published by Dr. A. VENUGOPAL, Secretary, Association of Surgeons, 164, Poonamallee High Road, Madras 10.

The Indian Journal of Surgery

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The Indian Journal of Surgery

Vol. XVII No. 4

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1. Christopher, F.: Minor Surgery. 5th Edition, Philadelphia and London: W. B. Saunders Company, 1945, p. 348.
2. Beard, J. W., Taylor, A. R., Sharp, D. G. and Beard Dorothy.: The Nature of a Virus Associated with Carcinoma in Rabbits. Surg., Gynec., & Obst. 74: 509-513, 1942.

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THE
INDIAN JOURNAL OF SURGERY

Vol. XVII DECEMBER 1955 No. 4

RHINOSPORIDIOSIS — A STUDY WITH REPORT OF A FATAL CASE OF SYSTEMIC DISSEMINATION

by R. V. RAJAM[1], G. S. VISWANATHAN[2], A. R. RAO[3], P. N. RANGIAH[4] and V. C. ANGULI[5], Madras.

Introduction.

Rhinosporidiosis is a fungus infection of the mucous membrane of the nose, eyes, ears, larynx, and occasionally the vagina, penis, and skin characterised by the development of polypoidal granulomatous growths which may be sessile or pedunculated. The causative agent is Rhinosporidium Seeberi named after Seeber[31], who described the fungus in 1900 although Malbran[22] in 1892 in Argentina, O'Kinealy[27] in 1894 in India, and Ellet[15] in 1897 in U.S.A., had seen the fungus in the nasal polypi of man. These authors regarded the agent as a protozoon. But the vegetative nature of R. Seeberi was definitely demonstrated in 1923 by Ashworth[3] who classified the parasite among the phycomycetes. In 1906 Theiler[35] in South Africa reported the first case of Rhinosporidiosis in domestic animals. Ayyar[4, 5, 6] in India (1925, 1928, 1932) recorded rhinosporidial tumours in the nostrils of cattle and horses. Ciferri, Redaelli and Scattizi[11] in 1936 established the identity of rhinosporidium seeberi and rhinosporidium equi. DeMellow[14] after reviewing the systematic position of R. Seeberi has given the following classification:

Division Eumycetes.
Class Phycomycetes.
Order Chytridiales.
Family Coccidioidaceae.
Genus Rhinosporidium.
Species Seeberi.

Geographical distribution:

DeMello has recorded the geographical distribution of rhinosporidiosis as reported in both man and animal upto 1953. In a total of 463 human infections and 49 animal infections, Asia heads the list with 384 human and 25 animal cases; the Americas taking the second place with 63 human and 21 animal infections. 13 human and 3 animal cases are reported from Africa and only 2 human infections from Europe and 1 from the Pacific islands are listed. Among the Asian countries, the disease is endemic in India and Ceylon, with the highest number of reported human cases in the world — 50 or 24% of the total. Even among animal infections, India easily leads with 25 cases. The reported 236 human cases from India up to 1953 does not in the opinion of the authors represent the actual incidence of the disease and seems an under estimate, as many cases are unreported or missed. The first case report from India was by O'Kinealy[28] from the Medical College Hospital, Calcutta (1903). Since then a number of workers have reported the occur-

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rence of the disease in various parts of India. In 1907 Beattie[7] recorded the occurrence of rhinosporidium in an aural polypus sent to him by T. M. Nair from Madras. In 1910 Ingram[17] from Madras published an account of the growth from the glans penis and conjunctiva. Tirumurti[33] in 1914 reported 15 cases from the Pathology Department of the Medical College, Madras. Allan and Dave[2] in 1936 gave a detailed description of 60 cases observed and collected by them from Madhya Pradesh. Mandlik[23] from Poona (1937) recorded 48 cases and made some significant observations on the occupational incidence of the disease. Dhayagude[13] (1941) from Bombay recorded 45 cases observed by him over a ten year period. Cherian and Satyanarayana[10] in 1949 published over a hundred cases of rhinosporidiosis observed and treated by them at the Government General Hospital, Madras, of which 72 patients were seen during the first half of 1948. Forsyth[16] (1924) placed on record the first case of skin infection and Tirumurti[34] (1924) reported the first case in a female whose history went back to 1904. Kirkpatrick[20] from Madras (1916) recorded the first case of lachrymal sac infection. The first unusual case of a parotid salivary cyst due to rhinosporidiosis was recorded by Mahadevan[21] in 1952 from a patient under his care in King George Hospital, Visakhapatnam. Thus it may be seen that workers from South India have reported the largest number of rhinosporidial infections from among the States of the Indian Union, and even from the whole world. Karunaratna[19] (1939) from Ceylon published detailed data on the incidence of the disease in 104 cases studied by him.

Incidence by age, sex, occupation and localisation :

The age range is very wide from 6 to 82 years although the majority of infections have occurred in children and young adults. Males are more often infected than females in the ratio of 9 to 1 as reported by Bhaskara Reddy[29] from the records of the Pathology Department of the Madras Medical College over a 12 year period. The great male preponderance in the incidence of infection is in keeping with the sex incidence of other deep mycoses and probably due to the greater occupational or environmental hazards to which the male is exposed. As in the case of other deep mycoses, rhinosporidiosis is predominantly a disease of persons living in the rural areas. There seems to be some evidence that dust and/or water, the latter particularly of the stagnant variety in tanks and ponds may be sources of infection. Mandlik[23] in Poona noted a high incidence of infection (20%) in a group of workers engaged in removing sand from the bed of a stagnant river although Norhona[24-25] failed to demonstrate the fungus either in the sand or water of the stagnant river. In South India, Cherian and Satyanarayana[10] in their collection of over 100 cases have reported that the majority of their patients hailed from Malabar and Cochin on the West Coast. It is reasonable to speculate whether the socio-hygienic habit of the Malayalee of frequent baths in tanks and rivers, with special attention paid to the ablution of the external orifices of the body, bears a causal relationship to the greater incidence of rhinosporidiosis among these folks. It used to be jokingly said of the Malayalee that whenever and wherever he sees a patch of water, he strips himself and jumps into the water and enjoys a nice dive and wash.

The nostrils are the most common sites of infection accounting for 67 to 82%, of cases reported by several workers in India and Ceylon. In domestic animals all the observed cases were found to be in the nostrils. This marked predilection for the mucous lining of the nose and naso-pharynx is difficult to explain except on the basis of an inherent susceptibility. The next site in order of frequency is the ocular apparatus including the eye lid, conjunctiva and lachrymal sac 14%[29]. A few cases have been recorded on the soft palate, uvula, tonsils, pharynx and larynx, trachea and bronchi. Penile localisation, first recorded by Ingram[17] is probably more frequent than the few reports in the literature would suggest. The disease on the glans penis or urethra may easily be mistaken for venereal warts and liable to be missed completely. Another peculiarity noticed in the observed cases of penile and urethral rhinosporidiosis is the greater frequency among Muslims who are in the habit of applying a piece of stone or brick to the external urinary meatus after every act of micturition to absorb the last few drops of urine. There is no epidemiological proof that the penile and urethral infections are caused by sexual intercourse as has been suggested by some workers. Cutaneous localisation of the infection has been only very infrequently reported by Forsyth[16] on the face ; by Allan and Dave[2] on the foot ; by Dhayagude[13] on the trunk and extremities ; and by Cherian and Satyanarayana[10] on the scalp.

Dhayagude's case[13] was a rare and unusual example of generalised sub-cutaneous rhinosporidial granulomata in a male aged 40 years. The sub-cutaneous swellings — some of them ulcerated as they grew bigger — occurred on the face, thorax, abdomen, back, genital region, and on both the upper extremities ; no primary lesion could be discovered in the nostrils or pharynx. On the hypothesis that the multiple sub-cutaneous localisations should have occurred through a hematogenous spread of the infection, repeated but unsuccessful attempts were made by him to demonstrate the fungus in the blood. A rare instance of a visceral localisation is a report by Alessandrini,[1] as quoted by DeMello, second hand, of tumour of the brain in the fluid of which the parasite was demonstrated. No further details are available about this case.

Clinical features :

When the lesions occur on the mucous membrane of the nostrils or conjunctiva, they start as pinpoint granulations which slowly grow in size and become sessile or pedunculated. They are pink in colour, friable, soft, very vascular and they bleed readily on removal. The papillary projections on the surface of the growth, give it an irregular lobulated appearance. A close examination of the surface of the growth preferably with a hand lens reveals multiple minute white spots which represent the bulging sporangia through the attenuated epithelium. The growths are usually single though multiple growths in the nostrils and conjunctiva are not uncommon. In the nostrils and upper respiratory passages, the growths may cause obstruction to breathing with symptoms of chronic coryza. Larger lesions on the conjunctiva and lid margins may cause lachrymation and photophobia. Infection of the lachrymal sac may cause obstruction to the flow of tears and set up a dacryocystitis. The lesions on the skin may be cutaneous, sub-cutaneous, subfascial or intramuscular. The cutaneous lesions start as tiny pin point papules and are painless. As they grow in size they assume a globular or slightly flattened shape with a pearly surface, some of the lesions looking not unlike molluscum contagiosum but without the umbilicated centre. The surface of the older cutaneous lesions tends to become slightly verrucous. Pedunculation of the cutaneous lesion is uncommon. The growths arising in the sub-cutaneous tissue or in the fascial or muscular planes are firm in consistency, rounded or ovoid in shape and tender to pressure. The lesions on the foot are particularly painful causing incapacitation in walking. The general health of the patient is not affected by the local tumours which have a slow and prolonged evolution. Spontaneous regression of the growths has been recorded in some cases. A tendency to recurrence after removal is a characteristic feature although the recurrence remains localised to the original site. The most remarkable example of recurrence is that described by Cherian[9] where a nasal lesion was operated on, ten times, in 15 years, the growth having recurred after each operation. The disease is benign as long as the lesions are confined to the external mucous or cutaneous surfaces. Castellani and Chalmers[8] suggested that the infection may endanger life by causing a

septicaemia, but have not recorded proof of such an occurrence. A search of the literature on the subject has failed to reveal any instance of a fatal termination or autopsy record of generalised or visceral dissemination.

Source and mode of infection :

The source of infection and the pathogenesis of the disease continue to remain unsolved problems although more than half a century has elapsed since the first recognition of the disease. R. Seeberi has not yet been cultivated and its infectivity has not been established by animal transmission experiments. Natural transmission from one member with the disease to other members of the family has not been recorded though they may be living in close propinquity under identical environmental conditions. According to DeMello,[14] two main hypotheses have been suggested with respect to the mode of infection — direct transmission, and a life cycle with a saprophytic phase ; in the former, the spores of the fungus may gain a foothold on the exposed mucous surfaces through dust or water or through infected clothes or fingers. Transmission through dust or water cannot account for the marked preponderance of the disease in males. The existence of an exogenous source has not been demonstrated. Some authors have suggested the possibility of transmission from an animal host, as the disease has been reported in certain domestic animals such as the horse or cattle. But there is no proof adduced for such transmission. As Karunaratna[18] points out, the tendency for local recurrence of the infection would suggest that the parasite undergoes its complete cycle of development in the human body without the intervention of an intermediate host. Fish have been suggested as possible sources of infection but here again proof is completely lacking. On the analogy of other deep mycoses, the existence of a life cycle with both a saprophytic and an infective phase in man and animals is postulated. DeMello[14] suggests the probability of a life cycle existing in nature similar to that observed in the other members of the order Chytridiales to which R. Seeberi belongs. The undiscovered saprophytic phase of the organism may take place in water or soil.

The exact site of infection has not yet been established. The great preponderance of occurrence of the lesion in the mucous lining of the nostrils or ocular apparatus suggests direct implantation of the spores of the fungus on the mucosal epithelium. Does the parasite gain entrace through the intact unbroken epithelial lining or is a breach of surface necessary for the fungus to pass on to the sub-epithelial connective tissue ? The rarity of epithelial localisation in the histological picture of the granuloma with the multiplication and perpetuation of the parasite strictly confined to the connective tissue spaces, seems to suggest a breach of the epithelial lining as a necessary condition for successful infection. Infection of contiguous areas of mucous membrane or skin takes place probably by a sort of permeation along the sub-epithelial connective tissue spaces. Auto inoculation may account for the infection of a site a little away from the primary lesion. Very rarely the infection may be carried to a secretory gland through the external opening of its duct as in the case reported by Mahadevan[21]. The very few reported cases of generalised dissemination must have been caused by blood stream transmission of the spores of the fungus from a primary lesion on the external mucous surfaces.

Mycology :

Rhinosporidium Seeberi has not yet been cultivated, and the infection has not been experimentally reproduced in man or animals. The earlier observers thought that the parasite is a sporozoan but Ashworth[3] (1923) in his classical researches on the subject brought forward evidence to show that the parasite is a fungus and his conclusions have been generally accepted. His evidence for classifying it as a fungus was based on the repeated synchronous mitosis,

Fig. 1.
Early Papular lesion, with stretched out epidermis and acanthotic collarette. (H & E x 32)

Fig. 2.
An intraepidermal ripe sporangium. (H & E x 320)

the late division of the cytoplasm in the formation of the spores, the absence of residual cytoplasm, the presence of a mucoid matrix and the formation of cellulose in the wall of the cyst. Ashworth[3] has established the developmental life cycle of the parasite as it is encountered in human tissues. The following is a summary of his findings[12] :

The early trophic stage of the parasite is a small round body (6 to 7u in diameter) with a chitinous wall, a nucleus and a karayosome. This increases in size until it becomes 50 to 60u in diameter. Mitotic nuclear division occurs revealing four chromosomes. Further increase in size and repeated nuclear divisions take place until the spore becomes 100u in diameter. At this stage a thick layer of cellulose is deposited inside the chitinous outer membrane. A thickening of the wall membrane is observed at one point with an opening at its centre called the pore. The nuclear divisions continue with cleavage and rounding up of the cytoplasm, which result in a sporangium containing about 4000 spores. Two further divisions increase the number of spores to approximately 16,000. The spores are spherical, 7 to 9u in diameter, have a thin chitinous membrane, contain a nucleus and several uniformly sized refringent granules or spherules. With the progressive but irregular maturation of

Fig. 3.
Nodule in deep dermis, bounded by fibrous tissue. (H & E x 160)

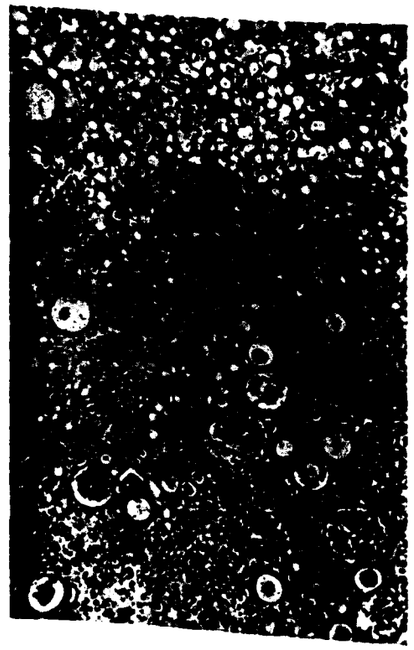

Fig. 4.
Parasites in various stages of development, set in a fibromyxomatous stroma, showing single globules lying free in the connective tissue space. (H & E x 160)

the spores, the sporangium becomes larger, 200 to 300u in diameter and rupture of the sporangium takes place at the pore, liberating the spores into the connective tissue or to the surface through a rupture of the epithelial lining. It is believed that these spores after liberation, evolve towards the early phase of the fungi beginning a new cycle; the refringent granules disappear.

Histopathology :

The paper by Karunaratna[18] based on the observation of 34 cases, gives excellent detailed descriptions of the histopathology of the disease as seen in sections from the lesions on the mucous membranes. The histological sections which the authors of this report have examined, are derived from the skin. subcutaneous tissue, skeletal muscle and viscera of the patient whose case report is presented below.

The two striking histological features which distinguish rhinosporidial granulomata of the skin and subcutaneous tissue, from those of lesions caused by other deep mycoses are the enormous numbers of the mycotic elements in the sub-epithelial connective tissue, and the slight inflammatory reaction in the affected tissues particularly in earlier lesions, which is almost obscured by the parasites. In early papular cutaneous lesions, the typical polypoidal character of the growth is lacking. The epidermis is stretched out over the bulging granulomata

Fig. 5.
High power of Fig. 4. (H & E x 320)

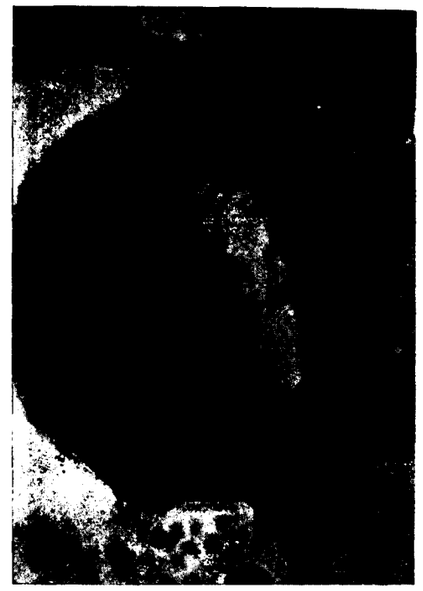

Fig. 7.
A degenerating sporangium filled partially with structuresless homogeneous material.
(McManus stain x 640)

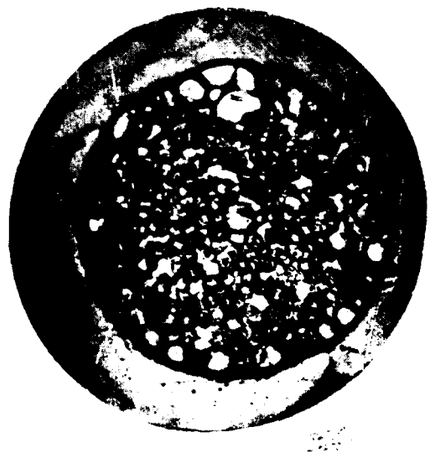

Fig. 6.
Fully gravid sporangium with closely packed spores in various stages of development.
(McManus stain x 640)

Fig. 8.
Shows buckled, looped and distorted forms.
(H & E x 160)

Fig. 9.

A medium sized sporangium within a mother sporangium. Note the margination of fibroblasts around the wall of the sporangium, separating it from the rest. (H & E x 640)

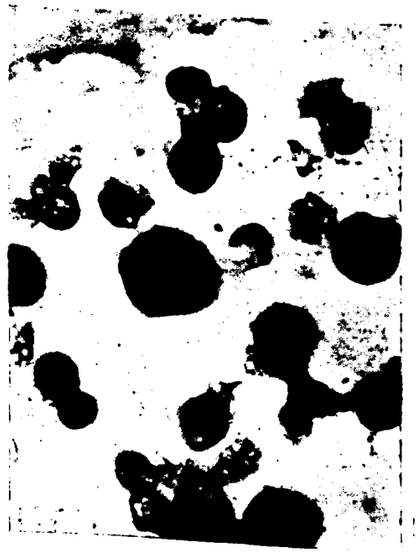

Fig. 11.

Spherules containing spores under high power magnification. (McManus stain x 1280)

Fig. 10.

Spherules inside the daughter spores within a sporangium. (McManus stain x 640)

Fig. 12.

Foreign body giant cells in the vicinity of degenerated sporangia. (H & E x 160)

except at the edges where a moderate collarette of acanthotic epithelium is seen going down into the connective tissue (Fig. 1). Localisation of the parasite in the epidermal layer has only been very infrequently observed (Fig. 2). The pressure of a ripe sporangium may cause a breach of the epidermis and the spores may be seen pushed out to the surface. In older cutaneous and sub-cutaneous lesions, there is a moderate epidermal hyperplasia with sub-epidermal fibrosis separating the deeper granulomatous nodule (Fig. 3). The core of the granulomata in earlier lesions consists of fibromyxomatous connective tissue in which the parasites in various stages of development and degeneration are found closely packed against one another in considerable numbers (Fig. 4). Such malignant multiplication of rhinosporidium seeberi, the dominating feature of the histological picture has not been observed in other mycotic infections. Looking at a typical section of the granulomata it appears there is a relentless struggle for survival among the parasites with the result that some are still born ; others grow up a little but die or become sterile. Only a thin chitinous envelope marks their identity. Many parasites grow up to 100 to 150u in diameter, develop a thick cellulose wall but fail to mature and produce spores, their interior almost empty with a little vacuolated protoplasm staining feebly with eosin or leuco fuchsin. Many sporangia 150 to 200u in diameter are found in different stages of maturation (Fig. 5). The developed sporangium 250 to 300u in diameter is fully gravid with closely packed spores in various stages of development (Fig. 6). A few of the degenerating sporangia are filled with a structureless homogeneous material (Fig. 7). Buckled, looped and distorted forms are also seen (Fig. 8). It is not uncommon to find an individual spore developing into a medium sized sporangium at the expense of other sister spores inside the mother sporangium (Fig. 9). As these spores mature, a number of highly refringent bodies appear in their cytoplasm. The function of these minute bodies has been a matter of controversy. Ashworth[3] called these, bits of proteinaceous matter which may be made use of in the formation of the future cell wall of the trophic stage of the parasite. In the maturing spore under high power magnification they appear as small spherical bodies with a definite cell wall and show a uniformity in size. In sections stained with haematoxylin eosin these spherules, about 2u in diameter show a slight eosinophilic cytoplasm with a thin darkly staining envelope. With Hotchkiss McManus stain they have a pink envelope and slightly purplish cytoplasm, with a suggestion of a nucleus. We confirm the observation of Shrewsbury[32] that these spherules appear at a very early stage of the development of the spores even before the cell envelope is formed. The spherules occupying the interior of the spore at different planes, give the latter a characteristic appearance of a hollow sphere filled with these smaller corpuscles. Shrewsbury[32] questioned the opinion expressed by Ashworth[3] that the spherules are merely building material for the wall of the future trophic stage of the parasite. It is suggested by the authors that these spherules, inside the daughter spores may represent a further stage in the cycle of development of the parasite and may be the precursors of the trophic stage (Fig. 10). Under high power magnification, when a sporangium containing the spherule-laden spores, is examined, the authors observed rupture of some spores, with the spherules lying outside the sphere envelope in a faintly stained matrix inside the sporangium (Fig. 11). Such globules singly or in clusters were also observed in the connective tissue spaces (Fig. 4). Shrewsbury[32] has recorded similar findings with photomicrographs. It is reasonable to conjecture that these globules have developed from the spherules and may either be a stage in the final transformation into the trophic stage or may represent the early phase of the fungus. The real nature of the spherules can only be established when the parasite can be successfully cultured.

In the sections prepared from many cutaneous lesions, evidence of increased vascularity, dilated thin walled sinusoidal blood

spaces, haemorrhages etc., was lacking. It is probably characteristic of mucous membrane lesions as described by Karunaratna[18]. The inflammatory reaction as seen in sections of the earlier lesions is not inconsiderable, consisting of a few scattered lymphocytes, histiocytes, and occasional polymorphonuclear leucocytes. But in older sub-cutaneous and intra-muscular lesions, there is a dense inflammatory reaction with a tendency to the formation of bands of fibrous tissue separating individual sporangia. In such lesions many foreign body giant cells are a constant feature. These giant cells are found in large numbers outside, in the immediate vicinity of degenerated sporangia (Fig. 12). Giant cells sometimes are also found inside a sporangium, containing in their cytoplasm a few spores of R. Seeberi (Fig. 13).

The so called trophic stage described by other workers consisting of a thin chitinous wall with a nucleus and karyosome was not easy to identify in sections but globules of the same size and staining reaction with no nucleus as described by Shrewsbury[32], were identified, both inside the sporangium and scattered in the connective tissue stroma (Fig. 4). Karunaratna[18] describes degenerating spores filled with fatty material; the authors have not been able to confirm his observations in the sections studied by them. In the histo-pathological study of rhinosporidial granulomata co-existing pathological changes indicating other diseases such as squamous epithelioma (Karunaratna[18]), Leishmaniasis (Migone[24]), and Leprosy (Allan and Dave[2], Rosenbaum[30]) have been described. The morbid anatomy and histopathology of visceral lesions will be dealt with under the case report as they were autopsy findings.

Diagnosis :

Rhinosporidiosis should be suspected in all polypoidal fleshy growths occurring on the external mucous surfaces such as the nostrils, naso-pharynx, conjunctiva and penis particularly in endemic areas as in South India. But when the disease occurs at unusual sites, skin, sub-cutaneous tissue etc., the clinical suspicion is not roused and the diagnosis may be missed. Direct examination of an impression smear from a growth in the mucous membrane or aspiration biopsy of a cutaneous lesion, mixed with a drop of water and pressed between slide and coverslip, will easily reveal the characteristic morphology of the parasite. No special fluid or stain is necessary for the identification of the parasite. One of the best staining procedures for studying the parasite in tissue smears or sections is the Hotchkiss McManus stain for fungus. The principle on which this special staining method is based, is that fungi contain a complex polysaccharide in their lining membrane and interior. The polysaccharide is reduced to a polyaldehyde by per iodic acid, and the latter is stained a deep red colour with leuco fuchsin (Schiff's reagent). The authors have found this method of staining particularly helpful in identifying the parasite in the blood, body fluids and viscera where they are found only in small numbers and with the ordinary routine stains, cannot be easily distinguished from other cellular elements.

The tinctorial characteristics of the parasite stained by the Hotchkiss McManus method vary with the stage of development of the fungus. The parasites stand out in vivid contrast from the surrounding inflammatory cellular and fibrous tissue elements, which are stained a pale red or light blue colour. The outer chitinous membrane of the sporangium is stained a dark purple and the inner cellulose layer, a bright red colour. The colour of the spores varies from a bright pink, dark red to a deep magenta. The immature spores are outlined by a thin pink cell membrane, with the interior occupied by vacuolated cytoplasm staining a pale red colour. The maturing spores are composed of clusters of spherules arranged in morula fashion and stain a deep red colour, with or without a definite cell envelope. The cell membrane when present stains a deep crimson.

Prognosis :

The prognosis of rhinosporidiosis occurring on the external mucous surfaces is favourable except for a tendency to recurrence of the lesions. Spontaneous disappearance of the growth has been recorded by some observers. The rare case of extensive systemic dissemination with cutaneous and visceral involvement such as the case under report may end fatally.

Fig. 13.

Spore containing giant cells within a degenerating sporangium. (H & E x 320)

Fig. 14.

Mr. A., aged 40 years, looking ill and malnourished, with moderate degree of ascites.

Treatment :

For the localised lesions occurring on the mucous or cutaneous surfaces, surgical excision of the growth has given the best results. The salts of antimony, bismuth, iodine etc., have been tried both by local instillation and parenteral administration by many workers, but most of these drugs have failed to cure the disease. One of the recently advocated aromatic diamidine compounds (Pentamidine) was tried in the authors' case without success.

Surgery gives the best results in pedunculated growths. In sessile tumours, recurrence is the rule after attempt at removal. There is a real danger of dissemination of the parasite in the use of a simple snare without cauterisation.

With this short review and study of rhinosporidiosis the following case report is presented :—

Fig. 15.

An oval doughy subcutaneous lump lateral to the inferior angle of the scapula. A raised cutaneous nodule is also seen in the loin region.

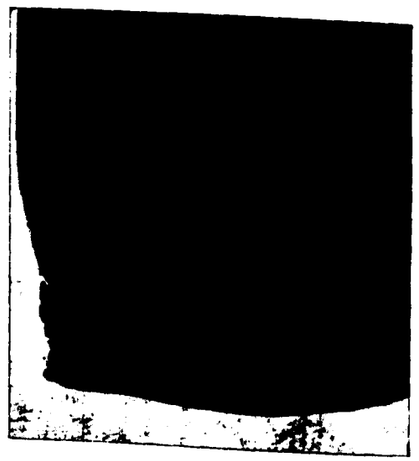

Fig. 17.

Multiple nodules back, the one to the right side of the spine is a mammillated globular tumour. The two tiny lesions to the left of the spine had a superficial resemblance to those of molluscum contagiosum but without the umbilication.

Fig. 16.

An ovoid nodule in the posterior axillary line at the junction with 10th rib, left side.

Fig. 18.

A fungating ulcer with irregular everted edges, above the left iliac crest.

CASE REPORT

A Hindu married male aged 40 years, tailor by profession and hailing from a village 100 miles from Madras had been attending the general out-patients of the Government General Hospital, Madras, off and on since 2nd February 1954 with multiple skin lesions which had been puzzling the Physicians for four months. 'Multiple Neuro-fibroma', 'Hansen's infection', 'Malignant Melanoma' were a few of the spot diagnoses recorded on the out-patient ticket in the patient's possession.

The present complaint seems to have started with the appearance of a painful swelling on the sole of the right foot followed by similar swellings on the trunk and extremities during a period of four months prior to his seeking relief at the Government General Hospital, Madras. During this period the patient stated he had been suffering from irregular attacks of low fever. The swelling on the sole of the right foot was incised at the out-patients suspecting the condition to be an abscess. While this had not healed, he went away and sustained an operation on another painful swelling in the region of the left iliac crest at a district hospital near his native village. After some time when he found that both the incised lesions were not showing any sign of healing, he sought admission at the General Hospital, Madras. The patient was admitted on 4-6-1954 into a surgical ward under the care of one of the authors of this study (A.R.R.). A biopsy of an unopened cutaneous lesion on the left thigh revealed Rhinosporidium Seeberi in the section and subsequently the exudate from the open lesions on the foot and loin likewise revealed the presence of the typical parasites. At the request of the senior author (R.V.R.) who is interested in the study of the deep mycoses, the patient was transferred to the Venereal Diseases Department for special study on 23-6-1954.

Previous history :

The antecedent history of the patient goes back to 1934 when he suffered from bleeding from the right nostril. A fleshy tumour was located and excised by a Physician in a Taluk hospital adjoining his village. In 1937, he sustained a genital sore after a sexual exposure, for which he underwent a circumcision. In 1948, after an interval of 14 years, the trouble in the nostrils recurred with obstruction and bleeding. He sought treatment at the E.N.T. Department of the Govt. General Hospital, Madras, where the growths were removed from both nostrils. After a second interval of freedom from the nasal trouble for about 5 years, he suffered a second recurrence of growth in the nostrils, which was again excised at the Govt. General Hospital, Madras. The present complaint started 2 months after the last operation.

Condition on admission :

The patient (Fig. 14) was looking ill and malnourished with a pinched pale painful facies, warm sweating skin and a dry coated tongue. Marked pallor of the conjunctiva. Temperature 100.8 degrees. Pulse 106 and respiration 20. The abdomen was slightly tumescent and shifting dullness was elicited. The liver and spleen were not palpable but there was tenderness in the region of the right hypochondrium. Heart and lungs normal. Circumcised phallus with a scar on the shaft. Bilateral hydrocele. Extensive scabieic lesions on the extremities. No evidence of lymph node enlargement. The striking clinical feature was the large number of cutaneous, sub-cutaneous and intramuscular tumours the details of which are listed below :

REGION	No.	LOCATION AND SHAPE	SIZE
FACE	1.	A tiny paule 0.5 cm below the inner end of the right eye brow.	2 mm. im diameter
AXILLA	2.	A date seed shaped sub-cutaneous swelling right anterior axillary fold.	2½ cm/1 cm.
	3.	A date seed shaped sub-cutaneous swelling posterior axillary fold right axilla.	2 cm/ ½ cm.
ARM	4.	A tender oval lump over the posterior surface of the left arm at the junction of the upper third with the lower 2/3 rds.	2 cm / ½ cm.
CHEST	5.	A pea shaped sub-cutaneous lump 1 in. internal to right nipple across the fourth rib.	½ cm. in diameter
	6.	A dome shaped nodule posterior axillary line at the junction with right 9th rib.	1 cm. in diamter.
	7.	A nodule on the left side chest 10th rib posterior axillary line.	1 cm. in diameter

Fig. 16

REGION	No.	LOCATION AND SHAPE	SIZE	
	8.	An oval, doughy sub-cutaneous freely movable swelling lateral to inferior angle of left scapula.	8 cm./5 cm.	Fig. 15
BACK	9.	A tiny papule over the 4th thoracic spine.		
	10	A mammilated tumour 1" to the right of 10th dorsal spine fixed to the skin but freely movable over the deeper parts.	4 cm. in diameter	
	11.	Two tiny molluscum contagiosum		Fig. 17
&	12.	like lesions to the left of the 11th dorsal spine.		
LOIN	13.	A fungating ulcer with irregular everted edges just above the iliac crest on the left side.	6 cm. in diameter	Fig. 18
LOWER EXTREMITIES	14.	A diffuse tender sub-cutaneous lump between the ischial tuberosity and greater trochanter on the left side.		
	15	A scar posterior aspect of left thigh (post-operative wound).		
	16.	A molluscum contagiosum like lesion on the lateral aspect of left thigh 5 cm. below the greater trochanter.	0.3 cm. in diameter	
	17.	A sub-cutaneous nodule about 5 cm. proximal to left patela.	1 cm. in diameter	
	18.	A papule at the junction of the upper 2/3rds with the lower third left thigh in front.	0.5 cm. in diameter	
	19.	A cutaneous lump firm to the feel on the left medial femoral epicondyle.	2 cm. in diameter	
	20.	A nodule on the skin of left calf.	1 cm. in diameter	
	21.	Another over the lateral aspect of left leg.	1 cm. in diameter	
	22.	A sub-cutaneous nodule just below the level of the left medial malleolus.	1.5 cm. in dimater	
	23.	A sub-cutaneous mass on the posterointernal aspect of the upper third of right thigh.	3 cm. in diameter	
	24	Cutaneous lumps, medial side of	1 5 cm in diameter	
&	25.	lower half of right thigh 6 cms apart.		Fig. 19
	26.	A diffuse doughy infiltration of the calf muscles on the right side.		Fig. 20
	27.	A molluscum contagiosum like lesion inner aspect of the right leg over its middle.		
	28	A ring of tiny papules suprapatellar		
to	32.	region on the right side.		
FOOT	33.	A fungating ulcer with everted edges and raised 1 cm. from the surrounding skin on the sole of the right foot.	3 cm. in diameter	Fig. 21

Fig. 19.

Multiple small cutaneous and subcutaneous nodules on the lower and inner aspect of the right thigh.

Fig. 20.

A diffuse doughy mass infiltrating the calf muscles on the right side.

In all about 33 lesions were counted, the greatest number occurring on the lower extremities. The larger cutaneous and sub-cutaneous swellings were tender to palpation and the patient complained of severe pain in the fungating ulcer on the sole of the right foot and the infiltrating mass on the right calf muscle. Rhinosporidium Seeberi were demonstrated from many of the lesions either by aspiration or excision biopsy. In view of his past history of nasal infection, he was examined by the Otc-Rhino-Laryngologist of the hospital for evidence of primary disease in the nostrils, naso-pharynx and larynx, with negative results. Examination of the rectum and urethra revealed no abnormality. The members of the patient's family were examined for evidence of rhinosporidial infection with negative results. A clinical diagnosis of generalised rhinosporidiosis was tentatively established.

The following investigations were conducted on the patient :—

24-6-1954 :

Blood count : Total R.B.C. — 1.6 million per cmm. Total W.B.C. — 2.800 per cmm.

Differential leucocyte count : P—49%. L—45%. M—2%. E—4%. Hb.—55%.

E.S.R. : 15 minutes — 3 mm. 45 minutes — 9 mm. 1 hour — 12 mm.

Blood smear — no parasite.

Night blood for microfilaria — Negative.

Blood for VDRL test — Positive 64 dilutions.

Blood pressure — 80 mm. 50 mm.

25-6-1954 :

Blood chemistry :

Serum proteins : Albumin — 3.5 Gm%.
Globulin — 3.5 Gm%.

Van Den Berg : Negative.

Icteric index : 4 units.

Thymol turbidity : 4 units.

Blood urea : 30 mgm%.

Gel and Chopra : Negative.

Urine :

Hazy with deposits.

Acid in reaction.

Specific gravity — 1016.

Albumin — a trace.

Sugar — Nil.

Fig. 21.
A malignant looking fungating ulcer on the sole of the right foot.

Fig. 22.
Spherical and oval forms of the spores of R. Seeberi, in laked venous blood.
(McManus stain x 320)

Centrifuged deposit : Pus cells and a few R.B.C. present. No casts. Spores of rhinosporidium seeberi demonstrated from both unstained and stained smears of the urinary deposit.

Motion :

Formed faecal matter. No E.H. or ova seen. Rhinosporidium seeberi absent.

26-6-1954 :

Skiagram of the skull, long bones and lungs revealed no abnormality.

27-6-1954 :

Smear from sternal marrow — No R. Seeberi seen.

7-7-1954 :

C.S.F. : Clear not under pressure.
Cells — 4 per cmm.
T.P. — 39 mgm%.
V.D.R.L. — Negative.
W.R. — Negative.
Goldsol — Negative.

Examination of the secretions from the nostrils pharynx and conjunctiva were negative to rhinosporidium seeberi.

9-8-1954 :

Examination of the centrifuge deposit of 1(c.c. of C.S.F. did not reveal any parasite.

In order to establish the haematogenous spreac of the infection, 20 c.c. of the peripheral venou

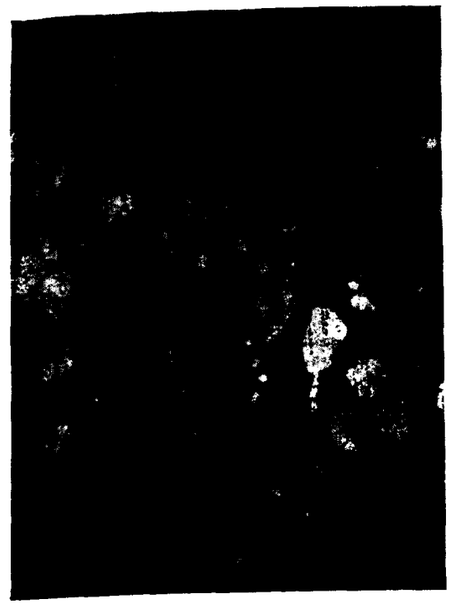

Fig. 23.
Liver biopsy section shows sparsely distributed spores. (McManus stain x 320)

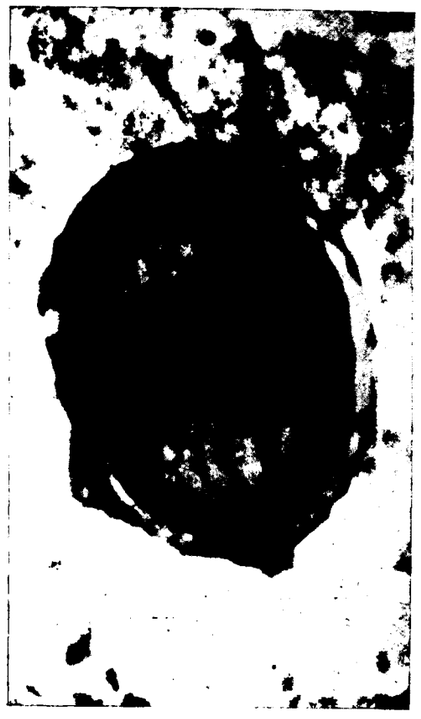

Fig. 24.
Spore in the urine, under high magnification.
(McManus stain x 320)

blood of the patient was drawn, laked and centrifuged repeatedly with sterile distilled water and the final filmy deposit was stained by Hotchkiss McManus method. The spherical and oval forms of the spores of rhinosporidium seeberi, stained a deep red colour, were demonstrated in the smear (Fig. 22). Liver biopsy and section stained by the same method revealed sparsely distributed spores of the parasite without any obvious inflammatory reaction or damage to the liver cells (Fig. 23).

As the spores of rhinosporidium seeberi were demonstrated in the urine of the patient, (Fig. 24) a cystoscopic examination was performed by one of us (A.R.R.). He reported no visible lesion in the bladder. Both ureteric orifices were visualised and the kidneys were functioning normally. Retrograde pyelogram did not reveal any abnormality.

Treatment :

For the severe anaemia, the patient was transfused with 250 c.c. of blood from a compatible donor on 2-7-1954. A high protein diet with injections of liver extract was prescribed. Surgical excision of as many of the cutaneous lesions as could be removed, was suggested but was considered inadvisable because of the debilitated anaemic condition of the patient and the serious doubt and fear that in an established hematogenous infection, attempts at surgical extirpation of the numerous lesions on the skin and sub-cutaneous tissue may cause further and dangerous seeding of the circulation with the spores of the fungus. It was decided to try the effect of chemotherapeutic and antibiotic drugs. Some of the previous workers (Allen and Dave[2]; Wright[36]) have reported beneficial therapeutic results by the parenteral administration of antimony compounds.

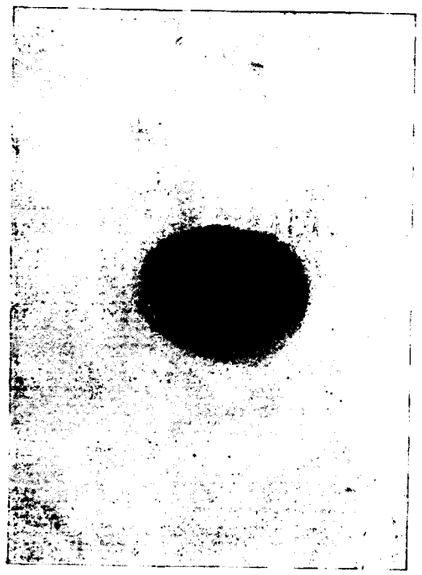

Fig. 25.
A spore in the ascitic fluid.
(McManus stain x 640)

Fig. 27.
Muscle tissue with multiple yellowish brown nodules of R. Seeberi.

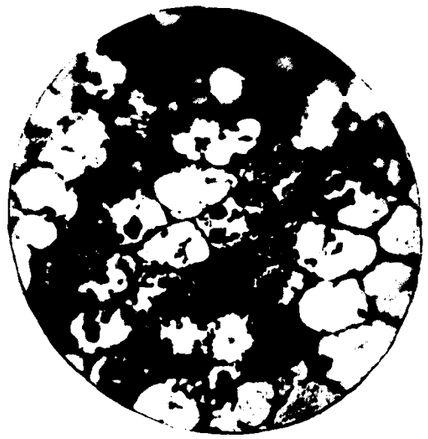

Fig. 26.
Yolk sac material — shows a few spores.
(McManus stain x 320)

Fig. 27-A.
A low power microphotograph of an intramuscular nodule.
(McManus stain x 32)

in their cases. A cautious start was made with intramuscular injections of 'Fouadin' 1 c.c. daily but the patient quickly exhibited intolerance to the drug, with severe vomiting and joint pains. The treatment had to be discontinued after the first few doses. A course of Strepto-penicillin to a total of 20 Gms. of Streptomycin and eight mega units of Penicillin were administered in the expectation that the treatment may favourably influence the positive serology and the rhinosporidial infection. The cutaneous and sub-cutaneous lesions far from showing any signs of regression were increasing in size and numbers. The large diffuse lesion in the calf muscle increased in size and became a huge fluctuant mass from which 100 c.c. of blood stained material was aspirated. A portion of the aspirated material was sent to the V. D. Laboratory for culture. The abscess cavity filled up again within a week and was incised and drained. Examination of the smear from the abscess, showed almost a pure culture of rhinosporidium seeberi in different stages of development and degeneration, besides pus cells and a few banal organisms. The fungating lesion on the sole of the right foot which was causing a great deal of pain was excised. The post-operative wound on the foot and the older ulcer on the left loin were healing satisfactorily, but the wound in the calf resulted in a persistent discharging sinus.

One of the aromatic diamidines, Pentamidine Isthionate, reported to be beneficial in other mycotic infections and kindly donated by Messrs. May and Baker Co. Ltd., was given a trial. Two courses of 8 intramuscular injections for each course at the rate of 100 mgm. daily, with an interval of a week between the courses, were given but without any apparent improvement. The patient was slowly declining in his general condition, suffering from irregular bouts of low fever, vide (Temp. chart) increasing ascites and oedema of the lower extremities. Blood count showed a slight improvement after the first transfusion with a total R.B.C. count of 2.37 million per cmm. and W.B.C. count 5,200 per cmm. but the haemoglobin did not show any rise from its previous level. The differential formula for W.B.C. showed a rise in lymphocytes to 51%. The erythrocyte sedimentation rate at the end of 1 hour was 20 mm.

A second blood transfusion of 300 c.c. was given on 4-10-1954. As the ascites was causing great discomfort, paracentesis was performed for the first time on 16-9-1954. A specimen of the ascitic fluid was reported to be VDRL positive in 4 dilutions and to contain 0.45 Gms% total protein with a specific gravity of 1014. The centrifuged deposit of a specimen of the fluid showed besides a few R.B.C., lymphocytes, endothelial cells, and a few spores of rhinosporidium seeberi (Fig. 25). Paracentesis was repeated eight times with a total withdrawal of 61½ pints of fluid during a period of 2½ months, the abdomen rapidly filling up after each tap, inspite of restricted fluid intake, high protein diet and the exhibition of mercurial diuretics. The cutaneous and sub-cutaneous lesions had increased in numbers from 33 to 53 when a count was made on 12-11-1954. The patient was rapidly going down hill and expired on 23-11-1954, five months after his admission into the hospital and nine months after he developed the first cutaneous lesion on the sole of his foot. He maintained consciousness till the end.

Report on attempted culture of Rhinosporidiosis Seeberi :

As attempts at experimental inoculation into laboratory animals by a succession of previous workers proved unsuccessful in transmitting the disease, a trial was made to propagate the fungus in the yolk sac of the developing chick embryo. The aspirated material from the fluctuant unruptured lesion on the calf muscle on the right was used in the experiment. Half of the specimen was treated with Penicillin and the other half was untreated. They were inoculated into the yolk sac of five to six day growing chick embryos using three eggs for each specimen. All the three embryos inoculated with untreated material died during the first or second day and showed evidence of contamination with pyogenic organisms. The eggs inoculated with Penicillin treated material survived and on harvesting the yolk sac material on the fifth day showed one or two spores of rhinosporidium seeberi in many fields of the smears (Fig. 26).

In the first subculture from the harvested yolk sac from the primary culture, the chick embryos survived and the harvested yolk sac showed a few spores without any apparent evidence of growth and multiplication. In the second subculture, the embryos survived again but showed no spores in the yolk sac. A healthy chick was hatched from one of the eggs.

Penicillin treated and untreated pus was inoculated into Sabouraud's medium and was observed for three weeks without any evidence of growth of the fungus.

Biopsy material from a small cutaneous lesion of the patient ground in sterile normal saline and treated with Penicillin was inoculated into another series of chick embryos, but all the embryos died the next day. The culture experiments were carried out by Dr. Chacko of the V.D. Laboratory, Medical College, and were limited to a small scale short pilot study.

Autopsy notes :

The autopsy was conducted by the Professor of Pathology (G.S.V.) one of the collaborators in this study. The following is the summary of the findings :

External examination :

The body is that of a grossly ill nourished anaemic man of about 40 years. Multiple tumours of

varying sizes were present on the skin, subcutaneous tissue and in the substance of the skeletal muscles, on both the lower and upper extremities, trunk, face, and scalp. The mucous membranes of the nostrils , mouth, throat, conjunctiva, and glans penis were singularly free of any growth or nodule. Two puckered scars were observed, one on the sole of the right foot and the other on the left loin above the iliac crest. The sub-cutaneous swelling on the left posterior axillary region was fluctuant and contained 3 Ozs. of pus, examination of which showed pus cells and numerous rhinosporidium seeberi on a wet unstained preparation. A fair sized doughy, deep seated swelling 3 x 3½ in. with a discharging sinus, was observed on the posterior aspect of the right leg. The swelling was dissected out and consisted of a mass of muscular tissue infiltrated with multiple yellowish brown nodules of varying sizes (Fig. 27). A low power photomicrograph of an intramuscular nodule is shown in Fig. 27(A). A rectangular piece of skin and sub-cutaneous tissue was excised from the front of the left thigh and revealed on its sub-cutaneous aspect multiple nodules of rhinosporidial granulomata (Fig. 28).

On opening the abdomen the peritoneal cavity contained 46 oz. of blood stained fluid. The omentum was adherent to the parietes in one or two areas. Patchy congestion with small areas of haemorrhages were present in the peritoneum. The entire alimentary tract from the mouth to the anus appeared normal, to the naked eye without any evidence of ulceration or growth on the mucous membrane or on the external serous surfaces. Mesenteric glands showed no enlargement.

Liver :

Weight 20 Oz. The surface of the lobes of the liver was slightly uneven and finely granular. There was well-marked mottling of the right lobe which was not so obvious on the left lobe. The cut surface showed congestion and small yellowish areas of fatty infiltration. The size of the organ suggested shrinkage. Gall-bladder small, contained 1 dr. of orange coloured bile. Mucosa normal.

Spleen :

Weight 3½ Oz. Whitish fibrinous exudate seen in the capsule. The organ was firm to the feel. Section showed congestion.

Pancreas :

Normal.

Heart :

Weight 5 Oz. Size small. Showed brown atrophy. The valves of the coronaries were normal. The arch of the aorta showed atheromatous changes. The abdominal aorta was normal.

Respiratory system :

Larynx and trachea normal. Weight of the lungs 7 Oz. each. Both lungs showed emphysematous bullae along the edges. Section otherwise normal.

Genito-urinary system :

An irregularly rounded nodule, 2.5 cm. in diameter yellowish brown in colour situated retroperitoneally above and medial to the left suprarenal gland which appeared normal. The left kidney with the nodule weighed 5½ Oz. The organ appeared congested, medulla more than the cortex. Slight increase of pelvic fat. The capsule strips easily leaving a smooth surface.

Right kidney :

Appearance was similar to those of the left kidney except for a retention cyst 1 cm. in diameter.

The bladder contained 1 Oz. of turbid urine. Mucosa normal. Ureters normal.

Meninges and brain :

Weight of the brain 41 Oz. Appearances normal.

Histopathology :

All the tissues were stained by H and E and by Hotchkiss McMannus methods.

Kidneys :

The convoluted tubules were distended and filled with hyaline granular material. A few tubules

Fig. 28.
Multiple subcutaneous granulomata.

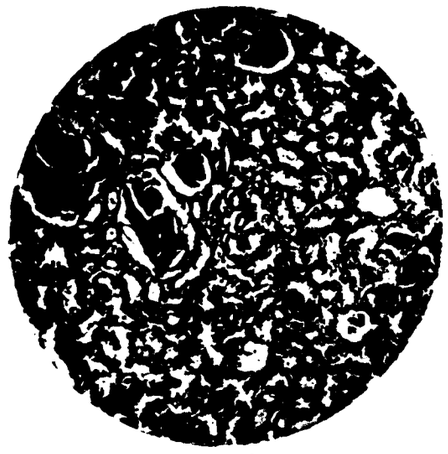

Fig. 29.
Kidney section showing dilated tubules containing degenerated eosinophillic sporangial masses. (H & E x 160)

Fig. 30.
A sporangium containing spores in the lumen of a dilated renal vessel. (McManus stain x 160)

Fig. 29-A.
Kidney section : Lymphocytic infiltration around collecting tubules and degenerated sporangia. (H & E x 160)

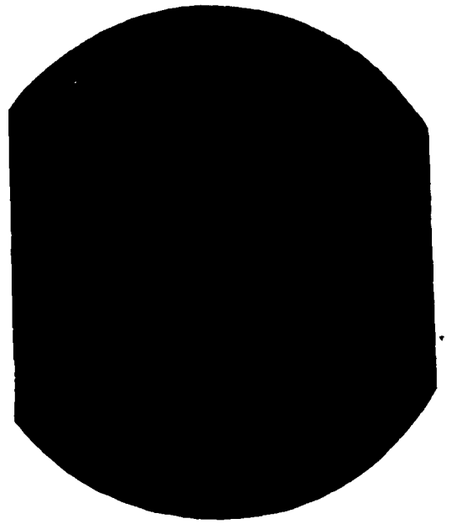

Fig. 30-A.
Kidney : A sporangium containing spores in the lumen of a vessel. (McManus stain x 160)

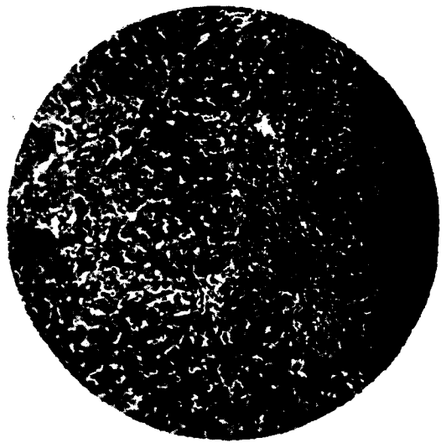

Fig. 31.
Liver : Portal cirrhosis. (H & E x 160

Fig. 32-A.
Shows foci of Necrobiosis. (H & E x 160)

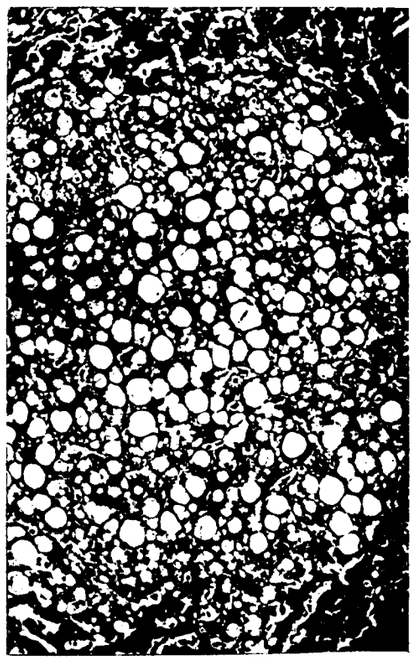

Fig. 32.
Shows fatty change in the liver cells. (H & E x 160)

Fig. 33.
Empty sporangium and scattered spores in the liver. (McManus stain x 320)

Fig. 34.
A sporangium containing two spores and a few scattered spores among the liver cells. (McManus stain x 640)

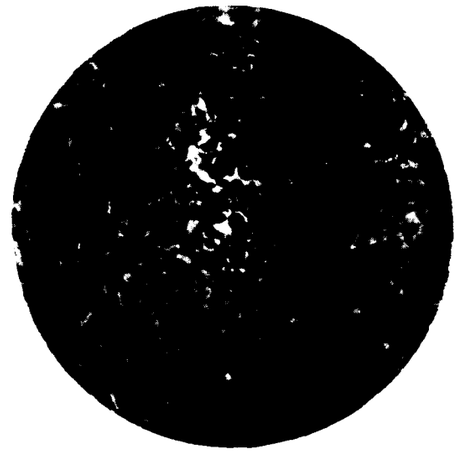

Fig. 35.
A spore in the splenic pulp. (McManus stain x 320)

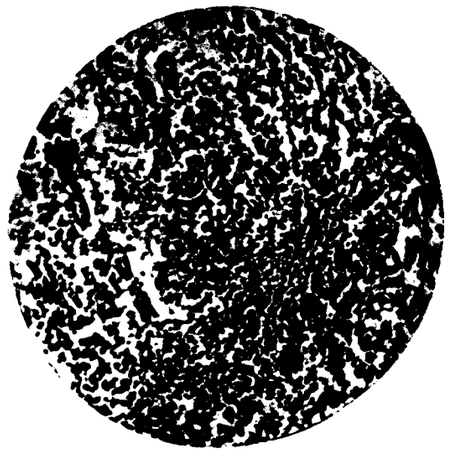

Fig. 36.
Myocardium : Lymphocytic infiltration with degeneration and disappearance of the muscle fibres. (H & E x 160)

Fig. 37.
An empty degenerated collapsed chitinous sporangium, within a large vessel. (H & E x 320)

Fig. 38.

A few spores in between myocardial fibres. (Inset x 320) (McManus stain x 160)

Fig. 39.

Pancreas: A few spores in the interacinar connective tissue. (McManus stain x 160)

were greatly dilated and contained spherical or oval structures with a chitinous wall and ill-defined degenerating spores, all in a deeply stained eosinophilic mass suggestive of degenerated sporangia (Fig. 29). A few glomeruli were hyalinised. There was dilation of the inter lobular blood vessels. Some collecting tubules showed lymphocytic infiltration round them. Small scattered areas of tubular atrophy were seen in the cortex. In one of the sections a sporangium filled with spores was observed in the lumen of a dilated thin walled blood vessel (Fig. 30). Small spores were found inside tubules scattered irregularly in the section. Some of the blood vessels showed slight thickening of the walls.

Liver :

The capsule was some what thickened. The main histological appearance was one of portal cirrhosis and fatty change (Fig. 31). Trabeculae of fibrous tissue infiltrated with lymphocytes were seen coursing through the liver giving the multilobulation. Numerous new bile ducts were present in the fibrous bands. The connective tissue round the portal triads showed numerous small congested blood vessels. The sinusoids were dilated and contained a few large R.E. cells. Tiny groups liver cells showed fatty change scattered here and there with no particular anatomical relationship to the liver lobule. Near a portal area are large blood vessels or spaces at the periphery of a lobule with disappearance of the intervening liver cells. Areas of foamy cells containing reddish fine granular masses of varying sizes in their cytoplasm were scattered irregularly in certain sections (Fig. 32). Evidence of any widespread inflammatory reaction or of granulomata were conspicuous by their absence in all the sections. In the sections stained by the Hotchkiss McManus method a few degenerated and empty sporangia of R. Seeberi were found here and there after a patient search (Figs. 33 & 34). Many more rhinosporidial spores staining a deep purplish red were observed lying near blood vessels and in the sinusoids.

Spleen :

Section showed increased connective tissue in the fibrous trabeculae, atrophy of the lymph follicles, and congestion of the pulp. Spores were found in small numbers (Fig. 35).

Heart :

The heart muscle showed a few areas of lymphocytic infiltration with degeneration and disappearance of the muscle fibres (Fig. 36). A large vessel contained a folded crescentic structure with thick chitinous wall but with no spores suggestive of a degenerated sporangium (Fig. 37). A few spores were observed lying between the muscle bundles (Fig. 38).

Fig. 40.

Brain: Spores in the vicinity of blood vessels. (McManus stain x 160)

Lungs :

There was congestion of the interalveolar septa. Numerous phagocytes containing blood and carbon pigment were present in the interstitial tissue and in the alveoli. Bronchial epithelium showed catarrh. The spores of R. Seeberi were not seen in sections of the lung, bronchi or trachea.

Thyroid gland :

The histological appearance was normal; no spores were found in the section.

Pancreas :

Section showed a normal histological appearance and a few spores were observed in the connective tissue between the acini (Fig. 39).

Cerebrum and meninges :

The histological picture appeared normal but numerous spores of varying size 6 to 12u were found scattered in both the white and grey matter particularly in the vicinity of blood vessels (Figs. 40 & 41). There was no evidence of inflammation in the sections examined.

Summary of the autopsy findings :

1. Emaciation.
2. Numerous rhinosporidial nodules of varying size in the skin, deeper muscles and in retroperitoneal tissues.
3. Ascites.
4. Liver atrophic, finely granular, congested and cirrhotic.
5. Brown atrophy of the heart.
6. Congestion of the kidneys.
7. A nodule above the left kidney which was proved to be a rhinosporidial granuloma.

Discussion :

From the past history, it would appear that the patient had been suffering from recurrent nasal rhinosporidiosis for about

Fig. 41.

Brain: Spores in the vicinity of blood vessels. (In-set x 320) (H & E x 160)

20 years before he developed the systemic disease, having during that period sustained repeated operations for the nasal growths. In February 1954, two months after the last operation for the nasal growth, the first cutaneous lesion appeared on the sole of the right foot, followed by the occurrence of multiple growths on the skin, subcutaneous tissue, and in the planes of skeletal muscles in rapid succession during a period of four months prior to his seeking relief at the hospital. It is reasonable to assume that the generalised dissemination of infection should have occurred at the time when he underwent the last operation for the recurrent growth in the nostrils. The evidence for the hematogenous spread of the infection was established by the demonstration of the spores of rhinosporidium seeberi in the peripheral venous blood, in the urine, in sections from liver biopsy and the ascitic fluid early in the course of our study.

The recurrent and irregular bouts of low fever from which the patient suffered over a period of nine months, is suggestive of a chronic low grade septicaemia derived initially from the nasal infection and maintained by the recurrent seeding of circulation with Rhinosporidium Seeberi from the numerous cutaneous lesions. It is a noteworthy clinical feature, that during the prolonged widespread dissemination of the parasite through the blood stream, the external localisation of the lesions occurred only on the skin and sub-cutaneous tissue and skeletal muscles but none on the external mucous surfaces of the nostrils, conjunctiva, naso-pharynx, penis and urethra or anus although the commonly occurring infection has a predilection for these surfaces. Another noteworthy feature is the absence of any obvious involvement of the lymph nodes which characterise other systemic mycotic infections.

Hypochromic anaemia, leucopenia, and increased erythocyte sedimentation rate are compatible with a state of chronic systemic rhinosporidiosis. The relative increase in the lymphocytes might have been caused by the latent luetic infection. The development of ascitis early in the systemic disease in the absence of evidence of gross cardiac or renal insufficiency suggested a hepatic pathology or a chronic rhinosporidial peritonitis.

The low specific gravity, low protein content of the ascitic fluid and the rapidity with which the fluid reaccumulated after each tap, are suggestive of a transudate the result of portal obstruction.

It is difficult to explain the great preponderance of localisation of the rhinosporidial granulomata in the lower extremities when the distribution of the parasite is hematogenous.

It is interesting to speculate whether the growth requirements of rhinosporidium seeberi such as temperature, oxygen tension etc., may determine the localisation of lesions in distal external areas of the body. Clinical observation has shown that rhinosporidium seeberi is primarily and predominantly a dermatrophic organism unlike other fungal pathogens such as Blastomyces, Coccidioides Immitis, Cryptococcus neoformans, Histoplasma capsulatum which also invade internal organs like lung, brain, bone, liver etc., causing grave complications with often fatal results. An unexplained feature of rhinosporidiosis is the extreme rarity of involvement of the lung parenchyma, particularly in view of the great frequency with which the upper respiratory passages become the sites of the disease in over 75% of recorded cases. It may be, the infection of the lung is asymptomatic or the parasite does not thrive in the vascular aerated lung tissue.

Autopsy studies of the principal viscera, heart, lungs, brain, kidney, pancreas, spleen, supra-renal glands, thyroid, pituitary, gastro-intestinal tract and bladder, failed to reveal any gross alteration in the anatomy of these organs or naked eye presence of rhinosporidial granulomata. The only exception was the liver which was cirrhotic with fatty infiltration. The absence of the parasite in sections of the lung, supra-renal gland, thyroid, gastro-intestinal tract and bladder and the paucity

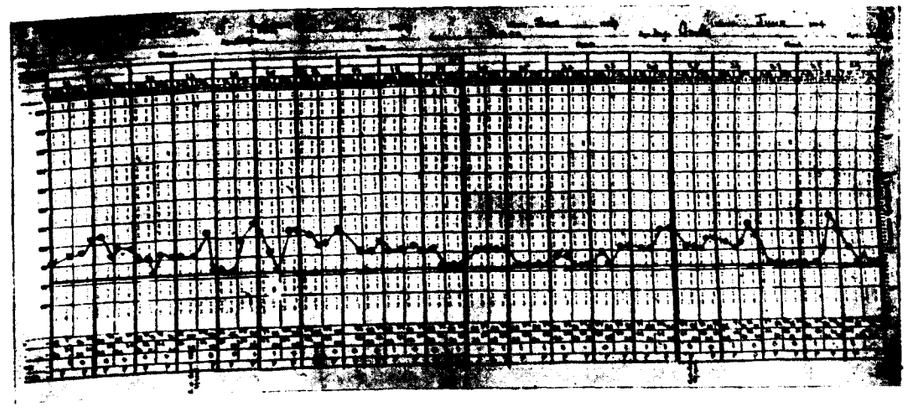

Chart I

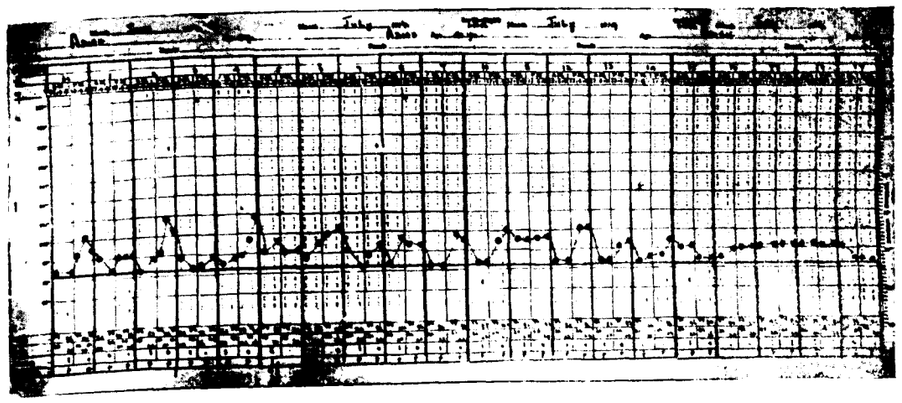

Chart II

of the same in those of the liver, spleen, heart, kidneys, brain, suggest that the biological environment of the viscera is not conducive to the growth of Rhinosporidium seeberi. Although the liver was cirrhotic with fatty degeneration, absence of gross or microscopic granulomata was a significant feature and seems to rule out the possibility of rhinosporidial infection as the direct aetiological factor in the causation of cirrhosis. The recognition of few scattered spores of rhinosporidium seeberi in the sections of the organs was made possible only when they were stained by the Hotchkiss McManus method. The larger sporangial forms of the parasite were rarely encountered in sections, except in a section of the kidney where a sporangium filled with spores was demonstrated in the lumen of a vein. A few degenerate distorted forms were seen in the sections of the liver, kidneys, heart, and brain after prolonged search.

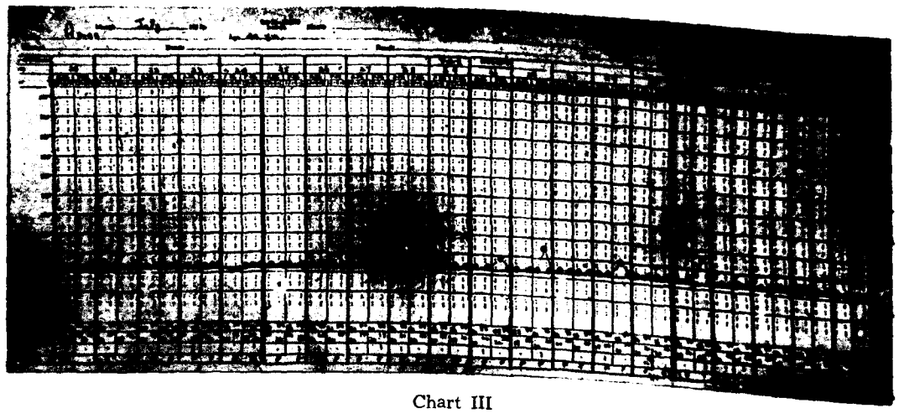

Chart III

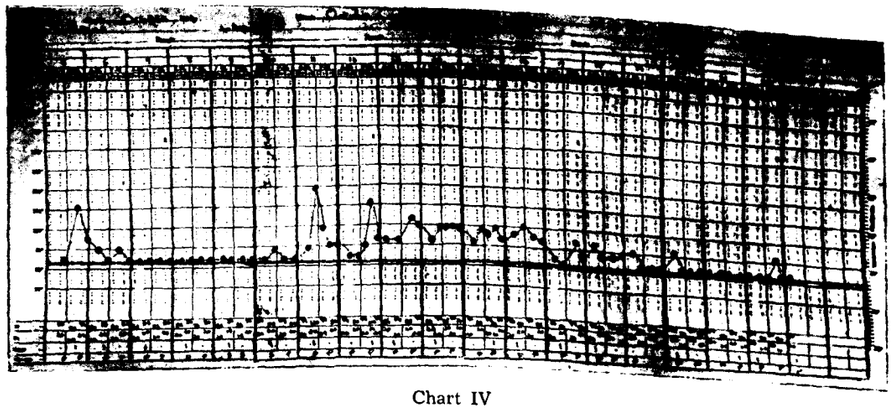

Chart IV

The cause of the cirrhosis of the liver appears to be nutritional, aggravated by a state of chronic hypochromic anaemia of systemic rhinosporidiosis. In spite of the invasion of the brain by the parasite there were no symptoms during life, no pathological changes in the C.S.F. and no autopsy evidence of inflammation of the meninges or parenchyma. The kidneys seemed to have been more heavily infected than other organs but no serious dysfunction of the organs was observed during life except a fleeting albuminuria.

Conclusion and Summary :

A study of rhinosporidiosis with a case report of systemic dissemination ending fatally is presented. The diagnosis of hematogenous spread of the infection, probably from the primary lesion in the nostrils was established during life by the demonstration of the parasite in the blood and body fluids and confirmed by the finding of the organisms in many of the internal viscera, after death. Although in the vast majority of recorded cases the infection is localised to the external mucous orifices, rarely endangering life ; the case reported in this paper is the first fatal case of systemic rhinosporidiosis. The chain of events in the case under report was a chronic low grade rhinosporidial septicaemia, hypochromic anaemia, cirrhosis of the liver with recurrent ascites ending in the death of the patient.

Our knowledge about the nature of the parasite, the source of infection, the mode of its entrance into the body and its growth requirements is almost nil. The disease is endemic in the Indian Union, particularly in the South and it is suggested that the Indian Council of Medical Research may sponsor a comprehensive research programme comprising clinical, mycological, epidemiological field studies of rhinosporidiosis in which the medical, veterinary and mycology experts may collaborate with advantage.

The authors have great pleasure in acknowledging with thanks the continued and enthusiastic cooperation and help from Dr. C. W. Chacko of the Venereal Diseases Laboratory for the pilot experimental study, from the staff of the V. D. Department of the Government General Hospital particularly Sri K. Parthasarathy for the unstinted secretarial assistance rendered in the preparation of this paper.

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Received for publication on 9-7-'55.

OSTEOTAXIS*

(A Reconsideration of External Skeletal Fixation)

by RAOUL HOFFMANN, Geneva, Switzerland.

OSTEOTAXIS — from the Greek word TASSO "I put the bone in its place" — aims at *taking direct hold of the bone* without laying it bare, and at providing the patient with a "*temporary skeleton*".

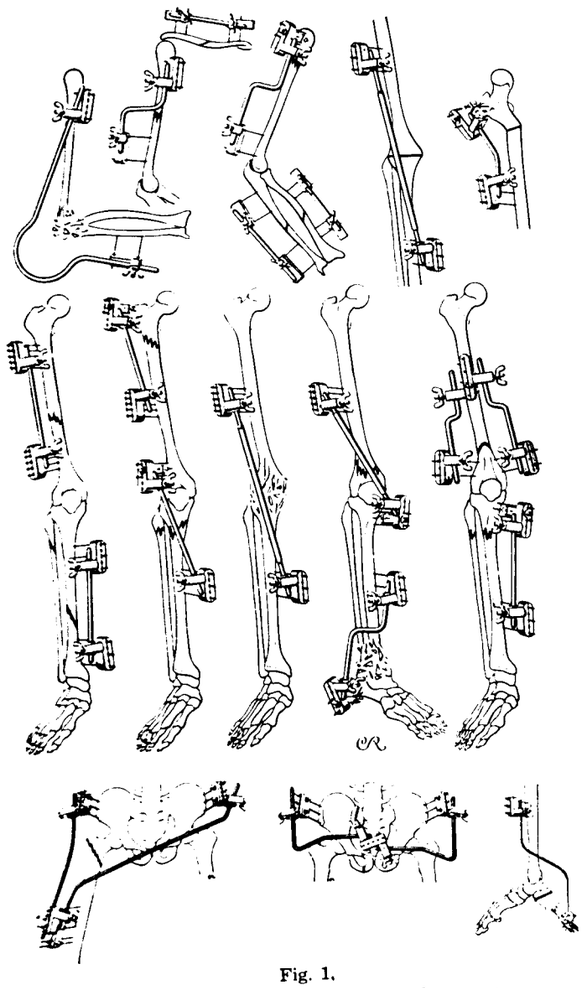

Fig. 1,
Chief modes of transcutaneous use of apparatus.

* Paper read at the XVI Annual Conference of the Association of Surgeons of India at Hyderabad (Dn.), Dec. 1954.

The process is as follows : before starting to reduce the fracture, the bone ends, or the parts of the skeleton to be submitted to an orthopaedic operation, are fitted *with transcutaneous " grips " at some distance from the focus.* That means that two groups of rustless bone screws are inserted into the bone, through the soft parts, to exactly the required depth, by a plain and very precise technique. Then we attach the grips to the bone screws. Grips are short, hand-hold splints, isolated against electrical currents, and provided with ball-and-socket joints which can be locked in any position. The screws are inserted *without* using X-Rays, on any operating table, and sometimes in the patient's bed. Fluoroscopy is used only later on, for reduction. As soon as the ball-and-socket joints are tightened on an external coupling bar, the fracture, or for instance, an osteotomy, is firmly fixed. Thus, the " transcutaneous support " (T.S.) is no longer a reducer but a *fixer,* and the patient has got his " temporary skeleton " just as in " medullary nailing ". But this skeleton is much stronger than *Kuntscher's,* and, from a technical point of view, easier to apply. The fixation allows *secondary adjustments,* simply by unlocking the ball-and-socket joints. Moreover, if the surgeon wants to exert a *" continuous axial pressure "* on the fracture in the case of delayed union or of pseudarthrosis, he may use a special coupling bar, called a " gliding bar ", which can be shortened at will by nuts. Towards the end of the treatment, before removing the T.S. one or several *trial unlockings* will show how the union is progressing.

The T.S. is so strong that the *joints can be used* from the outset as they remain free. It can be stated that Osteotaxis reconciles the two old enemies, fixation and function. It is a pleasure to see a patient using his arm fitted with the apparatus. A fractured femur is able to support the weight of the body after some practice when the patient wears a double T.S. on 2 planes which, other things being equal, is the most desirable appliance in this case. A T.S. can be used as an excellent *walking apparatus* for cases of leg fractures, even for spiral fractures, when after 2-3 weeks a short plaster gaiter is added just over the injury and *extends to embrace the coupling bar too* (Fig. 2). This embracing *is important,* as it annihilates any tendency of the bone ends to bend forward on account of the slight elasticity of the screws. This is almost the only occasion when plaster is used to reinforce the T.S. The patient thus discards his crutches for sticks, and wears ordinary shoes.

Now you must be wondering what are the draw-backs of the method : in other words, how great is the risk of infection, this only really important danger ?

Fig. 2.
Combined walking apparatus.

I shall come back to this later, but I should like to mention now some statistics from the Cantonal Hospital of *Frauenfeld,* in Eastern Switzerland, where about 15% of the fractures, that is, the most difficult ones, are treated by Osteotaxis : in these statistics, *one* screw out of about *180* caused a very *limited osteitis* with spontaneous expulsion of a tiny sequestrum measuring a few millimetres which never compelled the surgeon to any special form of treatment (in 90 cases of Osteotaxis : today the number would be much higher). The patient's stay in hospital was not prolonged on account of it.

I have found exactly the same thing to be true in my surgical experience. However, I know of *one* case of osteomyelitis in a *diabetic* patient from a German hospital. The bony structure disappeared, on the plates, round the upper humeral screws, but healing ensued without discharge of sequestrum, or any kind of operation. The shoulder stiffened at first, but became mobile again, and the final result was booked as satisfactory.

The bone screws, with their classical tip, are original in that their thread is interrupted by a *smooth segment,* of proper length, which will be level with the upper cortex at the " psychological " moment when the tip is piercing, more or less easily, the under cortex : thus the screw can revolve, unimpeded, as long as is needed until it has worked its way through the under cortex too, whereupon the threads start biting simultaneously on both cortices.

Always begin with *tangential probing,* by means of long, slender needles, to find the width of the bone and its depth under the soft parts.

The *piercing model,* called a " guide " — is then provided with 4 pins (only 2 in the case of a tibia) like stumps of knitting needles, placed apart at a distance approximately equal to the width of the bone, and long enough to embrace the skeleton below the apparatus.

The *" key of Osteotaxis "* is at this moment to place the guide astraddle the bone. This is easy as the blunt pins slide on the convex surface of the diaphysis.

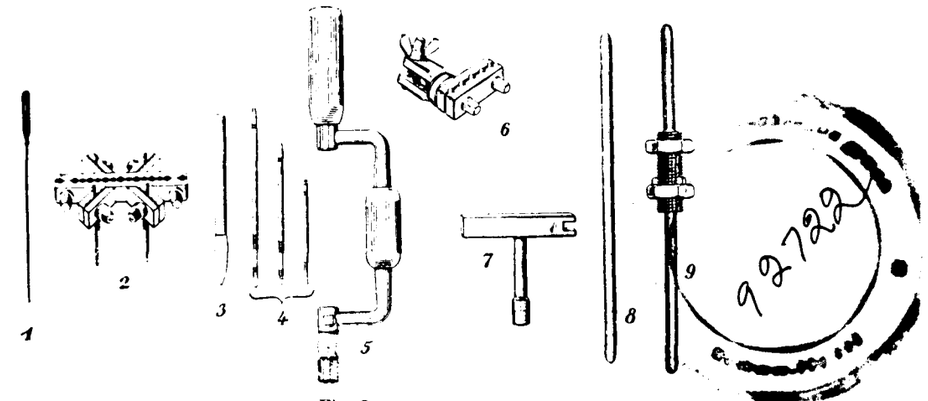

Fig. 3.
The main instruments : (1) needle ; (2) piercing model, called " guide ", with 4 pins ; (3) thin-bladed lancet ; (4) bone screws ; (5) whimble ; (6) short hand hold splint with ball-and-socket joint, called " grip "; (7) tubular key ; (8) ordinary coupling bar ; (9) " gliding bar " with screw-nuts to shorten — or lengthen — it at will. NOTE that bone screws, hand hold splints and coupling bars are available in two different calibers, for larger and smaller bones.

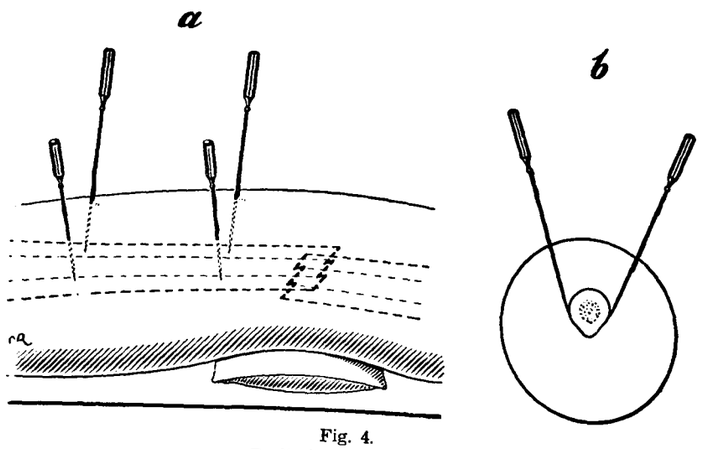

Fig. 4.
Preliminary probing.

The skin is incised for a length of 7-8 mm. with a thinbladed scalpel through a narrow cleft in the midline of the guide at the spots where the screws are to pass, to prevent them from dragging the epidermis with their threads into the tissues.

The first screw is pushed in with the fingers through a "chimney" of the instrument until it comes into contact with the skeleton. It must be lightly fixed there by *gently* tapping with a hammer.

When this is done, the number of centimetres equal to the diameter of the bone is counted on the graduated body of the screw, from the guide upwards. Add 8 millimetres to this number (or 6 for the small caliber of the T.S.) and make a coloured mark, with mercurochromium, or simply blood, at the appropriate height. Then you have only to put the whimble on top of the screw and push it in until the mark reaches the guide: that way you know (without using X-Rays) that the tip is sticking 8. or 6 millimetres out of the bone! The other screws — usually 3 in all, but there may be 2 to 5 — are inserted similarly, and then a grip is attached to them at about one inch from the skin. The process is repeated with the second bone end.

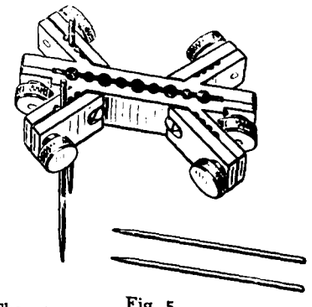

Fig. 5.
The piercing model, called "guide".

Note that if you have to do with a short cancellous fragment, two oblique and convergent screws are often added laterally to the two vertical and parallel ones, to ensure a firmer hold in the spongy bone. A short cross bar, fastened under the handle, will allow this (Fig. 14).

For carrying the patient, now, to the X-Ray room without endangering him, it is a good plan to lock the ball-and-socket joints temporarily on the coupling bar, irrespective of the position of the fragments.

As soon as the patient is under the fluoroscopic screen, check the tips of all the

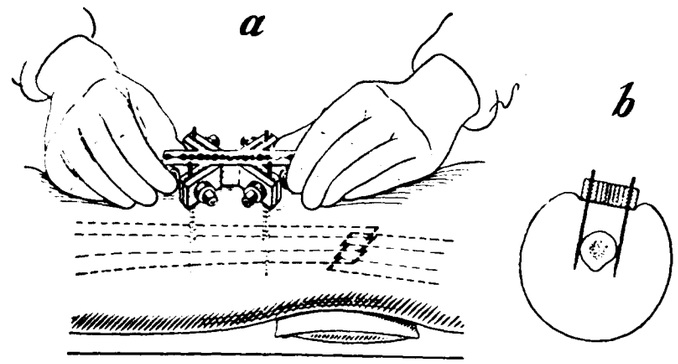

Fig. 6.
The guide astraddle the bone.

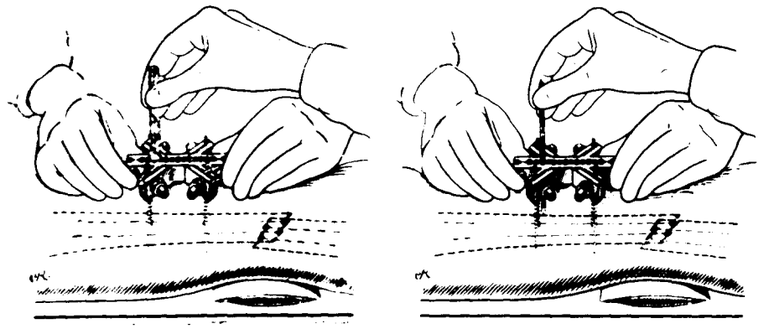

Fig. 7. Fig. 8.

Fig. 7. Skin pierced by scalpel.
Fig. 8. First screw pushed onto the bone.

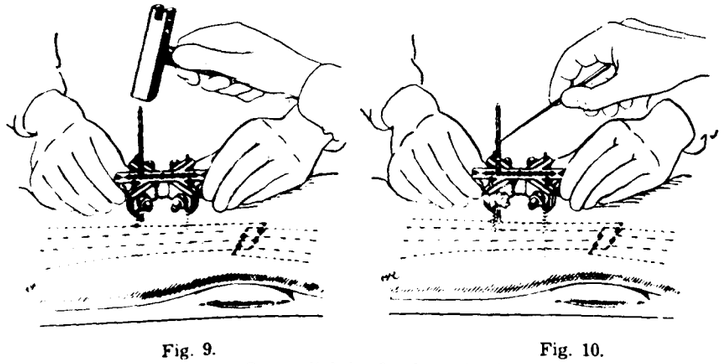

Fig. 9. Fig. 10.

Fig. 9. Screw lightly fixed to the bone.
Fig. 10. "Red mark" made on the screw.

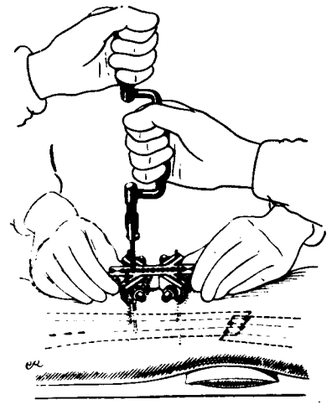

Fig. 11.
Screw driven in by means of whimble.

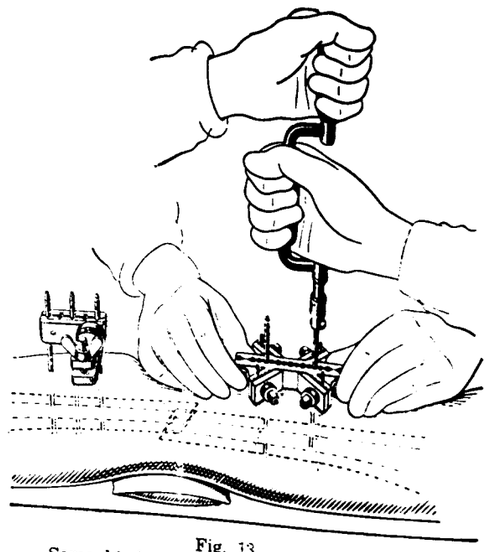

Fig. 13.
Same kind of work on other bone end.

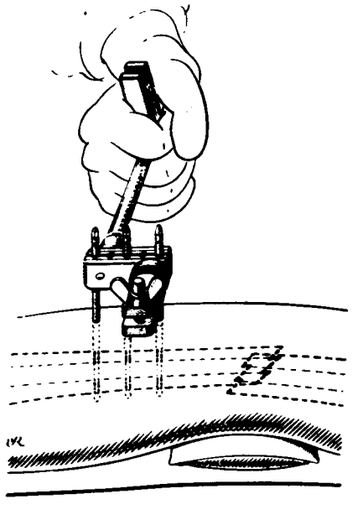

Fig. 12.
"Grip" fastened to the screws.

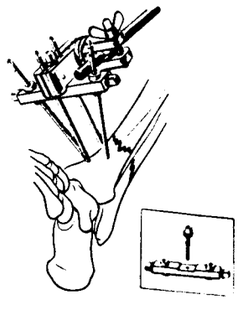

Fig. 14.
Lateral "anchoring" in cancellous bone.

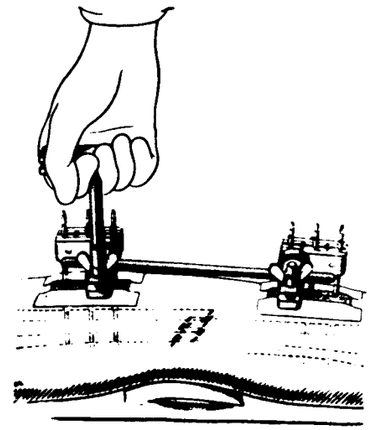

Fig. 15.
Temporary blocking of the — non reduced — fracture.

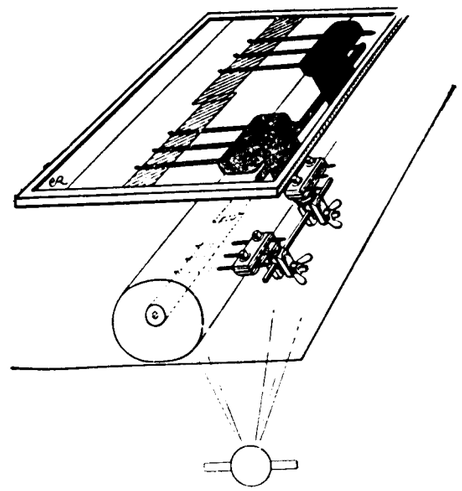

Fig. 16.
Checking of all screw tips.

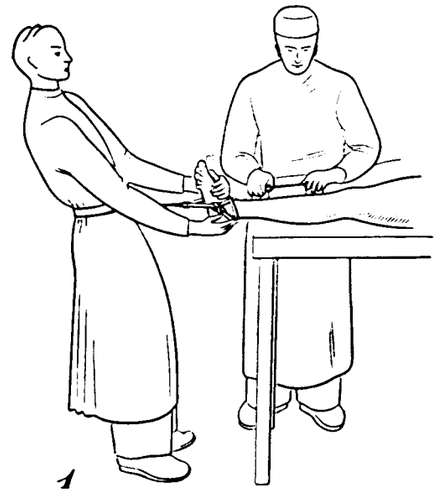

Fig. 17.
Reduction by manual traction.

screws from the side and, if some of them are, after all, pushed in too far or not far enough, change them accordingly by means of the whimble. This can be done under ordinary white light since you know that each turn makes a difference of 1.25 mm. in either direction.

Now *to reduce the fracture*, the ball-and-socket joints are unlocked and an attendant exerts a strong pull on the axis of the limb to overcome shortening whilst the surgeon adjusts the bone ends. When these are in place, the 2 ball-and-socket joints are quickly tightened, first by hand, then with the tubular key. Next follows a control from the side. If this is unsatisfactory, put the limb back in its first position, unlock the joints, and correct at a guess the mal-position in the vertical plane, whilst endeavouring not to loose what has been won in the horizontal one. The process can be repeated at will.

Fig. 18 shows the usefulness of *Lambotte's* big traction lever. Here, in addition, the surgeon manipulates the bone ends from a distance with heavy handled rods, called "pilots", which are temporarily fixed to the feet of the screws. If he has no pilots he may wear lead gloves, or he might check his work by films, taken after each reducing manipulation, as some surgeons choose to do.

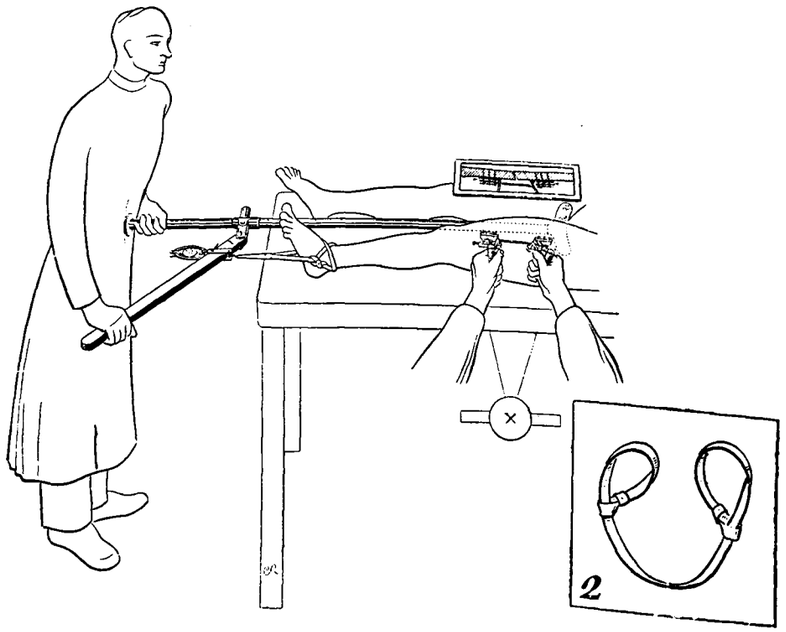

Fig. 18.
Reduction by means of Lambotte's lever and "Pilots".

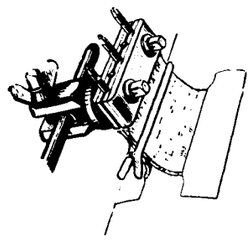

Fig. 19.
Final "hinge-dressings".

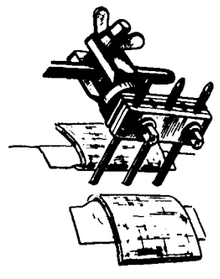

Fig. 20.
Opening of "hinge-dressings" to inspect puncture wounds.

Postoperative treatment is simple. One must make sure at once that nowhere is the skin stretched by a screw and, if necessary, loosen it by a cut of some millimetres.

The first, flat dressings should be replaced by other ones, called "hinge dressings". They are made of compresses fastened laterally to the skin by adhesive and joined at the top by ordinary "curl clips". They

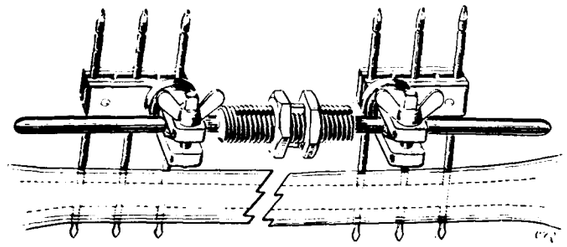

Fig. 21.
"To-and-Fro Reduction" by means of the "Gliding Bar".

are easy to open, so the small wounds can be controlled and powdered from time to time (Figs. 19 & 20).

Penicillin suspension is given for 8—10 days. After this period protective granulations will soon form. Antitetanus prophylaxis is emphasized in leg and heel Osteotaxis.

To-and-Fro Reduction

The "gliding bar", (Fig. 3, 8) is, intended essentially for delayed union and pseudarthrosis. The adjustment of *recent* fractures becomes almost automatic with this elegant instrument by the "*To-and-Fro Reduction*"! The bar is passed through the ball-and-socket joints which should be left free, and a distraction is effected by a strong pull of one kind on another, under curare if necessary. Thereby the bone ends come automatically into line (Fig. 21). Finally the ball-and-socket joints are locked, and the gliding bar has simply to be shortened for the fragments to come in touch with each other. The bar itself does not produce the diastasis. It is there only to *suppress* it at the end of the operation. Afterwards it can stay there during the whole treatment, or be replaced by an ordinary one which has been fixed to the screws above or below it before its removal.

General remarks

At the first sitting, whatever method of reduction be used, the surgeon should not always try to make the *axis* of the limb absolutely perfect. This would, at times, prolong the operation unduly, and also, "*the better may be the enemy of the good*"! One of the great advantages of Osteotaxis is that a defect of the axis can easily be rectified about 3 weeks later by simply unlocking the ball-and-socket joints for a moment once the callus has sufficiently formed to prevent the bone ends from overlapping. We frequently make use of this procedure, and it gives excellent results with the least amount of trouble.

When is Osteotaxis to be used?

1. The most obvious indication is for *open fractures*. There is no need to emphasize this: the grips greatly facilitate the cleansing of the bone ends since these are being steered from the outside. Reduction, carried out by sight without the aid of X-Rays, is achieved in the first sitting, and the strong fixation which immediately follows promotes considerably the aseptic healing of the injury. The danger of infectious complications around the screws, which is slight anyway, is more than compensated by such an increase in security. Whether it is sutured or not, the wound remains accessible. If it reaches the posterior region of the limb, the latter is suspended on a *Balkan* frame by means of the apparatus itself.

2. Secondly the method suits *multiple fractures* because of the benefits it offers to the patients. When their injured limbs are

immobilized by the T.S., they stop suffering; the screws themselves do not hurt, and for the morale of the patients it is good to be able to move.

3. Thanks to the gliding bar, the method is also highly recommended for cases of *delayed union* and *pseudarthrosis*. As the T.S. assumes all the mechanical functions, the grafts — if they are needed — may be of cancellous bone. Besides, experience shows that a continuous axial pressure alone, when combined with freshening of bone ends, may be sufficient. We know even of cases of pseudarthrosis which have been treated successfully without opening the focus at all. This is easily understood, especially where the beneficial effects of the gliding bar are combined with those of early walking. Still more remarkable are cases whose actual recovery in bed was solely due to the bar; a man of 50 broke the diaphysis of his Femur on September 9th, 1951 and was treated unsuccessfully by medullary nailing, then put in plaster. The abnormal mobility was striking when we saw him on April 26th, 1952 — one could hardly speak any more of delayed union; that day assisted by Prof. Ivar *Palmer*, in Stockholm, we put the Femur under continuous axial pressure, without laying it bare. The result was a surprisingly swift union, almost complete when we made a trial unlocking on July 18th, after which we insisted that he get up.

In the case of a lady of 36, it was, on the contrary, considered advisable — perhaps it was not really necessary — to freshen slightly the focus of the pseudarthrosis and to leave some chips of bone in contact with it, after having first inserted the screws of the 4 grips of a double T.S. It was a Femur which had been treated without avail for 15 months by medullary nailing, then this having failed, by wiring, grafting and plaster. The patient was quite driven to despair. On July 17th, 1952, Prof. Svante *Orell*, in his Clinic in Stockholm, and I performed the Osteotaxis operation. I insisted strongly upon the patient's getting up after 10 days and walking with sticks, not with crutches, which she did accordingly. As the callus — as to be expected — was slow to form, she kept the apparatus 208 days. The injury healed perfectly.

I should like to mention two other cases of the same kind which my colleague, Dr. *Isler* from *Frauenfeld* was asked to treat. These two femurs had been submitted, elsewhere, to medullary nailing without success. Dr. Isler removed the *Kuntscher* nails — a rather difficult task as they had bent — and replaced them with a T.S. A satisfactory healing ensued.

4. Various *orthopaedic operations* are greatly facilitated by Osteotaxis, especially current resections of the knee. I do not need to explain why. The same is true for complicated cases like the following one:

The patient was a man in the fifties, a former syphilitic. His knee was resected for a heavy staphylococcic infection, as a last resort before amputation, but the infection started immediately anew. The plaster splint became soon worthless on account of the pus and the continuous irrigation. After 8 days we were requested to apply the T.S., in spite of our misgivings. The screws were inserted as far away as possible from the wound, with grips superimposed on one another and 2 coupling bars 50 cm. long. A little staphylococcic discharge appeared round only one of the screws and healed in a week under chloromycetin by mouth. The apparatus was removed after 83 days, all the fistulas of the knee area had closed, and bony union obtained.

A few other cases are mentioned at random. A big girl, whose Femur, after an osteotomy intended to correct a defective rotation, failed finally to unite, although *van Hoff's* transcutaneous fixation apparatus — a rather elementary appliance, as a matter of fact, with which you are acquainted — had been used. Without reopening the focus, Dr. Adolphe *Perrot*, the genevese orthopedist and I fixed a T.S. with a gliding bar giving the desirable axial pressure, and a fairly rapid recovery ensued.

Dr. *Cronin*, formerly orthopaedic surgeon at the French Hospital in London told me that he preferred the T.S. to the huge, cumbersome plaster cases to immobilize

Fig. 22.
Arthroplasty of elbow.

hips, and Prof. *Compere* of Chicago, the well known editor of the *Year Book of Orthopaedics* wrote to me after using with success the gliding bar to *lengthen* a limb after a stair case osteotomy. The T.S. is fixed to the skeleton as usual at the beginning of the operation; then, by turning the nuts of the gliding bar in the opposite direction to the normal, the length required can be obtained slowly and safely, millimetre by millimetre.

In a somewhat similar way, but without the gliding bar, the T.S. can create, on purpose, a gap between the bony sections in certain arthroplasties. Fig. 22 shows the elbow of a tuberculous patient, aged 36. I carefully separated the bone ends at closure of the operation, and afterwards, during a little more than one month, I changed the angle of the new-shaped elbow every 4-5 days, this too in order to prevent ankylosis. This patient recovered a strong and mobile joint and is now a rock climber.

5. In mandible fractures, if either the teeth... or the specialist are missing, very easy reductions or even reconstructions are possible with a special, lightly built pattern of the T.S. Prof. Paul *Guillermin* of the Geneva Dental Institute used, for instance, the method in a very interesting case.

6. For *ordinary fractures*, if they are *severe*, Osteotaxis nearly always supersedes open osteosynthesis or *Kuntscher's* medullary nailing. Remember, moreover, that the practical scope of the latter is rather restricted as it does not suit injuries near the joints.

I relate, for instance, the personal case history of our Professor of Traumatic Surgery at the University of Geneva. He not only allowed, but even stimulated us to publish his case. Our colleague, in the seventies, who had a "discal" paralysis of the quadriceps, fell on account of this and broke his femur just above the condyles. He had been bedridden and in cruel pain for a long time just before, and Osteotaxis seemed the only practicable treatment. The two, double angled gliding bars enabled the immediate correction of the considerable diastasis noted after reduction, a diastasis due to the muscular paralysis, and they proved at the same time very convenient in putting the bone ends under continuous axial pressure. The patient was soon able to move his knee, and presently to sit in a chair. He wore the apparatus for 4½ months. The fracture as well as the paralysis are now completely healed, and the mobility of the knee is very good. Our colleague gave the Medical Society of Geneva "his impressions from the other side of the fence", to use his expression, and concluded by saying that if he had to start the whole thing again, well! he would do so!

7. For the *simpler fractures*, where purely conservative methods would be suitable too, I should not consider it fair to urge systematically the use of Osteotaxis. But one thing in its favour, even here, is that in many respects it is the most "physiological" method, that "anatomically speaking" it is very efficient, and, last but not least, that the patients highly

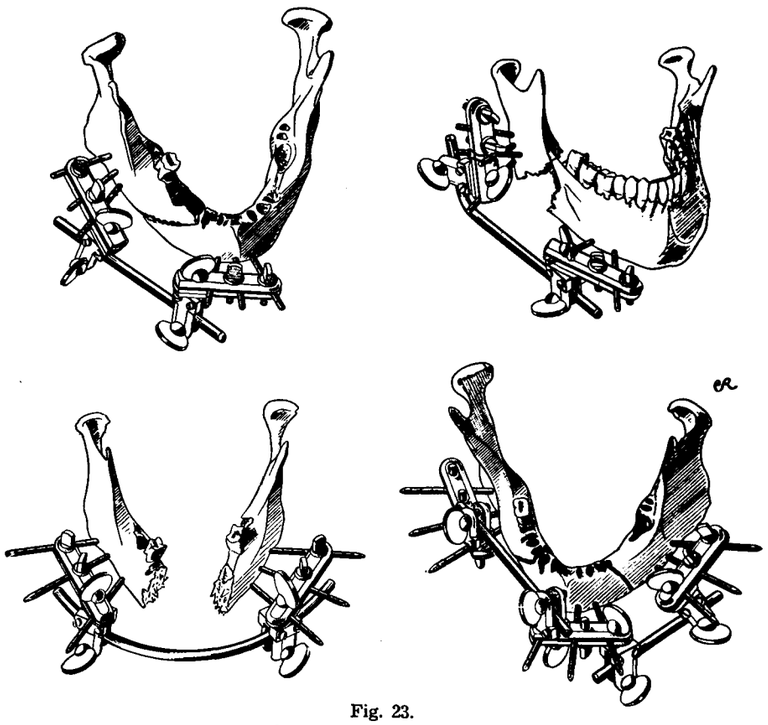

Fig. 23.
Osteotaxis of mandibles.

appreciate the suppression of pain, the liberty of movements and the swift recovery it brings. One of our patients, 11 days after a classic leg fracture while skiing, was obliged to nurse day and night his old mother who was seriously ill. He used crutches at first, until his apparatus was fitted with the short plaster gaiter you have seen, for walking. This was his criticism of the method, a rather funny one, because it is really a compliment: "The trouble with Osteotaxis", he said, "is that it makes you aware of other pains, since you hardly think any more of the fracture itself". He meant his foot, the ankle of which had. in fact, been violently twisted before the two bones of the leg gave way. In spite of this he was, after a certain number of weeks, able to resume his work, as a mechanic, standing the whole day on his feet and still wearing the T.S.

8. In conclusion, Osteotaxis is able to prevent delayed union in *isolated fractures of the tibia* in adults, where such mishaps occur often on account of the barrier, the non-broken fibula opposes to our efforts in adjusting the main bone.

There is in Osteotaxis, as we said, a *slight risk* of infection round the screws but it can be reduced almost to nothing if the following rules are strictly observed:

The skin should be washed with soap and water morning and evening for one or two days before operating. In compound fractures, of course, the procedure must, at times, be shortened. Iodine must be avoided absolutely for the final disinfection, as it will damage some parts of the T.S. There are plenty of substitutes to

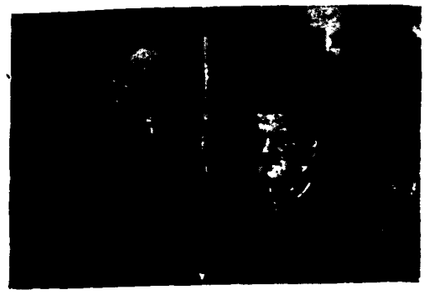

Fig. 24.
Two patients with double mandibular fractures.

replace iodine. The skin is to be oiled and powdered — with a mixture of penicillin and sulfonamide for instance — just before the guide is placed on it, to prevent the screws from tearing the epidermis with their threads. The screws too, should be oiled and covered with powder. And — an important item — the button-holes made with the thin scalpel through the guide, must be large enough to allow them to enter easily.

When the shortening is very pronounced, the skin should be displaced towards the fracture by the guide itself, or, to be more exact, by its pins: we displace likewise the skin before inserting a *Kirschner's* transosseous wire, to prevent its being stretched after reduction.

I have already mentioned penicillin as a preventive, and the small secondary cuts aiming to hinder, eventually, the stretching of the skin by some screws, postoperatively. Watch the skin in that respect (hinge dressings)!

The resistance of the bone to infection is remarkable if it is not seriously ill-treated, and if no foreign bodies are definitely left in touch with it. Osteotaxis fulfills these two requirements.

As to the soft parts, they are somewhat more subject to irritation. However, cultures show that a discharge is not always infectious. As a rule it is easy to stop any infection arising round a screw, thanks to the antibiotics indicated by laboratory tests, without at the same time despising sulfonamides. In the worst case, a screw ought to be extracted separately, and the treatment of the fracture would continue as before. We have scarcely ever had to do this.

Conclusions

It may be said that Osteotaxis both enriches and simplifies our armamentarium in bone work.

It makes us really "masters of the human skeleton". In a certain sense, and without exaggerating very much, we might call it a "transcutaneous form of bone surgery".

Summary

Osteotaxis—a development of *Lambotte's,* and *Boever's* "External Skeletal Fixation", not of *Roger Anderson's,* or *Stader's,* in spite of certain similarities, — is a *transcutaneous* method providing the patient in an easy way with an "external skeleton", which is strong, easy to apply without simultaneous X-Ray control on all long bones, even near their ends, and allows musculoarticular function almost from the very beginning. In fact, a number of patients are going back to work still wearing the apparatus.

Description of technique

Indications: Compound, or multiple, or severe fractures. Cases of delayed union and of pseudarthrosis, with or without freshening the fragments, with or without adding cancellous bone grafts. In current fractures, other things being equal, Osteotaxis is to be considered whenever stress is laid upon early function and swift recovery — the procedure being a highly "physiological" one — and good anatomic result.

Evaluation of the — very slight, and to a great extent avoidable — risks, which are more than compensated by the advantages. Compared with *medullary nailing* and its claims, Osteotaxis gives the same, or, as a rule, better results with lesser dangers and technical difficulties. It ought to supersede it, and in most cases osteosynthesis as well.

Received for publication on 1-1-'55.

EXCISIONAL SURGERY IN THE TREATMENT OF SKELETOL TUBERCULOSIS

*by B. MUKOPADHAYA, Patna.**

Osteoarticular tuberculosis is always a secondary lesion. It is caused by a haematogenous spread from a primary focus — active or latent — in the lungs or lymph glands. It can only occur when there is a breakdown, variable in degree, in the patient's resistance to tuberculous infection.

The characteristic lesion is the formation of the tuberculous follicle — a lesion which, from a very early stage in its evolution, is completely devoid of blood vessels. This avascularity is attributable to the action of the bacillary toxins, which effect a necrosis of the capillary walls and an obliterating endarteritis in the larger vessels of the surrounding tissues. This is very marked in the late stages when the lesion becomes chronic. In many cases the infection leads to the formation of sequestra which are completely cut off from the circulation and these sequestra are impregnated with tubercle bacilli. As the disease spreads wider areas of tissues become involved. Although in osteoarticular tuberculosis the variation from patient to patient is very great, in the vast majority, the lesion progresses accompanied by rarefaction, destruction, caseation, abscess formation, local spread with involvement of adjacent tissues, sinus formation, spread into the regional lymph glands and in bad cases, dissemination to other tissues by the haematogenous route. At any stage of its evolution, host resistance can arrest the further progress of the disease and a slow, gradual but very prolonged convalescence may occur.

In the early part of the 19th century, following the clear recognition of the tuberculous nature of the infection by Rokitansky, radical surgical procedures were extensively performed in these cases regardless of the general condition of the patient and without any clear knowledge of the consequences of such interference. The results were disastrous. Then came the period dominated by the teaching of Hilton and Thomas in which conservatism became the sheet-anchor of treatment. The older authors taught repeatedly against disturbing these bony lesions. Calot used to say "To open an abscess, is to open a door through which death almost always enters." Dickson warned by saying that "Introducing a drainage tube into a tuberculous abscess means certain that a draining sinus will form, which will become secondarily infected, which probably will never heal."

The results of conservative care, though a great improvement on early radical surgery, is not altogether satisfactory. In cases of involvement of one or the other of the major joints, clearly 30% of the patients ultimately succumb to the infection in spite of treatment. This proportion has certainly fallen with the advent of specific antituberculous drugs, though to what extent, it is still difficult to state. In the rest, who respond satisfactorily to conservative care, the results are usually good in the sense that the patient survives and the disease

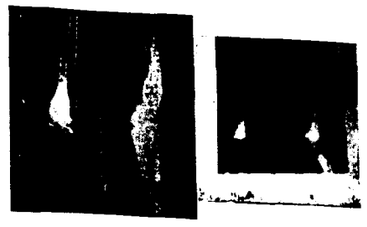

Fig. 1-a. Fig. 1-b.

Fig. 1. Mrs. Jafri Begum, 42 M.F. Case of tuberculous wrist and carpus — 10 years old. Previous history of tuberculous neck glands. Wrist lesion repeatedly operated upon. 2 sinuses of 8 years duration present at the time of operation. Complete healing of the sinuses 4 weeks after operation.

(a) shows appearance before operation.
(b) shows X-ray 8 weeks after operation.

* From the Orthopaedic Service, Medical College Hospital, Patna.

Fig. 2-a. Fig. 2-b.

Fig. 2 (c & d).

Fig. 2. Mrs. Parbati Debi, 22 H.F. Tuberculous disease left elbow joint. Deteriorated steadily inspite of routine conservative measures. Marked swelling, tenderness with multiple abscesses round the elbow with sinuses both in front and back of the joint. One abscess extended to the lower part of the forearm.

(a) X-ray before operation.
(b) X-ray 12 weeks after operation.
(c & d) Clinical photographs showing range of movement at the elbow 3 months after operation.

becomes quiescent, arrested or even healed. But there are certain evil consequences of prolonged conservative therapy which were not fully realized in the past. These are —

(1) The treatment is long-continued and uneconomic. It is beyond the means of the majority of our patients.

(2) Secondary physical complications frequently occur as a result of prolonged uninterrupted and continuous rest. The most serious of these consequences is damage to epiphyseal growth plates leading to shortening or deformity in the lower limbs.

(3) Extensive local destruction of tissue with ankylosis of a major joint results, causing serious loss of function.

(4) Operation is often necessary to stabilize the results of conservative care.

(5) In neglected cases with multiple discharging sinuses, conservative care has very little to offer. In the case of peripheral joints of the limbs, such cases often require amputation. In the case of proximal joints like the hip or shoulder, pioneers

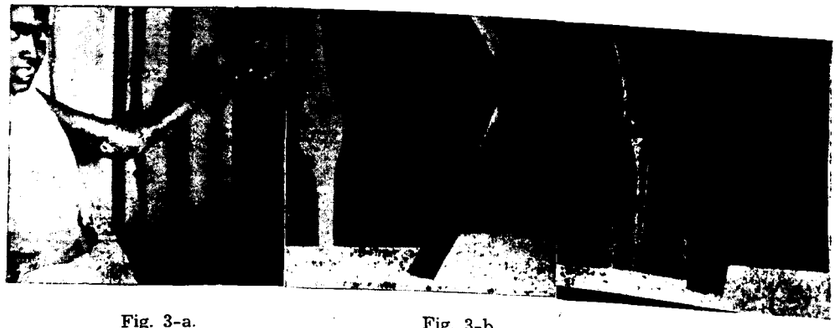

Fig. 3-a. Fig. 3-b. Fig. 3-c.

Fig. 3-d. Fig. 3 (e & f).

Fig. 3. Kamala Debi, 14 H.F. Case similar to that of Fig. 2 but more acute. Very low general condition with loss of weight, high hectic temperature, anaemia and very high E.S.R. Multiple sinuses with copious purulent discharge.

(a) Clinical photograph before operation.

(b) X-ray before operation.

(c) X-ray 6 weeks after operation.

(d) Clinical photograph 6 weeks after operation.

(e) & (f) Clinical photographs 12 weeks after operation.

like Gridlestone attempted local radical excisional surgery but these measures could hardly be considered elective procedures but were rather the surgery of despair.

The advent of specific anti-tuberculous drugs brought new hope for these patients and opened up prospects of an early cure. The first reports on the value of these drugs were rather discouraging. The drugs failed to arrest the local spread of the disease, could not prevent local destruction and had no really material influence on the period of treatment necessary to bring about healing. Success however was reported in the treatment of tuberculous sinuses with prolonged systemic anti-tuberculous drug therapy.

Fig. 4-a. Fig. 4-b.

Fig. 4. Banslochan, 18 H.M. Long standing tuberculous infection of the right shoulder with complete loss of movement and sinus formation.

(a) X-ray appearances before operation.

(b) X-ray appearances 12 weeks after operation.

Patient had more than 90° of painless abduction at shoulder.

The comparative failure of anti-tuberculous drug therapy to control the local infection in skeletol tuberculous is very likely related to the nature of the local tissue reaction to tuberculous infection. Because of the avascularity of the lesion and the fact that a tuberculosis focus is usually isolated by a fibrous wall, drugs administered through the parenteral route cannot reach the centre of the diseased area in therapeutic concentrations. Even if administered locally through a sinus, the drug cannot be uniformly diffused and distributed into the interstices of the involved area. Unless a pathway is opened surgically to allow the drugs to get access to the diseased area, they can only act indirectly by enhancing host resistance and such a process is naturally a time-consuming one.

In making a direct assault on tuberculous lesions, the surgeon fears not so much the infection itself, as the inability of the tuberculous soil to deal with secondary infection. There is also the danger of a general dissemination of infection following surgical procedures. The success of anti-tuberculous drug therapy in controlling sinuses and also in the treatment of acute forms of tuberculous lesions including tuberculous meningitis, raised hopes of a direct attack on the tuberculous lesion.

Simple incisional surgery in osteoarticular tuberculosis is not followed by gratifying results, even when surgery is combined with adequate anti-tuberculous drug therapy. Bosworth and Wright (1952) considering the problem, reported that in patients where incision of the abscess was the patients were so fortunate as to be found with healed wounds when dressings done without definitive surgery, none of were first removed. The speed of closure in all of them was unpredictable. On the other hand, in the group where incision was done without streptomycin, two patients out of three died of profuse drainage and cachexia. In the streptomycin treated group, when the wound healed, the permanency of the healing cannot be assured. There is every chance for the primary lesion to reactivate unless the bony lesion is properly dealt with.

In the present series, definitive surgery under an umbrella of anti-tuberculous drugs has been performed on 92 cases of osteoarticular tuberculosis with long standing abscesses or sinuses during the period from

Fig. 5 (a & b).

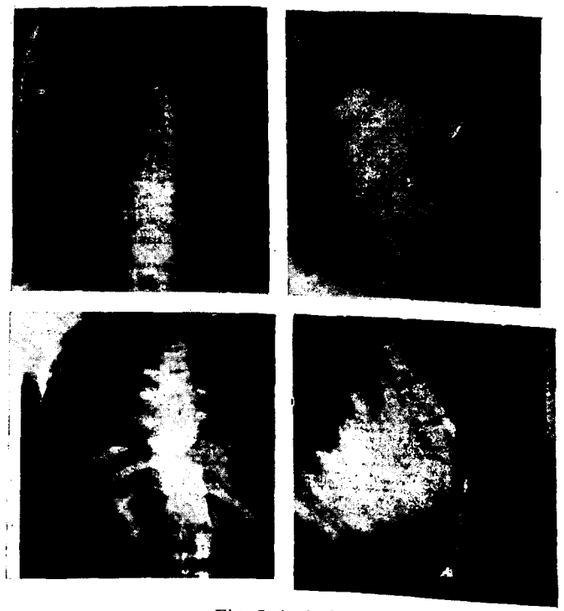

Fig. 5 (c & d).

Fig. 5. Khakia, 22 H.F. Tuberculous disease of the lower dorsal spine with large paravertebral abscess and complete motor and sensory paraplegia of 3 months duration. Antero-lateral decompression with complete excision of diseased vertebrae performed. Paraplegia recovered in 2 weeks.

(a & b) X-ray appearances before operation.

(c & d) X-ray appearances 4 months after operation showing complete healing of the lesion.

1952—July 1954. These were all very advanced and neglected cases with a prolonged history, the duration of the disease varying from 1 year to 9 years, low general condition, suppuration and multiple sinus formation. Many of these patients were given up as hopeless cases by other surgeons and quite a few had been advised amputation. There is one case in this series for whom I myself advised amputation of the leg in January 1950 and who had since that time 3 operations by one of my colleagues, the operations being ot a simple incisional nature. Some of these patients had more than one focus of infection and quite a few had suppuration with sinus formation in the regional lymph glands. All the abscess cases had repeated aspirations combined with rest and general anti-tuberculous drug therapy. The abscess cases were of such a nature that spontaneous rupture was likely to occur inspite of aspiration. In a number of these patients one or more operations had been performed by

Fig. 6 (a & b).

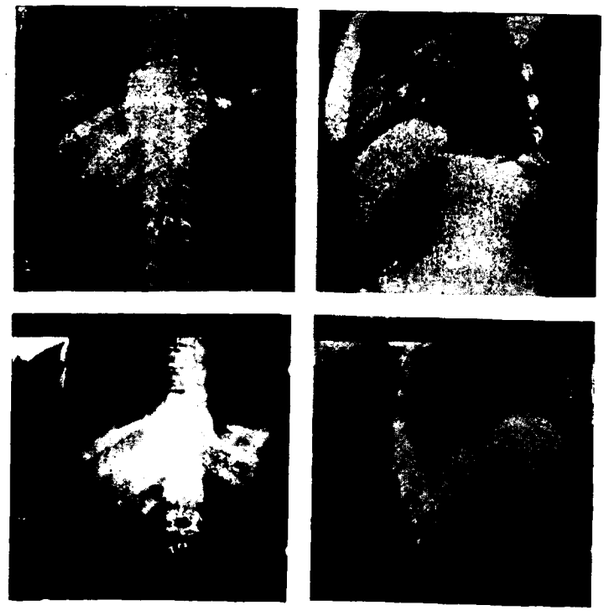

Fig. 6 (c & d).

Fig. 6. Beital, 40 M.F., caries spine with paravertebral abscess and fairly severe pain with low general condition.

(a & b) Appearances before operation.

(c & d) Four months after operation showing complete healing of the disease.

other surgeons. The distribution of these cases according to sites are—

Phalanges	—	2
Foot and tarsus	—	22
Calcaneum —10		
Other bones—12		
Ankle	—	6
Knee joint	—	6
Hip	—	6
Pelvis	—	3
Sacro-iliac joint	—	2
Spine	—	10
Shoulder	—	2
Elbow	—	8
Wrist and carpus	—	5
Ribs	—	9
Gluteal bursitis with trochanteric disease	—	6
Medial condyle of humerus	—	1
Olecranon process of ulna	—	2
Mastoid	—	1
Total	—	92

An uniform routine procedure was followed in all these cases. The patients were hospitalized 3 weeks prior to operation. During this period they were placed on a high caloric diet containing adequate amounts of the essential vitamins. This was supplemented by Liver Extract and Iron and other haematinics, if there was

Fig. 7-a. Fig. 7-b

Fig. 7. Choa Rai, 38 H.M. One year old tuberculous disease of the right hip with severe pain and abscess formation. Progressive inspite of three months plaster immobilization and general anti-tuberculous care.

(a) X-ray appearances before operation.

(b) X-ray appearances 3 months after operation.

Patient can walk without pain and has 60° painless movement at the hip.

Fig. 8-a. Fig. 8-b.

Fig. 8. Lakhi, 8 H.F. Acute type of tuberculous lesion of right hip with low general condition. At operation a large intrapelvic abscess was encountered. Complete healing of lesion 4 months after operation. This patient has shortening of the limb which may require treatment later on. She has been fitted with special shoes.

any evidence of anaemia. The patients were placed in complete bed rest and the involved area was suitably splinted. They were placed on—

(1) One gram of streptomycin daily by parenteral route.

(2) 10 to 12 grams of P.A.S. daily by oral route.

(3) 200 to 250 mgm. of Isonicotinic acid daily by oral route.

The dose was varied in accordance with the age and weight of the patient. After 3 weeks of this treatment, definitive surgery was performed. This consisted of—

(a) Adequate exposure of the involved osteo-articular structure through the most

Fig. 9-a. Fig. 9-b. Fig. 9-c. Fig. 9-d.

Fig. 9. Sohagi, 27 H.F. Long standing tuberculous disease of the left knee joint; fixed flexion deformity.

(a) Clinical photograph before operation.

(b) X-ray photograph before operation.

(c) Photograph of the removed synovial membrane.

(d) Six months after operation showing complete bony fusion.

Fig. 10-a. Fig. 10 (b & c).

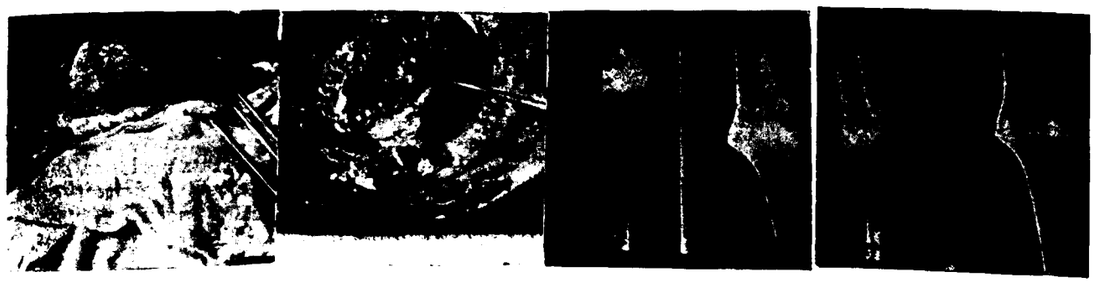

Fig. 10-d. Fig. 10-e. Fig. 10 (f & g).

Fig. 10. Suhagi, 28 H.F. Long standing tuberculous disease of the knee with cold abscess and sinus formation.

(a) Clinical photograph of the affected knee.

(b & c) X-ray appearances before operation.

(d) Appearances on complete exposure of the knee showing the involvement of the synovial tissues.

(e) Photograph of the resected tissues.

(f & g) X-ray two months and four months after operation. The joint is soundly ankylosed with bony fusion.

Fig. 11 (a & b).

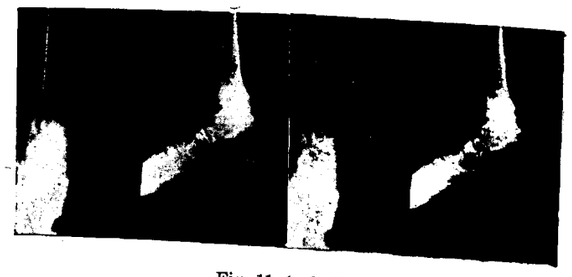

Fig. 11 (c & d).

Fig. 11. Kamal Ahmad, 14 M.M. Long standing tuberculous disease of the ankle. Not responsive to plaster and general anti-tuberculous care.

(a & b) X-ray appearances before operation shows marked soft tissue swelling.

(c & d) X-ray appearances 4 months after operation.

Lesion clinically and radiologically healed. Patient has 50% of normal painless movement at the ankle.

direct route preferably through the sinus or the abscess. When the sinus was away from the line of incision, the tract was thoroughly scraped out.

(b) Removal of all dead and necrotic tissues specially sequestrated pieces of bone. All diseased structure are ruthlessly excised except the blood vessels and nerves and muscles. Fascial structures which appear to possess very poor resistance to tuberculous infection are excised widely. Bone being expendable fairly wide removal of bone is performed aiming to reach uninvolved areas of the bone beyond the limits of the diseased area. Tuberculous myositis being almost unknown, wherever possible an attempt is made to leave bleeding muscle tissue in the bed of the wound cavity. In the case of the ankle or knee, excision was combined with an attempt at arthrodesis.

(c) Conversion of the avascular lesion into a vascular one, free bleeding during the time of the operation being encouraged. At the end of the operation all bleeders are completely ligated.

(d) Thorough spraying of the whole surface of the wound with dry streptomycin powder using anywhere upto 3 gram of streptomycin.

(e) Primary closure of the wound leaving a No. 1 or 2 soft rubber catheter in the depth of the wound through which anti-

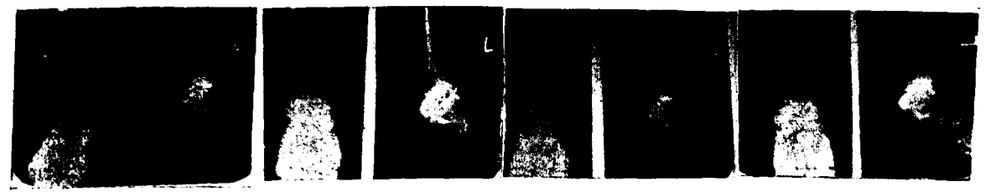

Fig. 12-a. Fig. 12 (b, c & d).

Fig. 12. Kailash Behari Jha, 36 H.M. Long standing tuberculous disease of the left ankle joint with sinus formation. Resistant to conservative treatment.

(a) Pre-operative skiagram.

(b, c & d) X-ray appearances two months, four months and six months after operation.

Firm bony ankylosis has been achieved.

tuberculous drugs can be instilled locally during the post-operative period. Primary closure was performed in every case except the first patient. This was a case of tuberculosis disease of the greater trochanter with a large cold abscess in an old, and emaciated woman. Nearly ¾ pints of pus was aspirated at weekly intervals for nearly 2 months. Her general condition continued to deteriorate inspite of repeated aspirations and routine conservative care with rest, good food and anti-biotics. After definitive surgery, the wound was packed with gauge impregnated with iodoform. The dressings were removed on the 3rd day when the wound was found fresh and healthy and it healed gradually by formation of granulation tissue.

(f) Adequate splinting of the affected area. This was achieved by applying a plaster of paris spica at the end of the operation, the indwelling catheter being carefully covered with sterile dressings and left outside the plaster.

Post-operatively the following regime has been followed—

(a) General treatment consisting of complete bed rest, good food with adequate quantities of vitamins and anti-tuberculous drugs as during the pre-operative period.

(b) Daily instillation of 1 gram of Dihydro streptomycin dissolved in 2 c.c. normal saline through the catheter into the wound. The dose was reduced in children. This was done under strict aseptic precautions treating the catheter as a part of a clean surgical wound. The local instillation was continued for 3 weeks.

(c) The preliminary plaster was removed after 3 weeks. In every case the wound healed by primary intention. In a few cases there was a small collection of serous effusion in the depth of the wound. This could be easily squeezed out through the opening left by the catheter track. Secondary sinuses, which were not included in the operative incision also showed complete healing in most cases.

The stitches were removed on the 21st day and the limb again immobilized in a plaster spica, except for cases of rib disease. General anti-tuberculous treatment was continued for 2 to 3 months after removal of stitches. This consists of the same regime as in the 3 week pre-operative period.

The results with this form of management have been uniformly successful. The improvement in the general condition of the patient following operation has been very

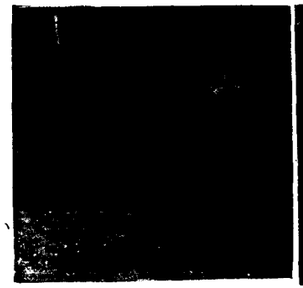

Fig. 13-a.

Fig. 13 (b & c).

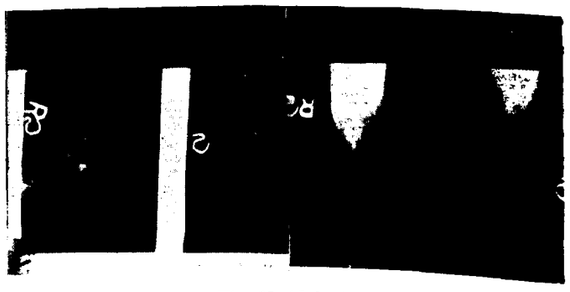

Fig. 13 (d & e).

Fig. 13. Lalita, 8 H.M.Ch. Case of bilateral calcaneal tuberculosis with sinus formation on both sides with run down general condition.

(a) Shows pre-operative skiagrams of calcaneous of both sides.

(b & c) Shows operative findings. Also shows extent of tissue removal.

(d & e) Shows X-ray appearances 3 months after operation.

Complete healing with full restoration of movements have been achieved.

striking. This has been most dramatic in the group where anti-tuberculous drugs had not been used parenterally for prolonged periods before the operation. It was not so evident in the patients who had specific drug therapy before operation. The improvement in the local condition also has been very satisfactory. Local pain, tenderness and oedema almost completely disappeared by the end of 3 weeks after operation. In 3 cases a small amount of discharge persisted for a few weeks through the site of insertion of the indwelling catheter. It is interesting to note that all these were patients who had very prolonged anti-tuberculous drug therapy before operation. It is quite possible that the organisms in these cases had developed some degree of drug resistance prior to surgery. This is one aspect of the risk that attends careless and indiscriminate use of anti-tuberculous drugs. However, complete healing was achieved in every case by the end of 8 weeks and radiological healing of the lesion was seen by the end of 12th to 24th week depending on site involved. Most of these patients have been allowed a relatively normal degree of activity 4 months after operation. Following thorough excisional surgery of the primary focus of infection, lesions of the regional lymph glands also healed rapidly and no special measures

Fig. 14-a. Fig. 14-b. Fig. 14-c.

Fig. 14 (d & e). Fig. 14-f.

Fig. 14. Sancharia, 25 H.F. Case of long standing tuberculous disease of the calcaneo-cuboid area with sinus formation. Sinus present for over a year.

(a) Clinical photograph before operation.

(b) Preoperative skiagram.

(c) Operative findings showing extent of excision.

(d & e) X-ray appearances three months after operation.

(f) Clinical appearances three months after operation on the day of removal of plaster.

Complete healing with full restoration of function achieved.

were needed for that purpose. In some cases E.S.R. was done before and after operation. In all of them, the E.S.R. returned to normal level by the end of the 4th week following operation. Patients who were febrile before operation became afebrile, as a rule, within a week of the operation and the blood condition of the anaemic cases returned quickly to normal.

Two things stand out very strikingly—

(a) Rapid improvement in the general condition of the patient due to elimination of tuberculous toxaemia. This was most striking in those patients who did not receive prolonged anti-tuberculous drug therapy before operation.

(b) Rapid healing of the bony lesion following radical excision of the involved tissues.

It was very surprising that none of the patients developed wound infection and all of them healed by primary intention. During the same period, a proportion of patients operated on for other conditions developed wound infection. In this respect, the present series differ from other

Fig. 15-a. Fig. 15-b.

Fig. 15. Lalita Debi, 20 H.F. Long standing tuberculous disease of the coniciform, metatarsal joint with sinus formation.

(a) Shows pre-operative skiagram.

(b) Skiagram three months after operation.

Complete healing with full function.

similar reports where the wound has been left open and secondary suture has been performed once healthy granulation appeared. We have been surprised at the relative immunity of these wounds from ordinary surgical wound sepsis. This may be related to local tissue immunity developed as a result of prolonged exposure to infection.

Encouraged by the strikingly good results in late and complicated cases, we started excisional surgery for earlier cases. There are fewer cases in this series as there is still a strong feeling against any operative interference in closed cases of tuberculous disease and quite a number of patients are unwilling to submit to operation. We have been surprised at the advanced stage and also the extent of local lesion seen on operative exposure in cases which clinically appeared to be early ones. The cases in this series consist of the following—

Tarsus	—	3
Ankle	—	4
Knee	—	8 *
Hip	—	6
Spine	—	4 †
Elbow	—	5
Wrist and carpus	—	2
Ribs	—	8

* Excision is here combined with arthrodesis at the same time.

† All cases of dorsal spinal disease with large paravertebral abscesses.

The routine of treatment has been the same as in the first group. In all these cases primary wound healing has been achieved. No attempt at restoration of the joint movements was possible as the lesions were all fairly advanced and involvement of the articular cartilages was present in every case. However, the results surpassed even our most optimistic hopes. The striking feature of this group was the speed with which the general condition of the patients improved, the E.S.R. came down to normal and healing in the local lesion was obtained.

In cases of involvement of the larger joints like ankle, knee, hip, sacro-iliac joint, vertebra, and elbow arrest of the diseases with or without bony ankylosis was obtained within a period of 3 to 4 months — a result which is inconceivable with conservative treatment alone. In comparing records of cases treated before 1952, we found that not a single case of disease of these joints healed in less than 18 months to 2 years from the time when treatment was instituted.

The accumulated evidence and the results observed in the present series suggest that definitive surgical procedures under an

umbrella of anti-biotics is the treatment of choice in osteo-articular tuberculosis once the lesion has reached the avascular stage. That such cases require surgery becomes more evident when it is realised that multiple sequestra and calcified caseous debris surrounded by thick fibrotic walls were found in many of these cases during operation. In our view, once the patient has reached this stage, prolongation of conservative treatment only prolongs the suffering of the patient. The presence of active lesions in other parts of the body does not contra-indicate surgery. In fact, such cases have a more compelling indication for surgery than simple uncomplicated cases.

It seems likely that streptomycin and surgery are inter-related to each other in their value on osteo-articular tuberculosis and ought to be interlinked in their use. Whereas streptomycin prepares the ground for such surgical procedures, surgery opens the pathway for the anti-biotic to have its full effect on the local lesion, apart from removal of the grossly necrosed tissues.

The series is numerically small and the period of observation rather short. It is therefore not possible to be dogmatic on the future prognosis of a chronic disease as prolonged and unpredictable as tuberculosis on the basis of such a study. In tuberculous disease particularly osteo-articular tuberculosis, experience is not always substantiated by later knowledge and accumulated observations. Even so, the experience in the present series of cases is so striking and so different from the experience of only a few years ago that a formulation of a revised concept of the principles of treatment will be fully justified. The results have really been remarkable in many respects.

A procedure so diametrically opposed to the principles and practice of treatment haloed by established tradition can hardly be accepted totally on the basis of observations lasting for such a short period of time. However, we cannot remain blind to the new prospects opening before us. The struggle against tuberculous disease has been hard, long and costly, but to see the enemy in retreat, is one of the rare, exhilirating episodes reserved for our generation.

I wish to express my sincere thanks to the Superintendent, Patna Medical College Hospital, and Col. D. P. Nath, Director of Health Services, Bihar, for kindly permitting me to use hospital records for the preparation of this paper.

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Received for publication on 1-2-'55.

OBSERVATIONS ON UMBILICAL AND MIDLINE VENTRAL HERNIAS

by S. K. SINHA, Patna.

Introduction

The incidence of hernias of the umbilical region in infants, is pretty high as seen in the Outpatient department, but it is found that most of these children are brought for other ailments and not for umbilical hernia ; only a few of them are brought for umbilical hernia. Unless the hernias are big or are causing trouble, they hardly worry the parents. This might explain the low incidence of cases of umbilical hernia reporting for treatment.

The hernias of this region are probably the earliest to appear and are there since the tenth week of intra-uterine life, the time when the physiological hernia in the yolk sac should have returned back to the abdomen.

The final word, about the exact mode of the development of the anterior abdominal wall has not yet been said. The developmental abnormalities of the midline abdominal ventral wall cover a wide field of surgical entities and owe their origin to the defects in the formation of the ventral wall.

Other hernias of the midline ventral wall viz., hernia of the linea alba, divarication of recti and incisional hernia are also fairly common. It will be interesting to note that (except in incisional hernias) congenital weakness or deficiencies in the abdominal wall play an important part in the production of such hernias.

A brief review of the anatomy of the region will not be out of place for a proper understanding of the hernias of this region.

Anatomy

In the midline ventral abdominal wall the peritoneum is covered by the fascia transversalis and the linea alba. On either side, the linea-alba breaks up into the posterior and the anterior rectus sheaths enclosing the rectus muscles. These are covered by sub-cutaneous tissue and skin.

The linea alba is a tendinous raphe. It consists of elastic tissue and fibrous tissue. The fibres intersect with each other. At the site of the umbilical cicatrix, there is a gap in this structure. The base of the umbilical cord was originally attached to the margins of the gap. The aperture in the aponeurosis at the site of the umbilical cicatrix is called the umbilical ring. The interval between the two recti is more above the umbilicus than below it so that the linea alba is wider above the umbilicus than below it.

There are minute openings in the linea alba, usually five on each side, for the passage of vessels and nerves (Watson). Where the vessels pierce the transversalis fascia, they carry a prolongation of this fascia with them and these openings are weak points in the linea alba. The aponeurotic fibres interlace from either side and produce slit like openings in this structure. With increase of intra-abdominal pressure the properitoneal fat may be forced through these minute openings and slits.

Umbilical-Hernia in Children

The sac of an infantile umbilical hernia may be covered by amnion or by skin. In those which are covered by amnion three types can be differentiated according to severity. These types differ to some extent in mode of development and can be differentiated without much difficulty. They result from the error in return, of the mid-gut loop after the physiological hernia that occurs in the sixth or seventh week of intra-uterine life, in which the mid-gut loop is extruded from the abdominal cavity.

1. The most severe variety is the one in which there is also a defect in the supra-umbilical part of the abdominal wall and the defect may extend up to the Xiphi-sternum. The sac, besides the gut, may contain other viscera, like the liver. The

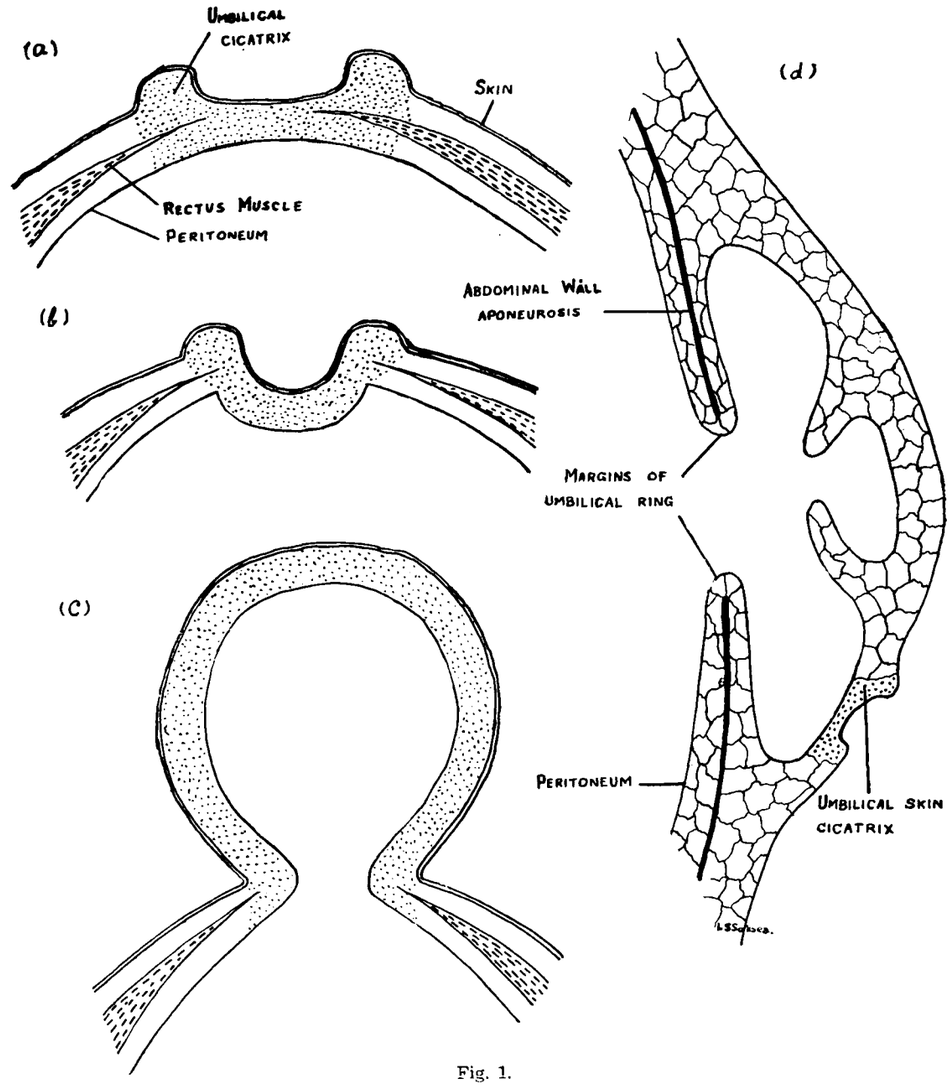

Fig. 1.

(a) Horizontal section through abdominal wall at level of umbilicus to show the umbilical cicatrix.
(b) A section at the same level in which there had been a deep separation of the umbilical cord.
(c) A section at the same level in the case of an infantile umbilical hernia.
(d) A vertical midline section through the abdominal wall in a case of adult umbilical hernia.

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gut has also not undergone the normal process of rotation, in fact these structures have developed in the sac.

2. In the next type there is no defect in the supra-umbilical part of the abdominal wall but peritoneal sac extends into the umbilical cord and the gut with its mesentry is present inside the sac. Normal rotation of the gut has not occurred.

3. In the third type the peritoneal sac persists in the umbilical cord. It remains an empty sac and gut is protruded whenever intra-abdominal pressure rises. The first two types could be called exomphalos and the third type funicular hernia into the umbilical cord or congenital hernia. In some of these, (third type) differentiation of the amnion into skin has occurred at the periphery so that the sac is covered partly by skin and partly by amnion. The first two types are brought to the clinician immediately after birth and the third type is brought some time later after the umbilical cord has fallen off.

Skin covered infantile hernia could be due to (a) persistence of the minor degree of funicular hernia into the umbilical cord or (b) weakness of the umbilical cicatrix so that it easily bulges out with minor rise of intra-abdominal pressure (Milroy Paul). "The umbilical cicatrix is usually a firm plug welding the skin to the peritoneum, but when the line of demarcation which separates the umbilical cord from the abdominal wall has been deep (Fig. 1-b), the fibrous tissue forming at this line of demarcation would be so thin, that minor rises of intra-abdominal pressure would push out, as the walls of a hernial sac, the skin and peritoneum united by this thin fibrous tissue sheet" (Fig. 1-c).

"When the umbilical cicatrix, walling the umbilical ring is pushed outwards as a hernial sac, the elasticity of the aponeurosis of the abdominal wall prevents its being stretched to become part of the hernial sac. This preserves the integrity of the umbilical ring at the neck of the hernial sac (Fig. 2-b). Enlargement of orifice of sac could only occur from stretching of the ring by the visceral contents of the hernial sac, but such stretching would not enlarge the ring very much."

The skin of the umbilical cicatrix is widely adherent to the sac wall in hernias of infants and children, but in adults it is not so adherent. Because of this firm adhesion the contents do not get into the periumbilical subcutaneous tissues and the hernia grows like a tube (Fig. 2). The sac is unilocular and strangulation rarely occurs.

Hernias of infants and children could be divided into

(1) Those that cure themselves.

(2) Those that do not cure themselves.

The infantile umbilical hernias which cure themselves inspite of rise of intra-abdominal pressure, which is quite common during crying, coughing and straining

Fig. 2.
A photograph of a patient in which the hernia has grown like a tube.

(respiratory infections are common and bowel upsets are also frequent in infants) are about 50% (Ladd & Gross). Perhaps several factors are at work in the cure of these hernias. Properly applied strapping aids in the cure. These factors are :—

1. There is spontaneous shrinking of the umbilical ring after birth because it has no further function to perform. The contents of the two umbilical arteries and umbilical vein clot, and later only slender connective tissue cords represent these vessels, the vein from above and the arteries from below. As the scar tissue at the umbilicus, after falling off of the cord, becomes firmer, and as the growth of the abdomen continues, these cords become tense and the umbilicus is drawn inward (Watson). This indrawing of the umbilicus is more marked at the lower portion than at the upper. This is because the cords representing the umbilical arteries and urachus are stronger and are firmly attached to the ring exerting a greater pull than the cord representing the umbilical vein which is weaker and loosely attached to the upper edge of the ring. The umbilical cicatrix is thus weakest at the upper margin of the ring. This explains the common occurrence of para-umbilical hernia in the upper sector of the umbilicus.

2. It is likely that the relative growth of the abdominal wall is more than its contents. The space inside the abdomen increases and the pressure inside becomes less so that inspite of rises of intra-abdominal pressure during crying, coughing, and straining, the rise of pressure is not enough to force the contents out. Liver is palpable below the costal margin in infants and as it grows the liver becomes less and less palpable due to the fact that the abdominal cavity becomes more capacious in relation to its contents.

3. In cases where the hernia is due to persistance of minor degree of furnicular hernia of umbilical cord the process of peritoneum which was inside the umbilical cord starts fusing. This process of fusion of the two layers of peritoneum continues inside at the site of the umbilicus so that the sac is obliterated and nothing can be forced out through the umbilical ring.

The umbilical hernias which do not cure themselves are probably those (1) where the ring is so wide that normal process of growth of the abdominal wall, shrinking of the umbilical ring and apposition of the rectii, fail to constrict the ring; (2) the second group of cases which persists are those in which the separation of the cord has occurred deep (3) or where both these factors work together.

History of onset of hernia helps to distinguish these two groups of cases. In the congenital variety the ring is wide and the hernia is noticed since the time of birth or immediately (within the first week) after the cord separates. In the second group (where the separation of the cord has occurred deep) the hernia appears some weeks or months after the separation of the cord and is associated with disturbance of the bowel or an attack of respiratory infection. Fifteen cases of umbilical hernias in infants and children were treated. All were umbilical excepting one which extended into the supra-umbilical region. Of these nine were treated by strapping and six were operated upon.

Treatment :

Strapping — It is an important point to note that — a coin, button, or padding should not be inserted under the strapping. Any such material tends to keep the hernial ring wide and also does not allow the rectus muscles to grow. The cases which improve by the use of coin or padding under the strapping are probably those in which the strapping was not properly applied so that the padding did not cause pressure on the ring and in fact the hernia would have cured itself even if there was no padding. The correct way to apply the strapping is as follows :—

"Two adhesive tapes two inches wide are taken (Fig. 3). A hole is made in one,

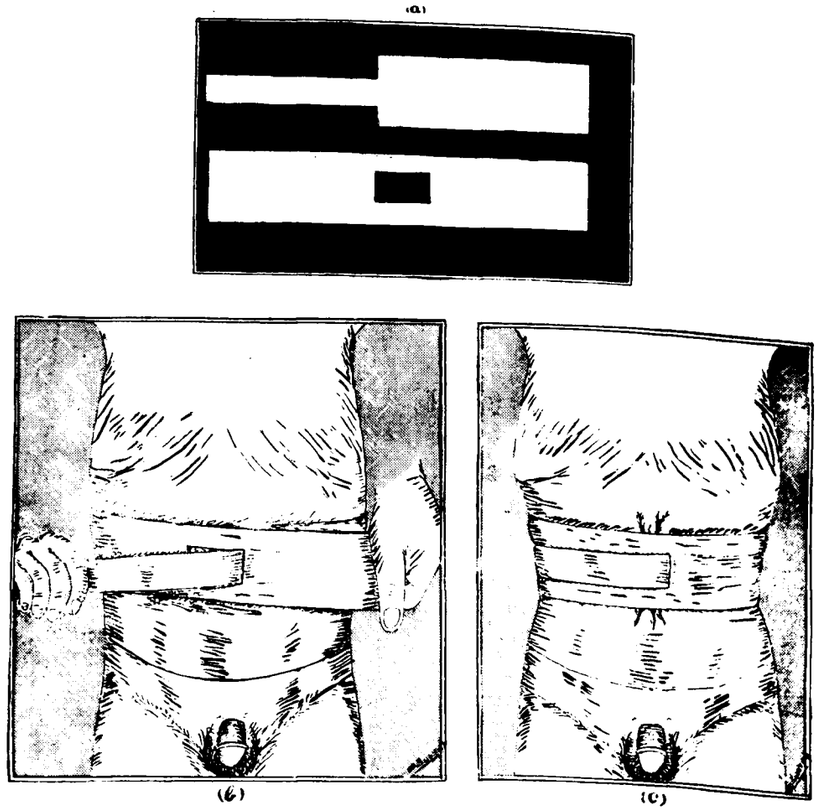

Fig. 3.

Satisfactory type of adhesive strapping for an umbilical hernia in an infant. The adhesive straps are 2 inches wide. One has a hole and the other a tongue, as shown. The two straps are applied to the lateral parts of the abdominal wall and then interlaced with each other. Pulling on the free ends relieves the abdominal wall tension at the umbilicus when the umbilical skin becomes wrinkled, the free ends of the straps are stuck down.

—From Ladd and Gross: "Abdominal Surgery of Infancy and Childhood", published by W. B. Saunders Company, 1941.

and a tongue is made in another. The two straps are applied on either side of the lateral part of the abdominal wall and the tongue of the one is withdrawn through the hole of the other. Pulling on the tongue and the free end of the other reduces the tension in the region of the umbilicus and wrinkles are formed in the skin. Now the free edges of the straps are stuck down" (Ladd and Gross).

Operative treatment:

In a small hernia a curved incision is made below the umbilicus, the skin flap is raised upwards and freed from the aponeurosis. With a finger acting as guide at

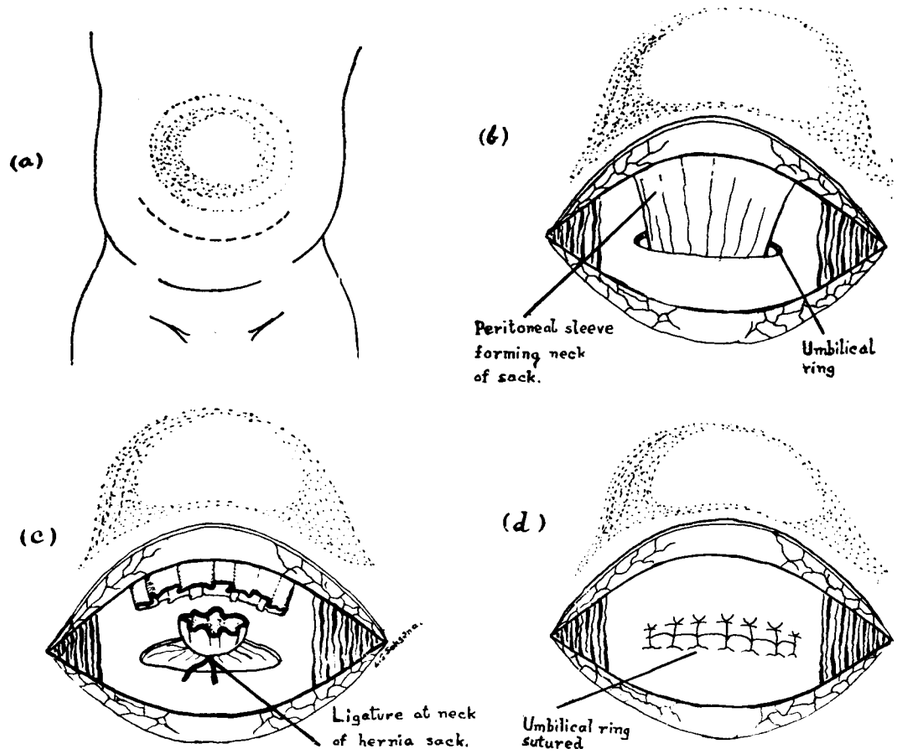

Fig. 4.

The steps of an operation for the repair of an umbilical hernia.

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the umbilical cicatrix, the umbilical skin cicatrix is separated by cutting through the fundus of the sac which is adherent to the umbilicus. The opening made in the sac is repaired and the peritonium is then separated from all round the umbilical ring for some distance. The umbilical ring is then closed by interrupted mattress sutures in Mayo's fashion. Skin flap is then replaced and sutured. In larger hernias the same procedure may be adopted, and as soon as the empty sac is seen it is cut through (Fig. 4). It is not required to free the whole of the sac and excise it, as this dissection is likely to cause devitalisation of the umbilical skin flap (Milroy Paul). This procedure has the advantage of preserving the normal umbilicus. The extra care in preserving the umbilicus in these cases is worth-while taking. The absence of umbilicus may be noticed by the patients' school mates later and he may have to be a subject of ridicule.

Treatment of Exomphalus:

In the severe degree with supra-umbilical defect early operative treatment is indicated in a well equipped hospital where

arrangements for good baby nursing, oxygen tent and arrangement for transfusion together with the services of an experienced anaesthetist are available. There is danger of rupture and infection, reaching the sac. This danger lies from the fact that the thin amnion dries up soon and permits passage of pathogenic bacteria inside the peritoneal cavity, setting up peritonitis.

In cases where the amount of extra-abdominal bowel is not great the operation is not so urgent. It should be borne in mind that a child's life cannot be saved unless the hospital is well equipped. It should also be borne in mind that a spontaneous cure is also possible by the growth of skin on the amnion (Ellison Nash).

Operation

The closure of the abdominal wall is the most difficult part of the operation. The edges of the gap are excised. Attention should be paid to the umbilical arteries and vein and each carefully ligated. The peritoneum and posterior rectus sheath may be freed sufficiently to close the gap. The anterior rectus sheath is then repaired and finally the skin. If there is great difficulty in bringing the peritoneum together or if it is brought together with great difficulty it causes rise of intra-abdominal pressure resulting in respiratory and circulatory embarassment. In such cases a two stage closure should be done. At the time of the initial operation skin should be under cut and freed and then sutured so that the patient is left with an incisional hernia. At a late stage varying from one to three weeks the wound is re-opened and now the peritoneum and muscles can be approximated without difficulty (Ladd and Gros).

Umbilical Hernia in Adults

The sac of umbilical hernias in adults is often multilocular in the loose abdominal wall. They are more often para-umbilical than umbilical. They have no tendency to cure themselves. Strangulation is not an uncommon complication. Strangulation is perhaps due to the fact that the contents of such hernias are omentum, transverse colon and small intestine. The entering loop presses upon the returning loop. This causes distention of the large bowel and organisms escape through the wall of the bowel into the sac setting up mild inflammation and causing adhesions. The umbilical ring then acts as the strangulating agent. Incarceration as a complication of hernia occurs most often here than in hernias at other sites like inguinal or femoral. This is due to the fact that solid faeces are impacted in the lumen of the large gut, which is the usual content of the hernia.

Treatment :

Strapping has no place. Where the contents of the sac can be completely reduced a procedure similar to that described for children may be adopted. In cases where the hernia is large and adhesions are present in the sac (which may also be multilocular) and the hernial contents are not completely reduced the operation of choice is to make an elliptical (transverse or vertical) incision round the swelling which remains as an island. The incision is deepened till the aponeurosis is reached, and the fat is dissected off from the aponeurosis working from periphery to the centre till the opening in the aponeurosis is defined. The neck of the sac is opened at a place where adhesions are not present. The contents are reduced. Portion of the omentum may require removal. Peritoneum is repaired. Opening in the aponeurosis is repaired by Mayo's technique or in vertical direction and then the subcutaneous tissue and lastly the skin is repaired. It is advisable to put in a rubber drain for 24 hours in the subcutaneous tissue.

Abdominal binders to support the hernia may be the only method of treatment possible in patients who are obese with poor cardio-respiratory reserve and have a large hernia.

Strangulated Umbilical Hernia

Strangulation occurs most commonly at the umbilical ring which is narrow. The

ring is enlarged, releasing the strangulation. The gut or omentum is examined to see if it is viable and is dealt with as occasion demands. The mortality of strangulated umbilical hernia is high because persons affected are obese and the part of gut involved is large bowel which contains many bacteria.

Six cases of umbilical hernias in adults were operated upon by the author; four were paraumbilical and two were umbilical. Strangulation was present in two cases. Incarceration was not present in any case.

Hernia of linea alba

The common site in the linea alba where herniation occurs is within three inches above the umbilicus and less commonly within two inches below it. Most of these hernias are symptomless but some produce symptoms out of proportion to their size. Attacks of pain in abdomen simulating an "acute abdomen" (like that of intestinal obstruction or appendicular colic) or peptic ulcer or gall bladder dyspepsia may occur. It may be pointed out that some times a small umbilical hernia may also produce symptoms out of proportion to its size. It is not clearly understood why this occurs. Through the opening in the linea alba for the blood vessels, or the interval in the linea alba between the lattice work of fibres, a portion of properitoneal fat or fat of the falciform ligament insinuates itself and results in the fatty hernia of the linea alba. A process of peritoneum may follow together with omentum or a loop of intestine. Symptoms referred to the bowel are then present. In most of these cases the hernia ring remains small and in those cases where omentum and intestines find their way into the sac, sacculation may occur and the hernial contents are not completely reduced. Strangulation is then as common as in umbilical hernia. Such large hernias of the linea alba occur close to the umbilicus. Ten cases of hernia of the linea alba were operated upon by the author out of which two came with strangulation

Treatment is similar to that of umbilical hernia. In those cases where only fat comes out through the hernial opening this may be excised after a transfixing ligature; and the hernia ring closed; but in those where a process of peritoneum comes out as a sac the sac should be opened and its neck transfixed and ligated and the sac removed followed by repair of the hernial ring.

Divarication of Rectii

The factor responsible for this condition is the lessened tone of the rectii, so that the lower abdomen below the umbilicus becomes protuberant and the gap between the rectii in severe cases increases to as much as four inches or so. On asking the patient to rise up from the bed the edges of the rectii can be clearly felt and fingers can be insinuated between them. There is no clearly defined sac, no hernical ring, and no neck of the sac. Strangulation does not occur. In severe cases the defect may run upwards beyond the umbilicus. This occurs most commonly in females following pregnancy. In a series of 6 patients, history revealed that the condition appeared after first pregnancy in two cases, after fourth pregnancy in one case, after fifth pregnancy in one case and after sixth pregnancy in two cases. It is not clearly understood why this divarication should occur in some cases following the first pregnancy and in others after the fifth or sixth pregnancy. Perhaps there may be some factor which is yet undetermined and may be responsible for regulating the tone of the muscles. The answer may be found in some congenital weakness of the muscles or may be that a large foetus which stretched the muscles resulted in the condition. More observations are required before one can come to any conclusion.

Treatment :

Abdominal exercises improve the tone of the rectii and quite a number of these cases improve so much that they do not need any operative treatment. If after exercises the

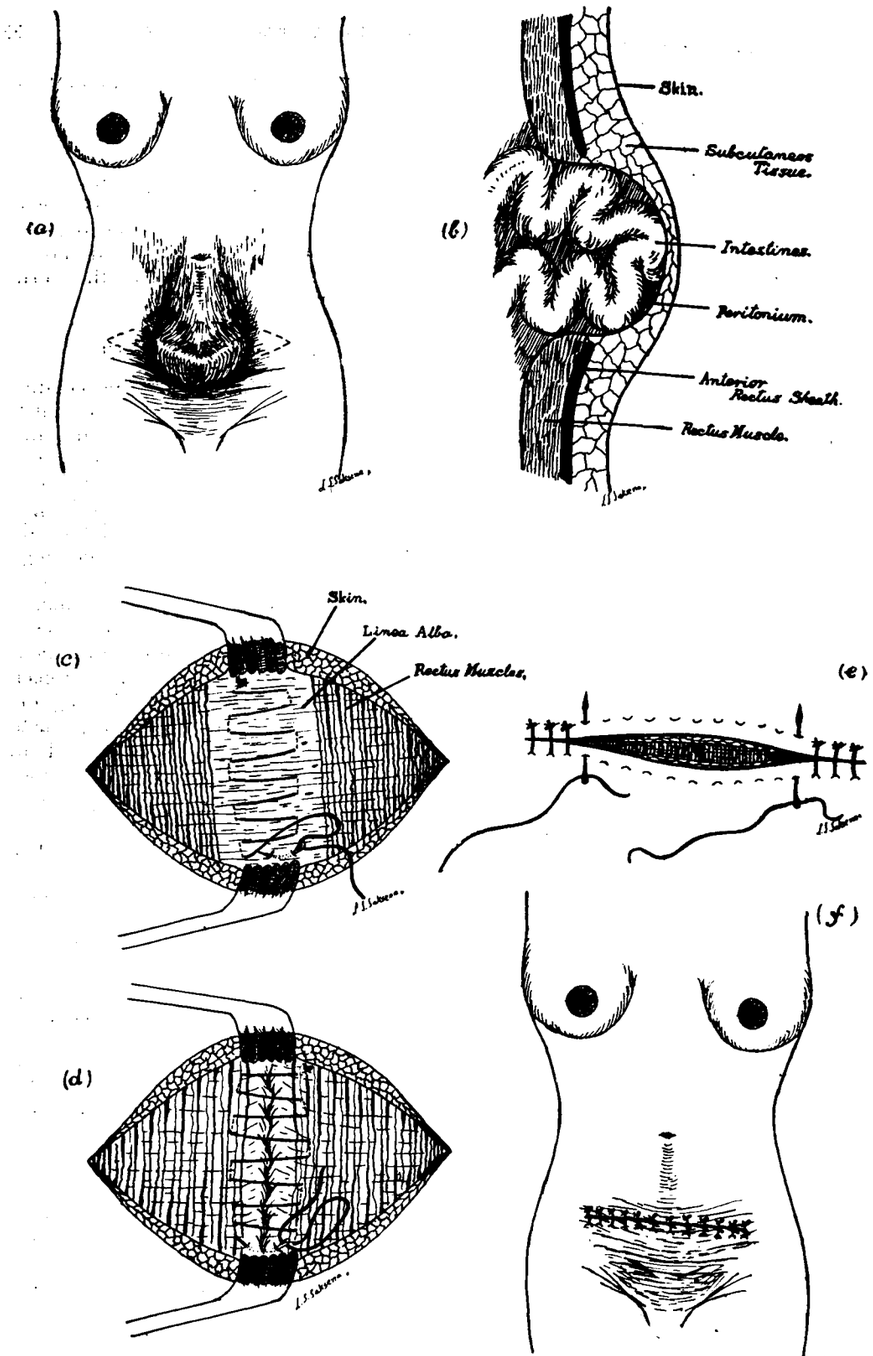

Fig. 5.

The steps of an operation for the repair of divarication of rectii.

improvement is not as desired, operative treatment is indicated. An ellipitical transverse incision is made so as to remove the loose skin (Fig. 5). The stretched out linea alba and anterior rectus sheaths are exposed. By continuous mattress sutures of floss silk the aponeurosis is plicated and inverted in a vertical direction picking up the aponeurosis at a distance of one and a half inches in the transverse axis. A second row of sutures of the same material is taken which now picks up the medial margin of the rectus muscles and anterior rectus sheath so that the muscles are brought into apposition. The skin edges are then sutured. This operation was done in two cases and the remaining four cases improved with exercises only, so that operative treatment was not advised.

Incisional Hernia

Such hernias in the midline are large ones and are really concealed cases of burst abdomen in that the linea alba or the posterior rectus sheath and the anterior rectus sheath did not unite but the skin united following the operation for which the abdomen was opened previously; or are cases of stretching of the scar specially noticed after infection. These patients suffer from the discomforts of weakness of the abdominal wall and some form of dyspepsia but strangulation is uncommon because of the large size of the defect in the abdominal wall. Four such cases that came for treatment were previously operated upon for the following conditions. Two were cases of intestinal obstruction, one was a case of exploratory laparotomy in which appendicectomy was done and one was a case of tube ligation. Two types of operation can be done for such cases, (1) opening the sac and removing it and bringing the edges together. (2) Inverting the sac without opening it. This can only be performed in those cases where there is absence of adhesions between the gut or omentum with the sac wall. This can be felt through the skin of abdomen while reducing the hernia after the contents have entered the sac following coughing. A longitudinal elliptical skin incision is made and the scar dissected off from the sac to which it is closely adherent. Skin flaps are then raised on both the sides till the rectii are exposed. Absence of adhesions between the sac and its contents is confirmed. The sac is now plicated and inverted in vertical axis picking up the sac wall in transverse direction at a distance of 1½″ by a running mattress suture of floss silk. Two or three rows of such sutures are required before the edges of the rectii are brought into apposition, depending upon the width of the sac. In those cases where adhesions are preesnt, the sac is opened, adhesions are liberated, the sac is excised and its margins are sutured together. The advantage of the inversion operation over excision of sac is that post-operative period is very smooth. There is no distension of abdomen, flatus is passed within twelve hours, the patient enjoys his food early and becomes ambulant soon.

Summary

1. Forty cases of umbilical, paraumbilical hernias and those of midline ventral abdominal wall (hernia of the linea alba, divarication of rectii and incisional hernia) have been reviewed.

2. From the above study it was noticed that umbilical hernias in infants and children differ in several respects from those of hernias in adults.

(a) The hernias in infants have a tendency to cure themselves but not so in the case of adults.

(b) In infants the skin of the umbilical cicatrix is widely adherent to the sac wall, in adults it is not so adherent.

(c) The sac is unilocular in infants and multilocular in adults; strangulation rarely occurs in children while in adults it is not uncommon.

(d) The hernias are preponderantly umbilical in children and paraumbilical in adults.

3. Advantages of preserving the umbilicus, as far as practicable, in the operative treatment has been discussed.

4. The role of non-operative treatment i.e. by proper strapping, in some cases of infantile hernia, has been indicated; and the correct method of strapping has been stressed.

5. The variegated and sometimes confusing, clinical features of hernia of the linea alba have been elaborated.

6. Etiological factors leading to divarication of rectii and their relation to child birth has been discussed.

7. The concept that some cases of incisional hernias are really 'concealed' cases of burst abdomen has been advanced.

8. In the treatment of divarication of rectii and of incisional hernias, the advantages of 'inverting operation' without opening the peritoneum has been indicated.

ACKNOWLEDGEMENTS

The author is thankful to the Editor of the Annals of the Royal College of Surgeons of England and Professor Milroy Paul for permission to reproduce some figures and extracts from the November, 1953 issue of the journal. He is thankful to W. B. Saunders Company and Professor R. E. Gross, M.D., for permission to reproduce some figures and extracts from Abdominal Surgery of Infancy and Childhood. He is thankful to Dr. Mohamed Imam, the Superintendent of the Patna Medical College Hospital for permission to publish these cases.

He is thankful to his present and past house Surgeons and clinical assistants and his colleagues particularly Dr. R. N. Sinha, F.R.C.S., and Dr. S. C. Almast, M.S., for many valuable suggestions. He is indebted to Prof. U. P. Sinha, who allowed the author to operate on cases under his care without which this paper would not have been possible.

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Received for publication on 7-4-'55.

PLASTIC AND RECONSTRUCTIVE SURGERY OF THE NOSE

by M. MUKHERJEE, Calcutta.

The history of plastic surgery is as old as the history of Rhinoplasty, i.e., reconstruction of the nose. It was in India that reconstruction of the nose was first done by the Hindu Surgeons of 3000 B.C. These Surgeons utilised a flap graft from the forehead to build the nose and even now the skin from the forehead has been found to be the best material for the same. This method is known as the Indian method of Rhinoplasty and it is still the best in the field of Plastic Surgery (Figs. 1 & 2).

This art spread through Arabia and Persia to Egypt. The Italian Surgeons learned the subject from Egypt. Tagliacozzi, the famous Italian Surgeon reconstructed the nose from the skin of the medial side of the arm. This procedure has been recognized as the Italian method of Rhinoplasty. In patients whose foreheads are very narrow or who do not like to have a scar on the forehead, the Italian method is of much use. But the complexion of such a nose seldom matches with the surrounding facial skin (Figs. 3 & 4).

The most interesting part of the history of Rhinoplasty is that it was in 1744 (i.e. in the 18th Century A.D.), that the Surgeons of the East India Company learned the art of Rhinoplasty from a Mahratta Surgeon near Poona. These British Surgeons watched him doing a Rhinoplasty on a bullock cart driver. The first successful case, however, of reconstruction of the nose was published in 1814 by the British Surgeons, i.e. 70 years after they learned the art from India. After this glorious history, this branch of Surgery degenerated in India while it went on progressing in England and Europe.

In the history of Rhinoplasty, there is no mention about the construction of an inner lining for the nose nor is there any remarks about a supporting frame work. It was Sir Harold Gillies (Photo) father of the modern Plastic Surgery, who brought the art of Rhinoplasty to perfection. He utilized the Skin of the face or folded the margins of the flap for making the inner lining and used bone or cartilage grafts for the maintenance of the Nasal frame work.

ANATOMY

The external nose is a pyramid extending from the glabella above and terminating in the nasal tip below. The outer covering skin has got different shades of colour in different parts. The inner lining is mucous membrane except at the vestibule where it is skin with nasal whiskers. For surgical purposes the nose has been divided into 3 parts.

(1) Upper third.
(2) Middle third.
(3) Lower third.

The upper third is supported by nasal bones and the nasal processes of the Maxillae. Middle third — the two upper lateral cartilages from its frame work. Lower third — the two alar cartilages form the frame work. Each has a lateral and medial crus. The medial ones form the septum mobile nasi. The nasal septum is the supporting armature of the nose particularly from the nasal bones to down between the domes of the alar cartilages where the lower points of the upper lateral cartilages terminate. Loss of septal support causes depression or collapse of the segment of the nose — the socalled saddle nose deformity.

METHODS FOLLOWED FOR RECORDING OF CASES

(1) Clinical description.
(2) Photograph.
(3) Facial casts made of Plaster of Paris.

Injuries: Injuries of the soft parts of the nose — In most cases these injuries are

Fig. 1.

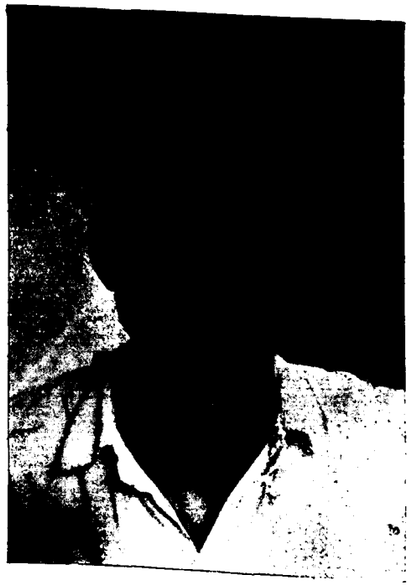

Fig. 2.

Figs. 1 & 2. Indian method of Rhinoplasty.

Fig. 3.

Fig. 4.

Figs. 3 & 4. Italian method of Rhinoplasty.

Fig. 5. An Ideal Nose.

Angle of the nose from the face — 30° to 40° on an average. 36° is ideal. Anything beyond 30° to 40° is abnormal.

Columllar lip angle — 90° to 110° on an average. 90° is ideal.

either associated with fracture of the bones or splitting of the cartilages.

Treatment: The injured parts are cleaned thoroughly with cetavlon. As a rule no excision of the wound margins is done except when the skin margins are very badly damaged or are very irregularly cut. Then the margins are made even before suture. Suturing is done with the utmost care so that no stitch mark is left and the scar is only a line. Lately attempts have been made not to put any skin sutures but to keep the skin margins apposed by interrupted sub-cuticular catgut stitches. In case where these catgut stitches cannot hold the skin margins properly apposed a continuous subcuticular dermalon suture is made (Fig. 6).

Fractures of the nasal bones

The fractures are diagnosed from the history and the clinical examination. A photograph may help in detecting minor deformities. An X-ray picture is not of much value in the estimation of Nasal fractures. Reduction should be done as soon as possible but always with the advantages of an well equipped operation theatre (Fig. 7).

Injuries of the Naso-Maxillary complex: In these fractures, the nose with the central third of the face is depressed causing a deformity known as 'Dish face'. These patients may require traction with Hyne's apparatus (Fig. 8) from a plaster shell on the skull to keep the fractures in position after the reduction is done.

Operations for reconstruction or correction of the nose are divided into 4 groups:—

(1) Total Rhinoplasty.
(2) Partial Rhinoplasty.
(3) Corrective Rhinoplasty.
(4) Operation for saddle nose.

In one particular patient more than one of the above operations may be necessary, e.g., a partial loss of the middle of the nose may be covered by a fore-head flap but unless it is elevated by a bone graft, the saddle nose deformity persists (Fig. 9).

(1) *Total Rhinoplasty*:

Total Rhinoplasty is best done with skin from the fore-head, the Indian method. The defect is assessed by a facial cast. A wax nose is made on the cast to find out the extent of tissue loss. A piece of jackonet is cut in the form of the wax model. Then the required flap is designed on the fore-head with the jackonet piece. If the flap is found to be too big then its suture is delayed in the first stage. After one week the skin around the margin of the nasal defect is incised and everted to form the inner layer and the fore-head flap is transferred to cover the whole of the raw surface over the nose. The pedicle of the flap

Fig. 6-a.
Injuries of the nose and face (before operation).

Fig. 6-b.
Injuries of the nose and face (4 months after operation).

Fig. 7-a. Fig. 7-b.
Fig. 7 (a & b). Fracture nasal bones before and after treatment.

Fig. 8.

is detached after 3 weeks and the nose is shaped. But the nose thus made needs a support for the maintenance of its proper shape and size. Bone grafts and hinged cartilage grafts were used for this purpose. Both the methods fail to give a proper shape and support to the nose. If such noses are built on bivalved prosthetic supports which can be removed from the nostrils, cleaned and replaced, then the final shape of the nose is much better (Figs. 10, 11, 12, 13 & 14).

(2) *Partial Rhinoplasty* :

Partial Rhinoplasty is also best done with forehead flaps. But local facial flaps or even composite grafts from the auricular pinna have been utilised to construct the columella or the ala of the nose (Figs. 15, 16, 17, 18 & 19).

(3) *Corrective Rhinoplasty* :

Corrective Rhinoplasties may be grouped as cosmetic operations although at times these are absolutely essential.

(i) Depressed tip of the nose with short columella — This defect can be corrected by constructing a columella from the skin

Fig. 9-a. Fig. 9-b.

Fig. 9 (a & b). Partial Rhinoplasty with nasal bone graft.

Fig. 10.

Fig. 11.

Figs. 10 & 11. Total Rhinoplasty in different stages.

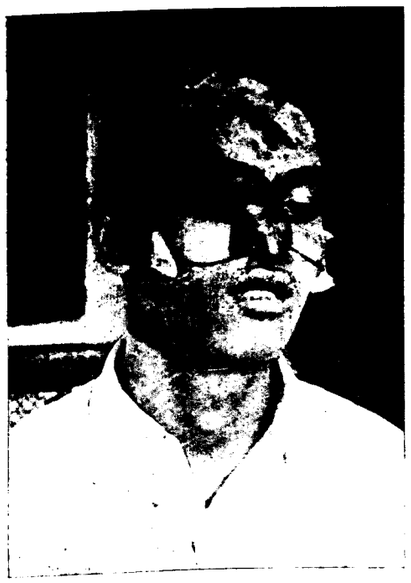

Fig. 12.

Fig. 13.

Figs. 12 & 13. Total Rhinoplasty in different stages.

Fig. 14.
Total Rhinoplasty in different stages.

Fig. 15.
Partial Rhinoplasty in different stages.

Fig. 16.

Fig. 17.

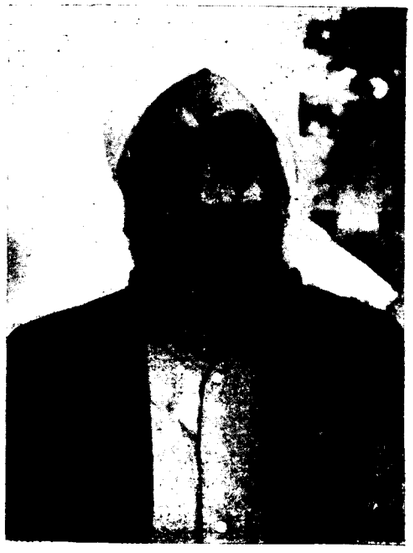

Fig. 18.

Fig. 19.

Figs. 16, 17, 18 & 19. Partial Rhinoplasty in different stages.

Fig. 20-a.

Fig. 20-b.

Fig. 20 (a & b). Depressed tip of the nose (a) before and (b) after repair.

Fig. 21-a. Fig. 21-b.

Fig. 21 (a & b). Mild degree of bifid nose before and after repair.

Fig. 22-a. Fig. 22-b.

Fig. 22 (a & b). Rhinophyma before and after operation.

Fig. 23-a. Fig. 23-b.

Fig. 23 (a & b). Displaced alae nasi before and after repair.

Fig. 24-a. Fig. 24-b.

Fig. 24 (a & b). Closure of nostrils before and after operation.

Fig. 25-a. Fig. 25-b.

Fig. 25 (a & b). Hairly mole on the nose cured by excision and local flap.

of the lip by ' V — Y ' extension flap (Figs. 20 a & b).

(ii) Bifid nose — This is a very difficult problem but mild degree can be repaired by local plastic procedures. The tip of the nose was narrowed by excising cartilage chips from both sides of the nasal septum. These cartilage chips were utilized to raise the tip of the nose. The columella was narrowed and elongated (Fig. 21).

(iii) Rhinophyma — The best procedure to relieve this condition is to excise the tumour mass in one piece keeping a normal nasal contour behind. The raw surface will be covered with skin growing from the hypertrophied ducts of the sebaceous glands (Fig. 22).

(iv) Displacement of alae nasi — This child had an injury of the nose with fracture and displacement of the right ala of the nose. The ala was separated from the nasal process of the maxilla and a transposition of flaps was done to bring the ala down to its normal site (Fig. 23).

(v) Closure of nostrils — ulceration of the nostrils, burns or injuries may cause this defect with stoppage of breathing through the nose.

The defect can be corrected by transposition of flaps or onlay skingrafting. The moulds on which skin grafts are spread have to be kept in place for 2 months. This is done either from a dental cap splint or a Head cast (Fig. 24).

(vi) Moles and simple tumours of the nose — Small sized moles and tumours can be excised and the loss filled up by local flaps. But if the mole is big a medium

Fig. 26-a.
Saddle nose (before operation).

Fig. 26-b.
Saddle nose (after operation).

thickness skin graft is probably best as a forehead flap will be too thick and will produce an extra scar on the forehead (Fig. 25).

(4) *Saddle nose*:

Corrective operation for saddle noses pleases both the Surgeon and the patient. There are different procedures and different types of materials have been used, e.g. Autogenous cartilage, or bone, bovine cartilage, Homogenous bone, and the newer plastic materials like polythene, alkathene, etc. Autogenous spongy bone graft from the iliac crest has been used in all the cases in our hospital with fair results. The size and shape of the graft is estimated from the amount of defect, and a bone graft slightly bigger than required is removed from the iliac crest. Then the graft is shaped properly. The columella is split in the middle and by blind dissection the skin of the nose is elevated from the depressed base, i.e. the damaged septum. The graft is then pushed into the space thus made. The nose is fixed in a plaster cast for 15 days (Fig. 26 a & b).

Received for publication on 1-1-'55.

CONGENITAL ABSENCE OF THE PENIS

*by U. MOHAN RAU, Madras.**

One of the rarest of congenital anomalies recorded in literature is that of absence of the penis. Writing in 1939, Drury and Schwarzell[1] state, "we have been able to collect only seven genuine cases in a review of literature after 1700". Harris[3] estimates that this condition occurs once in 30,000,000 births. McCrea[5] has stated that there were only ten authenticated cases reported upto 1942. Sir Harold Gillies[2] added two more cases to this number in 1948.

CASE REPORT

Sri E., aged 47 years, was admitted into the Govt. General Hospital, Madras on 19-12-1946, for a rapidly progressive tumour in the lower half of the abdomen.

Routine physical examination revealed that besides having an intra-abdominal mass, the patient had a rare congenital anomaly — the absence of his penis.

Examination of the genitalia (Fig. 1). The scrotum was well developed and appeared slightly bifid. Both testes, epididymes and vas deferens were normal; the left testis was on a slightly higher level than the right. There was no penis; nor was there any evidence of corpora cavernosa or corpus spongiosum. No urethral orifice could be made out either in the pre-scrotal region or in the perineal region.

When the patient was made to pass urine, he did so with ease, the urine coming out through the anal orifice. The patient had full control over his micturition. His secondary sex characters were all normally present.

Proctoscopy revealed, after a lengthy and meticulous search, a small orifice in the anterior anal wall. This orifice was hidden by a fold of mucous membrane. During micturition, urine was seen to come out from this orifice. The urine was clear. There was no evidence of any proctitis or perianal cutaneous excoriation. The intra-abdominal tumour mass was pushing the anterior rectal wall backwards.

After further investigations which did not yield information of much diagnostic value, a laparotomy was done. The intra-abdominal mass was retro-peritoneal with a moderate sized bulge into the peritoneal cavity. The mass was densely adherent and inoperable. The *urinary bladder* was displaced downwards by this mass. The *kidneys and ureters* were normal.

After a biopsy, the abdomen was closed. *Histological report* on the biopsy material—Neurofibrosarcoma.

The patient was sent for post-operative irradiation therapy.

He did not desire to have any treatment given for the correction of his genital abnormality.

No information could be obtained from him regarding erotic feelings or orgasms, or seminal emissions through the anal orifice.

* From a Surgical Unit, Govt. General Hospital, Madras.

DISCUSSION

(A) An outline of the development of the male urethra and the external genitalia.

Urethra: In a human embryo of about 4 mm. length, the entodermal cloaca is continuous with the allantois and the hindgut (Fig. 2). Over the ventral wall of the cloaca the entoderm comes into direct contact with the surface ectoderm without

Fig. 1.

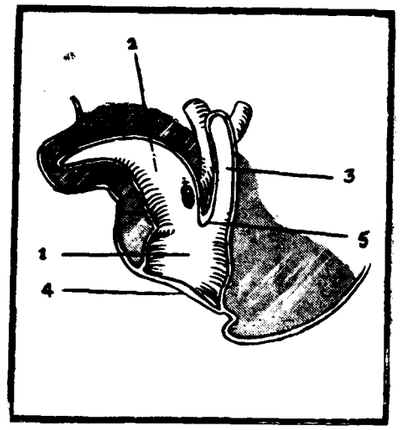

Fig. 2.
1. Entodermal cloaca.
2. Allantois.
3. Hind-gut.
4. Cloacal membrane.
5. Uro-rectal septum.

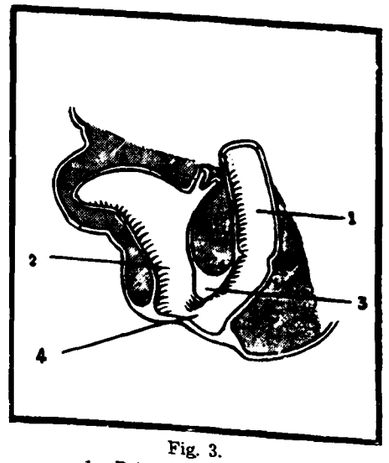

Fig. 3.
1. Primitive rectum.
2. Urogenital sinus.
3. Uro-rectal septum.
4. Cloacal duct.

interposition of mesoderm and this area is termed the cloacal membrane.

When the embryo is about 5 mm. (about 35th day) the entodermal cloaca is divided by a uro-rectal septum arising from the angle between the allantois and the hind-gut (Fig. 3). As this septum grows caudally, it divides the cloaca into a dorsal primitive rectum and a *ventral primitive urogenital sinus*. For a time (till about 16 mm. stage) a communication named the *cloacal duct or passage* exists between the two parts of the entodermal cloaca; this passage gets closed by the urorectal septum reaching the cloacal membrane. The cloacal membrane is thus divided into a posterior part, the anal membrane and an anterior part, the urogenital membrane (Fig. 4).

After its separation from the rectum, the primitive urogenital sinus consists of a part above the entrance of the mesonephric ducts called the *vesico-urethral canal* and a part below this level, called the *definitive urogenital sinus*. The vesico-urethral canal eventually gives rise to the urinary bladder and the upper part of the urethra. *The definitive urogenital sinus* (Fig. 4) can be divided into *an upper pelvic* and a *lower phallic part*. The *pelvic part* develops into the lower part of the posterior urethra and the membranous urethra, while the *lower phallic portion* elongates, is drawn into the under surface of the genital tubercle and is separated from the exterior of the embryo by the urogenital membrane (the anterior part of the cloacal membrane). This phallic portion plays an important part in the development of the rest of the urethra.

External genitalia: In embryos in the indifferent phase of sexual development, the surface area around the external aspect of the cloacal membrane shows certain changes. A surface elevation termed the *genital or cloacal tubercle* (Fig. 5) appears at the cranial end of the cloacal membrane and lengthens to form the phallus. A median groove develops on its caudal surface and includes the urogenital membrane in its floor. The raised margins of the groove are named the *genital folds*. The rupture of the urogenital membrane provides a perineal orifice for the urinary tract.

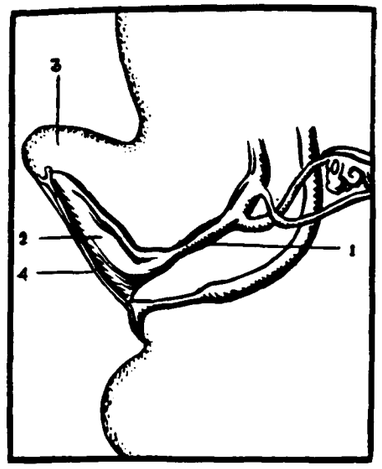

Fig. 4.
1. Pelvic part of definitive urogenital sinus.
2. Phallic part of definitive urogenital sinus.
3. Genital tubercle.
4. Urogenital membrane.
(After Shikinami)

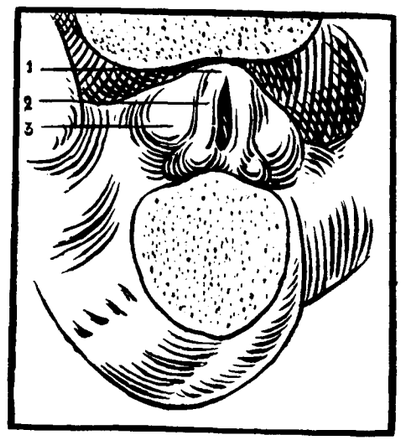

Fig. 5.
1. Genital or cloacal tubercle.
2. Genital folds.
3. Genital swellings or labio-scrotal folds.
(After Otis & Spaulding)

While these changes are in progress, two *genital swellings* (*labioscrotal folds*) appear on each side of the phallus and extend caudally, separated from the genital folds by distinct grooves.

Later still, *the phallus* enlarges and becomes the penis (Figs. 6 & 7). The *genital folds* meet one another and then fuse from behind forwards enclosing the penile part of the urethra and completing the ventral aspect of the penis. The *genital swellings* unite in the midline and form the scrotum (Johnston[4]).

After the penile urethra has been established, connective tissue surrounding the urethra becomes condensed to form the corpus spongiosum urethra.

Comments: This case showed evidence of persistence of the cloacal passage — a very early embryonic condition. Besides this the distal portion of the urogenital sinus and the genital tubercle have failed to develop. The continued development of the proximal portion of the urogenital sinus corresponding to the prostatic and membranous urethra, has resulted in the urethra opening within the rectum. The rest of the urinary system was normal. The scrotum, developing from the labio-scrotal folds and the testes were all normally developed.

(B) Associated congenital anomalies.

Though in the cases reported earlier in literature there are references to co-existing congenital abnormalities, in the detailed case-reports of later authors (Drury and Schwarzell[1], McCrea[4] and Gillies[2]) as well as in the case reported here, there was no other congenital anomaly either in the urinary tract or elsewhere in the patient's body.

(C) Associated clinical and pathological conditions.

(i) *Hydroureters*: In the case reported by Drury and Schwarzell[1], intravenous pyelogram revealed bilateral hydroureters,

Fig. 6.
1. Glans penis.
2. Scrotal swellings.
(After Otis & Spaulding)

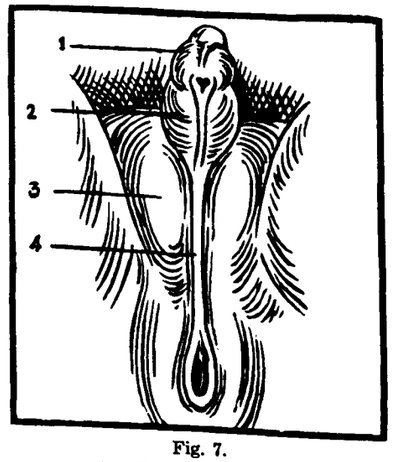

Fig. 7.
1. Glans penis.
2. Phallus.
3. Scrotum.
4. Scrotal raphe.
(After Otis & Spaulding)

most marked at the level of the 5th lumbar vertebra. The bladder outlined by the dye lay opposite the sacro-iliac joints and extended upwards to the midline of the 5th lumbar vertebra.

(ii) *Ano-proctitis*: Two of the case reports collected by Drury and Schwarzell[1], revealed that the respective patients had excoriation and ulceration about the anus, as a result of discharge of urine per rectum. In a few, burning and itching in the rectum were troublesome and in some, these symptoms were accompanied by chills, fever and sweats, apparently due to sepsis. Orchitis occurred in one instance. Neither hydroureters nor anal itching or proctitis were seen in McCrea's patient.

(iii) *Ectopic erectile tissue*: Ectopic erectile tissue was seen in some of the cases reported. Some of them had a small erectile eminence below the urethral opening in the anus (Rauber[6]), and others had a small erectile mass in the perineum in front of the anus. The case reported by McCrea[5] had a small elevation about 1 c.m. in front of the anterior anal margin. This elevation was soft and pliable and through this eminence urination was accomplished. On sexual excitement this little eminence became somewhat enlarged and very sensitive. By digital manipulation, masturbation could be completed with the ejaculation of a thick, viscous fluid.

(iv) *Secondary sex characters*: As was to be expected secondary sex characteristics were normally present in all the cases reported.

Comments: In this case none of these clinical and pathological states was present. No ectopic erectile tissue was made out. The secondary sex characteristics were normal.

(D) Treatment.

Plastic reconstruction of the penis after traumatic or surgical amputation has been reported by several authors. The majority of these authors have used abdominal tube flaps reinforced with rib cartilage, and attached to the penile stump in staged operations. The urethra was reconstructed either from a free split-thickness tube graft or by using skin from the new phallus.

Encouraged by the success of phalloplasty for absence of penis as a result of trauma or disease, plastic surgeons have attempted to mitigate the misery of those unfortunate patients who had congenital absence of the penis.

Gillies[2] describes in detail one such case. In this the opening of the urethra in the anal canal was isolated with a collar of mucous membrane around it and was brought out to the perineum anterior to the anal sphincter. A new phallus with a urethra was constructed with the help of a tubed pedicle flap from the abdominal wall containing buried cartilage; the urethra was incorporated in the body of the new penis by an ingenous "skin-flap tunnel method".

Comments: No such treatment was attempted in this case, as the patient was neither desirous of, nor willing for any such operative attempts at "curing" his condition.

Summary

1. A case of congenital absence of the penis is reported.

2. The embryological development of the urethra and external genitalia in the male is outlined.

3. The associated symptomatology as recorded in literature is briefly surveyed.

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Received for publication on 17-5-'55.

ANOMALOUS VASCULAR SUPPLY ASSOCIATED WITH CONGENITAL PULMONARY ABNORMALITY*

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Introduction

The first concise report regarding a vascular anomaly associated with a pulmonary abnormality appeared in an article published by Miller[14] in 1928, who reviewed Fischer's work. In 1946, Pryce[16] published the first complete review of the literature on the subject. He also put forth a theory which explained adequately the dual abnormalities. His findings showed that the abnormal artery to the lung usually arose from the aorta, midway between the diaphragm and the inferior pulmonary ligament. There was an associated broncho-pulmonary dislocation or sequestration in the area supplied by the vessel which carried oxygenated blood. These abnormalities occurred most commonly in the lower lobes, more often on the left side than on the right side.

The object of this paper is to review the recent literature and present two additional cases, bringing up to date about 100[6] cases reported in the literature. The incidence of this condition, in our experience, is approximately 0.4% compared to 1.8% as reported by Pryce[15, 16]. Since Pryce's original paper in 1946, a few important contributions on this subject have appeared; two of these came from Pryce[2, 15] himself in collaboration with others. The isolated arterial abnormality without the broncho-pulmonary component is not within the scope of this review. As is well known, the suprahilar arterial abnormalities are usually associated with the anomalies of heart and/or great vessels in about 75% of the cases; while such association is present in about 15% of cases of infrahilar arterial abnormalities[10].

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Embryology

This interesting dual anomaly can be understood by a resume of the embryology. The final pattern of persisting vessels that result from an original network of capillaries is uniform. But the factors, which differentiate the arteries from the veins, are not clearly known. The capillary plexus surrounding the primitive foregut is called the splanchnic plexus of capillaries. These have attachments mainly with three embryonic arteries, the two dorsal aortas, one on each side, and the central aorta. The future lung bud appears as an outpouch from the foregut in its ventral aspect in the embryo of 3 to 3.5 mm. (about 20 days). The lung bud carries with it part of the splanchnic plexus, which is termed the 'post bronchial pulmonary plexus' according to Huntington. In normal course, the primitive pulmonary arteries which develop from the aortic sac join the plexus present in the lung bud. By the time the embryo is 8 mm. in size, the lung bud has not only separated itself from the foregut but has also developed the major lobar buds. The mesenchymal tissue around these budgs grow about them leading to lobes of the lung. Pryce[15] suggested that probably simple mechanical factors during growth of the lung bud as cephalad shift and the close situation of the ventral aorta may favour the latter in retaining the communication with the lung bud. These form the future normal pulmonary arteries. But anything which interferes with this normal growth may result in persistence of the vascular supply from the dorsal aorta of either side instead of their atrophy, apart from the normal bronchial arteries. These embryonic vessels are of the size of capillaries and can lead to amputation of bulbous tips of the developing tree, which anatomically have only thin epithelium enmeshed in mesen-

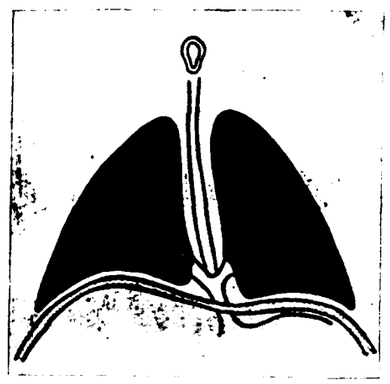


Fig. 1.
Agenesis of both lungs which would result if sequestration were to occur at 3 mm. stage.

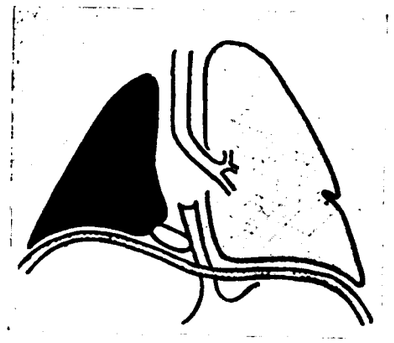


Fig. 2.
Agenesis of one lung which would result if sequestration were to occur at 5 mm. stage.

(Figs. 1 and 2 are from Pryce, O. M., Sellers, T. H. and Blair, L. G. Intralobar sequestration of lung associated with an abnormal pulmonary artery. British Journal of Surgery. 35: 18, 1947. Used by permission of the Publishers.)

chyme. These thin vessels capture one or more developing bulbous tips of the pulmonary tree which provide a good hold for these capillaries due to the shape of the bulbous tips. This arterial anomaly is subject to effects of traction resulting in various abnormalities of the lung. This is termed the traction theory where the resulting abnormality is part of the developing lung. If there is no distortion of growth of the bronchi, then the result is presence of an anomalous artery to an otherwise normal lung (Type I). If traction from such an abnormal arterial communication to the lung results in the dislocation of the bronchus so captured, varying degrees of congenital bronchial lesions will be associated with the arterial abnormalities. This artery may also supply adjacent normal lung (Type II[16]) or may be restricted to a congenital bronchial lesion (Type III). This 'capture' by the dorsal aorta may occur at varying phases of embryologic development. The earlier this abnormality occurs, the greater is the extent of the lung covered by this anomalous artery. This theory of Pryce explains most of the abnormalities that occur and also can date their origin in the course of embryologic development. Pulmonary agenesia can occur if this detachment takes place with death of the same at the 3 mm. stage as in the case report of Beneke[1] (Fig. 1), where there was sequestration of both lungs. If unilateral pulmonary agenesis were to take place, it is the result of capture and death of the first unilateral bulbous tip at the 5 mm. level as it occurred in Kleb's[12] case (Fig. 2), where the right lung became sequestrated. Lobar sequestration occurs at the 10 to 14 mm. stage. The small arteries in the inferior pulmonary ligament, even if they are to be regarded as arterial abnormalities, have only a pleural distribution.

The liver bud also arises from the foregut ventrally and grows into the mesenchymal mass. The stroma of the liver and septum transversum result from this growth. When the pleural spaces grow, enveloping the pericardium, they may still be communicating with the peritoneal

space through the pleuroperitoneal iter. Congenital diaphragmatic defects may be associated with and may also be due to the traction of the abnormal arterial communications between the developing diaphragm and the lung. This development of the diaphragm and the pleurae occur by the time the embryo reaches the 19 mm. stage.

If the dislocated or sequestrated mass remains within the lung it is called 'intralobar sequestration'. If this process becomes complete then 'extralobar sequestration' or lower accessory lung may result with a pleural sheath of its own. This probably arises at a later stage, when the pleural sacs have already enveloped the pericardium, which bulges into the left hemithorax. This results in asymmetery, which may lead to preponderance of the extralobar sequestration on the left side, due to an increase in the attached surface area of the developing left lung. Moreover, the venous drainage in case of the extralobar sequestration is usually to the hemiazygos vein unlike in intralobar sequestration where the venous drainage is usually normal. The lower accessory lung may be found in the abdomen or even associated with diaphragmatic defects. The former may be due to capture of bulbous tips of developing lung by an upper abdominal artery. Beneke[1] felt that sequestrated pulmonary tissue was the primary abnormality which secured its own feeding vessel. But since there are primarily vascular anomalies without concomitant pulmonary sequestration, it is more likely that pulmonary component is secondary to arterial abnormality. Capture and detachment of bulbous tips can be multiple leading to more than one broncho-pulmonary abnormality.

At the time of birth, there are 17 generations of bronchi but the full complement of the bronchi and alveoli are attained when the child reaches the age of seven years. Infection is common in intralobar sequestration and any interference in the growth due to inflammation occurring in pre- or post-natal period may result in cystic disease appearing after birth, not restricted to one lung[2].

The accessory theory (Eppinger) though it may explain lower accessory lung on the basis that it arises from an extra lung bud, does not satisfactorily explain intralobar sequestration. Pryce's theory correlates both intra- and extra-lobar sequestration, as resulting from similar abnormality during growth.

Cole, et al[8] included also other theories to explain the above phenomena as (i) deepening of pulmonary fissures (Retoryk); (ii) pressure of embryonic aortic arch system producing deficiency of bronchial system (Vogel); (iii) diaphragmatic amputation of the pleuroperitoneal iter; (iv) constriction of the portion of the normally developing lower lobe similar to azygos lobe formation (Humphreys); and (v) embryonic adhesions between the lung bud and the adjoining tissue (Gladstone).

The first four theories are self-explanatory and need not be elaborated. The last implies the idea of traction but still does not satisfactorily explain the sequestration of the whole lung nor the relationship between diaphragmatic defects and lower accessory lung. Surface attachment, however important it is, does not by itself produce sequestration, though it may play a part in distribution of the abnormality. This is evidenced by common situation of the sequestrated mass near the pulmonary ligament. They thought that none of the above theories are satisfactory and were of the view that any imbalance of 'organizing influences' during the embryologic development in a localised anatomic area as the lower chest would result in an anomaly or combination of anomalies or morphologic structures. We do not share the opinion that an area of normal lung supplied by an anomalous artery developed cystic changes secondary to other causes. But Pryce's theory is more appealing as it presents a single basis for the different anomalous conditions as systemic pulmonary arteries, pulmonary agenesis including the relationship between extra- and intra-lobar sequestration and pulmonary abnormality and diaphragmatic defects.

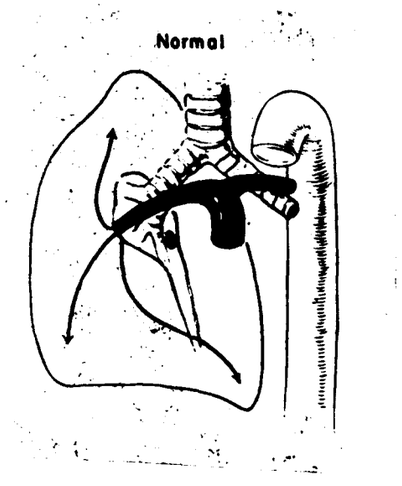


Fig. 3.
Shows the normal vascular supply.

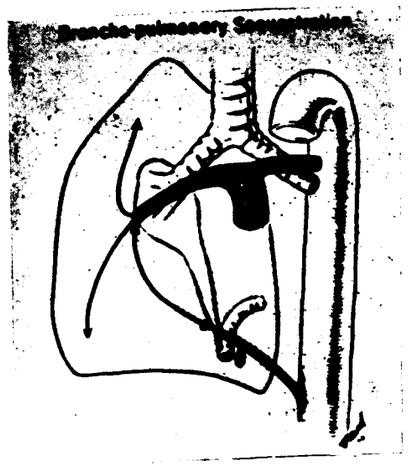


Fig. 4.
Shows an anomalous pulmonary artery from the aorta supplying an area of the lung which is sequestrated.

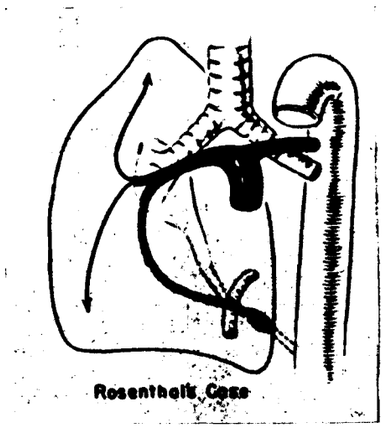


Fig. 5.
Rosenthal's case showing the anomalous artery which in turn got sequestrated.

(Figs. 3 to 5 are from Bruwer, A., Clagett, O. T. and McDonald, J. R. Anomalous arteries to the lung associated with congenital pulmonary abnormality. Journal of Thoracic Surgery. 19: 957, 1950. Used by permission of the Authors and the Publishers.)

A case was reported by Rosenthal[17] (Figs. 3, 4 & 5) where there appeared to be sequestration of a portion of a lower lobe supplied by anomalous artery which in turn got sequestrated from the aorta. This report gives a clue and also forms a 'missing link' between those cases of sequestration of part of the lung associated with the anomalous artery and those cases of congenital cysts of lung in which the anomalous vessel is absent. Some of these cases may have only the intrapulmonic part of an abnormal arterial communication present. Bruwer et al[4, 5, 6] in their excellent articles suggested the presence of increased vascularity in the walls of the congenital cysts of lung as an additional point in favour of the above view.

Nature of the Abnormal Vessels

Since the arterial supply in these abnormal cases is from the aorta or systemic

Fig. 6.
The anomalous pulmonary artery showing elastic tissue in its wall.

artery and carries oxygenated blood, the lung supplied by this vessel becomes sequestrated and functionless. They are usually situated in the inferior part of the thorax close to the pulmonary ligament. There is no accompanying bronchial artery. As stated above, the arterial supply may be (i) to normally connected lung; (ii) to a sequestrated mass and normal adjacent lung; and (iii) to sequestrated mass alone. Pryce[15] called it a systemic pulmonary artery on the basis that it was carrying blood at systemic pressure and hence thick-walled. The vessel has elastic structure typical of a pulmonary artery. Pryce says that the smaller pulmonary circulation can accommodate the blood present in the systemic circulation with each cardiac beat, due to the nature of its elasticity and extent of the vascularity of pulmonary tissue. Therefore, if the lung supplied by aberrant artery is fully developed, the systemic pulmonary vessel will show elastic tissue in its wall (Fig. 6). And the artery will be muscular if there is no development of the area of the lung being supplied by it. Being subjected to systemic pressure the vessel may show a theromatous changes, which may reduce the blood flow. It was formerly presumed that since the lung supplied by the abnormal artery was non-functional, the arterial changes were thought to be secondary to it. Experimental work was done by Blalock and Levy[4] in this direction. They transplanted the proximal cut end of the subclavian artery into the distal cut end of the left pulmonary artery of animals. There was an increased uptake of oxygen during anoxaemia though the uptake of oxygen was minimal under resting conditions. Subsequent pathologic examination of the pulmonary artery and the affected lung showed no apparent changes. Estimation of the pressure beyond the anastamotic site revealed it to be about half of the systemic pressure. Further proof to substantiate this work may be learnt from the examination of material obtained at autopsy of those who had systemic pulmonary artery anastomosis for cyanotic congenital heart disease. Clagett and McDonald[7] suggested that the lung supplied by the aberrant artery being essentially non-functional is more likely to get infected. They presented a case where a left lower lobectomy was done for bronchiectasis with lipoid pneumonitis in association with an anomalous pulmonary artery. They thought that bronchiectasis with secondary infection resulted in the breakdown of cells releasing intracellular fat which was taken up by macrophages.

Since in the majority of cases the venous drainage is normal, there should be a communication between the aberrant artery and the pulmonary vein. To show this communication Bruwer[4] and Kergin[11] suggested injecting the two vascular systems with plastic solutions and then corroding the specimens leaving the vascular cast. One of Kergin's cases showed the two arteries having an independent distribution restricted to separate anatomic areas without the plastic material flowing from one to the other arterial system. Yet saline perfused freely into the pulmonary vein from both pulmonary and anomalous arteries. This proves that there is an arterio-venous shunt of no small magnitude as blood passes through the anomalous artery past essentially non-functioning lung into pulmonary veins. This may impose cardiac strain. Cole, et al[8] found anastomosis of anomalous artery with branches of the pulmonary artery in neighbouring lung field. As both veins and arteries develop from a single source, it is not surprising to find the communication with either the vein or the artery. Kergin[11] thought that increased post-operative exercise tolerance in a sixty-year old man operated for intralobar sequestration may have been due to the arrest of the vascular shunt. Whether such an anomalous arterial supply can be suspected pre-operatively by cardiac catheterisation and angiocardiographic studies remains to be worked out.

The Bronchopulmonary Mass

While discussing the embryology, attention was drawn to the various bronchopulmonary abnormalities that could result. The most common location is the posteromedial portion of a lower lobe, usually on the left side. Tosatti and Gravel[18] published a case report wherein the superior segment of the lower lobe was involved. It may appear to be a mass of alveolar hypoplasia surrounding bronchial cyst, or a simple large cyst or may be an area of localised congenital bronchiectasis. The sequestrated mass may appear quite distinct, if the dislocation is completely filled with mucoid material. Otherwise, this area may still be communicating with a normal bronchial tree. The communication may be congenital in origin or through a process of ulceration. Infection may enter the mass through the bronchi, if normal communication is present or direct spread may also occur. In both cases, the histological picture may be altered. If it is a big cyst, infection would convert it into an healed abscess cavity with epithelisation of the inner layer. Pryce reported a case where infection was by the hematagenous route, the focus being an osteomyelitis of the femur. Since the area is essentially non-functioning, it may appear solid and yellowish, being non-pigmented. The adjacent lung may show, if dislocation is incomplete, areas of bronchiectasis, or cysts placed between the broncho-pulmonary mass and normal lung. These may communicate with both the mass and the normal bronchial tree. Probably, these intervening cysts may be due to traction of long duration between the normal lung moving in a cephalad direction and the sequestrated mass held by the aberrant artery, resulting in tear. The tissue between the dilated bronchi is mainly fibrotic with inflammatory cells. The regional lymph glands, which are usually present in the accessory hilum, may show no anthracosis, if the area of the lung is non-functioning. Gladys Boyd[3] presented two cases with large cysts which showed tubercle bacilli in a series of six cases. The remaining pulmonary segments may be normal though they may occupy more or less space due to changes caused by the presence of the bronchopulmonary mass. Confirmation of these may be had by bronchography. Obviously, if there is complete sequestration, there cannot be any compensation and agenesia must occur.

Symptomatology

If infection does not supervene, symptoms may be absent. In an autopsy survey of about 6,000 cases covering 25 years, Boyd[3] could not find a case of intralobar sequestration and concluded that superadded infection would change the picture and prognosis of these cases. Age of the patients has ranged up to 65 years. Though symptoms may occur at any age period due to infection, usually they do so in the first or second decades of life. Patients usually complain of recurrent episodes of pneumonia not completely controlled by antibiotics. Continued infection is due to

inadequate drainage. They may have cough with foul-smelling expectoration, and occasional small bouts of haemoptysis, and fever and be mistaken for lung abscesses as in our second case.

Diagnosis

If asymptomatic and discovered by routine radiologic examination a mass, if seen, in either lower lobe of young patients, may be suspected to be intralobar sequestration. The skiagram usually shows a rounded density, cysts or bronchiectatic areas in region of the lower lobe. If bronchial communication is present, a fluid level may be visible in the involved area. It has been suggested that the possibility of connection with the lower thoracic aorta is brought out by the long axis of lesion being directed medially and posteriorly. Bronchoscopy shows a normal bronchial tree or purulent secretions from the result of infection. The bronchogram may reveal filling of the mass or cysts if bronchial communication is present. Associated areas of bronchiectasis are frequently revealed. If in a good bronchogram, a mass not filled by the opaque oil with adjacent incompletely developed bronchial tree is seen, a tentative diagnosis of sequestrated mass can be made. It may be mistaken for a pleural effusion or other tuberculous lesion and antituberculous therapy given. It can be misdiagnosed as empyema as in our first case and may be subjected to unnecessary surgical measures. Drainage of such an 'empyema' may result in severe haemorrhage due to the increased vascular supply present at a higher pressure. Drainage does not result in shrinkage of such cysts. Angio-cardiography could show up the anomalous vessel from the aorta lower down, but has not been so reported as yet.

Treatment

Surgical excision is the treatment of choice. At thoracotomy, the appearance of a non-functioning, rubbery yellowish mass, usually situated in the mediastinal aspect of lower lobe should evoke suspicion of a sequestrated mass. This part of the lung is usually not densely adherent to neighbouring structures. Close scrutiny of the area near the diaphragm may reveal the anomalous vessel. If this vessel is not secured, severe haemorrhage can occur. The importance of this vessel is evidenced in the literature by three surgical deaths, which resulted from injury to these anomalous vessels. Segmental resection may be unusually difficult due to abnormal vascular supply. If thoracotomy is done primarily for diaphragmatic defects, and an abnormal vessel seen emerging through the defect, preliminary examination of the lung supplied together with existing pulmonary circulation must be made before sacrificing the abnormal vessel and repairing the defect. Cole et al[8] reported two cases where such a step was taken before diaphragmatic repair was completed.

Case Reports

CASE I. Hospital No. 113383.

Miss B., a 20-year old girl was admitted on August 21, 1951 with a history of having had pneumonia at the age of eleven months. Since then, she was subject to repeated attacks of cough with mucopurulent expectoration and occasional bouts of fever. At the age of 12 years, an empyema was diagnosed, her left chest was aspirated and purulent material was removed. Her sputum was negative for tubercle bacilli. After a short course of streptomycin she underwent a staged thoracoplasty with removal of short segments of 3 to 9 ribs. Left phrenic evulsion was done soon after, with no benefit. Two years later, she had a revision thoracoplasty with no change in her symptoms. She had a marked scoliosis resulting from this operative procedure (Fig. 7). At this admission, she complained of cough with large amounts of purulent expectoration. She had had no haemoptysis. There was a flaccid left hemithorax with multiple scars, evidence of previous collapse therapy.

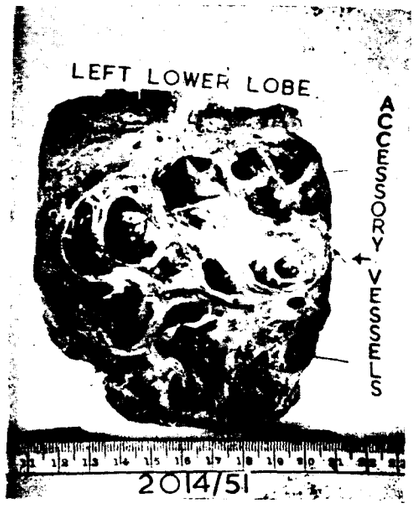
A skiagram of the chest taken on admission showed no change when compared with previous ones (Fig. 8). There appeared to be large cysts in the region of the left lower lobe with fluid levels. There was no evidence of pleural thickening. Bronchogram showed a normal left upper lobe but the lower lobe was replaced by multiple cysts with fluid levels into which the opaque oil flowed easily (Fig. 9). A provisional diagnosis of sequestration of the left lower lobe was made. On September 13, 1951 a left thoracotomy was done

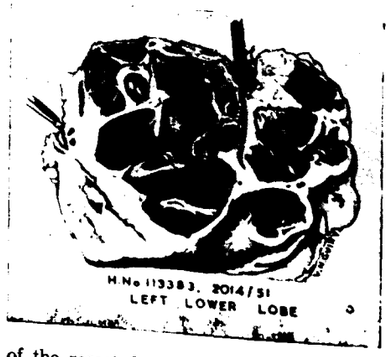
Fig. 7.
A view of the patient's back showing the scoliosis and the scar of the previous multiple operations.

Fig. 8.
Skiagram of the chest showing the sequestrated lung which appeared as cystic mass with fluid levels.

Fig. 9.
Bronchogram showing the oil flowing into the cystic space.

Fig. 10.
Post-operative X-ray of the chest showing the aerating left upper lobe.





Figs. 11 & 12. Section and diagramatic view of the resected specimen showing the lobe replaced by cystic spaces with the abnormal vessels in situ.

Figs. 13 & 14. P.A. and lateral view of the chest showing the cyst in the right lower lobe.

through the fibrous chest wall, with the patient in the prone position. The left lung was not densely adherent and was freed easily. The lower lobe appeared to be non-functioning and replaced by the sacs. The inferior pulmonary vein was found to be of normal size and in its usual position. It was ligated and divided. The bronchus to the lower lobe at its segmental division was divided and the proximal ends sutured with cotton. The pulmonary arteries to the lower lobe, in usual position, were next ligated and divided. Since preoperatively sequestration of the lower lobe was thought of, careful dissection was made between the inferior pulmonary ligament and the diaphragm. In this location, three moderate-sized arteries were found entering the medial surface of the lower lobe from the aorta opposite it. The largest of these had a diameter of 2.5 mm. and the rest were slightly smaller. There was one vein 4 mm. in diameter emptying into an intercostal vein. After securing these vessels, the lower lobe was removed without difficulty. The bronchial stump was buried with flap of pleura. The upper lobe expanded to fill the left hemithorax. The wound was closed in the usual layers leaving two drains. Post-operative period was uneventful. A skiagram of chest taken later showed a good left upper lobe (Figs. 10, 11 & 12).

CASE II. Hospital No. 117896.

A.K., a thirteen-year old boy was admitted on January 23, 1952 with a history of cough, since childhood. He underwent tonsillectomy at the age of ten years with only slight relief. A diagnosis of right-sided pleurisy with effusion was made a few months later. He had 30 grams of streptomycin and a right-sided pneumothorax induced and kept up for short duration. Two months prior to admission, he developed severe cough with foul-smelling expectoration. He was diagnosed then as a case of lung abscess of the right lower lower lobe. An intensive course of penicillin therapy controlled his symptoms. A skiagram of chest taken soon after admission showed an abscess cavity with a fluid level in the right lower lobe (Figs. 13 & 14). Bronchoscopy was done mainly to aspirate the copious purulent secretions. Sputum revealed strepto-viridans, pneumococci and M. catarrhalis.

Right thoracotomy was done on February 5, 1952 in the prone position. On entering the pleural cavity through the sixth intercostal space, the lower lobe was found to be adherent to chest wall and diaphragm but the adhesions were easily separable. It appeared than an abscess had almost replaced the basal segments and had encroached on the superior segment of the right lower lobe. The remaining lobes were free. The fissures were fairly well-developed. It was decided to do a lower lobectomy and the bronchus to lower lobe was isolated and divided to prevent spill-over of secretions. The proximal segmental bronchi were closed with interrupted cotton sutures. The bronchial arteries were larger than normal. There were a few enlarged lymph glands in the vicinity. The basal segmental artery was ligated and divided. When the lower part of lower lobe was being treed up the inferior pulmonary vein came into view and appeared to be about one and a half times normal size. Further dissection revealed an artery arising from the aorta and entering the lower lobe at the junction of the superior and the basal segments. The diameter of the vessel was about 4 mm. After ligation and division of this anomalous artery and the inferior pulmonary vein, the lower lobe was removed. The bronchus was buried with a flap of pleura. The wound was closed in the usual layers after allowing the upper and middle lobes to fill the chest and leaving two drains in situ.

Post-operative skiagram (Fig. 15) of chest showed well-expanded upper and middle lobes (Figs. 16 & 17).

Discussion

Discussion of the different theories in relation to the various congenital pulmonary anomalies in association with the vascular abnormalities has resulted in a vivid conception of the embryologic development together with the pathogenesis. Pryce's theory is attractive as it postulates a single

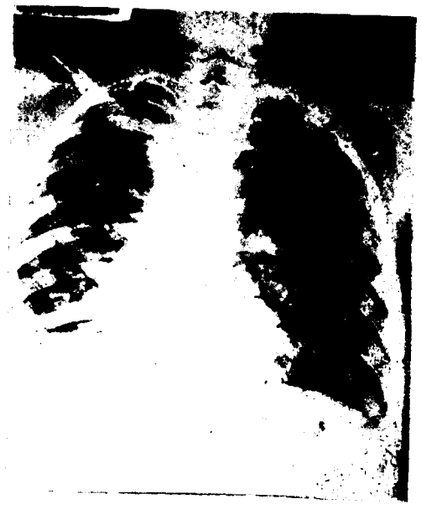
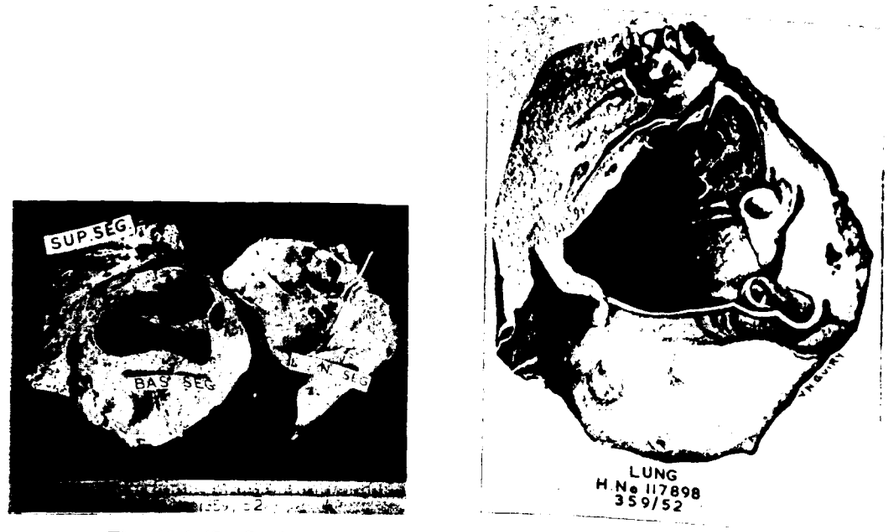


Fig. 15.
Post-operative X-ray of the chest after resection of the right lower lobe.



Figs. 16 & 17. Section and diagramatic view of the resected right lower lobe which shows the big cyst.

factor to explain anomalies ranging from diaphragmatic defects to pulmonary agenosia. It has shown that intra- and extra-lobar sequestration are anomalies varying in degree. Our first case showed, in addition to the arterial supply from aorta, there was an abnormal venous drainage to an intercostal vein, besides the normal inferior pulmonary vein. Probably this anomalous vein and the inferior pulmonary vein shared the venous drainage of the lobe. This may be an example of both intra- and extra-lobar sequestration being present in the same lung. We agree that symptoms in the case of sequestrated mass are largely due to infection.

If sequestration of portion of lung is suspected initially, many of the unnecessary surgical measures and much misery to the patient can be avoided. It should alert the surgeon and enable him to proceed cautiously during the surgery.

This diagnosis has to be borne in mind in all cases of cystic disease restricted to lower lobes. Rosenthal's[17] case arouses second thoughts as regards the nature of the cystic disease itself. Probably careful dissection may reveal sequestrated anomalous vessels in the region of the cysts. Methodical dissection of dead bodies of premature-born and infants may reveal confirmatory evidence in this respect. Further work is needed to study anatomical and physiological effects of pulmonary hypertension in a restricted area and of the abnormal circulation.

Summary

A review of the present literature on congenital arterial anomalies associated with pulmonary abnormality has been made. Two case reports have been presented. The consequences of the abnormal vascular supply have been stressed. A suggestion as to the aetiology of cystic disease has been re-emphasized.

The main clinical features of this condition shall suggest the true nature of the lesion pre-operatively. The treatment of choice is excision of the affected area.

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Received for publication on 2-2-'55.

HYPERTROPHIC PYLORIC STENOSIS IN AN ADULT

(Report of a case)

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Hypertrophic pyloric stenosis in the infant is a well-known clinical entity. Hypertrophic stenosis occurring in an adult is a rarity. Less than 150 cases have been reported in the literature. It is so rare that Vorhaus called it 'the enigma of adult'. Fibricus Hildanus was the first to recognise this condition; Wolfgang was the first to record a case in 1675; Landerer in 1879, applied the name 'congenital pyloric stenosis in adult.'

CASE REPORT

Jayalakshmi, aged 20 years, female, was admitted for severe vomiting of 4 days' duration.

Family history: She is the only child of her parents who are both healthy; she was married 10 years ago. She has a male child 2 years old.

Present illness: The present complaint started with a sudden attack of vomiting, for 4 days. Whatever she took by mouth, could not be retained and the vomiting was of a projectile nature. She was constipated for the last four days.

On admission the patient was under-nourished, and dehydrated, pulse was rapid and of poor volume and tension. Examination of the cardio-vascular, respiratory and nervous systems did not reveal any abnormality.

Abdomen was distended, the distension was confined to the upper part of the abdomen. Visible peristalsis of the stomach was seen coursing from the left to the right and just stopping a little beyond the midline. The stomach was markedly dilated and the borders of the stomach could easily be seen standing out. No lump was palpable in the abdomen. Liver and spleen were not palpable.

A diagnosis of high bowel obstruction was made; the presence of visible peristalsis ruled out any paralytic lesion.

The patient was vomiting more than what she was taking. Vomit contained undigested food, gastric juice and occasionally blood. At no time was bile present. F.T.M. showed achlorhydria.

The persistant absence of bile from the vomit localised the place of obstruction to the region of the pylorus. Since the general condition of the patient was poor, no immediate operative interference was possible. A continuous intravenous saline drip was started and the stomach was kept empty by aspirating frequently. In a week, there was considerable improvement in the general condition of the patient and she was started on intra-gastric feeds by a slow drip with a Ryle's tube in situ. Barium meal series done at this stage revealed the following:

1. Narrowing of the pars pylorica.
2. Smooth regular contour of the stomach at the antral extremity of the narrowed area.
3. A fleck of barium seen paroximal at the base of the duodenal bulb.
4. Invagination of the base of the duodenal bulb and its smooth concave base.
5. Barium present in small intestine in the 10 minutes picture. (Fig. 1).

These appearances were typical and diagnostic of a hypertrophic pyloric stenosis as described by Kirklin and Harris, 1930.

After a further week, she was started on semi-solid diet. This resulted in a recurrence of the original condition and inspite of continuous aspiration of the stomach, and intravenous fluid replacement therapy, she was rapidly going downhill. An emergency feeding jejunostomy was decided on as X-ray revealed a complete hold up of the stomach contents (Fig. 2).

Operation: On 16-7-1950 under local anaesthesia, abdomen was opened by a left paramedian incision. Stomach was very much dilated and there was a markedly hypertrophied pylorus. A jejunostomy was done and the indwelling catheter brought out through a separate stab wound. Abdomen was closed in layers.

Feeding was continued through the jejunostomy tube and the general condition of the patient improved gradually. On 11-8-1950 under local anaesthesia, abdomen was opened again by a right paramedian incision and a posterior vertical short-loop gastro-jejunostomy was done in the usual way. Exploration of the stomach revealed no other abnormality. The stomach showed evidence of chronic gastritis and the pylorus was markedly hypertrophied.

The post-operative convalescence was uneventful and 10 days after the operation, the patient was taking small solid feeds by mouth without discomfort.

Fig. 1.

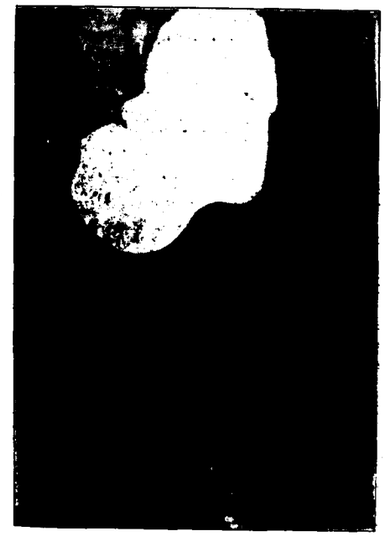

Fig. 2.

Fig. 3.

Showed a satisfactory functioning stoma with barium in the proximal loops of the ilium five minutes after an opaque meal.

Fig. 4.

Clinical picture of the patient taken just before discharge.

A post-operative barium meal series was done to visualise the function of the stoma. The stoma was found functioning well. To combat hypoproteinaemia patient had two plasma transfusions. The patient was discharged on 9-10-1950 (Figs. 3 and 4).

Discussion

The etiology of this condition is still obscure. There are two theories to explain its occurrence in the adult (i) the congenital theory and (ii) the spastic theory.

1. *Congenital theory*: (a) It is natural to assume that hypertrophy in adult represents a persistance of the infantile condition since morphologically both the lesions are identical. It is considered to be a persistance of the relatively thickened pylorus present normally in the fifth month of embryonic life.

(b) Crohn believes that it is a carry over of the infantile form with exciting factors bringing about the manifestation in adults.

(c) Katz stresses that sub-clinical forms of hypertrophy exist from birth. He states that the imbalance between the circular and the longitudinal muscles may lead to hypertrophy. The circular fibres are four times greater in number than the longitudinal.

(d) Freeman suggests that the hypertrophy is a throw-back to the ancestral types in the process of evolution. In graminivorous birds the gizzard is located in the same place as the pylorus in the human-beings. In the coloured ant-eater, a muscle tumour occupies the same region.

2. *Spastic theory*: (a) Morton speculates that it can arise either *de novo* or is due to varying degrees of hypertonicity which leads to hypertrophy.

(b) Martin and Burden put forward the view of sympathetic influence or impaired vagal inhibition leads to intermittent spasm of the muscle in intra-uterine life which leads to hypertrophy. Sub-clinical varieties of this condition exist which may give rise to symptoms during adult life when exciting causes are super-imposed.

(c) McLure is of the opinion that long-standing spasticity leads to hypertrophy. The spasticity can itself be produced by nervousness alone.

(d) Pinie believes that hyper-adrenalism is the stimulus which leads to hypertrophy. Excess of adrenaline inhibits the pancreas and lack of pancreatic secretion delays the neutralisation of acid chyme in the stomach which in turn leads to closure of the pylorus for an abnormally long time causing gastric retention and hyper-acidity which leads to hypertrophy.

(e) Recently Berke and Dunlop (1944) have brought forward evidence to show that the personality pattern plays a definite role in producing spasm. They stress the importance played by psychogenic factors. Whenever an individual is confronted by a situation which would arouse in him a natural reaction of concern and anxiety, the personality dysfunction tends to express itself in somatic distress. Prolonged recurrent pylorospasm associated with personality dysfunction may lead ultimately to a fixed hypertrophy and thickening of the pyloric antral musculature.

The precise relationship of the hypertrophic pyloric stenosis to the occurrence of non-specific chronic gastritis is not well-established.

Histopathology: The hypertrophied muscle forms a firm mass which in itself can give rise to varying degree of obstruction. The stomach proximal to it dilates and secretes an excess of mucus which may form a plug in the pylorus to complete the obstruction. Possibly an extra degree of gastritis accounted for the complete occlusion of the pylorus coming off all of a sudden in this case. Oedema of the submucus layer can also precipitate an attack of obstruction; the circular fibres have connective tissue septa which run perpendicular to the long axis of the pylorus making a series of closed units. These septa rarely penetrate the longitudinal muscle. The oedema fluid can collect in this series of closed units leading to obstruction. Due to the absence of the septa among the longitudinal fibres, there is rarely oedema in that layer. Further the complete separation of the muscles of the pylorus from the muscles of the duodenum has a physiological significance in that this separation causes a block in the antral wave. Stone and Ruggles stress that the hypertrophy has two suggestive features, viz., (i) decreased diameter of the orifice and failure to open, (ii) elongation of the pylorus with an immediate pre-pyloric deformity. In all the cases recorded, chronic gastritis, hypertrophy of the pyloric muscle and hypertrophy of the antral musculature have been constant features.

Clinical manifestation: The manifestation of this rare disease is very varied. Bockus divides them into (i) those who continued to have symptoms from childhood (ii) those with typical ulcer history of long duration (iii) those who manifest the symptoms of sudden acute obstruction.

X-ray appearances: Though Kirklin and Harris have described the typical appearance of this condition to be pathognomonic of this disease as mentioned above, yet Pendergrass has shown that the so-called umbrella-shaped deformity of Harris can be found in cases of prolapse of the mucus membrane of the stomach also. Further North and Johnson have reported identical pictures in pyloric ulcers.

Treatment: Rammstedt's pyloromyotomy as done for the infantile condition has been tried in adults with poor results though it is the operation of choice in infants. Gastro-jejunostomy seems to be a rational procedure. More so, as the presence of achlorhydria in such cases prevents the possible formation of anastomotic ulcers. Berke & Dunlop with many others believe that since there is no possibility of excluding a pyloric carcinoma except by a complete microscopic study of the pylorus, gastric resection must be the treatment of choice.

Summary

1. A case of hypertrophic pyloric stenosis in an adult is presented with the arresting feature of an acute onset resembling a high bowel obstruction.

2. The probable aetiological basis is discussed. An extensive study of personality factors may throw light on this interesting and insufficiently explained condition.

3. The rationale of treatment and the reason for the modification in this case are also brought out.

We are extremely grateful to Dr. K. N. Pisharoty, M.D., M.R.C.P., Dean, Stanley Hospital, Madras for giving permission to publish this article.

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Received for publication on 12-4-'55.

PRIMARY ADENO-CARCINOMA OF THE VERMIFORM APPENDIX

by D. J. REDDY and D. BHASKARA REDDY, Madras.

Primary adeno-carcinoma of the appendix is rare and is said to comprise approximately 3 per cent of the neoplasms of the appendix. Hence it is not surprising that many surgeons do not encounter a single case of this neoplasm throughout their career as a surgeon. It is rarely recognised by the surgeon at operation and invariably requires microscopic identification. It is perhaps rather than it is supposed to occur since many cases recorded in the literature may not have been adequately screened and have not satisfied the criteria for the same. Included in some reports are carcinomata arising from the adjacent caecum while in other instances carcinoid tumours have not been differentiated. Norment[3] estimates that the relation of carcinoma of the appendix to carcinoma of other parts of the intestinal tract is 1 to 250. Woodruff[8] and McDonald in 1940 found an incidence of 1 in 4,300 appendicectomies. Selinger[5] recorded 34 cancer lesions of the appendix in 45,302 appendices examined, forming 0.075 per cent of all surgical material and 0.35 per cent of appendices removed. Schudet[4] reported 0.027 per cent of adenocarcinoma in 3,692 appendices examined. Recently Lesnick[2] and Miller from New York reviewed 12 bonafide cases and added 5 of their cases to the list. Since their publication 5 more were reported, four from America and one from Holland.

Berger is credited with having recorded the first unquestionable case of primary adenocarcinoma of the appendix in 1882. Pre-operative correct diagnosis of this neoplasm of the appendix has so far never been made. Although adenocarcinomata of the appendix resemble carcinoma of the colon in that they occur in a comparable age group, behave in general in the same way and are pathologically similar, they, unlike cancers of the large bowel, produce no pathognomonic clinical symptoms which lead to an accurate diagnosis. In 16 of 22 previously reported casesm, the diagnosis of simple appendicitis or one of its complications was made pre-operatively. Disease of the appendix was not even suspected in the other 6 cases. Diagnosis is always made by routine histological examination of incidentally removed appendices.

Adenocarcinoma of the appendix is more commonly encountered in the female and Boyer[1] recorded 60 to 70 per cent of them occurring in the female. This is justified by the fact that the female abdomen is more often subjected to surgical operation than the male abdomen and naturally the appendices removed at each such operations on histological examination discloses greater incidence of this neoplasm in that sex.

Adeno-carcinoma of the appendix is always situated either at the base or in the proximal half of the organ where it frequently produces obstructive symptoms. The tumour assumes polypoid or fungoid appearance. Histologically it is composed of well formed glands or undifferentiated and illdefined glandular structures. A variable amount of mucus is produced and the characteristic signet ring shaped cancer cells are seen.

Prognosis as compared with carcinoma of the colon is better since the lesion is limited in extent at the time of removal, though a radical operative procedure is indicated.

Review of the biopsy reports of the Madras and Andhra Medical Colleges from 1927 to 1954 revealed only 2 cases of adenocarcinoma of the appendix, one in 1927 and the other in 1950 and both were from the Madras Medical College series. Two cases of this neoplasm of the appendix found amidst a large series of appendices histologically examined during the last 27 years is reason sufficient to justify our interest in recording the clinico-pathological findings.

CASE REPORTS

CASE 1.

R., male, aged 50 was admitted under the care of Dr. U. Mohan Rao, on 11-1-1950 in Government General Hospital, Madras, for discomfort in the abdomen. He nas had vague abdominal pain since 6 months and noticed a lump in the right iliac fossa. He complained of occasional bouts of diarrhoea. A course of emetine treatment did not give him any relief. He had not lost weight and his appetite was not impaired.

Physical examination :

A firm mass with illdefined outlines was felt in the right iliac fossa. No reduction in the size of the lump was observed 19 days after admission (30-1-1950).

Investigations :

Urine and faeces nil remarkable. Haemoglobin 80%. Blood pressure : 114 84 mm. Hg. X-ray : Barium enema was suggestive of some morbid lesion in the appendix. Intravenous pyelogram, plain X-ray kidney, and X-ray spine were nil contributory.

Treatment :

No response was observed to liver injections given on alternate days and a course of sulphaguanidine tablets. Six months after the first consultation on 1-6-1950 under high spinal anaesthesia through right paramedian incision the abdomen was opened and the appendix was found enlarged, thickened and adherent. It occupied the paracolic position. Retrograde appendicectomy was done. Drainage tube was included. On opening into the appendix a fleshy growth was seen at its base, the rest of the lumen was filled with muco-purulent material. Caecum and the rest of the colon appeared normal.

Biopsy report : (2228|50)

Multiple sections of the appendix histologically studied disclosed adeno-carcinomatous lesion with illdefined glandular pattern (Fig. 1). Most of the

Fig. 1.
Case report 1. Photomicrograph illustrates illdefined glandular elements infiltrating the wall of the appendix. (H & E x 60)

Fig. 2.
Case report 1. Photomicrograph illustrates gland distended with mucus infiltrating the appendicular wall. (H & E x 100)

Fig. 3.

Case report 2. Photomicrograph illustrates adenocarcinoma of the appendix arising from the mucous membrane of the organ and infiltrating into the deeper layers. (H & E x 60)

lumina of the glands were distented with mucus. Extensive infiltration of the appendicular wall with mucus filled glands was seen (Fig. 2). Stratification and hyperchromatism of the cells lining the glands were conspicuous features.

Morbid Anatomical diagnosis: "Adeno-carcinoma Appendix."

CASE 2.

I., male, aged 47 sought medical aid at the Govt. Hq. Hospital, Calicut for relief of symptoms typical of gastric ulcer. On 22-11-1927 gastro-jejunostomy was done. It was observed at the time of operation that the appendix was coiled up and its distal end was nodular. This portion of the appendix was hard. Lymph nodes of the meso-appendix were enlarged.

Fig. 4.

Case report 2. Photomicrograph illustrates adenocarcinoma of the appendix infiltrating the muscle layer. Stratification and hyperchromatism of the cells lining the glands are illustrated. (H & E x 100)

Biopsy report: (6575/27)

Arising from the mucosa and infiltrating into all the layers of the appendix were seen well formed glands. Mitotic figures and nuclear hyperchromatism of the cells forming these glands were significant features. None of the lumina of the glands contained mucus (Figs. 3 & 4). Sections of lymph node showed infiltration with similar glandular structures.

"Adenocarcinoma — appendix with secondaries in lymph nodes" was the diagnosis.

Comment:

In both the cases a preoperative correct diagnosis was not made. Disease of the appendix was not thought of in the second

Fig. 5.

Case report 2. Photomicrograph shows adeno-carcinoma of the appendix infiltrating the serous coat of the appendix. (H & E x 100)

case though a suggestion that the appendix is the probable site of pathology was hinted by the radiologist in the first case. In both the cases at operation the surgeons suspected malignant lesion of the appendix owing to the advanced stage of the disease. Vague abdominal symptoms complained of in the first case and the absence of definite localising symptoms forced the surgeon to treat the patients symptomatically. The case reports confirm the findings of others in that carcinoma of the appendix may remain silent and asymptomatic for an indefinite period. That appendicular carcinoma is likely to be a cause for reflex gastric symptoms is illustrated by these case reports.

The histology of the appendices examined confirm that the neoplasm arose *sui gen'eris* from the appendix. In both diagnosis of adenocarcinoma was made only by biopsy examination. It is worthwhile to routinely examine all the appendices removed by the surgeon or those encountered at necropsy.

Summary

1. Literature on adenocarcinoma of the vermiform appendix is briefly recorded.

2. Our biopsy analysis of the Madras and Andhra medical colleges for the last 27 years confirm the findings of others in that adenocarcinoma of the appendix is a rare lesion of the appendix and that a preoperative diagnosis of the lesion is usually missed.

3. That vague abdominal symptoms, sometimes pointing to peptic ulcer may be the sole manifestation of appendicular carcinoma is well illustrated by the case reports.

ACKNOWLEDGEMENTS

We are grateful to Dr. D. Govinda Reddy, M.D., formerly Professor of Pathology, Madras Medical College and now Professor of Pathology, Andhra Medical College for permission to peruse the biopsy reports. We acknowledge with pleasure the help rendered by technician T. Govindarajan of Madras Medical College and photo-artist Edwin of the Andhra Medical College.

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Received for publication on 5-2-'55.

CASES & COMMENTS

GAS CYSTS OF THE INTESTINE

(Report of two cases)

*by M. P. ALEYAMMA and E. W. GAULT, Vellore.**

Introduction

This is a relatively uncommon condition in man. Cysts containing gas have been observed in the mucosa of the urinary and genital tracts during pregnancy; but the best examples of gas cysts are found in the alimentary tract and the appearance at operation or autopsy is quite characteristic. Many names have been given to this condition; some of the commonest are, gas cysts of the intestine, emphysema of the intestine, multiple cysts of the intestine, pneumatosis cystoides intestinalis etc.

Historical

King[4] gives a good historical discussion of this condition. He states that gas cysts were first described in the pig's intestine and John Hunter had a specimen in his famous museum. In 1737 an example of this condition was observed in an anatomical museum in Amsterdam. The first description of a case found at operation in man, was by Bang in 1876. Finney in 1908 compared these cysts to soap bubbles on the intestine. Since then, many authors have analysed series of cases.

Wainwright[8] in his article states that about 200 cases have been reported in adults. He quotes Moore who found 4 cases in a series of 260 autopsies on infants. Wainwright himself found six cases in 240 consecutive autopsies reported from the Duchess of York Hospital for Babies, Manchester, all associated with severe diarrhoea. Judge et al[3] found 17 cases in 501 autopsies.

Case Reports

The two cases reported here, are specimens obtained at operation, and sent for examination to the Pathology department of the Christian Medical College Hospital, Vellore.

CASE I. 2413|51:

The patient was a Hindu male aged 30 years. He gave a history of 4—5 years duodenal ulcer symptoms with vomiting after meals and constant gastric distension. Visible peristalsis had been present for 3—4 months. At laparotomy, numerous large and small cyst like structures were noticed on the jejunum and the mesentery. The stomach was large and thick walled with a mass obstructing the pylorus. A gastro-jejunostomy and resection of a segment of the involved intestine were done.

Macroscopic appearance: The specimen consisted of 40 cm. length of small intestine with attached mesentery. The intestinal wall appeared thickened and on section, numerous air filled cysts varying in size from 2 mm. to 2 cm. in diameter were seen in the wall (Fig. 1). There were a few centimeters of the bowel wall which were uninvolved. Some of the cysts contained a little clear fluid.

Microscopic appearance: Large cystic spaces were seen in the serous, muscular and submucous coats of the bowel. In many places the wall of the cyst consisted of thin fibrous tissue. In a few areas, there was a suggestion of flattened endothelial lining. There were areas showing foreign body giant cells in the wall, some of them apparently lining the lumen in one place. The mucous membrane showed no lesion (Figs. 2 & 3).

CASE II. 1215|54.

This patient was a Hindu male aged 35 years. He had complained of "dyspeptic trouble" for one year. At laparotomy, a segment of jejunum was resected as it showed cystic structures on the wall giving a sponge like appearance.

Macroscopic appearance: The specimen consisted of 3 cm. length of small intestine, the surface of which appeared cystic. On cut section, there were cystic spaces in the wall, confined to the peritoneal coat. Some of these cysts contained gelatinous white material, while the others were empty (Fig. 4).

Microscopic appearance: The mucosa appeared normal. A few chronic inflammatory cells were

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Fig. 1.
2413|51. Macroscopic picture of small intestine with cysts in the wall, of case 1.

Fig. 2.
2413|51. Photomicrograph showing the walls of three of the cysts. The lining resembles flattened endothelium and a number of foreign body giant cells are seen at one point. (H & E x 110)

Fig. 3.
2413 51. Photomicrograph of giant cell reaction in the wall of a cyst. (H & E x 460)

Fig. 4.
1215 54. Macroscopic picture of the intestine in case 2 with the cysts confined to the peritoneal coat.

Fig. 5.
1215 54. Photomicrograph showing cysts in the serous coat. (H & E x 27)

Fig. 6.
1215|54. Photomicrograph of the wall of the cyst, to show the lining of the flattened cells and the relation of the cyst to the muscle coat. (H & E x 110)

seen in the submucosa. A number of ganglion cells were noted in the muscle layer. The peritoneal coat showed a number of large cystic spaces, lined by flattened cells (Figs. 5 & 6). A few macrophages and foreign body giant cells were also seen in the wall.

Unfortunately the gas in the cysts was not analysed in either of these cases.

Discussion

Diagnosis: There is no specific feature which characterises the condition as it is usually associated with other chronic inflammatory lesions of the alimentary tract. Hence many of the cases reported are those found at laparotomy for other abdominal conditions. The commonest symptoms are those of pyloric obstruction or chronic peptic ulcer. The history in infants may be chronic diarrhoea.

X-ray diagnosis: Lerner et al[5] consider that the presence of constant "filling defects" of increased translucency between the outer intestinal wall and the contrast medium in the lumen of the bowel, is pathognomonic. According to Lindsay et al[6] the most important finding is the absence of intestinal loops between the diaphragm and the liver. Frostberg[2] considers that a small amount of free gas under both the arches of the diaphragm, is an important sign. He has also described a peculiar micro-alveolar structure involving the viscera in the X-ray picture. In a case of spontaneous pneumoperitoneum, ruptured gas cysts should be considered in the differential diagnosis.

Treatment: Local excision and treatment of the cause is the usual procedure, but King[4] states that the disease is self limited and recovery occurs without interference.

Etiology

Many theories have been put forth by various authors regarding the causation of gas cysts. Some of the more important views are bacterial, neoplastic, dietary deficiency and mechanical. Judge et al[3] mention other possibilities also, such as local changes in fat metabolism, haematoma with organisation and parasitic infections.

1. *Bacterial*: Bacterial action may produce gas in the interstitial tissues of the bowel wall, but Lerner[5] states that the majority of bacteriological studies failed to reveal the presence of bacteria in the cysts. Moreover, chemical analysis of the gas showed the presence of oxygen in the cysts which would not be produced by bacteria. This theory therefore seems unlikely.

2. *Neoplastic*: Judge et al[3] and Lerner et al[5] point out that there is no evidence of a neoplasm, the cells of which could produce gas.

3. *Dietary deficiency*: Dale et al[1] consider that a deficiency state, predisposes to the formation of gas cysts. They describe the experiments of Biester and Eveleth who produced gas cysts in pigs by feeding them on polished rice and a small amount of skimmed milk. A more complete milk diet prevented the development of cysts. This effect of diet may be the result of the absorption of the contents of a dilated stomach or bowel, as suggested by Lamont (quoted by Parsons and Parsons[7]). These absorbed substances probably undergo chemical changes later on, with the formation of gas. In the human, the association of the condition with peptic ulcer could quite easily be explained in terms of the special diet which these patients often take, resulting in some deficiency. But here in South India, where peptic ulcer is very common, this condition of gas cysts has not been observed often. It would be worthwhile for surgeons, to examine the intestines for gas cysts, as these may be overlooked some times, unless present in the first part of the jejunum, especially in gastric and upper abdominal surgery. Judge et al[3] state that the common sites are the distal parts of the ileum with the caecum, ascending colon, and jejunum in that order of frequency and very occasionally the stomach.

4. *Mechanical*: This hypothesis depends on the supposition of a break in the continuity of the mucosa of the bowel, due to localised infection or over distension by gas. Dale et al[1] consider that an increase in intraluminal pressure as in obstruction, forces gas through mucosal defects into the various coats of the bowel. They believe that gas is forced through the damaged mucosa into the lymphatics, and as a result, there is dilatation of the lymphatic channels with the formation of cysts. King[4] quotes Ellenberger and Jaeger who have figures for the contents of the intestinal gas and the gas in the cysts, and show that they are not similar. Dale et al[1] describe the experiments of Jung and Nagai, on dogs. They first outlined the lymphatics of the stomach and intestines with Indian ink or after a fatty meal. Then they injected air into the intestinal wall musculature and found that the air followed the outlined lymphatics, which had disappeared completely after 48 hours. In other dogs with acute gastric ulceration and after stimulation of vigorous peristalsis, they found gas bubbles in the serous coat and omental attachments of stomach, which persisted till the second postoperative day. They believe that the bubbles excite a foreign body reaction which walls off the gas as cysts. Lerner et al[5] mention Nitch and Shattock, who reported on 85 cases of gas cysts, out of which 55% occurred in patients with peptic ulcers and 83% were associated with varying degrees of intestinal obstruction.

We believe that the most reasonable explanation for the condition is the mechanical theory, in which the lymphatics are involved in the dilatation. (This is supported by the resemblance of the lining of some of these cysts to endothelium). Some inflammatory reaction was seen in

the wall of the cysts in both cases. The difference in the composition between the cyst contents and the intestinal gas may be due to the fact that they are not in constant communication with each other and the encysted gas may undergo changes.

Summary

1. Two cases of gas cysts of the intestine are reported.

2. The diagnosis is discussed.

3. The etiological factors are discussed and the mechanical theory is favoured.

Acknowledgement

We appreciate the help given from operation notes and history by the Medical Superintendents of the Willis F. Pierce Memorial Hospital, Wai, Satara District and Mohulpahari Christian Hospital, Mohulpahari. Our thanks are due to Miss Saraswathy for clerical help and to Mr. Sigamani for the photographs.

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Received for publication on 4-4-'55.

PARATHYROID ADENOMA

(Report of a case)

by V. BALASUBRAMANIAN, Madras.

Hyperparathyroidism is a condition of great interest since the clinical picture is an interesting confirmation of our knowledge of parathyroid activity.

While the classical picture makes diagnosis of this condition easy when its occurrence is borne in mind, many cases probably go undiagnosed because of atypical features. Thus we can have a case presenting mainly because of fractures, deformities or osteoclastomata and epulides. Some cases come in mainly for renal symptoms and renal failure. There can be various combinations of these two. Again a patient may come for weakness, lassitude and other general symptoms. The case presented here came mainly for general symptoms of weakness etc. Further in this patient, because of her having undergone some operation, there was some difficulty in excluding secondary malignancy.

Patient V, female aged 44 years was admitted on 22-6-1954 for a complaint of loose motions and pain in the back for a month.

The history was that she suffered from frequent attacks of diarrhoea for the last one and a half years and that she had pain all over the body especially in the back and the head. She felt very weak and was breathless on exertion.

She was operated upon one and a half years before for mennorrhagia. The notes of that operation revealed that total hysterectomy with bilateral salpingo-oophorectomy had been performed. The pathology report on the removed organs was that there were only fibromyomata of the uterus but no malignancy.

She was the mother of three children. The last child was ten years old.

Examination revealed a fairly well nourished individual but rather anaemic.

No abnormality was detected in th abdomen; nor in the cardiovascular an respiratory systems. There was limitatio of the movements of the lumbar spine. Bu there was no tenderness over the spine.

The following routine investigations wer done:

Urine—nil abnormal.

Motion—semi-solid, ascaris and Trichuri Ova present.

R.B.C.—2.7 millions|cu.mm.

Hb.—55%.

Blood picture revealed a normocyti hypochromic anaemia.

X-Rays: Spine—showed sclerosis of th vertebral bodies.

Pelvis—showed sclerosis of the bone (Fig. 1).

Skull—showed a marked degree of fin stippling of the vault and osteoporosis witl a characteristic woolly appearance (Fig. 2)

Bones of the hands did not reveal an changes.

The bio-chemical investigations that were done are given in table I.

VDRL slide test was negative.

On 12-7-1954 under local anaesthesi open biopsy was done on the skull. The pathology report was "Osteitis Fibrosa" (Fig. 4).

A diagnosis of hyperparathyroidism wa made and on 2-8-1954 under endotracheal anaesthesia the region of the thyroid wa explored. On mobilising the right lowe pole of the thyroid, a tumour arising from the right inferior parathyroid was discovered and was removed.

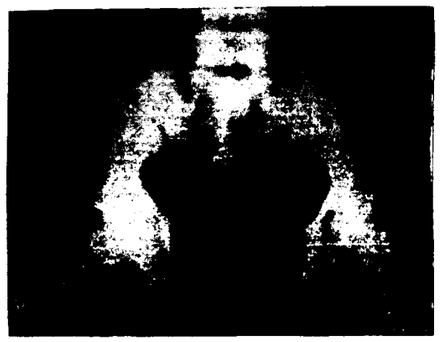

Fig. 1.
Showing the sclerosis of the pelvis — the only atypical feature.

Fig. 2.
Showing marked thinning of the vault, the 'woolly' appearance and fine stippling.

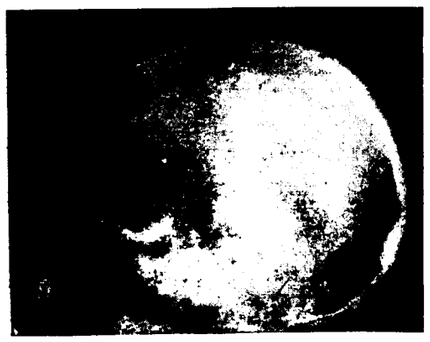

Fig. 3.
Showing the return of the skull bones to normal within a few weeks.

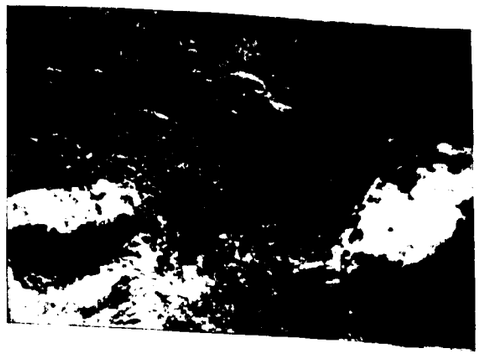

Fig. 4.
Bone Biopsy showing the replacement of the osseous tissue by fibrous tissue and osteoclastic activity.

During the postoperative period, for the first ten days the patient was rather dull and melancholic and at times even disoriented.

A biochemical check up was done after the operation and the results are given in table I.

The pathology report was 'Parathyroid Adenoma'.

The patient was discharged and asked to come again for a check up. At the time of discharge she was almost back to her normal state (Fig. 3).

She was readmitted on 7-11-1954 and the biochemical investigations repeated. The results are given in table I.

Discussion

Clinically, though hyperparathyroidism can be easily diagnosed when the full picture is present, often times, only the biochemical and radiographic data lead us to the correct diagnosis.

Fig. 5.
The adenoma.

Fig. 6.
Microphotograph showing the arrangement of the 'cells' in an alveolar pattern. (about x 360)

The earliest changes are seen in the radiographs of the Jaw, Skull and the Phalanges. In the jaw the absorption of the lamina dura is considered characteristic. In the skull there is a fine mottling of the vault with alternating areas of normal density and osteoporosis. Also there is absorption of both the tables. The changes seen in the phalanges are considered diagnostic (Brailsford). They consist of absence of the compact bone and the presence of small areas of decalcification, crenation of the borders and 'tufting' of the terminal phalanges.

Even with all these radiological findings final confirmation comes only from the biochemical changes. Elevation of the serum calcium, increase in the urinary calcium, low serum phosphorous, and an increase in the urinary phosphorous are generally considered to be very characteristic.

The normal serum level is 9 to 10 mgm% of calcium. A serum level of above 13 mgm% definitely points to parathyroid disease. In the consideration of the value of the calcium level one must bear in mind the different forms in which calcium can exist in blood. Because of this the protein level has also got to be taken into account. Where there is a marked hypoproteinemia the total serum calcium will be low and so the rise of ionic calcium will be masked. In such cases a correction has to be made for the low calcium protein level.

The serum phosphorous closely follows the calcium level. The serum alkaline phosphatase is something about which it is difficult to be dogmatic. If the clinical and radiographic features are in favour of a diagnosis of hyperparathyroidism, then a raised alkaline phosphatase is confirmatory.

A bone biopsy is often useful to confirm and demonstrate the fibrous replacement of the osseous tissue. It also helps to exclude other conditions such as secondary malignancy. In this case the possibility of the condition being such a one, was entertained and a bone biopsy was done to exclude it.

The treatment of hyperparathyroidism is almost always by surgery. Albright mentions that by a large intake of calcium one could maintain even a positive calcium balance. This apart, it is always safer to employ surgery in these cases as the altered metabolic state of the body predisposes to metastatic calcification, nephrocalcinosis and renal lithiasis.

Having decided upon surgery the next thing is to decide the amount of parathyroid tissue to be removed.

If there is an adenoma arising from one of the glands, only that gland is removed. The rest are left behind. This is because it is very unusual to have adenomata in

the other glands. More than this, it is always better to err on the safe side and remove less of tissue than more of it. If too much of the glandular tissue is removed a severe form of tetany results — a condition more refractory to treatment than that resulting from accidental removal of the parathyroid during thyroidectomy.

If there is no adenoma and there is reason to believe that one is dealing with hyperplasia of the glands then three-fourths of the total amount of parathyroid tissue is removed.

Sometimes the parathyroid glands are not found in their usual position in relation to the poles of the thyroid gland. They may be found behind the thyroid fascia or even in the mediastinum. They may even be embedded in the substance of the thyroid gland. One must be prepared to dissect in the substance of the thyroid to discover the parathyroids. In cases where the diagnosis is beyond doubt, a mediastinal exploration is indicated. Walton has described in detail the technique of such a procedure and the various situations in which the gland may be found.

It is very interesting to watch the progress of the cases after operation. While clinical improvement may not be appreciated for some time the biochemical features alter quickly. The serum calcium is the first to alter. In cases where the osteoporosis is marked the level of calcium not only comes to normal but actually goes below it. Even intravenous calcium fails to keep the level at normal. The 'hungry' bones utilise all the calcium. If tetany supervenes the immediate treatment is to give parathormone — not calcium, as all this is 'sucked' into the bones. If the osteoporosis is not marked the serum calcium does not fall below normal.

The phosphorous takes a little longer time to come to normal. Then comes alkaline phosphatase. The bones recalcify within four weeks.

In our case the serum calcium went below normal but came up after fifteen weeks. By this time all the other levels had come to normal.

Some cases exhibit (for an unexplained reason) symptoms like melancholia or irritability in the immediate postoperative period. Whether this is the result of the violent Biochemical upheavals in the system is a difficult thing to say. However they come back to normal. Our case too exhibited such a state.

It has been postulated that the stimulii for hyperplasia may even result in the formation of adenomata. Osteoporosis is often associated with a stimulus to the parathyroid. It is quite possible that in this patient the acute menopause caused by the oophorectomy resulted in a severe post-menopausal osteoporosis which caused compensatory hyperparathyroidism and the eventual formation of an adenoma.

TABLE 1

		Normal	Pre-operative	Post-operative	After 15 wks
Serum Ca	...	9-11 mgm%	17.3 mgm%	6.7 mgm%	9.9 mgm%
Serum P	...	3-5 mgm%	2.61 mgm%	6.8 mgm%	3.8 mgm%
Ca in 24 hrs. urine	...	150 mgm (Albright)	139.2 mgm	73.6 mgm	107 mgm
Alk. Phosphatase	...	14 KA units	78 units.	9.8 units	12 units

Summary

A case of hyperparathyroidism diagnosed and treated successfully is described.

My thanks are due to my Chief Dr. C. P. Viswanatha Menon, M.S., F.R.C.S. (by whom the case was operated upon) and to the Dean, Government General Hospital, Madras for permission to report this case.

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Received for publication on 5-4-'55.

A CASE OF UNATTACHED RETROPERITONEAL NEPHROBLASTOMA

by M. S. RAMAKRISHNAN and M. N. GANAPATHY, Madras.

Tumours disclosing the typical histology of Wilm's Embryoma but occurring completely outside the renal capsule are rare occurrences and very few reports of similar cases have been published. The following is one such case.

Kamala, female child, 2 years old was admitted into the Stanley Hospital, Madras on 7-4-1954 with a complaint of abdominal swelling on the right side of 3 weeks' duration. The patient is the only child in the family. The tumour was noticed to be growing rapidly by the parents. The patient had no urinary or respiratory complaint.

On examination the child showed a swelling on the right side of the abdomen, situated more towards the upper quadrant. The swelling did not show any distended or tortuous veins over it. Palpation revealed it to be a well-circumscribed tumour 4" x 4" in size occupying the right upper quadrant and to a certain extent crossing over to the left side. It was further revealed to be definitely retroperitoneal in situation but not entirely filling the loin. The surface of the swelling was smooth and the swelling was not moving with respiration. The tumour was soft, and in places cystic but not trans-illuminant nor could fluid thrill be elicited. Percussion showed the tumour to be dull in note with no particular area of resonance over it. The intestinal sounds were easily auscultated all over the abdomen.

There was no other pertinent finding elicited in the other systems.

Investigations :

Total erythrocyte count — 4.3 mil cmm.

Haemoglobin percentage — 80 gms. per cent.

Total leucocyte count — 8300 cells per cmm.

Blood group — '0'.

Plain X-ray of the abdomen — a rounded opacity corresponding to that of the tumour was made out, in the upper right quadrant (Fig. 1) which extended slightly to the left side. The intestinal shadows were all on the left side.

I. V. Pyelography — showed normal excretion of the dye (5-7 min.) on the left side. There was no excretion on the right side (Fig. 2).

Based upon the above findings, a provisional diagnosis of mesocolic cyst exerting pressure over the right kidney was made. The possibility of other retro-peritoneal tumours were kept in mind and laparotomy was decided upon.

On 9-4-1954, under Rectal Pentothal Sodium supplemented by gas and oxygen the abdomen was opened by a right transverse incision. A moderately large pink, soft tumour was evident over the right kidney, the kidney being implanted over the tumour. No attempt to separate the small kidney from the tumour was made since it was considered a hazardous procedure at that time. Hence Nephrectomy 'along with the tumour' was done on the right side and abdomen closed in layers. Patient had blood transfusion during the operation.

The patient had an uneventful recovery. With a histopathological report of a Nephroblastoma on the specimen, the patient had post-operative irradiation of 1620 r units in 43 days after which it was discontinued due to intractable diarrhoea; the diarrhoea stopped after the termination of irradiation.

Path. report :

The morbid anatomy of the tumour disclosed it to be an oval growth about 6" x 4" x 3" in size weighing about 100 gms. The tumour was well-separated from the small kidney which had its own intact capsule. The pinkish tumour had a smooth surface. Cut section of the tumour revealed a homogeneous pinkish appearance with definite lobulations. There were a few areas of haemorrhages but no calcified areas could be seen (Fig. 3).

Histopathology :

Several serial sections were studied to facilitate reconstruction. All the sections presented a similar picture. The tumour was found to be composed chiefly of undifferentiated mesenchyme (Fig. 6) made up of uniform polyhedral cells with dark staining nuclei and a generous acidophile cytoplasm. In places these mesenchyme showed attempted glomerular formation in the form of proglomerules (Fig. 4). The epithelial components were further represented by the presence of well-developed tubules lined by tall columnar epithelium (Fig. 5). The cells did not show many mitotic figures. No representatives of the primitive ureteric bud in the form of the presence of dichotomous collecting tubules with blind ends were seen in all the sections studied after diligent search. Other structures found in the tumour were the presence of smooth muscle fibres (Fig. 7). No calcified areas were seen. Based upon these findings a histological diagnosis of Nephroblastoma, occurring outside the kidney substance was made.

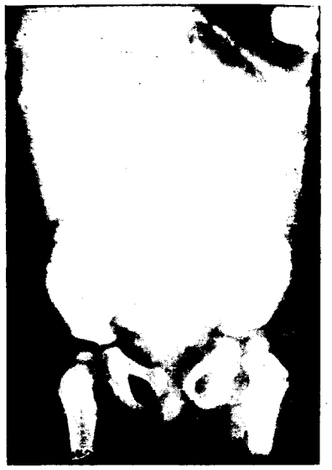

Fig. 1.
Plain X-ray of abdomen. Note intestinal shadow pushed to the left side and soft tissue opocity produced by the tumours seen in the right side.

Fig. 2.
I.V. Pyelogram. No excretion of dye on the right side. Normal excretion on the left side.

Fig. 3.
Colour photograph of specimen. Note that the tumour is separated completely away from the kidney.

Fig. 4.
Area showing Proglomerules.

Fig. 5.
Area showing well-formed tubules.

Fig. 6.
Area showing undifferentiated mesenchyme.

Fig. 7.
Area showing muscle tissue.

Comment :

Unattached retro-peritoneal nephroblastoma has been used to describe a solid or partly cystic tumour which may occur anywhere along the posterior abdominal or even thoracic wall. The adjective 'unattached' is meant to imply that the tumour is not connected with the kidney inspite of its histopathological resemblance to that of a nephroblastoma arising from the kidney parenchyme. Since the tumour is believed to arise from the remnants of the nephrogenic tissue it may be found on either side of the vertebral column from the 4th cervical segment downward to as low as the internal genitalis.

Since 1894 instances of retro-peritoneal tumours unattached to but arising from the remnants of the uro-genital apparatus were reported in the medical literature averaging less than one case per year. The pathogenesis of these tumours is still controversial. From a review of the literature and from a study of 17 of their cases

Hansmann and Budd believed that there is a general explanation for the genesis of these tumours, namely that they take their origin from the remnants of the embryonal urogenital apparatus.

Brock, Brandt and Borst have recognised instances of these growths which were entirely extra-renal. This fact is explained by the finding of extraneous dissimilar cell nests, i.e., remnants of embryonic urogenital apparatus, during routine post-mortem examination of cadavers. This evidence of its origin may well account for the structure and diversity of the histological elements in these tumours in much the same way as Nephroblastomas occurring in the kidney substance.

In fact this idea concerning the etiology seems to unify all the pertinent known facts with regard to unattached retro-peritoneal tumours which otherwise would require varied etiological explanation.

Nephroblastomas have been described as arising from within the renal capsule, though they may present outside after secondarily rupturing the capsule. Occasionally Nephroblastomas of renal origin have been said to occur outside the renal capsule, though this is neither universally accepted nor explained.

Nicholson in his monograph on the pathogenesis of the Nephroblastoma which he convincingly points out as a malformation and not a tumour, emphasizes the role of the components of the ureteric bud, as organisers in the differentiation of the nephroblastomas. He describes how the nephrogenic vesicles surround the blind end of the dichomotous collecting tubules, and how the mere presence of these collecting tubules lead to their further development into glomeruli.

This tumour presents one curious finding in that it looks as if there is differentiation and development without the aid of the organiser. The ureteric bud could not have participated in this tumour which was situated well away from the kidney; neither were their representatives, namely the dichomotous tubules, present in any of the sections studied; still the section presented the picture of a fairly advanced stage of differentiation with the presence of proglomerules and tubules.

The diagnosis from other kidney and retro-peritoneal tumours may be difficult; especially if the kidney fails to show secretion as in this case. This is further complicated by their close proximity to the kidney.

The prognosis is somewhat dependent upon the degree of malignancy and upon the promptness and efficiency with which the tumour is recognised and removed. Treatment follows closely along the lines of the nephroblastomas arising from the kidney parenchyme. In this case surgery was followed by irradiation. In view of the proximity of the tumour to the kidney and its size, and difficulties of separation on the table, the kidney was removed along with the tumour mass.

Conclusion :

The occurrence of unattached retroperitoneal nephroblastoma is rare; when compared to nephroblastomas arising from the kidney proper, as also other retroperitoneal tumours like Neuroblastomas. As an instance it may be cited that Ladd and Gross have encountered 56 Nephroblastomas of the kidney as opposed to 5 arising outside the kidney.

Our thanks are due to Dr. C. Raghavachari, M.S., F.R.C.S., for allowing us to publish his case as also for his kind guidance and advice in the preparation of the case sheet. We also thank the Dean, Stanley Medical College and Hospital for having permitted us to publish the same.

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Received for publication on 12-2-'55.

BIBLIOGRAPHY ON SURGERY

by FAQIR CHAND

CHIEF LIBRARIAN, D G.H.S.

Bibliography is an important Tool which helps the readers and specialists to know as to what literature, books, articles, etc., have been published on a special subject. Bibliography given below is an attempt to bring to the notice of surgeons as to what important books have been published during the last five years. In its construction the entries have been arranged alphabetically by the name of the author. Title of the book, edition, year of publication and the publishers have been given.

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Received for publication on 9-12-'55.

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THE XVII ANNUAL CONFERENCE

The XVII Annual Conference of the Association of Surgeons of India will be held on the 29th, 30th and 31st December, 1955 at Amritsar. The General Body meeting will be held on the last day of the Conference, i.e. 31st December, 1955. The meetings of the Editorial Board and the Governing Body will be held in the evening on the 28th December, 1955. All members are requested to attend. Details regarding arrangements for the Conference and accommodation at Amritsar during the Conference can be had from the Local Secretary, Dr. S. S. Anand, F.R.C.S., F.A.C.S., F.C.C.P., 35, The Mall, Amritsar.

At the Conference the following subjects will be discussed :—

1. *Surgery of the heart and great vessels—*
   Opener : Dr. P. K. Sen, Bombay.
   Seconders : Dr. S. S. Anand, Amritsar.
   Dr. A. K. Basu, Calcutta.

2. *Tuberculous disease of the Spine—*
   Opener : Dr. B. Mukopadhaya, Patna.
   Seconder : Dr. K. S. Grewal, Amritsar.

3. *Urinary Calculii—*
   Opener : Dr. L. B. Joshi, Poona.
   Seconder : Dr. M. Krishnamurthi, Madras.

* * *

Besides these, a few "Short Papers" will be read at the Conference.

Subjects for discussion at future meetings

18th Meeting :

1. *Cancer of the Lung—*
   Opener : Dr. A. K. Basu, Calcutta.

2. *Hypospadias—*
   Opener : Dr. R. N. Sinha, Patna.
   Seconder : Dr. R. N. Sharma, Lucknow.

3. *Spinal injuries particularly of the cervical region—*
   Opener : Dr. H. K. Sarkar, Calcutta.
   Seconder : Dr. A. K. Saha, Calcutta.

19th Meeting :

1. *Non-malignant Stricture of Oesophagus* by Dr. Subrata Banerjee, Calcutta.

2. *Surgery of Intracranial Vascular Lesions* by Dr. B. Ramamurthi, Madras.

3. *Genito-Urinary Testis* by Dr. E. J. Borges, Bombay.

CONTRIBUTORS—December, 1955

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THE INDIAN JOURNAL OF SURGERY

DECEMBER, 1955.

QUARTERLY

Annual Subscription Rs. 16 (Inland); Rs. 18 (Foreign)

INDEX TO ADVERTISERS

Printed by Mr. G. Raghavan at The Huxley Press, 114, Armenian St., G.T., Madras, and Published by Dr. A. VENUGOPAL, Secretary, Association of Surgeons, 164, Poonamallee High Road, Madras 10. December 1956