

The
Indian Journal of
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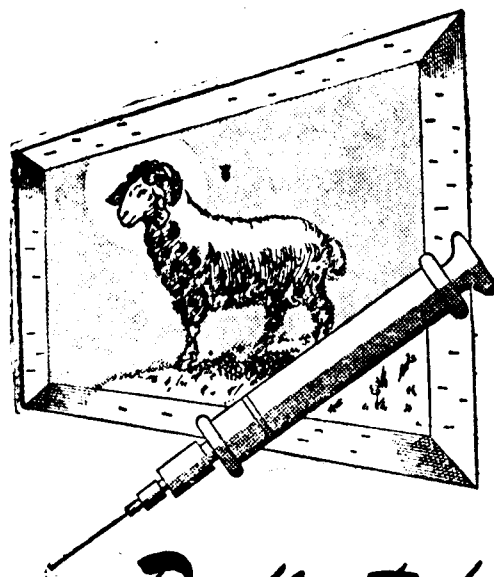
The
Indian Journal of
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Vol. XII]

JUNE 1950

[No. 2



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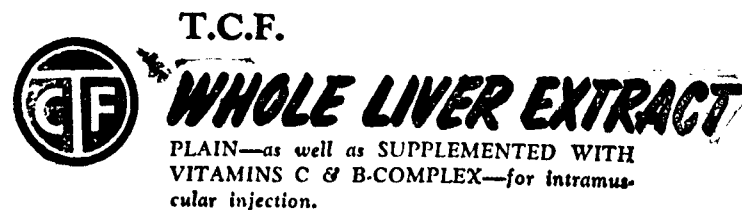
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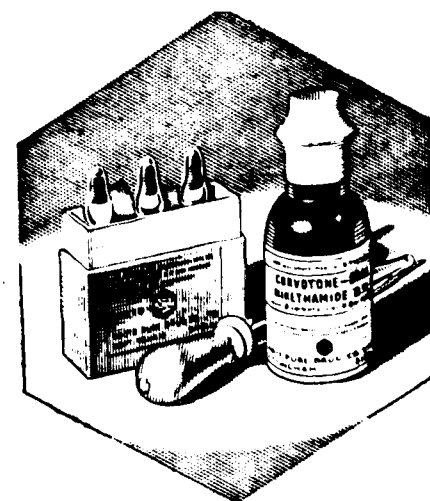
1. Christopher, F. Minor Surgery. 5th Edition, Philadelphia and London: W. B. Saunders Company, 1945, p. 348.
2. Beard, J. W., Taylor, A. R., Sharp, D. G., and Beard, Dorothy. The Nature of a Virus Associated with Carcinoma in Rabbits. Surg., Gynec., & Obst., 74: 509-513. 1942.

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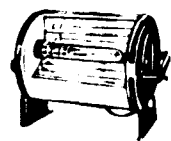
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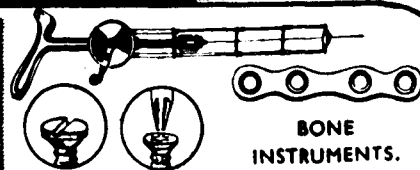
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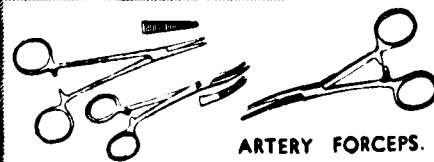
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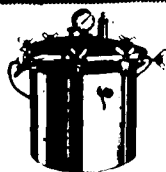
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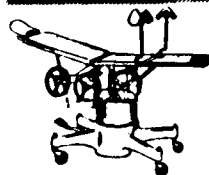
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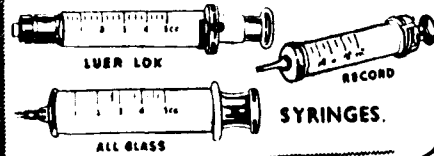
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Vol. XII

JUNE 1950

No. 2

TREATMENT OF FILARIAL LYMPHOEDEMA AND ELEPHANTIASIS*

by V. P. MEHTA, Bombay.

The purpose of this paper is to put before you some aspects of filarial lymphatic obstruction that I have been confronted with and attempted to understand.

The problem is essentially one of the tropical countries; the disease is very rampant in certain parts of India, and Bombay is no exception.

The disease is transmitted by culex mosquitoes and caused by *Wuchereria bancrofti*. The larvae are deposited on the skin by infected mosquitoes. These larvae penetrate unbroken skin and travel along the cellular spaces and lymphatics to lodge in the regional lymph nodes and terminal lymphatics. Having lodged there they undergo a process of maturation; the gravid female discharges its larvae into the lymphatic and subsequently into the blood circulation.

Blockage of lymphatics by the adult worms leads to stasis and repeated attacks of lymphangitis which are essentially due to an associated streptococcal infection. These repeated attacks bring about a massive obliterative lymphangitis and produce different clinical types of chronic lymphatic obstruction, the commonest being lymphoedema and elephantiasis.

The lymphatics most commonly involved are those of the scrotum and inferior extremities. Elephantiasis in the legs practically never extends above the level of the knee.

Anatomy :

Lymphatic capillaries drain into lymphatic channels which ultimately end in the

larger lymphatics and the thoracic duct. In the extremities the skin is rich in lymphatic capillaries but according to Gray¹ the subcutaneous tissue is devoid of capillaries and contains smaller lymphatic channels.

The capillaries of muscles are poorly understood while the periosteum and bones have an abundant supply of lymphatic capillaries. The lymphatic system is divided into two parts between which there is hardly any communication.

The superficial lymphatic system of the superior extremities has a much greater communication with the deeper system and hence the relative infrequency of elephantiasis in the superior extremities.

Physiology :

Lymph circulation in human beings is maintained by arteriolar pulsations as shown by McMaster and Parsons² and by Cressman and Blalock, and the active and passive contraction of skeletal muscles. The centripetal flow is ensured by valves along the lymphatics.

Other factors that increase the flow of lymph are increased venous pressure and local or general hyperthermia. According to Allen³ the rate of flow is unaffected by increased arterial pressure or by section of peripheral nerves.

The great function of the lymphatics is to remove from the tissue fluids, material which is not absorbed by the blood capillaries. The production of elephantiasis is explained by the fact that normally a certain amount of tissue fluid is being formed which is absorbed by the lymphatics and the capillaries. The tissue fluid can be ab-

*A paper read at the XI Annual Conference of the Association of Surgeons of India, Madras, Dec. 1949.

sorbed by either route but the proteins in it can only be absorbed by the lymphatics so that when there is a lymphatic oedema, the protein content of the oedema fluid continues to rise and it can be as high as 3 per cent. Numerous workers have demonstrated that lymphatic obstruction by itself cannot produce elephantiasis. Unna and Sabouraud have contended that there is an associated infection which further increases the protein content and produces elephantiasis.

Matas suggested that there are probably many factors capable of producing initial lymph stasis of both the inflammatory and non-inflammatory types and that the resulting oedema, regardless of its mode of onset, increases the susceptibility of the involved area to infection by pyogenic organisms.

Tests for lymphatic obstruction :

Methylene blue test : In this test 3 c.c.s. of sterile methylene blue are injected subcutaneously in the affected limb and urine is collected at the end of six, twelve and twenty four hours to show its presence.

Indian ink test : In this test 2 c.c.s. of Indian ink are injected subcutaneously in the area of lymphoedema and subsequently the regional lymph nodes are excised and examined for the presence of the dye. Both these tests have been devised during my study of this problem and have always proved the completeness of the lymphatic obstruction in a well established case.

Diagnosis :

The diagnosis of filariasis is conclusively proved by demonstrating microfilaria in clinically suspected cases. The present conception of our knowledge is that microfilaria come out in the peripheral blood only at night at the height of sleep and so routine blood examination is carried out at night. It is my experience during the last five years that bloods that are positive at night are also positive during daytime when the patient is awake so much so that nowadays I recommend a routine examination during daytime and only when it is nega-

tive in a clinically acute case, a confirmatory nightly check up is carried out.

In established cases of elephantiasis the blood examination has been invariably negative and the diagnosis is only made by exclusion of other known causes, as well as the finding of a typical clinical appearance in patients coming from endemic areas.

Atypical cases :

Before I come to the treatment proper I would like to record some atypical cases that I have seen.

In two cases there was definite chronic lymphoedema of the chest wall. In the first case the oedema was solid, woody hard, extended all over the abdomen and chest and had been present for six months. In the second case it was localised over a small area on the left side in front of the chest wall. In both these cases the blood examination was negative but both of them responded to a course of glycerin injections.

One case came to me with a history of fever with rigors every month and had been treated variously as malaria and tuberculosis for twenty years till his new family doctor suspected filariasis and brought him to me. The blood examination was positive and careful history taking revealed that he had also noticed slight swelling of the right inguinal lymph nodes every month with the fever.

Treatment :

Antimony injections have no more effect than that of temporarily sterilising the blood stream of microfilaria which are not responsible for the clinical picture.

During acute exacerbations the associated streptococcal infection always responds well to chemotherapy.

"Hetrazan" tablets are valuable for actively infected patients in killing the worms and thus preventing the further progress of the disease.

They can be of no use in improving lymphoedema or elephantiasis just as quinine cannot be useful in reducing the size

of the spleen in a case of chronic malaria. I shall not dilate upon "Hetrazan" therapy as it is not concerned directly with the problem of elephantiasis.

In addition to the chemotherapy during recurrent acute exacerbations it is important that the oedema be prevented by proper conservative measures. The patient should keep the limb in an elastic stocking or the limb should be strapped with elastoplast. In addition periodic elevation should be practiced.

These conservative measures can be used even in cases which do not give a history of acute exacerbations since Drinker⁴ has shown that lymph stasis predisposes to infection.

The importance of preventing and controlling the oedema cannot be too strongly stressed. Regardless of the etiology, oedema predisposes to secondary infection. The inflammatory process resulting from the secondary infection produces a transudation rich in proteins into the interstitial spaces which, due to the impaired lymphatic circulation, accumulates excessively. This protein plus the other products of inflammation are ideal for the production of fibrous tissue. It is because of this susceptibility of the oedematous tissue that the prevention of oedema is not only prophylactic against infection, but if completely controlled, may arrest the condition. Low and Dixon⁵, McGorlick⁶ and others have treated patients with T.A.B. injections intravenously on an empirical basis and report good results in the acute phase. "Arsenotyphoid" injections have been tried by all and I am sure that you will agree with me when I say that the results are far from ideal. Bowesman (1938)⁷ reported 19 cases of lymphoedema and elephantiasis treated with intra-arterial glycerin. He employed sterile glycerin 10 per cent and gave 2 to 3 cc.s at weekly intervals into the femoral artery. This was the basis of the glycerin treatment which has been tried by me and subsequently modified as regards percentage, dosage, frequency of injections and the interval between injections. The treat-

ment has been employed in 163 patients out of which 54 have been in private practice and so the measurements of the limbs have been carefully taken and recorded.

In the initial stages glycerin B.P. was diluted with sterile distilled water and used after autoclaving. As these produced pyrexial reactions many times and interfered with the continuance of treatment, glycerin ampoules have been prepared and since they have been employed no pyrexial reactions have occurred. The sterile glycerin is diluted with sterile doubly distilled, pyrogen free water and 25 cc. ampoules made in 10, 25 and 50 per cent strengths. In the beginning I started using 10 per cent glycerin and as the results were not very satisfactory the percentage has been gradually raised to 50 per cent.

For the last three years I have routinely used 50 per cent glycerin from the first dose.

Mode of action :

Glycerin was first employed by Bowesman on the belief that glycerin being hygroscopic it should absorb fluid from the lymphoedematous area. I have referred to books on pharmacology and from the scanty literature available find that glycerin has no hygroscopic property in strengths below 30 per cent. Even if it did have any hygroscopic action the dose of 1 to 2 cc. employed by Bowesman was too small to produce any action. Finally the physical hygroscopic action would only be transient.

Personally I believe that it is some other property of glycerin which brings about results. It possibly exerts some lymphagogue action and opens out partially blocked lymphatics. Glycerin being one of the products of fat metabolism gets destroyed in the body and serves as food.

Dosage :

Bowesman employed a dose of 1 to 2 cc. I have gradually increased the dose and now I give 20 to 25 cc. of glycerin (50 per cent) intravenously or 10 cc. intra-arterially.

The largest dose I have given is 100 cc. of 50 percent glycerin but as it can produce toxic effects it should not be used unless the patient is hospitalised and the urine can be examined repeatedly. A nurse was admitted under my care with a chronic lymphoedema of right leg and a difference in girth of the limbs of an inch at the ankle. She had a job in another place outside Bombay and wanted a hurried treatment for which reason she was admitted.

The house-surgeon was asked to give 40 cc. injections twice a day but due to a misunderstanding he gave 80 cc. in one dose. The patient had pain in the back and passed red urine, which completely cleared up in two days. The greatest surprise was that the swelling of the limb completely subsided and she has remained cured since then.

100 cc. glycerin have been given subsequently in a small group of patients. The dose quite often produces temporary hemoglobinuria, and hence I have not used it unless the patient is not responding to the usual dose.

Routes of administration :

Intra-arterial : This route is often employed in cases of unilateral elephantiasis of the leg and foot.

Bowesman used it with an idea that glycerin would reach the affected part without getting very diluted.

Technique of intra-arterial injection :

Though this route sounds difficult it is fairly easy and with a little practice it should be possible to hit the artery every time. The inguino-femoral region should be shaved in hairy individuals, if possible a day previous to giving the injection.

The patient is made to lie down supine and the femoral pulsations are well located with the right hand. The skin is cleaned with spirit and the index and the middle fingers of the left hand are put over the artery and spread apart. A long no. 2 size

needle is taken in the right hand and puncture is made in the artery at a spot between the index and middle fingers of the left hand which are already in position. The blood comes out in spurts and the injection is then made very slowly. As the injection produces an arterial spasm and quite a severe pain for about five minutes, it is advisable to give a capsule of nembutal half an hour before injection in highly strung individuals. After the needle is removed a little pressure with a cotton pledget controls bleeding from the puncture wound.

Advantage of intra-arterial injection :

As the drug reaches the affected limb in an almost undiluted form it can have a marked effect with a much smaller dose.

Disadvantages of intra-arterial injections :

Though the technique is fairly simple yet the medical profession is not used to this route of administration and the general practitioner is reluctant to give it himself with the result that the patient has to come to the specialist for the injection.

The other theoretical disadvantage raised is that repeated arterial punctures may result in a traumatic aneurysm.

In over 350 arterial punctures done in 163 patients during the last four years no traumatic aneurysm has been observed. Although it is too early to conclude my answer to the problem is that if repeated venous punctures do not produce varicose veins there is no reason why repeated arterial punctures of an otherwise healthy artery should produce a traumatic aneurysm.

Scope of intra-arterial route in glycerin therapy :

I have given glycerin intra-arterially once a week and it is supplemented by the intravenous route two or more times a week as required. Once the size of the limb is reduced considerably which occurs by about the sixth week, the intra-arterial route is given up and only the intravenous route is employed.

Intravenous route :

Whenever intra-arterial route is not possible this is the only route employed or otherwise it supplements the arterial injections.

Injections are given in the ante-cubital or any other suitable vein.

Interval between injections :

Bowesman gave injections once in a week. As the results with this interval were not satisfactory I have given them on alternate days and of late I prefer to give six injections in a week to get the best results.

Total number of injections :

In all cases at least six injections should be given to find out whether a given case is responding or not. If the patient is responding the injections should be continued as long as the limb continues to decrease in size and either reaches the normal or becomes refractory. On an average 4 to 5 arterial injections and 20 to 25 intravenous injections are required. In one case as many as 150 injections had to be given before the limb became normal.

Toxic effects :

Febrile reactions : These occurred only in the early cases when glycerin was being autoclaved before use. To avoid these reactions it is necessary that glycerin is diluted in pyrogen free double or triple distilled water and then autoclaved and kept in sterile ampoules.

Hemoglobinuria :

This is a common complication and it is always best to warn the patient about it. He should be asked to keep a watch on the urine and bring the urine for examination if there is any change in colour.

Microscopic examination of urine does not show R.B.C.s and the colour is of altered blood. This complication is much more common with a dose exceeding 25 cc. of 50 per cent solution. It usually does not

appear for the first ten to twenty injections. There is one observation I wish to record in this connection. Whenever a lot of blood is aspirated in the syringe and the injection made after two or three venipunctures this complication almost invariably occurs. Glycerin produces this hemoglobinuria possibly because of its property of hemolysing blood.

Uncommon complications :

There is one case in which the glycerin escaped in the subcutaneous tissue while injecting in the antecubital vein. On the second day patient had a slight swelling of the arm and then developed a transient paresis of the musculocutaneous nerve. Temporary thrombophlebitis occurs if injections are made repeatedly at the same site.

Results :

Diminution in calf circumference.

1. More than 2 inches	..	22 cases
2. One to 2 inches	..	27 "
3. Less than one inch	..	10 "
4. No change	..	11 "
		—
Total	..	70 "

Diminution in ankle circumference.

1. One inch and over	..	46 "
2. Below one inch	..	11 "
3. No change	..	13 "
		—
Total	..	70 "

Out of 163 patients treated measurements were taken by me personally in 70 cases and they are shown in the tables above. The results have been very gratifying in scrotal cases and in leg cases of less than five years duration. The constant feature in all cases is the relief of the dull aching pain and relief of a sensation of heaviness which are noticed by the patient by about the second injection.

In cases cured or improved after glycerin injections, increase of oedema has not been observed after discontinuing the injections.

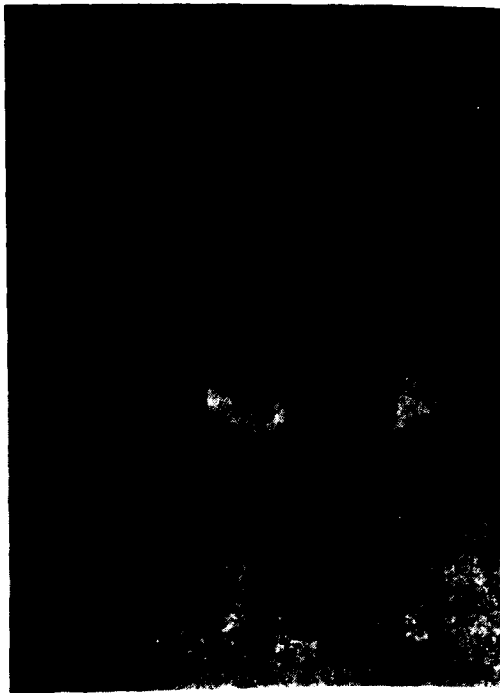


Fig. 1.
Before operation.

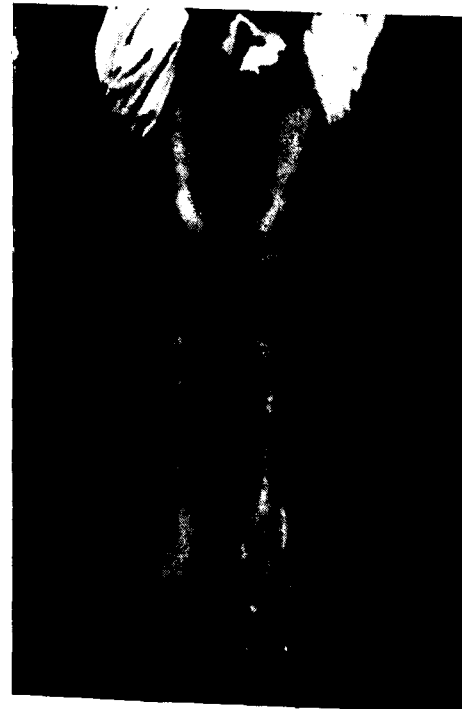


Fig. 2.
Six months after operation (Anterior view).



Fig. 3.
Six months after operation (Posterior view).

Regarding the improvement in scrotal cases I want to mention one very interesting case that was accidentally cured. About four years back a patient was admitted with a marked thickening of the scrotum and the penis was actually distorted. A routine methylene blue test could not be done as the scrotum was woody hard in consistency. I did not expect the patient to respond to glycerin and so the patient was fixed up for an operation which got postponed on two consecutive occasions due to some reason or the other. In the meantime the house-surgeon had been giving glycerin injections as a routine and the patient felt that there was some softening of the swelling in the upper part. A full course of glycerin injections was therefore given a trial and within one month he was completely cured but for a patch of thickening round the median raphe which also finally disappeared.

Finally in all operated cases glycerin is very valuable in preventing elephantoid changes in the grafted skin.

Operative Treatment :

There have been various operative procedures that have been practiced for cases of advanced elephantiasis. There have been attempts to construct new lymphatic channels or to establish communication between the superficial and deep lymphatics. These operations have had very poor results and the only surgical procedure which has helped these cases has been the actual removal of the hypertrophied subcutaneous tissue.

Lisfranc described a method of scarification of tissues and Carnochan recommended ligation of external iliac or femoral artery as a means to diminish circulation and thus the oedema.

Handley⁸ used silk threads to make artificial lymphatic channels.

Lever used strips of fascia lata instead and Lanz went a step further, trephined the femur and placed strips of fascia lata in the trephined holes.

I have used silk lymphangioplasty in five patients and found it very unsatisfactory.

In two cases there was an improvement only as long as the patients were in bed.

Kondolen (1912) reported the operation of wide excision of deep fascia extending from the leg to the thigh.

As the operation was not very successful various modifications were made and the Sistrunk's⁹ modification of excision of a wedge of skin and subcutaneous tissue with the deep fascia of the leg is still the one commonly practised though with poor results.

Macey (1940)¹⁰ reported grafting of healthy skin and excision of elephantoid tissue at the second stage.

In 1946 I¹¹ did an excision of elephantoid tissue followed by Thiersch's skin grafting with grafts taken from the thigh. The result was very gratifying and the grafts took very well but the great problem that confronted me was the large amount of donor skin required in these cases and specially if there was bilateral elephantiasis.

In order to solve this I attempted dissecting out large flaps of skin over the elephantoid tissue and replacing them after excision of the elephantoid tissue. The flaps sloughed off quite often and the excision could never be thorough. Hence I resorted to removing the skin from the affected limb, excising the elephantoid tissue and grafting the same skin.

The skin in elephantiasis limbs is fairly healthy and can be grafted satisfactorily. There are unhealthy portions of the skin specially over the foot which should be discarded but as the size of the limb diminishes considerably after excision there is always sufficient skin to cover the raw area.

The operation can be done in one or two stages depending on how long it takes to operate and the general condition of the patient. Except on four occasions I have operated in two stages.

Technique of operation :

The skin of the leg is carefully prepared and I do not hesitate in using antiseptics in

pre-operative preparation. The grafts take quite well even when donor area has been prepared with antiseptics. One great advantage in elephantiasis is that no matter what you do the grafts always take as the tissue fluid is rich in proteins. A tourniquet is applied to the thigh and grafts taken out from the affected limb. I have used both the dermatome and the razor blade for cutting the grafts.

Dermatome grafting :

The dermatome cement is poured in a bowl and diluted with ether. The glue is applied with a brush on the dermatome and then on the donor area. The dermatome is adjusted to cut a graft of the required thickness, usually 0.6 to 0.8 mms.

The drum is pressed upon the donor area and the graft cut by a side to side movement of the knife and the drum is rotated as the graft is cut. In order to get longer grafts after the whole drum surface of the dermatome is used up I detach the graft from the dermatome without cutting it off at its lower end. The glue is applied again over the drum surface, the graft is passed between the drum and the knife of the dermatome and a further length cut in the same fashion.

I do not like the use of the dermatome in these cases as it takes much longer and requires glue which is sometimes not of good quality and the graft may not come out.

The elephantoid tissue is then incised right down to muscle. After the proper plane is reached it is much easier and quicker to detach the elephantoid tissue by finger dissection rather than with knife or scissors which is very tiring and leave behind fibrous tissue at places making the surface uneven. The grafts are applied and the limb put in plaster of Paris. I make it a practice of removing the tourniquet only after the plaster is applied as it presses on the oozing surface and produces hemostasis.

The plaster is changed on the fourth day and then every ten days.

Glycerin injections are given post operatively for six weeks.

Results of operation :

Immediately all the patients benefit, the limb becomes lighter and patient is able to move about very comfortably but recurrence occurs in cases which do not continue the full course of glycerin injections post operatively.

	No. of cases
Recurrence within two years of operation ..	4
No recurrence ..	23
Not reported ..	10
Total ..	37

Out of the 4 cases in which the grafts had become elephantoid two have been re-operated recently and one had to be amputated as he came back with ulceration and marked eczema.

My thanks are due to Dr. K. G. Munsif for giving me opportunity to work on this problem and to the dean, K. E. M. Hospital, Bombay for allowing me to report the cases treated there.

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FILARIAL LYMPHOEDEMA*

by M. G. KINI, Bombay.

The problem of filariasis is intimately connected with water supply and drainage. The fact is that when underground drainage scheme is introduced, filarial incidence automatically reduces itself. In Madras City itself, Rayapuram, which was a notoriously filarial place showed considerable diminution in incidence rate, after installation of underground drainage. Same good results occurred in incidence of diseases like Kala Azar and Malaria. At present, extensions of Madras City, such as Mambalam area, show a higher rate of incidence of filariasis due to lack of drainage. Stagnation of sewage with cess pits, provides a fertile ground for the growth of *Culex Fatigans* type of mosquito, which is the carrier of filarial germ. Filariasis which causes lymphatic obstruction, affects every part of the human body, with particular predilection to the lower limbs, scrotum and penis. Upper limbs, breasts and scalp have been involved in certain percentage of cases. The chief consequence of this infection is lymphangitis, which either leads to lymphatic edema and subsequent development of lumps of fibro-fatty tissue after the edema subsides or it leads to a frank elephantoid condition. Wasserman had observed that primitive fatty tissue is formed from the same embryonic element as the lymph nodes, capillaries, reticular cells and vascular adventitia subject to reversible changes from fatty to lymphoid and from lymphoid to fatty tissue. The fatty deposits after a lymphangitis attack in filariasis, may manifest as nodules or as lumps or as a diffuse infiltration causing enormous masses. (Kini—Lipomas, Big & Small. I.M.G. No. 10, Oct. 1949.).

Many drugs and vaccines have been advertised for the cure of filariasis. None

of them has proved useful. "Hetrazan" is a new drug. It is too premature to draw any inference regarding its efficacy though it is stated by some, who have tried this drug, that the size of swelling diminishes and micro-filaria disappear from peripheral circulation. The modern chemotherapeutic drugs like penicillin and the sulfa drugs are very helpful in curbing the associated infection by organisms of the type of streptococcus and staphylococcus. It is also a notable experience that some patients who are subject to repeated filarial attacks, keep free from them when they leave an endemic area.

OPERATIVE TREATMENT

I wish to ask Dr. Mehta whether I am right in inferring from his lecture that he left the deep fascia severely alone in the leg, while removing elephantoid fibro-fatty tissue. If that is so, the object of the operation is defeated because the deep fascia, after repeated attacks with inflammation, becomes very fibrous and sometimes cuts like cartilage and forms an impenetrable barrier for communication between superficial and deep lymphatics. Kondoleon designed his operation to promote drainage from the superficial to the deep tissue. If elephantoid masses are only dissected without excision of deep fascia, no good result will occur. In two cases with a very large elephantoid leg, even after extensive removal of the fibro-fatty tissue with strips of deep fascia elephantoid condition recurred. In these cases three longitudinal incisions were employed. The first in front of the shin of the tibia and the second antero-laterally and the third, antero-medially. Preliminary tourniquet was used. The fibro-fatty structure was carefully dissected out along with strips of deep fascia 1" wide, from all the three aspects and the skin flaps after dissection were only held at the two ends, namely the knee and the ankle. After

dissection, the flaps became oversize and baggy and they were made taut, after pleating at the top and bottom ends and the skin flaps after trimming, were sutured. The pleated ends were cut at a later date. A drain was used in the most dependant part and the limb firmly bandaged and put in plaster. In both the cases the medial flap sloughed at the lower third of the limb, which ultimately granulated and subsequently was grafted with Thiersch type of skin graft. It was found that recurrence of swelling began to be appreciated after a lapse of 4 months. These cases were done prior to the penicillin and sulfa era. After this experience, no similar procedure was adopted. In moderate sized swellings the swellings have been controlled by the following line of treatment :—

1. The limb or the scrotum is immersed in a bath containing a solution of Eusol (a drachm to a pint). The water should be as warm as the skin of the affected part can bear. This is done daily twice, for fifteen to twenty minutes. After removal, the limb or the scrotum is dried and gently massaged with talcum powder and the patient is instructed to keep the leg raised while sleeping or the scrotum supported.

2. Routine injections of 0.15 gm. of "Neosalvarsan" were given to adults once a week for four weeks, the object being to stimulate the reticulo-endothelial cells. The results in some cases have been very good but it cannot be said that it is a cure. In some cases of elephantoid scrotum, due to bad skin condition, the patients were advised conservative line of treatment suggested above, to improve the skin condition, to fit them for operative procedure. Some of them became so satisfied with this treatment, that they did not return for operation. Cases Nos. 27, 39, 81b are examples. If more replies had come on follow up, the pharmacological value of chlorine lotion would have been studied.

Complete excision of the elephantoid tissues including skin covering the penis has to be done. In elephantoid condition of scrotum, skin of penis even if it looks

healthy, should be sacrificed because when recurrence occurs it starts in this part of the skin. It is suggested that better drainage between the superficial and deep lymphatics can be attained by cutting away completely, the cremasteric muscle and fascia right up to the external ring. It is an usual experience to find that this fascia and muscle become dead white due to formation of fibrous tissue extending right up to the tunica vaginalis of the testicle. This tough fibrous layer probably forms a barrier to the superficial lymphatics, to drain into deeper lymphatics, which travel along the cord. In some cases where part of the scrotal wall which appeared healthy, near the perinium, was utilised to form a bag for the housing of the testis, recurrence started in this area, with the result that a secondary operation had to be done (cases 19, 23, 53, 67, 68.).

The testes after mobilisation are transposed into the upper and medial parts of the respective thighs below inguinal ligament and in this procedure it is essential to make a comfortable pocket between the deep fascia and muscle and not between the superficial and deep fascia. With this technique the testis remains in one situation snugly and though this procedure prolongs the operation a bit as it involves a little more dissection and ligature of spouting pudic blood vessels, yet it is worth this effort. Better lymphatic drainage is helped along the cord from the superficial to deeper lymphatics. Skin grafting has to be done for the penis, without which the operation is not complete. In some cases mucous membrane of prepuce has been used to cover the raw area of the penis, but in one case there was edema and persistent erection which disturbed the sleep so much, that a secondary operation of excision and skin grafting had to be done. In the earlier series of cases the mucous membrane of the prepuce was used as a graft to cover the raw area of the penis. In selected cases Nos. 1, 6, 8 and 13, this procedure was adopted but case 13 taught a lesson. It is important that the mucous membrane should be long and loose enough

*A summary of this paper formed part of the discussion on filarial lymphoedema at the XI Annual Conference of the Association of Surgeons of India, at Madras, Dec. 1949.



Fig. 1.
A clinical photo of case 14 showing a fistula at the penoscrotal junction, 3 years after operation.

and the penis short enough while selecting cases for this procedure. Case 19 is Case 13 secondarily operated 3 months later. Case No. 1 gave a good impression at the time of discharge which prompted the adoption of this method in a few selected cases. After the experience of case No. 13 such a procedure was given up. It is unfortunate that no replies have come from the other 3 cases.

Thiersch grafting was always used, using the skin from the thigh. For the retention of the graft, a simple procedure of dressing was adopted. A ribbon gauze soaked in saline is wound round, starting from the root of the penis and ending below the glans penis, so that at the end of the procedure it appears like a truncated cone with the broad base resting on the pubic part and the apex of the cone is formed by the glans

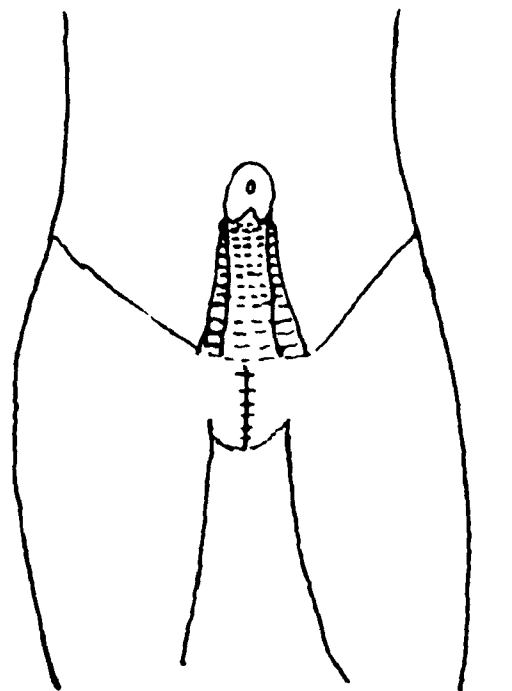


Fig. 2.
An illustration to show how the penis is dressed after skin grafting.

penis which is free (Fig. 2). This helps to retain the penis upright, keeps the grafts in position and also enables free passage of urine without soiling the dressings. It is also easier to pass a rubber catheter when there is retention of urine.

Every case before operation has to be tested for patency of urethral passage. This is done clinically by making the patient pass urine before the doctor or lab-assistant who has to test the urine before operation. If there is difficulty in passing urine, a rubber catheter is passed under strict precaution and if it passes freely it reduces the anxiety after the operation. In the majority of the cases when the swelling is very big, the penis gets retracted in the swelling, with the result it is impossible to pass a catheter and in such cases it has been the procedure that during operation after

excision of elephantoid tissues and the skin covering the penis, a rubber catheter is passed per urethra into the bladder, and if it passes easily then the catheter is removed and skin grafting is done. In some cases where this catheter does not pass easily, urethra is dilated with a sound and a rubber catheter is passed to test the patency. Only one case (case 44) had to be dilated during operation in the series. In the majority of cases there was no stricture as probably the mechanical difficulty for intercourse probably prevented the patient acquiring Neisserian infection. Even if there is a bad stricture, operation for elephantoid scrotum need not be deferred as external urethrotomy can be done easily after excision of the elephantoid tissues and establishment of perineal drainage in the suture line.

POSITION OF PATIENT AND ANAESTHESIA

Either spinal anaesthesia with extradural block or intradural type of anaesthesia was

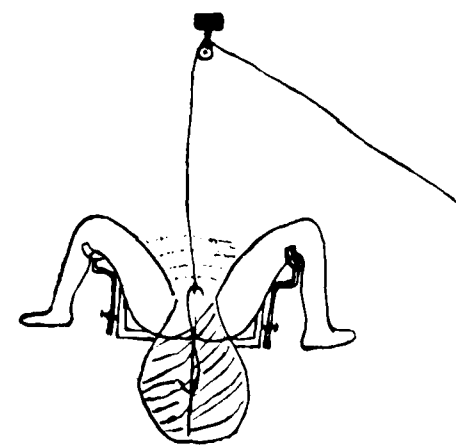


Fig. 3.

An illustration showing the lithotomy position and the way how a heavy elephantoid scrotum is slung over a pulley attachment with the help of the decapitation hook buried into the scrotum. It is raised and lowered as and when required by the surgeon during his operative procedure by an assistant.

generally used. In some cases caudal block supplemented by local in the supra-pubic region was used when the general condition was not satisfactory. Lithotomy position was used and in big scrotal swellings crochets part of the decapitation hook was dug into the scrotum and a rope attached at the distal end of hook and taken over an overhead pulley, which was held by one of the assistants who lowered and raised it as and when required by the surgeon to facilitate the operative procedure (Fig. 3).

The tabular statement appended to this discussion was prepared in 1938. Only 84 cases are analysed in this statement. Later more cases have been seen and operated but are not included, as they have not been tabulated and followed up. With a view to find out the results of operative procedure on the scrotum a follow up was attempted. Out of 84 cases 20 have been treated conservatively for the following reasons.

Skin condition unhealthy — Nos. 2, 5, 7, 24, 27, 30, 42, 57, 62, 70, 72.

Absconded — No. 22.

Lymph scrotum with unhealthy skin — Nos. 25, 61, 63.

High fever and pain — No. 39.

Venereal disease — Nos. 76, 81.

Valvular disease of the heart — No. 50.

Hyperchromic anaemia — No. 59.

Three of the non-operated cases have replied. Case 27 has reported that he was keeping fit for 6 years with the injections and local treatment but in 1940 he got another attack of fever with enlargement of the scrotum. The son of case 39, who had come for some other surgical trouble, has stated that his father was keeping fit with the conservative treatment. Case 81 who had venereal disease was treated conservatively with advice for a thorough treatment for his venereal disease. He reports he is quite fit with no recurrence. Out of 64 operated cases 34 cases, i.e. 53.1% of operated cases have replied and the following analysis shows the results.

Follow up result of operated cases				
Result	Sepsis & other minor complications	No Complications	Total	
No recurrence; keeping fit...	32, 35, 40, 52, 63, 71, 74, 75.	12, 15, 16, 17, 19, 21, 29, 31, 38, 44, 48, 49, 54, 64, 65, 73, 82, 83, 84.	27	
No recurrence but developed urinary fistula at peno-scrotal junction ...		14, 28.	2	
No recurrence of hernia as well as swelling ...		44.	1	
Recurrence of hernia but not the elephantoid scrotum ...		36.		
Recurrence of swelling ...		13, 20, 64.	3	
No recurrence but was seen accidentally in a mental hospital when visiting the same ...		79.	1	
Total	...	8	26	34

Only one died out of 64 operated cases, and case No. 23 and 51 have been reported dead by the Post Office. It is stated case No. 23 died of high fever and in case 51 cause of death is not known. The case that died in the hospital was 60 years old and had an elephantoid scrotum weighing 28 lbs. He was a fatty individual and had poor kidney function. This patient insisted on the operation. Though it was a poor risk he was built up for operation by attending to kidney function. He developed marked sepsis and was reacting favourably to treatment but on the 21st day he died suddenly.

27 cases had no recurrence, of these 8 cases had sepsis of various types from stitch abscesses to frank suppuration and abscess formation. Fortunately no case of cellulitis occurred, even though one case was a diabetic case. Most of the cases had a

preliminary course of vaccine treatment and it was given as a rule to avoid serious consequences due to infection, as good aseptic procedure could not be guaranteed in this area. With modern treatment for diabetes it is possible to tackle this problem with greater safety than before and with the advent of chemotherapeutic drugs, the margin of safety has become greater. 2 cases Nos. 14 & 28 developed fistula at the penoscrotal junction. In both, an indwelling catheter was used to drain the bladder. In case 14 the fistula developed on the fifth day (Fig. 5). In case 28 it is presumed that he might have acquired a neisserian infection later leading to fistula formation, as he had no fistula at the time of discharge. In case 14 in spite of the fistula formation the healing process of the skin graft was good.

In some cases operated, the following noteworthy points were observed with a few complications:—

1. Imperfect primary operation elsewhere with recurrence of swelling was observed in cases Nos. 1, 4, 5, 19, 23, 53, 67, 68.

2. Hydrocele operation as an exciting cause for the development of elephantoid scrotum was observed in cases Nos. 8, 11, 20, 21, 31, 33, 34, 41, 64, 83.

3. Phimosis operation as an exciting cause for the development of elephantoid scrotum was observed in case No. 80.

4. Albuminuria as a complication was observed in cases Nos. 32 & 52.

5. Diabetes as a complication was observed in cases Nos. 35, 64.

6. Gonorrheal stricture as a complication was observed in case No. 44. He had also a right oblique inguinal hernia which was found while dissecting the cord to free it from cremasteric fascia.

7. Recurrent hernia as a complication was observed in cases Nos. 36 & 47.

Though surgery has helped to a great extent to solve the discomfort of elephantoid scrotum, yet one case which is not included in this series is worthy of notice. A



Fig. 4.
The clinical photo of case 36 showing the anterior aspect of a huge elephantoid scrotum with a recurrent hernia.



Fig. 5.
A side view of the same.



Fig. 6.
An anterior view showing a big sized elephantoid scrotum with a recurrent hernia.



Fig. 7.
A clinical photo taken after operation showing the result of skin graft and the position of transposed testis in the upper and medial aspect of thigh below the inguinal ligament. The scar of the hernia operation done at the same time is also seen.



Fig. 8.

An illustration showing one of the bad effects of removing enlarged lymphatic glands along with elephantoid tissue. Note the enormous size of elephantoid condition of lower limbs with fibro lipomatous mass hanging from the upper and medial aspect of the right thigh. The left leg also shows a noticeable elephantoid condition of lower limb.



Fig. 9.

An illustration showing a type of enlargement of the scrotum and the penis in filariasis and refers to case 35. Note the remarkable thickening of skin of penis.



Fig. 10.

A side view of another type of elephantoid scrotum and refers to case 74. Note the retraction of penis in the swelling.



Fig. 11.

An anterior view of the same.

young man aged 35 years had enlarged inguinal glands with elephantoid scrotum. He sought advice a year later for elephantoid condition in the legs (see Fig. 8). The right lower limb showed enormous swelling and the left had appreciable swelling with not much of discomfort. He had a huge pendulous fibro-lipomatous mass hanging from the medial and upper aspect of the thigh and he was advised disarticulation for the right lower limb. He went away and some other surgeon removed the fibro-lipomatous mass only. This led to further increase in size and girth of his limb which added to his discomfort and annoyance. The clinical photo taken when

he returned for advice again, has been lost. This case is illustrated to show the inadvisability of removing the glands along with elephantoid tissues of scrotum. There was no recurrence of the elephantoid condition in the perineal region but the lower limbs afforded a great problem to the patient and the surgeon.

The old adage "prevention is better than cure" applies with greater force to elephantoid condition of legs and scrotum. The ugly and uncomfortable consequences can be more surely cured by preventive medicine than by the well meant efforts of physicians and surgeons.

TABLE I—AN ANALYSIS OF 84 TREATED CASES OF FILARIAL SCROTUM ETC.

Serial No.	Religion & age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	Yrs. 46 H M	25	Size of a coconut unpealed	No history of fever but swelling was noticed gradually increasing. Was operated for elephantoid condition 4 years before but recurred	Excision of elephantoid tissues and transposition of testes in thighs	The mucous membrane of the prepuce was used as a graft for the raw area on penis	Slight inflammation at root of penis which subsided after removal of stitches	1932	No proper address	
2	H M 45	5	Big unpealed coconut	No history of fever but gradual increase in size	Not operated as skin condition was unhealthy; put on bath & injection of .15 gm. of Neo Salvarsan; was asked to report at the end of 2 months	—	—	1932	No proper address	Did not return.
3	H M 20	1	Small coconut unpealed	Recurrent attacks of fever & gradual enlargement of scrotum	Excision of elephantoid tissues and transposition of testes in thighs	Thiersch graft used for raw area on penis taken well	Had oozing from perineal wound on the stopped with Haemoplastin	1932	No proper address	
4	H M 25	10	Small coconut	No history of fever but gradual enlargement of inguinal glands	Excision of elephantoid tissues and testis transposed into resective thighs	Thiersch graft took well	Had fever 10th day	1932	No proper address	
5	H M 20	Not entered in case sheet	Not noted	Gradual enlargement	Not operated but treated on conservative lines to improve the skin condition	—	—	1932	No proper address	
6	H M 40	3	Big coconut	Fever with rigors	Excision of elephantoid tissues and testes transposed in thighs	Mucous membrane of prepuce used as time of dis- graft for the charge penis	Had slight fever, result good at time of discharge	1932	do	
7	H M 25	4 mths	Coconut	Rigors with fever orchitis & funiculitis	Local pigment bellodonna 5% 5 c.c. Ca. chloride injection & later .3 gm. Neosalvarsan weekly for 4 weeks, not operated	—	—	1932	No reply	
8	H M 29	1 1/2	do	Fever with rigors, was operated for hydrocele 6 years before	Excision of elephantoid tissues & testis transposed to resective thighs	The mucous membrane was used to cover the raw area	Slight fever, no sepsis	1932	do	
9	H M 36	1	do	History of gonorrhea 2 years prior to operation, history of fever BP 190-130	Excision of elephantoid tissues, double hydrocele sacs excised, testis transposed in the resective thighs, dilation of urethra done on the table	Thiersch graft to penis took well	Shocked during operation due to fluid loss Temp. 101° from 2nd to 10th day retention of urine	1932	Letter written in 1940 returned by Dead Letter Office	
10	H M 25	5	Pealed coconut	History of fever	Excision of elephantoid tissues	Thiersch graft done good	No complication	1933		In reply says no recurrence but there is pain in left testicle when he works hard unable to report due to poverty
11	H M 53	21	Huge swelling weighing 40 lbs.	No history of fever but was operated for double hydrocele 24 years ago and the swelling started 3 years after	Excision of elephantoid tissues, had no hydrocele, testes transposed to thighs and the rubber catheter passed into bladder per urethra for constant drainage	Thiersch graft done to the penis graft took well	Temp. 101.5° from 2nd to 8th day; wound around root of penis slight sepsis	1933	No reply to letter	

Serial No.	Religion & age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
12	H M 30	Yrs. 4	Size of a big Bang and-palli mango	No history of fever, operated 10 years ago for stricture urethra BP 180-110	Excision of elephantoid tissues transposition of testis to respective thighs, rubber catheter into bladder per urethra	Thiersch graft done on penis took well	Irregular temp. highest 103°c on 3rd day; later came down to normal	1933	Keeping fit	
13	Re M 25	2	Size of peeled coconut	History of fever, his inguinal glands had been removed 3 yrs. before	Excision of elephantoid tissues & testis transposed in respective thighs	The mucous membrane of the prepuce used as a graft to cover the raw area on the penis	Temp. 100°c in the evening	1933	Cycles well but gets painful erection, there is oedema round the penis, was subsequently operated	Operated 3 months later see case No. 19
14	H M 38	2	Size of Bang and a palli mango	History of fever	Excision of elephantoid tissues Testis embedded in respective groins Drainage of bladder with a rubber catheter per urethra	Thiersch graft took partially. later the raw area got epithelialised	Temp. rising to 102°c for 6 days daily. Urinary fistula developed at penoscrotal junction on 5th day	1933	Reported in 1940. Fistula persistent; advised operation to close the fistula	
15	H M 25	4	Pealed coconut	History of fever, was operated before for the same complaint but partial excision done	Excision of elephantoid tissues and testis transposed in both the thighs	Thiersch graft for penis; good result	Temp. rising to 101°c daily from 6th to 10th day	1933	Replied in 1940 keeping fit, no recurrence	
16	H M 18	3	Foot ball adult size	History of fever and enlargement of scrotum	Excision of elephantoid tissues with testis transposed to respective thighs	Thiersch graft for penis; result good	No complication	1933	Reported in 1925 & 1940; no recurrence	
17	H M 35	1 1/2	Pealed coconut	Slight fever 4 years before	Excision of elephantoid tissues with testis transposed to respective thighs	Thiersch graft for penis; good result	do	1933	1935 no recurrence; 1940 had a child	
18	H M 26	3	Coconut	Operated for enlarged left inguinal glands previously Has attacks of fever with enlargement of scrotum	Excision of elephantoid tissues and testis transposed to the respective thighs	Thiersch graft done; good result	Temp. running to 100°c for 1st 3 days	1933	Letter returned from D.L.O. as addressee not traceable	
19	Re M 25	3 mths.	Thickening of penis	Was operated for elephantoid scrotum 3 months before, gets painful erections. The mucous membrane of prepuce was used as graft	Excision of elephantoid condition of tissues in the region of penis	Thiersch graft used; good result	No complication	1933	Keeping fit; good result; no recurrence of painful erections (see case 13)	Secondary operation after three months.
20	H M 41	7	Small un-pealed coconut	1916 while studying in Bombay had fever & swelling; operated for elephantoid condition No microfilaria found in blood	Excision of elephantoid tissues and testis transposed to the respective thighs	Thiersch graft; good result	Temp. rising to 101°c from 7th to 9th day	1933	Had again fever and some gro- with round the grafted part of penis; took to tub bath; fever subsided No scrotal or penile swelling	
21	H M 20	3	Small coconut	14 years before operated; for hydrocele gets fever off & on	Excision of elephantoid tissues & testis transposed to respective thighs	Thiersch graft done; good result	nil	1933	No recurrence. Keeping fit	
22	H M 30	2	do	Fever with rigors, unhealthy skin	—	—	—	1933	Absconded; no proper address	
23	H M 34	5	Size of pumpkin	Was operated for a similar complaint elsewhere. Partial excision was done; or 2 yrs. he was free, but recurred	Excision of elephantoid tissues and testis were transposed to respective thighs	Thiersch graft done	Rise of temp. to 100°c from 2nd to 7th day	1933	1940, reported dead by the post office	

Serial No	Religion & age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Yrs.	Yrs.								
24	H M 36	3	Size of pumpkin	Fever with ulcers on penis	Advised baths & conservative treatment & injections of .15 gm. of Neosalvarsan at weekly intervals	—	—	1933	No reply to letter	
25	H M 34	5	Pealed coanut	History of fever with lymph scrotum	Advised baths & conservative treatment	—	—	1934	No reply to letter	
26	H M 32	10	Pealed coanut	No fever, gradual enlargement of scrotum	Excision of elephantoid tissues & transposition of testis in respective thighs	Thiersch graft done to penis, good result	No complication	1934	Letter returned from D.L.O. as addressee untraceable	
27	H M 22	5	Cocoanut	Fever with enlargement	Patient had unhealthy condition of scrotum; was treated conservatively	—	—	1934	In 1940 replied to letter; says he was better with the treatment but he had an attack again with noticeable enlargement	
28	H M 32	4 mths	Large mango	Bouts of fever with pain and enlargement	Excision of elephantoid tissues. Testis markedly adherent; transposition of testis to respective thighs, passed a catheter per urethra into bladder	Thiersch graft done	Temp. rose to 100° from 2nd to 5th day	1934	Is alright but there is a small fistula at the time of discharge.	
29	H M 35	4	Pealed coanut	No history of fever	Excision of elephantoid tissues with transposition of testis in respective thighs	Thiersch graft for raw area on the penis; good result	No complication	1934	Reported keeping fit	
30	H M age not noted	2	Pumpkin	History of fever	Skin unhealthy treated conservatively	—	—	1934	Returned from D.L.O. as untraceable	
31	H M age not noted	2	do	History of fever with enlargement and pain. Had an operation for double hydrocele elsewhere	Skin was made healthy by baths later excision of elephantoid tissues & transposition of testis in respective thighs	Thiersch graft to penis; good result	No complication	1934	Reported keeping fit	
32	H M 50 mths	6	Large mango	History of fever. Albumen in urine	Under caudal & local excision of elephantoid tissues & transposition of testis in respective thighs	Thiersch graft for penis; good result	Temp rose daily to 101° from 2nd to 7th day. Lower part of wound became septic; got better after treatment	1934	Reported keeping fit	
33	H M age not noted	3	Size of football - children's size	Bouts of fever started after an operation for double hydrocele	Excision of elephantoid tissues and transposition of testis in respective thighs	Thiersch graft done for penis; good result	Perineal wound became septic, healed after drainage	1934	No reply to letter	
34	H M 40	10	Small ball	Bouts of fever. 1st was operated for rt. side hydrocele later for left side	Excision of elephantoid tissues & transposition of testis in respective thighs	do	Perineal wound became septic healed after fomentation	1934	No reply to letter	
35	H M 35	2	do	Diabetic treated & made fit for operation. Elder brother also was operated previously for same complaint. Bouts of fever with enlargement & pain	Excision of elephantoid tissues & transposition of testis in respective thighs	do	No complication except stitch abscess in perineal wound	1934	Reported in 1940 good result, no recurrence	

Serial No.	Religion & age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Yrs	Yrs.								
36	H M 60	6½	Jack fruit moderate size	History of fever followed by enlargement of scrotum with a big recurrent hernia on left side.	Operated for recurrent inguinal hernia, excision of elephantoid tissues & transposition of testis in respective thighs; did not consent for orchidectomy	Thiersch graft done, good result	Temp. rose to 104° on 2nd day but subsided after two days.	1934	1940 recurrence of hernia but no recurrence of elephantoid scrotum	
37	H M 12	2	Big sized mango	History of fever with gradual enlargement of scrotum	Excision of elephantoid scrotum & transposition of testis in respective thighs	Thiersch graft done for penis, good result	Temp. for 3 days after operation	1935	Letter returned by post office as addressee not traceable	
38	H M 30	1½ mths	Small size cocoanut	History of recurrent attacks of fever with enlargement of scrotum	Excision of elephantoid tissues & transposition of testis in respective thighs	Thiersch graft for penis good result	Temp. 101° for 3 days from the 3rd day after operation	1935	Keeping fit; no recurrence	
39	H M 50	5	Size not noted	History of recurrent attacks of fever & pain	Usual conservative treatment	—	—	1935	Son reports that the father has no pain & swelling is better	
40	H M 20	2	Pealed cocoanut	History of fever with gradual enlargement	Excision of sacs of double hydrocele Excision of elephantoid tissues with transposition of testis in respective thighs	Thiersch graft done, good result	Perineal & suprapubic part of wound has sepsis	1935	1940 no recurrence, has indigestion	
41	H M 40		Big cocoanut	History of fever with pain & swelling, elephantoid condition followed one month after operation for hydrocele	Usual excision & transposition of testis in respective thighs	Skin graft Thiersch type done; good result	Slight distension of abdomen	1935	No reply to letters written	
42	H M 40	2½	Size of foot ball	History of gradual enlargement	Unhealthy skin, advised conservative treatment	—	—	1935	Did not return for operation, no reply to letter written	
43	H M 45	1	Size of a big mango	History of attack of fever	Double hydrocele excision of sac, excision of elephantoid tissues & transposition of testis in respective thighs	Skin graft to penis good result	No complication	1935	No reply to letter written	
44	H M 35	3	Children's foot ball	Recurrent attack of fever had taken filarial vaccine without effect had gonorrhoeal stricture had inguinal glands	(1) Dilation of stricture for 2 months, (2) Excision of elephantoid tissues combined with an operation for cure of rt. oblique inguinal hernia & transposition of testis in respective groins	Thiersch graft done for the penis good result	Temp. 101° from 2nd to 7th day	1935	1940 reported quite fit no recurrence of hernia	
45	H M 25	2	Small cocoanut	History of injury with fever	Excision of elephantoid tissues with excision of sacs for the double hydrocele & testis transposed into respective groins	do	Temp. 100° for 4 days after operation	1935	No reply to letter	

Serial No.	Religion & age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Yrs.	Yrs.								
46	H M 35		do	History of fever pain & swelling	Excision of elephantoid tissues excision of sacs on rt. side & transposition of testis in respective thighs	do	No complication	1935	do	
47	H M 35	10	Size of a jack fruit	There was trauma to lt. testis has a recurrent hernia with attacks of fever	Lt. orchidectomy markedly fibrosed testis, usual cure for left recurrent inguinal hernia, excision of elephantoid tissues & transposition of rt. testis in right thigh	Skin graft done for penis good result	Had bronchitis & temp. rising to 101° for 3 days	1935	do	
48	H M 35	2	Size of a mango	Recurrent attacks of fever and enlargement of scrotum and penis	Excision of elephantoid tissues difficulty of mobilisation of rt. testis due to adhesion. Transposition of both testis to respective thighs	Skin graft to penis good result	No complication	1935	1946 reported stated no children after operation, had sexual vigour till 1943 but lost after-wards	
49	H M 32	3	Size of a cocoanut	Recurrent attacks of fever with gradual enlargement of scrotum	Excision of elephantoid tissues with transposition of testis in respective thighs	do	Temp. for two days after operation	1935	1940 reported no recurrence	
50	H M 30	6	Big sized cocoanut	Gradual enlargement of scrotum; had valvular heart disease not compensated	Not operated conservative treatment	Advised to report later		1935	No reply to letter	
51	H M 45	10	do	Recurrent attacks of fever with enlargement and pain; had vaccine treatment	Excision of elephantoid tissues & transposition of testis in respective thighs	Skin graft to penis good result	Perineal wound slightly septic	1935	1940 reported dead got an acute attack of high fever & died	
52	H M 44	4	Size of a pumpkin	Elephantoid condition of rt. leg had albumen in urine kept under salt free diet BP 150-100	Big hydrocele treated by excision of sacs & excision of elephantoid tissues & transposition of testis in respective groins	do	Perineal wound slightly septic	1936	Reported in 1941, no recurrence of elephantoid condition of scrotum gets recurrent attacks of fever which last 24 hours. Since 1938 had arthritis of leg. Swelling of legs still persists not increased in size carries on the baths advised	
53	H M 50	15	Cocoanut	Attacks of fever, was operated with operation partially 15 yrs. back, recurred in one year after first operation	Excision of elephantoid tissues with operation for hydrocele radical cure & transposition of testis in respective thighs	Skin graft taken well	Temp. ranging to 101° for 7 days & 100° for end week an abscess formed in the rt. thigh drained	1936	No reply to letter	
54	H M 40	4	Big mango	Attacks of fever with enlargement & pain	Excision of elephantoid tissues Hydrocele treated in usual way; testis transposed in respective thighs	Skin graft to penis taken well	Temp. rose to 102.5° for two days after operation	1936	1940 Fever recurred but now better; advised to report again	

Serial No.	Religion & age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	Yrs.	Yrs.								
56	H M 40	10	Jack fruit	Gradual enlargement of scrotum	Very large hydroceles; varicose condition of lymphatics marked orchitis & secondary ectomy done with excision of varicose lymphatics and left testis transposed to left thigh, skin grafting not done as patient had shock	After 3 weeks secondary skin graft done to penis; took well & secondary suture to perineal wound healed	Perineal wound had become very septic; was drained	1936	No reply to letter	
56	H M 56	1 1/2	Size not noted	Recurrent attacks of fever	Double hydrocele treated in the usual way & excision of elephantoid tissues & transposition of testis to respective thighs	Skin graft took in patches, later epithelialised the whole area	Perineal wound slightly septic	1936	do	
57	H M 60	25	Big coconut	Recurrent attacks of fever with enlargement	Skin condition poor; advised baths & to report later	Advised to report later		1936	Did not return for operation no reply to letter	
58	H M 23	5	do	Recurrent attacks of fever with enlargement & pain	Hydroceles on both sides radical cure, excision of elephantoid tissues & transposition of testis in respective thighs	Skin graft to penis good result	Wound healed by 1st intention	1937	No reply to letter	
59	H M age not noted	12	Foot ball adult size	Gradual enlargement was operated for hernia 10 years ago elsewhere	Suffering from hyper—chronic macrocytic anaemia and so was not operated, was asked to be medically treated & later to report for operation	Not operated, advised to report later		1937	No reply to letter; did not return for operation	
60	H M 30	2 yrs. acute 3 mths	Size not recorded	Acute enlargement a dense scar in the left inguinal region; old healed suppurating lymphadenitis	Excision of elephantoid tissues & testis transposed in respective thighs	Thiersch skin grafting good result	No complication	1937	No reply to letter written	
61	H M 45	4 mths	do	Lymph scrotum elephantoid condition of leg; enlarged lymphatic glands groins	Conservative treatment	Advised to report later		1937	Letter returned from D.L.O.	
62	H M 30	15 days	Big coconut	Elephantoid condition of leg big hydroceles and skin condition very unhealthy	do	do		1937	Letters returned from D.L.O. as addressee not traceable	
63	H M 36	4	Cocoanut	Elephantoid condition of both legs Wasserman + +	do	do		1937	No reply to letter	
64	H M 28	6	Pealed coconut	Had undergone operation for double hydrocele before & the skin thickening occurred after operation Diabetic with acetone + +	First treated for diabetes later excision of elephantoid tissues & transposition of testis in respective thighs	Thiersch skin graft used for penis with good result	No complication	1937	1940 replied; no recurrence	

Serial No	Religion & Age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
65	H M 45 yrs.	5 yrs. acute 3 mths	Size not noted	Before each attack of swelling he used to get severe pain	Excision of elephantoid tissues with transposition of testis in respective thighs	do	Temp. on 5th, 6th, 10th & 11th day	1937	1940 replied no recurrence no pain no swelling in legs	
66	H M 30	2	Pealed coconut	Gradual enlargement	Excision of elephantoid tissues & transposing of testis in respective thighs	do	From day of operation 101° till 8th day; afterwards normal; perineal wound infection present	1937	No reply to letter written	
67	H M 24	4	do	Partial excision elsewhere in 1935 with recurrence in the skin used for lodging the testis; skin of penis not touched	Excision of elephantoid tissues & transposing of testis in respective thighs	do	Temp. from 6th to 11th day; sepsis in perineal wound	1937	Letter returned as addressee not traceable	
68	H M 35	1	Big sized mango	Partial excision healthy part of perineal skin used for the lodging of testis, skin graft had been done for the penis	Excision of elephantoid tissues & transposing of testis in respective thighs	Not done as it was done before	Irregular temp. for a week, no sepsis in wound	1937	Reported no recurrence has osteo-arthritis of knee	Similar disease in members of family.
69	H M 35	1	Cocoanut	Gradual enlargement Inguinal glands markedly enlarged	Excision of Elephantoid tissues & transposing of testis in respective thighs	Thiersch graft done good result	Evening temp. for 4 days	1937	No reply to letter	
70	H M 48	15	Pumpkin	Gradual enlargement with very unhealthy skin	Conservative treatment	—	—	1937	Returned from D.L.O. as addressee untraceable	
71	H M 22	1	Cocoanut	History of venereal disease; difficulty in passing of urine; dilated before undertaking operation	Excision of elephantoid tissues & testis transposed in respective thighs	—	Temp. 100° for 4 days after operation lower part of wound septic	1937	1940 Reported getting fever since a fortnight with slight thickening of skin; urethra dilated again; cystitis present	
72	H M 30	3	do	Gradual enlargement of scrotum; skin very unhealthy	Conservative treatment asked to report after a month	—	—	1937	Did not return; not written to as address was imperfect	
73	H M 14	1½	Pealed coconut	Gradual enlargement with bouts of fever	Excision of elephantoid tissues & transposing of testis in respective thighs	Thiersch graft for penis good result	Temp. 101° 2nd day after operation	1937	1940 no recurrence; keeping fit	
74	H M 48	13	Pumpkin	Gradual enlargement with pain; inguinal glands +	Excision of elephantoid tissues; both sides haematocoele present; excision of sacs & transposing of testis in respective thighs	do	Temp. 101° for a week but subsided after removal of stitches; slight sepsis	1938	1940 reported good result, clinical photo taken	Has several members suffering from this.
75	H M 42	1	Big unpealed coconut	Gradual enlargement without fever	Excision of elephantoid tissues & transposing of testis in respective thighs	Thiersch graft for penis good result	Temp. 101° about a week on removal of stitches perineal sepsis present	1938	1940 reported good result; no recurrence	
76	H M 52	7	Cocoanut	History of syphilis & other venereals; skin condition poor	Conservative treatment asked to undergo treatment for venereal disease	—	—	—	No reply to letter written	

Serial No.	Religion & age	Duration of disease	Size of swelling	Short history	Nature of operation	Result of skin graft	Post operative complication	Year of operation	Follow up result	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
77	H M 60 Yrs.	7	Jack fruit	Gradual enlargement; penis could not be seen; Blood urea 66 mgms % Kidney function 48-69	Excision of elephantoid tissues & transposing of testis in thighs. Huge big hydrocele on both sides Excision of sac Scrotum 28 lbs. weight	Thiersch done graft	Temp. 100° from 2nd to 7th abcess in left groin, drained	1938	Died suddenly on 21st day	
78	H M 30	8	Size not noted	Gradual enlargement WR + +	Excision of elephantoid tissues & transposing of testis in respective thighs	Thiersch done for penis; good result	Temp. of 100° from 2nd to 7th day; abated after removal of stitches; slight sepsis	1938	Address not clear and so was not written to	
79	H M 40	4	Pealed coconut	Underwent an operation for inguinal hernia 20 years ago; no recurrence	Excision of elephantoid tissues & transposition of testis in respective thighs	do	No complication	1938	Saw accidentally in mental hospital as an inmate while visiting the hospital A lecturer in philosophy; no recurrence; testis were in good position; size normal	
80	H M 32	13	Size not noted	History of swelling & scrotum after an operation for phimosis	Excision of elephantoid tissues & transposition of testis in respective thighs	Thiersch done for penis; good result	Temp. 101° for three days	1938	No reply to letter written	
81	H M 32	1	Big mango	History of venereal; WR + +	Conservative treatment & advised to undergo treatment for venereal disease	—	—	1938	Replied; keeping fit, no recurrence	
82	H M 30	6	Pealed coconut	Gradual enlargement	Excision of elephantoid tissues using a diathermy knife & transposition of testis in respective thighs rt side big hydrocele radical cure done before transposition; Balanic type of hypopadias	Thiersch done for penis; good result	No complication	1938	Replied no recurrence keeping fit	
83	H M 35	6	Big sized coconut	Was operated for hydrocele swelling started after this; BP 170-100 Blood urea 75 mgms. N. P. N. 28.56 mgm.	Operation done under caudal field block & local. Excision of elephantoid tissues big hydrocele rt. side radically treated & testis transposed in respective thighs	do	do	1938	do	Similar history in other male members of his family.
84	H M 50	8	Size not noted	Gradual enlargement; WR + +	Under caudal & field block. Excision of elephantoid tissues Using a diathermy knife & transposition of testis in respective thighs	do	Perineal wound was septic	1938	1940 replied; no recurrence; keeping fit	

DISCUSSION—FILARIAL LYMPHOEDEMA AND ELEPHANTIASIS

Dr. Kapur (Assam) said (1) That in cases of elephantiasis seen by him the oedema extended to the thigh and was not limited to regions below the knee; (2) That the elephantoid skin when not infected or ulcerated offered an ideal surface for removing all the split skin grafts that are needed to cover raw area. It was he said a "thrilling experience" to the operating surgeon to cut sheets after sheets, of skin grafts, from the infiltrated tissues; and (3) That the dissection removed the entire skin with its subcutaneous infiltrated tissues except a narrow strip of skin covering the tibia anteriorly and the dorsum of the foot. He exhibited a photograph of a patient treated on these principles.

Dr. R. N. Cooper (Bombay) wanted to draw the attention of the meeting to the beneficial effects of injections of Old Tuberculin in the treatment of lymph oedema of filarial origin. His attention was drawn to this therapy by the observations of a patient of his brother Dr. S. N. Cooper who is an ophthalmic surgeon. The patient in question was receiving Tuberculin treatment for some ophthalmic trouble. When this patient came to Bombay from Surat (a heavily infected filarial region) to report himself, he congratulated his brother for not only curing the eye condition but also materially improving the scrotal condition which was of filarial origin. Acting up on this suggestion the speaker has tried old Tuberculin injections in filarial cases. In about fifty per cent of the cases there is an appreciable diminution of the oedema; and the quiescent intervals between acute exacerbations are lengthened considerably. The dosage employed is 0.1 c.c. of a 1 in 100,000 dilution of Old Tuberculin. A weekly injection is given for a period of three months. The same dose is maintained. If no benefit accrues at the end of three months, the treatment is given up.

Dr. Somervell (Vellore). "The relation between the locality of the infection, and the part of the body where the disease

manifests itself, is of great interest. In Cochin nearly every case has the disease in the leg; in parts of South Travancore, and of the Madras Province, the scrotum is the usual site; in North Arcot I have seen a majority of cases showing chyluria and sometimes haematuria. Do we know what it is that determines the site of disease? Is it a variation in the genus of filaria, or has it to do with the water or the weeds that habitually grow therein? I have seen several Europeans with filariasis of the arm, and hardly any Indians with this type of disease; in one village I treated some 20 cases of scrotal disease, but only one case of upper arm, and one of foot. These two cases were in Brahmins, the scrotum cases all in lower castes. It seems there is an opportunity for research here.

Regarding lymphatic oedema following cancer of the breast with gross involvement of lymphatic glands, I have found that removal of the breast and double ovariectomy has in every case so far operated been followed by a marked recession of the oedema of the arm, and it seems as if in a few years' time I may even be able to report cures, if one may use the expression, on the majority of these cases. Twice lately I have had an inoperable cancer of one breast, with secondaries in the other; I have removed the secondary breast with glands complete, and have done double ovariectomy; the primary breast in both cases became moveable and showed much recession of the growth. I hope to report later on these cases."

Dr. R. Mahadevan (Madras). "I would stress the importance of some very simple measures, which because of their very simplicity are often forgotten. One is that that patient should be advised to scrupulously avoid walking bare-footed. At least some of the pathological effects of elephantoid leg are due to walking on bare foot. The minute and frequent traumata that occur when walking bare-footed and the superimposed infection that is bound to occur, are probably important factors in

inducing an acute infection and keeping up a chronic infection. People with clean habits have less disabilities. I know of some of the middle class and educated people where enlargement of the leg is very slow and no ulceration has occurred over a long time. In one of them at least, the condition existed for over 20 years without any ulceration. The unsightliness of the leg is the real distressing factor for these patients. All the precautions that they take are merely to avoid walking bare-footed and to keep the foot and leg clean and dry, well washed with soap and water. The second factor is to impress on the patient the importance of the use of a mosquito curtain. It is known that when people with filarial infection leave the endemic area, in course of time they sometimes get rid of their infection—at least they cease to suffer from frequent attacks of filarial lymphangitis. Further, it is one of the observed facts that filarial infection does not result from a mere stray and occasional bite by the infected mosquito, but that the pathological condition results from mass infection, by mass mosquito bites: perhaps periodical re-infections also play a part. While it will not be possible for every body to leave the endemic area, the simple precaution of sleeping in a mosquito curtain is within the reach of almost every body and this ensures freedom from infections and re-infections.

Holding a skin graft to the penis in place by moulding over it, strips of plaster of paris, is, I consider a very dangerous procedure because the sharp edge of the plaster of paris can cause trauma to the peno-scrotal junction and create an urinary fistula. Indeed, I have seen this occurring even in cases where adhesive plaster only had been applied and in some cases where the gauze used for dressing was applied rather tight round the base of the penis. Urinary fistula of the peno-scrotal junction is notoriously difficult to treat. It is a totally avoidable complication. The easiest and perhaps the most comfortable way to keep the skin-graft in place is to use moist roller gauze, about two fingers in breadth as a dressing

round the penis, taking care that the top of the bandage just snugly fits under the corona-glandis. If this is done, the penis will not slip inside the plaster. Otherwise it will and the graft will get displaced. The roller gauze should not be applied tightly either. The method of applying the roller gauze is well illustrated in Sir Frank O'Connor's book on "Surgery in Tropics."

Some surgeons tie a catheter in the urethra for the first few days. This again is totally unnecessary and this also may lead to the complication of peno-scrotal fistula. The easiest way to avoid catheterisation is to allow the patient to sit up in bed and pass urine or even to allow him to stand up if necessary. People are not accustomed to passing urine in the recumbent posture and that is the real difficulty. Allowing them to sit up or even stand is in no way harmful. I have often adopted this measure and I have had no reason to regret it. In an occasional case where the patient cannot micturate by adopting such simple measures, catheterisation once or twice may be required. Such necessity arises only in very few cases. With proper care in the application of the bandage and necessary instructions to the patient, there is usually no danger of the graft getting displaced while sitting up or standing.

There is an acute condition resulting from filarial infection called "endemic funiculitis" occurring in areas where filarial infection is endemic. In this condition, there is an acute streptococcal infection of the spermatic cord. The patient gets severe pain in the inguinal region with rigors and high fever. There is an associated constipation and abdominal distension, possibly due to reflex inhibition of the bowels. Such cases may be mistaken for strangulated hernia especially when no accurate history is forthcoming as sometimes happens. On incision, the spermatic cord is found acutely inflamed and beads of pus exude from multiple points. The mortality of the condition was very high, but now due to the ad-

vent of sulphonamides and penicillin the mortality is practically nil, provided the condition is detected early and treated. Where there is a doubt as to the diagnosis and the possibility of a strangulated hernia is entertained, I would advise opening and seeing rather than sitting over a strangulated hernia. If on incision, the condition is found to be acute funiculitis, the spermatic cord may be excised as high as possible, sulphonamides and penicillin applied locally, and administration of these drugs by the other well known routes is also adopted. If it is thought on exposure, that the condition does not require excision of the cord, the wound may be left open and the results of the use of sulphonamides and

penicillin watched. A decision is taken later. Where the diagnosis of funiculitis is certain, exposure is not required now-a-days, as chemotherapy and antibiotics will immediately ameliorate the condition."

Dr. D. K. Sabhesan (Madras). (1) Patients suffering from elephantiasis of the scrotum as well as lower limbs, after operation of the scrotal condition, often show considerable improvement in the extent of their leg swelling.

(2) Elephantiasis of the vulva, is a not uncommon condition and may result from filarial obliterative lymphangitis, but more often from lymphatic obstruction resulting from lymphogranuloma venereum.

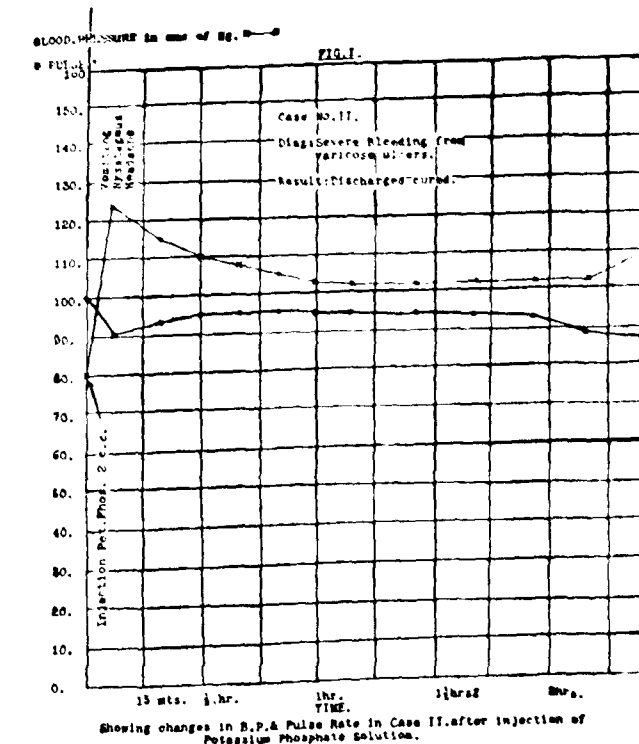
TREATMENT OF SHOCK BY DIRECT STIMULATION OF THE MEDULLARY CENTRES IN THE BRAIN*

by P. K. SEN and K. P. PRABHU, Bombay.

In this short paper, I am presenting to you the results of an investigation into an unorthodox and not too well publicised method of treatment of shock. The work was carried out in the Seth G. S. Medical College and in K. E. M. Hospital, Bombay under an inquiry grant from the I.R.F.A.

These investigations were based on the original work of Dr. Lena Stern—Professor of Physiology, II Moscow Medical Institute, first published during the war years. Her method in brief is to inject a solution of potassium salt directly into the cisterna magna in the shocked patient in order to stimulate the medullary and hypothalamic vaso-motor and sympathetic centres directly to restore circulatory pressure.

The complex clinical syndrome that passes under the sobriquet of 'shock' has been investigated from diverse angles as exemplified by the plethora of literature on the subject. The earlier impressions of the pioneer workers e.g. (Rendle Short, Dale & Laidlaw, Bayliss & Canon, Blalock & Moon) had been mainly concerned with the presence of a lowered circulatory blood volume in shock. This in fact does exist in most types of shock, but in recent years the neurogenic aspect in shock pathology has been receiving considerable attention. Revising the older theories of Crile (anoci-association) and others, Slome & O'Shaughnessy (1939) were the first to point out the presence of excessive parasympathetic and depressed sympathetic activity in certain



*A paper read at the XI Annual Conference of the Association of Surgeons of India at Madras, Dec. 1949.

DOGS—(Contd.)

tail	Duration of subsequent level	Respiration	Heart beat	Remarks
...	...	...	..	Dog died of histamine shock.
...	...	Respn. stopped after 7 min. of 1 st. inj.	"	Dog died of resp. failure.
...	...	Respn. stopped at B. P. 84	"	" " "
...	...	Respn. stopped 5 mts. after inj	"	Artifl. resp. given—died of resp. failure
...	...	Respn. stopped	..	died of resp. failure.
...	...	Slowed & stopped	..	Resp. became deep and fast after Na No ₂ inj. Dog died of resp. failure.
...	...	Resp. shallow to slow	..	Died of resp. failure.
—>	...	Respn. stopped	"	" "
—>	...	Slowed & stopped	..	Resp. stopped after K inj. —> artificial resp—Normal resp—then stopped finally
...	...	...	..	Dog died of resp. failure
—>	...	Respn. stopped	"	Trinitrin produced only transient fall of B. P. hence Na No ₂ used
...	...	Respn. stopped at B. P. 60	"	Peptone inj. do not produce much fall in B. P.—cannula clots.
...	...	Respn. stopped B. P.—180	"	Peptone inj. only increase clotting power B. P. does not fall appreciably
...	...	Respn. stopped B. P. 40	"	Peptone does not cause fall in B. P. and hence histamine used
...	...	K. C. N. fails to produce appreciable fall in B. P. without producing resp. depression. Respn. failed, and artifl. resp. started. Further 0.02 gr KCN		

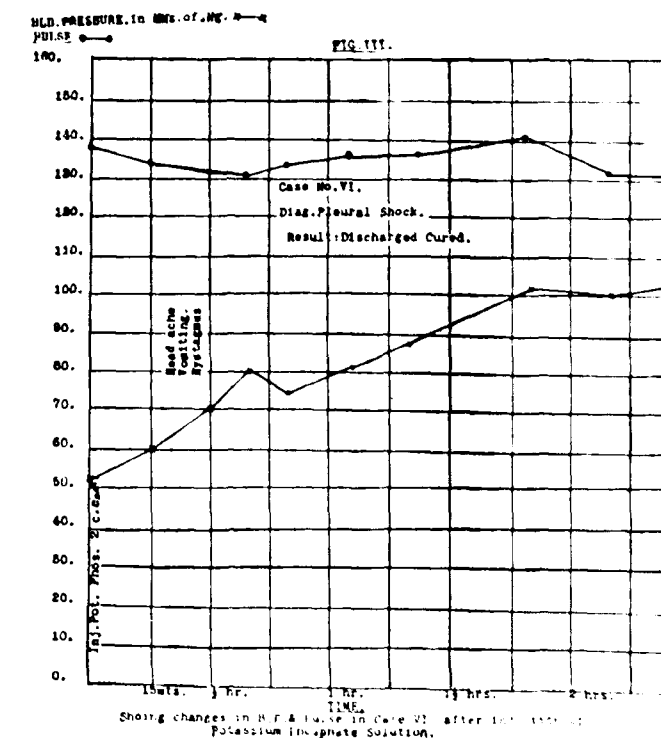
mentally shocked animals (dogs),—shock being produced by different methods and agents. The object was to make a comparative observation of the effect of this injection on different types of shock as well as to study the mechanism of the method further. And secondly, a series of clinical cases of shock (from various causes) were treated by this method and the results recorded.

The animal experiments were all conducted under general anaesthesia, mostly urethane intramuscularly. In a few cases intratracheal ether was used. Urethane was found to be the most satisfactory agent for the purpose. The carotid blood pressure was directly recorded during the experiments through a canula in the neck connected through a mercury manometer

to a recording drum. The cisternal puncture (quite easy to perform in a dog) was done before the shocking was begun. The amount of solution injected varied from 1 to 10 ccs.—either given in a single or multiple injections or as a continuous drip perfusion. The blood pressure was the main guide for observations and the pressure was allowed to drop to at least half the original recorded blood pressure before the solution was injected.

In all 41 animals were thus experimented upon. To this series I might add 10 more experiments from a preliminary investigation published elsewhere. That makes a personal observation of over 50 animal experiments.

The result of the experiments are tabulated in table I.

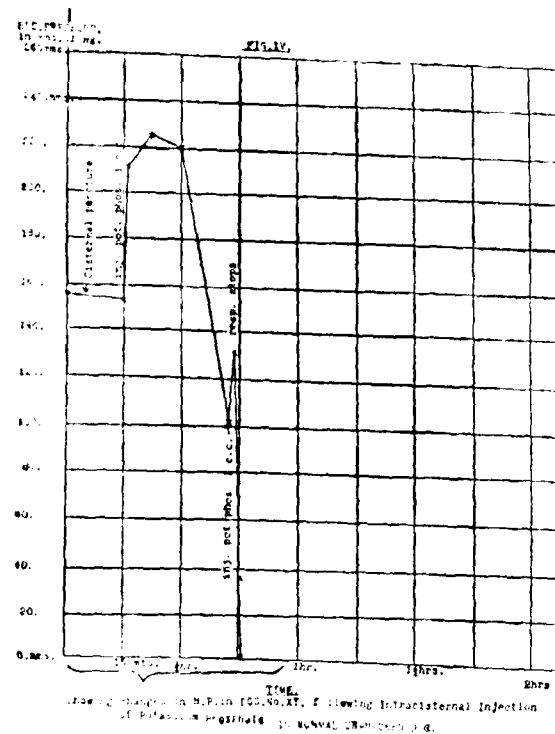


It will be noticed that in most instances there was an immediate rise of blood pressure within a minute or so after the injection. In some types of shock e.g. toxic shock produced by novocaine, percaïne, KCN, the response was not marked. In peptone, histamine and nitrite shock the effect was well seen, as well as in traumatic, haemorrhagic and in the shock of intestinal strangulation.

It is evident from the experiments that the mode of action is stimulation of the hypothalamic and medullary sympathetic centres and depends on an intact hypothalamic and medullary centre plus functioning peripheral arterioles. Toxic shock is the least amenable because the drugs e.g. KCN, percaïne etc., produced shock by acting on and paralysing the same centres as are sought to be stimulated by the intra-cisternal injection of potassium phosphate. It may be asked why nitrite shock is amenable to this method—as the plain muscle of

the arterioles are paralysed by the nitrite. It is probably explained thus; unless a very large dose of nitrite is administered all the arterioles are not completely paralysed, and those functional ones still respond to the stimulation. Besides the effect of sodium nitrite is not prolonged.

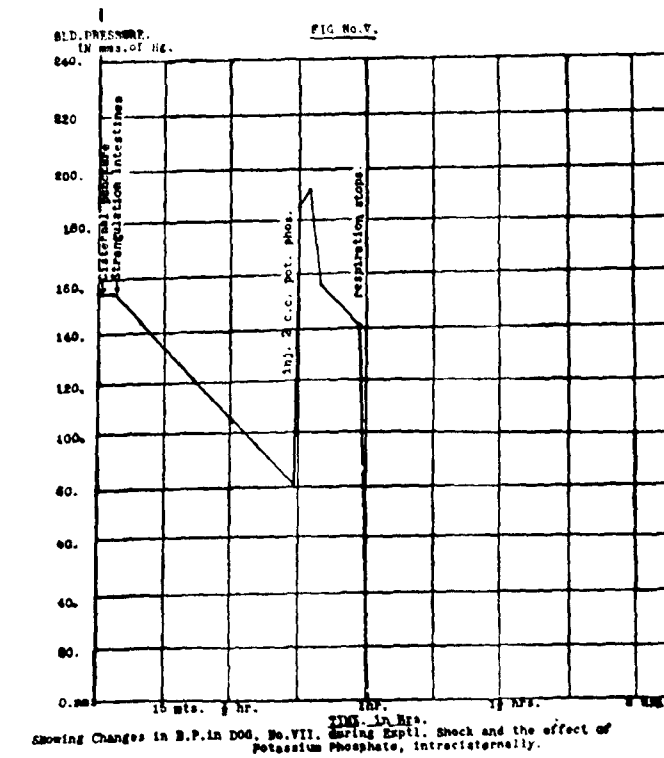
In a fair number of instances the respiration stopped immediately on injection and artificial respiration had to be started. Mostly spontaneous restoration of respiration did not take place in these cases. There are only two possible explanations of this. Either, the respiratory centre was directly affected by the solution injected or, as is more likely the needle may have been touching or even in the substance of the medulla (the dog's cisterna magna is very shallow)—and the effect is due to mechanical insult to the medullary centres. In support of this I may mention that in clinical trials respiratory arrest has never been noted.

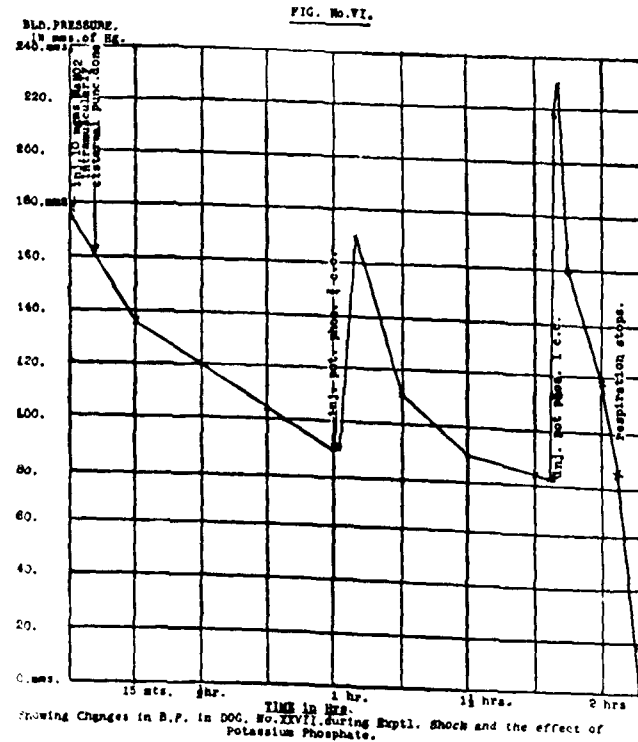


Sundry other difficulties were encountered during the experiments. For instance we failed to produce anaphylactic shock in dogs—till we learnt that the dog is not susceptible to it—but the cat is. In attempting to produce shock with intravenous injection of KCN, we observed that large doses—as much as 1.5 grain—are needed before the blood pressure starts falling; when it does so it happens with sudden completeness resulting in death of the animal. Here again we have an example of refractoriness of a species to a particular drug.

The final conclusion that we arrived at, was that the pressor response of intracisternal injection of potassium phosphate in hypotensive animals was a constant response provided the physiological units concerned in the pressor response were intact. The response however is variable both in degree and duration.

The clinical trials offered greater difficulties. Suitable cases were not easy to come by and the desperate condition of the patient naturally prevented an unorthodox method like this being tried on all available cases. Most cases of severe burns with shock—the limbs had been involved and the estimation of the blood pressure was impossible and therefore unsuitable for trial. Many other cases were moribund on admission with unrecordable blood pressures. Injections were given in some of these with transient pressor effects. However, 23 cases in all could be investigated satisfactorily. The observations are tabulated in table II. No control experiments were done here with the exception of preliminary intracisternal injections in a few cases with normal saline, slowly and with force to eliminate the possibility of the effect being a purely mechanical one. No response was noted with saline.





It will be noticed again as in the animal experiments that though the response is almost constant, the degree and duration were subject to considerable variation. Side effects were noticed; the respiration became slower and deeper, vomiting, nystagmus and restlessness followed the injection for a short period in some cases, but in none were these symptoms alarming. Performance of cisternal puncture usually presented little difficulty after initial sedation with morphia. The usual dose was 2 c.c.s.; in a few cases this was repeated.

The conclusion that we have arrived at after these clinical trials is that the pressor response of the injection in various shocked and hypotensive states, though variable, is definite and may prove of considerable value in these cases of so called "irreversible" shock—where the giving of fluids would be useless or even dangerous. This injection by restoring the normal rhythmicity of a failing sympathetic centre in the

hypothalamus, may render such a case suitable for fluid administration. According to Stern, there are two phases in the genesis of shock an earlier one of sympathetic overaction and a later of sympathetic paralysis. It is in the later phase that this treatment has been advocated. And judging from our experience of even this small series at hand, the method is well worth a routine trial as the practical risks are hardly any.

ACKNOWLEDGEMENTS

In carrying out this inquiry there are many to whom my thanks are due. First, to the Indian Research Fund Association which provided a grant for the purpose. Then to the Dean and my colleagues of the K. E. M. Hospital for permission to use the cases for this trial; to the departments of Physiology, Pharmacology and Pathology, G. S. Medical College for help and assistance afforded and lastly but not the least to my research Assistant Dr. K. P. Prabhu, the co-author of this paper who actually did most of the work, both experimental and clinical.

SURGICAL TREATMENT OF PULMONARY TUBERCULOSIS

by K. N. RAO, Bellary.

INTRODUCTION

The importance of the study of tuberculosis as a National problem of our country can be seen from the available statistics (Figs. 1 and 2). It is stated that half a

personnel cannot be tackled adequately by the few trained workers alone is self evident and it will be the responsibility of the entire medical profession to help in the prevention and cure, if not eradication of this disease.

TUBERCULOSIS MORTALITY, MORBIDITY Etc. (India including Pakistan 1946)

1. Annual deaths	..	500,000
2. Open cases	..	2500,000
3. Total no. of beds available	..	6,000
4. Experienced Tuberculosis doctors	..	70 to 80
5. Short-term trained doctors	..	250 to 300
6. Thoracic surgeons	..	less than 20
7. Tuberculosis health visitors	..	100

Fig. 1.

Shows Tuberculosis Mortality, Morbidity etc. (India, including Pakistan 1946).

million deaths occur annually due to tuberculosis in India and Pakistan and it is estimated that there are five active cases for each death giving the number of active cases in which sputum is positive as 2½ millions to 3 millions.³ Recent mass radiography studies according to Heaf and Rusby in other countries show 2—4 per 1,000 require sanatorium treatment, 8—9 per 1,000 show disease of clinical significance, and 15—22 per 1,000 show changes in the lungs due to tuberculosis.⁶ If such estimates are adopted for purposes of our calculation, about 1,00,000 to 1,50,000 cases require sanatorium treatment in Madras State alone. As you are aware, the essential requirement for controlling the spread of this disease is the provision for isolation of infective cases either at home or in an institution. As against 2.5 million active cases we have only 6,000 beds in our country. There are only 60—70 fully trained and 200—300 short term trained doctors for the treatment of this disease.³ There are only less than 20 thoracic surgeons in the whole of India. That the problem of tuberculosis with the paucity of beds and

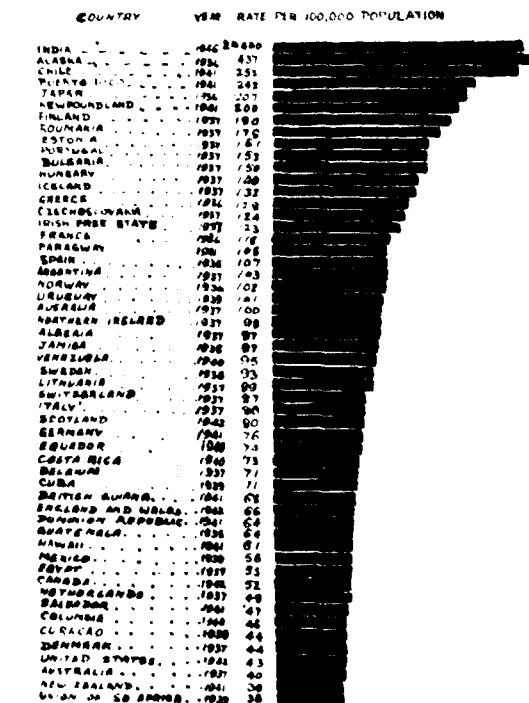


Fig. 2.

Shows the Tuberculosis Death rate in 54 different countries.

Due to the efforts of our Health Minister, Government of India, The Hon'ble Rajkumari Amrit Kaur, great strides are taking place in our country in the tuberculosis control programme such as B.C.G. vaccination and opening of regional centres of the W.H.O. for training personnel. The Bore Committee recommended establish-

ment of (1) Domiciliary service (2) Clinics (3) Hospitals and Sanatoria (4) After Care Colonies (5) Houses for incurables and (6) Certain ancillary Welfare Services for Tuberculosis control in India. Unless the entire medical profession is aware of the serious nature of the problem and has knowledge of the recent progress in the preventive and curative spheres of the disease, the scheme of the Bhole Committee cannot be put into operation in view of the paucity of workers. Further domiciliary treatment will have to be done entirely by the general practitioners under the guidance of the clinic and sanatorium specialists.

PATHOGENESIS AND TYPES OF DISEASE

Pathogenesis :

Every individual is infected with tubercle bacillus after birth at some period before he is an adult. Such infection produces certain changes in the body such as allergy and immunity but not necessarily followed by disease. In the vast majority of cases the body deals with the infection leaving only a minute healed focus in the lung, though more obvious evidence is available in the associated lymph glands. In certain percentage of cases, however, the disease manifests later, due to reinfection either from endogenous or exogenous sources, which is commonly preceded by lowered resistance. The work of Ranke and others has clarified our conceptions of the evolution of the disease process after infection. Thus three phases of the disease are recognized the primary, the secondary and the tertiary phase on the analogy of syphilis. The primary phase or the larval phase of Cummins is the silent phase and is marked by the introduction of tubercle bacillus with the formation of triple phenomena in the primary focus in the lung, lymphatics and regional lymph glands. Complete resolution may occur. Healing and calcification may later occur in the glands. Allergy does not result at once. But in rare cases a type of progressive primary complex

showing clinical manifestations occurs. There are two forms of primary tuberculosis, one that which occurs in children (70—80%) and the other that occurs in adolescents and adults (20—30%).

In the secondary phase allergy is definitely established which is clinically demonstrable by tuberculin tests. (Perquet and Mantoux Tests). This phase has two sub-types early secondary state and late secondary state. In the early secondary state only a few symptoms like malaise, anorexia, fever and focal reactions occur. If the power of the lymphatic system is broken down, the late secondary state is entered and wide spread metastasis occurs in the blood stream and acute disease results. This secondary haematogenous manifestation is commonly associated with childhood and early adolescence, and the most virulent and fatal forms of disease are liable to develop. Exudative process takes place, tracheo-bronchial glands swell, tuberculous pneumonia, broncho-pneumonia, meningitis or miliary tuberculosis etc., occur.

The third phase is reached by those whose resistance protected them without a breakdown from the first two phases. This is marked by a high degree of immunity though allergy persists. If however reinfection occurs in this state and immunity fails, the resulting disease is localized in the lung (bronchogenic tuberculosis) and appears in sub-acute and chronic forms, either as an exudative or productive or mixed type depending upon the degree of allergy, resistance of the individual, virulence and dose of infection.

CLINICAL TYPES, ACUTE AND CHRONIC

Acute Types: There are three types. Tuberculosis in childhood tends to show itself as a more acute process than in adults and the lesion is apt to be generalised.

(a) The acute miliary tuberculosis which occurs in the haematogenous phase manifests itself as a meningeal form, pulmonary form, and typhoid form. In this there is

complete breakdown of defence mechanism and usually ends fatally.

(b) In the sub-acute and chronic miliary tuberculosis, three forms occur. The first which resembles the acute form, death results in six months. In the second, remissions are seen but death takes place in 12 months. In the third, arrest of disease may occur with active lesions in the various parts of the body.

(c) Acute pulmonary tuberculosis: In contradistinction to acute miliary, in acute pulmonary local symptoms are evident from the beginning and that is manifested in two types (1) the pneumonic, (2) the broncho-pneumonic. The former is a massive lobar consolidation and the latter a more diffuse nodular infiltration which tends rapidly to become confluent.

CHRONIC TYPES

There is a great variation in clinical picture. These may be chronic from the beginning or have become chronic after

acute onset. The effects of active tuberculous lesion are local and general. Local symptoms manifest as cough, expectoration, haemoptysis, chest pain due to pleural involvement etc. The general effects are seen as anorexia, wasting, fever, tachycardia etc. For the purpose of clinical description chronic types are usually classified into three groups. (1) Early sub-apical lesion (2) chronic ulcerative (3) fibroid lesion. Inman has divided these chronic types into (a) ambulant-afebrile, (b) resting afebrile (or ambulant febrile) and (c) resting febrile.

Lyle Cummins has incorporated Inman's division of cases and classified cases into group A, the acute cases, group C, the chronic cases and group B, those of acute exacerbation of C. Each group is divided into minimal, moderately advanced and far too advanced as 1, 2, 3, and accordingly as they are ambulatory afebrile, ambulatory febrile and resting febrile as a, b, c. Thus 18 types are clinically recognised.

Acute Types Group A.

A. 1.	A. 2.	A. 3.
(A. 1. a) (A. 1. b) (A. 1. c)	(A. 2. a) (A. 2. b) (A. 2. c)	(A. 3. a) (A. 3. b) (A. 3. c)

Chronic Types Group C.

C. 1.	C. 2.	C. 3.
(C. 1. a) (C. 1. b) (C. 1. c)	(C. 2. a) (C. 2. b) (C. 2. c)	(C. 3. a) (C. 3. b) (C. 3. c)

In the acute varieties the course of illness is rapid and often fatal and the chronic forms go on for years. The adult symptomless pulmonary tuberculosis is a very important clinical variety of this chronic type (A.S.P.T.).

Lesions of the lungs are referred to pathologically and radiologically as exudative in which caseation predominates with breaking down of the lung parenchyma with consequent ulceration and cavitation and productive, in which fibrosis plays a

great part. With greater use of the bronchoscope, tracheo-bronchial tuberculosis is being recognized in greater numbers. Surgical treatment generally comes for consideration in the chronic clinical types of the tertiary phase after the acute process is controlled by rest and antibiotics.

TREATMENT

Once the diagnosis of tuberculosis is made, the attending physician is confronted with the following problems:—

- (1) Does the patient require active treatment?
- (2) If so, where should the treatment be given, at home, clinic, or sanatorium?
- (3) What type of treatment should be given?

The answers to the above depend on (1) the character of the disease (2) the facilities available (3) age, sex and temperament of the patient.

OBJECTIVES OF TREATMENT

The aims of the treatment of pulmonary tuberculosis are (1) to stop the progress of the lesion, (2) to restore the patient's capacity to live and work, and (3) to prevent him from infecting his associates. All this is to be achieved by arresting the infection and increasing the resistance of the individual. Success in the treatment of pulmonary tuberculosis cannot be realised without the whole hearted co-operation and confidence of the patient. No treatment of a tuberculous patient, no matter how extensively surgical or non-surgical, is complete in the absence of a strict sanatorium regimen. Surgical procedures are merely units of our armamentarium for treatment and they are no substitutes for complete, prolonged, adequate bed rest, proper diet, general supervision and the careful use of antibiotics as adjuncts.

REST PRINCIPLE

It is the foundation of all treatment. Rest does not only mean physical and mental rest but also local rest of the diseased lung achieved by collapse therapy either by A.P. or P.I. or P.P. etc. The value of additional local rest may be judged when it is remembered that even with strict rest in bed a man breathes 26,000 times a day. A diseased lung cannot heal in the shortest possible time unless it is rested. A tuberculous joint is immobilized to help healing, without which the disease progresses. It is astonishing that in spite of lack of rest some lung lesions heal. The immense value of

local rest is less well known and the object of this paper is to stress the value of collapse therapy and other surgical measures, especially when used in conjunction with sanatorium regimen in the treatment of pulmonary tuberculosis.

Although the procedures are surgical in nature the major technics must be carried out by trained thoracic surgeons. Practically all patients who die of tuberculosis have been curable at some time or other of their lives. If these patients are given the benefit of surgical treatment by early detection of disease, it is safe to assume that death rate would be lower than it is now.

Time element in the treatment of tuberculosis is vital. Disease processes are not static. They must progress or regress. The symptom complex, physical signs and x-ray findings may appear to remain stationary but yet local or general extension, fibrosis or exudation, tissue destruction may all be taking place. The longer the disease continues the more will be the major surgical methods needed. The result of the loss of time may be disastrous. The treatment of pulmonary tuberculosis has passed from the stage of merely medical treatment by passive methods, in spite of the new antibiotics like streptomycin and P.A.S., to the stage of essentially surgical methods, except in some of the acute types. In the leading tuberculosis hospitals more than 80% of all patients are under some form of collapse therapy. The remaining percentage includes those who are either under observation or non-tuberculous or too ill for surgical procedures or who need no collapse therapy.

When such large percentage of sanatorium patients require collapse therapy a complete knowledge of the indications and contra-indications for collapse therapy is imperative.

The indications and contra-indications for each procedure will be mentioned later but the following groupings may be applied in a general way to all forms of collapse therapy.

Group I. Patients 21 years and under :—

Collapse therapy is indicated for all ac-

tive patients of this group because active pulmonary tuberculosis demands more energetic treatment than those of 21 and over.

Group II. Patients whose sanatorium stay must be limited :—

If the sanatorium treatment has to be limited on account of economic or other reasons collapse measures not only give added protection but also reduce the period of their stay in the sanatorium.

Group III. As a supplement to bed rest :—

(a) In minimal unilateral lesions, distinctly superior results are obtained with additional collapse therapy such as phrenic interruption, pneumoperitoneum or A.P. in suitable cases. This however should be given only after a suitable bed rest, and if the lesion shows a tendency to progress.

(b) For bilateral lesions: bilateral lesions, when active, generally require some form of collapse therapy. Active measures are directed against the more active side. Here also preliminary bed rest and proper assessment of the activity of either side is necessary.

(c) For moderate and advanced lesions: All moderate and far advanced active lesions should be given the benefit of collapse therapy where there are no contra-indications. Here also the trial period is necessary for some time. However, in hopeless cases, where general toxæmia is great and if dyspnoea is present and if the total lung area is too greatly infiltrated and its function is lost or if there are prohibitive extra-pulmonary complications then one can do little but await the inevitable.

But the slogan in the treatment of pulmonary tuberculosis according to Alexander¹ could well be "active disease demands active therapy". Failure to institute surgical procedure in pulmonary tuberculosis is as great a crime as failure to perform a prompt appendicectomy for an acute attack of appendicitis on the ground that many attacks of appendicitis are

known to subside under medical management.

SURGICAL PROCEDURES

There are five main lines of surgical treatment. Each of these methods depends on different therapeutic conceptions :—

1. Collapse Therapy :

- (a) Artificial pneumothorax (A.P.).
- (b) Pneumolysis closed and open.
- (c) Phrenic nerve interruption.
- (d) Pneumoperitoneum.
- (e) Thoracoplasty.

2. Compression Therapy :

Extra pleural pneumolysis with plom-bage or lucite balls.
Extra pleural pneumothorax.

3. Cavity Drainage :

Monaldi's method. Closed suction drainage.
Open cavity drainage with muscle flap closure.

4. Extirpation or Resection Surgery :

- (a) Lobectomy.
- (b) Pneumonectomy.

5. Tuberculous Empyema Treatment :

In this paper it is not proposed to give details of the various techniques but only discuss broadly the general principles.

1. COLLAPSE THERAPY

It may be noted that in collapse therapy, resting the lung is not the main explanation of the function of collapse therapy. In spite of collapse the lung still moves with expiration and inspiration though it may not be to the same degree. The study of bronchial mechanism shows that bronchial occlusion is produced resulting in cavity closure, atelectasis and fibrosis. The one consideration that might alter the above is the chestwall factor due to adhesions between the visceral and parietal pleura. These adhesions may be simple or complex from a mere band to a broad symphysis.

(a) ARTIFICIAL PNEUMOTHORAX

Artificial pneumothorax or the introduction of measured amounts of air into the pleural space on the diseased side is intended to reduce the negative pressure (Fig. 3). This procedure causes relaxation of lung as well as causes bronchial obstruction which produces in consequence cavity closure, atelectasis and fibrosis. The negative pressure can be reduced and even be changed into positive pressure at the discretion of the surgeon but in pneumothorax positive pressure is never attempted.

Indications

(1) *Control of Toxaemia*: Pneumothorax is not an emergency therapy except in rare causes of haemoptysis and so, for the control of toxaemia, suitable trial period of bed rest should precede induction. Additional delay of 2–3 weeks for this will not alter the prognosis of adhesions if any.

(2) *Spread of disease*: If the disease in the lung is spreading inspite of bed rest as evidenced by clinical and radiological data, even though there is no associated toxaemia, A.P., is indicated.

(3) *For the closure of cavity*: In the unilateral exudative lesions with cavitation,

A.P. is especially invaluable. Spontaneous closure of cavities though possible by simple rest alone is very rare and it is neither economical nor sound to leave it to nature. A.P. is the more certain and rapid method of closure of cavities if there are no adhesions which can only be judged after induction. For this type a lateral picture also should be taken for accurate localization of cavity. All cavities do not respond in the same manner. Large cavities are not amenable. Cavities in the middle and base of the lobe may not collapse sufficiently. Cavities near the mediastinum may prove refractory. One has to be careful of the peripleural cavities, which may burst if there are adhesions and produce tension pneumothorax. The thick walled chronic cavity may prove resistant. It is mainly the soft cavity situated in the substance of the lung that is ideally suited for A.P.

(4) *For Sputum conversion*: It may be noted that sputum is positive only when there is ulceration or cavitation. Hence it may be assumed that all sputum positive cases have ulceration or cavitation even though clinically or radiologically they are not seen. Unless sputum conversion is achieved ultimate prognosis is unfavourable.

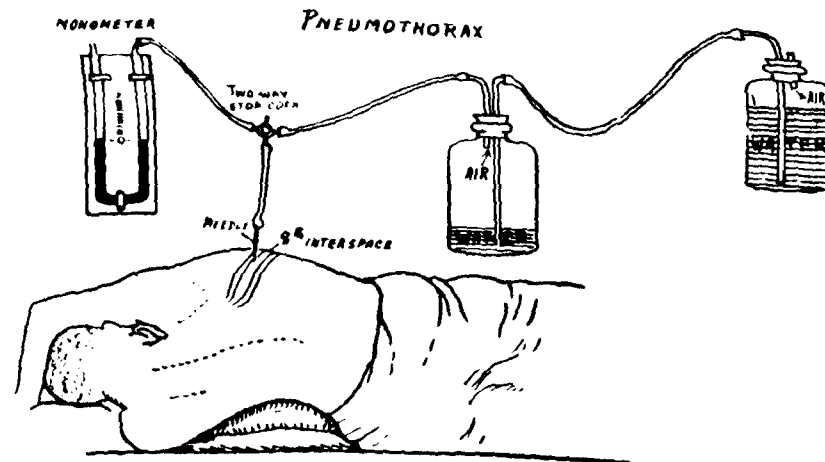


Fig. 3.
Shows method of artificial pneumothorax administration.

(5) *Control of Haemoptysis*: Before using A.P. other methods should have been used and x-ray localization of the side should be clear and certain. If decided to give A.P. the induction should be a large one i.e., 600–800 c.c. of air is introduced. I prefer pneumoperitoneum for these cases as it satisfies the requirements of the situation better and produces satisfactory results.

(6) *For the relief of pleural pain*: To separate the visceral and parietal pleural A.P. is given.

(7) *For the treatment of pleural effusion*: In cases of tuberculous pleurisy with effusion, fluid should be removed and air replacement done to prevent symphysis of the two layers.

(8) *Pregnancy*: In the first few weeks after parturition there is usually a flare up of a tuberculous process which can be controlled only by collapse therapy and the best procedure is A.P. As a preventive measure early use of A.P. is recommended a few weeks before labour.

(9) *In children*: If the nature of lesion demands, age is no criterion. In the adult type of lesion even in children under fourteen which has a very bad prognosis, A.P. is indicated.

The results have been encouraging.

(10) *Diabetes and other complications*: In cases of diabetes and laryngeal and other lesions, more energetic treatment is required. Sputum conversion should be attempted with A.P.

Complications: Though A.P. is a simple technical procedure, judgment and clinical experience is essential. In spite of it complications occur. Effusion, empyema (7%), tension pneumothorax, interstitial emphysema, pneumoperitoneum, air embolism and pleural shock, puncture of the heart or large vessels or puncture of abdominal viscera are some of the noteworthy complications.

Contraindications: It is always a good maxim to know the contra-indications

than indications to avoid complications. They are (1) Previous pleurisy and pleural symphysis, (2) Pleural adhesions, (3) Obliterative pleuritis and pleural effusion, (4) Mobile mediastinum, (5) Mediastinal hernia.

Surgical technique and management (Fig 3): Sterile precautions should be taken. All the disrepute to the pneumothorax therapy has come because of lack of observance of this principle which results in effusion or empyema.

Initial pneumothorax should be done with care and caution as the success of the therapy depends on this and not more than 200 c.c. should be given. Recent x-ray is essential. It is better to perform A.P. in patient's bed. Fine trocar is passed through an intercostal space under local anaesthesia. The trocar is connected to the manometer and the apparatus. Refills of 400 c.c. of air are given at periodic intervals on the third day, sixth day, tenth day and later once a week. As the induction is successful the refills are spaced at longer intervals to maintain the collapse.

Duration of the collapse: It is not sufficiently realized that pneumothorax therapy should be given for 2–4 years depending on the lesion and the degree of response. The popular feeling that with a few A.P.s the disease would be controlled is calamitous and that is the easiest way to hasten death. Pneumothorax that has been effective if the sputum has been negative for 3–4 years, may be abandoned gradually. Lung expansion should be followed up radiologically. If cavity reopens it should be detected and controlled by A.P. Incidence of complications is high if the treatment is prolonged more than 3–4 years. Prevention of mixed empyema and broncho-pleural fistula is imperative.

Selective: Contralateral: Bilateral: Contra Selective-pneumothorax:

Selective pneumothorax is one in which the diseased part of the lung only collapses leaving healthy lung uncollapsed. Generally diseased part of the lung collapses more

rapidly. By adjusting pressures one would be able to attain this.

Contralateral is one in which the diseased lung cannot be collapsed due to adhesions and A.P. is induced on the healthy side with the object of giving rest to the bad lung. This procedure is not recommended.

Bilateral pneumothorax. After inducing on the worse side and gaining control of it, A.P. could be induced on the other side also, for the control of bilateral disease. Complete collapse of the lungs cannot be maintained simultaneously but lungs have a large reserve (Fig. 6 a, b & c).

Contraselective pneumothorax. When the diseased part is adherent, the healthy lung only collapses producing contraselective pneumothorax. If this cannot be converted into effective collapse by pneumolysis it should be abandoned.

Thoracoscopy and pneumolysis should form an integral part of the induction management. Thoracoscopy should be done invariably in all ineffective collapses and an attempt at adhesions cutting should be made.

Results: In about 25% of cases A.P. fails completely due to pleural adhesions. Insufficient or unsatisfactory collapse is obtained in about 40%. Complete collapse is obtained only in 20—25% of cases. With thoracoscopy and adhesions cutting, we can raise this figure to about 35% to 40%. 70% show improvement in complete collapses, 50—55% in partial collapses. Sputum conversion occurs in 90% of successful A.P.s with or without thoracoscopy and cutting of adhesions. Persistently positive sputums may be due to disease of the other lung or development of tracheo-bronchial disease.

Cavity closure is satisfactory in 39% with A.P. alone but with cutting of adhesions the figures improve to 80%.

(b) INTRA PLEURAL PNEUMOLYSIS—
THORACOSCOPY (Fig. 4)

Thoracoscopy forms an integral part of A.P. management. This procedure of adhesions cutting is done either by the closed or

open method. The closed pneumolysis is the method of choice and it was first described by Hans C. Jacobeauss⁷ in 1913. This requires skill and practice and is certainly a major surgical procedure to be performed by thoracic surgeons. There are instruments with a single canula as well as with two canulae. Corylla's thoracoscope used with two canulae technique is widely practised and has yielded very good results. Exploratory thoracoscopy is recommended in all doubtful cases as many adhesions may not be evident radiographically. Commonest site of adhesions is on the superio-lateral surface of the lung and the line of lobar septum.

Six types of adhesions are described by Dick.⁵

(1) Fibrous strings, (2) Cords, (3) Bands, straps and fans, (4) Funnels and cones, (5) Spools and capstans, (6) Curtains.

It is difficult to state with accuracy before the operation whether a particular adhesion could be cut or not. Hence thoracoscopy should invariably be done, if there are no contra-indications, such as, reduced vital capacity, tuberculous pleura in the presence of fluid either clear or empyematous mixed tuberculous empyema and an inadequate cardiovascular reserve.

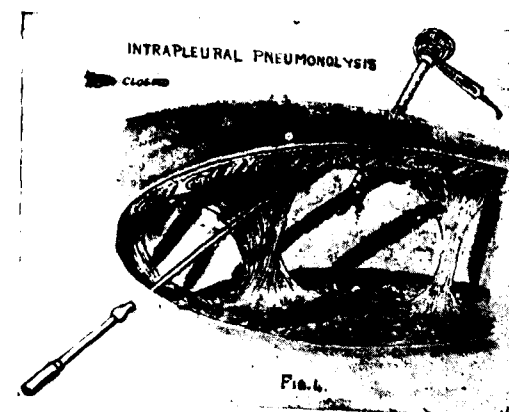


Fig. 4.

Shows intrapleural pneumolysis with the thoracoscope and cautery in position.

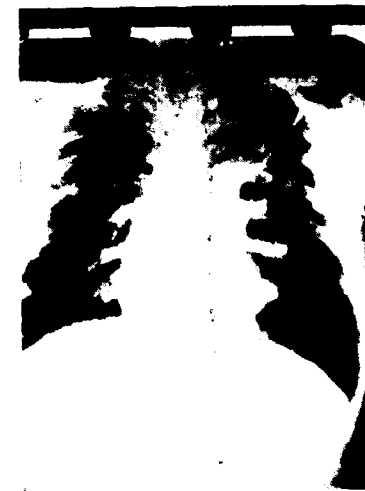


Fig. 5-a.

Diagram shows bilateral pulmonary tuberculosis with cavities (Stage II) A.P. was given on the left and the band of adhesion is seen.



Fig. 6-a.

Shows bilateral pulmonary tuberculosis (Stage III) with multiple cavities.



Fig. 5-b.

Shows complete collapse of the lung after pneumolysis. Sputum became negative after procedure.



Fig. 6-b.

Shows A.P. done on the rt. side and a band of adhesion is seen.



Fig. 6-c.
Pulmonary tuberculosis (Stage II) with cavities.
Pneumothorax left side.



Fig. 7-a.
Pulmonary tuberculosis (Stage II) with cavities.

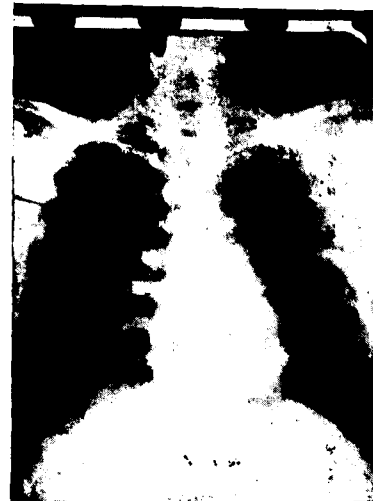


Fig. 7-b.
Shows A.P. rt. side with adhesion.



Fig. 7-c.
Shows collapse of the lung after pneumolysis.
Sputum became negative.



Fig. 8-a.
Shows bilateral pulmonary tuberculosis (Stage II) A.P. done on the rt. side. Adhesion seen preventing collapse.



Fig. 8-b.
Shows collapse of lung after pneumolysis.

Technique : (Fig. 4 ; 5a, b ; 6a, b, c ; 7, a, b, c ; 8a, b.). A stab incision is made at a convenient site usually third intercostal space in the axillary line, fourth space in the posterior axillary line and seventh space in the scapular line. The adhesions are viewed through the thoracoscope and it is determined whether they can be lysed. If so, a second stab incision is made at a convenient place and the canula introduced. The band is anaesthetized close to chest wall by a long needle introduced through the thoracoscope carrier. Electro-cautery is used through the second opening and the adhesions are cut near the chest wall under visual control through the thoracoscope.

Some complications :

- (1) Pleural effusion occurs in 25% of operations,
- (2) Bleeding is profuse only in 1%,
- (3) Surgical emphysema is not uncommon but it is of no importance,
- (4) Spontaneous pneumothorax occurs in 2%. It is due to injury to the lung.

It should be suspected when caseous material oozes from the point of section,

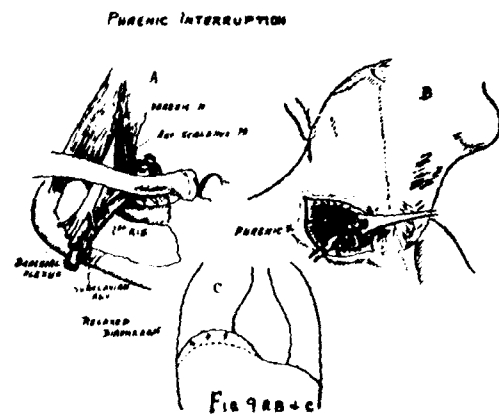
- (5) Broncho-pleural fistula
- (6) Empyema.
- (7) Pleurocutaneous fistula.

We invariably use intra pleurally 3,00,000 units of penicillin and 1 gram of streptomycin after the operation. Just before the operation A.P. has to be done and after the operation the pleural pressure should be reduced to negative side.

Open pneumolysis is performed where closed method has failed. This is a more severe operation in that it is an open thoracotomy. It is only indicated when thoracoplasty is contra-indicated and closed pneumolysis has failed. This method is not generally practiced.

(c) PHRENIC INTERRUPTION
(Fig. 9 a, b, c.)

Phrenic crush or interruption will cause hemidiaphragmatic paralysis and causes relaxation of the homolateral lung by ele-



(A) Shows the anatomy of the phrenic nerve. (B) Shows the nerve being crushed after exposure. (C) Shows the effect on the diaphragm which is relaxed and raised.

vation and reduces tension by the cessation of movements of that half of diaphragm. The crush effect would last for 5—6 months and it is the practice now not to carry out the irrevocable procedure of avulsion. If the crush does any good it may be crushed again if necessary, and this procedure is revocable since the diaphragm regains its function at the end of six months.

Indications :

1. To relieve symptoms of diaphragmatic irritation.
2. As an adjunct to bed rest in early cases, pneumothorax to be followed up later.
3. To control haemoptysis.
4. An alternative to failed pneumothorax.
5. As an adjunct to pneumothorax if there are basal adhesions.
6. In cases selected for thoracoplasty but who are not fit for operation for a period of 4—5 months.
7. As a final step at the gradual abandonment of pneumothorax if there is any evidence of mediastinal shift or pulmonary fibrosis.

8. In cases of adult symptomless pulmonary tuberculosis discovered in mass radiography.

Complications are only due to bad surgery, and knowledge of anatomy of that portion of the neck would avoid most of them.

Technique : The nerve is exposed under local anaesthesia by an incision transversely made one inch above the clavicle from the outer edge of the sternomastoid. The skin, superficial fascia, platysma, the superficial fascia of the deep cervical fascia are incised. The cervical fat in the (triangle formed by sternomastoid medially, omohyoid laterally and clavicle below) is incised and the scalenus anticus exposed. The phrenic nerve is the only nerve running downwards and inwards on the scalenus anticus muscle. The nerve may be behind fascia covering the muscle and it requires freeing. The nerve is crushed for $\frac{1}{2}$ " after preliminary novocain infiltration.

Post-operative fluoroscopic study of the diaphragmatic motion should be done to note the effect.

Though this operation had become obsolete, interest in it has been revived by the recent introduction of therapeutic pneumoperitoneum (Fig. 10 ; 11 a, b ; and 12 a, b).

(d) PNEUMOPERITONEUM

We owe a deep debt of gratitude to Prof. A. L. Banyai² for the extended use of pneumoperitoneum therapy in pulmonary tuberculosis. Pneumoperitoneum relies for success upon the upward elevation of diaphragm which follows an increase in the intra-abdominal pressure. It may be used either before or after phrenic crush or in combination. Both in phrenic interruption and pneumoperitoneum, the effect is vertical, both in relaxation and diminution of lung volume, in contradistinction to the transverse effect in pneumothorax (Figs. 10 ; 11 a, b ; and 12 a, b).

Indications : are the same as for phrenic interruption except that it is not used for relieving cough and at the conclusion of



Fig. 10.

Shows the skiagram of case of bilateral pulmonary tuberculosis (Stage II) where A.P. has failed both sides and pneumoperitoneum and phrenic interruption done on the right side. Sputum became negative.



Fig. 11-b.

Shows A.P. left side, pneumoperitoneum and phrenic interruption on the right side. Sputum became negative.

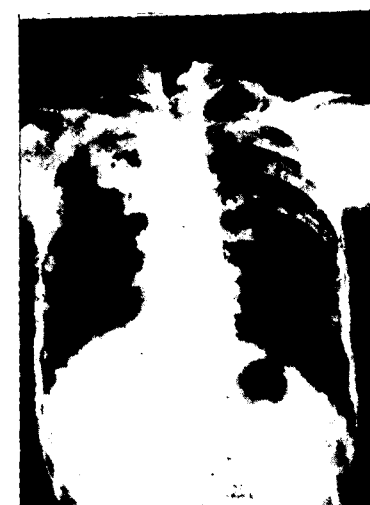


Fig. 11-a.

Shows bilateral pulmonary tuberculosis (Stage III) with cavities.

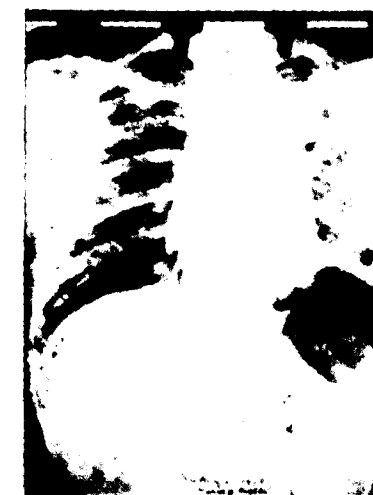


Fig. 12-a.

Shows bilateral pulmonary tuberculosis (Stage II) where A.P. failed both sides and pneumoperitoneum given.



Fig. 12-b.

Shows phrenic interruption done on the left side in addition to pneumoperitoneum. Sputum became negative.

pneumothorax therapy. In addition pneumoperitoneum therapy is used in:

- (1) In extensive bilateral disease.
- (2) After child birth—(the effect is doubtful with a weak abdominal wall).
- (3) Control of thin walled cavities which do not respond to pneumothorax and as an alternative to lobectomy or open drainage.
- (4) In elderly patients if the cardiovascular system is sound.

Complications: Complications may be due to error in technique and selection of unsuitable cases. Subcutaneous emphysema, peritoneal effusion, shock, haemorrhage, air embolism, perforation of bowel or viscera, accidental induction of pneumothorax, rupture of the diaphragm and death.

Important contraindications are hernia and myocardial disease.

Technique: The A.P. apparatus is used. The needle is introduced in one of three places.

- (1) 1"—2" below left subcostal region lateral to the rectus. (Exclude splenic enlargement.)
- (2) Below the umbilicus or lateral to the rectus at the same level. (See the bladder is not distended.)
- (3) Transpleurally through one of the intercostal spaces in the midaxillary line: not recommended.

In the initial induction 400 to 600 c.c. are introduced and the intra-abdominal pressure is raised to plus 3 or 4. Refills are given on third day, fifth day and later on once a week. Upto 1,000 c.c. could be given and the pressure kept up to plus 9 to 10. Radiological studies are essential. Pneumoperitoneum with phrenic crush on the diseased side may reduce the lung volume to 1/3rd, basal and mid-lung cavities collapse and even apical cavities shrink.

(e) THORACOPLASTY (Figs. 13 a, b, c; 14 a, b, c, d.)

As already stated pneumothorax, pneumoperitoneum and thoracoplasty are the main stays of tuberculosis therapy. The aim of thoracoplasty is to effect closure of cavities and cause complete collapse of the lung by the removal of segments from the posterior ends of the ribs so that the unsupported anterior ends fall downwards and inwards and obliterate the thoracic cavity on that side. The modern thoracoplasty operation consists in the removal of posterolateral as well as anterior rib lengths in several stages. This is a permanent or irrevocable procedure. When some ribs only are removed it is called partial thoracoplasty. Morriston Davis, Sauerbruch, Alexander, Holst, Semb and Price Thomas have contributed largely for the evolution of the modern thoracoplasty operation.

Indications: Morriston Davis⁹ gave the following indications for thoracoplasty:—

- (1) Cases of chronic unilateral tuberculosis upto 45 years of age which cannot be arrested by simpler means.

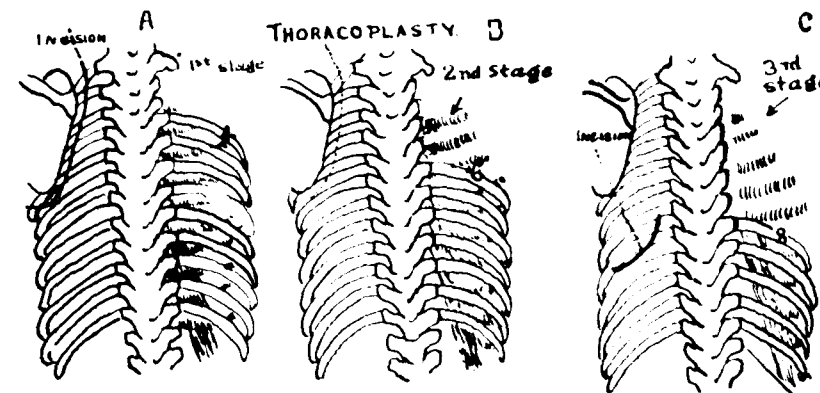
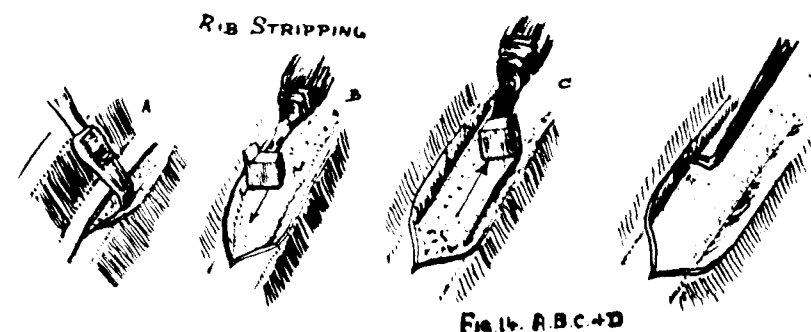


Fig. 13 a, b & c.

(A) Shows the removal of the first three ribs (I Stage). (B) Shows the removal of further two ribs (II Stage). (C) Shows the removal of further two ribs (III Stage).



Figs. 14 a, b, c, d.

Show the method of rib stripping.

- (2) Every unilateral disease with multiple cavities.
- (3) Cases of uncontrolled haemoptysis.
- (4) In exceptional cases of exudative lesions.

But in any decision about thoracoplasty operations in a particular case, the type of lesion, the previous therapeutic procedures and the physiological condition of the patient should be taken into consideration. Acute exudative lesion generally contraindicates thoracoplasty. The ideal lesion for thoracoplasty is one of productive nature with cavities. In minimal lesions thoracoplasty is rarely indicated but Prof.

Corylloss⁴ advocates apical thoracoplasty in selected cases in preference to pneumothorax. Moderate and far advanced cases, if otherwise suitable, are clear indications. Even in bilateral lesions the operation is advocated with caution in conjunction with other surgical procedures.

Price Thomas and Cleland¹² adopt the following classifications for chronic disease:—

- (1) The stationary chronic.
- (2) The relapsing chronic.
- (3) The slipping chronic.
- (4) The hopeless chronic.

The ideal group is the stationary chronic for thoracoplasty and the prospect of cure is great.

The pre- and post-operative management should be perfect. Streptomycin and P.A.S. should be used as adjuncts.

Technique: Thoracoplasty is performed in two or three stages and the mortality is reduced to 1 to 2%, in the properly selected cases. The operation is begun at the apex and in the first stage 1, 2 and 3 ribs are removed. In the second stage four, five and six are removed. In the third and fourth stages the rest of the required ribs are removed. Every case is to be judged individually. There are cases which need only one stage and others two depending on the type of lesion and the location of the cavity. The interval between the stages is about two or three weeks.

Either local anaesthesia alone or local supplemented with gas and oxygen is used. The first and second ribs are removed entirely and the third rib is removed as far as it can be reached from the posterior approach.

The incision extends from the level of the upper border of the scapula to the sixth or seventh rib and is carried along that to the axilla. The superficial and deep layers of the back muscles in the line of incision are cut and the ribs resected from the costovertebral joints as far as the posterior axillary line. In some chest clinics transverse processes are also excised but scoliosis results. Semb's modification of apicolysis is not universally accepted.

Complications: Shock and loss of blood, paradoxical movement and respiratory distress, atelectasis, spread of disease, pneumonitis, infection of wounds, anaemia and cardiac failure.

Other types of thoracoplasty: Antero-lateral, supplementary and revision thoracoplasty operations may be necessary in some cases. But many surgeons are considering lung excision as the only alternative to thoracoplasty failure cases if they are otherwise suitable.

Results: (Figs. 15, a, b; 16a, b, c, d, e, f; 17a, b, c, d, e.).

In a selected group of Arthur Aufses, about 71% are arrested 18% not arrested, 7% post-operative deaths and 4% later deaths occurred. In my series of 30 thoracoplasty stages there has been no operative mortality. As 4 to 5% of sanatorium cases require thoracoplasty and with an incidence of 1,50,000 active cases in Madras state requiring sanatorium treatment there would be about 7,500 prospective cases for thoracoplasty in our state. Hardly 500 are done at present.

But it is well to remember that the right type of procedure should be done at the right time. Procedure delayed is procedure denied.

2. COMPRESSION THERAPY

In cases where pneumothorax has failed and if the cases are unsuitable for thoracoplasty, less severe operations are sometimes indicated. Extra-pleural pneumolysis involves separation of lung with its adherent parietal pleura, in part or whole from the chest wall (Fig. 18, a, b, c.).

Technique: An incision is made on the back along the lateral border of erector spinae with its centre over the third rib. 8 cm. of the rib is removed and its bed incised. The proper plane is found between the endothoracic fascia and pleura and the apex is separated as far as it is wanted. The depression of the apex is maintained by plompage with fat, paraffin or muscle, or gauze pack. These are rendered unnecessary if extra-pleural pneumothorax is employed as an alternative to extra-pleural pneumolysis. Recently good reports are coming in with the use of leucite balls. In view of the complications such as tuberculous infection, pyogenic infection, tearing of the pleura, haemorrhage, emphysema and mediastinal displacement, this operation is not in much use.

3. CAVITY DRAINAGE

Residual cavities are treated with cavity drainage closed or open though no method



Fig. 15-a.

Show skiagram of a patient of pulmonary tuberculosis (Stage III) with cavities on the rt. side after 1st stage of thoracoplasty.



Fig. 16-a.

Shows patient after thoracoplasty operation.



Fig. 15-b.

Shows after 2nd stage of the thoracoplasty. Sputum has become negative and patient afebrile.



Fig. 16-b.

Shows the back of the patient and incision marks on the right side.



Fig. 16-c.
Shows functional result.



Fig. 16-e.
Shows skiagrams after the 1st stage thoracoplasty exudate in the Sembs space seen.

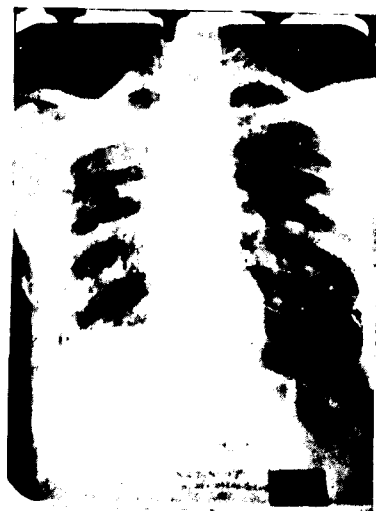


Fig. 16-d.
Shows skiagram of the same patient with the unilateral advanced lesion with cavities on right side. A.P. has failed.



Fig. 16-f.
Shows skiagrams of the same patient after 2nd stage of thoracoplasty. Sputum has become negative, patient apyrexial and much improved.



Fig. 17-a.
Shows the result after two stages thoracoplasty operation.

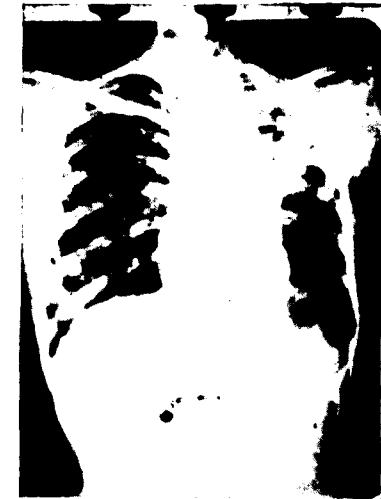


Fig. 17-c.
Shows a skiagram of advanced tuberculosis left side where A.P. has failed.



Fig. 17-b.
Shows the same patient from behind.



Fig. 17-d.
Shows skiagram after 1st stage thoracoplasty.



Fig. 17-e.

Shows skiagram after 2nd stage thoracoplasty. Patient became afebrile and improving. Sputum negative.

used so far for the treatment of tension and other persistent cavities has proved both efficacious and safe.

Monaldi introduced catheter suction as a closed method. Lilienthal⁸ used open drainage and Nissen¹⁰ used drainage by a long muscle flap which filled the cavity space.

EXTRAPLEURAL PNEUMOLYSIS

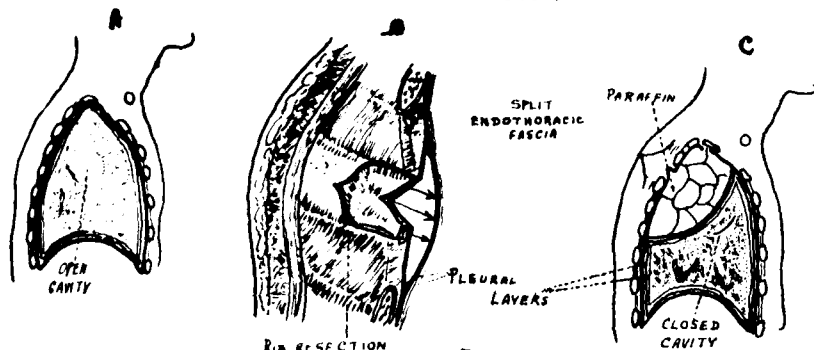


Fig. 18 a, b & c.

(A) Shows open cavity of the lung. (B) Shows the method of ribresection. (C) Shows extra-pleural pneumolysis with paraffin plombage resulting closure of the cavity.

4. RESECTION OR EXTIRPATION SURGERY

Lobectomy and pneumonectomy have now been used by several surgeons in selected unilateral cases with the following indications:—

- (1) In cases where thoracoplasty failed.
- (2) Associated suppurative disease.
- (3) Upper lobe disease.
- (4) Basal disease.
- (5) Tuberculoma.

Much credit goes to Overholt¹¹ and his colleagues for improving the technique with the face down position (Fig. 19 a, b) and by the use of local and paravertebral anaesthesia. Endotracheal tube is used for suction or drainage. The secret of success of intra-thoracic surgery is the attainment of perfection in anaesthesia and administration of blood transfusion. In the words of Overholt¹¹ "Resection Surgery has a definite place in tuberculosis in selected cases. Resection is not a competitive form of treatment but only a supplementary one. It is the obligation of the physician to recognize certain types of tuberculosis that respond best to certain types of therapy and fail to respond to others. It is the obligation of the thoracic surgeon to provide operative technique, which minimises complications and the hazard of the operation. Progress has been made but it is rea-



Fig. 19-a.

Shows the position of the patient in Overholt's technique of pulmonary resection.



Fig. 19-b.

Shows exposure of the chest for resection.

sonable to expect further improvement. It is necessary to follow longer series of patients treated under modern and standardized technique for a longer period. A final appraisal of the value of resection in the treatment of tuberculosis cannot be made at this time.

It can be said with certain amount of confidence that resection will never be applicable to more than a small minority of those patients for whom collapse therapy is selected.

5. TREATMENT OF TUBERCULOUS EMPYEMA

Prevention is the main emphasis. In the pneumothorax therapy empyema is a grave

complication. Closed drainage, use of streptomycin locally as well as parenterally and also plasty operations are indicated. The outlook is bad in empyema but in the absence of contra-indications thoracoplasty should be performed in most cases. Before and after operation the space should be kept empty.

SUMMARY

1. Incidence of the disease in India and the necessity for the entire medical profession taking interest in the disease are stressed.

2. Pathogenesis and the phenomena of the primary phase, the secondary and the tertiary phase are outlined.

3. The clinical types—the acute and the chronic and Lyle Cummins classification mentioned. The clinical importance of asymptomatic pulmonary tuberculosis is mentioned.

4. In the treatment section—the selection of line of treatment, objective of treatment, importance of rest principle and indication of treatment in the various groups is discussed.

5. Indications, technique, complications of the five main lines of surgical procedures viz.,

- (i) Collapse Therapy (A.P. pneumolysis, phrenic interruption, pneumoperitoneum, thoracoplasty).
- (ii) Compression Therapy (extra-pleural pneumolysis with plombage, lucite balls, extra-pleural pneumothorax).
- (iii) Cavity Drainage—Monaldi's method, open drainage.
- (iv) Resection Surgery—lobectomy and pneumonectomy, and
- (v) Treatment of tuberculous empyema, are discussed.

6. Artificial pneumothorax, pneumoperitoneum and thoracoplasty are the main stays of the surgical therapy of pulmonary tuberculosis.

CONCLUSION

Surgery of pulmonary tuberculosis is a specialised field. In conjunction with sana-

torium regimen surgery offers great progress in therapy to attain the objectives, viz., to arrest the disease, to rehabilitate and to make the sputum negative for safeguarding the society. There are not many thoracic surgeons in our country at present and at the moment there is need for incorporating the two roles of chest physician and surgeon in one in the tuberculosis speciality. Every thoracic surgeon should be an operating physician and bronchoscopist. Unquestionably, the ideal is the physician surgeon combination in the curative branch of anti-tuberculosis programme.

Dr. J. B. McDougall, M.D., Chief of Tuberculosis Section, World Health Organisation, while congratulating Madras for the excellent progress made in the anti-tuberculosis work stated that the tuberculosis problem in India cannot be solved by a handful of specialists and that it is a problem which will have to be taken on hand by all members of the medical profession and also by members of the lay public who have in their power to do something for the amelioration of tuberculosis patients. His view is that it is an army of workers that is needed and not a platoon. One cannot but agree with him.

I have to express my gratitude to Dr. K. Vasudeva Rao, M.D., M.R.C.P., T.D.D., Deputy Surgeon-General with the Govt. of Madras, Madras, and Dr. R. Betts, M.D., F.A.C.S., Thoracic Surgeon, Christian Medical College, Vellore, for much that I have learnt in Thoracic Surgery and to Dr. J. C. David, the Surgeon-General with the Govt. of Madras, Madras, for his encouragement and permission to publish this paper. Thanks are also due to Dr. N. P. Devadas, Assistant Superintendent, Dr. Ramachandran, Radiologist, Dr. Kidyoor, Dr. Sanjeeva Rao and the Nursing Staff of the Government Wellesley Tuberculosis Sanatorium for their whole-hearted co-operation in the surgery of pulmonary tuberculosis that was carried out.

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MECHANISM OF SHOULDER MOVEMENTS AND A PLEA FOR THE RECOGNITION OF "ZERO POSITION" OF GLENOHUMERAL JOINT

by A. K. SAHA, Gwalior.

The mechanism of shoulder movements had never been on a scientific footing till the investigations of Inman, Dec. M. Saunders and Abbot. In this article it is intended to put forward a few more facts about movements of the shoulder joint complex and to advocate the use of a new position which has been termed 'zero-position' for reduction of unimpacted fractures of the humeral neck.

Elevation of the upper extremity overhead has long been known to be a composite process whether it is carried out in abduction or in flexion. The precise relationship of the individual components were neither determined nor were their roles emphasised. According to some, full external rotation at the gleno-humeral joint is necessary to free the locked greater tuberosity of the humerus from the acromion process when elevation in abduction above 90 degrees is attempted. A similar barrier by the coraco-acromial arch while elevating in flexion brings about the desired internal rotation. Others, however, hold that the humerus is neither rotated inwards nor outwards when it is raised to vertical, the final common position for either flexion or abduction overhead. The arm in this position is in the plane of the scapula. Active movement in the opposite direction is necessary to counteract the rotation which is imposed passively in the gleno-humeral joint due to passage backwards or forwards towards the plane of the scapula.

Indeed the contradictory views just mentioned bear conclusive evidence of the hitherto nebulous nature of our knowledge of the mechanism. Inman, Dec. M. Saunders and Abbot approached the problem from a practical standpoint and clarified many events in the movements of the shoulder joint complex. The chain of events

according to these observers during elevation in abduction or flexion are to all intents and purposes similar and can roughly be divided into 3 phases.

PHASE I

Elevation to 60 degrees in Flexion or 30 degrees in Abduction

Besides the principal movement at the gleno-humeral joint the following accessory movements take place:—

- (a) Elevation of the outer end of the clavicle by about 12—15 degrees.
- (b) Scapular rotation through an antero-posterior axis takes place one way or the other in the majority of individuals; it is too irregular to be of any significance. Hence it has been termed the "setting phase of the scapula".
- (c) The angle between the scapular spine and clavicle is increased by about 10 degrees and is produced by the counterclockwise rotation of the scapula round a vertical axis through the acromio-clavicular joint.
- (d) Rotation of the clavicle round its long axis does not take place in this phase.

PHASE II

Elevation from the end of Phase I to 90 degrees of Flexion or Abduction

The following movements take place in addition to the movement at the gleno-humeral joint:—

- (a) Further elevation of the outer end of the clavicle (with scapula attached) to its final position, i.e. 30—36 degrees over its usual bearing with the midsagittal plane.

- (b) No change in the spino-clavicular angle.
- (c) Scapular rotation in the antero-posterior axis takes place in 2 : 1 ratio; for each 10 degrees of gleno-humeral movement 5 degrees of rotation take place.
- (d) Rotation of the clavicle in its long axis has not yet commenced.

PHASE III

Elevation vertically overhead from end of Phase II position

- (a) Gleno-humeral movement and scapular rotation take place in the same 2 : 1 ratio.
- (b) No further elevation of the clavicle takes place.
- (c) Second quota of rotation of the scapula round vertical axis by about 10 degrees (total increase in spino-clavicular angle is thus 20 degrees).
- (d) Clavicular rotation in crankshaft fashion with conoid tubercle pointing downwards through about 30—40 degrees has now taken place.
- (e) External rotation of the humeral head is necessary if elevation is undertaken in coronal plane.

Much has been gained from the electromyographic studies in the living during various phases of elevation. Recognised roles of muscles have changed, hitherto unsuspected muscles have been shown to take active part in elevation.

Supraspinatus and deltoid have identical action currents at any particular phase of elevation. Thus supraspinatus has been deprived of its traditional role of fixing the head on the glenoid so that deltoid may act to advantage. In flexion, however, supraspinatus shows earlier rise and deltoid a slightly later rise of tension.

The depression of the humeral head with the help of the infraspinatus, teres minor and subscapularis is significant in fixing the

head on the glenoid in any position of elevation and these muscles show a corresponding rise in tension which is maximum at about 120 degrees of elevation. Sudden increase in muscle tension after about 90 degrees is significant as external rotation at the gleno-humeral joint takes place from this stage.

From what has already been said, it is plain that the following movements are essential for elevation overhead in abduction or in flexion.

Joint involved	Type of movement	Muscle power derived from
1. Sterno-clavicular	Elevation 30-36 degrees	1. Levator scapulae. 2. Trapezius (upper). 3. Upper fibres of serratus anterior.
	Rotation 30-40 degrees	1. Force-couple acting on scapula in terminal phase III is transmitted through taut conoid and trapezoid ligaments. 2. ? Subclavius.
2. Acromio-clavicular joint	Rotation of scapula round vertical axis through the joint by 20 degrees	1. Upper digitation of serratus anterior. 2. Pectoralis minor.
3. Scapulo-thoracic joint	Rotation through antero-posterior axis	1. Upper component of the force-couple derived from levator scapulae, trapezius (upper) and upper serratus anterior. 2. Lower component of the force-couple derived from (a) Trapezius (middle and lower). (b) Serratus anterior 5-8 digitations. Their action is complementary to produce the desired rotation.
4. Gleno-humeral joint	Abduction, flexion and rotation	Cone muscles described below.

Henry Milch has classified the muscles about the shoulder into three cone groups and has shown that in the final common position of the arm in elevation, the muscles constituting the cones arrange themselves coaxially and thus they lose their rotatory properties (Figs. 1 & 2).

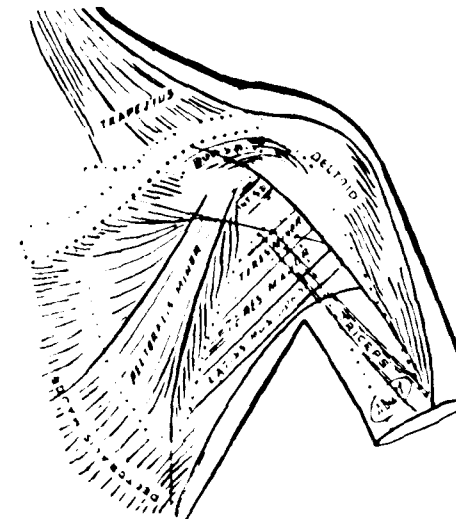


Fig. 1.

With arm by the side it is evident that most of the axio-humeral and scapulohumeral muscles have rotatory power in one or other direction.

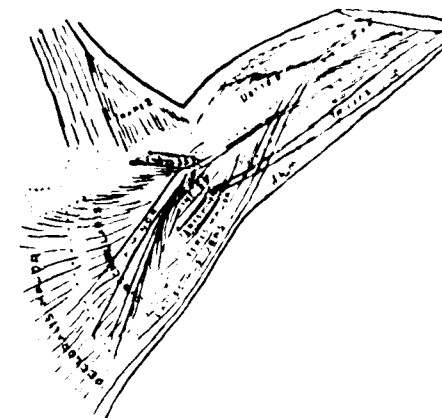


Fig. 2.

With elevation of arm overhead the muscles have arranged coaxially in three overlapping cones. It is apparent that these muscles have lost all rotatory power in this position.

He has further shown that reduction of shoulder dislocation is even possible in delayed and difficult cases by bringing the arm to this position and pushing the head up with the help of the thumb into the glenoid.

1. The shortest cone consisting of	Supraspinatus Infraspinatus Teres minor Subscapularis	Musculotendinous cuff of Codman.
2. Intermediate cone consisting of	Teres major Pectoralis major Latissimus dorsi The shortest deep fibres of deltoid.	
3. Largest cone consisting of	Triceps Biceps (long head) Coracobrachialis Superficial fibres of deltoid	

All of these converge on the humerus. The apical angle is smallest in longest cone and largest in the shortest cone.

It is now proposed to put forward—

- (A) Few more facts of importance about movements of the shoulder joint complex.
- (B) Pleas for recognition of the "zero-position" of the gleno-humeral joint and its usefulness in reduction of abduction fracture (unimpacted) of the neck of the humerus.

The discussion already presented is to acquaint the reader with the present trend of thought and to help in the understanding of the succeeding paragraphs.

A. Important facts about the movements of the shoulder-joint complex

- 1. The greater tuberosity never locks against the acromion in any position of elevation in abduction. In a healthy joint there is just enough clearance to permit the greater tuberosity to glide underneath the

process; this is further facilitated by (1) action of depressors on the head of the humerus (2) inevitable rolling down of the head of the humerus on the glenoid (vide infra) Figs. 3—8.

2. In abduction or in flexion of the humerus overhead forward movement of the clavicle takes place at the sternoclavicular joint. Spino-clavicular angular variation is thus as much a function of this movement as rotation of the scapula round the vertical axis through the acromio-clavicular joint. During yawning one is unable to raise both arms overhead with shoulders bracing tightly against the vertical back-rest (Figs. 9, 10 and 11).



Fig. 3.

Chronic osteomyelitis of the left acromion process; rather a rare isolated pathological process.

3. Rolling down movement at the gleno-humeral joint (Figs. 12, 13 and 14): The gleno-humeral joint is a ball and socket joint; the ball, the head of the humerus is nearly $\frac{1}{2}$ of a sphere and the socket, the glenoid cavity of the scapula has an articular area which is less than a third of the articular area on the head. The glenoid cavity is a part of a sphere having its centre at G and radius R (Fig. 13 & 14). The articular surface of the humerus is part of the surface of a smaller sphere with centre at O and radius r. In every position of the head the point of contact C and the centres O and G are colinear. Let the centre of gravity of the upper limb act at M. The line joining



Fig. 4.

Acromiectomy was performed on the case in figure 3.



Figs. 5 & 6.

Photograph of the patient eight weeks after the operation showing inability to raise internally rotated arm beyond 90 degrees though the skiagram shows no bony block acromion process.



Figs. 7 & 8.

Photograph showing elevation is possible after externally rotating the arm at the gleno-humeral joint. Control skiagram showing the identical bicipital grooves on either side proves equal amounts of rotation have taken place on each side.



Fig. 9.

Elevation of both arms overhead as takes place normally.



Fig. 11.

Identical effect as in Fig. 10 when the clavicle is prevented from swinging forward during elevation.



Fig. 10.

Depression of the clavicle results in limitation of elevation.

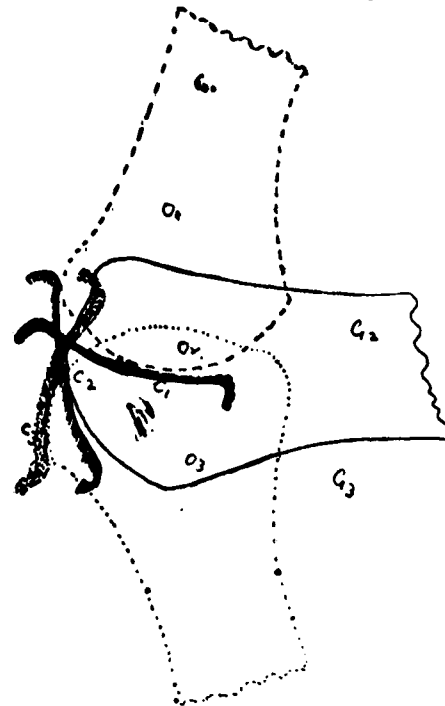


Fig. 12.

Diagrammatic representation of the three positions of the glenohumeral joint. Scapular rotation as seen by shaded glenoid cavity has also contributed to the elevation in different positions.

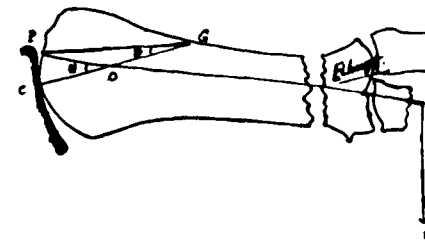


Fig. 13.

Diagrammatic representation of the glenohumeral joint elevated nearly to 90 degrees.

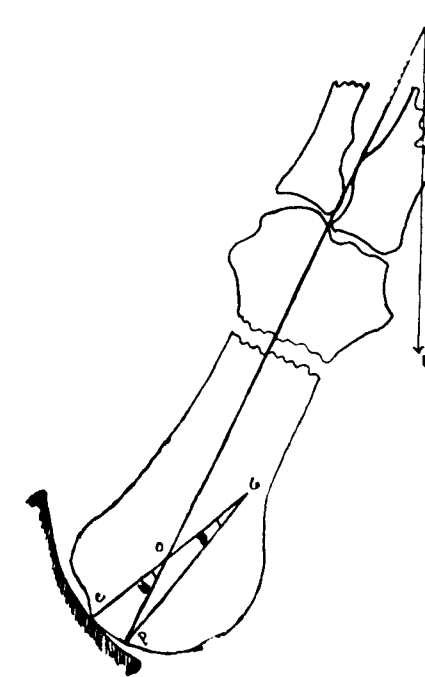


Fig. 14.

Diagrammatic representation of the glenohumeral joint elevated almost to vertical.

M and O is the axis of the limb and when produced meets the articular surface at P. P is a constant point on the head for all positions of the limb.

For different positions of the limb in the plane of the paper, angles POC and PGC will vary. Let the two angles in a particular position be U and V with the constant lines PO and PG respectively. A rotation

over a small surface (in the plane of the paper) ds in an instant dt would be represented by—

$$dU = \frac{ds}{r}$$

(small change in the angle U)

$$dV = \frac{ds}{R}$$

(small change in the angle V)

So the respective angular displacements are—

$$(1) \dots \dots \dots \frac{dU}{dt} = \frac{1}{r} \frac{ds}{dt}$$

$$(2) \dots \dots \dots \frac{dV}{dt} = \frac{1}{R} \frac{ds}{dt}$$

Dividing (1) and (2) we get—

$$\frac{dU}{dV} = \frac{R}{r}$$

Integrating—

$$(3) \dots \dots \dots U = \frac{R}{r} V + K$$

When P becomes the contact point C, $U = 0$, $V = 0$ and thus K of the equation (3) also becomes zero.

Thus (3) reduces to

$$(4) \dots \dots \dots U = \frac{R}{r} V$$

Now equation (4) states that even if the glenoid was stationary when there was counter-clockwise rotation of the axis of the limb round O, there would occur a counter-clockwise rotation of the head as a whole round G but to a smaller extent (r is less than R). So the head rolls down to a new position governed by the above equation. Similarly a clockwise rotation would result in the rotation of the head as a whole in a clockwise direction round G, i.e., it rolls upwards in the glenoid cavity. In every ball and socket joint with great disparity of the joint surfaces as in the glenohumeral joint this "rolling" inevitably takes place and depending on the length of the lever this magnifies distally at the business end. This rolling movement is most economical to perform. This needs differentiation from gliding or another inaccurate term sliding, these being costly to perform result in the development of shearing forces between the joint surfaces thus bringing about rapid wear and tear. This essential rolling with every movement at the glenohumeral joint

may aptly be compared with "ball-bearing" joint where each ball rolls and thus minimises the shear between the joint surfaces of the revolving wheel and fixed axle. It is worth noticing Nature's provision of curved surfaces for all joints with appreciable movements. The joints with plane or rough surfaces are either syndesmosis or synchondrosis.

4. Every position of the gleno-humeral joint can be studied from two standpoints:

- (i) Forces which bring the arm to a new position.
- (ii) Forces which are responsible for fixation in this particular position.

In Fig. 15 the humeral head contacts the glenoid at the point C. Thus COG is the direction of reaction due to contact, assumed after P1, P2, etc. the different pulls of muscles have brought the limb to the position drawn in the figure. W is the weight of the limb acting at the centre of gravity (M) somewhere beyond the upper third of forearm. These forces (P1, P2, etc. and W) acting on the humerus cannot be in equilibrium because C is not a fixed fulcrum, neither is enough reaction resistance available to fix the head at C; the humerus is thus liable to glide down without the intervention of other forces to be explained below.

So we are confronted with two possibilities

- (i) Formation of couple when
 $\sum P_1 \sin \alpha_1 = W \sin \alpha$ i.e., condition of equality of forces.
- (ii) $\sum P_1 \sin \alpha_1 > W \sin \alpha$
 $\sum P_1 \sin \alpha_1 < W \sin \alpha$
 i.e., conditions for inequality of forces.
 $[\alpha_1, \alpha_2 \text{ etc. are the angles which the forces (pull of muscles) make with the limb axis, } \alpha \text{ similar angle made by direction of weight with the axis}]$

The first condition cannot produce equilibrium and the second condition is a condition for actual movement to the position drawn in the figure.

Thus the depressor action (D) by the pull of the infraspinatus, teres minor and subscapularis is necessary. This apart from increasing reaction at the point of contact actually holds the head against the glenoid (Inman, Dec. M. Saunders & Abbot). In the absence of above (paralysis of depressors), pull by the long scapulohumeral muscles (biceps and triceps) could bring about equilibrium in any position provided their power is harnessed beyond the point where the weight of the limb acts. This can be improvised by transplantation on the forearm with the aid of a tendograft (after fixation of the elbow in optimum position) if necessary. This has so far not been confirmed.

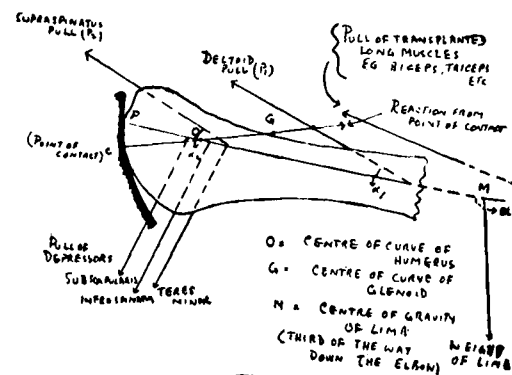


Fig. 15.

Diagrammatic representation of glenohumeral joint to show the various forces acting on the limb from static and kinetic considerations.

5. Scapular plane is not a fixed one. Scapula rotates round a vertical axis and is thrown forward by the clavicle round the chest wall. So any reference to this unstable structure would be useless. Scapular planes at the beginning of abduction or flexion and at the end of these movements are not the same.

6. Codman Paradox:—T. B. Johnston's explanation is indeed ingenious though it is difficult to grasp. The overhead position of the glenohumeral joint is the same no matter which way it is carried out. The necessary rotations take place merely to enhance the critical level of the power at that stage. Without these the muscles would twist or

themselves and lose further power though in such a position the limb could be moved a little further passively. Finally the muscles arrange in coaxial cones when the limb has been brought in this overhead position. Roughly this position corresponds to humero-scapular aligned axes; the scapular axis being taken as the base of the spine of the scapula.

B. Plea for recognition of 'zero-position' of gleno-humeral joint

'Zero-position' of the humerus is defined as that position where the humero-scapular aligned axes coincide with the common axis of the cone muscle groups. Roughly in this position the humerus is 165 degrees overhead and 45 degrees in front of the coronal plane, that is, in the plane of the scapula, the latter being at the limit of vertical rotation and forward migration on the chest wall. The medial epicondyle of the humerus points forwards and slightly medially. In this position the glenohumeral joint loses all active rotation.



Fig. 16.

Ability to abduct at the shoulder nearly 8 months after unimpacted fracture of the right surgical neck treated only by collar and cuff sling and active movements.

Thus defined, pleas for accepting are—

- (i) Steady increase in rotation of the limb as it is moved from this 'zero-position' one way or the other.
- (ii) While treating unimpacted abduction fracture of the humeral neck or the upper third of the humeral shaft, alignment with complete elimination of torsion deformities is possible with the help of 'zero-position'. In the final reduced position the medial epicondyle of humerus should point forwards and slightly medially as it does when the healthy limb is brought up to this 'zero-position'.
- (iii) In treating dislocation of the head of the humerus, the detrimental effects of the rotators (subscapularis specially) can be effectively transformed into axial pull when the limb is brought into the 'zero-position'. This is the principle of reduction of dislocations either recent or delayed, by Henry Milch's method.



Fig. 17.

Radiograph of the same patient showing the present state of fragments.

(iv) In horses where the forelimbs are used for weight bearing, the relative scapulo-humeral position is identical with the 'zero-position' in man. This is how Nature attempts to abolish rotation movements at the gleno-humeral joint in fast moving horses. Scapula and humerus bear constant relationship and move together in a pendulum like swinging manner during running, thus converting the forelimb into a stable weight bearing pillar.

(v) To leave it alone if unable to impact by Frankau's method for



Fig. 18.

Unimpacted abduction fracture of the neck of the right humerus; full internal rotation of the upper fragment is seen when radiograph is taken with arm by the side.



Fig. 19.

As the arm is elevated to 90 degrees the proximal fragment is also seen to take up a new position of elevation with marked improvement of the internal rotation deformity.



Fig. 20.

Elevation to 130 degrees shows further tilting upwards of the proximal fragment and improvement in the internal rotation deformity. Study of similar positions under surgical anaesthesia to relax all muscles was impossible owing to uncontrolled movements due to breathing.

unimpacted abduction fracture of the humeral neck, is the time-honoured conservatism followed by Prof. G. Perkins (Figs. 16 & 17). Indeed even standard text books have not demonstrated a good reduction by the above method, (strong traction and adduction of the arm on the chest, the upper end of the lower fragment being then made to push outwards by a pad in axilla and hitch (impact) the upper fragment). R. Watson-Jones has studied 10 such fractures from



Fig. 21.

Check radiograph after alignment and hitching in "zero-position" and subsequent impaction with arm by the side shows complete reduction of rotation deformity and tilt of the upper fragment.

amongst 571 shoulder injuries. The demonstration radiograph taken 2 years after reduction in his illustration shows 20 degrees of tilt of the upper fragment. The method of reduction by traction on an abduction frame is equally disappointing.

Firm traction of the limb in this 'zero-position' with medial epicondyle pointing forwards and slightly medially can alone bring about complete alignment. By traction the fragments can be made to hitch in this position. The final firmer impaction is obtained after bringing this aligned humerus down and compressing the arm between the shoulder and elbow. Impaction can be maintained by keeping the arm by the side with a couple of overlapping adhesive U straps over the shoulder and elbow for 3 weeks as shown in the Figs. 18—24.



Fig. 22.

Maintenance of reduction with the help of two U adhesive strips round elbow and shoulder for 3 weeks.



Figs. 23 & 24.

Picture and radiogram taken immediately after removal of adhesives (3 weeks) in identical position.

SUMMARY

1. Locking of greater tuberosity against acromion never takes place in any position of abduction.
2. Rolling down movement of humeral head in glenoid inevitably takes place while lifting the arm either in flexed or in abducted position.
3. Forward shift of clavicle with the scapula at the sterno-clavicular joint is an important event during elevation of shoulder joint complex overhead.
4. From theoretical static considerations an attempt has been made to show that properly harnessed biceps and triceps (long heads) may take the place of depressors of the head of the humerus.
5. Recognition of 'zero-position' of the gleno-humeral joint is advocated.

6. Perfect reduction of unimpacted fracture of humeral neck has been shown to be possible if it is carried out in this 'zero-position'.

I express my sincere thanks to the Superintendent, Campbell Medical School and Hospitals, Calcutta for permission to publish from his hospital records; Dr. R. Roychoudhary—Asst. Radiologist of Campbell Medical School and Hospitals and Lt.-Col. J. L. Razdan, D.M.R.E. (Cantab), Radiologist G. R. Medical College and Hospitals for help rendered in taking and reading skiagrams; the Professor and staff of the Dept. of Anatomy, R. G. Kar Medical College and Professor S. K. Basu, Ph.D. (Edin.) for valuable guidance on anatomical considerations of the shoulder joint. Lastly I tender my grateful thanks to my teacher Mr. B. L. McFarland, F.R.C.S., M.Ch.Orth., Director of the Dept. of Orthopaedics of Liverpool University for his encouragement and permission to lecture on this subject before postgraduate Orthopaedic colleagues on 26-11-48, on the theoretical basis of which this article is based.

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*Both are available in the Orthopaedic Department of the Liverpool University.

THE RESISTANCE INDEX AND THE EVALUATION OF SOME HEMATOLOGICAL FINDINGS IN ACUTE SURGICAL PYOGENIC INFECTIONS*

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Introductory

Ever since the existence of the cellular elements of the blood was recognized, great importance has been attached to the changes that take place in the morphological and numerical characteristics of the blood cells in disease. In recent times physicians have come to depend upon laboratory reports to such an extent that clinical laboratories have become part and parcel of the physicians armamentarium to enable him to come to definite diagnoses and express a prognosis with unchallengeable certainty. But, it is only later on that the value of hematology was realised where surgical cases were concerned, especially when a pyogenic infection of a surgical nature had occurred. The most elementary hematological procedures that were employed were the total leucocyte count and the differential counts. A bald enumeration of the total number of white cells and the different varieties of the leucocytes gives no more information to the surgeon than that an infection is present or can be ruled out. As will be seen later, even this interpretation of such counts may be so misleading that, where a grave condition exists, the interpretation may suggest a perfectly normal condition, or, at best, a very mild pathology.

With a view to greater dependability, hematologists have made studies of blood and interpretation of the findings a matter of precision. For this advance no hematologist has contributed more than Schilling, and to a lesser extent, Arneth, Naegeli and others before him. The ability to interpret blood findings correctly, depends upon a broad knowledge of the physiology of the blood cells, their morphology, and changes

in both morphology and numbers that take place in these cells in disease.

The origin and development of the leucocytes:

According to the accepted findings of almost all hematologists, the white cell elements of the blood arise from three distinct sources:

- (1) The granulocytes, which include the neutrophils, eosinophils and the basophils, are produced and developed exclusively in the bone marrow;
- (2) The lymphocytes are produced from the lymphnodes; and
- (3) The monocytes derived from the reticulo-endothelial system.

Figure 1 gives a clear illustration of the origin of the white cells and the various stages through which they pass in their development. According to Schilling and others who belong to the polyphyllitic school, each of the three varieties of white cells has its own precursor, namely the myeloblast for the granulocytes, the lymphoblast for the lymphocytes and the monoblasts for the monocytes. The myeloblast in the normal course of development gives place to the promyelocyte, which in its turn gives rise, successively, to the myelocytes, the juveniles or the metamyelocytes, the "stab" or band form granulocyte and lastly the mature, fully segmented polymorphonuclear leucocyte. This is the normal course of events where the neutrophils are concerned, while in the case of the eosinophils and the basophils, though they are derived from the parent myeloblast, the actual differentiation takes place only at the level of the myelocyte. Thus the earliest cell of these two granulocytes are the eosinophilic and basophilic myelocytes. In the peripheral blood, granulocytes younger

than the juveniles are not seen in normal health. The lymphoblasts and the monoblasts are not seen in the normal, and atypical cells of these two groups consist mainly of intermediate forms if and when they are encountered in the peripheral circulation; and their appearance is indicative of an underlying pathology.

The normal number of leucocytes in the blood stream varies constantly, both in individuals and also at various times in 24 hours. Taking this physiological variation into account, a range of 4,000 to 10,000 leucocytes per cmm. has been accepted as the normal range of variation. The normal differential count of leucocytes as formulated by Schilling and accepted on all hands as the most comprehensive, is called a normal Schilling hemogram. The following is the range of individual leucocytes in a normal haemogram.

Eosinos.	Basos.	Myelocytes.	Juveniles.	Stabs.	Segments.	Lympho.	Monos.
0.5%	0.1%	0%	0%	2.5%	58.66%	21.30%	4.8%

Physiology of Leucocytes:

Taken in their entirety, the leucocytes form the main defensive cellular mechanism of the blood against all infection. The particular cell which is called upon to play its part in combating an infection is determined by the tissue and locality which is affected and also by the nature of the infecting organism. Thus, the neutrophils form the main defence against all pyogenic infections. On account of their high motility, they arrive at the site of infection in an incredibly short space of time, cluster round the site in a defensive pallisade and try to liquidate the infection. Some of them engulf the offending organism, while others release their proteolytic enzymes to

digest the perished tissue, while yet others help to carry the necrotic debris away from the field of battle. Eventually most of them die, disintegrate and disappear.

The exact function of the eosinophil and basophil polymorpho-nuclear cells are not definitely known; but it is a fact that they entirely disappear from the blood stream in a severe grade infection and reappear only when the infection is removed and the dawn of convalescence has been ushered in. Of these two, the eosinophils are the more active.

The lymphocytes come into play when the healing process of a lesion is fully established or when the contending forces of infection and resistance have called a truce and settled down, to result in a silent chronic condition. Apart from this, the lymphocytes are said to be producers of immunising bodies. With the granulocytes, the lymphocytes constitute the really motile elements of the blood, the difference in their rapidity of movement being the immediate urgency for the neutrophils to be present at the site of infection. Macallum has very aptly described this difference when he says, "the polymorphs hop about in a sort of ecstatic frenzy, while the lymphocytes move humbly like slugs crawling with head to ground."

The monocytes are entirely phagocytic in their function and are concerned in the "mopping up" operations so necessary in any infection which involves destruction of tissue of whatever magnitude it may be. While the granulocytes and the lymphocytes are carried by the blood stream to the site of an infection, the monocytes are produced in situ at the site of infection from the neighbouring reticulo-endothelial tissue. When the infection is liquidated, their presence is no longer necessary at the site, and so, they overflow into the peripheral blood stream. This is termed the monocytic crisis which is indicative of the initiation of resolution and is only a temporary phenomenon lasting not more than a day or two.

*A paper read at the XI Annual Conference of the Association of Surgeons of India at Madras, during Dec. 1949.

The Bone Marrow in pyogenic infection :

In health as well as in disease, the bone marrow is concerned with the production, development and maturation of both the granulocytes and the red blood cells. Though the lymphoid tissues and the reticulo-endothelial system produce the bulk of lymphocytes and monocytes, there is enough of these tissues in the bone marrow to produce a small number of cells also. It

is also concerned with the rate of delivery of the cells thus developed into the peripheral blood stream at a uniform rate so that a proper replacement of the cells that are being constantly destroyed in the blood stream, may be effected. The first of these functions is governed by the *maturation factor*, and the second by the *chemotactic factor*. For the maintenance of the steady orderly rhythm of the blood cells in physio-

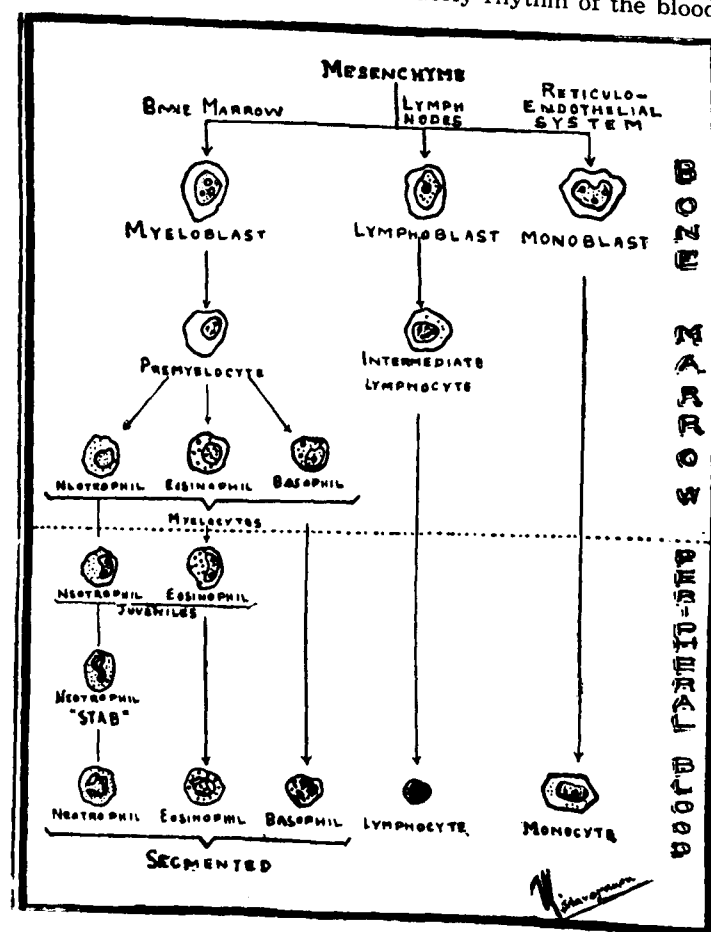


Fig. 1.

Representation of the origin and development of the white cells elements in blood.

The peripheral blood in normal conditions shows only forms illustrated in the lower half.

logical blood, these two factors have to keep pace with each other. The Schilling Hemogram of normal blood is the picture resulting from such a state of marrow equilibrium and depicts a marrow picture in the absence of any toxic irritation of the bone marrow. In the event of any toxic irritation due to a pyogenic infection, the myeloid element of the marrow is mildly stimulated or grossly irritated according to the severity of the infection. The necessity for a greater supply of granulocytes to the peripheral blood demands a stepping up of production and the rate of delivery of the cells into the blood stream is also increased. But, with increasing severity of infection, the rate of delivery increases; in other words the chemotactic factor with the result that, the leucocytes are pushed out into the peripheral stream even before they have attained the status of mature cells. Thus we see, in a pyogenic infection, an influx of immature cells varying in proportion and morphology directly with the severity of the infection and the intensity with which the marrow has been irritated. The blood picture will, therefore be a mild replica of the marrow picture.

Peripheral blood in pyogenic infections :

Infection is in the nature of a declaration of war by the invading organism on the body defences, and the blood pictures seen during the course of the infection depict the struggle between the two, for ascendancy. At the beginning of an infection, the bone marrow—the depot and carrier of the main cellular defence forces—is mildly stimulated. Its response to this stimulus is to throw into the blood all the available adult neutrophils it can possibly muster in an effort at cutting off of the infection at a very early stage. This therefore results in a *simple neutrophilic leucocytosis*. Prompt measures at this stage may annul the infection and cause a subsidence of the leucocytosis to normal level.

But if the infection is too strong to be overcome by the simple mobilisation of adult neutrophils, a further phase of bone

marrow irritation sets in. Having given off all the available adult neutrophils, the marrow suffers a state of temporary functional degeneration. The maturation factor is slightly behind time, while the chemotactic factor is accelerated. This results in the appearance of ill-developed immature, "war-quality" neutrophils, namely, the band-form neutrophils or the "stab" cells in the peripheral blood. This appearance of stab cells in large numbers is called the *degenerative shift* or the *simple shift to the left* by Schilling. The normal ratio between the stab and other younger cells taken together, and the mature neutrophils in a blood smear is about 1 : 16. This is called the *shift index*. This index is increased in pyogenic infection. At this stage of the infection, the lymphocytes and the monocytes show a tendency to decline in number, while the number of the eosinophils and the basophils are relatively decreased. Measures taken now to combat the infection successfully, will see the stab shift disappearing simultaneously with the reappearance of the other cells in normal numbers.

If, on the other hand, the infection is allowed to progress by neglect or incorrect treatment, a picture of a severe grade, well-established infection is obtained. The production and maturation of the neutrophils is not allowed to progress beyond the juveniles or the myelocytes and the increased tempo of the chemotactic factor draws these very young cells into the blood stream. This naturally causes a further increase in the shift index. The blood picture at this stage is (a) a *neutrophilic leucocytosis*, (b) *preponderance of the immature neutrophils*, (c) a *marked reduction in the lymphocytes and monocytes*, and (d) the *total absence of the eosinophils and basophils from the blood*. Even at this stage of an advanced infection with prompt and appropriate treatment a recession of the blood picture to normal with an amelioration of the clinical condition, is possible. In the cases which progress beyond this stage, the blood picture assumes a very grave aspect, with the clinical condition fol-

lowing suit. So far, we have had a bone marrow functioning as best as it can, under the terrific stress of an unchecked pyogenic infection. But, in the terminal stages of a neglected pyogenic infection, we reach a point where the bone marrow suffers a complete breakdown in its leucopoietic activity. It is true the bone marrow has been working at a great disadvantage so far; but at any rate, it has been able to keep up the fight. The maturation factor responsible for the production and division of cells has been overactive all along. Now this factor is completely withdrawn, so much so, with the chemotactic factor maintaining the highest pitch of activity, all that the bone marrow can be expected to deliver to the blood stream consists of the youngest of the young neutrophils in large numbers. As a matter of fact, in moribund cases of pyogenic infections, leucopoiesis is arrested at the level of the myelocytes. Concurrently with this maturation arrest, there is a sudden and alarming decline in the number of total leucocytes produced. Thus, the blood picture at this stage will reveal a very low total absolute leucocyte count, out of all proportion to the severity of the infection, a high neutrophil percentage in the differential count consisting for the major part of myelocytes and juveniles, with the stab cells and segmented neutrophils very poorly represented, a very low lymphocyte and monocyte percentage and a complete absence of the eosinophils and the basophils even from a thick drop blood smear. This picture of a pyogenic infection in extremis has been styled the "gay" picture of Schilling or the leucomoid or liberation picture. A recession from this fatal grade picture is well nigh impossible, because of the establishment of an irreversible reaction.

An interesting sidelight on the method of making blood counts and interpreting the findings will be apparent in cases like this. The Schilling count will show a very high neutrophil percentage, while the total count is low. Thus, for instance, if the total count in a fatal infection is 7000 per cmm.

and the neutrophil percentage is, say, 95%, the actual number of neutrophils per cmm. will work out at 6650 neutrophils of all varieties per cmm. This figure is very nearly the same as the absolute number of neutrophils in a normal healthy blood. Considering the magnitude and the severity of the infection this is woefully low figure, totally inadequate to combat an advanced infection.

From all the pictures except, probably, the last one, a regression is possible, and the chances of recovery are not very remote. Even in the case of a "gay" picture, a recovery is possible if the condition is detected early and prompt measures instituted. This regression is evidenced by, first of all, a lowering of the shift index till it attains the normal ratio of 1 : 16; this is followed by the disappearance of the immature cells, commencing with the myelocytes and ending with the superfluous number of juveniles and stab cells. The total count comes down to normal levels and the lymphocytes increase. This is very soon followed by a sharp rise in the monocytes which lasts for a short period. The picture of complete recovery is crowned by the re-appearance of the eosinophils and basophils in the peripheral blood. The changes in the blood picture with an advancing infection as well as an infection which is being systematically controlled, broken down, and finally liquidated, are so well described by Gradwohl in his excellent book on Clinical Laboratory Methods and Diagnosis, that it is well worth quoting in extenso.

"A simple 'degenerative blood picture' is a simple left shift in which the 'stabs' increase in number. With a continued infection and with the defensive forces of the body acting intensively, under infection, this shift continues perhaps with the 'stabs' remaining stationary or increasing, but with the appearance of juvenile cells in the peripheral blood. At this time the appearance of the juvenile cells indicates an irritation of bone marrow with regeneration. This we call a

'regenerative blood picture'. If the infection continues and the patient's resistance declines, the shift advances further to the left. If improvement ensues, the shift declines and recedes to the right. A 'leucomoid' shift is a shift in which the blood picture resembles leucaemia; that is, a marked increase in myelocytes, juveniles stabs and segmented neutrophilic cells. In this type of shift, there are no eosinophils or basophils, and the number of lymphocytes and monocytes is very low; sometimes are none. This is a serious blood picture. Attention is also to be called to the change in the number of lymphocytes and monocytes during this infectious period. With a beginning shift to the left, there is a coincident decline in lymphocytes. This decline continues until recuperation begins. With recuperation and retrogression of the shift towards the right, lymphocytes increase. Manifestly, a decline in lymphocytes indicates beginning infection, and increase in lymphocytes indicates resistance against infection. The neutrophilic regenerative shift implies a 'battle' phase. The decline in lymphocytes indicates that the fortunes of war are with the invading organism; but with receding neutrophilia, a rising number of lymphocytes means a 'phase of cure'. At some stage in the infectious period when resistance overcomes infection, the monocytes show a sudden rise. This occurs often even before the shift is materially changed to the right and is what is termed the 'phase of defence'. At the same time, we must mention that in the beginning of infections, the eosinophils decline and often totally disappear and reappear only when the shift turns about from left to right. This is termed the 'dawn of convalescence'. We have, therefore, as a means of favourable prognosis, a return of eosinophils, a shift changing from left to the right of neutrophils, an increase in lymphocytes, and a marked increase in the monocytes."

In chronic infectious conditions, a persistent high shift with low counts of eosinophils and high count of monocytes shows a chronic simultaneous continuance of a phase of neutrophilic struggle and of monocytic defence. We thus see that with the Schilling hemogram we have a kaledoscopic view of infection in the blood picture which far surpasses in clinical import what we have been accustomed to see with the old Ehrlich differential count. We are enabled to note infection, to note susceptibility and to note resistance. We are also able to note, very clearly, an increase in the severity of the infection and can predict, with certainty, impending death. It is in impending death that we see 'flooding' or 'liberation' picture, where the bone marrow has finally been overcome and the peripheral blood shows almost intact cells ordinarily found only in the bone marrow.

Methods of recording blood findings:

Of all the methods adopted for the recording of blood counts in infections, the tabular form finds universal application. This method good enough as it is in cases of non-surgical infections, is too elaborate and confusing when surgical pyogenic infections are concerned. In this type of cases, the relation between the total leucocyte count and the neutrophil percentage is of more importance to the operating surgeon. To give a rapid bird's eye view of the actual condition of case, we adopted the Gibson chart in all our pyogenic infections. The Gibson chart (see illustration) is a vertical twin axis graph, the left axis recording the total white count in thousands, while the right axis records the neutrophil percentage. For purposes of this chart certain arbitrary figures are adopted; thus, the high normal percentage of all forms of neutrophils taken together is taken as 75%, and that of the total white count as 10,000 per cmm. A decrease or increase of 1% of neutrophils presupposes a decrease or increase of 1000 white cells, per cmm. respectively. In the chart a line joining the high normal figures of the two counts will be horizontal line. Equivalent counts on the two axis will also form horizontal lines indicating thereby that the resistance is

equivalent to the infection and that the two are balanced, and the disproportion is said to be zero. If, in a particular count, the neutrophil end of the line is tilted up, it is said to indicate the ascendancy of the infection over the resistance. The degree of such disproportion will indicate the severity of the lesion and can also give an idea as to the urgency or otherwise for surgical interference. Surgery is usually to be kept in mind when this disproportion goes beyond 5. If, on the other hand, the neutrophil end of the line is tilted down, the infection is being overcome and broken down. This does not preclude surgery altogether, but only indicates that surgery can safely be postponed. But when several counts relating to same case have to be recorded at very frequent intervals, the chart becomes very confusing on account of the vast number of criss-crossing lines. We, in our clinic, therefore adopted the Wilson Index of Resistance to give us a rapid view of the progress of the patient. This Index is derived from the formula $(T - 10) - (P - 70)$ where T — total white count in thousands, 10 — the high normal white count in thousands, viz., 10,000 per cmm., P — the neutrophil percentage for the particular count, and 70 — the arbitrary high normal neutrophil percentage as adopted by Wilson. This gives a positive or negative figure; if positive it is said to indicate a good resistance with a fairly well controlled infection. If negative, it is indicative of a declining resistance requiring careful watching or even surgical interference if such negative figures persist at a high level for more than a few counts.

However useful these charts and graphs may be to gain a rapid idea of the condition of the patient, they are only a part of the hematological picture of the condition. The information afforded by them must be completed by a study of the Schilling count and the total white count. The Schilling count is extremely important in that it serves to decide whether surgery has to be resorted to immediately or it can safely be postponed in cases which have come to office

probably two or three days after the initial attack, and to foresee an uneventful or a stormy convalescence. So, unless all factors in the blood picture are taken into consideration, decision by the surgeon is apt to be difficult.

In our Clinic, we have incorporated all these in a composite chart (see illustration). The Gibson chart is on the left, the graph obtained by plotting the index of resistance for every count is plotted in the bottom, and the Schilling count for every reading is plotted in vertical columns in the centre of the chart. For the sake of convenience, the total white is recorded in the form of a graph at the top in a continuous line, while the percentage of all neutrophils "graphed" in interrupted line is also shown at the top of the chart.

The potentialities of a minute blood examination in its application to all infectious diseases in general and pyogenic infections in particular, will be apparent on a perusal of the chapter dealing with Hematology in Gradwohl's Clinical Laboratory Methods and Diagnosis. There even the most insignificant of changes in blood findings, finds an interpretation; and in our experience over the past several months we have found them very dependable. It is the study and practise of the methods advocated by him, supplemented by observations on some of our own cases, that has enabled us to bring out this article. We have tried it in a variety of clinical conditions, among which are several cases of appendicitis in its different stages, large gut obstruction, gonorrhoea with urinary retention, stone in the urinary bladder, strangulated hernia, empyema including one of *B. coli* origin, diabetic carbuncle and a case of third degree burns. For purposes of impressive elucidation we have chosen four of our cases of appendicitis. They have been selected to represent the various stages of the disease.

1. The first of these cases is a first attack of appendicitis coming to office with the classical symptoms and clinical history, but

about 4 days after the onset. This eventually settled down to chronicity.

2. The second case is that of a chronic appendicitis during one of its acute exacerbations, coming 3 days late to office.

3. The third was a case of chronic appendicitis preceding suppuration.

4. A case of chronic appendicitis admitted with clinical signs of an acute exacerbation, but which in a very short time ended in perforation.

It will be seen that, though these four are different patients, taken as a series they can very well be one single case, depicting the hematological picture of a single case of appendicitis proceeding from its very first attack to the final stage of perforation.

It is a matter for regret that we have no case, on our records, of a perforated appen-

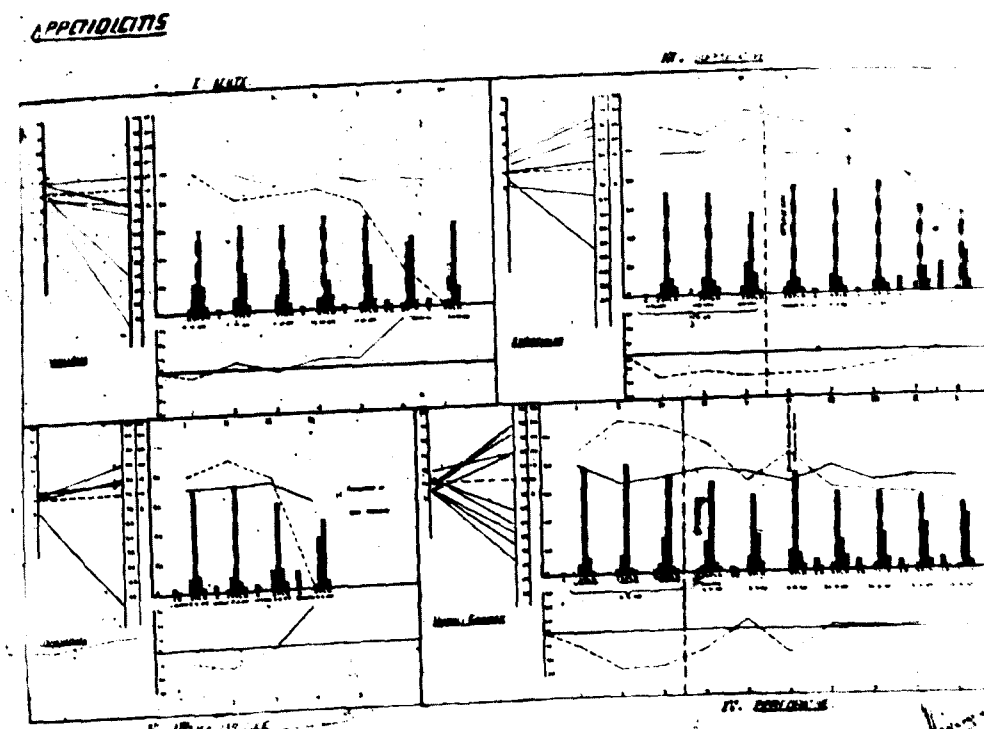


Fig. 2.

The Composite chart as used in our clinic.

This shows the Gibson chart on the left, the Wilson chart in bottom and the charting of the Schilling Haemogram in the centre, the total Leucocyte count as continuous lines and percentage of neutrophils in interrupted line in the top.

- Case I. One of a first attack of appendicitis settling down to chronicity.
- Case II. A chronic case with an acute exacerbation settling down to its old chronicity.
- Case III. A chronic case with acute exacerbation that was operated.
- Case IV. A chronic case with an attack leading to perforation that was operated and drained but no appendicectomy done.

ditis with resultant peritoneal soiling on a large scale to complete the picture of this disease.

Chart I: This shows the picture of a first attack of acute appendicitis with a classical history and symptoms, coming to the Clinic 4 days after the onset. The patient had a mild laxative before coming to the office.

The leucocytosis is moderate and mainly neutrophilic. The Gibson Chart does not show a negative disproportion in that the neutrophil end of the line is tilted down, indicating thereby an infection well resisted and under control. As a matter of fact, the chart shows that the infection started with an inherent immunity from the time of admission and maintained this happy state of affairs till the condition settled down to chronicity. The Schilling count does not show any deterioration in shift which has all along been of a 'simple left' type. Towards the latter half of the chart, there is a reappearance of eosinophils, with a monocytic and lymphocytic rise heralding the full mobilisation of the healing process. The index of resistance has been mostly on the positive side except for a few counts; and this is to be expected in a condition, which, more than any other surgical infection produces surprisingly rapid clinical and hematological variations. The high lymphocyte count in the terminal counts is the true index of a silent chronic condition and will persist till the offending appendage is removed.

Two months after the last records were made, the patient underwent an appendectomy. The post operative counts taken at the time of discharge on the 10th day showed: Total W.B.C. Count: 8,200 per cmm. Eos. 14%, Basos. 0%, Myelos. 0%, Juvs. 0%, Stabs. 0%, Segmenters. 51%, Lymphos. 29%, Monos. 6%. It will be seen that the pre-operative count taken when the patient was discharged on the previous occasion showed a lymphocyte count of 56% as against the lymphocyte count of 39% in the post-operative count. This has been brought about by the appendectomy.

Chart II: This was a case of chronic appendicitis, earlier diagnosed by us and advised operation after undergoing a full course of treatment for co-existing amoebic infestation. But the patient did not turn up for operation. At the time of admission, he exhibited all the signs of appendicular pathology which had developed three days prior to admission. The moderate leucocytosis, the neutrophilia with a marked and progressive shift to the left, the tilting up of the neutrophil end of the line in the Gibson chart with a disproportion of more than 5 units, the persistence of the graph of the index of resistance on the negative side, supported the claim for surgery. But in this case which came some days after the onset of the attack, the persistent appearance of the eosinophils in fairly good numbers in consecutive hourly counts, held our hands. The assumption was that there was no immediate surgical emergency as the eosinophils would have disappeared from the blood stream if the case showed any tendency to worsen. As it was, it was assumed that it was only one of those attacks of acute exacerbation which resettled down again to the original condition of chronic appendicitis. How far this assumption was justified can be seen from the fourth and last count where there is a complete recession of the picture with complete clinical restoration to normalcy. The high lymphocyte count in the last count is again indicative of a chronic healed lesion.

Chart III: This was a case of chronic appendicitis having an acute attack and reporting at the Clinic immediately after the attack began. This case is a further amplification of the last one in that the indications for surgery enumerated in the last one were all present, though in a more marked way. The neutrophilic shift was progressive, the solitary eosinophil seen in the first count had disappeared in subsequent hourly counts and the lymphocytes and the monocytes showed a steady decline. This surely, was a case for immediate surgical interference. Appendectomy, revealed an appendage filled with pus and presenting an angry tip about to rupture.

The post-operative counts are worth close study. The operation was done under ideal conditions and was done with the least amount of handling. The expectations of an uneventful convalescence was cent per cent and the patient himself was very comfortable except for a slight abdominal discomfort. Clinical examination could not yield any reason for this discomfort. But the blood picture in the post-operative counts, the graph of index of resistance, and the Gibson chart were not very encouraging. There must have been a marked increase in the lymphocytes, monocytes and the eosinophils must have showed a tendency to increase with each succeeding count. The Gibson chart lines were still hovering well over the high normal level and the resistance graph was constantly on the negative side. But, a day later, the patient developed paralytic ileus. This was relieved by Wangenstein suction and supplementary intravenous fluid electrolyte replacement. This resulted in the last two counts showing a complete restoration of a normal hemogram, a positive resistance index, and the assumption of the Gibson chart lines to normal levels.

The value of these findings recorded at frequent intervals is apparent in prognosis. They can warn the surgeon of an impending setback long before clinical manifestations set in, thereby giving him a chance to predict the occurrence of anything that may retard convalescence.

Chart IV: This case was diagnosed by us a year and a half prior to the present admission as chronic appendicitis and advised operation. But the patient turned up only when he had an acute attack of about 12 hours duration, further complicated by a few doses of castor oil and some futile enemas. The first count revealed all the indications for surgery and in view of the acute clinical condition, it was decided to operate at once, despite the fact that the blood still showed a few eosinophils. About an hour later, while the patient was on the table and the operation was about to be commenced, another count was done. This

revealed an alarming state of affairs. The total leucocyte count had dropped suddenly, the Gibson chart showed a steep rise of the neutrophil end and the resistance graph showed an increase on the negative side. The Schilling count showed a regenerative shift to the left and the blood picture assumed a mild leucomoid aspect. The sudden fall in the total white count with an aggravation of the blood picture and the shift coupled with the complete aneosinophilia and a leucomoid blood picture could occur only in case of a perforation. This was confirmed by operation when a perforated appendix was seen fortunately walled off by adhesions. Drainage was effected and the patient progressed well clinically except for a low temperature, a persistent high sedimentation rate and a constant left shift. This was partly explained by the onset of delayed gastric dilatation. Relief of this with appropriate measures did not bring about any change in the blood findings the temperature or the sedimentation rate. The Manteoux's test was done, and this proved to be strongly positive. A completion of a course of streptomycin brought about normal findings and the patient was directed to report later for further investigations and treatment.

CONCLUSION

The comparatively short space of time that has elapsed since we adopted this method of detailed investigations in our clinic and the limited volume of work possible in a 15 bed cottage hospital in the mofussil, preclude the presentation of more cases. But we feel convinced that the available data hold out a promise of usefulness if larger institutions with greater scope and facilities will take up this procedure.

When in December 1949, this article was read in a condensed form during the Short Papers Session of the All India Surgeon's Conference, some of the delegates, while admitting the usefulness of the methods advocated, expressed doubts as to whether or not, the procedure was a time consuming

process. We assure our readers that with a little practice and a great amount of enthusiasm, six to seven counts can be done within an hour very comfortably.

The procedure adopted in our Clinic as soon as an appropriate case is admitted, is to have complete hematological and biochemical investigations carried out. The leucocyte and Schilling counts alone are repeated every hour for 3 or 4 hours to observe the progress of the case. If there is any tendency for the condition to remain stationary or improve plenty of time is devoted for pre-operative preparation such as replacement of fluid electrolytes, pre-operative medication and such of those investigations which can be done with ample time at our disposal. Otherwise, the most essential pre-operative measures are carried out and surgery resorted to. After the operation, unless indicated by the clinical condition of the patient, counts are taken twice a day and later on, once daily till there is no indication at all of anything untoward transpiring.

We do not claim infallibility in our procedure; but, all that we can say is that it has served us well, and may be of use to those who take it up, provided always that it has not so far been tried.

SUMMARY

1. The physiology and the pathology of leucocytes in both the bone marrow and the peripheral blood are explained and discussed and the morphological and numerical variations in these cells are interpreted in

relation to acute surgical pyogenic infections.

2. The Schilling hemogram as procedure of choice in the hematological survey of infections and its relation to the total leucocyte count, are fully discussed.

3. The value of minute and correct findings to the surgeon in his task of assessing the risks of operating on a case of acute pyogenic surgical condition; to aid the surgeon in expressing a prognosis on such cases with absolute certainty; to warn him of any untoward occurrence that may retard a favourable progress of a case long before clinical symptoms manifest themselves; and to predict impending death are also outlined.

4. The various methods that may be used to record findings; their advantages and disadvantages; and the necessity for a concerted study of all aspects of the findings are given.

5. Case reports of four cases of appendicitis, in various stages, that reported at our office are presented.

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REVIEW OF RECENT PROGRESS

RECENT ADVANCES IN THE SURGERY OF PORTAL HYPERTENSION

by A. K. BASU, Calcutta.

More than 50 years ago, Guido Banti enunciated the clinical, pathological and, as he then understood it, the etiological features of a disease, which for years since, has borne his name. His concept of primary toxic splenomegaly associated with anaemia and followed much later by development of cirrhosis in the liver and its associated features was accepted until recently without much questioning.

In recent times, however there has been a change in our trend of thought. Warthin (1910) was the first seriously to question Banti's hypothesis and he was followed by other workers, Mc. Michael (1934), Rousselot (1936 & 1940) and others. The workers of the spleen clinic of the Presbyterian hospital in New York have been mainly responsible for the elucidation of this difficult subject and in this respect the following names are outstanding:—Whipple, Blakemore, Rousselot and others. Their initial report in 1936 produced the hypothesis of "congestive splenomegaly"—a primary congestive mechanism in the portal bed as the result of intra- or extra-hepatic obstruction, producing a back pressure—splenic or portal vein hypertension. This term "Portal hypertension" was first coined by Mc. Michael (1934) and indicates the huge rise of the venous pressure in the portal bed which rises to 250 m.m. to 500 m.m. of water—the normal pressure being + 65 m.m.

According to Rousselot (1949), the sites of obstruction may be as follows:

I. Intrahepatic.

A. Cirrhosis of the liver

1. Laennec's cirrhosis
2. Schistosomiasis — Egyptian Splenomegaly
3. Biliary cirrhosis
4. Infectious hepatitis

II. Extra-hepatic.

A. Stenosis of vein

1. Congenital
2. Acquired (a) Phleboscclerosis

B. Compression of vein

1. Inflammatory Cicatrix
(following pancreatitis, cholangitis, etc.)
2. Pancreatic cyst
3. Tumour
4. Aneurysm of splenic artery

C. Thrombosis of vein

1. Inflammatory
2. Traumatic

D. Cavernomatous transformation of vein.

Cirrhosis of the liver does not produce splenomegaly and portal hypertension in all cases, probably in not more than 20%. The term "cavernomatous transformation" has been used by Whipple and is used to indicate a condition, sometimes found, in which there is a prolific development of dilated and tortuous venous collateral circulation between the portal tributaries outside the liver and portal branches within the porta hepatis. This is most probably due to congenital portal stenosis.

DIAGNOSIS

In most cases diagnosis does not present much difficulty. The typical case with hypochromic anaemia, thrombocytopenia, enlarged spleen, ascites and history of gastro-intestinal haemorrhages is too well known to admit of much doubt in diagnosis. If in addition, tests of liver function point to hepatic disease—then diagnosis is easy. But the obscure case without haemorrhage or without cirrhosis may resemble a multiplicity of blood dyscrasias—leukæmia, lymphadenoma, kala-azar, Gaucher's

disease etc. and in such cases, complete haematological studies, lymph node biopsy, bone marrow examination, etc. will help.

Barium swallow of the oesophagus, to indicate the varicose condition of the para-cardiac veins, will be helpful to determine the site of haemorrhage.

It is necessary to estimate renal function—separately if possible of each kidney, in case it is necessary to sacrifice one kidney in the process of splenorenal anastomosis.

Estimation of hepatic function by all the available tests is most essential and is helpful in determining the site of the block—whether intra or extra hepatic. According to Whipple (1945), if there is great retention of bromsulphalein in the blood 30 minutes after intravenous injection, if the hippuric acid test is positive, if there is reversal of albumin—globulin ratio, or if the cephalin flocculation test is positive, presence of cirrhosis with intrahepatic portal block is fairly certain. If these tests are negative, it is safe to assume that the block is extra-hepatic. However, this does not necessarily determine the site of the extra hepatic block. In patients with normal liver function and a history of antecedent pancreatitis or a severe trauma to the epigastrium, the diagnosis of splenic vein thrombosis is valid. In a young child with normal liver function and a history of haematemesis at an early age, the diagnosis of portal vein occlusion as a result of continuation of the obliterative process in the umbilical vein and ductus venosus is probable. In most cases however, the final accurate determination of the site of block can only be made at the operation table. In more than half of the patients, Whipple has been unable to make a correct preoperative diagnosis.

SURGICAL TREATMENT

The factors determining the type of surgical attack and in fact the ultimate prognosis in a given case are (1) the nature of the obstructing agent (2) its site (3) the degree of portal hypertension and (4) the competency of the collateral circulation.

In the past, three lines of surgical attack had been followed with very indifferent results—

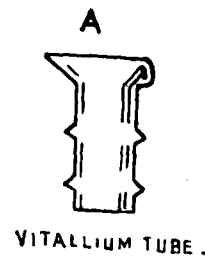
- (a) splenectomy
- (b) omentopexy and
- (c) ligation or injection of the oesophageal varices.

Splenectomy by itself is curative only in those rare cases where there is a block in the splenic vein close to the hilum of the spleen—due to a thrombotic process in the vein or pressure from a pancreatic cyst or pancreatitis. In other cases where the block is anywhere between the entrance of the inferior mesenteric vein and the liver, splenectomy may only be palliative. It might give temporary relief with reduction of the considerable volume of stagnant blood, post-operative rise of erythrocytes, and thrombocytes and a general feeling of well-being. The relief however is short-lived.

Results of omentopexy are disappointing though Grey Turner (1940) has reported one case with considerable relief. Results of ligation or injection of oesophageal veins have been frankly discouraging.

PORT CAVAL ANASTOMOSIS

Attempts to establish direct anastomosis between the portal and the systemic circulation received great encouragement with the introduction by Balkmore & Lord (1945) of their endothelial lined vitallium tube (Fig. 1-a). This was a sequel to their earlier experiences with arterial anastomosis and transplants (1944). Initially, the splenic vein was anastomosed to the left renal vein—end to end. This anastomosis is



VITALLIUM TUBE.
Fig. 1-a.

capable of handling a large volume of blood and in addition eliminates a sizeable portion (40%) of the total circulating portal blood volume by splenectomy.

SPLENO-RENAL ANASTOMOSIS

(Blakemore & Lord 1945) (Fig. 1 a-c)

The spleen is mobilized. The gastro-splenic omentum is cut through and the splenic pedicle is isolated and dissected. The full length of the splenic vein is preserved with minimum trauma. The splenic artery is ligated. A rubber shod clamp is applied on the splenic vein. After removal of the spleen—the stump of the vein is thoroughly irrigated with N-saline. The vein should be mobilized for 8 c.m. or more necessitating ligation of the small pancreatic branches flush with the splenic vein. Through transperitoneal approach, the left kidney is mobilized, the ureter and the renal artery isolated and ligated. The main renal vein is dissected for 5 to 6 c.m. and a rubber shod clamp applied as far proximally as possible, the vein being sectioned close to the kidney. The stump of this vein is also irrigated with saline. The kidney is removed.

The end of the splenic vein is next passed through a proper sized vitallium tube, triangulated with mosquito forceps, and everted over the end of the tube (Fig. 1-b). The vein is held in place by a ligature of no. 1 Deknatel silk being placed behind a holding ridge. The tube-mounted splenic

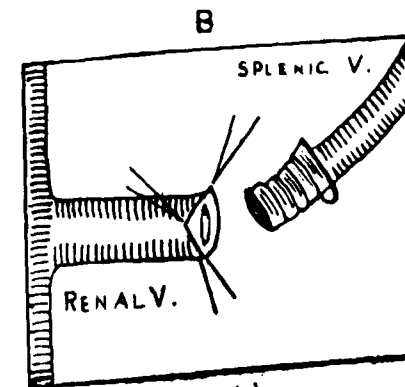


Fig. 1-b.

vein is freshly irrigated and wrapped in vaseline gauze.

The renal vein stump is triangulated with mosquito forceps. A no. 3 Deknatel silk ligature is placed loosely round the vein. The vitallium tube is grasped with a forceps and the intima covered end is directed towards the renal vein stump. Care is taken that neither vein is twisted. The tube is introduced into the renal vein so that the latter comes up well proximal to the tying ridge on the tube (Fig. 1-c). The

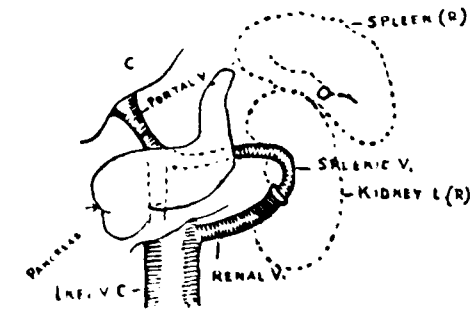


Fig. 1-c.

previously placed silk ligature is tied tightly about the renal vein approximating it to the splenic vein at a point proximal to the tying ridge on the tube. A second ligature of no. 3 Deknatel silk is tied in identical manner. Finally a ligature of no. 1 Deknatel silk is tied just snug about the renal vein approximating it to the splenic vein

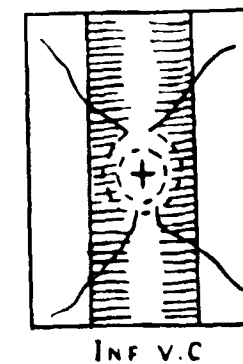


Fig. 2-a.

near the end of the tube. This is important because it keeps blood from penetrating between the two intimas. The clamps on the splenic and the renal vein are released. The raw area is peritonized. The splenic vein should make a gentle curve and acute angulation should be avoided.

The same method was utilised in anastomosing the end of the portal vein to the side of the inferior vena cava (Fig. 2 a, b). It is necessary to mobilize the portal vein from its bifurcation at the liver to the origin of the splenic vein. The second part of the duodenum along its lateral wall will need mobilization also. The cystic vein and if necessary the pyloric vein need ligation. A rubber shod clamp is placed on the splenic vein. A transfixion ligature of no. 3 Deknatel silk is placed round the portal vein at its bifurcation close to the liver. The vein is transected 4 m.m. distal to the ligature. The vena cava is mobilized from the level of the liver down past the entrance of the left renal vein to the upper level of the right renal vein. A large rubber shod clamp is placed around the vena cava at the upper level of the left renal vein but is not tightened. The portal vein is passed through a proper sized vitallium tube. The end of the vein is everted and cuffed over the tube and tied lightly behind a tying ridge on the tube. The vein covered tube is swung out from behind the common duct over the vena cava at a convenient site.

The surface of the vena cava is cleared of adventitia and a purse string suture of vaselized no. 3 Deknatel silk suture introduced in the wall. The suture forms a circle the diameter of which is 4 m.m. larger than that of the vitallium tube. 2 m.m. outside this another similar purse string suture is introduced (Fig. 2-a). Another rubber shod clamp is put in position about the vena cava as close to the liver as possible. The distal clamp is quickly tightened and then the proximal. A crucial incision is made in the wall of the vena cava, the vitallium tube is introduced and the purse string sutures tightened after

taking care that the vena cava is pulled well up on the tube so that the inner purse string suture will fall proximal to the tying ridge of the tube (Fig. 2-b). The proximal clamp is first released and finally the distal clamp.

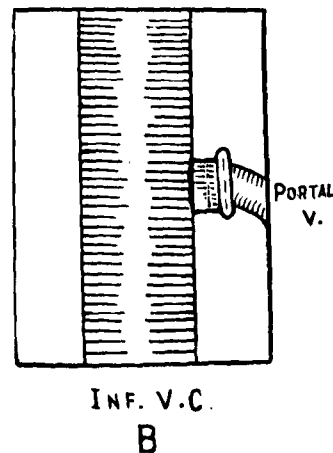


Fig. 2-b.

The disadvantage of the port caval anastomosis lies in the necessity to produce complete obstruction of the inferior vena cava. It has been estimated that this can be done with safety only up to 10 minutes. Longer obstruction will cause irreversible damage to the kidneys. Welch (1947) has described an ingenious modification of the operation in which the anastomosis is performed with partial obstruction of the vena cava and part of the blood is allowed to flow through the vena cava during the whole time the anastomosis is performed.

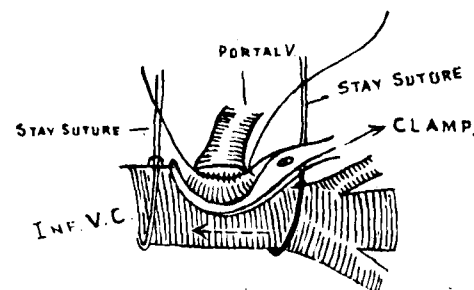


Fig. 3.

a portion of the wide cava and the anastomosis is performed almost at leisure (Fig. 3).

The Blakemore and Lord method of non-suture anastomosis has now given place to suture anastomosis. The suture used is usually 00000 braided silk with an eyeless no. 9 needle—a continuous mattress type of suture is used, the cut edges of the vein of suture is used, the cut edges of the vein walls being everted so that intima is approximated to intima. The suture line is interrupted at 3 equidistant points by tying it to stay sutures to prevent narrowing of the anastomotic lumen from a purse string effect. During the last 2 years, the suture type of anastomosis has almost solely been used by all surgeons interested in the operation and it has given good results.

There has been further improvements and modifications in the operative technique. The end to end spleno-renal anastomosis with sacrifice of the left kidney has given place to end to side anastomosis with the preservation of the left kidney. This operation has been mainly practised by Linton (1947) of the Massachusetts General Hospital. He uses further a thoraco-abdominal incision over the tenth left rib from its angle to the abdominal midline. The rib is resected subperiosteally, the pleural and peritoneal cavities are opened and the anterior portion of diaphragm divided parallel to the incision. After splenectomy, the vein being ligated as close to the hilum as possible, the peritoneum over the kidney is incised and the organ mobilized. The renal artery is isolated so that a small bulldog clamp may be placed on it to control arterial inflow to the kidney during the venous anastomosis. Sufficient length of the renal vein is dissected to allow application of 2 clamps with enough space between them. A transverse incision is made on the antero-superior surface of the renal vein—the length being equal to the diameter of the splenic vein. An end to side anastomosis is performed. The clamps on the renal vein and the splenic vein are opened first and haemostasis of the suture line determined. Finally the clamp on the renal

A curved Thomas Smith intestinal forceps with spring blades temporarily isolates artery is removed. The kidney is replaced and the peritoneum over it is sutured.

The same incision has been used on the right side for portocaval anastomosis by Satinsky (1948) and is said to give better exposure.

In those cases where simple splenectomy had been performed previously, and where further haemorrhages necessitated anastomotic procedures, it has been found that the splenic vein is usually thrombosed or fibrosed and cannot be utilized for spleno-renal anastomosis. From a review of such cases, Linton (1948) concluded that a surgeon who does splenectomy for portal hypertension should also perform spleno-renal anastomosis at the same operation, since this may be the only opportunity for such anastomosis. In such post splenectomy cases, the following ingenious anastomoses have been used in the Presbyterian Hospital spleen clinic (Rousselot 1949).

- Superior mesenteric vein to the inferior vena cava, end to side by suture.
- Inferior mesenteric vein to left renal vein, end to side by suture.
- Splenic vein to inferior vena cava, end to side by suture.
- Inferior mesenteric vein to inferior vena cava, end to side by suture.

RESULTS

The results of the Presbyterian spleen clinic are as follows:—

Number of cases operated on—58.

	Hospital mortality	Late mortality	Total mortality
with intra hepatic cirrhosis			
42	21.4	16.6%	38
extra hepatic obstruction 16	12.5%	12.5%	25%

Late results in the Surviving group.

	Cirrhotic patients	Extrahepatic block
Successful (no recurrence of bleeding) ...	18	8
Moderately successful (minor bleeding at long intervals) ...	1	2
Unsuccessful (recurrent bleeding but patient alive) ...	4	2

Of the cases reported by Linton (Massachusetts General Hospital) Number of cases operated—25.

	Hospital mortality	Late mortality
Intrahepatic block (cirrhosis).	15 28%	71%
Extrahepatic block ...	10 0%	Not
Late results Extrahepatic block ...	7 patients have not bled for 5 to 22 months.	

SUMMARY

- 1. The modern concept of portal hypertension and its gradual development from the original concept of Banti is reviewed.
- 2. The surgical management of these cases and the various recent operations are described in detail.
- 3. The experiences and the results of Presbyterian Hospital spleen clinic and the

Massachusetts General Hospital are summarized.

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CASES & COMMENTS
AN INTERESTING CASE OF MULTIPLE BONE DEFORMITIES
FOLLOWING SMALL-POX EPIPHYSITES

by A. K. BASU, Calcutta.

It is generally known that one of the common complications of small-pox fever is multiple bone and joint involvements. One has often come across osteomyelitis of different bones both of acute and chronic varieties and their late sequelae in the form of discharging sinuses and sequestra formation following small-pox. Also acute suppurative arthritis is quite common in this disease and leads in many cases to marked joint deformities and much disability. The following case where many epiphyses of long bones were specially affected to the exclusion of the diaphyses or of the joints and where interesting growth deformities

resulted, is in my experience unique, and the case, therefore, seems worthy of record.

CASE REPORT

Sk. Kasem aged 11 years came under my care on 1-8-49. The history was that 2 years before his admission to the hospital he had an attack of small-pox. He had pock-marks on the face and generally on the flexor aspects of the body. During the later stages of this disease he noticed swellings of the different joints which was associated with acute pain. This subsided gradually in about 2 months but since then he was noticing slow but progressive deformities both in his upper and lower extremities.

On examination (Fig. 1) the most noticeable feature was the marked genu valgum. The medial condyles of the lower ends of both femurs were markedly prominent and the leg had formed an angle of about 130° with the thighs. Lying in bed with the two condyles touching, the medial malleoli were 24" apart. On flexing the knee joint, however, the legs were parallel.

The gait was typical scissor leg type and the peculiar way he walked first by bringing one knee in front of the other and then the other leg taking



Fig. 1.
Showing marked genu-valgum and radial deviation of the hand especially on left side.

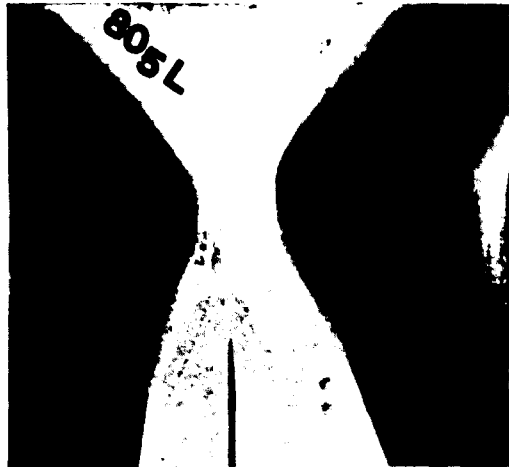


Fig. 2.
Showing the knee joint. Note A & B - premature synostosis of the lateral side of the epiphyses of the lower ends of femur and upper ends of tibia. C - abnormality of the head of fibula. D - outline of the cuneiform osteotomy.

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Fig. 2.

Showing the knee joint. Note A & B—premature synostosis of the lateral side of the epiphyses of the lower ends of femur and upper ends of tibia. C—abnormality of the head of fibula. D—outline of the cuneiform osteotomy.

a wide circle to come to a relative position was most amusing.

There were deformities in the upper extremity too (Fig. 1). There was marked radial deviation

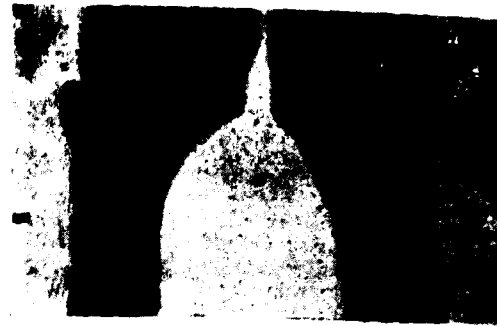


Fig. 3.

Wrist joints — antero-posterior and lateral views. A — on the left side, the lower radial epiphysis had fused and the ulna had grown in length.



Fig. 4.

Showing the elbow joint — antero-posterior and lateral views. Showing abnormalities of the upper ends of radius, ulna and also of the lower ends of the humerus.

of the hand especially of the left side and the lower end of the ulna on this side was unusually prominent. There were abnormal bony prominences around the elbow also. Movements, however, in each of the joints were more or less free and normal and there was no pain.

Skiagrams (Figs. 2, 3 & 4) revealed multiple epiphyseal affections showing irregular epiphyseal outlines, broadening, sclerosis and premature epiphyseodysia at several sites. At the lower end of the femur and the upper end of the tibia (Fig. 2), and more specially at the former, the epiphysis on the lateral side had fused explaining the prominence of the medial condyle and the genu valgum.

At the wrist joint especially on the left side (Fig. 3), the lower radial epiphysis had fused completely but not the ulnar epiphysis explaining the continued growth and prominence of the ulna, and the radial deviation of the hand.

Also there were epiphyseal irregularities of the lower ends of the humerus, upper ends of the radius and ulna (Fig. 4) producing the bony



Fig. 5.

After operation. 4 months. Note both lower limbs are more or less parallel and radial deviation of hand has been corrected.

irregularities but not sufficient to cause marked deformities.

The joint outlines were normal and the bony texture elsewhere did not show any abnormality.

Operation: On 10-8-49 through a medial approach between the posterior border of sartorius and gracilis and splitting the vastus medialis, the medial surface of femur was exposed and a wedge shaped osteotomy, the base being on the medial side, was performed (Fig. 2). Both sides were tackled at the same time, and the legs were brought parallel to each other. At the same time the lower end of the ulna on the left side for about 1½" was completely resected together with the periosteum. Both the lower limbs were enclosed in plaster including the hip joints.

Convalescence was uneventful. The plaster was removed after 3 months and the osteotomy sites were well consolidated. The patient was examined

again after 1 month (Fig. 5). He was walking well, the legs were more or less parallel. Flexion of the knee was full and painless and he could sit on the ground with his knee fully flexed. The radial deviation of the left hand was fully corrected (Fig. 5).

SUMMARY

An interesting case of multiple epiphyseal affections as the result of small-pox fever and the resultant bony deformities is described.

Bilateral supracondylar wedge osteotomy for the genu-valgum and resection of the lower end of the ulna for the radial deviation of the hand produced satisfactory results.

PLASMACYTOMA OF THE NOSE

by P. N. WAHI and N. L. SHARMA, Agra.

Tumors consisting of plasma cells can occur in four different forms: (i) multiple plasma cell tumors of the bone; (ii) diffuse plasmacytosis with no apparent tumors in which the bone marrow shows infiltration with plasma cells, and in addition the internal organs particularly the liver, spleen and lymph nodes also show infiltration; (iii) solitary plasmacytoma of bones; (iv) primary plasmacytoma of the soft tissues—also known as extramedullary plasmacytoma. The extramedullary plasma cell tumors are relatively uncommon. Such neoplasms at times develop in the upper part of the respiratory tract as well as elsewhere in the body. The nature of these tumors and their relationship to multiple myelomas is not definitely established. Different observers have claimed them as inflammatory or granulomatous masses, and also as benign or malignant neoplasms.

Helwig⁹ in 1943 reviewed 127 cases of extra-medullary plasmacytoma reported between 1905 and 1942. Of these 63 cases arose in the upper respiratory tract, 47 in the conjunctiva, 2 each in thyroid gland and skin, and one each in the pleura, lacrimal gland, kidney, spermatic cord, vulva and gastrointestinal tract. Solitary plasma cell tumors of the nose and nasopharynx are rare. Claiborn and Ferris⁵ found 12 cases in literature prior to 1931 involving nose and nasopharynx, and added 2 of their own. Cappell⁴ in 1938 reported on 122 cases of tumors of the nose and throat and this included only 2 cases of plasmacytoma. New and Childrey¹⁵ found only two instances of this tumor in their 230 cases of malignant neoplasms of the palate, oropharynx, and tonsil. Mattick and Thibandeau¹² reviewed 19 cases of plasma cell tumors of the upper air passages reported in the literature prior to 1935 and added one of their own.

Figi, Broders and Havens⁶ in 1945 reported 2 cases of solitary plasma cell myeloma

of the upper part of the respiratory tract which they observed at the Mayo clinic between 1930 and 1943. During these 14 years, out of 625 cases of malignant growths of the nose and accessory nasal sinuses, they found only 6 cases of plasma cell myeloma.

Plasma cell tumors of the nose and accessory nasal sinuses are rare. Recently we have come across two cases of plasmacytoma of the nose. The rarity of these tumors warrants the description of these cases.



Fig. 1.

Extensive plasma cell tumour of the nose involving both the nostrils and the upper lip (Case I).

REPORT OF CASES

Case 1.—A Hindu male aged 26 years came to the S. N. Hospital because of a tumor blocking both the nostrils. This had started as a small nodule of the size of a pea in his right nostril, about six years back. It had gradually increased in size. Examination revealed an extensive fungating growth 5 x 3 cm., involving the upper lip and both the nasal fossae (Fig. 1). There was no

palpable enlargement of the regional lymph-nodes. No other swellings in connection with any bone was seen. Roentgenogram of the thorax was normal. Bence-Jones proteinuria was not demonstrable.

Blood examination revealed—total proteins 8.03 gm.; albumin 3.12 gm.; globulin 4.91 gm.; r.b.c. 4.5 million; hemoglobin 13 gm. per 100 c.c.; w.b.c. 15,000 per c.mm.; differential count showed polymorphs 70%, lymphocytes 21%, and eosinophils 9%; serum calcium 9.9 mgm. 100 c.c.

Biopsy revealed that this tumor was a plasmacytoma (Fig. 2).

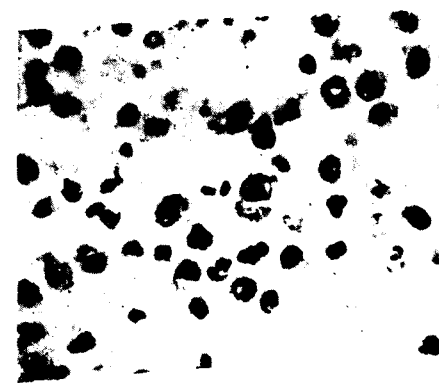


Fig. 2.

Plasma cell myeloma of the nose showing diffuse arrangement of cells (Case I). (Hematoxylin and eosin. x 580.)

Case 2.—This 25 years old Hindu male was admitted to the S. N. Hospital with complaints of difficulty in breathing and bleeding per nose. He had noticed a small tumor in the right nostril about 7 months back. This had gradually increased in size till it blocked the nostrils completely.

Examination revealed a tumor in the right nostril blocking the nose completely and extending upto right side of the pharynx. Bence-Jones proteinuria was not demonstrable.

Biopsy revealed that the tumor was a plasmacytoma.

COMMENTS

Most authors regard the multiple myeloma as a hypertrophied tumor of the hemopoietic system. This concept cannot explain the existence of most cases of extramedullary plasmacytoma. Michels¹³ critically reviewed the theories of morphogenesis, function and development of the plasma cell. He gave the following concepts as to its origin: (i) from connective tissue cells; (ii) from emigrated lympho-

cytes; (iii) monocytes or pre-existent tissue lymphocytes, and (iv) immature blood cells. Lowenhaupt¹¹ in 1945 suggested that plasma cells arose from tissue histiocytes of the spleen and lymphnodes. Considering these views as to the origin of the plasma cell, it seems reasonable to assume that plasmacytoma could arise in nose and lips, besides the other extramedullary situations.

Plasma cells are commonly present to varying degree in chronic pyogenic and granulomatous lesions. Lately we have seen 2 cases of rhinoscleroma of the nose in which large numbers of plasma cells were present together with the characteristic cells of rhinoscleroma. In the latter cases the histologic picture was of a granulomatous process. The two cases cited above did not present the remotest suggestion that any of these tumors were granulomatous or inflammatory. The plasma cells were neoplastic and were diffusely massed like the cells of lymphosarcoma. These were in conformity with the concept of plasmacytoma of Figi et al.⁶ We concluded therefore that these two cases were of primary plasmacytoma of the nose.

Plasma cell tumors occur more often in males than in females, and usually after the age of 40 years. Willis²⁰ in his review mentions the lowest age in recorded cases as 29 years. Figi et al.⁶ had all their cases between 37 and 71 years of age. Both the cases cited here were males and their ages were 25 and 26 years. This is much lower than the hitherto recorded ages. Wahi and Razdan¹⁹ have reported a case of plasma cell myelomatosis in a girl of 12 years and they think this is the lowest age recorded.

Extramedullary plasmacytoma are most commonly seen in nose, accessory nasal sinuses, palate and pharynx. They may however arise in any portion of the upper respiratory tract. Cases have been reported where the tumor was situated behind the ear, in the mastoid cells, on the alveolar process, on the scalp, conjunctiva, tongue and in the stomach. Recently cases of diffuse plasmacytoma without manifest tumor formation have been reported. Of the

11 cases reported by Figi et al.⁶, 6 arose from the maxillary sinuses, 2 in oropharynx, 2 in nasopharynx, and 1 in larynx. In one of the two cases of nasopharyngeal tumors, the tumor had originated in the sella turcica.

Bence-Jones proteinuria was absent in both cases, and this is not an uncommon finding, especially in plasmacytoma of the soft tissues. Willis²⁰ pointed out that if proteosuria has been regularly absent for one year from the tentative diagnosis of solitary plasmacytoma, it is impossible that signs of generalised myelomatosis will appear later.

It has long been known that plasma cell tumors in the majority of cases are associated with disturbances in protein metabolism. Kahler¹⁰ in 1889 was the first to point out the coincidence of Bence-Jones proteinuria with the disease which now bears his name. However Bence-Jones proteinuria is not the only manifestation of disturbed protein metabolism. Perlzweig et al.¹⁶ found an increase of blood proteins—a hyperproteinemia, in most cases of myeloma. Foord⁷ reported plasma proteins as high as 18.37 per cent in myeloma. The rise is mainly due to increase of globulin fractions. This is in conformity with our findings. Our case No. 1 showed evidence of disturbed protein metabolism. The total blood proteins was 8.03 gm. The normal total proteins in this class of patients (as determined in our laboratory) is between 5.5 to 5.9 gm. This rise in total protein in this case was mainly due to increased globulin fraction.

Another evidence of disturbed protein metabolism is the reported frequent occurrence of atypical amyloidosis in myeloma, the so called paramyloidosis of Picchini and Fabris.¹⁷ Still more interesting is the finding of crystalline material microscopically—both intra- and extracellularly.^{1, 2, 8, 14, 18} Brass³ reported crystalline deposits outside tumors, in endothelial cells of the lymph-nodes, in loose fibrous tissue, and in stellate cells of the liver. Recently Sikl¹⁸ and Neumann¹⁴ have each reported a case

of plasmacytosis with protein crystals in kidneys. This they thought was the result of paraproteinuria. This disturbance of protein metabolism has been dealt with in detail by Apitz² and Brass³ separately. However they have come to the almost identical conclusion that plasma cells in general are producers of serum proteins. In myeloma this function is disturbed to the point of giving rise to pathological products. For this disturbance they suggested the name of paraproteinemia, and the excretion of these products by kidney as paraproteinuria.

SUMMARY

Two cases of plasmacytoma of the nose are described with a brief review of the literature.

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REVIEWS OF BOOKS

Harvey Cushing, Surgeon, Author, Artist. By Elizabeth H. Thomson. Pp. 347. M. S. Henry Schuman, Inc., Publishers, New York. 1950. Price \$4.00.

The work of Harvey Cushing has always been of intense interest to surgeons all over the world, particularly to neurosurgeons many of whom have been his pupils, and remember the lessons they have learnt thro' years of contact as housemen and understudies at Baltimore or Boston. Miss Thomson's book is welcome to a still larger circle of admirers, who though without personal contacts, practise what he taught and have benefited by his discoveries. His death in 1939 shortly after the start of the Second World War is said to have been hastened by it. Highly strung as he was with numerous friends in Europe suffering from the horrors of the war, it is said Cushing was so upset that he could not concentrate his mind. He soon tired of listening to radio news of the war and lapsed into a state of stolid indifference which so many others of a like nature felt while the war lasted.

He lived at a time when America was fast developing into full maturity as a world leader, making discoveries in many fields and typified the virility and inventiveness of his race. His life when closely studied will be a source of inspiration to surgeons all over the world.

Born at Cleveland in 1869 in a prosperous New England family, he was the last of a family of 10 children; his ancestors for generations had been doctors. He was a handsome child and as he grew up, his fondness for sports and ready wit made him popular among all who met him. He had the best available primary and secondary school education available at the time at Cleveland where his father was in active medical practice, had his collegiate education at Yale University, and joined Harvard Medical School for his medical studies. Medical students of Harvard at this time attended for their clinical work the wards

of the Massachusetts General Hospital in Boston and the arrangement at the time was similar to what obtains now in Madras. The Medical courses lasted three years only. The lecture rooms were even at that period too small to seat all the pupils who sought admission, so that some had to stand. There were not enough microscopes either to go round. Cushing from the first was noted for his beautiful dissections. His artistic tastes were manifest even in his Anatomy dissections and many were those that came to see them.

After graduation he went to Baltimore as an assistant at the Johns Hopkins Hospital under Dr. Halsted, who was then the Professor of Surgery and Senior Surgeon. Halsted was already famous as a surgeon, his operative technique was matchless, and many were the new fields in which his courage and leadership brought him renown all over the world. But his health was never too good, and so it happened that on many mornings he could not come or get through his list of operations for the day. On all such occasions it fell to Cushing's lot to complete the list, and this gave Cushing opportunities to operate more often than was the lot of many others of his age. Halsted's patients soon realised that Cushing's results were just as good as Halsted's, and they did not mind the change. Even Halsted's private patients were willing to be operated on by Cushing. But his early efforts with brain surgery were not always successful. There were many fatalities, patients became nervous of brain operations, these fatalities came to be noted in the local Press upsetting him greatly, but he had the quality of hoping for the best and continued his work until success began to dawn. Gradually he overcame the drawbacks of anaesthesia, haemorrhage from the brain, post-operative complications due to infection, etc., which were some of the stumbling blocks in the way of success in brain surgery. Brain operations which he began now to undertake took considerably longer to complete

than other surgical measures. The average duration of an operation was 4 to 6 hours, and the patients were maintained in a safe condition by blood transfusions.

He organised a surgical laboratory where he conducted classes in operative surgery on animals and experiments in physiology. These were novelties at the time and elicited adverse criticism.

He served for over a year in the First World War and kept a diary which became a source of much contemporary history later. During his formative years he made many trips to Europe and England where he came in contact with the leaders of his time, among them Dr. Kocher of Berne, under whom he worked as an Assistant for many months. At Baltimore he came under the personal influence of Osler, who was then the Professor of Medicine. Osler soon left America for Oxford where he became Regius Professor of Medicine. On his death in 1919, Cushing was commissioned to write his biography. He performed his task with much thoroughness, taking 5 years to complete it. This book in two volumes is an authoritative work on the subject of Osler's many-sided activities in a fairly long life.

Many were the offers of employment at this time from other University Centres. Although his own Hospital (Johns Hopkins Hospital) was not willing to lose his services nor under Osler's advice did he want to leave at the time, after many years of absence, his longing for his Alma mater overcame him and he accepted the Professorship of Surgery at the Harvard Medical School. Shortly after, Peter Bent Brigham Hospital was built under Cushing's own supervision. Here he taught for the remainder of his active life and worked day after day till he attained the age of retirement which here was 63. He would have liked to stay on but custom forbade this. Yale University came to the rescue and welcomed him with an appointment as Professor of Neurology.

Here the retirement age was 67. Cushing then moved out of Boston and settled in his house at New Haven till the end of his life.

Here he worked and completed the monumental book on 'Meningiomas', in which he described in detail with sketches made by his own hand many cases of brain tumour numbering over 2000. When he retired from his Professorship of Neurology, he continued as Director of Studies in the History of Medicine at New Haven where he spent the remaining years of his life interesting himself in the building of the present Yale Medical Library.

He married at the age of 33 and had a family of five children. His second daughter married Franklin, the second son of the late President Roosevelt. His eldest son William inherited his father's qualities, but did not wish to be a doctor and died when he was still very young in a motor crash. This was one of Cushing's severest shocks. He was a disciplinarian among children and did not approve of the modern craze for reading fiction, so much in vogue among youth in this country. He kept careful accounts of expenditure but spent liberally on deserving charities. He was a book lover and spent time and money on Medical histories. One of his special hobbies was the collecting of the works of Vesalius. His library of several thousand books was bequeathed to Yale University after his death. His days were so crowded with professional work that he saw very little of his family and when he found time to go home, he almost felt himself a guest in his own house. He disliked being photographed and was averse to publicity in any form.

He was a hard worker, starting hospital work at 8-30 in the morning on a frugal breakfast, had no lunch but kept going on tea and toast till 7 in the evening when he left hospital. He was constantly thinking of his patients, and many were the occasions when late at night he would ring up his housemen for detailed information about the cases operated on that day, and if the young man failed to give him satisfactory and correct information, Cushing never spared the erring junior. He worked so hard that his health broke down on more than one occasion and he had to go on a holiday. He was a hard taskmaster and

expected his juniors to be as conscientious as he himself was. Approving as he did of the American 'full time' system of teaching, wherein the teachers did all their work at the hospital and took no income for themselves from paying patients, he still felt that private practice was essential for the success of a medical man. He did not mince his words when his arrangements went wrong. He was known to have a short temper but whatever the juniors might have felt at the time, in the long run they loved and adored the teacher all the more. His patients and subordinates adored him and they wrote to him frequently and he answered everyone of them. His case sheets were full of details not only professional but anything else he knew about the patient, and contained photographs. He was a slow operator, could not do more than one case daily and had no respect for the men of the old type who operated by the clock. He had the privilege of training under Kocher in his wards and laboratories at Berne and greatly admired the man.

Professor Dandy, another famous neurosurgeon, who introduced ventriculography in neurological surgery, was one of Cushing's assistants, succeeded him at Baltimore, and became as famous as his senior in the years that followed.

His eating habits and intense nervous makeup contributed to stomach upsets and he suffered for long from peptic ulcer symptoms necessitating a Sippy diet. Later he developed signs of ascending thrombosis in the vessels of the legs which necessitated his stay in hospital and a few of his toes had to be removed.

He was not an easy lecturer and prepared his talks in advance. He preferred to teach in the operating theatre or at special demonstrations. Of medical societies he was fond and he did not miss their meetings. At Baltimore he introduced the method of teaching operative surgery on dogs. The method appealed to students and they flocked to his classes. His special classes in operative surgery to post-graduates were so popular that he had to intro-

duce fees to regulate admissions. In the operating room he insisted on silence. He was in favour of students coming into contact with patients early in the second year of studies. Patients adored him as is illustrated by the case of a young pianist of Baltimore, Dorothy Russell, who suffered from brain tumour and had 21 admissions to hospital. She underwent nearly 17 operations in the course of 13 years and willingly came each time for relief when symptoms of increasing blindness and weakness of limbs indicated a recurrence of growth. In the course of these several operations, he became so familiar with the look and feel of the patient's brain that when she finally died and her brain was removed at post-mortem, Cushing was too upset to examine a tissue after death which he knew so well in life. It is stated that he held over his custom of writing the post-mortem notes for over ten years till he had got over the acuteness of his pain.

He was not a music lover, and was never religious in the ordinary sense. He hated routine, and his philosophy of life was a simple humanism. He took very little interest in politics. He gave away a large portion of his income to his hospital which benefited by his generous gifts of money and books. He died of heart block at the age of 70.

One of his teachings and aims in life, was to be a 'Good Doctor' and he often said that every surgeon or other specialist should as a part of his post-graduate training spend a period of apprenticeship under a busy country practitioner, and learn the lives of the people at first hand before he settled in cities.

One of his disappointments was his failure to found a National Institute of Neurology for which he made supreme efforts but could not succeed.

To chronicle a life so complex and many-sided is by no means an easy task. Miss Thomson has achieved remarkable success in her effort and her book should be read by everyman of ambition who recognises

the debt we owe to those who went before us.

K. G. P.

Reconstructive and Reparative Surgery: by Hans May, M.D., F.A.C.S., with a foreward by James Barret Brown. Pp. 964. Illust. 967 (17 in colour), F. A. Davis & Co., Philadelphia, is a book of great utility to the general surgeon. Methods that have proved satisfactory in practice and final results are presented. Clinical examples are given to enhance the value of the methods presented and end results are shown.

The book is of real value to the general surgeons.

N. S. N.

Cardio-vascular Disease: by Louis H. Sinle, M.D., F.A.C.P.—Grune & Stratton, Inc., New York, 1949.

The book though concerned with a speciality is written with the larger perspective of disease as a unit affecting the whole organism. Many of the limitations conspicuous in the writings of specialists are, therefore, absent. The treatment of the subject is predominantly clinical. Two chapters are devoted to the review of the necessary back ground of anatomy and physiology of the cardio-vascular system. The most upto date knowledge of these subjects is given in a precise and concise manner without making it either obscure or taxing. Many problems arising from the study of the diseases of cardio-vascular system are discussed and in doing so the author brought out the limitations of the scientific method in unravelling the problems of human life.

The book contains 31 chapters. The chapters dealing with the subjective and objective manifestations of the functions of the cardio-vascular system in health and disease are well written. The chapters on heart failure and cardiac pain written interpreting the symptomology in the light of physiology are very instructive. The role of psycho-somatic reactions in the sympto-

mology and treatment of cardio-vascular disease is well stressed. The more recent methods of diagnosis of cardio-vascular diseases are also discussed though in a brief manner. No special discussion on electro-cardiography is incorporated but e.c.g. records are introduced wherever necessary.

On the whole the book is well-planned and well-written with a clinical bias. The matter and manner is of a high standard.

C. K. P.

Hand Book of Obstetrics and Diagnostic Gynaecology: by Leo Doyle, M.S.M.D. First Edition. University Medical Publishers, California—1950.

In the preface to the book Dr. Doyle remarks that the purpose of the book is to present in the most concise form the essential features of obstetrics and diagnostic gynaecology. He is to be congratulated in bringing out all the most important details in obstetric work in such a short and concise form and all within 194 pages of a small sized book. The management of normal pregnancy and its complications occupy more than threefourth of the obstetric section. Even in this short synopsis the author has devoted full seven pages to the emotional aspects of pregnancy labour and puerperium which is surprising when we consider the fact that even in some of the big standard textbooks in obstetrics one finds often only either a passing mention or a couple of pages on this particular aspect. The author is evidently trying to impress on the practitioner this very much neglected aspect and it is indeed a welcome change. At the same time one feels that the section on prolonged and abnormal labour could have been written in a little more detail. The whole section occupies only ten pages. Cephalo-pelvic disproportion, variations in pelvic shape and its effect on labour which are some of the difficult and very important aspects of obstetrics have been sadly neglected.

The section on diagnostic gynaecology is fairly comprehensive and is very well presented.

The author is to be congratulated in bringing out a book which contains much useful up to date information presented in a very concise form avoiding all controversies—a book which will be very useful to the general practitioner.

M. K. M.

Fundamental Considerations in Anaesthesia: by Charles L. Burstein, M.D. The Macmillan Company, New York, Pp. 153, Illus. 64. Price \$4.00. (1949).

Dr. Burstein is to be complimented on the excellent book which contains a fund of useful information concerning the basic principles in pharmacology, physiology and physio-pathology and their significance in every-day clinical anaesthesia. Much of the

information is new and the result of his researches.

The treatment of physio-pathology of the autonomic nervous system, respiration and circulation, under various types of anaesthesia is original, clear and concise. The correlation between the experimental and clinical aspects deserves to be highly commended.

The book also contains useful information regarding the therapeutic measures that are necessary to combat untoward effects that may occur during clinical anaesthesia and what is more valuable the reasons for the same.

This book is very valuable not only to the clinical anaesthesiologist but also to the instructor on the subject.

N. C. S.

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Subjects for discussion at future meetings

12th Meeting:

1. (a) Bronchiectasis—

Dr. R. Mahadevan, Madras.

(b) Lung Abscess—

Dr. S. J. Mehta, Bombay.

2. Intestinal Obstruction in Children—

Opener: Dr. A. E. DeSa', Bombay.

Seconder: Dr. R. A. Irani, Bombay.

3. Sciatic Syndrome—

Opener: Dr. S. K. Sen, New Delhi.

Seconder: Dr. V. P. Mehta, Bombay.

13th Meeting:

1. Hydrocephalus—

Opener: Dr. A. E. DeSa', Bombay.

Seconder: Dr. R. Nigam, Nagpur.

2. Prolapse of the Rectum—

Opener: Dr. K. G. Munsif, Bombay.

Seconder: Dr. S. N. Mathur, Lucknow.

3. Tuberculosis of the Hip Joint—

Opener: Dr. A. K. Basu, Calcutta.

Seconder: Dr. B. N. Sinha, Lucknow.

14th Meeting:

1. Surgical Treatment of Hypertension—

Opener: Dr. A. V. Baliga, Bombay.

Seconder: Dr. V. P. Mehta, Bombay.

2. Strictures of the Urethra—

Opener: Dr. H. Y. Khwaja, Bombay.

Seconder: Dr. U. Mohan Rau, Madras.

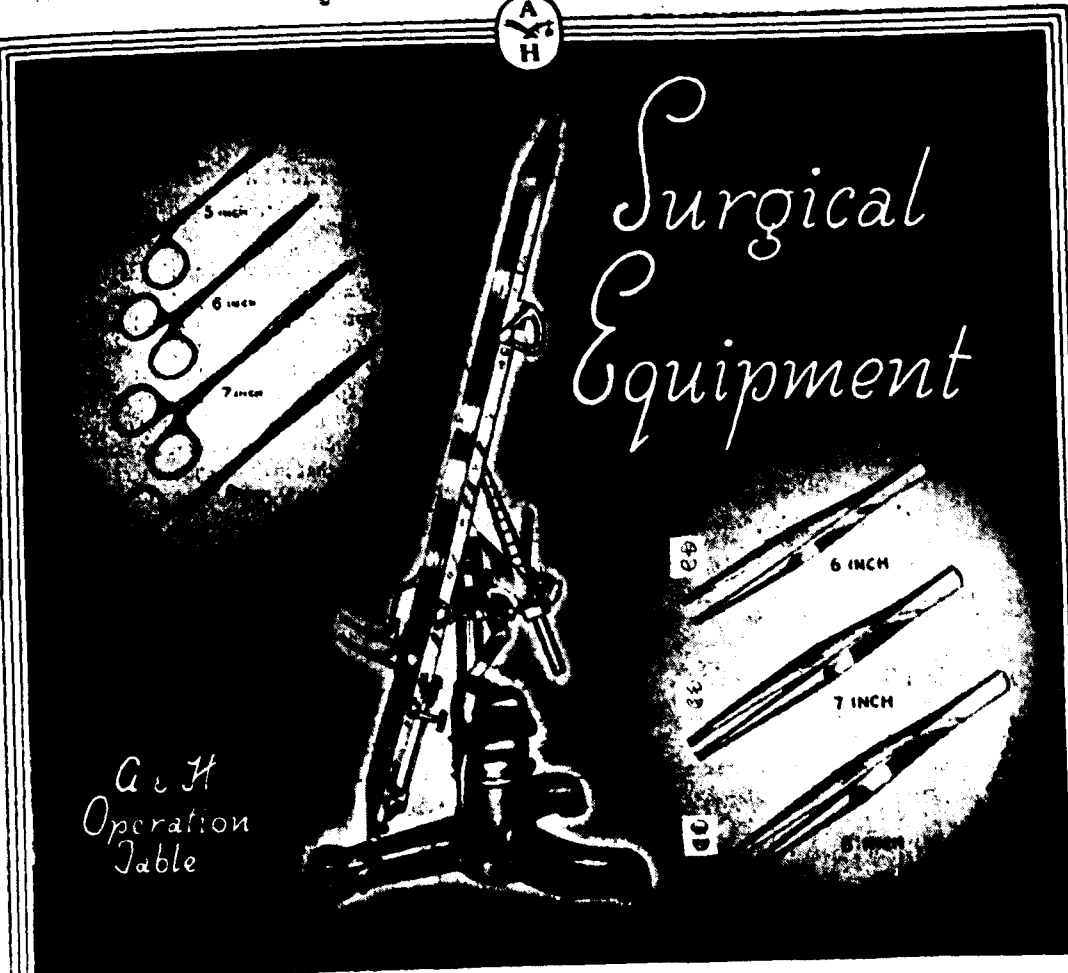
3. Tuberculosis of Lymph Nodes—

Opener: Dr. D. S. Iyer, Madras.

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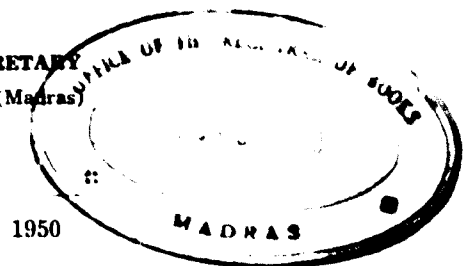
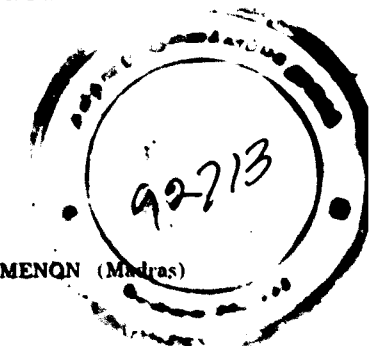
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2. Beard, J. W., Taylor, A. R., Sharp, D. G., and Beard, Dorothy. The Nature of a Virus Associated with Carcinoma in Rabbits. Surg., Gynec., & Obst., 74: 509-513. 1942.

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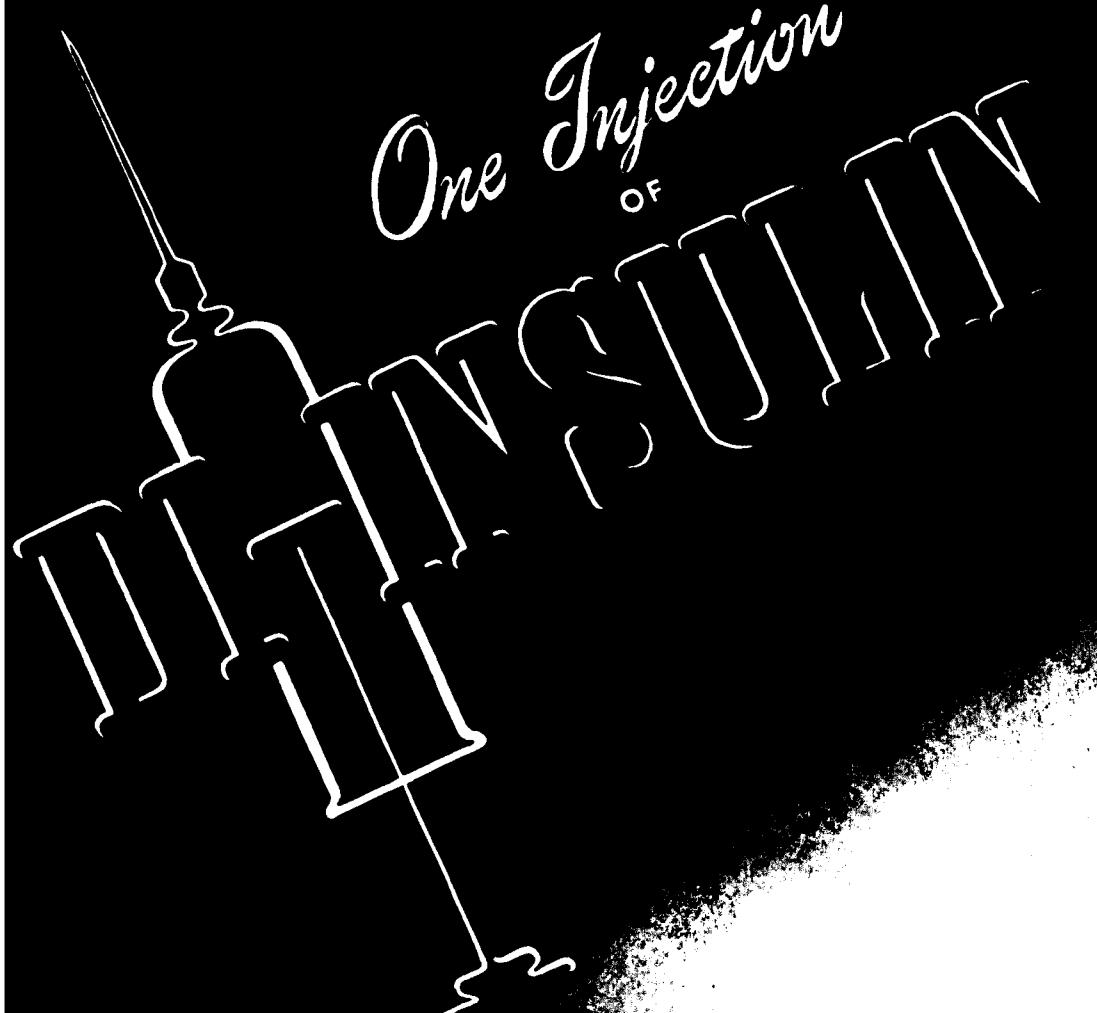


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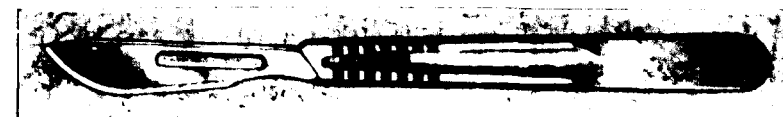
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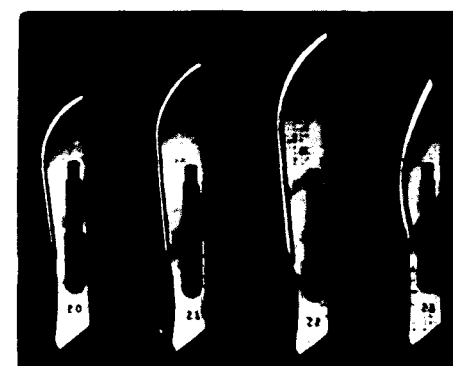


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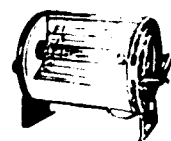
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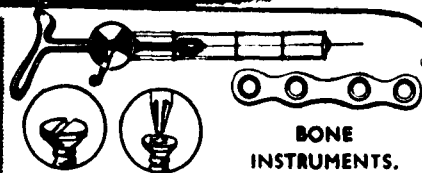
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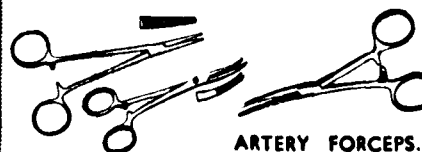
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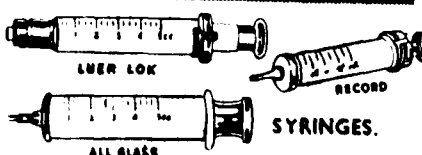
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THE INDIAN JOURNAL OF SURGERY

Vol. XII

SEPTEMBER 1950

No. 3

VOLVULUS OF THE SMALL INTESTINE*

by B. N. BANERJI, Laherasarai (Bihar).

Of surgical emergencies in civilian practice a large and important quota is contributed by acute intestinal obstruction, and volvulus of the small intestine is the commonest cause of acute internal intestinal obstruction that I have come across in my surgical career in North Bihar. Since this condition, so frequent in occurrence, has received so little attention and has been so inadequately described, and since mortality in untreated cases is so high and the results obtained with proper treatment are so favourable, I am tempted to present this subject to the conference this morning.

To start with I put up a survey of the cases of acute internal intestinal obstructions that were admitted into the Darbhanga Medical College Hospital and treated by me from April, 1938 to September, 1949.

Total number ... 603

Large Bowel	...	80
Volvulus of the sigmoid	...	67
Stenosis	...	8
Malignant	...	7
Fibrous	...	1
Colic intussusception	...	1
Faecal impaction	...	4
Junctional	...	22
Ileocaecal intussusception	...	19
Ileocaecal tuberculosis with acute obstruction	...	3

*A paper read at the XI Annual Conference of the Association of Surgeons of India at Madras, during Dec, 1949.

Small Bowel	...	501
Paralytic (mostly peritonitic)	...	107
Mechanical	...	394
Internal hernia	...	6
Foreign body	...	3
Enteric intussusception	...	5
Pathological condition associated with Meckel's diverticulum	...	2
Acquired band and kinks	...	69
Volvulus	...	309

Calculating from these figures volvulus of the small intestine accounts for :—

- 51% of all varieties of acute internal obstructions.
- 59.4% of all varieties of acute small bowel obstructions.
- 78.3% of small bowel obstructions of mechanical origin.
- 79.1% of volvulus.

Figures from other sources :—

Reginald Vick—who collected 176 cases of volvulus from 21 Hospitals in 5 years from 1927 to 1931.

Small intestine	...	85
Sigmoid	...	56
Caecum	...	35

Mayo Clinic—figures given by Hilton between 1915 & 1946.

Small intestine	...	73%
Sigmoid	...	19%
Caecum	...	8%

INCIDENCE

Age: 25-50; majority being between 25 and 35.

Sex: Male—295 cases; Female—14 cases.

Class of people: Labouring class usually field labourers fairly healthy in constitution but with history of dyspepsia and occasional attacks of abdominal colic.

Religion: Hindus 298; Muhammadans 11.

Environment: Not particularly insanitary. Practically all the cases of my series are villagers.

Diet: Mostly vegetarians and heavy eaters, principle articles being rice, maize, wheat, marua, sweat-potatoes and gram.

Associated Bowel Infection: Hook worm 53%; round worm 48%; protozal infection 76%; tuberculosis—multiple tuberculous ulcer of the ileum 0.3%.

PATHOLOGY

Introduction:

Early in 1938 in 4 of my cases of acute small bowel obstruction, I failed to discover any mechanical factor responsible for the ileus, though I found empty caecum in every one of them. I closed the abdomen in disappointment. Three of them were not relieved and died. The fourth case to my surprise, and a very pleasant one indeed, was relieved of obstruction and survived. This made me think that the obstruction must have been such as could be overcome by handling of the bowel and eventration. I regretted that I did not see if the caecum was filling up before I closed the abdomen. By analogy with volvulus of the sigmoid where during operation, in some of the early cases untwisting has occurred before the surgeon has deliberately done so, I labelled these four cases as volvulus of the small bowel. Since then I have been alert and more searching. For the next twelve years I did all the cases of acute intestinal obstruction myself not relegating any to the resident staff lest I should miss important material. The pathology I present in this paper is based on my personal observation of a fairly long series of

cases that became available for operation at different stages of the disease. The descriptions I could obtain so far from the scanty literature are very different from my own observation.

Mechanism:

This volvulus has been described by most of the writers as similar to volvulus of the sigmoid colon, giving rise to loop obstruction and later on loop strangulation. This is far from correct. The messosigmoid has a short parietal attachment, especially in cases where volvulus has occurred. The anatomical condition is such that the twist may progress to several turns and this does occur, the two limbs of the sigmoid colon winding round each other like a twisted rope. The mesentery of the small bowel, after complete developmental rotation of the bowel and fixation of the caecum have occurred, has, on the other hand, quite a long attachment on the posterior abdominal wall and fans out over a long stretch of bowel. This anatomical condition cannot allow even one complete turn to occur, not to speak of a number of turns. What happens is quite different from this conception. The mesentery is simply folded upon itself till it is completely doubled up. The volvulus cannot and does not proceed further, because the doubling up of one part of the mesentery over the other has to stop short when they have come in apposition. This folding or doubling up occurs along a line just to the right of the superior mesenteric artery and parallel to it. In two of my cases where Meckel's diverticulum was present this line could be extended right up to it. The portion of the mesentery distal to the fold is twisted in clockwise direction. As the twist occurs, the segment of the small bowel attached to the distal fold of mesentery i.e. the sub-terminal coils of small bowel are lifted from the pelvis into the abdominal cavity and swung towards the left. In this swing the entire lower part of the mesentery which hangs in the pelvis is flung upwards, so that the mesenteric surface that looked forward now looks backwards and the posterior surface becomes the presenting surface on opening



Fig 1-a.

This is a sketch of a cadaveric specimen showing the mesenteric twist. It shows how a border is created on the right side by the torsion in which the distal fold is twisted in a clockwise direction. It has passed towards the left side behind the proximal fold, because the whole mesentery is flung up into the abdomen from the pelvis. Note that its posterior surface is now the presenting surface on opening the abdomen. The terminal ileum is seen emerging from underneath the twisted mesentery and running downwards and outwards to join the caecum.

the abdomen. The distal section of the mesentery after this doubling up has occurred comes to lie behind the section proximal to the fold. The coils of the bowel attached to the distal segment now lie behind the doubled up mesentery. The disposition of the terminal ileum is thus altered. Normally it runs upward and outward from the pelvis to meet the caecum but now when the twist has occurred the terminal ileum runs downward and out-



Fig 1-b.

Is a photograph of a cadaveric specimen which shows very clearly how the terminal ileum emerges from underneath the mesenteric border by the torsion, as described under Fig 1-a.

Note the almost transverse lie of the ileum and also note how it has been wedged into the root of the mesentery and pressed upon by its twisted edge. This is the mechanism by which the obstruction in continuity is produced.

The manoeuvre of untwisting the volvulus without eventration as described in the text can be easily followed by reference to this picture.

ward from the mid abdomen underneath the doubled up border of the mesentery to join the caecum. This anatomical alteration of the position and direction of the terminal ileum gives the immediate clue to the diagnosis when the abdomen is opened. The whole of this mechanism can be reproduced on a cadaver and the details described above can be clearly demonstrated. (Figs. 1-a and 1-b.)

Events that follow the twist :

Reference to Fig. 1-a shows clearly how a border has been created on the right side by this folding up of the mesentery on itself, and how this border runs across the distal ileum. At the commencement, the site where the ileum is crossed is usually 5-7 inches proximal to the ileo-caecal junction. All the subsequent events are the result of this incident. This doubled up border presses on the bowel here and produces obstruction in continuity. At this stage two things may happen, the volvulus may undergo spontaneous detorsion or it may not. In the latter event, the proximal coils become distended with gas and heavy with collection of fluid. As they become progressively heavy, chances of spontaneous reduction become increasingly remote. The heavy coils drag the distal segment towards the left under the doubled up mesenteric border thereby shifting the site of obstruction more and more towards the right till further dragging is rendered impossible by the fixation of the bowel at or about the ileo-caecal junction (Fig. 1-b). In cases where the caecum is unfixed, this structure is also dragged and comes to lie under the twisted mesentery under cover of coils of small bowel. The site where the bowel is crossed by the folded mesenteric border now becomes stationary. Here the wall of the bowel is pressed upon and subjected to ischaemic state, (Fig. 1-b) exactly resembling what happens when the bowel is crossed and pressed upon by an intra-abdominal band. Since the overlying mesenteric border is broad and soft as compared to a narrow and tough fibrous band, the obstructive effect on the movement of the contents and the ischaemic effect on the wall of the bowel at the site of crossing are milder. Consequently the obstruction to start with is incomplete and remains so for sometime, but left to itself it becomes complete.

As time passes, adhesions take place between this part of the small bowel and the root of the mesentery as the result of plastic peritonitis. The mesentery becomes oedematous and stiff. The fold becomes so

sharp that it looks like a recently ironed linen crease. A white linear streak, fibrous or fibrinous appears on the peritoneum on both the aspects of the fold (Fig. 3). The opposing surfaces may even be glued together. Spontaneous derotation is now an impossibility and untwisting by the surgeon is now less easy, and after untwisting, the mesentery tends to twist again. The cases on record of recurrence of this volvulus and particularly very soon after operation are presumably the cases where operation was undertaken at this stage and no fixative measures were adopted. On the bowel wall there is first only a pressure mark (Fig. 8) which subsequently becomes pale and white (Fig. 2) due to ischaemia. As the ischaemia becomes more intense and prolonged a band of necrosis round the bowel occurs (Figs. 4-a and 4-b). This sometimes leads to perforation but usually due to coexisting plastic peritoneal reaction there is only a localised abscess. There is likelihood of rupture at the site of the ring necrosis during operation even on careful manipulation.

There is no gangrene of any loop of the bowel since it is not a loop obstruction and there is no mesenteric vascular occlusion either, as occurs in sigmoid volvulus.

The obstructed segment presents all the usual changes that take place on other instances of obstruction in continuity e.g., congestion, loss of peritoneal lustre, distension with gas, presence of fluid, patches of gangrene in cases of great distension and diminution or absence of peristalsis. In the majority of the cases I have noticed varying degrees of hypertrophy (Fig. 7) of the last 12-18 inches of the obstructed segment signifying thereby that intermittent or partial obstruction had existed for sometime before the acute obstruction was manifest, or that frequent transient obstructions had occurred.

The segment of ileum distal to the obstruction is collapsed and has the position and direction already described. The caecum and colon are collapsed and contracted.

A moderate amount of free fluid, sero-fibrinous or occasionally sero-purulent,



Fig. 2

Photograph taken during operation on a case of 10 days' duration. The volvulus is just untwisted and the caecum has started to fill up.

Note the broad white band (indicated by the probe) over the ileum just proximal to the ileo-caecal junction, where it was crossed and pressed upon by the twisted mesenteric border. As result of this compression, the bowel wall here became very thin, appearing as if it was crushed. After careful examination it was considered that necrosis had not occurred and so it was not exteriorised. The whole operation was finished in 18 minutes. The patient made an uneventful recovery.

is present in the peritoneal cavity. I have not seen sero-sanguinous fluid in any case.

Associated Pathological conditions.

I have so far not come across evidence of any previous disease in the ileo-caecal region, e.g. tuberculosis, peri-appendicular bands or neoplasm. None of my cases had a previous abdominal operation. In only one case in this whole series was there bowel tuberculosis in the form of multiple tuberculous ulcers on the ileum.

Morbid Physiology :

Since this is a low small bowel obstruction and mild in its course the resulting electrolytic imbalance is practically insigni-



Fig. 3

Photograph taken during operation on the same case. It shows the mesenteric fold after the volvulus has been untwisted.

Note the sharpness of the fold which look like a freshly ironed crease. Note also the narrow white streak on the fold. This appeared like linear fibrosis. It clearly demonstrates how and why the volvulus tends to recur after reduction. Corresponding to this white line there is a similar one on the opposite aspect.

ficant. There is a very slight alteration in blood chloride and carbon dioxide combining power of the plasma. Anhydraemia is a prominent feature when obstruction has existed for several days. This tends to raise total plasma protein. Plasma albumin goes down probably because of the peritoneal exudation. Raised azotaemia is the result of hemoconcentration and oliguria possibly also of renal damage. Total R.B.C. count is high. Clinically this is manifest during operation in the dark hue of the arterial blood.

Etiology :

The factors responsible for this volvulus are still obscure to me but in my attempt



Fig. 4-a.

Photograph of a specimen of a small segment of the bowel after resection, showing necrotic band at the site of pressure. This illustrates more advanced pathology as compared to Fig. 3. During manipulation the bowel cracked over the necrosed portion.



Fig. 4-b.

Is the coloured reproduction of Fig. 4-a, just to illustrate the gangrenous change since the colour changes of gangrene are not demonstrable in the photograph.

to unearth them I have been impressed with the following facts:—

1. The situation where the twist takes place.
2. The dietetic habit.
3. Co-existing bowel infection.
4. Sex incidence.

The twist occurs in every case over the superior mesenteric artery as its axis, the bowel corresponding to the post-arterial segment of the mid-gut rotating round the main stem of the superior mesenteric artery. This is an invariable feature of this volvulus.

In only one case of my series where the caecum and ascending colon were unfixed up to the hepatic flexure, the attachment of the mesentery was transverse in direction and short in length extending from the left side of the body of the second lumbar vertebra to the front of the right kidney resembling the faetal duodeno-colic isthmus. In this instance a complete turn had occurred.

Is it due to persistence of the tendency of rotation of the mid-gut? The direction of developmental rotation is anti-clockwise, but the rotation in this volvulus is clockwise. Here I want to point out that in rare cases of volvulus-nonrotation the unfixed and consequently unduly mobile mid-gut suspended from its short attachment the 'duodeno-colic isthmus' rotates clockwise. The bowel in this region possibly possesses an inherent unstable equilibrium and probably more so since it is close to the junction of the mobile and the fixed segments.

The Dietetic factor:

From what I have gathered so far, I have not the least doubt that heavy eaters and particularly vegetarians are subject to this anomaly. Heavy meals with abundance of starch and cellulose lead to collection of large amount of fermentable residue at the distant ileum. This is liable to react on this region of the bowel and induce structural and functional changes. Chronic

catarrhal inflammation of the mucosa, luminal dilatation and hypertrophy of the wall are the reasonable structural alterations expected at this region. Functionally the sub-terminal ileum is subjected to fre-



Fig. 5.

Shows the end-to-end anastomosis in the same case after resection of about 3 inches of the bowel (Fig. 4) which had undergone band necrosis. By this small segment resection and anastomosis, the patient was relieved of the acute obstruction but intermittent colic persisted and ladder patterns again appeared 5 days after operation. On the 7th day after the first operation, ileocolic resection and end to lateral ileo-transverse-colostomy was performed by a transverse incision under local anaesthesia. The patient made an uneventful recovery after the second operation.

quent occurrences of excessive and possibly irregular peristalsis induced by heavy and irritable residue.

Co-existing bowel infection:

This factor, so common a feature in my series, probably plays a contributory role by keeping up unhealthy state of the mucus membrane of this segment.

I am led to believe that ileal stasis as a result of faulty diet and irregular or hyperperistalsis induced by irritation caused by fermentable residues, and infection coupled with the peculiar anatomical and developmental factors that exist in this region are responsible for this pathological state.

Having observed these cases closely before, during and after operation I imagine that this twist is presumably a usual occur-

rence in every individual every now and again, followed by spontaneous rectification. This swing of the bowel over the superior mesenteric arterial axis is in all probability a physiological phenomenon in the dynamics of the bowel. This becomes a pathological condition when due to some circumstances normal derotation fails to take place. I believe that the functional alteration, e.g. the excessive and presumably irregular peristalsis leads to more frequent occurrence of this twist and the heaviness of the bowel contributed by the hypertrophy so frequently noticed in these cases and accumulation of food residue as a result of faulty diet prevents spontaneous rectification. Once the rectification is prevented for some time the pathological condition is established and becomes progressive.

Sex incidence:

The overwhelming preponderance in males may be accounted for by the hypothetical argument as is done in the case of the sigmoid volvulus, i.e. masculine abdominal musculature obstructs spontaneous restitution of the volvulus at its initial stages. This hypothesis also presupposes, not infrequent occurrence of twists which untwist themselves at initial stages provided circumstances are not unfavourable. In women lax abdominal wall and roomy abdominal cavity allows spontaneous derotation. This argument does not hold good in all cases. Among the labouring class, in whom this condition is so common women perform physical work almost as much as men and child bearing is definitely few and far between.

In women the mobile abdominal structures have to be adapted to gross positional disturbances occasioned by pregnancy and parturition. It is therefore quite possible that the bowel is endowed with more free mobility and consequently there is less chance of arrest of normal spontaneous detorsion.

Volvulus of the caecum:

This condition has often been described as a twist of the caecum alone when this struc-

12713



Fig. 6.

Photograph of a patient with exteriorized caecum. She was admitted with 7 days' acute obstruction. She had fairly huge distension almost simulating large bowel obstruction, but at the same time prominent ladder patterns were present. She was very much dehydrated but not so very toxic. Pulse rate 128 p.m. B.P. 90/68. On opening the abdomen, this huge caecum was extracted from underneath the twisted mesentery. The twisted border of the mesentery ran across the ascending colon about 2 inches below the hepatic flexure, making deep pressure mark over it, which did not fade in 6 days, i.e. till resection was done. In this patient the caecum and ascending colon were unfixed almost up to the hepatic flexure and consequently they were dragged towards the left, underneath the twisted mesentery. The mesentery and the coils of small bowel were in front of the caecum and that was why the ladder patterns were visible. Presumably this is the condition that has often been described as volvulus of the caecum. It is clear that the caecal condition is the result of torsion of the mesentery in a case where the caecum and ascending colon were not fixed. I have so far compared 7 cases like this. In my series of 509 operated cases of intestinal obstruction I have not come across a single case where caecum alone has undergone torsion and I cannot imagine that this can ever occur.

Note the huge hypertrophy of the caecum. This could not have occurred in 7 days. Either she had subacute obstruction for some time preceding the acute condition or she had habitual twists each lasting for some time.



Fig. 7.

Photograph of the resected bowel of the case referred to in Fig. 6. After exteriorization, an opening was made in the caecum and the obstructed bowel drained freely. Six days later, resection and lateral ileotransverse anastomosis was performed under local anaesthesia. There was moderate wound infection. The patient left the hospital 25 days after the second operation.

Note the dilatation and hypertrophy of the caecum. The ileal dilatation and hypertrophy is also remarkable in this picture.

Note the pressure mark on the ascending colon.

ture is mobile and has a mesentery. I am convinced that the volvulus of the caecum never occurs as such. In cases of volvulus of small intestine which should more correctly be called twist of the mesentery the caecum when it is unfixed is involved in this twist and passes over towards the left underneath the doubled up border of the mesentery and comes to lie on the left side of the abdomen behind the mesentery and the coils of small bowel. The site of obstruction caused by the overlying mesenteric border has now shifted to the ascending colon and the caecum forms part of the

obstructed bowel. The case cited with the photographs justify my contention (Figs. 6 and 7).

CLINICAL FEATURES

It is a low small bowel obstruction of less dramatic onset and slow progress. Initial shock is practically absent. Vomiting is not a marked feature though there are always a few vomits at the onset. Distension is always central except when the caecum is involved in the volvulus in which case the distension is more marked on the left of the midline. In the latter event the distension is also considerable simulating large bowel obstruction. Visible peristalsis as ladder patterns and peristaltic roar are present in all cases except in late ones. Both of them gradually wane as exhaustion of the bowel sets in. Dehydration indicated by sunken eyes, pinched features, dry tongue and unquenchable thirst is a marked feature particularly towards the latter part of the disease.

Circulation :

The quality and the rate of the pulse are unaffected for several days till dehydration becomes pronounced. Even in late cases the circulatory state is not too bad.

Pain :

The abrupt and acute pain is preceded by milder attacks of colic for a day or two. This feature was present in most of my cases. In quite a fair number of cases history of previous attacks of abdominal colic with transient absolute constipation was available. One case of this series was admitted into the hospital and diagnosed as acute appendicular obstruction. He had relief of pain and left the hospital. After 25 days he came back with acute intestinal obstruction. On operation volvulus of the small bowel was found and there was no appendicular pathology whatsoever.

Free fluid in abdomen :

Shifting dullness in the flank was present in almost all cases.

These features indicating milder onset and slow progress of the obstruction added

to the fact that this catastrophe occurs mostly in apparently healthy adults, i.e. subjects with healthy cardiovascular system offer an optimistic outlook.

TREATMENT

To discuss the treatment, I divide this volvulus into four stages :—

First stage :—This is the initial stage when the site of obstruction has not yet been stationary and the coils of bowel proximal to the obstruction have not yet become sufficiently distended and heavy, so that it is not unlikely for the volvulus to undergo spontaneous reduction.

Second stage :—The proximal coils have become distended and heavy but adhesions have not yet taken place and the mesentery has not yet become stiff and oedematous and spontaneous rectification may yet take place though the chances are remote.

Third stage :—Adhesions have now taken place between the bowel and the overlying mesenteric border at the site of obstruction, and between the apposed surfaces of the mesentery. The root of the mesentery, here, has become oedematous and stiff. Spontaneous untwisting is impossible at this stage and even after manual reduction the twist is likely to recur immediately.

Fourth stage :—When a necrotic band has occurred on the bowel at the site where it is pressed upon by the mesenteric border.

The treatment for these different stages may be considered as follows :—

In the first stage :—Postural treatment may result in reduction of the volvulus. This is done by placing the patient in genu-pectoral position with slight turning towards the right side. This is not a feasible procedure. The patient is in agony and does not tolerate this posture for more than a few minutes. I have not been able to carry out this treatment. Administration of morphine with atropine and complete restriction of oral intake of even water supplemented by suction is likely to effect spontaneous untwisting. In this series 5

cases had spontaneous relief after morphine, before operation could be undertaken. It is presumed they were cases of small bowel volvulus and in the first stage.

In the second stage:—If suction is carried out efficiently the volvulus may be converted into the first stage. For this long intestinal intubation under x-ray control is necessary. It is likely that spontaneous reduction will occur in some of these cases. The success of suction in the treatment of intestinal obstruction has so often been reported. I believe quite a number of these cases must have been small bowel volvulus. This is the ideal type of intestinal obstruction to be treated successfully by suction.

For the third and fourth stages:—Operation is imperative.

Now the question arises, should operation be undertaken straightaway or should fair trial be given to suction before operation.

From clinical data it is difficult to ascertain definitely what stage has been reached in a particular case.

For cases of the 3rd and 4th stages suction is bound to be futile to effect reduction of the volvulus, and delay in operation only adds to the gravity of the case. On the other hand operation undertaken in the first stage might have been unnecessary. It can be avoided also in cases of the second stage provided efficient suction is employed. It has to be borne in mind that spontaneous reduction of the volvulus in the first stage or in the second stage artificially converted into the first, by suction, is only a possibility and not a certainty. The operation carries no risk in early stages and only trivial additional risk in the late stages. So I see no ground why operative treatment should not be undertaken straightaway in all cases except the moribund. Suction, however, plays a very important role. It removes the toxic contents of the obstructed bowel and thereby prevents subsequent post-operative toxemia. It overcomes the distension and thereby early return of peristalsis is facilitated and also the cardiac and respiratory embarrassment and physical

discomfort are relieved. Taking every thing into consideration, suction is an important procedure but should not replace operation.

Operative Treatment:

Preparation: To overcome dehydration and consequent circulatory and renal failure saline is administered to the extent of 3-4 pints by intravenous, hypodermic and rectal routes. Transfusion of blood has not been considered necessary since there is no loss of blood. Plasma transfusion may be helpful when undertaken in addition to saline infusion as plasma protein content is said to be deficient though I have not been able to establish it on a few cases where I had this estimation done.



Fig. 8.

Is a close up view of Fig. 7 to demonstrate the site of obstruction, indicated by the oblique indentation on the transverse colon which did not fade in 6 days. Here it was crossed and pressed upon by the twisted mesentery.

Continuous suction is carried out for reasons already discussed.

Morphine is given when operation is decided upon.

Anaesthesia: (1) Open ether. (2) Local infiltration with intercostal block, supplemented by intravenous "Myanesisin" just before the closure of abdomen.

Operation: Right paramedian incision is made as small as is consistent with easy and quick performance of the intra-abdominal manipulation.

A large incision is suitable for quick derotation after eventrating the small bowel but the time taken in the struggle to close the abdomen and the shock as result of the mesenteric drag which occurs on eventration are points against it.

Untwisting of the volvulus without eventration (Fig. 1-a):

This is possible only when distension of the ileal coils are moderate. On opening the abdomen the distended coils are pushed towards the left and held by a large wet sponge. The collapsed terminal ileum is held between the fingers of the left hand and followed towards the left underneath the mesenteric border. The right hand is then passed on the left side and the fingers working between the coils of the bowel are made to meet the fingers of the left hand. Now the segment of the bowel immediately proximal to the obstruction is within the grip of the fingers of both the hands. This segment of bowel is now pulled by the left hand and pushed by the right towards the right side. By this manouvre there is very little risk of rupturing the bowel which might occur if the segment was only pulled by the left hand. By the time 12-18 inches of the obstructed bowel is brought over to the right side the volvulus undergoes derotation.

In cases where distension is already considerable eventration is unavoidable. Usually spontaneous untwisting takes place on eventration. When adhesions have taken place spontaneous reduction does not occur and this has to be performed and with difficulty.

After untwisting the volvulus by any of the two methods the lower end of the mesentery is fixed to the posterior parietal peritoneum by three or four catgut stitches in order to prevent recurrence.

Post-operative: To help return of peristalsis which may be sluggish or absent suction is continued with splinting of the bowel by morphine till flatus is passed. A flatus tube is left in. My practice is to get a flatus tube passed on the operation table guiding the end of the flatus tube through the abdominal wound till it reaches high up in the descending colon. I have so far never employed whipping of the bowel by pituitrin, eserine or acetylcholine derivatives. I hold that the cholinergic drugs have no place in encouraging peristalsis in exhausted bowel.

Fluid by intravenous or subcutaneous route is continued but with limitation. Proctolysis with glucose in tap water though a very efficient method of hydration cannot be suitably employed at this stage because of the diarrhoea that follows relief of the obstruction. Oral nourishment is started as soon as flatus is passed.

In cases where band necrosis has occurred only exteriorization should be done at this stage. Resection and anastomosis should be done subsequently (Fig. 5).

Results: In this series, in 291 operated cases diagnosis was either made or confirmed during operation. Out of 18 non-operated cases, in 13 that came in moribund and died without operation, diagnosis was established post-mortem. 5 cases were relieved after morphia before operation was undertaken. Diagnosis in these 5 cases were made on clinical findings and remained unconfirmed.

There have been 13 deaths out of 291 cases operated upon. 2 cases had faecal vomiting during operation. 3 cases had prolonged operation with resection and anastomosis.

In 3 cases there was no relief of obstruction, though during operation, untwisting was followed by filling up of the caecum. No fixative measure was undertaken in these cases.

In 2 cases there was paralytic ileus with gangrenous patches on the highly distended obstructed segment.

In one case the bowel was completely severed at the site of necrosis resulting in faecal extravasation. This case died on the operation table.

2 cases died 28 and 32 hours after operation of progressive toxæmia even though obstruction was relieved.

One patient aged 52 had relief of obstruction but died 20 hours after operation of progressive circulatory failure.

Causes of mortality :

1. Recurrence of the volvulus—When fixative measure is not undertaken especially in the late cases recurrence may occur immediately and may be on the operation table. In these cases obstruction remains unrelieved and mortality is inevitable if re-opening is not undertaken.

2. Non-return of peristalsis—In late cases or where the obstruction has been sudden and complete from the onset, the obstructed segment becomes widely distended, thinned out and paralytic. Peristalsis may not return and obstruction remains unrelieved. Proximal ileostomy has not been a beneficial procedure.

3. Age of the patient—The prognosis is bad in elderly subjects. Due to sclerotic condition of the coronary vessels there is poor cardiac reserve and cardiac failure supervenes even though obstruction is relieved. Mortality in these cases usually occurs between 24-48 hours.

4. Toxæmia—Late cases are severely toxic. Faecal vomiting indicating obstruction of long standing carries very grave prognosis.

After relief of obstruction the highly toxic obstructed contents flow into the healthy non-obstructed bowel. The toxins that could not be absorbed from the obstructed segment are quickly absorbed from the healthy distal segment. Profound toxæmia results and the patient may succumb within 18-24 hours.

5. Operation—This should be done as quickly as possible. Prolonged operation and resection and anastomosis done at first sitting are liable to yield bad results.

6. Pulmonary complication—Pulmonary oedema is a troublesome complication. It does not usually lead to mortality. This occurs more often in cases with great distension particularly when the caecum is involved. Early movement after operation and judiciously limited administration of saline will often obviate this complication.

7. Dehydration—If this is not compensated the blood volume remains so small, the blood so viscid and the blood pressure so low that suppression of urine and consequent uræmia may occur.

SUMMARY & CONCLUSIONS

1. This paper is based on a record of 309 cases of small bowel volvulus of which 291 were operated upon.

2. Volvulus of the small intestine or more correctly twist of the mesentery has been the commonest cause of small bowel obstruction in this series.

3. It is common in healthy male adults who are vegetarians and heavy eaters.

4. It produces obstruction in continuity by the doubled up mesenteric border pressing on the terminal ileum or the caecum or the ascending colon.

5. It is not a loop obstruction and consequently strangulation or gangrene of a loop never occurs in this condition.

6. The pressure on the bowel at the site where it is crossed by the mesenteric border leads to ischaemic condition varying from a pressure mark to a necrotic band.

7. It is not associated with any gross pathological condition of the ileo-caecal region.

8. The twist of the mesentery occurs over the superior mesenteric arterial axis.

9. A to and fro swing of the bowel at this region is believed to be a normal event and if the rectification does not occur due to some circumstances the pathological condition is established and is progressive.

10. Volvulus of the caecum is not a different entity but is a similar condition in which due to absence of fixation of the caecum this structure is involved in the obstruction.

11. Many cases of recurrent appendicular attacks in which the appendices removed are found to be normal are presumably cases of transient volvulus of the small bowel.

12. Many cases of small bowel obstruction relieved by suction are probably cases of this condition.

13. This catastrophe is less dramatic in onset and milder in progress as compared to acute small bowel obstruction due to other causes.

14. The result of operation is surprisingly satisfactory even when undertaken a week or ten days after the onset.

15. Operation has been the treatment of choice in this series.

16. Suction is employed as a routine from the very beginning as a very important procedure in the treatment but it is not considered to replace operation.

17. Fixative procedure must be adopted in all cases.

18. Post-operative stimulation of the bowel by cholinergic drug is deprecated.

19. Proximal ileostomy has proved to be an unsatisfactory procedure in this series.

ILEO-COLIC TUBERCULOSIS AND NON-SPECIFIC ULCERATION

by Mrs. V. C. ANGULI & C. P. V. MENON, Madras.

Ileocolic tuberculosis was recognised as a clinical entity long before the discovery of the *Mycobacterium tuberculosis*, our attention having been drawn by Hippocrates to terminal diarrhoea as a mortal symptom complicating phthisis. With the discovery of the different strains of the bacterium, our conception has widened and primary tuberculous involvement of the alimentary tract has been distinguished as an entity separate from intestinal lesions, secondary to primary foci in the lungs.

Although the cellular response to infection with *M. tuberculosis* is often very specific, this alone can never be considered diagnostic. Without bacteriological data, a histologist is at sea, and is often faced with similar cytological features in the study of various granulomata. As an instance may be mentioned regional ileitis with its varied nomenclature and with the divergent views on its aetiology and on the criteria for diagnosing it. Crohn, Ginzburg and Oppenheimer described their cases at the meeting of the American Medical Association in 1932 and their description of this disease remains unsurpassed even to this day. Their work had followed on that of Moschcowitz and Wilensky who, in 1923, had reported on "non-specific granuloma of the intestine." Dalziel in England, in 1931, had described a condition called chronic interstitial enteritis involving the small as well as the large intestine.

Opinions regarding the aetiology of this condition have undergone a very interesting evolution and yet much remains to be clarified. It was originally thought to be idiopathic in nature. Later it was considered a modified tuberculous process. Now it is regarded as the result of a mixed infection where secondary organisms arrest the normal tendency to resolution of the tuberculous process and cause chronic cicatrising lesions of the bowel.

Failure to demonstrate the aetiological agent in cases of non-specific ulceration leads one to the assumption that they are cases where the invading organisms perish in an acute phase of infection with secondary organisms. In the chronic phase, the marked fibrotic reaction of the tissue has perhaps led to a complete annihilation of the organisms. An entirely different conception about the aetiology of this disease has also been developed and animal experiments have been conducted to substantiate these new ideas. Cases of acute non-specific ulceration may be due to a vascular disturbance, e.g. an embolus blocking one of the straight branches of the marginal artery (a fact awaiting experimental confirmation). The chronic cases may be the result of obstruction to the lymphatic drainage of the bowel—confined to one segment or involving several segments with skip areas in between.

EXPERIMENTAL WORK

The short account that follows of a course of experiments to investigate the relationship between entero-colic tuberculosis and non-specific ulceration is part of an ambitious major study undertaken with a view to throwing more light on the pathogenesis, dissemination, mode of arrest and eradication of the established tuberculous lesion of the intestines. The experiments were conducted along the following lines:

I. An initial attempt to produce tuberculous lesions in normal animals by:

- Oral feeding
- Parenteral injection of *Myco. tuberculosis* into the wall of the gut (ileo-caecal region).

The animals were sensitised to avoid delay in the production of the lesion and at the same time to simulate the course of the disease

in man. The sensitisation was done with tuberculous proteins—old tuberculin dose 0.1 c.c. of 1 1000 diln. diluted to 0.5 c.c. with N. saline and then a series of experiments were started. Sensitised animals were subjected to the same modes of infection.

II. Taking into consideration the role of the lymphatics in the evolution of the lesion, the lymphatics were removed and observations were made after oral feeding and injection of the pathogen at the site of election.

It was realised in the course of the work that excision of the lymphatics was not easy and could not be complete. The excision of the lymph nodes was a simple procedure and produced a complete lymphatic block in an ideal manner. So the lymph nodes in the ileo-caecal region were removed and oral feeding and injection experiments were carried out.

Throughout these experiments control animals were maintained.

Attempts at introducing the organisms into the blood stream proved a failure because the animals died of shock immediately. Incidentally, it is interesting to record that in all these cases of shocked

animals, intravascular hemolysis was observed in histological sections. The significance of this observation in shock requires further investigation.

The animals chosen were guinea-pigs and the stock maintained had no particular special genetic attribute and no attempt was made to maintain a special breed with particular susceptibility or non-susceptibility towards tuberculous infection. Attempt at oral feeding through an ureteric catheter was a failure, the material often finding its way into the trachea. The object, however, was easily achieved by dripping the material mixed in sweetened milk into the oro-pharynx through a blunt needle attached to a syringe.

For laparotomy the animals were anaesthetised with ether and the abdomen was opened under sterile conditions. The lymph nodes were removed by incising the serosa over the lymph nodes and carefully enucleating them. Haemorrhage was never severe to demand any ligation, and the arrest of oozing was often obtained by digital pressure. Local injection of a suspension of *Myco. tuberculosis* in normal saline was done with a 2 c.c. syringe and a fine needle, the material being deposited in the subserosa or submucosa.

The general scheme and the observations on the experimental work are given below:

SYNOPSIS OF EXPERIMENTAL WORK

Animal	Experiment	Observations		Microscopic	Remarks
		Alimentary system	Other systems		
1 NO	Normal animal orally fed with a suspension of 0.0001G of <i>Myco. tuberculosis</i> in sweetened milk. Died immediately after a laparotomy done three months later.	Ulcers in the stomach. Prominent Peyer's patches. Enlargement of the mesenteric lymph nodes.	No other lesions in other organs.	Stomach — Acute ulceration. Intestines — Collections of epithelioid cells in the submucosa. Tuberculous reaction in the liver and the spleen.	A. F. B. in stomach sections.

Animal	Experiment	Observations		Microscopic	Remarks
		Macroscopic			
		Alimentary system	Other systems		
2 NO	Sensitised guinea pig (sensitised with 0.1 c.c. of 1/1000 old tuberculin diluted to 0.5 c.c. with N. saline injected subcutaneously in the groin 3 weeks before the date of experiment), orally fed as in the previous cases (a) Laparotomy done after 3 months. (b) Diarrhoea and cough during the 3rd month. Animal died.	Lymphnodes of the mesentery and the ileocaecal region enlarged. Generalised miliary tuberculosis.		Generalised miliary tuberculosis.	A. F. B. isolated from tissues.
3 NI	Normal guinea pig. Half the oral dose of Myco. tuberculosis injected into the subserous or submucous layer of the caecum. Laparotomy after 3 months. H'gic exudate in peritoneal cavity. Animal died on the table.	Abdominal miliary tuberculosis.	Liver, spleen showed macroscopic tubercles.	Tuberculous reaction in all the organs excepting kidney.	Culture positive for A. F. B. in h'gic exudate. Tissues showed A. F. B.
4 AI	Sensitised guinea pig similarly treated as in NI. Died in a month.	Sclerosed peritoneum with tubercles. Terminal ileum, caecum, appendix, ascending colon, mesenteric nodes show tuberculous lesion.	Spleen showed tubercles.	Tuberculous reaction in intestines, spleen, liver, lung and mesenteric lymph nodes excepting in kidney.	
5 NI.O	Normal animal in which the ileocaecal lymph nodes were removed earlier and the animal was orally fed with a suspension of Myco. tuberculosis. Died after seven months.	Tubercles over ileocaecal region.	No lesions elsewhere	Ileo-caecal region hyperplastic Peyer's patches in ileum lymphatic sclerosis, submucous fibrosis, epithelioid cell collections in subserosa.	

Animal	Experiment	Observations		Microscopic	Remarks
		Macroscopic			
		Alimentary system	Other systems		
6 ALO	Sensitised guinea pig with its ileo caecal lymph nodes removed and similarly treated as NLO. Killed after 7 months. Autopsy.	Excessive deposition of mesenteric fat. Mesenteric lymph node enlargement. Tubercles in the ileo-caecal region in the serous surface.	No obvious lesion in other organs.	Subserous and submucous tubercles in the intestines; tuberculous lymphadenitis of the mesenteric nodes. Hyperplasia of the lymph follicles in terminal ileum, endothelial proliferation of the lymphatics in the submucosa. Miliary tuberculosis of the liver and the spleen.	A. F. B. positive.
7 NLI	Normal guinea pig. lymph nodes in the ileo caecal lymph nodes were removed and tuberculous emulsion injected into the caecal wall. Killed after 4 months.	Localised thickening of the ileo-caecal region. Marked deposition of mesenteric nodes.	No lesions in other regions.	Intestine and caecum, marked submucous fibrosis, reticular hyperplasia in follicular pattern lymphatic sclerosis.	A. F. B. positive.
8 ALI	Ditto in a sensitised guinea pig. Killed after 6 months.	Excessive deposition of fat in the mesentery and the retroperitoneal space. Marked thickening to the caecum. Prominent Peyer's patch.	No lesions in other regions.	Intestine and caecum — marked submucous fibrosis, reticular hyperplasia in follicular pattern lymphatic sclerosis. Epithelioid cell collections and giant cells in sub-mucosa.	A. F. B. positive.
9 NL	Control normal animal in which the ileocaecal lymph nodes were removed. Laparotomy four months later.	Thickening of the wall of the ileo-caecal region of the gut. Mesenteric fat increased. Shrivelling of the ascending colon.		Reticular hyperplasia in follicular pattern in the terminal ileum. Caecum—marked submucous fibrosis.	
10 AL	A control sensitised animal in which the ileocaecal lymph nodes were removed.	Marked thickening of the caecal wall, prominence of Peyer's patch. Thickening of mesentery.	"	Submucous endothelial proliferation, reticular hyperplasia in follicular pattern, sclerosis of lymphatics and endothelial proliferation of the lymphatics	



Fig. 1.

Ileo-caecal tuberculosis localised to the site of inoculation in a guinea pig—after removal of the ileo-caecal lymph nodes.

From the preceding observations the following conclusions are drawn:

1. A sensitised animal is very susceptible to tuberculous infection and the disease becomes rapidly generalised. A normal animal is also susceptible but puts up a good cellular defence.

2. In the presence of an intact lymphatic system, irrespective of the site of entry of the organism, the dissemination tends to be generalised.

3. Where the lymphatics are tampered with or the lymph nodes are removed, the disease gets localised (Fig. 1) and the further spread depends upon tissue continuity established by adhesions between normal and diseased areas.

4. Removal of the lymph nodes incidentally interferes with the normal lipid metabolism and this is seen in the increased deposition of fat in the subserous layer of the gut and in the mesentery.

5. The anatomical and histological changes noticed in the gut of animals after removal of lymph nodes are similar to changes seen in chronic, non-specific ulceration of the intestine.

6. The gross morbid anatomical changes following lymphatic removal are identical in infected and uninfected animals. In the infected animals, however, histological changes suggest tuberculous infection.

STUDY OF AUTOPSY AND BIOPSY MATERIAL

The following is an analysis of the autopsy and biopsy work done in the Department of Pathology, Madras Medical College, during the period 1934—1948, with reference to intestinal tuberculosis and non-specific ulceration.

A total of 47 autopsies on intestinal tuberculosis were studied.

Table I shows age and sex distributions.

TABLE I		
Age	Number of cases	
Not specified	...	2
0-10	...	0
11-15	...	5
16-20	...	10
21-25	...	2
26-30	...	5
31-35	...	8
36-40	...	3
41-45	...	2
46-50	...	8
51-55	...	1
56-60	...	1
Total	47	
Males	41	
Females	6	
Lesions in intestines only	11 23.4%	
Lesions in intestines & lung	36 76.6%	

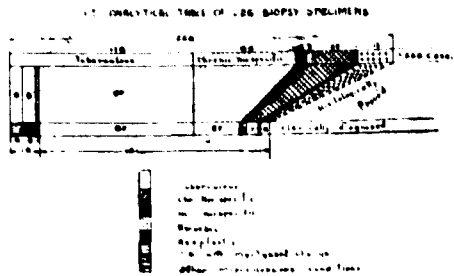
Nearly 50% of the cases fall in the age group 15—40. Lesions in the lung were found in 76.6% of these cases in addition to intestinal lesions, and 23.4% showed only lesions in the intestine—primary intestinal tuberculosis.

During the same period, 226 biopsy specimens were examined for various pathological conditions of the intestines (Table II). Of these, 116 were of tuberculosis and 71 were of non-specific ulceration (acute and chronic). The statistics are interesting from the point of view of age and sex incidence. The incidence of tuberculosis is equal in both sexes whereas non-specific ulceration is more common among the males than females in the ratio of 2 : 1. A large number of cases in both groups of diseases fall into between 16—40 years a period associated with loss of resistance or weakened resistance when the individuals are subjected to maximum stresses and strains of life.

The age and sex distribution of intestinal tuberculosis and non-specific ulceration in a series of 187 cases is shown below:

TABLE II						
AGE	Intestinal Tuberculosis			Non-specific ulceration		
	Male	Female	Total	Male	Female	Total
?	6	5	11	4	—	4
0-5	—	1	1	—	1	1
6-10	1	3	4	—	1	1
11-15	3	10	13	2	—	2
16-20	4	7	11	1	3	4
21-25	11	15	26	4	1	5
26-30	10	7	17	13	6	19
31-35	7	6	13	9	2	11
36-40	7	1	8	9	4	13
41-45	4	1	5	4	3	7
46-50	4	—	4	2	2	4
51-55	—	—	—	1	—	1
56-60	1	—	1	—	—	—
61-65	—	—	—	—	—	—
66-70	1	—	—	1	—	—
Total	58	58	116	49	22	71
Per-centage	50	50		69.1	30.9	

TABLE II



From the analytical table one could see how often one of these diseases is mistaken for the other and how often neoplasms offer difficulty in differential diagnosis.

As a result of the clinical and experimental studies certain general observations may be made:

Primary intestinal tuberculosis: The organisms could enter through an intact mucosa and leave their trail in the intervening lymph nodes. Further dissemination depends upon the resistance of the individual and patency of the channels of spread. Where the resistance is good, the disease tends to get localised and this process is aided by the tissue barrage raised by endothelial proliferation in the lymph channels—both in lymph nodes and in afferent and efferent lymphatics. Under favourable conditions a hyperplastic tuberculous reaction is noticed and very little of caseation. The disease may heal spontaneously or pursue a chronic course, with ulceration, stricture causing subacute obstruction and fistula or sinus formation.

Tubercles on the serous surface are noticed in the early stages and also during the stage of ulceration; they disappear with the onset of fibrosis when stenosis results. The ulceration on the mucosal surface is undermined and placed along the transverse axis (girdle-shaped) (Fig. 2); with healing these characteristics disappear. The muscle coat shows tubercles on cross section (Fig. 3) and later when caseation results, this layer is not well demarcated



Fig. 2.
Tuberculous ulceration of the small intestine.



Fig. 3.
Tuberculous reaction in the muscle layer.



Fig. 4.
Commencing ulceration of the mucosa, submucous reaction suggested reticulosis? (same case).



Fig. 5.
Submucous endothelial proliferation, lymphangiectasis and lymphoid cell collections — reticulosis? in a case of tuberculosis of the intestine, proved by guinea pig inoculation.

and, finally, is replaced by fibrous tissue. This fibrous replacement in the continuity of the muscle coat perhaps accounts for the absence or cessation of peristalsis over the affected segment of the gut. The propulsion of the chyme is dependant upon the consistency of the material, the patency of the lumen and the peristaltic force of the muscular layer of the gut. Where the muscle layer is replaced by fibrous tissue, there is discontinuity in the peristaltic wave

and this may explain the cause of intestinal obstruction in some cases.

Histopathology: The earliest lesion in tuberculosis is submucosa or subserous tubercle formation (Fig. 7), perhaps preceded by lymphoid and reticular hyperplasia (Figs. 4, 5 & 6). Epithelioid cell collections with formation of giant cells and final central caseation is the typical lesion (Figs. 8 & 9); peripheral collections of lymphocytes are seen round the tubercles.



Fig. 6.
Submucous endothelial proliferation — in a case of tuberculous ulceration proved by guinea pig inoculation.



Fig. 7.
Submucous tubercle.

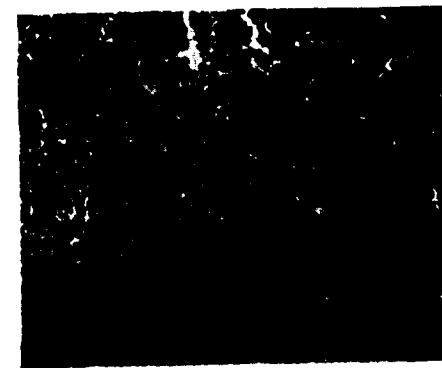


Fig. 8.
Caseation with giant cells and epithelioid cells.



Fig. 9.
Various stages in the evolution of tubercle formation in the subserous layer.

When the disease has been violent in onset, there may not be this orderly reaction of tissue; extensive necrosis may be the only evidence of infection. Acid fast organisms can be demonstrated in the tissue. There has been difficulty in growing the organism from the tissues directly, but it was possible to isolate the organisms after transplanting the tissues into experimental animals

which were allowed to develop the disease.

Pathology of non-specific ulceration: In some cases diagnosed as acute non-specific ulceration, it was possible to demonstrate *Entamoeba histolytica* on repeated histological examination. Some of these acute ulcerations, sometimes leading to perforation may also be due to vascular obstruction such as an embolus blocking a branch

from the marginal artery—a miniature replica of what happens in thrombosis of the superior mesenteric artery. Since the infarcted area is small, instead of perforating, inflammatory reactions on the serosal surface may aid healing. Fibrosis of this segment may result in a single stricture, and may be mistaken for non-specific ulceration.

The chronic lesions may be the end result of an ulcerative process, (ulceration being secondary to tuberculous enteritis or enteritis due to any other cause where the pathogenic agent is not demonstrable) or due to lymphatic obstruction to a segment or segments of the gut with skip areas in between.

The aetiology can be classified as follows:

Non-specific ulceration :

1. Acute cases : Vascular occlusions as a result of an embolus blocking one of the straight branches from the marginal artery

2. Chronic cases :

- (a) Acute ulcers becoming chronic.
- (b) Chronic ulcers (due to obstruction to lymph drainage).
- (i) Congenital absence of lymphatics or failure in canalisation.
- (ii) Obstruction to the lymphatics as a result of inflammation of the mesentery or inflammation of the lymphatics and lymph nodes.
- (iii) Pressure on the lymphatics by neoplasms.
- (iv) Lymphatic sclerosis.

In the acute phase, acute inflammatory changes with signs of imminent perforation are noticed and in a case where the transverse colon had to be resected, autopsy revealed amoebic ulcerations in the caecum and ascending colon. In other cases patchy gangrene in the wall of the gut is noticed, black in colour and friable. The intestine in chronic non-specific ulceration presents very typical features. The subserosal fat is very markedly increased and very often the

gut is obscured by the dense layer of fat all round and especially in the colon the appendices epiploicae are prominently numerous, larger in size and distended with fat. Where a fistulous track is found, it could be traced from the gut wall to a pool of pus surrounded by dense connective tissue and fat. The appearance of the gut suggests considerable thickening, but on section the wall of the gut itself is reduced in thickness, the distinction between the various layers are lost due to fibrosis. The mucosa is found ulcerated or absent over large tracts or absent over islands and in the centre of these islands may be found small papillary areas of hypertrophied mucosa (Fig. 10). The lumen is very much



Fig. 10.

Non-specific ulceration of the ileo-caecal region.

narrowed often admitting only the tip of a quill, and multiple stenosis may be found situated at a distance of a few inches as in tuberculous ulceration (Fig. 11). The portion of the gut proximal to the stenosis is dilated, and stercoral ulcers may be found in this region. The local lymph nodes are buried in a mass of fat and, on section, present a homogenous appearance and at times resemble hyperplastic tuberculous lymphadenitis on section.

Histopathology : The histopathology presents the following phases in the develop-



Fig. 11.

Tuberculous ulceration with stenosis of the ileo-caecal region and the transverse colon (macroscopically simulated non-specific ulceration).



Figs. 12 & 13.

Fig. 12. Left. Submucous endothelial proliferation in a case of non-specific ulceration

Fig. 13. Right. Endothelial proliferation in follicular pattern with formation of giant cells.

ment of the cellular changes. Submucous reticular hyperplasia, endothelial proliferation, follicular collections of lymphocytes, submucous oedema,—usually lymphoedema, and lymphangiectasis are the early changes to be seen (Figs. 12—14). With the folli-

cular hyperplasia of the lymphoid tissues and endothelial proliferation, denudation of the epithelial cells and ulceration of the mucosa result. Vascularisation is not very evident, but the changes in the lymphatics are arresting. Even before the endothelial

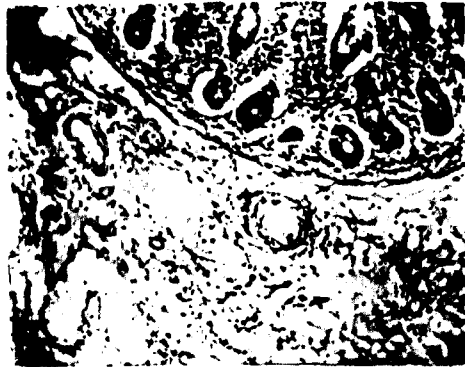


Fig. 14.

Submucous oedema and lymphangiectasis—from a case of non-specific ulceration.



Fig. 15.

Submucous fibrosis in a case of non-specific ulceration.



Fig. 16.

Lymphatic sclerosis in the subserous layer—from a case of non-specific ulceration.

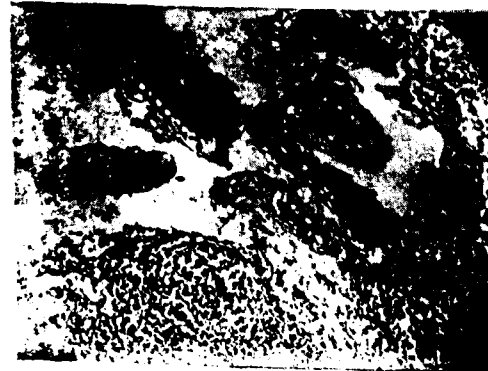


Fig. 17.

Lymphangiectasis and lymphatic sclerosis in a mesenteric node—(same case).

proliferation, the lymphatics in the lacteals and the submucosa layer are engorged with lymph and later endothelial proliferation of the lymphatics occurs and in the final stages marked sclerosis and endobliterative changes take place in the lymphatics (Fig. 16). Concomittant with these changes, progressive fibrotic reaction is seen in the submucous layer (Fig. 15); the muscle and the subserous layers show endothelial proliferation in their lymph vessels in the earlier stages, and, later, infiltration with chronic inflammatory cells, mostly composed of lymphocytes. Perhaps it is this

stage which is referred to as 'Reticulosis', because of the predominant reticular and endothelial hyperplasia and the resemblance of the cellular reaction to what is found in the early stages of Mycosis fungoides,—a pleomorphic cellular reaction with a preponderant reticulo-endothelial proliferation. Giant cells may appear in the midst of endothelial cells in the sub-mucosa and such appearance may simulate a tuberculous reaction. These are foreign body giant cells which are supposed to appear after the ulceration.

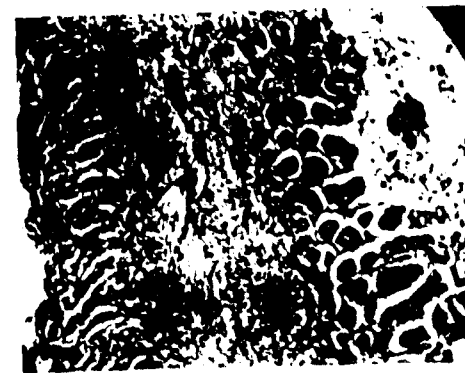


Fig. 18.

Submucous endothelial proliferation (guinea pig).

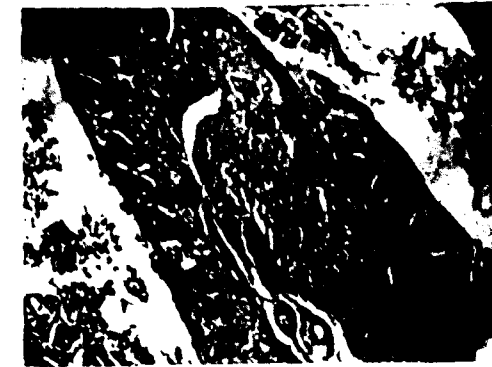


Fig. 19.

Lymphatic sclerosis in the villus of the intestine (guinea pig).

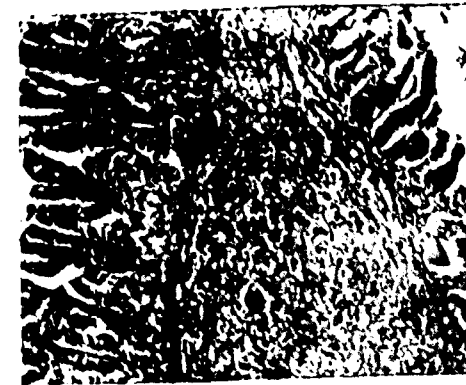


Fig. 20.

Submucous epithelioid collections and giant cells (guinea pig).

The local lymph nodes show sinus catarrh and lymph stasis. The afferent and efferent lymphatics undergo dilatation and sclerotic changes (Fig. 17). Whether giant cells occurring in the lymph nodes are genuine giants or pseudo ones should be considered. Cell collections around an area of lymph stasis may simulate giant cells. A lymph vessel with lymph inside and prominent endothelial cells in the periphery gives an appearance similar to a giant cell.

The changes in the lymphatics are always associated with lymphatic obstruction. Excessive fatty infiltration in the subserous

layer is found in all the experimental animals in which the local lymph nodes were removed. The endothelial proliferation, the reticular hyperplasia and the endobliterative changes are seen in these animals also and these changes are similar to those found in cases of non-specific ulceration (Figs. 18, 19 & 20). The fatty infiltration, the cellular reaction, the oedema and the ulceration of the mucosa, the changes in the lymphatic vessels with evidence of lymph stasis and the fibrosis that follow chronic lymphatic obstruction lead to the conclusion that lymphatic obstruction is one of the main causes of non-specific ulceration.

CONCLUSION

Does healed tuberculosis in the terminal stages present a picture of non-specific ulceration? The preponderating majority of this series of 44 surgical cases has been proved, on painstaking histological examination, to be tuberculous, but it has not been possible to demonstrate the acidfast organisms in the tissues or to grow them in culture. It was possible to isolate the organism—after transplanting them into animals. The ulceration in the gut was typical of non-specific ulceration and the lymph nodes showed tuberculous reaction. In the experimental animals it was possible to produce lesions similar to non-specific ulceration by removal of the

lymphatics and wherever acidfast organisms were introduced into the ileo-caecal region, it was possible to demonstrate the acidfast organisms in the lesions. In these latter cases, cellular reaction (epithelioid cell collections and giant cells) typical of tuberculous reaction was noticed, in addition to the histological changes found in the control animals without lymphatics. The indefinite staining reactions of the acidfast organisms and the difficulty in recognising the other morphological variants,—Much's granular forms etc.,—and the paucity of organisms in the tissues of non-specific ulceration secondary to tuberculosis may account for the difficulty experienced in establishing the relationship between tuberculous enteritis and non-specific ulceration. With experience in animal experimentation and with perfected bacteriological technique, it is hoped to find this missing link in the evolution of the disease.

ACKNOWLEDGEMENTS

This paper is based on the work undertaken on Enterocolic Tuberculosis under the kind auspices of the Indian Research Fund Association. Our thanks are due to the Professor of Pathology, Madras Medical College, for his help and advice. Grateful acknowledgements are due to the Superintendent of the Government General Hospital, for kind permission to use the clinical material available there.

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TREATMENT OF BONE CAVITIES IN CHRONIC OSTEOMYELITIS*

by D. K. SABHESAN, Poona.

This is a serious crippling disease frequently occurring in children and sometimes in adults; it often entails a prolonged period of disability; the acute stages have in the past been attended with a considerable mortality; since the discovery of the sulpha-drugs and recently of penicillin, the mortality has been reduced to an almost negligible level; but still the ravages of the disease often leaves a grossly distorted and damaged osseous structure with consequential changes in the soft tissues, resulting in disturbed function. Though sepsis can be readily brought under control in the acute stages of chemotherapy, the structural defects in the bones and soft parts left, prevent the complete eradication of sepsis, as the damaged and devitalized tissues interfere with repair and lead to chronicity and prolonged ill-health. In the case of growing children it results in delayed physical and mental development, considerable national economic loss, with a possible permanent defective man power; and in the case of adults, there is the immediate loss of earning capacity and its implications of family handicaps and disadjustments. It is, therefore, worth while considering whether this prolonged period of disablement cannot be curtailed, and the sufferers returned as quickly as possible to be useful to society and contribute their quota to the national economy.

Chronicity:

The passage from the stage of acute osteomyelitis to the chronic period is a gradual process; it is characterised by the persistence of fistula and sequestrum which keep up the suppuration; in chronic osteomyelitis, the necrosed bone is denser than the neighbouring bone after 3—6 weeks, and then a line of demarcation appears between the living and dead bone; the sequestrum is usually surrounded by a

clear halo as seen in a radiogram. Chronicity is accompanied by rigidity, ankylosis, atrophy etc.; furthermore, infection is favoured by lesions of soft-tissues, nerves and tendons and amyloid degeneration and secondary anaemia. The presence of cavities, indurated bone, scar tissue and impediments to lymphatic and blood circulation causes penicillin treatment to fail; fistulas cause secondary infection with penicillin resisting micro-organisms; the secondary contaminants which delay wound healing have been found to be *Pseudomonas aeruginosa*, *Proteus vulgaris* and *Aerobacter aerogenosa*; even the usual penicillin sensitive pathogenic organisms become resistant to the antibiotics after sometime, particularly in the presence of these secondary contaminants and necrotic devitalized material. (Haemolytic *Staphylococcus*, Haemolytic *Streptococcus*, Non-haemolytic *Streptococcus* and *Pneumococcus* are extremely sensitive to penicillin; early administration should prevent the extensive thrombosis of the nutritive vessels with periosteal stripping.).

The principal factors responsible for maintenance of the infection in a chronic state are

- (1) the rigidity of the wall of the bony cavity,
- (2) the vessels running in the Haversian systems cannot expand or contract and
- (3) the sequestrum imprisoned within it cannot be extruded easily; small ones are discharged at intervals through the sinuses while residual fragments and bits reach the surface after varying periods, often long after the healing of the wound. Infection in the bone is therefore hard to control, and even if it is arrested the surrounding bone is abnormal because of the diminished circulation, being much denser than normal, the loss of organic material and the presence

*A paper read at the XI Annual Conference of the Association of Surgeons of India at Madras, during Dec. 1949.

of isolated cavities containing dormant organisms.

Removal of Dead Tissues :

It is therefore essential in the first instance to remove all dead tissue—bone or soft tissue alike, and this satisfactorily performed will pave the way for eradicating sepsis; recurrence and failure have often resulted from not realizing that damaged soft tissues (in close proximity or lining sinus tracks and the necrotic processes resulting from rough handling and stripping during the operation of dead bone removal) frequently die from impoverished blood supply and contamination with pyogenic organisms. Removal of a sequestrum should be delayed until there is a spontaneous separation; there should be no interference particularly in traumatic cases till erythrocyte sedimentation rate is down to or near normal; this can be achieved by an adequate period of rest. Early and frequent operation leads to increased fistula formation and increased sequestration. The ideal to be aimed at is "physiological sequestrectomy"—(Reuber) i.e. when the sequestrum is fully separated and with minimal damage to soft parts; especially in the case of the shaft of the femur or the humerus, sufficient time must elapse for the involucrum to become consolidated; extraction of a sequestrum not loose is likely to traumatize living bone in juxtaposition, and is also more likely to be incomplete. Undue delay, however makes the involucrum very dense, sclerotic and healing becomes difficult, as the blood supply to the new bone is impaired from the dense scar tissue encasing the surrounding soft parts. The process of complete detachment of a sequestrum from its moorings, is often however, a very slow and tedious one, and meanwhile the patient's general condition deteriorates from profuse purulent discharge from infected sinuses, progressive toxic absorption, resultant hypoproteinaemia and secondary anaemia; under these circumstances, there can be considerable improvement, if free drainage can be established by connecting up sinuses and evacuation of any free and loose dead bits only, and instituting the

appropriate chemotherapy. After a few days, the limb can be encased in a well-padded plaster cast, and the case reviewed after 4—6 weeks, for embarking on a radical sequestrectomy. In this connection it will be useful to refer to a type of treatment which has been found very useful in the removal of sloughs and dead bone and bringing the wound to a cleaner stage wherein, it may be possible to attempt the sequestrectomy operation under more favourable auspices. It is the "Maggots Treatment"—(Shrubshell of Burgesshill saw it first in China in 1888) and Dr. Williams Baer of John Hopkins University refers to it in the following way. "The naturally grown larvae of the blue and green bottle flies are not safe; they might contain both pathogenic micro-organisms or spores. Eggs cultured and free from infection can be kept alive and active in wounds for atleast 5 days before they pupated." His conclusions are :—

- (1) Maggots are useful adjuncts to thorough surgical treatment—far more successful in securing permanent healing of these extensive wounds than any other method tried by us.
- (2) Maggots by their digestive action, clear away the minute fragments of bone and tissue sloughs caused by operative trauma, in a way not accomplished by any other means—and are a valuable asset in healing.
- (3) Maggots cause wounds to become alkaline and in this way diminish the growth of pathogenic bacteria.
- (4) Maggots seem to have other more subtle biochemical effects within the wound itself and perhaps cause also a constitutional reaction inimical to bacterial growth.
- (5) Maggots reared thus are safe.
- (6) Post-traumatic and post-operative general condition of the patient is better in maggots treatment than in treatment with chemicals or dressings.

- (7) In bone tuberculosis with abscesses with or without secondary infection, wide exposure followed by maggots treatment is effective.

[Elmslie (BMJ-2-62) condemns this as an unsurgical and somewhat offensive method.]

Eradication of sepsis in the wound is essential before plastic procedures can be undertaken to close an osseous defect; when once dead tissue has been removed, and adequate drainage provided for inflammatory exudates and products of tissue damage following operating trauma, there is every reason to expect quick healing provided there are no mechanical obstacles to healing and reinfection does not occur. In any case the institution of an appropriate chemotherapy (in some cases both sulpha and penicillin) will effect a rapid progress in the cleansing up of the wound. It is however not always possible to close up a wound after sequestrectomy; sometimes it is due to want of sufficient skin cover and very often plastic procedures may have to be undertaken.

Difficulties in the healing of post-operative wounds :

One of the main difficulties is the disproportion in the rate of healing of the skin and soft parts to the filling up of the osseous floor; while epithelialisation takes place rapidly from the surface, the depths of the wound are not obliterated and latent pockets of retained blood clot, inflammatory exudates and mild dormant infection persist giving rise to a disruption of the wound and a discharging sinus after an apparent satisfactory surface healing. One of the main objects in using sterilised vaseline is its power of retardation of healing process in addition to its being a space filler—non-adherent and comparatively inert; it actually makes the granulations on the surface pale, exuberant and fluffy. To obviate this difficulty, Jorns of Liepzig recommends the use of elastic wound spreaders to keep the wound open so as to allow healing from the bottom; these are made of chromium plated spring steel in different sizes. During the

operation of sequestrectomy it may be possible to prepare and plan the bed for rapid healing and adequate coverage; in such cases after removal of the sequestrum or dead tissue there is left an irregular wound in the soft tissue with a bony trough at its bottom, and this should be made a flat bed or a shallow sloping depressed surface over which adjacent soft parts can fall and thus obliterate the dead space. This however is possible only in a small percentage of cases; it is more often necessary if possible to saucerize the bone. Overhanging bone edges must be cut away so as to leave a cavity with gently sloping walls; the defect in the bone, must be converted if possible from a tunnel to a shallow trough (Fig 1). This may be a simple procedure or one too



Fig 1
Tunnel into trough.

drastic to be done in one stage as it may lead to weakening of a single parent bone; in such cases "stage operations" will be needed.

Wound Healing :

The trough at the bottom of the soft tissue wound, may then be allowed to fill up by healing from the bottom; this is however a long process and leads to prolonged convalescence and impaired nutrition from surface loss of valuable material. To obviate this, the technique of Winnett Orr's (of Lincoln, Nebraska) closed treatment with plaster casing was advocated. After free exposure, cleansing and saucerisation the whole wound is plugged with vaseline gauze and another piece of vaseline gauze is spread over the area; vaseline is smeared lightly on the skin for a considerable distance around and the limb immobilized in a padded plaster cast. The advantages of this method are the infrequent dressings necessary and the patients do not require hospitalization in the general wards and thus hospital accommodation is conserved. Objection to its use however is the fetor and discharge; the infected malodorous wound encased in a dirty, stained plaster cast has now given place to a cleaner and more satisfactory surgical procedure; it is now clearly realized that the best dressing for a clean raw wound is normal or healthy skin, if possible with a pad of soft part under it.

Re-surfacing of post-operative wounds :

This leads us to the question of re-surfacing procedures that are in common practice. The aim of these procedures is to supply a suitable and adequate skin layer and or to create conditions favourable for major procedures on the deeper structures if necessary at a later date. This may be accomplished by the use of either

- (1) free grafts or
- (2) by flaps which may be
 - (a) contiguous
 - (b) direct flaps from the opposite extremity or

(c) distant flaps from the trunk.

(1) The free skin grafts are of intermediate thickness and is the simplest method and the one ordinarily used. It is a one stage procedure but its use is limited to areas where there is a soft tissue pad particularly over the bone as otherwise it has a tendency to form indolent ulcerations. Where there has been considerable loss of skin from excised skin edges which leave retracted margins but soft parts are available for covering the bone defect, this is an excellent procedure. It is also useful however to use it in conjunction with the use of extremity flaps to cover the secondary defect arising from the donor areas. Thin Thiersch grafts are used extensively for temporary resurfacing though later the areas would ultimately need more adequate cover.

(2) Where a soft tissue pad is needed in addition to skin, a flap is indicated. This



Fig. 2.
Relaxing Incisions.

serves as a protective as well as a vascularising factor in its new location; its use however should be delayed for a few weeks after the cessation of the drainage to prevent a flare up of the infection which will make the condition worse. A relaxation incision (Fig. 2 & 3) with complete undermining of the bridge of skin between it and the defect forms a bipediced sliding flap. It is particularly



Fig. 3.
Sliding bipediced flap.

applicable to a long and narrow defect. When the defect is broader and is square or circular in shape, a single pedicled rotation flap of adequate size and thickness can be made to adapt itself better to depressions and uneven surfaces. Where a contiguous flap of adequate size and thickness could not be obtained, it may often be possible to take a flap from the opposite extremity. An example of this is the crossed leg flap. In designing these flaps, the pedicle should be kept as wide as possible and its length should never be more than one and half times its width if possible. The recipient area must be approximated to the source of the flap and therefore the procedure indeed is a major operation requiring a consider-

able dissection. The middle and lateral posterior surfaces of the upper 2/3 of the legs and the lateral and anterior aspects of the thighs are most frequently used. The pedicle is severed in 3 weeks.

Distant Flaps :

In several instances, it may be necessary to get a flap from the abdominal wall or other distant source from want of a proper

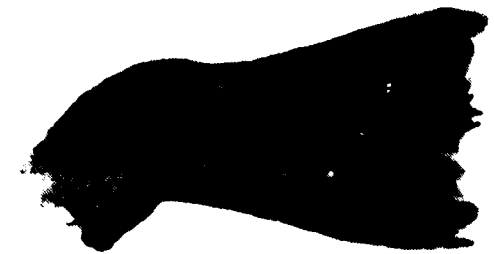


Fig. 4.
Single pedicle flap for a cupped cavity.

source nearby or from the opposite limb. This method however should be used only as a last resort. A tubed flap is the safest and most convenient form of transferring tissues from the trunk to the leg.

In the majority of cases however resurfacing is only one phase of the treatment. It will be necessary after sometime to effect a more satisfactory and permanent closure of the gap left in the bone and soft tissues, which we will consider now. The provision of a skin cover accelerates wound healing and improves the general condition of the patient more rapidly and also prepares the bed for further treatment more satisfactorily.

Cavity Obliteration :

Various methods have been suggested to obliterate the cavity in the bone. It may be filled with

- (a) foreign material or
- (b) living tissues like
 - (i) muscle or
 - (ii) bone.

It is a matter of individual selection and the requirements of each case have to be

studied carefully and the proper material chosen. No two bone cavities are alike, as regards their size, shape, situation or nature of their surroundings; a small shallow osseous cavity in a limb well clothed in muscles, may heal quite satisfactorily from the margins and the bottom, whereas a large cavity in a bone which is practically subcutaneous to a great part of its extent cannot fill up so easily.

(A) Foreign materials have been various.

(1) *Mosetig Moorhof's paste*, made up of iodoform 60, spermaeetic 40, oil of sesame 40, was used when I was a student in Edinburgh; later sterilised plaster of Paris mixed with sterile water was used; amongst other materials reported to have been used are dermatol, resin, melted pure sulphur etc.; most of the above have been abandoned in favour of more satisfying and less foreign materials.

(2) Excellent reports have come about the satisfactory use of sterilised mutton fat; as it could be poured into a cavity in a liquid state, it can fill every nook and corner of any irregular cavity, and as it sets at body temperature it cannot flow out and is therefore a satisfactory space filler. This is particularly useful in situations where saucerisation is not practicable, as in the case of deep seated cupped cavities.

(3) Recently Heatzer of Leipzig and later Grundman of Berlin have reported the use of sterilized *sea-sand* as filler of bone cavities; the action of sea-sand on wounds is complicated and consists of a chemical cleansing action from the silicates which calls forth a hyperaemic reaction, a mechanical cleansing action, suppression of excessive granulation from pressure, absorption of foreign material, drainage and holding the wound open and the formation of a protective coat of silicate; sea-sand should be used to fill the defect after the removal of all foreign bodies and sequestra and guttering the osteomyelitic bones. The use is simple; the wound after excision is filled with sterilised sand under pressure and covered with a compress and bandage. Dressing is infrequent and there is some odour. Rapid healing with diminished for-

mation of scar tissue is claimed (Grundman—Berlin).

(4) "*Gel-Foam*" can be used as an excellent space filler; it is absorbable, can be moulded well to adapt itself to the recesses of an irregular cavity; its additional advantage is its haemostatic action—just the very thing wanted to be applied to a vascular oozing area. After thorough surgical debridement, the wound is packed with "*Gel-Foam*" or "*Fibrin-Foam*" soaked in streptomycin, (local dosage being 150,000 units daily) with 200,000 to 500,000 units, intra-muscularly every 3 hours; daily local streptomycin therapy is continued until bacteriological proof of a clean wound is obtained. *Ps. aeruginosa*, resistant to streptomycin was combated with 1% acetic acid solution applied for 24 hours; it effected a more rapid abeyance of the infection.

(B) (i) *Muscle graft*: Muscle has been for a long time used to fill up gaps left in the bone; it is living tissue, it sticks to a raw area and stops bleeding, can be snugly moulded into any not too irregular cavity. It is particularly indicated for filling a large tunnel in the bone with overhanging edges which cannot safely be removed as it will leave a thin shell far too weak to stand the strain of powerful leverage or support body weight. Its use however is not always practicable. While it can be used as a primary operation of sequestrectomy easily, it is difficult to get an adequate muscle flap in older wounds where packing and plaster have previously been restored to. When it cannot be anchored in properly, when not filling the space fully and when its life is threatened by a too slender blood supply, it very often fails. A pedunculated muscle flap cut from the neighbourhood, falling into the cavity and filling it up evenly should be held in place by catgut sutures passed through small holes at the periphery of the shallow bony cavity. A flap should be raised if necessary by detaching it from its fascial sheath and lifting it up from the parent muscle, attached by a broad hinge (Fig. 5); and when dropped should snugly fall into the cavity and fill it. Local penicillin instillation and immobilisation in plaster should follow. I have given up the

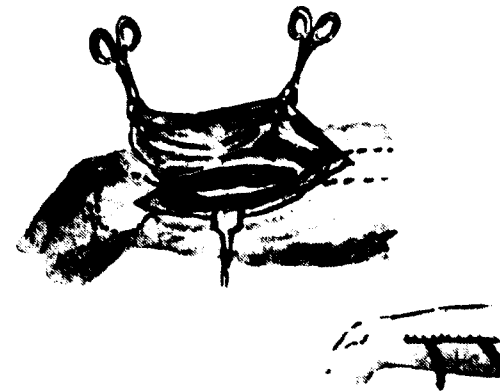


Fig. 5.

Muscle flap for a long canal.

use of local sulphonamide dusting as it becomes often gritty on sterilisation and does not lend itself to uniform dispersal. Penicillin should be preferably administered locally for 4 days, through glass tubes fixed in the plaster cast, in addition to systemic penicillin for ten days, together with sulphonamides. Some surgeons however consider that muscle implantation is unsuitable as it too frequently necroses; I do not think it will do so, if the bed is good, free from necrotic tissue or blood clot and if the muscle flap has a good blood supply—a sizable nutrient vessel; the ratio of the length of the flap to its breadth should not be more than 3 : 1; the principle is to cover healthy bleeding bone surfaces with healthy soft parts and absolutely without tension. Immediate closure without drainage and immobilization in a light plaster cast under a penicillin umbrella will secure a primary union in 90% of the cases, but the union is likely to be permanent in only 60% of these; in the remaining 40% after a few weeks, signs of a residual abscess nearby at one extremity or other of the wound will appear and when evacuated may probably show small bits of necrosed bone or soft parts. Lord advocates drainage and irrigation of the wound after operation for the first 12 hours with sodium citrate to obviate collection of clotted blood and therefore uses Dakin's solution. Failure to heal will be attributable to (1) incomplete removal

of scar and sclerotic bone (2) inadequate blood supply to bone and soft part coverings or (3) too great tension in the margins. The method is unsuitable for chronic cavities in the short bones as for example the calcaneus.

Bone grafts:

The ideal space filler for a cavity in the bone is bone itself; it may be a living transplant or a dead bone; autogenous, homologous or heterogenous; it may be packed in as chips or as a massive graft about the size of the defect. There is still a good deal of controversy about the fate of these various types of transplants. Ahaussier (in 1903) showed that the main part of the transplant dies but some degree of endosteal and subperiosteal bone formation may be retained. Leriche established the fact of permeation of the transplant. In 1912 McEwen's experiments proved definitely that the periosteum has no osteogenic function; it is regarded merely as a vascular limiting membrane but useful as such in assisting in the organic union of the transplant. Experiments with minute fragments or shavings of bone when transplanted showed that they can survive and act as centres of ossification. As a practical proposition, however it is still held that the main part of the transplant dies and new vessels grow in from the surrounding tissues, make their way along the Haversian canals and revascularisation of the necrosed bone occurs. Thus the graft becomes absorbed and at the same time replaced. The natural corollary from this will be that a dead bone would be as efficient as a living transplant in the living host, it has also been definitely shown that no recognisable differences macroscopically or microscopically are seen between living transplant and dead bone. What is however essential for success is that the transplant should be permeated and for this, it is necessary that the transplant should be firmly fixed in close contact with the living bone of the host. Permeation however is not a necessary consequence in every case and bone if, of a very dense texture may become encapsuled like an aseptic foreign body and its presence may be tolerated. McEwen has shown that the small transplants increase in size through a

combined proliferation and outpouring of all osteoblasts.

Taking all the above considerations in the use of bone grafts to fill up defects in the bone, we are left with the question of selecting the proper type of graft for any particular case. Some of the causes of failure of bone transplant may here be mentioned.

- (1) Infection causes failure of graft to unite to its bed. It also introduces the complication of septic necrosis; the open mouths of the Haversian canals which use such lymph as available, must not be injured by a hot saw and any technique must protect the endosteal surface and the sub-periosteal cells.
- (2) Insecure contact of the graft leads to its being thrown out.
- (3) Insufficient immobilization also results in a failure, and lastly
- (4) The graft should not be laid into an avascular bed of sclerosed ivory bone. It is quite unnecessary to transplant periosteum as well as bone; but if periosteum is available, it may help in the permeation of vascular channels from the surrounding tissue into the graft and facilitate the purpose of replacement of the original transplant.

Sources of the Bone-graft: There are three possible sources. (1) From the patient himself, (2) from amputated limbs or dead bodies and (3) animal bones.

There is no doubt that an autogenous graft is superior to a boiled dead graft but the main mass acts as a bone conducting medium and a space filler. And this is the most important objective in the filling up of bone cavities. When once the empty space in the saucerised bone has been filled up and provided with proper soft tissue coverage healing is rapid and general health improves rapidly.

Method of repairing a bone defect: Before proceeding to use a bone graft, it is essential to make sure that there is no dormant

sepsis; unfortunately skin may heal over tissues which are potentially infected; the presence of residual infections is often masked by concurrent antibiotic therapy, in some cases with fatal result; an unhealthy-looking scar, repeatedly scabbing in spite of treatment is suggestive of infection and must be regarded as such: X-Ray will give valuable information regards the presence or absence of infection; in a clean wound, the margins of the bone will be sclerosed, whereas if infection is active, the bony edges may be fluffy or sequestra may show. General operative technique is: expose the defect; reflect the skin, free the edges and ensure that the grafts fit in snugly into the defect and enable holes to be drilled into the bone if the graft has to be sutured into position by this means.

(i) **Bone chips as transplants:** This is the easiest of all methods, but not always successful.

Tibial defects following osteomyelitis are very common indications for this type of osteoplastic repair. When the post-operative sequestrotomy wound is clean, granulating and well stabilised and the temperature has remained normal for more than two weeks, it is time to think of securing adequate coverage for the raw area. Smear examinations from the surface are made to study the bacterial flora of the area; if satisfactory, the patient is put on a 'penicillin umbrella' for 48 hours and then taken up for a filling operation; the cavity is again debrided; if skin graft has been used, it is excised; the medullary cavities leading into the defect on both sides, are opened up and the defect itself is filled with cancellous bone chips taken from the iliac crest through a trap door raised in the bone. The skin over the tibia is mobilised and drawn over the defect. It will be necessary to make relaxing incisions to close the skin; a stab is made at the most dependant portion of this relaxing incision into the base of the cavity and a rubber drain is inserted. The wound is dressed heavily with gauze and a plaster of Paris posterior splint is applied. The drain is removed in 5 days; a number 12 soft rubber catheter is inserted into the track of the drain and incorporated in the

dressing so that 100,000 units of penicillin in 10 m.l. solution can be irrigated into the wound bed. Full doses of penicillin are continued parenterally together with sulphonamides.

(ii) **Massive graft:** is particularly useful to fill a long tubular defect in the femur or tibia; but it is essential for the take, that it should be used in a clean aseptic wound which has previously been grafted.

It is also easy to bridge the gap in the tibia left by old osteomyelitis by using terminal grafts. It is amazing that some of these grafts would survive even in the presence of slight sepsis in the wound. It has also been suggested that the sequestrum if sufficiently long and firm could be boiled and utilized to fill the gap in the bone after surgically cleaning the osteomyelitis cavity under a pre- and post-operative penicillin therapy; the removed sequestrum was reimplanted in its own place, with a view to performing osteoplasty; the wound healed per primum and the grafted sequestrum took perfectly. In this connection it will be interesting to refer to the use of *os porum* as a bridge for filling up gaps in the bone. When once we recognise that whatever may be the type of transplant we use, it is only to act as a scaffolding for new bone formation, it is immaterial what substance we use.

The use of bone graft for filling these bone defects, is a tremendous advance in the treatment of chronic osteomyelitis; it has now become possible and safer, with the availability of the chemotherapeutic

drugs and antibiotics; combined with the use of carefully planned plastic procedures on the skin and soft tissues, the treatment of these deformed bones with chronic discharging sinuses is no longer a source of despair to the surgeon.

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DISCUSSION—BONE CAVITIES IN CHRONIC OSTEOMYELITIS

Dr. B. N. Sinha (Lucknow) seconded the Paper and his contribution will be published separately later.

DISCUSSION

Dr. K. R. Chaudhri (Lucknow) said that anti-biotics in the chronic stage have not proved to be as useful as in the acute stage. He referred to exogenous periosteomyelitis following a chronic ulcer of the leg or ankle due to extension of infection from without inwards. He referred to 2% soda bicarb in normal saline for irrigation and pienne gauze packing for chronic cavities, as having been useful in his hands. He preferred fascia lata to catgut for anchoring bone grafts.

Dr. N. S. Narasimha Iyer (Madras) traced the history of the development of the principles in the treatment of osteomyelitis, and stressed upon rest as being the most important principle in Winnet Orr's treatment. Sub-periosteal diaphysectomy he condemned. Curettage of unhealthy granulation tissue in addition to the removal of the sequestra he considered necessary. Grafting of bone was not always successful. Sauterisation of the cavity and Theirsch skin-grafting has worked well in one case. In children, administration of anti-biotics has reduced the need for operation in a large number of cases. He stressed the importance of incision of the sub-periosteal collection with immobilisation and penicillin therapy. He has found that with the use of anti-biotics the amount of inflammatory new bone is minimal and sequestra are comparatively smaller. He made a brief reference to the lateral approach in the tibia and a posterior approach for the back of the lower end of the femur.

Dr. S. Chandrasekharan (Cuddalore) said he depended upon removal of sequestra curetting granulation tissue and closing up of the wound after treating the cavity with ether and Dipp. He did not think there was need for any special incisions for the femur as the muscles fill in. He said that in the medial incision of the tibia

undercutting and closing the wound resulted in healing by first intention. Cavities in the calcaneus he treated by exposure allowing healing by granulation tissue.

Dr. L. H. Athle (Bombay) pointed out certain technical aspects in the diagnosis of bone cavities and how cavities can always be demonstrated by careful technique. Some of the pictures (radiographs) shown by Dr. Sinha, he thought, were not cases of cavities but were gaps in osteogenesis. He also referred to the difficulty in distinguishing bone cavities in chronic osteomyelitis from those in tuberculous lesions. He did not consider Brodie's abscess suitable for x-ray therapy.

Dr. M. G. Kini (Bombay). The subject under discussion is limited to bone cavities and their treatment. Various other aspects of complications are excluded from the purview of this discussion. The mode of onset of osteomyelitis is common knowledge to all general surgeons, as well as orthopaedic surgeons. The object of commencement of this subject 3 years in advance is to give us a collected review of the subject and the various techniques and methods employed in the solution of this common and sometimes a difficult problem. A summation of experience of peculiar aspects of pathology with bacteriological investigations, radiological appearances correlating with clinical manifestations is a welcome feature to be aimed at while discussing bone cavities and their treatment. If this is combined with experimental details it would heighten the effect of the paper but the facilities for this type of work is only a dream in our colleges at present, as experimental surgery has not attracted the attention it deserves in clinical teaching institutions. We surgeons should demand this at least in future.

Brodie's abscess as a complication occurred in 3% of cases seen by me (Figs. 1, 2 & 3). Regarding other complications I wish to draw attention to my article "Sequelae of Osteomyelitis and treatment of Pathological Fracture with non-union"

published in the Indian Journal of Surgery, 1938. In this paper 120 cases were reviewed.

Bone cavities may be limited in extent conforming to type described by Brodie with or without sequestrum formation or may be extensive in the shaft of the bone associated with sequestrum formation (Figs. 5 & 6). Generally the sequestrum if present in the Brodie's type of abscess cavity is either spicular or very small and thin and flakelike (Fig. 3). In big cavities in the shaft they are usually tubular or laminated in type (Figs. 5 & 6). Sometimes there are multiple small cavities in bone with marked sclerosis in between the cavities. In smallpox osteomyelitis both small and large cavities occur (Kini & Kesava-swamy, "Role of smallpox in the production of deformities by causing infection of bones and joints," Antiseptic, 1941). A peculiar type of infection deserves mention. In this type though the bone gets infected no sinuses are seen. A quiet type of necrosis occurs. The involucrum is dense and cuts like ivory and there are no cloacae and the periosteum covering the bone is thick and strips with difficulty and when stripped, very little bleeding occurs. Clinically the patient gives a history of smallpox followed by one or multiple swellings in different bones and neighbouring joints. Later the disease gets limited to one or two bones and sometimes to one or two neighbouring joints. In the case illustrated by Fig. No. 7, both humeri were infected and there was ankylosis in one elbow. This was seen in a girl aged 20 years who had smallpox infection when she was aged 5 years. The parents sought advice because the husband of the girl discarded her as she had a fixed right elbow in extension at 160°. On clinical examination tenderness on deep pressure was elicited and the bone felt thickened. Periodic exacerbation of pain was complained of with no rise of temperature. At operation the granulation tissue between the involucrum and the sequestrum was found to be scanty. Unfortunately the culture from this case was not satisfactory because it was contaminated by extraneous

organisms. Is this peculiar type of pathology due to virus? A similar observation that virus as a possible cause of tumor formation was made in my paper entitled "Observations on Osteogenic Sarcoma and Osteoclastoma in Bone" published in Indian Journal of Surgery of 1948. I had only 2 such cases of extraordinary thickening of bone with no sinuses in 50 recorded cases of smallpox osteomyelitis.

The principle that used to be followed by me in dealing with bone cavities was to lay them open thoroughly, drain and allow them to heal from the bottom as suggested by Winnet Orr. The convalescence in these cases was prolonged and nauseating both to the patient and his neighbours. The ultimate result of such a method was good. It is well known that no surgeon could guarantee a complete cure however thoroughly the operation has been carried out at the first time of operation. The late Mr. McMurray while speaking about osteomyelitis used to say "The last surgeon who removed the last sequestrum cured the condition." This was perfectly true before, but it remains to be seen whether modern technique combined with chemotherapy will alter the picture. It must be the aim while laying open the bone cavities certain general principles must be adhered to:—

(1) It is always better to expose the bone leading to the cavity on the muscular side of the bone. For example:—The tibia should not be exposed on its medial aspect which is subcutaneous as it leads to persistent sinus formation. If it is done on the muscular side, that is on the lateral side the muscle herniates into the cavity and acts as a graft helping to close the cavity quickly.

(2) When laying open the bone cavity, it should be the principle not to weaken the shaft of the bone and the surgeon must be conversant with the mechanics and the stress and strain the bone has to bear. Through and through tunneling of bone is bad surgery (Fig. 4).

(3) Bone grafting should be done only in dealing with pathological fractures with non-union to bridge the gap after a period



Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.

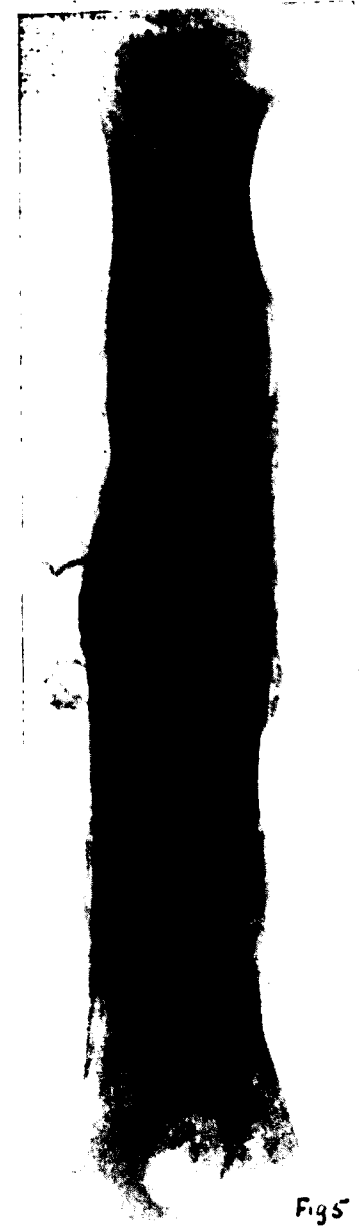


Fig. 5.

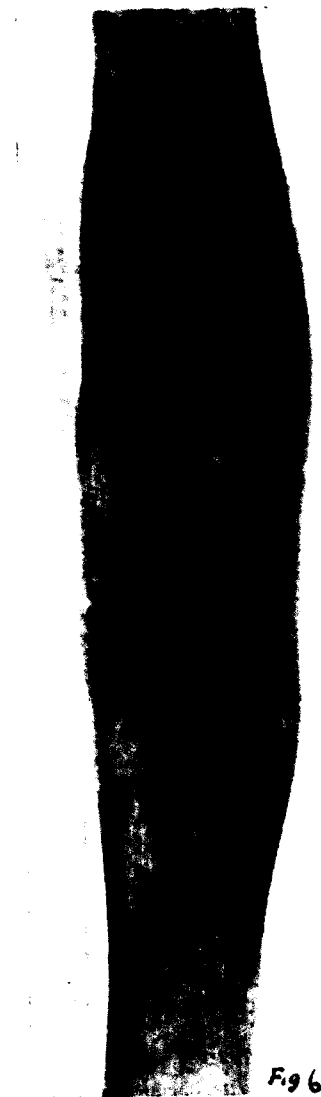


Fig. 6.



Fig. 7.



Fig. 8.



Fig. 9.



Fig. 10.

Fig 7

Fig 10



Fig. 11.



Fig. 12.

of time to make sure that there is no lurking infection. This procedure was not safe to be used to fill bone cavities before. It remains to be seen whether this principle can be relegated to the background using penicillin and sulpha drugs as an umbrella to protect the graft from infection when implanted in cavities to strengthen and promote healing in weight bearing bones with big cavities at ends.

After the advent of penicillin and sulpha drugs Winnett Orr's method has been completely given up by me. In 1945 when penicillin was first available in Madras for civilian use the following method was used by me for the first time in a young man aged 23 years who had a Brodie's abscess in the upper end of shaft of right femur (Kini & Vyagreswardu, "Penicillin therapy in acute infections" 1946, Ind. J. Surg.). The bone cavity was opened with an incision on the lateral side. There was a lot of sclerosis of bone and the cavity contained a teaspoonful of pus. The cavity was guttered, etherised, dried and the wound sutured in layers without drainage and before closing the wound one stitch in the middle was held without tying to guide the needle into

the cavity of the bone, into which was squirted 30,000 units of penicillin and the wound was closed and firmly bandaged and put in plaster. He was given a total dosage of 500,000 units of penicillin. He had no recurrence of the trouble till 1948. The result was so striking in the above case that all the subsequent 42 cases of all types of chronic osteomyelitis were dealt with in this way. In cases where there is doubt, a big sized drainage tube is put in, in the most dependant part through a stab wound and the original wound is completely closed. Skin grafting and muscle grafting was resorted to only in 2 cases where saucerisation was attempted elsewhere with a persisting sinus in the upper end of the tibia. Complete rest is enjoined after the operation in plaster which I consider is a very important part in post-operative procedure. Sometimes fractures occur in bones weakened by big cavities containing big sized sequestra. It occurred in a boy who had a big cavity with a tubular type of sequestrum in the upper end of a right humerus. He was treated in the way mentioned above with very good result. The plaster was removed after a month's treatment to give free movements to shoulder joint. He was given a sling for support. After a lapse of two months time he sustained a fracture due to an accident but with no recurrence of osteomyelitis. He reported immediately after this accident for treatment. The fracture united well after immobilisation in plaster again. It is interesting, the gap that was left on one side before was filled up by osteogenesis after fracture. The fracture was a blessing in disguise in strengthening this weakened bone (Figs. 11 & 12).

In dealing with cavities occurring in the calcaneus the part containing the cavity was excised when possible taking care to maintain a part of the insertion of tendo calcaneus at least at the top. A midline incision was used. On follow up of this case the functional result was found to be good (Figs. 8, 9 & 10).

Treatment of osteomyelitis in general and bone cavities in particular is sometimes a thankless job and the aphorism of Hey Groves applies with great force in this disease. "Bones are said to be filled with red bone marrow but I have found them full of black ingratitude."

Col. D. K. Sabhesan (Poona) in his reply said the existence of a sequestrum can be easily diagnosed by probing and finding it floating, feeling a grating sensation of bare bone and the discharge of oily pus, in the absence of x-rays or where they fail to show it.

2. The scope of this paper being necessarily the treatment of bone cavities in osteomyelitis, he said that he had refrained from discussion of bone grafting methods for gaps in compound fractures.

3. He had no experience of treating bone defects in osteomyelitis by x-ray therapy.

Dr. B. N. Sinha also replied to some of the points raised during the discussion. In the main, he agreed with the points raised in the discussion. He was, however, satisfied with the results of deep x-ray in his series of cases. He condemned probing for the diagnosis of sequestra. He agreed that cooperation with the radiologist was essential, but where x-rays fail to reveal the cavity and a sinus was present, he advocated opening up to explore for the cavity.

THE PYLORUS, AND ITS INFLUENCE ON GASTRIC OPERATIONS*

by T. H. SOMERVELL, Vellore.

The treatment of duodenal ulcer has never been really satisfactory. Medical treatment heals the ulcer, but (owing probably to the thin wall of the duodenum and the poor blood supply of a fibrosed and scarred duodenal cap) the ulcer very often recurs when normal diet and habits of life, with occasional irregular meals, are started again. It recurs in the same place; unlike gastric ulcer, which often heals up so well that recurrence (if it happens) takes place in a new situation. Nicol (1941) reported that after 2 years only 17 per cent of cases were cured, and 41 per cent improved; nearly half were either worse or no better. Gainsborough and Slater (1946) estimated that 67 per cent of medically treated cases relapse within 18 months.

Surgical treatment is more productive of sound healing, but carries with it several disadvantages. The risk of recurrent ulceration at the stoma or just below it is estimated from 6 to 20 per cent of cases after gastro-jejunostomy, and from 2 to 6 per cent after sub-total gastrectomy.

In addition, the original duodenal ulcer may not heal up; in 5 cent of cases it fails to do so. The cause of all this trouble of recurrent ulceration is, of course, hydrochloric acid. So, for many years surgeons have sought to devise treatment that will cut down acidity, while diverting the main stream of food and acid gastric juice from the neighbourhood of the ulcer. A recent text book introduces a diagram in which no less than 18 different operations for duodenal ulcer are depicted—a fact which shows in itself the unsatisfactory nature of the situation.

Broadly speaking, there are three ways in which the acidity of the stomach can be brought down to normal levels which will allow the ulcer to heal as well as prevent-

ing the supervention of ulcers at or near the stoma in nearly all cases.

1. *Gastrectomy*—The removal of the body of the stomach, which contains most of the acid-secreting *parietal cells*. This is useless unless at least three-quarters of the stomach is removed, a severely mutilating operation, not without risk even in skilled hands.

2. *Vagotomy*—The section of both vagi and all their constituent branches on the lower end of the oesophagus.

This cuts down the psychic secretion of acid to nil, the night secretion and fasting juice to a very low level; but does not cut down the acidity of the chemical phase of gastric digestion.

3. *Devascularisation*—The tying of all vessels, both arteries and veins, from the pylorus up to the junction between left gastroepiploic and splenic arteries along both curvatures, cuts down acidity to normal or sub-normal levels in about 90 per cent of cases. While its effect is known to last six or eight years, it is probably followed by a small percentage of gastro-jejunal ulcers in the later years.

This operation was started by Wilson Hey as a means of sympathectomising the stomach. But although I or my assistants have performed the operation, either in its original or more often in a modified form, for over 10 years and in over 600 cases, I have never believed that its efficacy had anything to do with sympathectomy—a procedure which would surely leave the vagus unopposed and lead if anything to a rise in acidity. In recent years, however, the explanation of the drop in acidity caused by devascularisation has been made clear by Uvnas (1942 &c.). This observer found that in the chemical phase of digestion the pyloric mucosa secretes into the bloodstream a hormone corresponding to the gastrin of Edkins (1905). This hormone, carried to the mucosa of the body of the

*A paper presented at the XI Annual Conference of the Association of Surgeons of India at Madras, during Dec. 1949.

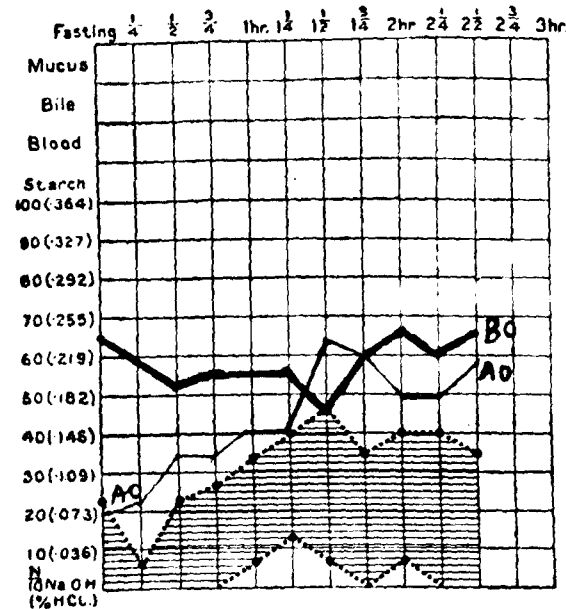


Fig. 1.

Result of vagotomy and posterior gastro-jejunostomy (B.O.—before operation; A.O.—after operation). Note that fasting juice has been rendered normal, but the digestive period juice is unchanged.

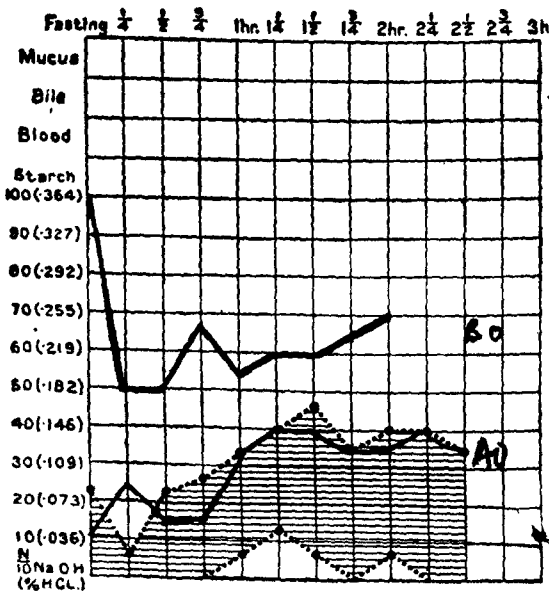


Fig. 2.

Typical case for vagotomy—fasting acid very high, but later acidity not so high. Note result of vagotomy and gastro-jejunostomy.

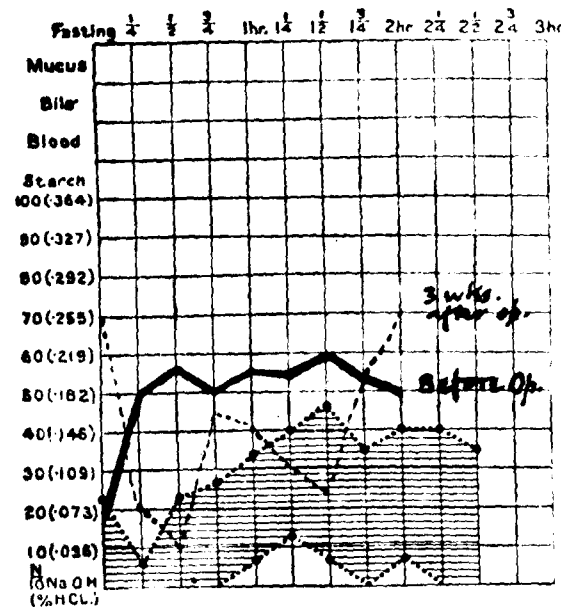


Fig. 3.

Shows result of vasoligation and posterior gastro-jejunostomy. This result—general lessened acidity but actual rise in fasting juice—is not uncommon after vasoligation.

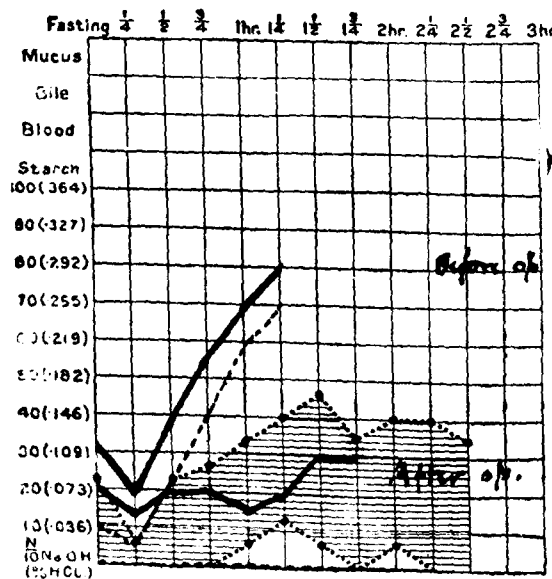


Fig. 4.

Typical case for vasoligation—fasting juice normal, later acidity high. Was treated with vasoligation only.

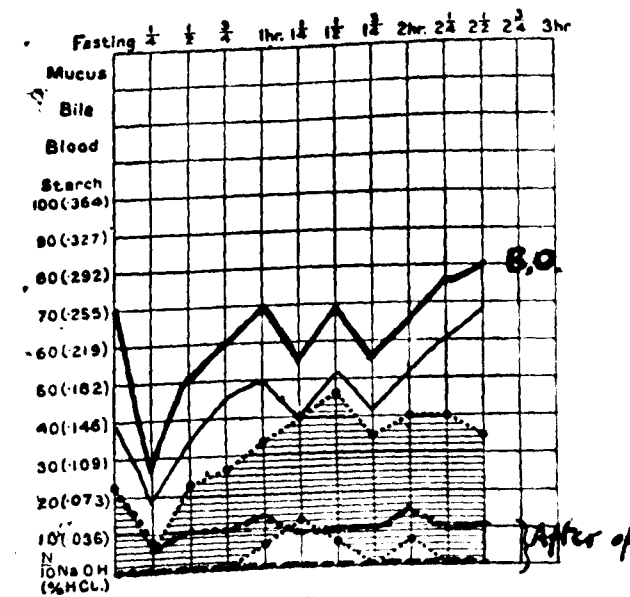


Fig. 5.

Shows high acidity throughout. Best treated by vagotomy and vasoligation. Shows result of vagotomy, vasoligation and posterior gastro-jejunostomy.

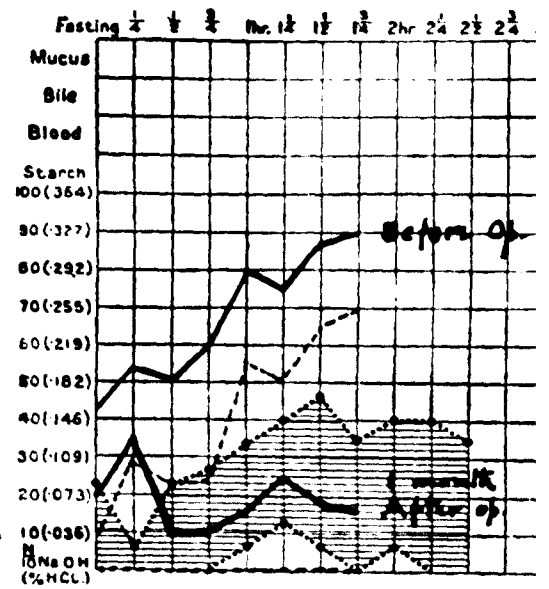


Fig. 6.

Shows typical result after vagotomy (reducing fasting acid) and vasoligation (reducing the acid during chemical phase).

stomach by the blood-stream, activates the parietal cells to secrete hydrochloric acid even in the presence of divided vagi. By cross-transfusion experiments with pairs of cats, Uvnas conclusively proved that it was by the blood-stream that this hormone is conveyed. Tying of all vessels to the pylorus and antrum cuts down its formation. Tying of the veins to this part prevents the absorption of gastrin into the general circulation. Tying of the arteries to the body of the stomach cuts down its access to the acid-secreting portion of the gastric mucosa.

Thus a complete explanation of the way by which devascularisation causes a fall in acidity in the chemical phase of digestion is obtained by these experiments.

We are now in a position to plan intelligently for the most beneficial treatment of any given case of duodenal ulcer. We must know the extent of the acidity, and whether the highest concentration of acid takes

place in the fasting juice, the period of gastric digestion, or the later part of the fractional test meal curve. We like to know also to what extent the pylorus is patent and functioning normally, or whether there is any stenosis; also we wish to know the size of the stomach. Every patient with gastric or duodenal ulcer must therefore have a fractional test meal and a Barium meal X-ray examination. We can then divide our cases into the following categories:

1. Low acidity throughout, pyloric stenosis: Treatment, posterior gastro-jejunostomy.
2. Low acidity, no stenosis: Treatment, gastro-jejunostomy with division of pylorus or fascial ligature around it.
3. Highly acid fasting juice, no high acidity during digestion, pyloric stenosis: Vagotomy with gastro-jejunostomy.
4. Highly acid fasting juice, pylorus patent: Vagotomy only.

Note: Owing to the relaxation of gastric muscular tone after vagotomy, the stomach is prone to develop acute dilatation. The pylorus must therefore be very patent and capable of emptying the stomach well and easily, if no gastro-jejunostomy is done.

5. Normal acidity in fasting juice, high acidity in gastric digestion period (chemical phase, second hour of test meal):

Vasoligation of pyloric two-thirds of stomach with posterior gastro-jejunostomy.

6. High acidity in fasting juice and during gastric digestion:

Vagotomy, plus either vasoligation of pyloric two-thirds of stomach, or resection of pyloric half of stomach.

Note: I am not yet certain which of these two procedures gives the better results, and for some time, I have been doing the two

alternately in a series of cases, which have not yet been followed-up.

The results of the application of this rule of procedure have been, with one solitary exception, very good to date; but I have only been following this plan for two-and-a-half years and can therefore only offer it in a tentative spirit. Nevertheless, most parts of it have been carried out for ten years on my cases, and have been tested by the following up of as many patients as possible; and as far as I know at present, the results of this system are far better than any other statistics I can find.

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A REVIEW OF LYMPH NODE BIOPSIES EXAMINED IN THE DEPARTMENT OF PATHOLOGY, MEDICAL COLLEGE, MADRAS*

by D. GOVINDA REDDY and M. THANGAVELU, Madras.

During the period 1940-1949, 2,000 specimens purported to be lymph nodes were received in the department of Pathology, Medical College, Madras, for histological examination. Of these, 100 were found to be non-lymphoid. Tissues mistaken for lymph nodes and their sites of origin are shown below:

REGION

Face — Chronic inflammatory tissues; tumours of the salivary glands; connective tissue tumours, such as fibroma, lipoma etc.

Neck — Chronic inflammatory tissues; aberrant thyroid, and thyroid tumours; branchial cysts and branchial carcinoma and other tumours.

Axilla — Chronic inflammatory tissues; sebaceous cyst; cysticercosis; tumours such as neurofibroma.

Abdomen — Fat and chronic inflammatory tissues; carcinomatous nodules.

Inguinal Region — Fat and chronic inflammatory masses; ectopic testis; tumours

TABLE I
Disease incidence.

Diseases	No. of cases	Percentage
Tuberculosis	696	36.0
Hodgkins	114	6.0
Lymphosarcoma	102	5.4
Secondary infiltration (Carcinoma and Sarcoma)	329	17.3
Miscellaneous	659	34.7
Total	1,900	100.0

The principal causes of glandular enlargement are shown in Table I. Since

*A paper presented at the XI Annual Conference of the Association of Surgeons of India at Madras, during Dec. 1949.

biopsy is done only to establish the diagnosis but not as a routine, the figures given are not representative of disease incidence. In this, the miscellaneous group covers climatic bubo, filarial lymphadenitis, lymphatic leukaemia, leprosy, mycotic infiltration, cysticercosis and acute and chronic lymphadenitis of non-specific

REGIONAL DISTRIBUTION

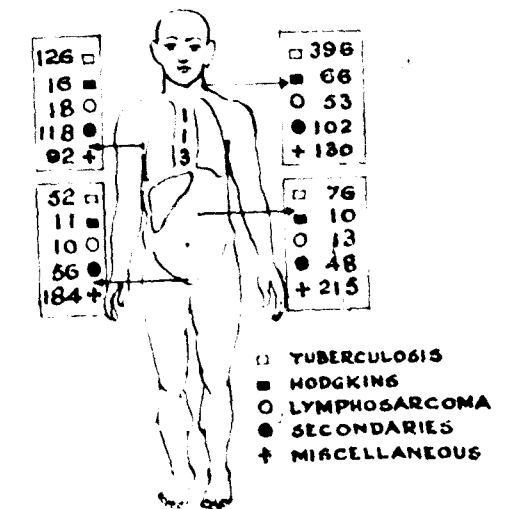


Fig. 1

origin. The last forms the bulk of this group, as cutaneous infections are prevalent in the tropics and since many Indians walk bare-footed. Though filariasis is a major cause of lymphadenitis, only a few cases were encountered because a biopsy examination is generally avoided if the condition is suspected. In leprosy the lymph nodes are rarely involved and we had a solitary instance. Only two lymph nodes showed metastatic madura-mycotic lesions, the primary being in the feet.

The regional distribution of the lymph nodes is shown in Fig. 1. Here the points

deserving attention are: (1) the preponderance of tuberculous lymphadenitis in the cervical region which is in agreement with published reports from other countries; (2) the high incidence of non-specific inflammatory changes in the abdominal lymph nodes; most of these were removed for suspected tuberculous or malignant infiltration. These were mostly nodes draining peptic ulcer. A similar high incidence of non-specific lymphadenitis under the miscellaneous group in the inguinal region is due to infections and injuries of feet. When tabulated according to sex, of the 126 tuberculous lymph nodes in the axillary region, 94 were in females. Similarly, of the 118 lymph nodes showing malignant infiltration, 105 were in females, Table II.

TABLE II
Significance of sex in the cause of lymphadenitis in axilla and inguinal region

Region	Tuberculosis			Malignant infiltration		
	Male	Female	Total	Male	Female	Total
Axilla	32	94	126	13	105	118
Inguinal	33	15	48	51	4	55

This high incidence of tuberculous lymphadenitis and malignant infiltration in the axillary group of lymph nodes in the female is due to carcinoma of the breast and a significant number of tuberculous mastitis. In the male, a comparatively larger percentage of carcinomatous lymph nodes in the inguinal region (51 out of 55) is essentially due to carcinomatous growths of the penis and scrotum.

The age incidence of lymphadenitis is shown in Table III. The only noteworthy point here is the greater frequency of Hodgkins disease in the younger group of individuals. Since most of the textbooks mention that the disease is rare below 10

TABLE III
Age incidence.

	Tuberculosis	Hodgkins	Lymphosarcoma	Secondaries
0-10	57	28	10	0
11-20	228	30	20	7
21-30	229	28	25	33
31-40	91	11	16	84
41-50	43	9	15	220
51-60	11	4	7	58
61-70	5	1	3	11
71 and above	0	0	0	1
Age not mentioned	32	3	6	15
Total	696	114	102	329

years, Hodgkins disease is very often missed in children.

TABLE IV
Incidence of error noted in the diagnosis of the causation of lymphadenitis.

Nature of lymphadenopathy	Clinically diagnosed	Clinical diagnosis confirmed by biopsy	Clinically diagnosed otherwise; but biopsy revealed	Total
Tuberculosis	605	441	255	696
Hodgkins	217	67	47	114
Lymphosarcoma	75	39	63	102
Secondaries	414	273	56	329

Table IV shows the incidence of error noted in the diagnosis of the causation of lymphadenitis. This will surely instance the difficulty experienced in distinguishing between the various forms of glandular enlargement and the importance of histological examination in every case of lym-

phadenitis. It should be understood, however, that even experienced pathologists encounter innumerable situations in which an exact histological diagnosis is extremely difficult.

Before concluding, a short note on the choice of lymph nodes for biopsy and the technique therefor may not be out of place. When only one group of lymph nodes is enlarged, there is no choice as to the site of biopsy. But in cases with generalised lymphadenopathy axillary or low cervical lymph nodes should be chosen for excision. Lymph nodes from inguinal and high cer-

vical regions should be avoided as they drain areas subject to infection and show chronic inflammatory changes with fibrosis. Nodes selected for biopsy need not necessarily be enlarged and a lymph node infiltrated with malignant cells may appear almost normal. A single node intact or preferably a group with surrounding tissue should be removed. Since both traction and incision distort the histological picture, the surgeon should avoid them. Aspiration biopsy has a place, but is only secondary to open biopsy except in the case of plague and leishmaniasis.

consequent preservation of the hearing. Though Heath's personal statistics showed improvement, the same results were not obtained by other otologists doing the same operation.

There is another modification which follows Heath in his steps but retains the membrano-cartilaginous canal intact and further dressings are done through the auditory meatus, the post auricular incision being closed without drainage. This was introduced by Dr. Hermann Strait of Germany.

Recently a new method of mastoid operation has been devised. It is called Endaural Atticotomy. Here the incision is done through the auditory canal and on the postero-superior aspect of the bony meatus the outer wall of the aditus ad antrum is opened up. The antrum is cleared of its contents and drainage is established through the auditory meatus. I have no personal knowledge of this method and have not yet seen it being done in Bombay.

A question which constantly present in otology is the various types of mastoids that exist. Schwartz and Witmaack have held the view that sclerosis of the mastoid was secondary to inflammation of the middle ear at an early period of growth, or at times, after completion of the development of the bone. On the other hand Cheatle has stated that ivory, diploetic and fully sclerosed formations are anatomical variations of the mastoid and that the solid varieties predispose to chronic otitis.

Inflammation of the middle ear spreads most often by the rhinopharyngeal way. An empyema of the tympanic cavity occurs and the inflammation spreads to the antrum. If the conditions for good drainage are present such as permeable aditus ad antrum and wide opened perforation of the drum head, the condition is benign. Should the margins of the aditus get swollen with an inclination to closure a condition of closed cavity mastoidism occurs. This is very different from a real mastoiditis.

Mastoidism is a common occurrence especially in children, at the beginning of secondary otitis in acute fevers. The pain

however is not accompanied by other signs, such as temperature, hemicrania, insomnia or by incipient meningeal signs. This usually disappears after effective drainage by paracentesis or after local treatment has been instituted within 24-48 hours. The pain diminishes or disappears after sulphonamide therapy. If it recurs or persists inspite of the sulphonamide therapy mastoiditis should be suspected.

In the army chronic middle ear disease or c.s.o.m. during the last war was dealt with as follows:—

As a radical mastoid operation entails a very prolonged after-treatment in the hospital at the end of which the patient is found to be unfit for duty as a soldier on account of marked deafness, he had to be invalided, so instructions were given that modified radical as well as the radical mastoid operation should not be performed even at the base hospitals unless some complication arises. Effective conservative local treatment, and removal of polypii etc. should be given a thorough trial. Such cases were located at a station where there were facilities for treatment and periodic inspection by the ENT specialist was available. The treatment was carried out with a view to keep dry ears and the nose, nasopharynx and the throat were to be thoroughly examined and sources of focal infection removed. The idea was to categorise these persons and keep them out of the hospital and use them as category "C" personell.

Since May 1947 in all 63 Mastoid cases were admitted. In all 54 Mastoid operations were done at the G. T. Hospital so far. For purposes of classification these 63 cases are divided as follows:—

- (a) Acute Mastoids,
- (b) Mastoid abscesses with or without sinuses,
- (c) Chronic Mastoids.

(a) Acute Mastoids. 14 cases were admitted—7 males, 2 females, and 4 boys and 1 child. Simple mastoid operation was done only on 5 cases. The rest were treated conservatively. Average duration of stay of non-operated cases was seven days. Besides local ear therapy, these cases had

penicillin therapy 30000 units 3 hourly for 3-5 days or sulphonamide therapy. No complications occurred in the operated cases.

(b) There were 13 cases of mastoid abscess admitted during the period: seven were children (the smallest being 8 months old), one girl aged 12, two boys aged 12 and 18 and three adults. The operation done in seven cases was modified radical mastoid operation without detachment of the membrano-cartilaginous canal. The rest six had simple mastoid operation. The mastoid wound was closed in each case and counter drainage of the abscess area was provided separately. After operation all cases had penicillin therapy 30000 units 3 hourly for 5 days; sulpha therapy; penicillin therapy again if necessary. These cases remained in hospital from 20 days to 60 days. Except three cases which are cited below, nothing untoward appeared in any of the cases and they left the hospital with healed mastoids.

(c) There were 36 cases of chronic mastoids admitted and operated on during the period. Four cases had radical mastoid operation and the rest thirty-two had modified radical mastoid operation as stated above.

All the 54 mastoid operations were done under general anaesthesia either by the open method or the intra tracheal method. No postanaesthetic complication was detected in the whole series. All the 36 chronic mastoids were confirmed radiologically and their past histories revealed the usual data of infectious fevers, pneumonia, typhoid or nasopharyngeal catarrh as the starting factor of the ear discharge. Out of 36 cases of chronic mastoids only 3 were children under nine years of age; 4 were boys under 15; 26 were adults (male & female) and 3 were girls. The ear inspection revealed old perforations, granulations over the drum, polypoid formations etc. No case of cholesteatoma has so far been seen at the G. T. Hospital since May 1947 or operated upon during the period. The ear discharge history showed duration from 3 months to 10 to 15 years. Some of these cases had their tonsil and adenoid operations done some time ago or had past sinusitis history.

Radical mastoid operation was done on four cases because of large polypi in the affected ear, long duration of the ear history and clinical deafness of a high degree in these ears. No complications occurred after the operation nor was any injury noticed during the operation. In three modified radical mastoid operations, the lateral sinus was accidentally punctured during the operation. This was immediately controlled by the "postage" stamp muscle graft application, the graft being obtained from the temporal muscle. It is gratifying to note that even in these three cases no complications developed and the healing and convalescence were normal. There were four cases of chronic mastoids who had facial paralysis. They also had the modified radical mastoid operation, but the facial canal was not exposed, and no attempt was made on the facial nerve because of the view held being that as the nerve paralysis was of long standing, it was necessary to clear up the ear condition first and then leave the repair of the facial nerve to experts. The following three cases of mastoid abscesses are cited as of clinical interest.

(1) R.G., male child age 4, No. 389, admitted on 14-7-49 with large left mastoid abscess. History of ear discharge only 2 weeks. Left side neck showed scarring suggestive of cold glandular abscesses. Left ear was pouring out thick pus. No left facial palsy. Modified radical operation on 14-7-49. Antrum full of pus. Aditus was inflamed. Bone carious. The whole area was curetted, wound was closed in the usual manner. The child was removed from the hospital by parents against advice on 22-7-49. The attendance at o. p. dept. was regular in the beginning. Reappeared in the o. p. dept. on 6th September 49 with a gaping left mastoid wound. Had the usual dressing & tone therapy; helio-therapy. After much persuasion the child was readmitted on 13-12-49 and secondary operation was done of curetting and cleaning the whole area. The examination revealed no sequestra. Still the infection persisted. He had penicillin and sulpha therapy. He is having U.V.R. exposures. His tonsils and adenoids were removed early this month to facilitate healing. The child has improved physically since readmission, still the mastoid cavity is not in a satisfactory condition. I think it was a case of tubercular mastoid with superadded sepsis which converted the condition into an acute abscess.

(2) G.D., aged 12, Christian No. 468 date of admission 25-11-47, acute mastoid abscess of rt.

ear. The right external ear was as it were floating over a soft tender area. Foul thick discharge from the right ear. No rt. facial palsy was noted. The child was toxic. Temp. on admission 102° F. General anaesthesia. Modified radical mastoid operation. It was noticed as soon as the area was cleaned of pus and debris that the whole of the cartilaginous auditory canal had sloughed out. The antrum was full of foul pus, debris, granulations etc. The lateral sinus was exposed and found satisfactory. The aditus was curetted and enlarged and the wound closed with counter drainage. Temperature settled down after 48 hours. Penicillin therapy for 5 days followed by sulpha therapy of 27 gms. in six days. Sutures were removed on 5-12-47. By 10-12-47 only local ear treatment was done. He weighed 57 lbs. on 7-12-47. His hb. was 62%. Iron mixture and liver injections were started and by 18-1-48 the day of discharge he weighed 68 lbs. and was a different picture. This abscess was either of a very fulminating type or of a gangrenous type, and the whole credit goes to the chemotherapy and antibiotics. I am sure 20 years ago this case would have ended fatally either from toxæmia alone or other intracranial complications.

(3) G.P., a Hindu boy of 18, No. 419 admitted on 18th August 1949 with the following:—pain and discharge left ear for 20 days. Lt. mastoiditis. No actual abscess, but tender and oedematous. His w.b.c. total count on day of admission was 10000; no m. p. detected. Urine was normal. Operation was fixed for the late afternoon. He had a severe rigor and temp. shot up to 105° F. No operation done that afternoon. Penicillin 60000 units given and repeated 3 hrly., besides ice pack and other measures. X-ray on 19-8-49 showed left mastoiditis. On 20-8-49 modified radical operation was done. After operation temp. 99° F.; p. 112 and resp. 24. Intratracheal ether was used. The mastoid antrum and cells contained foul pus. The lateral sinus was exposed and found satisfactory. The operation wound closed—counter drainage provided. No facial paralysis after operation. The boy had rigors on 21st, 23rd, 25th, 26th and 27th Aug. 49, temp. shooting up to 105° F on 23-24-25 and 26th. Penicillin therapy 60000 units 3 hourly continued. Other measures of sponging, ice packs etc. Penicillin was reduced to 30000 units 3 hourly from 26th till 5-9-49. Third course of penicillin 30000 units 3 hourly from 9th to 13-9-49. Temp. on 13-9-49 was normal. Another rigor on 14-9-49 and temp. of 102° F. Fourth course of penicillin 50000 units on 15-16-17-18th and 19th September. During this course no rigors occurred and temperature was normal. On 21st Aug. 49 day following operation he had 1200 c.c. glucose saline i.v. Second glucose saline 200 c.c. i.v. on 24th August. Lumbar puncture done on 26th the fluid being clear and not under tension; the pathologist

report being 6 cells per field, r.b.c. nil, organism nil and chlorides were. 710 mgm. Total w.b.c. count on 26-8-49 was 8900, hb. 78%, r.b.c. 4 million. Urine on 26-8-49 contained trace of albumin and few pus cells. Ophthalmic surgeon examined him on 26-8-49 and he stated:—

"Marked venous engorgement both eyes. Hazy-ness of both discs and horizontal nystagmus. He suggested x-rays of the skull which was done on 27-8-49; the report being "no evidence of cerebral abscess yet." Hon. Physician examined him on 27-8-49 and his examination revealed no cranial nerve palsy. The motor sensory and cerebellar systems were normal. Knee jerks were normal and superficial reflexes were present. At his suggestion sulphathiazole therapy was started on 27-8-49. Ophthalmic surgeon reexamined the eyes on 29-8-49 and stated optic discs clear, engorgement of veins still persisted. Stitches were moved on 1-9-49. The wound condition was satisfactory. Local ear therapy was continued. His weight on 4-9-49 was 70 lbs. and iron and liver injection therapy was started. The ear had recurrence of granulations which did not respond; so under "Pentothal" anaesthesia on 11-10-49 the granulations were removed and the ear was curetted and cleaned. He was allowed to go home on 17-10-49 after nearly 60 days stay and his weight had gone up to 77 lbs. This is another instance of the chemotherapy and antibiotics coming to the rescue.

The future of mastoid disease depends entirely on how early the ear conditions are detected and effective treatment carried out. The advent of sulphonamides and antibiotics have reduced the complications in their incidence as well as in their virulence and many acute ears can be cured in time if tackled early. From the otologist's point of view further improvement in surgical procedures will be mainly to save hearing acuity as far as practicable. If the ear disease is detected early, adequate local and general treatment undertaken, and paracentesis operation done early in acute ears to facilitate drainage, I am sure many cases will heal early and better chance to preserve hearing will be given to such cases. Side by side with ear treatment, the nose, naso-pharynx and oropharynx must be systematically examined and any condition liable to cause or prolong ear sepsis be treated surgically. As long as these conditions exist the middle ear is liable to reinfection through the Eustachean route.

SUMMARY OF THE CASES (20)

Reg. No. Date of Admission	Name	Age	Caste	Diagnosis	History	X-ray & other laboratory details	Nature of operation and type of anaesthesia	Other notes	Date of Discharge
424 24-6-47	R.M.	19-M	Ch.	Lt. Mastoid Abscess.	Marked tenderness over left mastoid for 4 days. Fever with rigors. Left ear discharge history for 2 months. Rt. ear normal. Pin point perforation lt. ear.	Total W. B. C. Count 10000 on 24 6-47. Polymorph. 70% on 24 6-47.	Modified Radical Mastoid operation 25-6-47. Intratracheal ether.	Pus in the antrum & aditus; oedematous, granulations also. Granulations in the drum membrane. Penicillin therapy 30000 units 3 hourly for 5 days followed by Sulphathiazole therapy for 6 days; total of 30 gms. Wound healed on 6 7 47. Ear condition cleared up on 15 7 47.	6-7-47 followed by 2 weeks O. P. dept. treatment of lt. ear.
50 3-7-47	P.B.V.	27-M	Parsi	Right Chronic Mastoiditis.	Rt. Ear discharge history since 13 years. Large polypus with thick discharge. Marked deafness in right ear. Polypus bleeds on pressure. Lt. ear, throat & nose normal.	X-ray Rt. Mastoiditis on 5-7-47. Nothing to note in blood count.	Radical Mastoid operation. Intratracheal ether.	Mastoid antrum & cells carious, contained debris, granulations. Lateral sinus exposed. Glucose saline 500 c.c. i.v. after operation. Wound closed without drainage. No untoward effects. Facial nerve unaffected. Penicillin therapy 30000 Units for 10 days. Total sulphathiazole 62 gms. in two courses. Lt. ear condition satisfactory.	3-8-48
214 9-9-47	A.V.	2-F	H.	Rt. Mastoid Abscess.	Rt. Ear discharge for 3 months. Rt. Mastoid Abscess for 4 days.	X-ray of Rt. Mastoid wound on 3-11-47 after operation. No cells remaining in Rt. mastoid area. No sequestrum.	Simple Mastoid operation 9-9-47 under general anaesthesia. Wound broke down and reculting and clearing on 3-11-47. Tonsils and adenoids removed on 2-11-47 both under general anaesthesia.	The child was removed against medical advice on 18-9-47 and was brought back with gaping mastoid wound and recurrent ear discharge on 3-11-47. Second operation as well. Tonsillectomy & removal of adenoids. Penicillin therapy Helio therapy. Satisfactory healing.	13-11-47
360 16-9-47	R.R.	30-M	H.	Lt. Mastoid Abscess.	Nil	Nil	Simple Mastoid operation under open ether.	Was an abscess of bezoid type mastoiditis. Mastoid antrum full of pus. Had fluctuating temperature for a week after operation varying from 99 to 102.5° F. Sulphadiazine given for 3 weeks. Penicillin therapy for one week. Developed an attack of diarrhoea. Wound healed. Convalescence and left ear dry on discharge.	22-11-47

SUMMARY OF THE CASES (20)—Contd.

Reg. No. Date of Admission	Name	Age Sex	Caste	Diagnosis	History	X-ray & other laboratory details	Nature of operation and type of anaesthesia	Other notes	Date of Discharge
468 25-11-47	G.D.	12-M	Ch	Rt. Mastoid Abscess.	Rt. ear discharge from 1 year. Acute symptoms since 1 week. No right facial palsy.	Total N. diff. count of blood on 3-12-47 RBC 302000 per mm. WBC 5600 Neutrophil 68%	Modified Radical Mastoid operation under tracheal ether. 26-11-47.	Large abscess over, in front and behind the rt. ear. rt. ear appeared to be floating. At operation the whole of membrano-cartilaginous. Ear canal came out as a slough. Counter drainage provided for. Mastoid wound closed. Fluctuating temperature upto 102°F. till 8-12-47. Penicillin therapy from 25-11-47 to 30-11-47. Sulphadiazine 2 tabs. t. d. s. from 1-12-47 to 6-12-47. Iron mixture and liver injections. Wound healed by 18-12-47 Rt ear dry by 25-12-47.	19-1-48
322 17-2-48	A.R.	4-M	M.	Lt. Acute Mastoid.	Thick left ear discharge since 6 months. Tender mastoid for 4 days varying temperature.	Nil	Simple Mastoid operation under general anaesthesia.	Mastoid bone necrosed; granulations. Facial nerve not injured. Lateral sinus exposed. Wound closed. Sulphadiazine tab 1/3 t. d. s. from 21-2-48 till 29-2-48. No complications. Wound healed on 29-2-48. Lt. ear healing. Further O. P. Dept. local ear therapy from 2-3-48 for 2 weeks.	2-3-48
287 15-4-48	K.P.	15-F	H.	Bilateral Mastoiditis (Chronic)	Old left mastoid abscess history and operation 4 months back. Now both ears thick discharge. Total duration 6 months.	X-ray No Sequestrum in left Mastoid. Rt. Mastoiditis intracanal cells indistinct 22-4-48.	Modified Radical Mastoid operation under intracanal ether.	Both Mastoids full of caseous material. Lateral Sinus exposed. Additus cleared of Debris. Granulations from the drum removed. Penicillin therapy 30000 units three hourly from 16-4-48. 27-4-48 two courses of sulphadiazine therapy. Ears healing on discharge. Further O. P. Dept. Therapy.	17-5-48
427 20-5-48	S.M.	11-M	H.	Rt. Chronic Mastoiditis with rt. ear polypus.	Tonsils removed 4 years ago. Ear discharge history for 4 months.	X-ray Rt. Mastoiditis cellular type.	Modified Radical operation under general.	Mastoid antrum and cells full of granulation and debris. Additus enlarged. Ear canal curetted. Polypus removed. No complication. Penicillin therapy for 8 days. Wound healed. Further local ear therapy at O. P. Dept.	2-6-48
11 1-6-48	P.M.	15-M	H.	Lt. Chronic Mastoiditis.	Ear discharge history for 6 months. Rt ear marginal perforation.	X-ray Rt. Mastoiditis cellular type.	Modified Radical operation under intracanal ether.	Mastoid antrum and cells full of caseous debris and granulations. Lateral sinus exposed. Ear canal curetted. Sulphadiazine therapy tabs. 2 t. d. s. for 1 week. No temperature.	21-6-48
315 22-6-48	K.M.	11-M	H.	Lt. Chronic Mastoiditis.	Ear discharge history for 6 months. Granulations on the drum. Tonsils removed 2 years ago.	X-ray Lt. Mastoiditis ossous type.	Modified Radical operations open ether method. 23.6.48.	Mastoid antrum and few cells full of granulations. Ear canal curetted. No complications. Lateral sinus exposed. Penicillin therapy for 5 days. Wound healed 1-7-48. Ear local treatment continued at O. P. Dept.	5-7-48
479 21-9-48	B.L.	3-F	F.	Rt. Chronic Mastoiditis with sinus.	Discharge from rt ear 3 months. Abscess behind rt ear burst and sinus since 2 weeks.	Nil	Modified Radical operation under open ether 22.9.48.	Mastoid antrum and cells carious & granulated. Lateral sinus exposed. Additus cleared. Rt. ear canal curetted and granulations removed. Penicillin and sulphadiazine therapy. No complications. Wound healed.	10 10-49
103 6-12-48	A.M.	15-M	Par-1	Lt. Chronic Mastoiditis.	Tonsils removed at age 7. Ear discharge history for 4 months. Large perforation and granulations.	X-ray Lt. Mastoiditis large cellular type of mastoid.	Radical Mastoid operation under intracanal ether.	Mastoid antrum and cells full of granulations and debris. Carious bone. Lateral sinus exposed. No injury. No complications. Penicillin therapy for 12 days. Sulphathiazole therapy for 5 days. Wound healed. Left ear condition satisfactory.	6-12-48
22 2-3-49	D.B.	17-F	H.	Lt. Chronic Mastoiditis.	Left ear discharge. History for two years. Ear shows granulations.	X-ray Lt. Mastoiditis.	Radical Mastoid operation under intracanal ether.	Mastoid antrum very large and full of granulations. Additus exposed and cleared. Lateral sinus exposed — was injured. Postage stamp muscular graft attached. Operation completed. No complications. Usual penicillin and sulphadiazine therapy. Wound healed.	22-3-49
601 25-5-49	P.S.	16-F	N.	Lt. Chronic Mastoiditis.	Left ear discharge off and on since last 2 years. Lt. ear contains a large polypus.	X-ray Lt. Mastoiditis.	Left Radical Mastoid operation under intracanal ether.	Mastoid antrum and cells full of granulations. Lateral sinus exposed, was accidentally punctured. Muscle graft applied as before. No other injury. No other complications. Usual penicillin therapy. Wound healed. Left ear healing. Further O. P. Dept. treatment.	16-6-49

SUMMARY OF THE CASES (20)—Contd.

Reg. No. Date of Admission	Name	Age	Sex	Diagnosis	History	X-ray & other laboratory details	Nature of operation and type of anaesthesia	Other notes	Date of Discharge
41 2-7-49	P.R. 25-M	25	M	Rt. Chronic Mastoiditis	History of ear discharge for 3 months. Headaches, noises in the ear are getting worse, unable to concentrate on his work as carpenter. The rt. ear drum was scarred and pulsating.	X-ray Rt. Mastoiditis.	Radical Mastoid operation under intratracheal ether.	Mastoid antrum and cells were exposed, few granulations (Lateral sinus graft). No complications on that account. Had penicillin therapy. Besides penicillin therapy he had "Prostigmin" 1 c.c. intra-muscularly twice a week and tablets 1 t. d. s. till 20-7-49. Wound healed. Noises much diminished. Rt. ear healing.	30-7-49
422 10-9-49	S.K. 13	13	H	Bi-Subacute Mastoiditis	History of typhoid fever 2 months back and discharge from ears since last 6 weeks. Very thick discharge. Rt. mastoid tender on pressure. Lt. ear discharge history of 3 years duration. Temp. 101° F. on admission. Tonsils were inflamed on admission. Rt. ear had granulations.	X-ray on 20-9-49 "Non-pneumatic Mastoids". X-ray on 20-10-49. No radiological evidence of cerebrale abscess. 26-9-49 Lab reports C. S. F. fluid is clear. Chlorides 710 mg. cells 21 mostly lymphocytes, otherwise normal. C.S.F. on 19-10-49. Fluid clear, chlorides 720 mg. cells 5 per field. Urine on 20-9-49 was normal. X-ray therapy to glandular abscess at neck and mastoids started on 7-10-49 for 15 sittings. Total WBC were as follows: Total WBC 8500 Neutrophils 74% HB 82% 20-9-49 4-10-49	Radical Mastoid operation under intratracheal ether.	Temperature varying from 99° to 102° 40. Penicillin therapy since admission on 1-9-49 200000 b. d. till 27-9-49 and sulphathiazole tabs. 14 grms. Paludrine tabs. 2d. s. for 4 days upto 27-9-49. Developed left side neck glandular abscess which was incised on 12-10-49. From 6-10-49 Streptomycin was injected. Total dose given 10 grm. 3 gm. a day 1 M. for 20 days. Eye surgeon examined the case on 20-10-49. "Marked pallor of the discs. Fundi almost white. Condition of the patient deteriorating. Became unconscious since 20-10-49. Lungs showing congestion. 21-10-49 Physicians first report "unconscious—very low—Rt. eye closed III. Paralysis—chest clear. marked tachycardia 134, pulse. No definite Kernig's sign. Cerebrale abscess. Penicillin and other glucose saline therapy continued. 12-11-49 Physicians second report condition better, conscious. No. III nerve paralysis Rt. lower extremity shows paresis. Encephalitis? following ear disease. Multiple bedsores have developed. Temperature came under control from 5-11-49 and remained so till discharged on 8-1-49. The ear condition had much improved. The polypus was cauterised. The discharge had become watery. The bedsores were healing.	8-1-50
419 18-8-49	G.P. 18-M	18	M	Acute Lt. Mastoiditis	Discharge left ear of few months duration. Acute signs since 4 days. Varying temperature.	X-ray on 19-5-49 Left Mastoiditis again on 27-8-49 No evidence of cerebrale abscess. Lab reports 26-8-49 C.S.F. Chlorides 710 mg. cells 6 per field. otherwise normal. Blood 19-5-40 RBC—4040000 HB 76% WBC 10200 Neutrophils 78% on 26-8-49. WBC 8900 Neutrophils 74% HB 78% Blood slide negative for M. P. repeatedly.	Modified Radical operation on 20-9-49 under general ether.	He had rigors on the day of admission. No operation was done till 20-8-49. 200000 units Penicillin 3 hours from 18-8-49. The antrum and cells contained foul pus. Lateral sinus exposed. operation wound closed. Counter drainage provided for. Rigors were repeated on the 21, 23, 24, 25, 26, 27, August, temp. shooting upto 105° F. Penicillin reduced on 26-8-49 to 30000 units 3 hourly and continued till 6-9-49. Third course of penicillin from 9-9-49 to 13-9-49. Temp. on 13-9-49 was normal. Another rigor on 14-9-49. Fourth course of penicillin 15-9-49 to 19-9-49 50000 units 3 hourly. He had glucose saline on the day following operations and off and on whenever necessary. Eye surgeon's report on 26-8-49 Marked venous engorgement both eyes. Haziness of both discs and horizontal nystagmus. At his suggestion X-ray of the skull was done. Eye surgeon re-examined him on 20-8-49 "optic discs clear, engorgement of veins still persisting". Operation-wound healed on 1-9-49. Physician examined him on 27-8-49. No cranial nerve palsy. The motor sensory and cerebellar systems were normal. Knee jerks normal. Superficial reflexes were present. Sulphathiazole therapy started on 27-8-49 for 1 week. The general condition improved from 7-9-49. Rt ear showed further granulations which were removed on 11-10-49 under Pentothal anaesthesia; was allowed to go home on 17-10-49.	17-10-49
5 1-2-50	K.K. 13-M	13	M	Lt. Mastoid abscess	History of both ear discharge since one year. Painful tender swelling Rt. mastoid since 10 days. Also scabies infection all over the body	Nil	Simple Mastoid operation under open ether	On incision pus poured out when the mastoid cortex was laid bare. No sinus seen or felt. Mastoid cortex opened up. No pus or debris seen—appeared to be ivory type of mastoid. Mastoid tip thoroughly opened up. Antrum also found to be dry. Wound closed without drainage. Usual penicillin therapy. Left hospital against advice.	6-2-50

SUMMARY OF THE CASES (20)—Contd.

Reg. No. Date of Admission	Name	Age	Sex	Diagnosis	History	X-ray & other laboratory details	Nature of operation and type of anaesthesia	Other notes	Date of Discharge
181 9-2-50	T. G. M.	H		Acute left Mastoid Abscess.	Huge swelling in front above and behind left ear. Ear discharge history only 2 weeks, with pain and swell- ing. Had rickets in infancy and chicken- pox at age 5. Tonsils and adenoid.		Simple Mastoid operation under open ether.	After opening the abscess behind the ear, the whole of cortex of mastoid including the antrum cells round about the lateral sinus as well the zygomatic cells laid bare and curetted. Granulations and pus removed. Wound closed. Counter drainage provided. Peni- cillin therapy. Wound healed. Ear-discharge much less. Still undergoing local therapy. T. A. operation is advised at once.	
475 23-2-50	Q.P.F.	60-M	Ch.	Rt. Acute Mastoid Abscess.	Ear discharge 2 months, swelling in front, be- hind and above left ear for 5 days. Pain- ful, severe eczematous condition of the rt. ear.	X-ray 23-2-50 Rt. Mastoiditis.	Modified Radical Rt. Mastoid operation under intra tracheal ether.	Large amount of pus removed on mastoid incision. There was a sinus in the antrum area which opened up easily. Carious bones. The outer wall of the additus and the posterior end of the zygoma- tu bone carious. All cells opened up. Lateral sinus exposed. Counter drainage provided. Peni- cillin therapy 30000 units 2 hour- ly for 7 days. Sulphathiazole therapy 5 days. Tabs. 2 t. d. s Progress satisfactory.	

REVIEW OF RECENT PROGRESS

REVIEW OF PROGRESS IN UROLOGY IN 1949

by S. R. JOGLEKAR, Bombay.

Prostate : Urological literature is still full of references to prostatic surgery in general and Millin's method in particular. Many urologists are adopting the retropubic method; but still there is far from unanimity on the procedure. Thomas D. Moore¹ is of the opinion that in selected cases, especially in large glands, the Millin method is useful, as, with no greater risk, convalescence and functional results are better. He also insists on the usual preoperative investigations; but prefers a pneumocystogram instead of cystoscopy to find out about the size of the gland and associated calculi, if any. In 17% of his cases, osteitis pubis occurred, while in no case operated on by the suprapubic route was this complication present. He thinks this is a most dreaded complication and therefore a deterrent to the adoption of the retropubic route.

David Presman and Harry C. Rolnick² emphasize that in all prostatic operations, three aspects must be considered, namely (1) immediate mortality and ease or otherwise of the operation, (2) post-operative morbidity and complications and (3) end results. As far as the retropubic method is concerned two factors are favourable, firstly it is the direct route and secondly no important organ is injured. The conclusion arrived at is that Millin's operation with some modifications deserves further trial.

Samuel K. Bacon³ initiating a discussion before the American Urological Association Meeting at Boston, gives his results in 102 cases treated by the retropubic route. The mortality was 6.8%, and the average hospitalization was 17 days. His opinion was, caution was necessary in selecting cases and thorough study of retropubic anatomy on the cadaver was essential before undertaking operations by this route. He is also of opinion⁴ that only large or medium growths should be tackled by this route.

In the discussion which followed Bacon's paper, Millin was a strong advocate of his own method, Creevy favoured trans-urethral route, G. J. Thomson was for transvesical route, Lowsley Grant's view was that the Millin method was not ideal but better than the rest, while Alejandro Palomo advocated choosing the best method for each case.

G. Austen and W. C. Quinby⁵ are of the opinion that the Millin technique is best suited for benign hypertrophy and benign hypertrophy with prostatic calculi, and not suitable for fibrous prostates and bladder neck obstructions.

C. A. Wells and R. Marcus⁶ prefer the suprapubic route with packing the prostatic cavity with "Gelfoam" and "Oxycel" gauze around a retrograde urethral tube and complete closure of bladder. They report good results in 21 consecutive cases.

H. P. Winsbury White⁷ taking part in a discussion on bladder neck obstruction expressed himself in favour of suprapubic methods only.

Vittorio Giongo⁸ in a resume of the present state of prostatic surgery, comes to the conclusion that no one method is of any exclusive use and advocates Freyer's operation for large glands and the Millin operation only in medium sized growths with no urinary or bladder infection.

C. L. Dening⁹ in discussing modern surgeries of the prostate, mentions that the pendulum in prostatic surgery has swung often in recent times; but it is important to observe that all methods must be mastered and each case judged on its merits as regards nature and size of growth, associated complications such as calculi, papillomas, impaired kidney function and cardiovascular and neurogenic complications. He says, "Surgeons who advocate one operation for all cases, only exemplify their ignorance of the problem involved."

Seymour F. Wilhelm and Selwyn Z. Freed¹⁰ mention two distressing complications after retropubic protatectomy. These are, postoperative stricture and osteitis pubis. The first occurred in 9 out of 33 cases and the second in 5 out of 32 cases. The second complication accords with experience of American urologists but not with that of Millin who had no case of this nature. They conclude that these complications are a serious drawback to retropubic methods.

Lawrence L. Lavalle and Frank C. Hamm¹¹ give an account of osteitis pubis and suggest a new method of treatment. The main symptoms and signs noticed are:—pain over the symphysis pubis and both pubic rami may be affected; there is difficulty in walking, pain in upper thighs and adductor magnus spasm; getting in and out of bed is painful and turning on the side brings on adductor spasm; there is low fever but no swelling or redness over pubis. They suggest large doses of vit. B-complex orally and by injection plus local diathermy, and they have found that cure takes place in 3–6 days instead of weeks or months as in cases treated otherwise.

C. F. Macdonald and C. Huggins¹² advocate simultaneous prostatectomy and inguinal herniorrhaphy in those cases where both lesions are present and have obtained good results in their practice.

Summarizing the opinions expressed about prostatic surgery during the last year, it seems that Millin's retropubic operation, although a valuable addition to the various techniques, is not firmly established still as a routine procedure and a few more years must elapse before any definite views can be expressed.

Kidneys: Frank A. Hughes¹³ and C. P. Sames¹⁴ have described a different approach to the kidneys, specially the upper pole, renal pedicle, and the adrenal glands, by resecting the 12th rib and going to the perirenal fascia and fat through the exposed bed of the rib. The reviewer has used this method and has found it very useful.

A new method of treating anuria has been suggested—intravenous injection of

procaine. Niels Peer Friis¹⁵ has found it successful in sulphur anuria. He gives 5 c.c. 1% procaine intravenously in 75 seconds or 10 c.c. 1% in 150 seconds, every two hours and has obtained good results. A French surgeon has tried it in a case of mercury bichloride poisoning. He gave slow injections of 10 to 15 c.c. of 1% novocaine twice a day on first day and 15 c.c. 1% a day on subsequent days, till urine flow was normal in quantity. It was found two months later on, that the kidneys did not show any trace of the effects of mercury poisoning.

J. Hartwell Harrison and B. E. Trichet¹⁷ have described a very remarkably useful method in removing renal calculi through pyelolithotomy. They use what is called a fibrin coagulum. The technique used is that of Dees¹⁸. Stones undetected by palpation or even by X-ray films are removed with certainty. There is less probing and exploration of pelvis or kidneys and therefore less bleeding and traumatization. This method is particularly useful for wandering or inaccessible stones in pelvis or calyces and can be used even when it is not possible or advisable to mobilize the kidney either due to its depth or surrounding adhesions. The material used is 1 unit of Fraction I of human plasma dissolved in 100 c.c. of a buffer solution of sterile 0.15 M (molar) Na_2HPO_4 , thirty minutes before use. (Fibrinogen is now sold with physiological saline as the diluent for it.) On addition of thrombin, a clot forms in this fibrinogen in 30 seconds and becomes firm in 4–5 minutes. The authors expect even bovine fibrinogen will be equally useful although they have not tried it as yet. The technique after exposure of the kidney and mobilization if possible or desirable is to demonstrate the posterior part of pelvis and upper part of ureter and the ureter is clamped by a bulldog clamp. Fibrinogen in solution is injected through a rubber catheter inserted through an opening in ureter above the bulldog clamp, after irrigating the pelvis with saline and finding its capacity. The fibrinogen is made to fill up the pelvis to its full capacity. Directly after or even simultaneously, through a separate syringe, thrombin or clotting globulin is injected

15–10 the volume of fibrinogen. After 5 minutes a firm clot forms and then the catheter is removed. The opening in the ureter is enlarged and the clot removed with stone forceps. The pelvis is irrigated with saline and digital exploration of pelvis is done to make sure that all calculi are removed. The operation is then completed in the usual way.

Uretero-colic anastomosis is prominently discussed at present in urological literature and E. W. Riches¹⁹ has given a good description of a safe extra-peritoneal method.

The question of stress incontinence has become quite important during recent times. This complaint is usually found in parous women and may or may not be associated with prolapse of uterus or cystocele, or may remain persistent after repair of vesico-vaginal fistula. The exact cause is somewhat obscure; but it is believed that there is abnormal descent of the bladder neck during micturition or during some other cause of increased intraabdominal or intrapelvic pressure due to straining or coughing, etc. This descent is due to laxity of some of the support to the bladder neck especially the pubo-coccygeous muscles or pubo-vesical ligaments. The operations more commonly performed are some type of sling operations suspending the bladder neck higher up by a piece of fascia lata or external oblique aponeurosis, either by the vaginal route or through the cave of Retzius or the combined route. The main types of procedures are the Aldridge method, Millin II method, or the Wilfred Shaw operation. Wilfred Shaw²⁰ has given a clear account in his article and a detailed discussion is published in the Proceedings of the Royal Society of Medicine²¹. Professor Chassar Moir favours the Aldridge operation, while Millin, Badenoch and others favour the Millin II method. (Millin and Reed²²).

A new method of operating for radical cure of varicocele is described by Alejandro Palomo²³. The internal abdominal ring is exposed under local anaesthesia and the pampiniform plexus and spermatic artery are isolated, leaving free the vas and the

artery to the vas. A $\frac{1}{2}$ " piece from the pampiniform plexus is excised. The whole operation is extra-peritoneal. The artery to the vas being intact, the testis does not atrophy and there is a radical cure. 40 operations in 38 patients (two bilateral cases), were all successful.

In many cases of vasectomy either done for birth control or due to accidental injuries during hernia operations, it happens that the patients for some reason of their own, desire to be fertile again. A method of joining together the cut ends of the vas deference has been described by Ben. D. Massey and Earl F. Nation²⁴. The ends of the vas are exposed and the ligated ends are cut away with a razor blade and the lumen is demonstrated. Tantalum wire no. 40 or stainless steel wire no. 32 is threaded on a blunt needle and passed in the lumen of both ends and brought out of tube at 1–3 cms. from cut ends. The two ends of the wire are then pulled to bring cut ends together and the sheath of the vas is sutured by interrupted stitches with no. 100 cotton or fine wire. The wire ends are brought out of the skin of the scrotum and fixed. This wire is pulled out after 8–10 days. Four cases, all successful are recorded.

The use of antibiotics in urinary infections is still under discussion. From a symposium in which M. E. Florey, C. A. Wells, H. Donovan and R. Marcus took part²⁵, followed by a discussion, many useful points came out. M. E. Florey mentioned that although over a hundred antibiotics have been discovered only about a dozen are really useful. They are not related to each other either chemically or physically. Wells pointed out the danger of producing resistant strains of *B. pyocyaneus* and *B. tuberculosis* after indiscriminate use of streptomycin, and therefore he suggested the following rules for observance.

1. Use other remedies first before invoking streptomycin.

2. Use streptomycin only when other germs are eliminated by sulpha drugs and penicillin.

3. Surgical treatment must be completed before streptomycin is started.

4. A course longer than 4 days should be avoided in urology as resistant germs are likely to be produced.

Marcus advocates the use of sulpha drugs and antibiotics together because of synergistic action.

In the discussion which followed, E. W. Riches said that he found streptomycin useful in sensitive germs. But he is still not sure about the exact time to use it in urinary infections. Toxic effects were not noticed if not more than 15 grms. of streptomycin were given. But he was of opinion that toxic effects on the vestibular nerve were worse than the disease in the effect on the patient's mind.

Wilson Hey remarked, "Anybody could use penicillin but only wise men knew when to use streptomycin."

Lady Florey, in reply, mentioned among other things that her impression was that streptomycin was dying out in America except perhaps in tuberculosis.

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CASES & COMMENTS

CHORDOMA

by A. K. BASU, Calcutta.

Chordoma has been considered as one of the rarest varieties of tumours and until recently only isolated cases have been described in the literature. In our country since 1939 — only one case has been described (De and Tribedi 1939). In recent times, however, there has been general recognition of the fact that this type of tumour is more common than it was supposed to be before and more and more cases are being published. Harvey and Dawson (1941) in an exhaustive and beautifully illustrated article described 14 of these tumours. Mabrey (1935) in a review of the subject analysed 150 cases. Gentil and Coley (1948) observed 7 cases from 1930 to 1943 and reviewed 128 cases from the literature. The separation of this tumour from Chondromas and its isolation as a distinct entity derived from the tissues of the notochord had been accomplished in the early years of this century. In the literature previous to this time such names as ecchondrosis physaliphora (Virchow 1857) abound.

The first sacrococcygeal chordoma was recorded in 1910 (Feldman). In Britain, the earliest case to be described in detail was by Stewart (1922), who also gave a historical review of the subject from 1853 and discussed the pathology, histology and the clinical manifestations. Among other writers who have discussed this subject are Capell (1928), Coenen (1925), Stewart and Morin (1926), Richards and King (1940), Faust, Gibmore and Mudgett (1944).

Considering the rarity of the tumour and the acknowledged unfavourable prognosis even following radical excision, the following case is worthy of record.

CASE REPORT

R.M. a married lady of 23 attended the Orthopaedic department of the hospital in December 1948 with a history of progressively increasing pain

in the sacrococcygeal region for the last 8 months. The pain was more marked during defaecation and after sitting for long periods. At other times there was a dull but bearable ache.

The patient who was an intelligent lady gave the history that 3 years previously she sustained a fall on her back and hurt herself about the sacrococcygeal region. She was inclined to ascribe her recent complaint to this fall though the pain had been more noticeable and been increasing in severity since the last 8 months.

She had two children, the older girl 4 years old and the youngest born only 2 months before coming to the hospital. There was no history of any difficulty or unusual occurrence during the birth of the last baby. On examination she was an average Bengali girl of lean type. About the lower part of the sacrum and between the two gluteal folds there was slight fullness and slight tenderness on pressure.

Rectal examination revealed a big mass projecting on the posterior wall of the rectum. The mass was fixed, firm and about the size of a billiard ball. The mucous membrane of the rectum could be freely moved over it, and the mass was projecting beyond the posterior wall to the lateral walls of the rectum.

Skiagrams (Figs 1 & 2) showed extensive destruction of the lower half of the sacrum with irregular bone formation anteriorly. The radiologist's report was "Osteogenic sarcoma". It can be seen in the antero-posterior view (Fig. 1) that the bone destruction mainly involves the lower half of the sacrum and the coccyx is affected to a less extent. In the lateral view (Fig. 2), the mass can be seen occupying the hollow of the pelvis and irregular lines of bone formation are evident. Looking at the skiagram it seems surprising that the patient had a normal delivery only 23 months previously.

Remembering the rarity of osteogenic sarcoma at this region and the possibility of chordoma, it was decided to do a biopsy before deciding the course of treatment, and this was done through a posterior incision on 20-12-48. The report was that it showed the typical picture of chordoma. The patient however developed chicken pox at this time and had to be discharged from the hospital with the advice to come back later. Thus she did on 9-2-49, and in a further skiagram at this time the neoplasm appeared to have grown in size and there was more bone destruction.



Fig. 1.

Before operation. Antero-posterior view showing widespread bone destruction of the lower half of sacrum. The lower 3 pieces of coccyx can be seen intact.

Operation (15-2-49). It was decided to try and do a radical excision as these tumours are generally acknowledged to be radio-resistant. A mid-line 7" incision was made extending from the lower lumbar spine to the posterior margin of the anus which had been closed by a purse string suture. The tumour which was easily found was well capsulated and by careful dissection a plane of cleavage could be found between the posterior and lateral walls of the rectum and the neoplasm. The rectum and the lower part of pelvic colon was displaced anteriorly and gradually the whole encapsulated wall of the tumour sitting in front of and involving the lower part of the sacrum could be isolated. The tumour was enucleated taking particular care to preserve the few nerve strands in association with it, and the whole of it together with the coccyx was removed. Oozing was considerable and this was controlled by hot pack and "Gelfoam" pressure. The wound was closed leaving a sheet drain. She received 300 c.c. of blood transfusion during the operation and a second transfusion of 300 c.c. afterwards. A self-retaining catheter in the bladder was tied in.

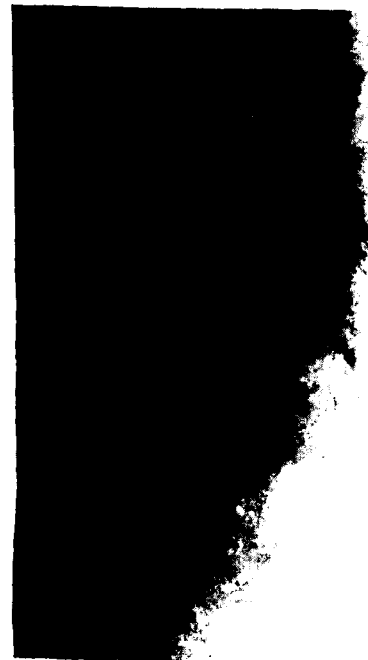


Fig. 2.

Before operation. Lateral view showing the neoplastic mass occupying the pelvic cavity.

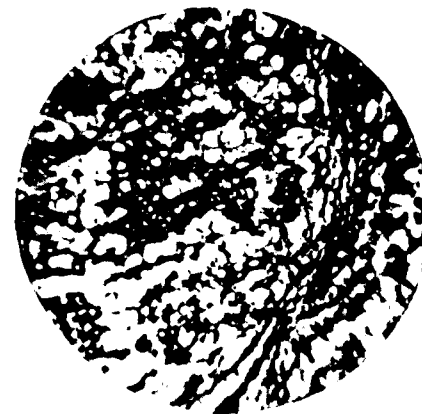


Fig. 3.

Histological section of the tumour. The physalipharous appearance of the cells is well seen. The cells are arranged in radiating columns and mucin is also present in the interstitial tissue.

During the post-operative period the bowels were kept locked for about 7 days and catheter drainage was maintained for 2 days. She passed urine by herself on the 3rd day. Wound healed well. She was discharged on 17-3-49. She came for re-examination one month after the operation and showed a well-healed scar and was improving in health. She went back to her home in Assam in April 1949.

The tumour after removal was seen to be larger than was originally thought. It measured 3 1/2" x 3". It was lobulated and on section contained jelly like pinkish material. The histological picture of the tumour (Fig. 3) presented columns of cells arranged in radiating manner and at certain places alveolar formation.

The physalipharous appearance of the cells was quite evident and mucin was present to a variable extent in the stroma. With higher magnification nuclear vacuolation was seen.



Fig. 4.

18 months after operation. Antero-posterior view showing well demarcated upper half of sacrum.

Follow Up: The patient continued to be in good health and came down to Calcutta on request about the middle of April 1950. Except for a small discharging sinus about the middle of the scar, which had developed about 3 months before, there was no complaint. Defecation was normal and without pain. Her general health had improved considerably. There was no nervous disturbance. The persistence of the sinus was due to a small

unabsorbed silk ligature which was easily taken out and thereafter it quickly healed.

Skilagrams (Fig. 4 & 5) showed a well demarcated upper 1/2 of the sacrum. In the lateral view (Fig. 5) the hollow of the pelvis was clear and to all intents, the neoplastic condition seemed to have been totally eradicated.



Fig 5

18 months after operation. Lateral view. The pelvic cavity is seen to be free.

DISCUSSION

A few points about the characteristics of this interesting tumour may not be out of place.

A. Sites: The common sites of the chordoma are the sacrococcygeal region and the basi-sphenoid. 60% of the tumours are said to occur in the former situation (Gentil and Colley 1949). They have also been described however in the occiput (Andrews

1942) in the nasopharynx (Travers 1942), in the lumbar vertebrae (Robbins 1945), in the sella turcica, clivus, suprasellar region (Globus and Bergman 1946), and in the cervical vertebrae. An uncommon place where it has been described is the frontal sinus (Adams 1948). Reich and Nechtow (1945) described a cystic pelvic chordoma which simulated an ovarian cyst. Harvey and Dawson (1941) gave the following percentages:—

Sacrococcygeal	51%
Cranial	37%
Vertebral	12%

Age: No age is exempt but the tumour is more common in the 3rd and 4th decades of life. De and Tribedi's case was a man of 42 and in Harvey and Dawson's series—the largest number of cases were seen in the age group between 30 and 50.

Sex: The tumour is said to be more common in males, though our case happened to be a female.

Influence of Trauma: Trauma has been supposed to be a factor in the initiation of the tumour. The association of trauma was evident in the case reported by De and Tribedi (1939) and was also quite evident in the case reported here.

Rate of growth: The tumour is essentially a slow growing one and it may remain quiescent and be symptomless for quite a long time. In our case, the interval between the history of trauma and the appearance of the patient for examination was 3 years and the duration of pain and difficulty in defecation was 8 months.

Radiosensitivity: The tumour is supposed to be fairly radio-resistant and radical operative excision is the recommended method of treatment. Examples of unusual radiosensitivity are, however, found in a few cases in the literature (Andrews 1942).

Metastases: Metastases are uncommon and usually the tumour recurs locally. Involvement of the regional lymph glands sometimes occurs. Morris and Rabinowitch (1947), however, described a case where a chordoma in the lumbar region metastasized to brain, lung, pancreas, axillary and iliac glands.

Prognosis: Radical cure is very rare. In most cases excision is only partial and the tumour usually recurs locally even after a long time. In De and Tribedi's case there was recurrence over the operative scar. In Gentil and Colley's (1948) opinion, local recurrence is a constant feature.

SUMMARY

1. A case of sacrococcygeal chordoma is described. The tumour was treated by radical excision and has been free of recurrence for the last 18 months.

2. Salient features of this interesting neoplasm with its varied clinical radiological and pathological features are stressed.

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REVIEWS OF BOOKS

Mongolism and Cretinism: Second edition by Clemens E. Benda, M.D. Pp. 316. Illust. 104. Grune & Stratton, Inc. New York City. (1949).

The original research in mongolism was done at the Wallace Research Laboratory, Wrentham (Massachusetts) for 10 years, 1936-46 and the second edition has incorporated some of the later works of the research which has been continuing. The author believes from his data which includes now a study of nearly 500 families, that mongolism is not due to genetic factors. Everyone will agree with him that the deficiency in a mongoloid baby must have developed in the pre-natal period during intra-uterine life. But while many have been content to ascribe it to a vague 'hereditary or genetic factor' he has discussed and given reasons why it could be neither. He has also given data which in his opinion point to certain pre-natal maternal factors as the probable cause of mongolism. These maternal factors are however common to various other conditions as abortion, pre-maturity and hormonal sterility. He has studied the pathology of the pituitary in 46 cases of mongolism and found a definite deficiency. It was hypoplastic in almost all, with a deficiency of the Cama cell system and general paucity of formation of chromophilic elements; in contrast the pituitary studied by him in cretinism was rather enlarged, due to congestion and secretory stasis. In his words, mongol is a 'pituitary cretin.' He gives a few possible maternal causes during the early weeks of pregnancy, which could result in this congenital acromiopia and admits that the matter has to be further investigated. Apart from these data, the book is very well illustrated by clinical photographs and drawings, besides original microphotographs and should be studied by all paediatricians.

S. T. A

A Short Practice of Surgery: by Hamilton Bailey & McNeill Love. 8th Edition - 5 Parts. [Part I. Pp. 224. Illus. 259 (86

coloured)—1948. Part II. Pp. 225-420. Illus. 271 (81 coloured)—1948. Part III. Pp. 421-628. Illus. 303 (81 coloured)—1948. Part IV. Pp. 629-808. Illus. 163 (21 coloured)—1949. Part V. Pp. 809-1050. Illus. 202 (11 coloured)—1949.] M. S. H. K. Lewis & Co. Ltd., London.

This well-known and popular Textbook of surgery is now in its eighth edition. In order to keep the material as upto date as is possible, the authors have presented this book in five parts which have appeared at intervals of approximately two months. Many chapters have been re-written and an additional chapter on peptic ulcers has been included. The matter has been brought upto date. As in previous editions, advanced surgery and rare conditions have been relegated to small types. The edition is profusely illustrated and many additional figures have been added. The quality of printing, the get-up and the illustrations are of a very high order. We are confident that this edition will continue to be as useful and as widely read as have been the previous ones.

U. M. R.

A Textbook of Surgical Pathology: by C. F. W. Illingworth, C.B.E., M.D., Ch.M., F.R.C.S.E. and Bruce M. Dick, M.B., F.R.C.S.E.—Sixth Edition. Pp. 726. Illus. 317. J. & A. Churchill Ltd., London, W.1. (1949).

The several advances made in surgical pathology in recent years have been included in this new edition. New chapters have been introduced and some of the older ones have been re-cast. In the sections on brachial neuritis and sciatica, the multiplicity of causes responsible for these syndromes have been clearly brought out. The all important chapters on thrombo-phlebitis and vascular hypertension have been brought upto date. The recent rapid strides that have been made in the understanding and therapy of conditions such as portal hypertension, peptic ulcer, and congenital anomalies of the

heart and big blood vessels have been incorporated. This edition will continue to be very useful to surgeons, pathologists and others interested in the subject.

U. M. R.

Rhinoplasty and Restoration of Facial Contour: by Jacques W. Maliniac, M.D. Pp. 327. Illus. 214. 1947. S. A. Davis & Co., Philadelphia.

Rhinoplasty is not common here, and there are few books devoted to the subject, but here is one such.

Mr. Maliniac devotes a whole chapter to the detailed study of the anatomy of the nose and its development which forms a good introduction to the study of deformities of the nose and their correction.

He classifies in detail injuries and fractures of the nasal bone, and deals in the next chapter with the immediate care and management of them; which is a subject that requires great attention and goes a long way in the prevention of deformities.

There is also a chapter devoted to the general technique and care in plastic procedures in general and with special reference to operations about the nose.

Description and useful modification of the various methods of rhinoplasty has been dealt with. Though all the procedures are enumerated, a few which in the author's opinion are the most useful have been discussed in detail. Separate chapters are devoted to depressed deformities, nasal

asymmetry, oversize deformities and associated contour deformities of the chin and malar zygomatic compounds.

There is only a passing mention of the total reconstruction of the nose for complete loss and details for the same are lacking.

On the whole the book is informative and useful.

B. V.

Cranioplasty: by David L. Reeves, A.B., M.D. Pp. 119, Illus. 71. Blackwell Scientific Publications, Ltd., Oxford (1950).

The covering of cranial defects with a view to protect the brain against accidental injury has always been a fascinating subject and Dr. Reeve's monograph is a notable addition to the already extensive literature on the subject. Autogenous grafts by their very nature are always available and are suitable for small defects, but for larger ones, especially those following war and automobile injuries, foreign material of a non-irritating nature has to be relied upon. The author's conclusions on the superiority of tantalum for this purpose are amply supported by the experience of other surgeons who have had practised this branch of traumatic surgery. The author's record of 196 cases of tantalum cranioplasty with no deaths is an achievement which conveys a message of cheer to others working in the same speciality.

K. G. P.

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The XII Annual Conference

The XII Annual Conference of the Association of Surgeons of India will be held on the 29th, 30th and 31st of Dec., 1950 and 1st of Jan., 1951 at New Delhi. All members are requested to attend. The details about accommodation, etc. at New Delhi can be had from the Local Secretary, Dr. S. K. Sen, F.R.C.S., 10, Hailey Road, New Delhi.

Resolutions to be moved at the Annual General Body Meeting should be given due notice of, and such notices should reach the Hony. Secretary not later than 10th of December, 1950.

Nominations for the Presidential election should be sent to the Hony. Secretary c/o Dr. S. K. Sen, New Delhi, so as to reach him on or before 30th of Dec '50.

Subjects for discussion at future meetings

12th Meeting (at Delhi):

1. (a) *Bronchiectasia*—

Dr. R. Mahadevan, Madras.

(b) *Lung Abscess*—

Dr. S. J. Mehta, Bombay.

2. *Intestinal Obstruction in Children*—

Opener: Dr. A. E. DeSa', Bombay.

Seconder: Dr. R. A. Irani, Bombay.

3. *Sciatic Syndrome*—

Opener: Dr. S. K. Sen, New Delhi

Seconder: Dr. V. P. Mehta, Bombay.

13th Meeting:

1. *Hydrocephalus*—

Opener: Dr. A. E. DeSa', Bombay.

Seconder: Dr. R. Nigam, Nagpur.

2. *Prolapse of the Rectum*—

Opener: Dr. K. G. Munsif, Bombay

Seconder: Dr. S. N. Mathur, Lucknow.

3. *Tuberculosis of the Hip Joint*—

Opener: Dr. A. K. Basu, Calcutta

Seconder: Dr. B. N. Sinha, Lucknow.

14th Meeting:

1. *Surgical Treatment of Hypertension*—

Opener: Dr. A. V. Bahga, Bombay

Seconder: Dr. V. P. Mehta, Bombay

2. *Strictures of the Urethra*—

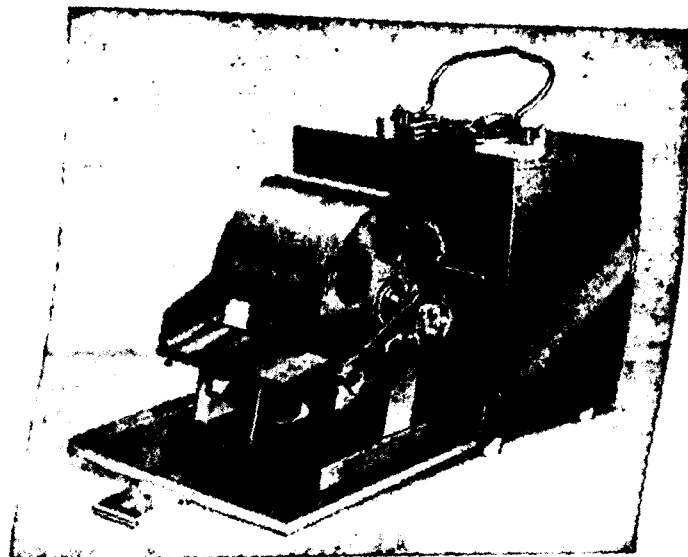
Opener: Dr. H. Y. Khwaja, Bombay

Seconder: Dr. U. Mohan Rau, Madras.

3. *Tuberculosis of Lymph Nodes*—

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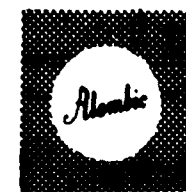
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Pyridoxin	
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Phenol as Preservative	0.5 %

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COMPOSITION

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Riboflavin	8 mg
Pyridoxin	
Hydrochloride	2 mg
Calcium	
Pantothenate	8 mg
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