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allied Sciences



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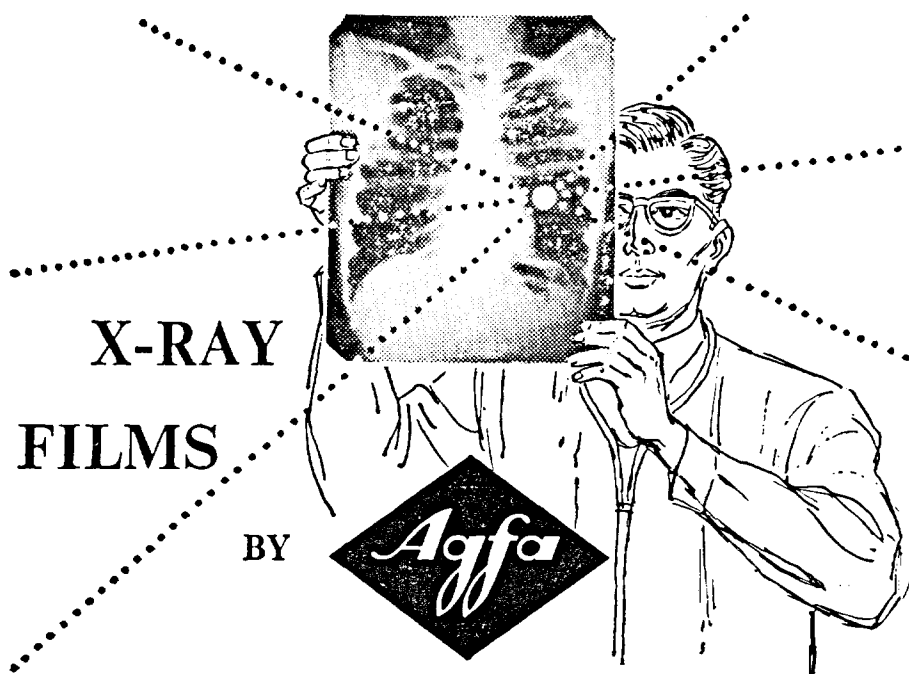
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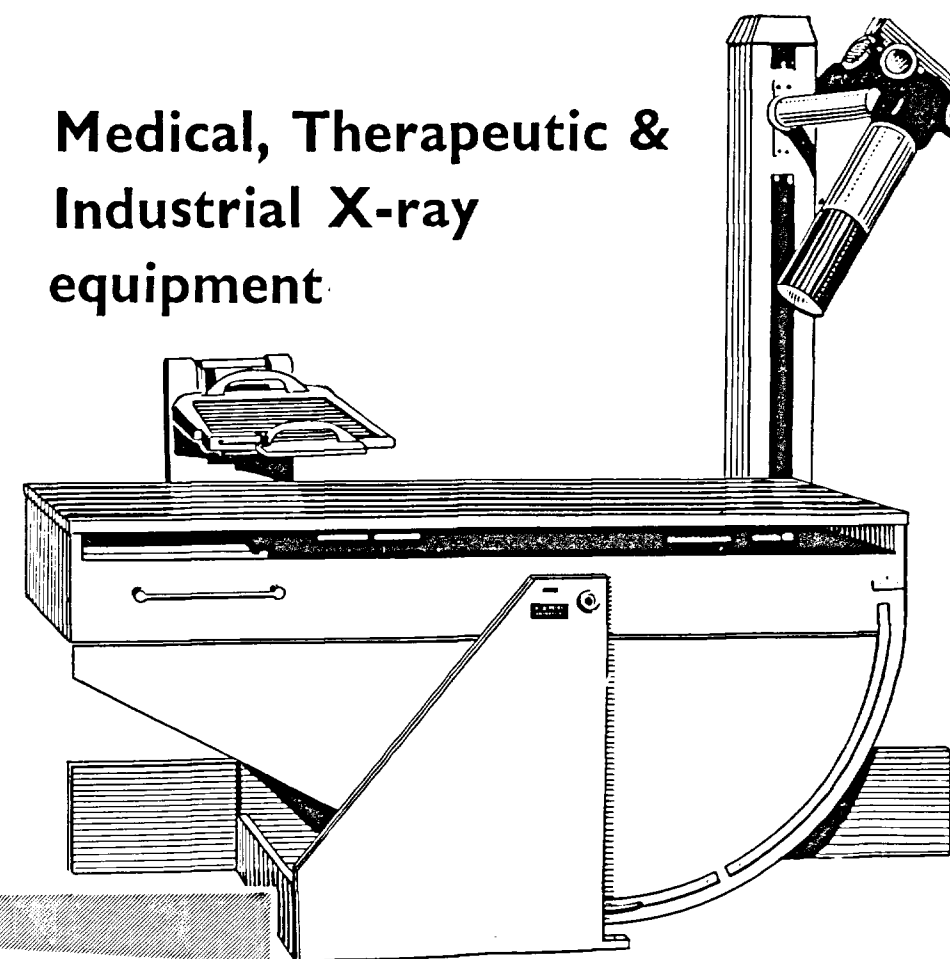
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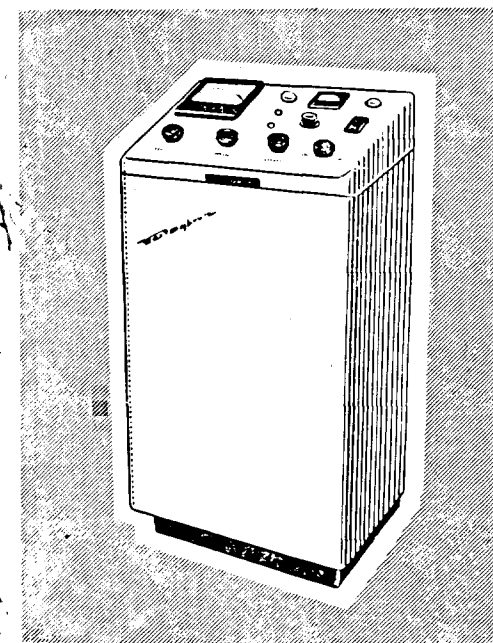
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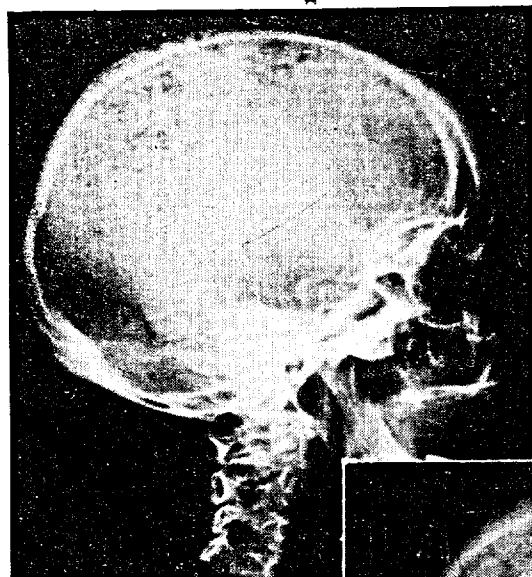


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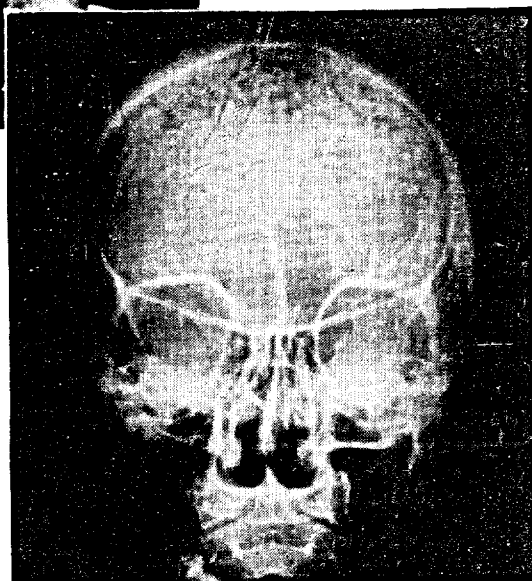
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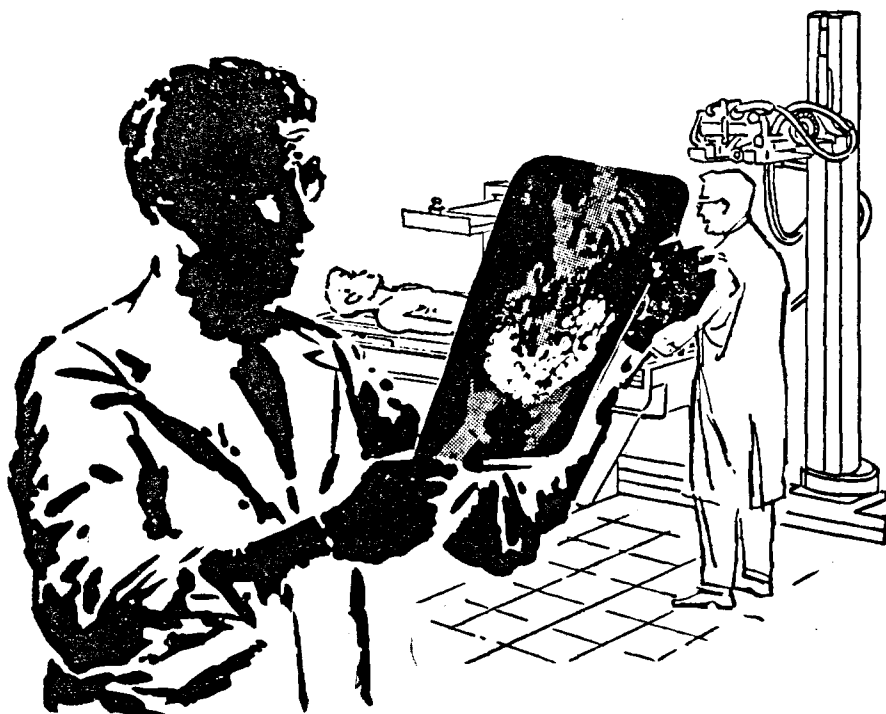
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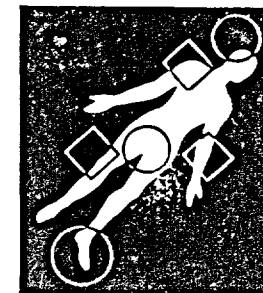
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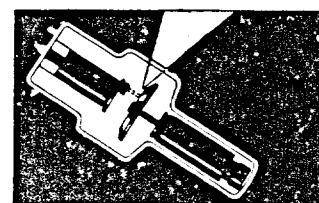
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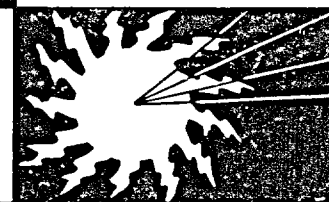
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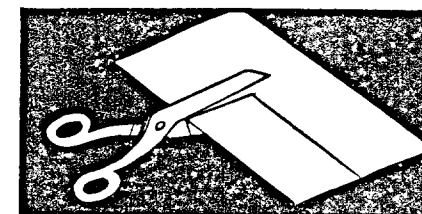
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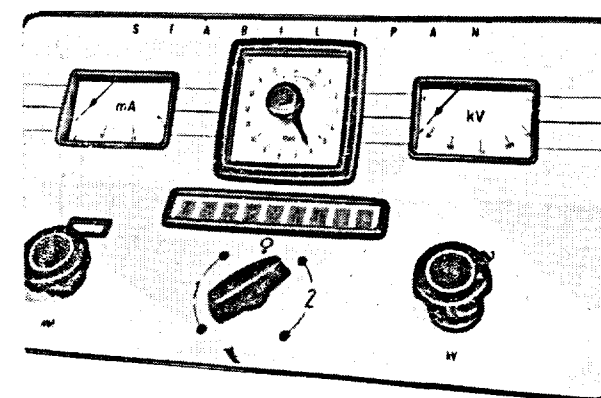
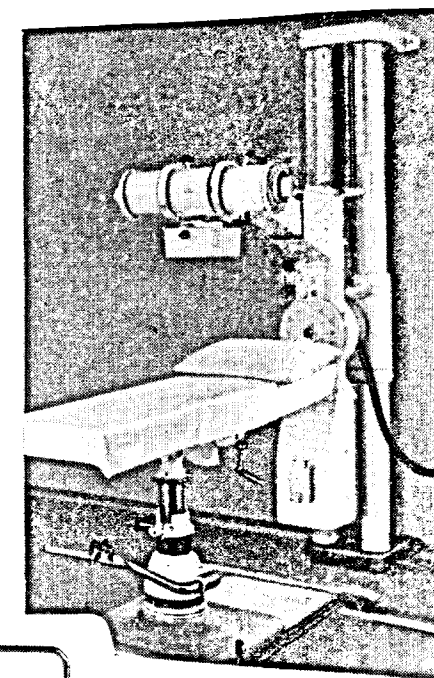
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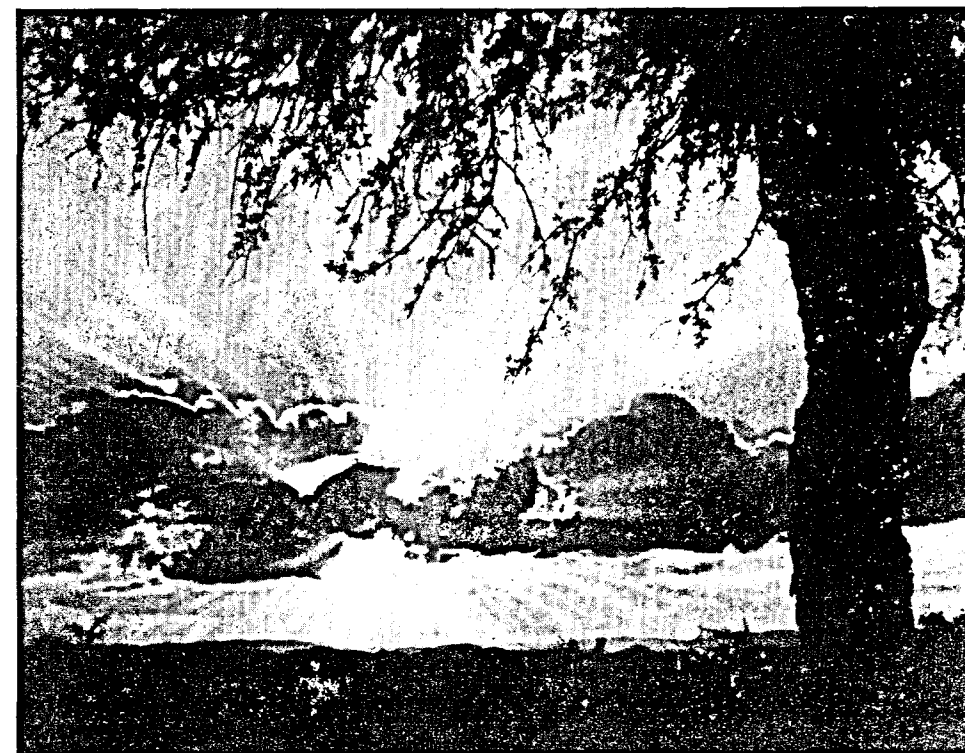
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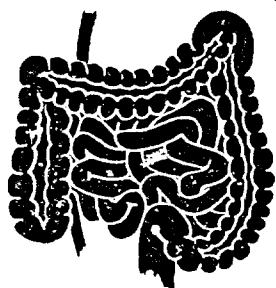
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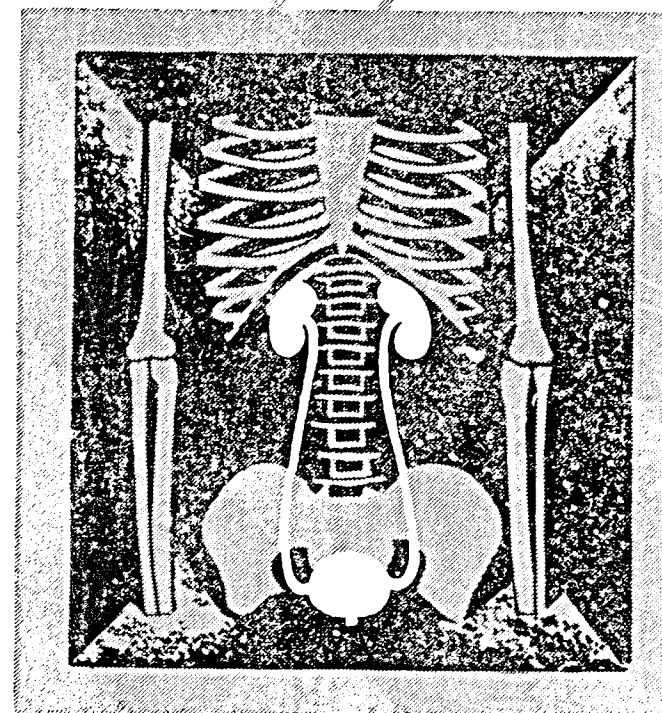
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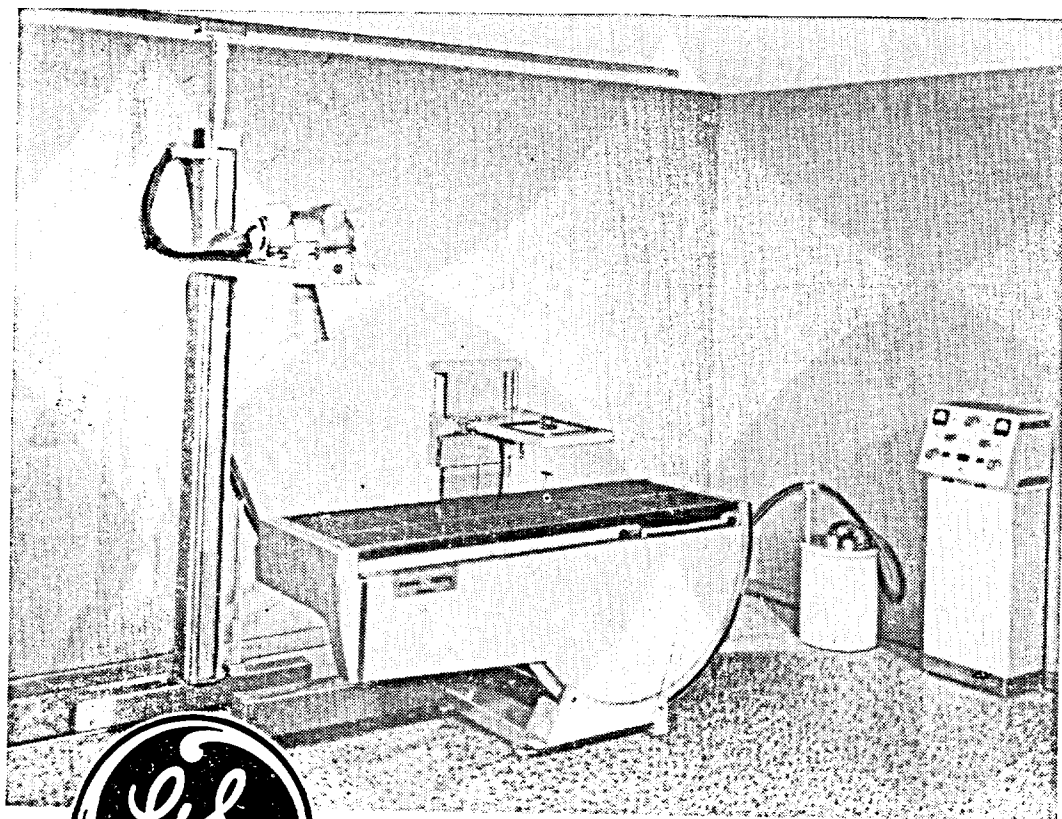
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Editorial

GRADUATE EDUCATION IN RADIOLOGY

BY

Dr. K. M. RAI, M.B.B.S., F.R.C.S., D.M.R.,

*Director and Professor of Radiology, Institute of Radiology,
Government General Hospital, Madras.*

There is such a growing and pressing demand in our Country in general and some States in particular for personnel trained in Radiology in connection with our expanding development schemes under the successive five year plans. The subject has therefore assumed a matter of extreme urgency and we will have to rise to the occasion and meet these demands if our Five Year Schemes should succeed.

There is comparatively greater demand for Radiologists trained in Radio-Diagnosis rather than those trained in Radio Therapy. How to meet this demand in a manner that would meet the needs of the urgent demand and also at the same time taking care that the standards of Radiological training in this country are not lowered. Would it be wise to split the training into its two branches of Radio Diagnosis and Radio Therapy and at the same time cut down the period of training to one year each or would it be possible for us under the existing circumstances of shortage of teachers and facilities for training to run a prolonged course in each of these sections as is obtained in United Kingdom! To examine this question, the Government of India have appointed a Committee known as the Post Graduate Medical Education Assessment Committee with Dr. B. C. Roy as Chairman. The Government of India also have appointed the Health Survey and Planning Committee with Sir A. L. Mudaliar as its Chairman. These two committees will make their recommendations shortly, to the Government in consultation with the Professors, teachers, and specialist associations as how best to meet this demand.

It is estimated that about 2000 teachers are necessary to staff the various medical colleges in the country and about 17,000 Post Graduate qualified Medical specialists would be necessary to provide specialised services

in the outlying areas of our country. This is not a small figure to achieve considering the availability of trained teachers, specialists and the facilities for training available in this country in the next 5 or 10 years. Administrative authorities find it difficult to provide specialist services to the large masses of our countrymen particularly in some of the specialities like ours. So, for some time at least some compromise has to be struck in the period of training imparted to them and the contents of the training. Along with this we have also to consider the interest of the personnel, their future chances of promotion, prospects, emoluments, etc. It would be necessary therefore to take up this question in earnest during our next annual congress at Hyderabad and come to a definite conclusion which should be applicable to the whole of India in the matter of duration of training, the standard of teaching and examination, and also the minimum qualification and experience that would be necessary for teachers of these post graduate courses. The aim should be the attainment of a uniform standard of education in Radiology throughout the country. Nothing less than this should be accepted as the hall-mark for the practice of this speciality. In case we have to cut down the course considering the exigencies of the times to say 12 months for each bifurcated course instead of 24 months as is available in United Kingdom how could we circumvent the deterioration of the standard as compared to the Western standard. The Editor has the following suggestion for the above which will not only ensure to a very large extent that proper standards are maintained ensuring at the same time the status of the Radiologists comparable to any of those who take other specialities like General Surgery, General Medicine, Obstetrics and Gynaecology or any of the conceivable specialities in Medicine and Surgery. The following scheme of Graduate Education in Radiology is therefore suggested for the consideration of all our brother-colleagues :—

1. We agree to bifurcate training in Radiology into its two branches—Radio Diagnosis and Radio Therapy on the same lines as is obtained in United Kingdom and some of the other advanced countries;

2. Considering the urgency of the large number of specialists needed in this branch to assist our developing schemes the courses be reduced to 12 months each until conditions are favourable for more extended courses as is obtained in U. K.

3. To maintain standards comparable to that obtained in the West, it is suggested that after the above Diploma training it should be open to such of those candidates who have the desire and ability to proceed further, that two higher degrees should be available to them in the speciality :—

(a) An M.D. in Radio Diagnosis of 2 years' duration of which one year's attendance in the medical wards of a recognised teaching hospital would be compulsory and the remaining one year period would be spent in a recognised teaching institution in radio diagnosis.

(b) An M.S. for Radiotherapy on the same lines as above, one year being spent in the Surgical wards of a recognised teaching hospital and the other year in the radiotherapeutic department of a recognised teaching department for this purpose. I am suggesting this on the same lines as the speciality of Obstetrics and Gynaecology which are now divided into an M.D. in Obstetrics and an M.S. in Gynaecology. I do not see that there should be any difficulty in organising the above courses. This would amount to a 'three year course' in each of the specialities—Radio diagnosis and Radio therapy for the ambitious and the brilliant candidate and at the same time would provide scope for training a much larger number of the average specialist to man smaller hospitals. Candidates who have taken either this M.D. or M.S. would have the same status as any other M.D. or M.S. They should be able to occupy the chairs of Professorship in any large institution with the above qualifications. This would incidentally standardise also the qualifications that would be necessary to fill up senior teaching appointments. I do not think that anybody should feel anxious about the emoluments that would accrue to incumbents of such posts. I believe that sooner or later there would be a uniform scale of pay for all teachers and as the socialist pattern of society develops the lure for private practice will disappear. I believe Medicine would be socialised in our Country also as was done in Great Britain.

*It is hereby announced with pleasure
that*

Dr. N. B. ROY

*has been elected President for the
year 1960*

Carcinoma of the Penis—Radium Treatment— Assessment of Results*

BY

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Anatomy

1. The parts that are of anatomical interest in the treatment of Carcinoma of the Penis by Radium may be considered as follows:—(1) The glans penis; (2) the prepuce and (3) the lymphatic drainage of these structures.

Embryology

At the 8th week of foetal growth, when the genital differences between the sexes are first visible, the glans penis is a naked terminal structure without an urethral canal and demarcated from the shaft by a shallow groove. At this period the future fore-skin appears as a ring of thickened epidermis at the base of the glans penis. It grows forward more rapidly on the upper surface leaving a certain deficiency of the preputial ring at the inferior aspect. At the 12th week the primary meatus still opens at the inferior aspect of the shaft of the penis proximal to the base of the glans. The secondary meatus is formed by a pair of outgrowths, growing on the ventral aspect of the glans which fuse to enclose the tube which proximally unites with the primary meatus and advances the urethra forwards to its final site. These outgrowths as they grow forward carry with them the prepuce on each side which joins in the middle to form the frenulum. The growth of the prepuce is completed by the 16th week of foetal life. During the un-equal

growth of the ectodermal and mesodermal tissues in the formation of the phallus, a layer of desquamating cells becomes imprisoned between the prepuce and the glans with intimate connections with both. This is continuous with the general skin. At this stage the epidermis of the glans penis and that of deep surface of the prepuce are one and indivisible, both consisting of squamous epithelium. The central cells in the imprisoned layer of squamous cells form cell-rests which degenerate forming a series of minute clefts which increase in size, link up with each other until finally the preputial space is formed^{1, 2, 3}.

The development of the prepuce with complete formation of the preputial sac is not complete when the child is born and it is non-retractable.

A clinical examination of the state of the prepuce was carried out among the new born infants and older children at the Women and Children Hospital, Egmore, Madras, and Paediatric Department of General Hospital; 121 new born infants and 175 older children upto 5 years of age were examined at the respective institutions (by Drs. Thampan and Achar). The observations were recorded as follows:—

1. Retractable; 2. Partially retractable; 3. Non-retractable.

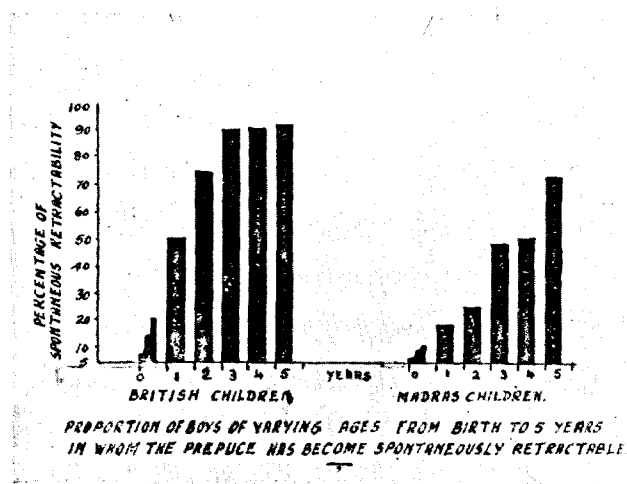
*Paper read at the 13th Indian Congress of Radiology—Poona.

Chart I

STATUS OF PREPUCE OF INFANTS IN THE NEO-NATAL PERIOD		
CONDITION OF PREPUCE	DR. GAIRDNER. CAMBRIDGE GROUP OF HOSPITALS	DR. THAMPAN & ACHAR W.C. HOSPITAL EGMORE GENERAL HOSPITAL MADRAS
RETRACTABLE	4.7.	2.57.
PARTIALLY RETRACTABLE	54.7.	26.47.
COMPLETELY NON RETRACTABLE	42.7.	71.17.

Comparative percentages of retractability, partial retractability and non-retractability in new born infants in England and those in Madras.

Chart II



Percentage of complete retractability in older children upto 5 years of age in the two groups.

It would appear from the above that the developmental separation of the prepuce of South Indian infants and children lags far behind that of English children. The much higher percentage of complete non-retractability in South Indian infants at birth is

in marked contrast to that reported among English infants; 71.1% in the former to 42% in the latter. Only 73.7% of South Indian children at the age of 5 years have achieved spontaneous retractability of the prepuce as against 92% of English children

at the same age. It is not correct to state that the incomplete separation is due to adhesions which suggests that the prepuce and the glans are developmentally separate structures^{3,4}.

Physiology

The inner surface of the prepuce and the outer surface of the glans are lined by stratified non-keratinising squamous epithelium. The outer skin of the prepuce consists of stratified keratinising epithelium richly pigmented. There is no agreed opinion whether the glans penis and the inner layer of the prepuce contain modified sebaceous glands, although the accepted, orthodox opinion is that modified sebaceous glands are present—secreting smegma. From the histological studies made by Rajam¹ in a limited number of circumcised fore-skin, sections of the sulcus and corona, he has not been able to observe any secreting glandular epithelium in serial sections.

The question therefore arises whether the foreskin serves any useful function. It may be a protective covering to the sensitive glans during childhood; but in the adult and older people it appears to be a distinct liability. As shown in Chart II in about 27% of South Indians the prepuce may be a grave liability as it may retain its embryological connections with the glans resulting in non-retractability and in the later life may become malignant.

Anatomical varieties of fore-skin

The following varieties have been described:—

1. The fore-skin which completely covers and fits the glans penis—neither more nor less;
2. The lax, loose variety which never stays in one position;

3. The fore-skin with a narrow, but dilatable orifice, otherwise normal;

4. A short fore-skin which stays behind permanently;

5. The congenital phymotic prepuce with an orifice as small as the meatus—never retractable; between this variety and the fully retractable type there are many gradations of retractability;

6. The fore-skin which covers only the proximal half of the glans penis;

7. The fore-skin which retracts dorsally but is held in check ventrally by a short, tight frenulum which frequently snaps on the first nuptial night; and

8. The fore-skin with an eccentric orifice causing ballooning of the skin during micturition⁴.

The above gradations of retractability are the results of incomplete separation of the prepuce from the glans penis.

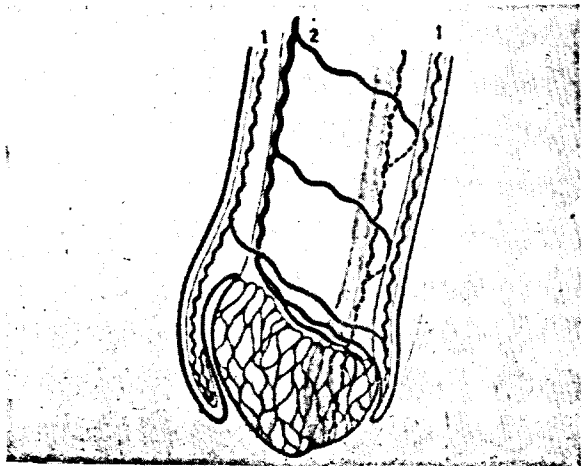
Lymphatic Drainage

The lymphatics of the prepuce arise from a network which covers both its internal and external surfaces. They converge towards the dorsal aspect, join with the lymphatics coming from the skin of the shaft of the penis, and form several trunks which run towards the pubis, ending in the upper inner group of superficial inguinal lymphatics. The lymphatics of the glans form a very rich net work which runs towards the frenulum. There they communicate with the lymphatics of the urethra and form several collecting trunks which follow the retroglandular sulcus forming a collar of lymphatics that entirely covers the corona and finally forms one, two or three trunks which run along the dorsal surface of penis under the penile fascia and together with the deep dorsal vein. These trunks form a pre-symphyseal plexus with multiple anastomosis and occasional nodules. From here

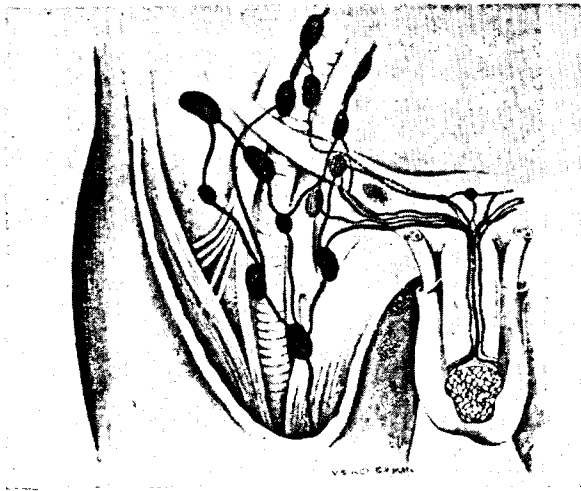
the lymphatic trunks are divided into two groups - one follows the femoral canal and end in deep inguinal glands, and those that follow the inguinal canal which running under the spermatic cord end in the external retrofemoral lymph nodes.

The lymphatics of the corpora cavernosa end in the superficial upper and inner group

of inguinal glands and sometimes in the deep inguinal nodes and retro-femoral nodes. The lymphatics of the urethra and of the corpora cavernosa usually end in the deep inguinal lymph nodes. It should be noted that the left and right inguinal lymph nodes have a rich intercommunication through the subcutaneous lymphatics.



Anatomic sketch of the lymphatic network of the penis: (1) Sub-cutaneous trunks and those of the glans drained by 2—a subfascial trunk.



Anatomic sketch of the lymphatics of the penis. A rich network of lymphatics gathers in several trunks which run towards the symphysis where they form a pre-symphysial plexus. From there the lymphatic trunks divide into two groups; those following the femoral canal terminate in the superficial lymph nodes (solid black) and those following the inguinal canal terminate in the deep lymph nodes (shaded). (Reproduction from Cancer-Ackerman and Regato).

Incidence

There is great geographical variation in the incidence of Carcinoma of the penis. It is stated that in Europe and in the United States, they make up at the most about 2%-5% of all Carcinomas seen in the male, whereas in Asia, it is stated that the incidence rises upto 20%, reaching its maximum in China, Siam, and Java. In Europe and the United States these carcinomas are mostly found in patients between 40 and 70 years of age whereas in the East they are found in men between 35 and 55 years and our figures are in agreement with this.

In the Royal Cancer Hospital, London, the number of Cancer penis cases seen between 1929 to 1952 (23 years) were only 75 (Lederman, B.J.R., September, 1953)². It is also stated to form only 2% of all male genitourinary tumours and 1.25% of all malignant tumours in the male (Dean, 1935). About 2000 patients are examined

annually in the Cancer Unit of the Barnard Institute of Radiology where all types of cancers are examined and treated. The figures for the year 1958 are as follows: Of the total number of 2036 patients examined, 182 were non-malignant leaving a total of 1854 cases of malignant tumours. Among these 1854 patients, 1148 were men. Of these 118 were found to suffer from Carcinoma of the penis giving an incidence of about 7%. But the figures for 5 years from 1954-58 are as follows:

Barnard Institute of Radiology - Madras

Table I

Cancer of Penis 1954-58

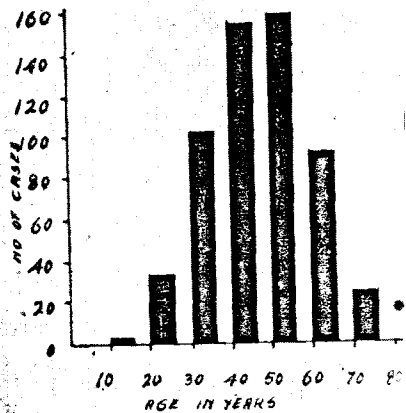
1954	...	115
1955	...	105
1956	...	100
1957	...	127
1958	...	118
Total	...	565

This works out at 10% of all male cancers and 79% of male genito-urinary cancers, whereas in the figures obtained for 1958, they are 7% and 79.7% respectively.

Aetiology

Almost all patients seen are those whose sex and personal hygiene were poor—the social status making no difference although patients from the richer strata are few. But statistically it does not appear to make any difference with regard to the above observation—as the number of rich people is proportionately smaller. A large percentage of patients:—54.5% in this series had congenital phimosis. A smaller percentage

BARNARD INSTITUTE OF RADIOLOGY-MADRAS
CANCER OF THE PENIS 1954-1958



was a constant feature. He suggests that these persistent bands may harbour embryonal epithelial rests which may develop into cancer in later years. From the facts presented above, it will be also seen that only 73.7% of South Indian children at the age of 5 years achieved spontaneous retractability of prepuce as against 93% of the English children at the same age. It is also seen from the above that the incidence of penile cancer in Madras is about 10% of the cancers occurring in the male population and 54.5% of these patients gave a history of phimosis. Out of the 722 cases of Penile cancer included in the several reports by the various Authors including the present one, there have been only 4 cases reported from among Muslims. Circumcision does away with these bands and probably removes the potential cancer-bearing cell rests. But it is the writer's experience that late circumcision is not an absolute safeguard against the occurrence of penile cancer. Therefore in the fight against cancer great stress should be laid on the early circumcision of children. We would advocate that the obstetrician should cut out the fore-skin when he cuts the umbilical cord. This can be done very simply and without any pain at that age.

Relationship of Circumcision to Cervical Carcinoma

Statistics have proved that the incidence of Cancer cervix is relatively less common among married women in communities where men are circumcised as a rule early in their childhood. It would be interesting if a study is made of the chemical composition of smegma and how far this acts as a carcinogenic factor.

Venereal Disease and Penile Cancer

Investigations carried out at the Institute of Venereology, General Hospital, Madras, does not show any definite causal relationship between venereal diseases and cancer.

A series of 101 cases of penile cancer treated with Radium are presented here. Almost all cases where biopsies have been done are epidermoid carcinomas. Clinically the lesions can be classified as a Papillary-Cauliflower or ulcerating type.

Distribution of Tumours

The almost invariable sites of origin are the glans or inner surface of the prepuce and spreads later on to other parts. Carcinoma originating on the skin of the penis or on the outer surface of the prepuce is rare. In only one case—a Muslim—the lesion appeared in the anterior part of the urethra—the Fossa terminalis.

Duration of complaint before seeking treatment varied from 3 months to 2 years.

Structure and Growth

As stated already the tumours are papillary or infiltrating growths similar to those found in the rest of the skin or oral mucous membrane. In their early stages, they may long remain superficial and papillomatous. This papillomatous changes may take place over a wide area of the surface of the glans penis and prepuce or multiple areas of growth may be found—distinct from each other—on the glans penis. Papillary tumours may form large exuberant masses before showing much invasiveness, but this does not justify their separation as a distinct group from the more invasive ulcerative form of former type of lesion. Since it is more radio-sensitive slight inaccuracies in the delivery of a homogeneous tumour—lethal dose to the lesion is not apt to be shown up as failures of treatment to the same extent as in the case of the ulcerative invasive type of carcinoma.

Spread and Metastasis

Besides extending to and perforating the overlying prepuce, the tumours often invade the urethra, the corpora cavernosa and

spongiosa. Some tumours spread into the vascular spaces of the erectile tissue and it is possible that local embolic metastases may also occur in this tissue as areas of growth apparently separate from the main mass are sometimes to be found in more proximal parts of the erectile body. Distant blood borne metastasis is rare.

Metastases in lymph gland develop at some stage of the disease if untreated. Although enlargement of the inguinal glands is usually present at an early stage—about 75%; it is often due to inflammation or due to other causes as is usual in the tropics and the bare-footed. Tumour metastases occurs relatively late.

The primary growth must therefore be treated regardless of the state of lymph nodes, except when these are large and fixed or already show obvious malignant infiltration of the skin.

Pelvic lymph nodes are known to have been affected earlier than the inguinal glands occasionally, but this is nothing unusual in cancers. If one lymphatic channel is blocked due to any reason the spread of these malignant cells may take another route which is open to them. Blood borne metastasis have been reported. Involvement of the pelvic bone is known; either a blood borne metastases or direct extension from metastatic glands. In one case out of the 101 patients reported here, there was multiple bone metastases in the skull and Ischium, although the primary lesion reacted well to Radium treatment.

Treatment with Radium

Choice of Cases.—Large growths extending to within an inch of the base of the penis or grossly infiltrating lesions with involvement of the penile urethra, are not suitable for radium treatment as the organ is already more or less destroyed.

Total emasculation is then the method of choice.

Treatment with cylindrical radium mould irradiating almost the whole length of the penis appears to be in most cases, by far the superior and safer method than local implantation of Radium or Chaoul therapy. For successful treatment, relentless vigilance is necessary to see that the mould is maintained in accurate position during the entire period of irradiation. Sometimes it may be necessary to remove and re-apply the mould 3 or 4 times during the course of treatment. But in the great majority of our cases, it has not been necessary. Comparative results obtainable with accurately planned and executed X-ray therapy are not available at present. This line of treatment is being now tried out during the past few months. The immediate results appear to be fairly satisfactory.

For growths of moderate size it is always worth trying Radio - Therapy in the first place. If it fails, it does not add to the risk to life, as amputation can be carried out as a second treatment. No difficulty is encountered during operation as a result of previous irradiation.

In our series of cases treated with cylindrical radium mould, erectile capacity of the organ does not appear to have diminished in the cases observed. The skin goes into moist desquamation reaction in a period of 7 to 10 days after removal of the mould which gradually heals with very slight scarring and discoloration in about 4 to 6 weeks. Emollients such as Shark Liver oil or Penicillin ointment are used during the period of reaction. We have done circumcision in a few cases after their complete recovery—about 6 weeks after recovery from radiation reaction. I have no information regarding sterility following Radium mould treatment.

Radium Mould

The material used for making the mould should be light, rigid, and should not absorb urine or the discharges from the ulcer.

During the earlier period we used Sorbo-rubber which is light, but this was found to be unsuitable because it is not rigid and could not maintain its shape. Then we tried Stent's dental composition. Although this answered the factor of rigidity and non-absorbability, it was heavy and hence uncomfortable to wear. Then we tried ordinary light country wood. Cylinders were made out of this light country wood and soaked in Collodium to make it non-absorbable. This has been found to be highly suitable and cheap. It costs only eight annas per cylinder and can be used several times. This material therefore can be very effectively used in place of the costly nidrose or other similar synthetic products. The next question was whether the radiation should be in interrupted daily doses, as practised in Manchester or whether it could be given as continuous irradiation as in interstitial implantations of radium. We prefer the latter method for the following reasons :

1. A smaller quantity of radium is sufficient ;

2. The whole irradiation can be finished on an average in about 7 days ; this gives a quicker rotation of the available quantity of radium which is an expensive and scarce commodity.

3. This is in consonance with the view held by Prof. Reguad and others—that

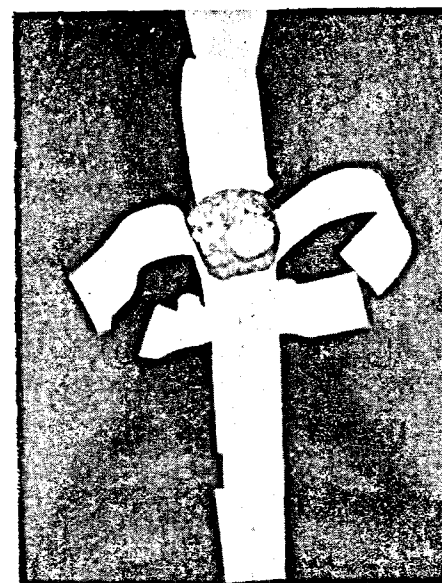
continuous irradiation is biologically superior to fractionated doses.

4. As the overall period of irradiation is shorter than as practised at Manchester—whether it is necessary to reduce the dose on the skin and at the central axis of the penile shaft or the dose advised as per Manchester technique can be raised with advantage and without running any risk.

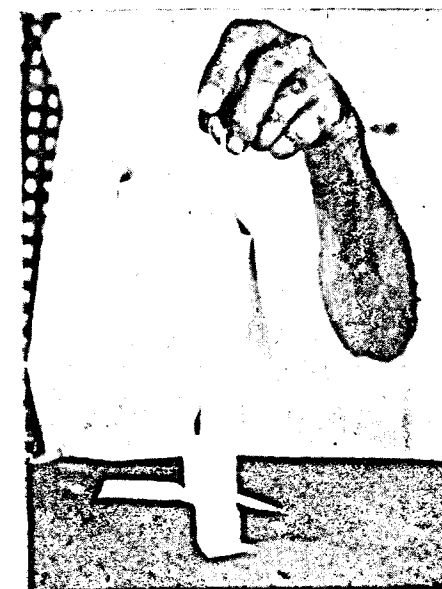
Method of Application

The application of the mould should be done under general anaesthesia, as otherwise it is painful and unsatisfactory. Strips leucoplasts of 1 inch width are cut in sufficient lengths and laid on the patient as shown in these illustrations. After these are secured in position by cross strips of leucoplasts, the radium mould is slipped down on the penis and the proximal end rests on a prepared lead protected shield equivalent to 2 mm. of lead, protecting the scrotum and part of the anterior abdominal wall. The penis is then pulled up by the strips of adhesive plaster until the distal end of the penis occupies a position about 1 cm. below distal ring of Radium needles in the mould. The strips of adhesive plaster covering the penis are then turned downwards over the outside of the lead protected radium mould and securely fastened to the mould by a number of cross strips of adhesive plaster. Finally a piece of bandage or tape is tied round the mould and adjusted so as to maintain the mould at right angles to the long axis of the body through out the period of treatment so that irradiation of the scrotum or the abdominal wall may be minimum.

Different stages in the method adopted in the Barnard Institute of Radiology in the application of the Radium Cylinder in the treatment of the cancer of the penis



I Stage



II Stage



III Stage



IV Final Stage

Statement showing the Survival Rate

At the end of	No. of patients	Percentage
1st year ...	44	93.6%
2nd year ...	44	93.6%
3rd year ...	40	90.9%
4th year ...	31	86.1%
5th year ...	21	80.8%
6th year ...	13	85.7%
7th year ...	12	85.7%
8th year ...	8	88.8%
9th year ...	2	50.0%
10th year ...	2	50.0%

Many difficulties have been encountered in estimating the correct survival rates. Complete information for all the patients treated, regarding their condition at the end of each year after discharge, is not available. Many of the patients have failed to comply with the enquiries regarding their condition and they have also not reported every year for the follow up. In cases of deaths, not all cases of death have been reported. Thus at various stages in the time lag after discharge, a number of patients have been lost sight of and hence follow up has not been complete. It would be realised that the great majority of the patients treated belong to the poor class of labourers and small agriculturists coming from various parts of South India. There have been a great migration of this class of people from one place to another during these 10 years due to economical and other reasons. Therefore inspite of the best effort to follow up these patients, it has been impossible to get any information in 40 out of 101 cases. Of the remaining 61 patients, we have been able to follow up with complete information only 47. Here

again 14 patients have been lost sight of during the period under review and they have not been included in the statistics from the date from which they were lost sight of. They might or might not be alive. Therefore the number of failure of follow up is fairly large; 40 out of 101 is quite an appreciable percentage of the total. To adjust for this lack of information about patients lost sight of, is a difficult process. Hence a table of percentages has been given where only those cases which were followed right upto 1959 have been taken into account. The total number of such cases is only 47 out of a total 101 treated. Thus the percentages cannot be fully relied upon for estimating the probabilities of survival at the end of each year after discharge. It may be that a major number of those who could not be contacted were either dead or still alive and migrated to various other parts. Thus the survival and fatality rates may appreciably differ from those which are indicated by the percentages calculated on the basis only of those observations followed upto 1959. Therefore the figures given above of cure rates may be accepted with some reservation.

Certain observations regarding the level of dosage

Most of the cases received a skin dose of 6000r in 7 days with 4800r-4900r in the mid axis of the shaft of the penis as advocated at Manchester. It was observed that primary healing was excellent in the majority of the cases treated leaving very little discoloration of the skin or scarring. Considering that dark pigmented skins can tolerate sometimes a considerably larger doses than the fair skin, we have now raised the dose to 5500r in the middle of the shaft of the penis. The result of this can only be assessed later, and some of the 9 patients doing well after one year are not included in these series.

Summary

1. The result of treatment by Radium mould of a series of 47 cases have been analysed up to 10 years.

2. The state of the prepuce in South Indian infants and in children upto the age of 5 years as compared to British children is mentioned;

3. The incidence of the disease in Madras patients and those reported from other parts of South India are given;

4. The relationship between incidence of the penile cancer and phymosis either congenital or acquired has been brought out.

5. Modifications made in the technique of treatment by Radium in the Manchester method to suit local conditions have been mentioned.

6. A few illustrations showing the conditions before and after treatment, are given.

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Pulmonary Arteriovenous Aneurysm with a Major Systemic Component

BY

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Pulmonary arteriovenous aneurysms are known by several names like pulmonary arteriovenous fistula, haemangioma, cavernous haemangioma of the lung, congenital telangiectasia of the lung, vascular hamartoma, pulmonary arteriovenous varix etc. They are considered to be one manifestation of a generalised angiomatous tendency in which there is gross deviation of capillary formation. They may be from very small capillary sized structures as in telangiectasia to large tubular or sacculated multilobular dilatations or labyrinths of distended blood vessels, all lined by mesothelium on thin layer of connective tissue. They may occur in the middle of the lung tissue or subpleurally. They may be single, multiple, unilateral or bilateral. Multiple bilateral pulmonary arteriovenous aneurysms are often small and seen with telangiectasia elsewhere. The larger ones are directly connected to the pulmonary arteries and veins. The afferent artery is thin walled and as it gets distended with advancing age gives rise to haemoptysis. The efferent veins are much distended. Sometimes, the arterial component of the pulmonary arteriovenous aneurysm may also contain bronchial arteries (Baker and Trounce) or may be fed

by anomalous aberrant systemic arteries or arteries from the neighbouring lobes (Steinberg) or again the pulmonary arteriovenous aneurysm may form adhesions to the chest wall establishing a secondary vascular supply (Burchell and Clagett). The circulatory fault resulting from pulmonary arteriovenous aneurysm is mainly a result of unoxygenated blood passing through the aneurysm. The cardinal symptoms are due to the anoxia produced by the incomplete aeration of blood in the lungs and consequently the degree of symptoms depend on the size and duration of the shunt.

Prior to the clinical studies, there had been anatomic description of the pulmonary lesions following post-mortem, by Churton, Wilkins and Rodes. In 1897 Churton was the first to describe the necropsy findings in pulmonary arteriovenous aneurysm. First accurately described case was recorded by Wilkins in 1918. His case was that of a 23 year old woman who died of an intrathoracic haemorrhage and three lesions were present in addition to a patent foramen ovale and bilateral apical tuberculosis. In Rode's case the pulmonary lesions were associated with the pre-mortem picture of cyanosis and

polycythemia. Smith and Horton in 1939 made a clinical diagnosis and demonstrated the value of angiography in the diagnosis of the pulmonary arteriovenous aneurysm. Hepburn and Dauphinee in 1942 were the first to report about the successful surgical cure of pulmonary arteriovenous aneurysm. Yater and Finnegan (1949) in their brilliant review, report 41 cases of pulmonary arteriovenous aneurysm found in the literature with surgical treatment in 23 cases and added on two of their cases with surgical treatment in one. Sloan and Cooley (1953) have extensively and exhaustively reviewed the world literature and added 9 cases of their own. Within 2 years after this review, the total has reached over 150 cases, according to Steinberg (1955).

Heredity

Familial character of the lesion was stressed by Goldman, who observed its occurrence in two brothers. Whitekar reported a family history of telangiectasis accompanied in one member by a proved pulmonary arteriovenous aneurysm. Moyer and Ackerman reported pulmonary arteriovenous aneurysm in two brothers in a family of seven all of whom had numerous telangiectasia of the face and lips. One of Maier's case gave a history of multiple telangiectasis in three generations. Dr. Lawrence M. Shefts of Texas presents a family of seven all of whom showed telangiectasis and haemangioma of skin and mucous membrane and two members presented evidence of pulmonary arteriovenous aneurysm.

Age Incidence

The youngest age recorded in literature is in a child of 2 days (Bowers) and the oldest on record is in a patient aged 79 years (Seaman and Goldman) with no symptoms. The age of patient seeking medical advice is round about 30 years.

Sex

Males predominate.

Site in the Lung

Incidence of pulmonary arteriovenous aneurysm in the various lobes according to frequency :—

1. Right Lower lobe.
2. Left lower lobe.
3. Right middle lobe.
4. Left upper lobe.
5. Right upper lobe.

In some cases after surgery for pulmonary arteriovenous aneurysm at one site, it was noticed that the latent lesions at other sites became more prominent as manifested by recurrence of symptoms after a variable period.

Number

Usually single, and when multiple, it is often bilateral. Rarely five lobes are involved. In a survey of 85 cases by Sloan, 27 cases were multiple, out of which in 21 both lungs were involved and in one of them all five lobes were involved.

SYMPTOMS

Haemorrhage

Haemorrhage from pulmonary arteriovenous aneurysm may be in the form of haemoptysis or haemothorax. Haemoptysis can prove fatal as in Rodes (1938) case.

Haemoptysis

Though this is a congenital condition, haemoptysis is noticed only late in the disease. It is due to the gradual dilatation and thinning out of the aneurysmal sac or due to infection and weakening of the vessel wall.

Haemoptysis may be the only presenting symptom or may be absent in cases associated with telangiectasis. Haemoptysis may be profuse in cases where there is communication between pulmonary arteriovenous aneurysm and systemic arteries (bronchial or collateral), when the feeder vessel is large and when the aneurysm is situated sub-pleurally. In the case under report, there is collateral communication between pulmonary arteriovenous aneurysm and right lateral thoracic artery. Haemoptysis can recur as in our case with varying severity and interval. A case has been recorded where four bouts occurred in as short a period as 18 days (Duisenberg and Arismendi) or at larger intervals over a period of 10 years (Ettinger et al). Haemoptysis may reduce the Hb and RBC level and reduce the degree of cyanosis and alter the classical text-book radiological appearance.

Haemothorax

In sub-pleural situation of the pulmonary arteriovenous aneurysm, bleeding can occur into the pleural cavity.

Dyspnoea

Dyspnoea is due to anoxia, due to the shunt and is seen in cases where pulmonary artery forms the major portion of pulmonary arteriovenous aneurysm. In these cases cyanosis is present in varying degrees. In our case, these symptoms were not present because the major portion of pulmonary arteriovenous aneurysm is predominantly systemic.

Dyspnoea may be due to stimulation of respiratory centre by increased carbon-dioxide content of arterial blood or stimulation of the sino-aortic chemoreceptors by anoxia.

Giddiness, faintness are due to anoxia or as suggested by Peel (1952) "due to some

kind of shunt mechanism in the lungs leading to pooling of blood in pulmonary arteriovenous aneurysm and lowering left ventricular output causing transient coronary ischemia".

Chest Pain

Chest pain is not common. When present, it is due to a complicating adhesive pleurisy, a not uncommon operative finding. It may also be due to anoxia of the myocardium. Giampalmo has pointed out the changes in electro-cardiogram of some patients with this symptom which is suggestive of myocardial damage.

Clubbing

Clubbing of the fingers and toes have been noted in cases where there is cyanosis. Along with clubbing, pulmonary Osteoarthropathy is noted in some cases. When there is clubbing alone without cyanosis, one has to investigate for an associated bronchiectasis as in our case. It has been observed that after surgery, clubbing disappears in a period of two to six months.

Cyanosis

Rodes in 1938 was the first to describe pulmonary arteriovenous aneurysm with secondary polycythemia as a cause of cyanosis. Cyanosis is absent in cases where the systemic component takes the major part in the formation of pulmonary arteriovenous aneurysm causing reversal of flow or when there is marked anaemia. Cyanosis can appear from birth or may be delayed to later life. Cyanosis becomes more, as the patient grows older. Degree of cyanosis is lessened after haemoptysis. Cyanosis is associated with clubbing. Degree of cyanosis depends upon degree of shunt in the lesser circulation and cases upto 89% have been recorded but a minimum of 30% is necessary to produce cyanosis.

Telangiectasis

About 40% of pulmonary arteriovenous aneurysms show telangiectatic spots elsewhere, out of which 25% give family incidence of telangiectasis. In a family of telangiectatics one or more members may show pulmonary arteriovenous aneurysm. In some cases of pulmonary arteriovenous aneurysm, telangiectatic spots may be seen in other members of the family and not in the patient. In the excellent review of 85 cases by Sloan and Cooley (1953) only 39 cases showed telangiectasis and in 14 there had been a fairly clear family history.

Epistaxis is a manifestation of telangiectasis in the mucosa of nasal passages and in some cases it occurs as the presenting symptom.

Murmur or Bruit

It may be systolic or systolic and diastolic or purely diastolic component may be present and is accentuated during inspiration. Intensity of murmur is increased when the patient is made to lie on the unaffected side. (Beddard 1949 and Nightingale 1951). It may be rarely associated with a thrill, when the systemic component is greater and when the finger is lightly placed over the vessel. Usual site is the axilla. Murmur is heard in cases where there is a large shunt, a major systemic component or when the pulmonary arteriovenous aneurysm is situated sub-pleurally. It is often absent in small multiple pulmonary arteriovenous aneurysms associated with telangiectasis or deeply situated pulmonary arteriovenous aneurysms.

Murmur in the case under report was systolic and diastolic in the apex of the right axilla and systolic thrill was present over the right lateral thoracic artery. Systolic murmur was heard below the right clavicle, more distinct and definite as one

approaches the axilla. A faint systolic murmur was heard over the upper half of the right interscapular region. On applying effective digital pressure over the right subclavian artery, the murmur in the axilla and below the clavicle disappeared completely, but the faint murmur heard in the right interscapular region became distinct and definite. No thrill was felt at any time in the right interscapular region. Following a severe bout of haemoptysis, the thrill was felt over a wider area upto the neck and the murmur was heard over the neck vessels on right side due to the haemorrhage distending and increasing the pressure in the sac leading to reversal of blood flow from the pulmonary arteriovenous aneurysm to the systemic collaterals. Within a course of two days the murmur was confined to the localised areas described above and the thrill was also localised.

Blood Changes in Pulmonary Arteriovenous Aneurysm

(a) Red blood cell count may be increased, normal or decreased. Polycythemia is due to anoxia and seen in cases with or without cyanosis. Rodes was the first to describe polycythemia as a feature of the disease. With cyanosis, polycythemia is marked. Maximum figure noted is 11.4 m/cm. in Goldman's case. Following a bout of haemoptysis, red blood cell count is lowered. Polycythemia is present in only half of the cases. With major systemic component of pulmonary arteriovenous aneurysm, polycythemia is minimal or absent. Haemoglobin value, haematocrit value in these cases are high. Polycythemia, if present, can give rise to thrombosis elsewhere in the peripheral or cerebral vessels. Polycythemia is a contraindication to selective angiography. To reduce post-operative risks of thrombosis, it is advisable to give plasma instead of blood. Symptoms as a

Roentgenograms of Munuswamy Chetty A case of Pulmonary Arteriovenous Aneurysm

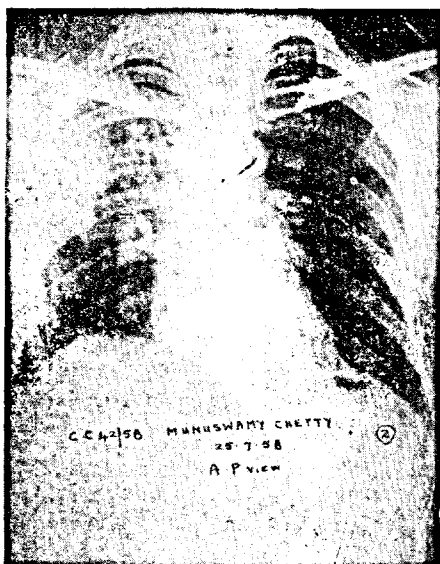


Fig. 1

Chest P. A. View—25-7-1958. A well marked quadrilateral opacity in the Right second intercostal space fading away towards the mediastinum. Within the opacity, lobular pattern can be made out. Feeder vessel is seen superimposed on the 2nd rib medial to the upper level of the opacity. Just above and medial to the opacity there is an irregular transradiant area in the first right intercostal space. Trachea is deviated slightly to the right. No erosion of the lower border of the ribs. Heart size normal.



Fig. 2

Chest-Right lateral view—25-7-58. A roughly triangular opacity with the apex pointing towards hilum involving segments 1 and 2.

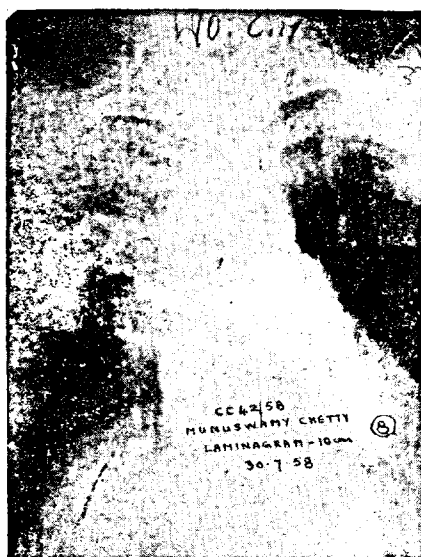
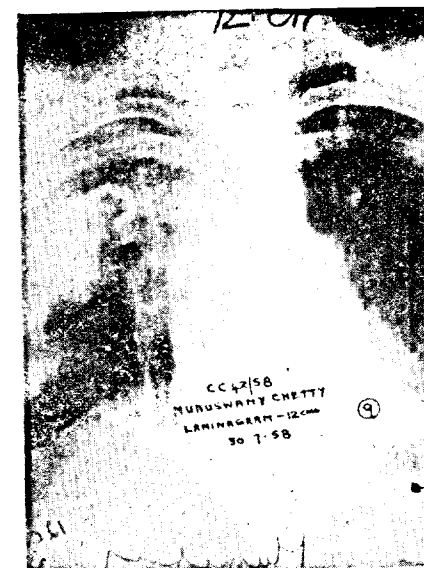


Fig. 3—(10 cms.)

Feeder artery visualised well.

Fig. 4—(12 cms.)
Feeder artery seen best.

Arteriogram Using Pyelocil Through Radial Artery



Fig. 5

Aneurysm is well visualised in the area described above and the feeder artery also visualised. The collaterals from the lateral thoracic artery are highly tortuous.

Angiopneumogram with Pyelocil Through the left Basilic vein



Fig. 6—(1.5 seconds)

Feeder artery faintly visualised. More dye seen in the aneurysmal sac than the lung fields.

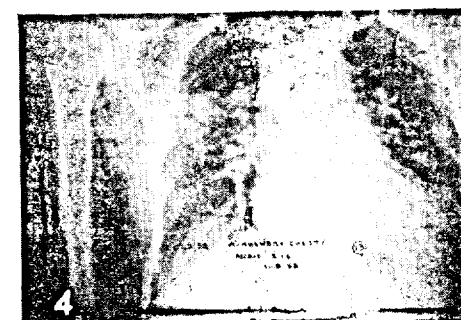


Fig. 7—(2.1 seconds)

Feeder artery better seen. Draining vessel faintly seen.



Fig. 8—(2.7 seconds)

Left atrium and aorta are visualised.

sequel to polycythemia are dyspnoea on exertion, weakness, pre-cardial pain, convulsions unconsciousness, dizziness, diplopia, cerebrovascular accidents, numbness, faintness, palpitation, headache, thick-speech and emesis. Large bouts of haemoptysis may produce anaemia and occasionally it may also be due to hidden haemangioma of the liver (Roberts and Hutchison).

(b) White blood cell count is normal.

(c) Circulation time is normal in most of the cases.

(d) Arterial oxygen tension is low depending upon the shunt and it is further reduced after exercise.

Pulmonary arteriovenous aneurysm is not associated with hypertension, cardiac enlargement and failure, as seen in peripheral arteriovenous aneurysm because of low pulmonary pressure. In pulmonary arteriovenous aneurysm, there is increase in only red blood cell content and haematocrit value unlike peripheral arteriovenous aneurysm where the increase is in all the elements of blood.

Neurological disturbances were noticed frequently and ranged from slight sensory or motor disturbances to grand-mal convulsive

episodes. Occasionally haemiplegia has been noted. It is due to cerebral insults due to anoxia or thrombosis due to Polycythemia.

Fluoroscopy

Generally an opacity in the lung field is noted. Pulsation may be detected where pulmonary vessels form the major part of the shunt. In cases where systemic vessels form the major part of the shunt, pulsation is absent (*Vide* Fig. 12). On effective occlusion of the systemic component (Pressure over right subclavian artery as in our case) pulsation is seen in the vascular tumour (*Vide* Fig. 13). Pulmonary arteriovenous aneurysm situated near hilum may show transmitted pulsation. Vascular nature of the tumour is established by the Valsalva maneuver.

During Valsalva maneuver, the margins of the opacity become well defined and decreases in size. Following Valsalva maneuver when the patient resumes normal breathing, it is spectacular to note that there is an initial momentary slow filling followed by a sudden gush of blood fully distending the sac to its original size. Mullers test shows an increase in the size of pulmonary arteriovenous aneurysm.

ARTERIOVENOUS ANEURYSM

Table showing the differences between pulmonary arteriovenous aneurysm and peripheral arteriovenous aneurysm

Particulars	Systemic	Pulmonary
(a) Total Blood Volume ...	Increased	Increased
(b) Total Plasma Volume ...	Increased	Normal
(c) Haematocrit ...	Normal	Increased
(d) Oxygen Hb saturation ...	Normal	Decreased
(e) Cardiac Output ...	Increased	Normal
(f) Cardiac Enlargement ...	Present	Absent

Roentgen Appearances

Roentgen findings in pulmonary arteriovenous aneurysms have been described by Lindgren and he has emphasised the relationship of the mass to the pulmonary vascular shadows as the most significant diagnostic sign. Crane, Lerner and Lawrence reviewed the Roentgen findings in 18 cases in the literature and reported that a pulmonary mass was present in all. Seaman and Goldman stress that the Roentgen appearance may be the only positive finding leading to the correct diagnosis. Plain roentgenogram of the chest may show rounded, oval or lobulated opacities connected to the hilum, by broad tortuous bands representing a distended branch of the pulmonary artery and a dilated pulmonary vein, both of which open into the vascular sac. Occasionally the lesions are multiple and bilateral. This classical picture may be altered to an irregular opacity following a bout of haemoptysis. Smaller aneurysms, retrocardiac aneurysms, and aneurysms overshadowed by the diaphragm are missed in the plain roentgenogram. Intrapulmonary haemorrhages due to rupture of the dilated vessel occasionally cause irregular densities and even segmental atelectasis obscuring the primary lesion. Roentgenogram taken in Valsalva maneuver will give a record of the screening findings already described. Appropriate lateral view may localise the segment involved.

Kymogram

Kymogram is the record of marked pulsation and of diagnostic aid in cases where pulsation could not be made out on fluoroscopy.

Laminograms

Laminograms are very valuable in bringing out the feeder artery and draining vein which are normally in different planes

and also help to localise the vascular tumour and tumours overlapped by heart and diaphragm.

Angiopneumogram

Angiography in the diagnosis of pulmonary arteriovenous aneurysm was first recorded by Smith and Horton in 1939. Only 9 cases of pulmonary arteriovenous aneurysms were noted in a total of 2000 patients studied angiocardigraphically during an eight year period by Steinberg and Clenahan (1955). It is absolutely essential for confirmation of diagnosis before submitting the patient for surgery. Smaller lesions, multiple lesions, lesions covered by other shadows, extent of the lesion and collaterals if any, are undisputedly brought out. Following the main pulmonary artery visualisation, the feeder vessel, early filling of the aneurysmal sac, delayed complete emptying of the sac, draining vein, early opacification of the left atrium and aorta are brought out. Polycythemia is a contraindication for selective angiocardigraphy. Sisson believes that cases of pulmonary arteriovenous aneurysms are susceptible to untoward cardiac effects because of the large amount of dye which may pass through the shunt into the left side of the heart, without adequate dilution in the pulmonary capillaries. Sisson's case is the only death reported in the literature after angiography with pulmonary arteriovenous aneurysm. Angiography is contraindicated in cases of hypertension and failure.

Arteriogram

It is essential to establish the nature of the systemic collateral taking part in the pulmonary arteriovenous aneurysm to give prior accurate information about the vascular connections to the surgeon. In our case where the upper lobe is involved, axillary



Fig. 9—(3.9 seconds)

There is greater pooling of the dye in the aneurysm and draining vein is well dilated and visualised. Axillary artery is well visualised now. This axillary artery was visualised at 3.3 seconds.

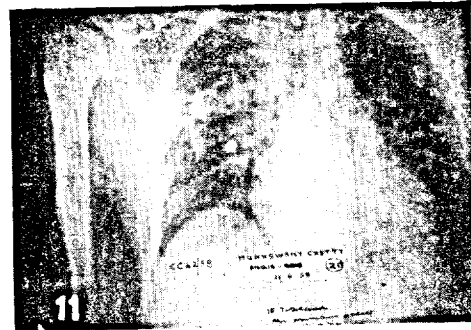


Fig. 11—(16.7 seconds)

Dye persists in the Aneurysmal sac.

Normal—Kymogram



Fig. 10—(5.7 seconds)

Axillary artery has emptied. Pooling of the dye in the aneurysm is better visualised than Fig. 16 due to the return of the dye from the axillary artery, showing that the blood flow is bidirectional. The draining vein continues to be visualised.

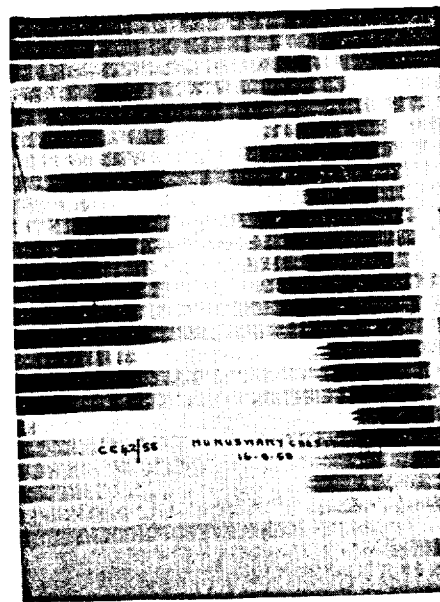


Fig. 12

No pulsation seen over the vascular tumour area. Cardiac pulsation seen well.

Kymogram—With pressure over the right subclavian artery...

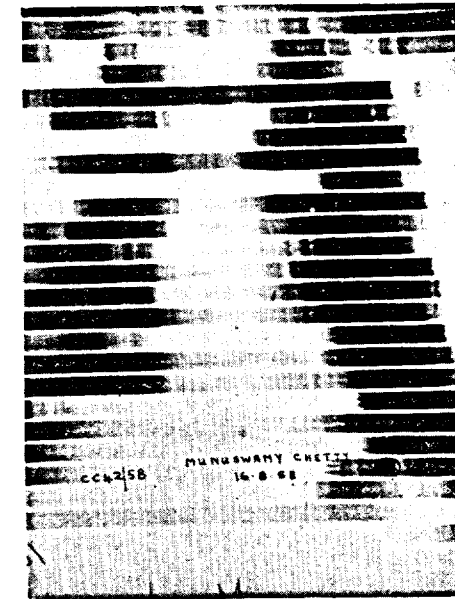


Fig. 13

Shows slight pulsation over the medial margin of the vascular tumour.

Spot films under Identical Conditions



Fig. 14

A quadrilateral opacity obliquely placed with ill-defined margins seen in the right 2nd intercostal space at the periphery.



Fig. 15

Valsalva maneuver—Size of the opacity has appreciably decreased and margins are clearer and density greater.

Bronchogram using dionosil oily solution and filling by Passing Endotracheal tube.



Fig. 16—Effective digital pressure on the right subclavian artery occluding the brachial pulsation completely. Size of the opacity is slightly smaller than Fig. 23 and bigger than Fig. 24. Margins better defined than Fig. 23 and not so well demarcated as in Fig. 24.

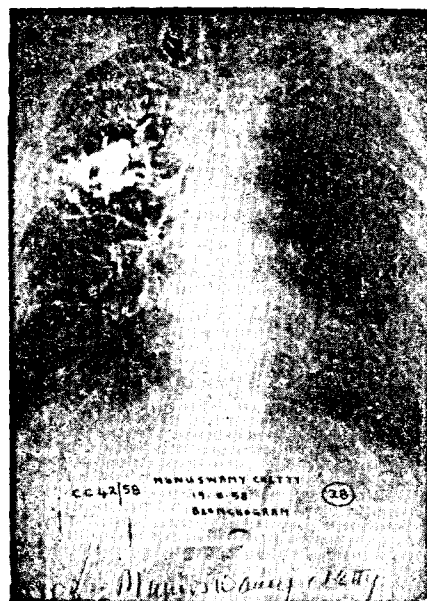


Fig. 17—P. A. View
Saccular Bronchiectasis over the anterior end of the 2nd rib and just below. Right 2nd rib: Note the shadow corresponds to transradiant area seen just above and medial to the opacity of Figure 1.



Fig. 18—Right lateral view
Shows saccular Bronchiectasis in segments 1 and 2. Compare Fig. 3 where the opacity is much more extensive with hazy borders.

arteriogram established the systemic collaterals. Retrograde aortogram will be useful in lower lobe lesions to show the normal or abnormal arteries from the aorta which contribute to the systemic collaterals.

Direction of blood flow in the Aneurysm

From the clinical findings and roentgen studies with contrast material, the direction of blood flow is noticed to be bi-directional (*Vide* Figure 5 and Review under the head "Murmur").

Treatment

Operation is certainly indicated in all cases of pulmonary arteriovenous aneurysm who have had haemoptysis or significant shunt. The symptomless case presents a more difficult problem, the operative risk having to be weighed against the risk of future haemorrhagic episodes, an increase in degree of shunt, risk of bacterial endarteritis in the wall of the aneurysm (Maier et al 1948) or neurological disturbances like hemiplegia and brain abscess. The present consensus of opinion is in favour of surgery in symptomless cases also.

After reviewing the world literature and from our experience of our case, we will like to divide the pulmonary arteriovenous aneurysm into two groups for the sake of clinical clarity.

I. Systemic Vessels form a Major part of the Shunt

- (i) Murmur is marked and thrill may be present.
- (ii) Large bouts of haemoptysis.
- (iii) Minimal polycythemia or normal count.
- (iv) No cyanosis.

- (v) No dyspnoea or giddiness or fainting attacks.
- (vi) Screening and Kymographic records show absence of pulsation.
- (vii) Systemic collaterals can be demonstrated by contrast radiography.

II. Pulmonary vessels form a Major part of the Shunt

- (i) Cyanosis.
- (ii) Clubbing of fingers and toes.
- (iii) Polycythemia.
- (iv) Dyspnoea, giddiness and fainting attacks.
- (v) Murmur may or may not be present.
- (vi) Haemoptysis often delayed.
- (vii) Telangiectasis over skin and mucous membrane seen.
- (viii) Screening and Kymographic records show pulsation.

Case Report

K. Munuswamy Chetty, male aged 50 years, glass bangles vendor by profession, got admitted into General Hospital on 14-7-1958 under Dr. C. S. Sadasivan and was referred to us on 18-7-1958 with presenting symptoms of haemoptysis and cough of 15 months duration and pain over the right scapular region of two months duration.

In August 1955 he slipped while standing and landed on his right shoulder. He became alright in a few days without any active treatment. No bony injury or haemoptysis was noticed at that time. He gives history of continuous fever in January 1957 which lasted for three weeks according to him. He was not hospitalised at that time and the nature of the fever could not be ascertained.

On the 11th day of the fever, he developed cough and was bringing out thick foul smelling sputum about 3 ozs. daily. Cough and expectoration has been persisting since then. He first noticed blood tinged sputum in March 1957 and after that small bouts of haemoptysis ($\frac{1}{2}$ to 3 ozs.) occurred about twice a month. Had a severe bout of haemoptysis (2 pints) on 16—6—58. For this he was investigated in a Tuberculosis sanatorium and no evidence of tuberculosis was found and so referred to Thoracic Unit of General Hospital. While under our care, he had another bout of haemoptysis on 24—7—58 and brought out about 14 ozs. of frank blood. After the haemoptysis, the quantity of sputum increased to 12 ozs. per day.

Family history not contributory. No evidence of Telangiectatic spots in any member of the family or in him. No history of pulmonary tuberculosis in the family.

A well nourished individual of about 50 years, not anaemic and not cyanosed. Clubbing of fingers and toes present. No glands palpable in the neck.

Examination of the respiratory system revealed slight dropping of the right shoulder. Trachea slightly deviated to the right. Impaired resonance over the right infraclavicular and right interscapular region. Vocal fremitus and vocal resonance normal. The thrill and murmur which is heard is described in detail in the review under the heading of "Murmur". No murmur heard over the heart and liver.

Laboratory Investigations

Urine: Nil abnormal.

21—7—58: R. B. C. 5.68 m/cm-Hb 78% (12.6 g) W. B. C. 7000 P. 64-L. 22-E. 14.

8—8—58: R. B. C. 4.9 m/cm-Hb 75%-P.C.V. 32% (after bout of haemoptysis).

21—7—58: E. S. R.: 16 mm - 1 hour. Sputum: Repeatedly negative for A.F.B. (Six occasions). Blood Group: "O". B.P. 106/50 in both upper arms.

26—8—58: Circulation time - 6 seconds using Pentothal sodium. E.C.G.: Normal. No left ventricular preponderance or myocardial insufficiency.

26—8—58: CO₂ combining power of plasma. 43.0 c.c's of CO₂ are bound as bicarbonate by 100 c.c's of plasma.

29—7—58: Sputum Culture: Streptococcus Non-haemolyticus and Staphylococcus coagulase negative grown. Both sensitive to Penicillin, streptomycin and achromycine.

13—9—58: Mycobacterium tuberculosis not grown in sputum culture.

The case was operated by the Thoracic Surgeon, Dr. C. S. Sadasivam; right lobectomy was done; the diagnosis of pulmonary arteriovenous aneurysm of the right posterior segment of the upper lobe and bronchiectasis was confirmed.

Summary

The world literature is reviewed. The signs and symptoms discussed and classified under two different groups:

- (a) Pulmonary arteriovenous aneurysm with a major systemic component.
- (b) Pulmonary arteriovenous aneurysm where the pulmonary vessels form the major part of the shunt.

A fully investigated case is reported wherein the systemic component is visualised in the arteriogram.

Associated bronchiectasis noted in our case is not met with in the reviewed literature.

Acknowledgements

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On Radiation Protection

BY

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The use of atomic radiation for peaceful purposes goes back to the times of its discovery itself. It did not take many years after that to recognise the harmful effects of these ionising radiations on human beings exposed. Early workers right from Roentgen and Madam Curie experimenting with sources of radiation in Scientific and medical fields were no doubt victims of Severe radiation hazards. Knowledge about radiation protection was incomplete in those days and slow spreading also. Methods of monitoring and surveying were practically unknown as judged by the present standards. Heavy doses must have been received by those who engaged in screening and other types of diagnostic work due to uncontrolled x-ray beams.

Development of Protection Rules

By about 1920, it had been very well recognised that excessive radiation exposure was capable of producing various hazards and protection devices were as important as the very use of the rays. The far-reaching genetic effects of radiation on human cells were later added to other hazards. Ample evidence was not wanting for efficient control officially and otherwise of production, distribution and use of the sources of radiation in a safe manner. A good start was made by the Atomic Energy Industry itself in this regard.

A number of British and American Roentgen Ray workers had strived hard by their pioneering work in the direction of radiation protection which the people of

atomic age will never forget. The first International Congress of Radiology held in 1925 greatly stressed and stimulated the need for radiation protection. As a result in 1928, the erstwhile International Commission for Radiological Protection came into being for the first time. Since then this body is keenly studying the protection problem and laying down rules for observation. Time to time these rules are being revised.

Maximum Permissible Dose

The so called tolerance dose of radiation has been exploded in recent years and the minimum dose as occupational exposure or otherwise is undoubtedly zero. Owing to the wide use of radiation Sources and x-rays some exposure to population is unavoidable and so the necessity of fixing up the maximum permissible level.

This is a very delicate problem to handle, for, the dose fixed has been changing all the while, apart from the fact that the same dose, varies with individuals as far as its action is concerned. Among workers in the radium mines lung cancer was found to develop after 17 years of service mainly due to the inhalation of radon containing air. Women painters for watch dials again were found to develop bone cancer after 20 to 22 years. What the writer wants to stress here is that it takes several years of protracted study after introducing very efficient monitoring system for investigations covering almost all the delayed effects before a reliable maximum permissible dose is fixed. It may be interesting to quote S. Russ "one might

almost say that if you accept the present standards of protection, you may still be in danger and if you neglect them you may get into troubles".

An investigation done in America showed that x-ray specialists die 5 years earlier than others. Like other nuclear accidents over exposure has to be treated on similar lines on the basis of the inadequate knowledge about safe dose. If one can get insured in the former case, there is no reason why the state cannot think of introducing insurance against the latter. Anyway fixing a maximum permissible dose brings in its wake the responsibility of the state in enacting the necessary laws which our government are yet to undertake.

The Medical Research Council recommended in 1956 owing to the risk in increasing incidence of Leukemia that the total life dose should not increase 200 r. They further stipulated that dose received upto the age of 30 should not exceed 5 r.

The story of ever changing maximum permissible dose may be interesting which only shows that much work is left to be done in this regard. What was fixed about 1 r. per week in 1931 was reduced to half of it at the 5th International Congress of Radiology held in Chicago in 1937. This was further reduced to 300 mr. per week in 1950 in their London meeting of the International Commission for Radiological protection. Again this is further reduced to 100 mr., now.

According to the latest recommendation by NCRP (U. S. A.) 500 mr. has been prescribed as the yearly dose for person in the uncontrolled areas. That is this dose is more or less the maximum permissible dose for population. The writer wants to argue in this way. If an occupational worker serves for 35 years and gets the now-permissible dose *i.e.* 100 mr. per week he gets a

total dose of 175 r. This knocks dangerously the very bottom of the total life dose fixed *i.e.*, 200 r. What about the dose to which he is exposed from sources from which the general population get their exposure during the span of his life not in service, say an equal or more number of years?

Some prefer 30 mr. per week as occupational exposure. Calculated on the basis of an occupational 40 hours week and 50 weeks year, dose will be 75 mr. per hour which is one tenth of 7.5 mr. per hour, the one time "Tolerance dose". As per the survey made in May 1957 (*vide* Bharatwal & Vaze, Atomic Energy Establishment, Trombay) the man in the monozite area in Travancore Coast gets an average dose of 1500 mr. per year, *i.e.*, 3 times NCRP dose and without any reported bad effects. This may be due to "the fishermen who largely inhabit this area, spend a major portion of their days out at sea where the radiation level can be considered to approximate to the normal background. Thus the average dose to which the population in this area is subjected can be construed at a level which is lower than the measured 1500 millirad per year". (Bharatwal & Vaze). Even if it is taken roughly as 1 r. per year on the basis of a 15 hours day for the man the hourly dose would be 2 mr. The Radiobiology will mark a difference between 500 mr. received all of a sudden say during a Radiologic Examination and double the dose received in several hundred hours. The latter is safer. It is estimated that (Refer A. R. Gopal Ayengar W. H. O. 1957) the background radiation at the equatorial sea level on the average is 92 mr. per year, considering Radiation from within the body from Cosmic sources and Earth's surface, which is not a negligible amount, leave apart the radiation risk due to test explosions. Considering all these 1.5 r. per year seems to be a safe maximum permissible dose in the above context for occupational workers *i.e.*,

30 mr. per week, double the NCRP dose for population. To set a dose more than 30 mr. may run the risk of exhausting all the reserves on hand.

All weekly doses exceeding 100 mr. per week (can be averaged over 13 weeks) are to be investigated to see whether further improvement in shielding and better techniques are possible. Health check up also forms an important routine. Rotation staff wherever possible should be effected to giving full justice to all concerned.

On the Diagnostic side

It is becoming a major scare among certain section of people that their average radiation exposure is increasing due to the wide use of x-rays for the diagnostic work. Modern x-ray equipments are affording protection to the radiologist to a very satisfactory and remarkable degree. Now the risk is felt on the other side. X-ray diagnostic work plays an indispensable part in the periodical health check up of persons and therefore the work has been steadily increasing because such persons form a great percentage of population if not in our country, in advanced countries.

So the responsibility of the physician and the radiologist has increased in avoiding unnecessary exposure and minimising radiation to the person whom they are examining. In an editorial (American Journal of Roentgenology, February 1959) George Tievsky stresses the important role of radiologists stating "He has become a significant link between the physicist and biologist on the one hand and general and medical communities on the other". He continues to write "A roentgen is a roentgen whether it is delivered from the tube of a radiologist or that of another physician". He strikes the bottom of one question. Can the state allow an x-ray tube function without the protective

accessories and above all without fully qualified persons behind it knowing the fundamentals of radiation biology, protection and dosage? If unmanned and half naked x-ray tubes spring up like mushrooms and function, it becomes a social menace to be checked in time.

To-day only a small fraction of the energy is required for the roentgenologic study compared to what required for a similar study in the past. The techniques have been all the time improving in multiforked directions as (1) x-ray film coating (2) intensifying screens, (3) choice of the best x-ray wave length leading to minimum time of exposure. The crux of the problem is how to produce image intensification with minimum dosage of radiation to the person.

Another method under active study (Hay & Banks, B. J. Radiology November, 1958) pointing to a most improved technique is as follows. First get a very light image on the Fluorescent screen using minimum energy. This is converted into a high energy electron image and that is allowed to fall on another fluorescent screen which will be a brighter image. This can also be scanned to produce a televised image on a cathode ray screen.

Another potential danger to the population is from the diagnostic study of pregnant women. Rapidly growing fetal cells are naturally very sensitive to radiation. It is estimated that 1 to 2 r. per film is given to the uterus by such study. This may be a safe dose in the general sense but enough to cause adverse effects in the fetal genes. This gives a warning to the obstetrician who is attempting a study involving the pelvis of a child bearing woman.

The radiologist may be failing in his duty to the society if he is not able to quench the overenthusiasm of the obstetrician. Studies made in Great Britain is giving an alarm

that Cancer is increasing by 80% in adults who were irradiated in the embryonic stage by diagnostic study. And further, the Leukemia rate of children irradiated in uterus is twice that of general population.

In an article (Am. J. O. & G. Jan. 1959) Edward A. Graber and others state: "It seems wrong for any Service to adhere to a fixed routine method of pelvimetry. The greatest exposure occurs with the inlet viewObstetrician should state exactly how many and which films he wants. There should be no routine". They proceed further: "Pelvimetry can be diminished by 70% if the indications are reduced to (1) malpresentation (2) lack of satisfactory progress in labour".

'The blind leading the blind' state of affairs should end. It is left to the Obstetrician to note the signal given by the Radiologist and the Physicist and realise the danger and act accordingly.

The writer has been doing the following measurements and calculations, in the diagnostic cases mentioned below.

1. baby x-ray chest
16 mr. to the gonad.
2. child x-ray chest
15 mr. to the gonad.
3. woman (Pregnant) x-ray abdomen
1.76 r. to the fetal gonads.
4. woman Hystrosalpingogram
1.25 r. to the ovary.
5. woman x-ray pelvimetry
average .75 r. to the fetal gonads per view.

Attempt is not made here to discuss the protection problem in the entire field of x-ray diagnostic and Radio-therapy. But one thing is certain that ordinary x-ray diagnostic study of an individual once made does impart a whole body exposure which does not warrant him to undergo a similar one in another few years. Especially the abdominal x-ray has been found to give to the extent of 3 to 5 r. to the body.

Osteogenesis Imperfecta, with case presentations

BY

Dr. H. M. LAL, P.M.S. (1) U. P.

Synonyms

Fragilitas ossium congenita; Osteoporosis Congenita; Congenital Osteopsathyrosis; Osteopsathyrosis idiopathica.

Definition

A generalized disorder of the skeleton manifested by multiple fractures, increased fragility of bones, blue sclera, dental defects and deafness due to osteosclerosis of the tissues. The disease is not congenital. Few cases of heredity have also been recorded without blue sclerotic. Inheritance factor follows Mendel's Law. Both sexes are equally affected. Children and infants are the chief sufferers.

History

The discovery of the disease dates back to the year 1716, when the pioneer 'Armand' labelled it for the first time. No work was done for more than a century, when in 1833 'Lobstein' described Post-natal type of the disease, and named it as 'Idiopathic osteopsathyrosis'. In 1845 Vorlik described this condition under the title of 'Osteogenesis Imperfecta'. The history reveals that the condition is extremely rare otherwise there would not have been long lapses. A thorough search into the literature reveals that the disease is extremely rare in India.

Classification

Attempts have been made in the past to classify the disease, but not quite satisfactory to embrace all the characters, probably for its being a rare condition. Shelling in the year 1848 described it as hereditary and

non-hereditary, the former being a condition of multiple bone fractures associated with blue sclerae, dentine defects and deafness in some cases. He also classified the non-hereditary type into two—(1) Osteogenesis Imperfecta Congenita and (2) Osteogenesis Imperfecta Infantilis, which can again be differentiated as with or without blue sclera. This is the prevalent classification, superseding Knagg's classification, who described the condition in three forms: (a) Foetal (b) Infantile and (c) adult-form. Some are of the opinion that Albers-Schonberg's disease—"Marble Bone"—is a rare variety of Osteogenesis Imperfecta of adult-form. I suggest to subclassify the infantile type into three classes...(1) in still born (2) in newly-born, and (3) in child-hood.

Summary of the Classification

1. SHELLING'S:

(A) Hereditary—with blue sclera, defective teeth, and deafness in some cases.

(B) Non-hereditary—

1. Osteogenesis Imperfecta Congenital is with blue sclera, and without blue sclera.

2. Osteogenesis Imperfecta Infantilis.

2. KNAGG'S:

(a) Foetal: in which individual is still-born or survives for a short time.

(b) Infantile: The child may live for a few months or a year or so.

(c) A form which affects children and adults.

(d) A form which affects persons of middle life or old age (Albers-Schonberg's disease).

3. PRENATAL TYPE OF VORLIK.

4. POST-NATAL TYPE OF LOBSTEIN.

Aetiology

Osteogenesis Imperfecta is a rare familial condition for which no definite cause has been ascertained. Various theories have been put forward from time to time, but none has been satisfactory to be adopted. Hensen believed that the condition was due to deficiency in alkaline phosphatase while others found no abnormality in the serum calcium. Kolmer and Boerner have found the blood phosphatase activity to be normal. Voegelin stated that there was functional inhibition of the endosteum specially in those cases in which bones were short and fragile and easily got fractured by slight trauma, muscle action or even by pressure in the intra-uterine life. In some cases there was inhibition of the periosteal activity, specially in cases where fractures resulted by simple body weight. This view was supported by Babaianz. Some attribute the condition to be due to hereditary hyperplasia of the mesenchyma, while others pointed out that it was due to a congenital defect in the evolution of connective tissue-cells, specially osteoblasts, the development of which stopped short at the formation of cartilage cells. There is no evidence what-so-ever of vitamin deficiency. Lately congenital abnormalities have been induced by various workers with certain teratogenic agents—*viz.* sulfonamide-compounds, thallium-salts, cortisone, 3-Acetylpyridin, lead-salts and Benzyl-alcohol. Recently appreciable work has been done by Professor P. K. Duraiswami, by injection of different doses of Insulin, 96 hours after beginning of the incubation

of eggs, and the embryos surviving the 11th day of incubation were examined. Generalized developmental disturbances of bones resembling prenatal type of osteogenesis imperfecta with defective ossification were seen. Some of these embryos showed angulation in one or both tibia and some showed beak-defects including Parrot-beaks. The degeneration in the cartilaginous core of tibia and radial arrangement of the bone trabeculae at the angulation was evident. From the foregoing experiment it seems that hypoglycemia may play a part in the causation of the appropriate deformity, whereas sulfonamide seems to induce the defect without lowering the blood sugar of the treated embryos.

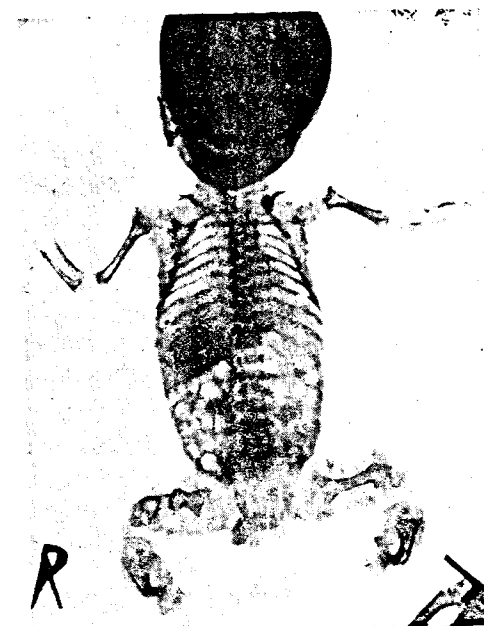
PATHOLOGY:

Macroscopic Examination

Changes are markedly seen both in the medulla and cortex of the bones, so much so, that they may be structurally indistinguishable. Skull may be represented by a membranous bag with a few small bony plates. Wormian bones may persist in skull. There is some controversy for epiphyses of bones. Some are of the opinion that epiphyses are large in proportion to diaphysis with epiphyseal-line, having normal contour, while others report that epiphyses may be absent. Angulation of shaft is common due to malunion of fractures. Vertebral column often exhibit scoliosis, or kyphosis. Vertebrae may be soft and there may be flattening of the bodies, and the ballooning of the inter-vertebral discs. Osteosclerosis commonly develops at about the third decade. The older fractures exhibit good callus formation. Congenital hyperplasia and sclerosis of mesenchymal tissues is notable in ligaments.

Microscopic Examination

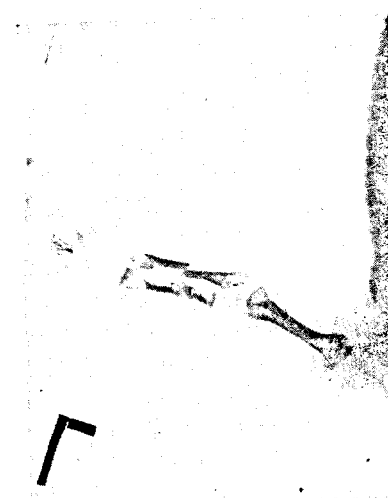
The periosteum of the bones is thickened and cortical bone beneath it is virtually



Skiagram No. 1

Antero-posterior entire-body—Radiograph.

Please Note:—(1) The presence of all the fractures found on clinical examination.
(2) The entire skeleton osteoporotic.



Skiagram No. 2—Lef upper limb. A.P.

Please Note:

(1) The fracture of the left radius with thick callus formation and incomplete union, where as fractures of the ulnar shaft (at two places) appear to be of recent occurrence.

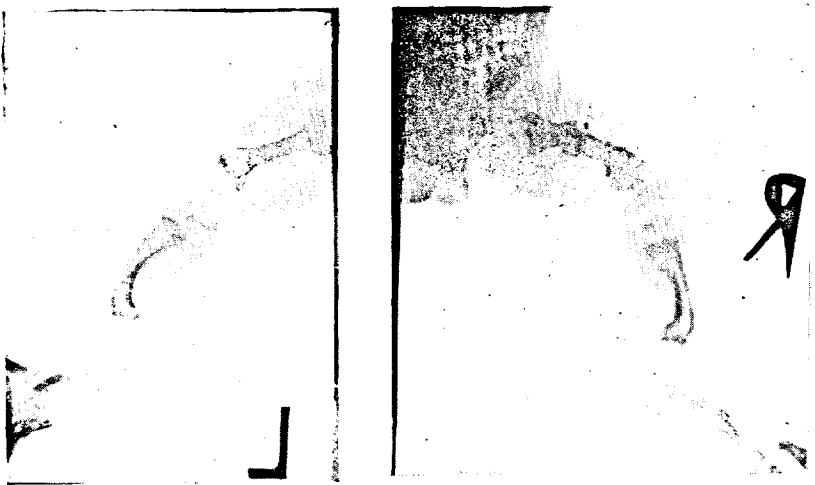
(2) Fracture of the upper end of the left humerus with little callus formation.



Skiagram No. 3—Right fore-arm A.P.

Please Note:

Slight bending of the right fore-arm bones.



Skiagram No. 4—Lower Limbs. A. P.

Please Note :

- (1) The malunited fracture of the right femur with thick callus formation.
- (2) The angulation at the seat of fractures of tibia and fibula on both sides.
- (3) Fracture of the epiphyses of the lower end of the left femur.

absent. There are areas of fine trabeculation and osteoclasts are irregularly disseminated in large numbers. Bone-marrow exhibits fibrous hyperplasia.

Clinical Features

Osteogenesis imperfecta, unlike other diseases, is supposed to be familial condition. In majority of case reports it has been noticed that no other member of the family was found to have had any similar symptoms.

Blue Sclera

In about 1/3rd cases blue sclera forms a diagnostic feature. The cause of this coloration as pointed out by Vol Ammon in 1841 is due to choroid which is seen through the sclera, which usually is thin in these cases. This view is contradicted by others. Some are of the opinion that the blue sclerotic so characteristic of the disease is not due to diminished thickness of sclera as no abnormality can be detected on microscopic

examination. The translucency is therefore due to some other peculiarity of the fibrous tissue. This is also supposed by some as the associated abnormality. A tendency to lax-ligaments and sprains is commonly seen with fragile bones.

Fractures

In these patients usually there are multiple fractures of bone. Every bone of the body may be deformed and thus limbs may be unequal in size and angulated. Pelvis may be deformed. During the course of the disease as many as hundred fractures have occurred from most trivial causes. The fractures cause little or no pain unlike what occurs in normal bone-fractures. Although union of fracture does take place deformities are common. Patient may be of short stature. Skull is commonly flattened with pointed ears so that the patient has "Elf-like" appearance. The deformity in vertebrae may give rise to scoliosis or kyphosis of varying degrees.

Dental defects

Teeth are badly calcified giving rise to dental defects.

Deafness

It develops usually after the age of 20 years due to otosclerosis.

Painful swellings

In a few cases there may be painful swellings, when X-Ray will reveal fractures of under lying bone.

Hoeve's Syndrome

A condition characterized by deafness, fragile bones, and blue sclerotics.

Differential Diagnosis

Osteogenesis Imperfecta is a rare known disease and presents little difficulty to diagnose, provided one remembers it. The condition needs differentiation from other similar disease having a few allied symptoms such as achondroplasia, rickets, hyperparathyroidism, myelomatosis, neuropathic atrophy of bones, hyperthyroidism, osteoclastic carcinomatosis, etc. Severe cases and all those with blue sclera are easily diagnosed. Congenital syphilis is some times mistaken as osteogenesis imperfecta.

Investigations

1. Blood calcium and phosphorous are usually normal.
2. Serum phosphatase—Smith has found to be raised. It is not confirmed by others.

X-Ray Examination

Whole skeleton is osteoporotic with multiple fractures of the bones and callus formation. All bones are thin and imperfect.

Prognosis

It is guarded in infantile type. Severe cases of prenatal type are either still born or they live for a short time. Congenital type of cases are invariably fatal. Multiple fractures in the first few years of life produce so much deformity that the patient can hardly walk. Most of them die before attaining puberty.

Treatment

Since the aetiology is still in dark, no specific cure has been found so far. The patient should be handled lightly, checked from accidents and falls. He should be given good diet, supplemented with vitamins calcium, and thyroid. The fracture should be treated and deformities corrected. If careful splinting is done, fractures usually unite firmly without any delay. Dislocations are reduced without much difficulty. Gorter in 1929 advocated thymus extract as specific for the disease. His views are supported by Hendersen. Some authorities have reported that Vitamin D and calcium salts along with high calcium diet have no effect on the course of the disease.

Case Report

Case No. 1.—The patient was a 3-day old male infant. The two previous pregnancies were normal and he had been also delivered normally. This child was born in a goldsmith's family at Pilibhit in 1955. The history obtained about the family background was non-contributory. The parents had never suffered from any disease, e.g., brittle bones or fractures. There was no history of blue sclerotic in the family. I was called in consultation on 18-9-1955 to see this newly born suffering from some undiscovered cause of pain. The parents informed us that he did not sleep since his birth, probably due to some pain in the body.

Physical examination revealed a fairly well-built infant weighing 6 lbs. 6 ounces (3.3 Kilograms). He was not in distress when lying in bed. Shaking of bed, slight movement of the child, like changing of the sides, or taking him into the lap, elicited pain. The skin of the boy was comparatively dry. The suture line between the frontal bone was apart. Anterior fontanelle extended from the glabella to the vertex. Multiple fractures of bones, presumably dating from intra-uterine life were detected and confirmed by radiograph (See Skg. No. 1). Fractures were found in both the clavicles, left humeral head, left radius and ulna (See Skg. No. 2), right radius, (Skg. No. 3), right and left tibia and fibula (Skg. No. 4) and right and left femora (Skg. No. 2). Left thorax appeared collapsed as compared to the right (See Skg. No. 1). It was interesting to note that these fractures had occurred at different stages of intra-uterine life, e.g., fracture of the right femur showed thick callus formation, whereas fracture of the left ulnar shaft appeared to be of recent occurrence. Some fractures were complete, a few were represented by slight bending of bones, and others showed a little callus formation. The sclerae did not show any blue coloration. The child was given supportive treatment. The parents refused

hospitalization for investigation. They did not take allopathic treatment either, and treated him with indigenous medicines and oil massage. The parents informed me that the infant stopped crying after two months of the above treatment. He put on weight and improved in general health. No further fractures were noticed by them. At about the age of 8 months the child got hyperpyrexia (41.1°C) suddenly, and expired.

Case No. 2.—A 4-day old male infant born at full term. This infant was the first issue of healthy parents. The parents though young, had fatty constitution, and to their ages they were over-weight. They belonged to a rich mill-owner's family of Kanpur. I was called to see this case by a colleague of mine in 1950.

Physical Examination of the Infant showed multiple fractures involving nearly all the long bones of the extremities, ribs and clavicles. Some of the fractured bones showed slight callus formation and others fairly thick. The skull bones were soft and the skeleton as a whole showed osteoporosis of the bones. These fractures occurred at different stages of the intra-uterine life. No further information could be had from the parents or the family physician.

Abstracts of Radiological Literature

"Thrush Complicating Radiotherapy of the Mouth and Neck". Eelkema, H. Harrison; Scanlon, Paul W.; Colby, Malcolm Y.; Ulrich, John A. *Radiology* 72: 26-29. January, 1959.

The authors have suggested that the grey-white friable membranes superimposed on a base of edematous, inflamed mucosa noticed during intensive radiotherapy may be due to infection by *Candida albicans*. They obtained a positive culture for this organism in every case studied by them. *Candida albicans* is a yeast commonly present in the mouth as a saprophyte. Pathogenic overgrowth of this organism results in the clinical infection known as thrush or moniliasis. The disease seen in the adult mouth results from imbalance of the normal mouth and throat flora caused by antibiotic therapy. Poor general nutrition, local injury and faulty oral hygiene account for some cases. Changes in salivary secretions and injury to the mucous membrane caused by radiation are the likely causes of the production of such a membrane during intensive radiotherapy. The treatment recommended by the authors consists of the administration of 1 to 2 ccs. of nystatin (Mycostatin, oral suspension, 100,000 units in 1 cc.) placed directly in the mouth and held there as long as possible before swallowing. This is repeated four times daily. Although this treatment does not produce a dramatic change in the discomfort of patients with severe degree of radiomucositis the elimination or diminution of concurrent thrush could be expected to lessen the duration of postirradiation morbidity and to make the patient relatively comfortable.

M. L. Aggarwal.

"Osteomyelitis of the Mandible Following Irradiation". Elmer N. G.; Chambers, Frank W.; Ogden, Harry S.; Coggs, Granville C.; Crane, Jackson T. *Radiology* 72: 68-74, January, 1959.

It has been generally believed that the likelihood of osteomyelitis of the mandible is decreased by the preliminary extraction of any teeth that are diseased or lie within the area to be irradiated. Quick and Paterson, however, advocate postponement of extraction and more recently Wildermuth and Cantil have proposed that extraction of teeth before irradiation actually predisposes to osteomyelitis.

Experimenting on adult mongrel dogs the authors found that (1) irradiation of the mandible was followed by gingival ulceration and osteomyelitis of the underlying mandible with 4,000 r (air) or more (2) removal of teeth prior to irradiation of the mandible significantly decreased the incidence of osteomyelitis, (3) osteomyelitis was not observed in the absence of ulceration of the overlying gingiva and (4) bone necrosis without osteomyelitis was not observed with the dosage and time range studied.

M. L. Aggarwal.

"Positive Roentgenograms Plus Positive Sputum Smears Do Not Always Equal Pulmonary Tuberculosis". Good, C. Allen; Carr, David T.; Weed, Lyle A.; *Am. J. Roentgenol. Rad. Therapy & Nuclear Med.*: 81, 187-195, February, 1959.

The authors report seven cases to stress to roentgenologists and others, who may not be familiar with bacteriologic details, that there

exist pathogenic acid fast bacilli which have got cultural characteristics and virulence for laboratory animals entirely different from those of tubercle bacillus. These atypical acid fast bacilli are resistant to isoniazid and paramino salicylic acid, though they are only partially resistant to streptomycin. Clinical and roentgenologic manifestations of disease caused by the tubercle bacillus and atypical acid fast bacilli are similar. It is therefore very important to realise that a firm diagnosis of tuberculosis should not be made on a smear examination of the sputum alone because the atypical bacilli will not respond to anti-tubercular drugs.

Three types of atypical acid fast bacilli have been described as follows: (1) photochromogens, which produce buff or cream-colored colonies when grown in darkness, but which develop lemon-yellow colonies when allowed to grow in light; (2) non-photochromogens, which produce buff or cream-colored colonies wherever they are grown; and (3) scoto-chromogens, which produce yellow or orange colonies wherever they are grown. Photochromogens and non-photochromogens are most commonly associated with pulmonary disease. The scoto-chromogens are commonly encountered but rarely in association with pulmonary lesions. While all the three types of microorganisms do not produce generalised disease in guineapigs, photochromogens and some non-photochromogens are pathologic formice.

M. L. Aggarwal.

"Less Familiar Roentgen Patterns of Pulmonary Granulomas". Felson, Benjamin; Am. J. Roentgenol, Rad. Therapy and Nuclear Med.: 81, 211-223. February, 1959.

Sarcoidosis.—Roentgen signs of lymph node enlargement, disseminated miliary densities,

localised infiltrates and fibrotic changes alone or in combination have been adequately described in literature. The author describes two more interesting but less familiar roentgen patterns of sarcoidosis which may, at times, bring the disease to mind. One such pattern, "the large multinodular pattern" consists of multiple round densities, 5 to 35 mm. in diameter. The nodules are usually numerous with hazy or fluffy outline and tend to the confluent: their resemblance to the "halo" metastatic nodules of chorionepithelioma and certain other neoplasms is striking. The nodules may be fewer in number, sharper in outline, and discrete when they cannot be distinguished from metastasis. Hilar mediastinal glands are enlarged in these cases. This pattern is a rare manifestation of sarcoidosis and more frequently a sign of metastatic neoplasm. The patients were usually young male Negroes who had mild clinical symptoms, continued state of well-being and stigmata of sarcoidosis in other parts of body. Other conditions to be considered in differential diagnosis include multiple histoplasmoses, the rare nodular form of tuberculosis, and multiple benign tumors and hamartomas. These lesions, however, often contain calcium (which is absent in sarcoidosis).

The other less familiar roentgen pattern of sarcoidosis is the "multicystic pattern" which probably is a complication of the irreversible fibrotic stage of sarcoidosis in which emphysematous bullae and bronchiectasis develop giving the lungs a cystic appearance. The large cavity lesions seen in chest roentgenograms in sarcoidosis usually prove to be emphysematous bullae. Spontaneous rupture of these bullae may produce pneumothorax. During the earlier stage of fibrosis of lungs no cysts may be seen in a serial study. The cystic lesions once they appear, increase gradually in number and

extent and clinically the respiratory symptoms such as cough and dyspnea are prominent and progressive. The ultimate roentgen picture consists of widespread involvement of lungs with strand-like or ill-defined densities honeycombed with large or small thin-walled cavities having the typical appearance of bullae. A multicystic roentgen pattern may be encountered in tuberculosis, histoplasmosis, progressive bullous emphysema, pneumoconiosis and many other diseases.

Histoplasmosis

The well known roentgen manifestations in the lungs are (1) disseminated miliary or small patchy densities, (2) localised pneumonia and (3) solitary nodule ("coin" lesion, histoplasmosis). Each of these types may be associated with tracheobronchial lymph node enlargement of variable degree and extent. At times, lymph node enlargement may be the only roentgen manifestation of the disease. The healing phase is often characterised by the deposition of calcium in the pulmonary lesions and lymph nodes. The less familiar patterns described by the author are: (1) fibrocavitary histoplasmosis, (2) enlarging histoplasmosis, (3) histoplasmic broncholithiasis, (4) multiple histoplasmoses and (5) other possible sequelae of histoplasmosis.

Fibrocavitary histoplasmosis.—Patients are usually chronically ill elderly males. Roentgenograms show fibrosis and cavitation. Cavitation is a prominent feature, the cavities often being quite large and multiple. The progress of lesions is slow. The sputum generally contains *H. capsulatum*. The skin and complement fixation tests are usually positive. Coexistence with active tuberculosis, malignant lymphoma and other fungus diseases is not rare.

Enlarging histoplasmosis.—Pulmonary histoplasmoses are generally regarded as

inactive lesions. However 2 cases showed definite enlargement over a period of several years. Nodules contained calcium. Tissue sections of resected specimens showed *H. capsulatum* in profusion.

Histoplasmic broncholithiasis.—The broncholiths are usually produced by erosion into a bronchus by calcific foci from lung or lymph nodes. Such foci are usually assumed to be quiescent or healed tubercular lesions. However, in an area in which histoplasmosis is endemic this disease rather than tuberculosis might be implicated as was the case in two of the author's cases.

Traction diverticulum of the esophagus.—Such a diverticulum may result from traction by cicatrix in and about lymph nodes infected by *H. capsulatum*.

Multiple histoplasmoses.—These consist of multiple large nodules measuring upto 3 cm. in diameter. One or more will show calcium. Presence of calcium, their non-progressive nature and the continued well being of patients over long periods of observation exclude metastatic neoplasm from consideration. Nodular form of sarcoidosis does not show calcium. Multiple benign tumors, hamartomas and other fungus diseases must also be considered in differential diagnosis.

Other possible sequelae of histoplasmosis.—Middle lobe syndrome and superior vena cava obstruction may be met with in histoplasmosis.

There is such a close resemblance between histoplasmosis and tuberculosis that in an endemic area histoplasmosis must be given serious consideration in all cases in which a diagnosis of pulmonary tuberculosis is suspected but unconfirmed.

Noninfectious Necrotising Granulomatosis (Wegner's Syndrome).

It is a fatal disease which affects adults beyond the age of thirty almost exclusively with no racial or sex preponderance. There is usually an allergic background with severe asthma, fever and eosinophilia associated with necrotising angitis and extravascular granulomas in various organs. Histologically the granulomas reveal a central coagulation necrosis surrounded by a zone of inflammatory cells in which eosinophils may predominate. The vascular alteration consists of localised necrotising inflammation of both arteries and veins with fibrinoid changes. Although any organ may be involved, the disease often affects the upper respiratory tract. There may be severe destruction of midline facial structures, perforation of the nasal septum and ulcerations and granulomas in the oral cavity and paranasal sinuses. When lungs are involved the granulomas are seen as solitary or multiple poorly defined nodular densities or localised infiltrates which may break down and show multiple cavities. Sometimes the presenting symptoms may be indolent ulcerations of the skin and soft tissues. The clinical diagnosis of non-infectious necrotising granulomatosis depends upon the presence of several of the following manifestations: an allergic background, destructive granulomatous lesions of the face, skin and upper respiratory structures, eosinophilia, evidence of renal disease and the roentgen signs described above.

M. L. Aggarwal.

Prognosis in Osteitis Ilii: J. K. Isley and G. J. Batlin: Rad. Feb. '59. pp. 234.

The etiology of osteitis condensans ilii is not definite and the clinical picture not constant. Relatively established aspects are radiological aspects, age and sex incidence,

and the pathological picture. The authors based the diagnosis radiologically on (a) homogeneous area of density in the ilium, near the joint inferiorly, (b) normal articular surfaces and the joint, (c) little or no involvement on the sacral side, (d) minimal or no spurring at the inferior end of the joint. In differential diagnosis hypertrophic arthritis of the sacroiliac joint, Marie-Strumpell arthritis, metastatic tumours, Paget's disease, osteomyelitis and syphilis are considered.

A high percentage of patients showed improvement radiologically. Out of authors present series of 19 only 2 did not improve. Most of the patients had episodic discomfort, spontaneously disappearing in a few days to weeks. None received deep X-ray therapy. None of patient was over 50 years of age; followup was for 3 to 13 years. Interesting points from Table I are: 1 male in the series; unilateral involvement in only 2; backache absent in 6; neurological changes in only 1; sacroiliac joint tenderness absent in 13; and prior pregnancy in 13. The authors conclude that the disease is a benign self-limiting one undergoing spontaneous regression in months to years.

B. N. Khanna, Kanpur.

Radiologic Aspects of Craniopharyngioma: Donald J. Barnett: Rad. Jan. '59. pp. 14.

Craniopharyngiomas are not frequently occurring intracranial tumours and about 5% of all brain tumours of this study were so. The sexes were equally affected. On account of its situation near optic chiasm, III ventricle and the hypothalamus, loss of vision (most common), endocrine disturbances and headache, nausea and vomiting

occur, the last due to III ventricle dilatation and compression. The ages varied from 4 to over 60 years. The craniopharyngiomas are of squamous origin. They arise from tuberal processes (of the craniopharyngeal duct) which forms pars tuberalis, attaching to the anterior aspect of the infundibulum. They may be solid or cystic and may contain enamel organs. Calcium is a common constituent. Radiologically the sella is not enlarged usually, but some cases show marked erosion. About 50% showed erosion of the anterior clinoid processes with involvement of their inferior surface thus causing them to be pointed. The dorsal surface rarely showed any change. The dorsum sellae and posterior clinoid processes suffered in 80%. About half the cases showed changes in the floor. Various portions of the sella turcica show increased density—two showed of all the clinoid processes and the floor. Some workers believe that the increased density may be a congenital variant. The calcifications in and around the sella is often enough for diagnosis. Some tumours show calcification at their periphery, some flocculant type. Usually multiple calcifications are seen. In all 73% showed it. (5% showed distortions of the lateral ventricles: 27% showed enlargement of the ventricles due to narrowing of the foramen of Munro. Cysterna chiasmatica and spaces adjacent to dorsum sellae are obliterated. Carotid angiography showed displacement and widening of carotid syphon in varying degrees. Sutures may be widened in children.

Cystic astrocytoma, chromophil pituitary adenoma, chordoma and oligodendroglioma give similar radiological appearance.

B. N. Khanna, Kanpur.

The Importance of the lateral view in the Evaluation of Left Ventricular Enlargement in Rheumatic Heart Disease: W. R. Eyler, D. L. Wayne and J. E. Rhodenbaugh: Radiology, July 1959.

Surgery gives much more relief in rheumatic mitral stenosis than in mitral insufficiency the degree of which is determined essentially to gauge the benefit expected. The authors found the lateral view to be the most reliable indication of insufficiency. The enlargement of the left ventricle is more posteriorly than laterally. The present study is from 214 patients of rheumatic valvular disease surgically explored.

The heart is in contact with the left dome of the diaphragm. The posterior outline of the heart is sigmoid shaped often with a clear space between the heart and the esophagus and the heart does not protrude more than 10 mms. behind the upper end of the inferior vena cava. In P. A. view upper lobe venous distention is seen but in spite of increased transverse cardiac diameter the apex is usually normally situated. In the presence of mitral insufficiency, an aortic valve lesion leading to left ventricular hypertrophy, or systemic hypertension, the posterior enlargement of the left ventricle causes the segment in contact with the diaphragm to lengthen, the left ventricle is convex posteroinferiorly and usually extends behind the upper end of the inferior vena cava for at least 15 mms. horizontally. In P. A. view the apex may show minimal change in its configuration. The proper evaluation of the size of the cardiac chambers requires the use of all the four projections and of fluoroscopy. For measurements the thorax is kept vertical in the lateral position. The internal diameter (D) is from the anterior to the posterior pleural surfaces at the level of the left dome, and the

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length of the cardiac segment is from the anterior pleura to the posterior part of contact between the heart and the left dome. The C/D ratio of 0.42 provides a good boundary between stenosis and other lesions. In pure mitral stenosis C/D ratio was 0.42 or below in 86 and above it in 12 cases; those with stenosis and minimal insufficiency showed 23 below and 11 above 0.42; those with stenosis and moderate insufficiency—10 below and 17 above 0.42; and those with marked insufficiency, or with associated aortic valve lesion, or those with pure aortic valve lesion 15 below and 40 above 0.42. With too much barium in the lower esophagus or pleural effusion or marked Lt. ventricular enlargement, the method is not applicable.

Due to overlapping of measurements, in various types of lesions complete separation and differential diagnosis cannot be made by this method. All the four views are necessary and attention paid to the pulmonary vessels. If the clinical findings do not agree, Lt. ventricular catheterisation in restorted to, otherwise not. Patients with giant Lt. atrium or deformed Lt. dome cannot be evaluated by this method.

B. N. Khanna, Kanpur.

Middlemiss, J. H.—The dangers arising from the Medical Use of X-Rays. The Medical Annual, Bristol, John Wright & Sons, Ltd., 1958, pp. 33-39.

In this special article a distinguished radiologist rightly stresses that "a certain amount of ill-informed speculation, and relatively wide publicity in the daily press has created a general anxiety and alarm which it is often difficult to allay. In fact the extent of the problem is still not fully appreciated and statistical data are conspicuous by their absence". A survey of the obituary notices of the Jour. Amer. Med.

Ass. 1929-1948, showed that relative to the number at risk there are about nine times as many deaths from leukaemia among American radiologists as among other American physicians. The cases of leukaemia in Japan during 1947-1954 were four times the number expected from estimates of vital statistics. In 1957 Crown Brown and Doll reported increased incidence of leukaemia in 13,352 cases of ankylosing spondylitis treated by X-rays. The author considers that in the United Kingdom the background radiation is increased by 22% by the medical use of X-rays alone and in Sweden and the U.S.A. by 100% or even more. The natural background radiation accounts for 2-20% of the natural genetic mutation rate. The small increase of the natural background in U.K. by X-rays alone is not significant but "it is only when this is considered against the background of all man-made radiations and alongside the considerably greater increases in background radiation due to the use of diagnostic X-rays in some other countries that the extent of the problem is realised". The 1956 Report of the Medical Research Council recommends a whole life-time wholebody threshold dose of 200 roentgens in addition to the natural background radiation, and a total gonadal dose of 50 roentgens (r), from conception to the age of 30 years. In this context of wholebody (leukaemia producing) and gonadal (genetic hazard) doses the author says that "even extensive skeletal surveys repeated two or three times are unlikely to produce a total-body dose of 3 or 4 (r) and actual dose to the bone marrow must be minimal and leukaemia is an unlikely event. In his clinic the dose to the heart during cardiac catheterisation was between fifty and eighty (r) for the one examination". This dose can be greatly reduced by the use of the image amplifier. Gonadal dose is a different problem and the following figures are quoted by Osborne and Smith (1956).

Region X'rayed.	Male.	Female.
Chest	0.36 mr.	0.07 mr.
Abdomen	69.00 mr.	200.00 mr.
Pelvis	1100.00 mr.	210.00 mr.
I.V.P.	486.00 mr.	1290.00 mr.

In 1957 Witts wrote "The possible 50 cases of leukaemia a year from X'radiation in utero must be set against 439 deaths of mothers in childbirth, 15,829 still births and 9,750 deaths in the first week of life in 1955. Obstetricians and radiologists believe that they can save more lives by X-rays than are likely to be lost from leukaemia appreciating as they now do the hazards of X'radiation". This warning says the author is applicable to all fields of diagnosis and the radiotherapy of non-malignant conditions and "is timely when so much speculation and ill-informed opinion have reached the popular ear".

Col. Rebello, Poona.

Tudway, R. C.—Radiotherapy—Review of the Year's Work. The Medical Annual, 1958, pp. 366-371.

The unwanted effects of radiation in particular the genetic effects and the production of malignancy are surveyed in the MRC's report "The Hazard to Man of Nuclear and Allied Radiations (1956)". The natural radiation to the gonads is 1 roentgen in 10 years and there is probably no safe dose so far as genetic effects are concerned. An additional 15-20 (r) will double the genetic mutation rate, usually adversely. The increase of exposure to man-made radiation is almost entirely due to medical radiology. In Britain this dose rate is 22% of the natural rate and in U.S.A. and Sweden it is at least 100% the natural background rate. This excludes radiotherapy because the patients are generally beyond the child bearing age. The next important

sources are industrial radiology and strangely, the wearing of luminous watches. For the whole population watches contribute 1% of the natural back-ground rate but to the wearer of the watch the contribution is 10% at the gonads.

The doses needed to induce malignancy are only likely to be met with in radiotherapy or in accidents to workers with atomic energy. In previous years the dosages involved were mostly unknown, were multiple, of fairly low penetration and repeated over long periods of time often for benign conditions such as lupus vulgaris, thyrotoxicosis, pruritus or even hyperidrosis. The tumours induced were usually epitheliomata. These are not likely to be seen now with modern dosage methods. There is now a new form of the same danger with the advent of supervoltage and the physical success of heavy depth doses. It is now possible to produce a fibrosarcoma in the tissues without any excessive reaction in the overlying skin. This must be borne in mind when high doses are used in benign conditions. A leukaemia is still not very likely to arise even if the spinal marrow is treated. A course of 1500 (r) given to the whole spine will raise the likelihood of leukaemia by 10 times. Thus, a 1 in 20,000 chance of acquiring it is raised to 1 in 2,000. Small doses in small areas may yet be dangerous in the case of infants treated for enlarged thymus. "However, if the infant really is choking because of the thymus and a little deep X'ray therapy will probably save life, then it is difficult to say that the method should not be used because of an increased possibility of carcinoma of the thyroid in seven years".

The author gives examples of damage caused by "lower than the usual" doses by X-rays which "are mostly en route to a neighbouring part that is perfectly well able to stand a full dose". Thus in treating

malignancy near the orbit cataract can occur at 600 (r) and damage to the ciliary apparatus at 4,000 (r) in four weeks. In the central nervous system damage occurs at 4,500 (r) in 17 days or 5,000 (r) given over a month or slightly higher doses for super-voltage. Radiation causes decalcification and mechanical weakness in bones. 4,000 (r) will produce fracture of the neck of the femur after deep X-ray for cancer of the cervix. Theoretically supervoltage should be much safer because the differential bone absorption is less.

An important effect in the young is the action on the epiphyses and a dose of 1,000 (r) may be critical. For this purpose the author includes the germinal centres for the developing teeth and the base of the skull along with the epiphysis. The kidneys should not receive more than 2,000 (r) unless a useful part of the kidney tissue can be spared. Ross, W. M., (1956) *Thorax*, 11, 241, reports that 90% of patients treated for cancer breast developed some degree of fibrosis of the lung.

In the field of radioactive tracer techniques there is little risk to the patient. In the tracer tests for malignancy by uptake of radiophosphorus doses up to 1 millicurie are used and may cause some genetic damage though the dose to the gonads in this case is said to be less than 1 (r). The dose to the bone marrow though somewhat greater than 1 (r) is still unlikely to induce leukaemia. The author does not advise these tests in patients of child bearing age.

The smaller tracer doses of 25 micro-curries of radioiodine are safe for patient and operator alike. Therapeutic doses of isotopes carry definite risks which vary with the emission of the isotope, its half-life, etc. Radioiodine used for the treatment of thyrotoxicosis, carries a potential genetic risk, but "10000 r. e. p. have been given to

parts of the thyroid without inducing malignancy. In the U. S. A. it has been in use long enough for the danger to be fulfilled if it exists and there is no such report so far".

Radiophosphorus is used mainly for palliative treatment in malignancy and therefore the genetic and carcinogenic hazards are not significant. It has been shown that transfusions of bone marrow protect the body against the effects of ionising radiations.

Col. Rebello, Poona.

Pulmonary Hypertension, A symposium.
III. R. G. Granger. Interstitial pulmonary oedema and its radiological diagnosis. A sign of pulmonary venous and capillary hypertension. *Br. Jour. Radiol.* April 1958, Vol. 31, 201-217.

In 1933 Kerley described fine dense peripheral lines, horizontal, usually basal, seen frequently at the costophrenic angles of patients with mitral stenosis, naming them arbitrarily as "B-Lines". Similar dense, fine thread like lines ("A-Lines") are seen less frequently in the centre of the lung fields. These are often much longer, slightly curved or sharply angulated, and run obliquely towards the hilum unlike B-lines.

There is now abundant evidence to enable us to attribute these radiographic lines to an increased radioopacity of the connective tissue stroma or septa of the lung, resulting from an interstitial extraalveolar pulmonary oedema. These A or B-lines may therefore be utilised as a radiological sign of interstitial pulmonary oedema and therefore of the high pulmonary venous pressure of failure of the left side of the heart. In cardiac diseases they are related to a high pulmonary venous and capillary pressure, but not primarily to an increased arterial pressure.

Septal lines are seen most frequently in mitral stenosis; in predominant regurgitation as well as in stenosis. They indicate that the patient is suffering from dyspnoea, and that there is present interstitial pulmonary oedema, indicating a dangerously high pulmonary capillary pressure. These lines disappear after relief of the left heart failure, either by medical or surgical treatment. The value of septal lines in mitral stenosis is that they are the most prominent and occasionally the only radiological sign of a dangerously high left auricular pressure.

Septal lines (often less marked than in mitral disease) may be seen in pulmonary venous thrombosis or in left auricular or ventricular failure of any etiology.

There are 2 radiological patterns of pulmonary oedema, the first is the alveolar oedema, the second is the interstitial oedema.

For the Radiologist, they are important because clinical examination will frequently not reveal the interstitial oedema, and that these lines frequently provide him with the first objective evidence of slowly developing failure of the left auricle or left ventricle.

14 radiograms, 11 figures.

S. N. Deboo, Bombay.

Bernard S. Wolf, Richard H. Marshak and Max L. Som. Peptic oesophagitis and peptic ulceration of the oesophagus. *Am. Jour. Roentgenol.* Vol. 79, May 1958, 741-759.

Peptic oesophagitis usually of mild degree is frequently present in association with a hiatus hernia. In the presence of a duodenal ulcer or excessive gastric acidity, peptic oesophagitis of a severe degree may occur and result in stricture formation. In the first group, there may be no pre-existing abnormality in the oesophagogastric region or at the diaphragmatic hiatus, but there is a

small oval sac-like dilatation above the hiatus. In the severe form, there is a long straightened segment involving 5 to 10 cms. of the oesophagus which is markedly narrowed with irregularly serrated and indistinct contours. Proximally the oesophagus is moderately dilated, no large niche or ulcer is present. Mucosal pattern is markedly distorted or effaced.

A group of patients exists in which a variable length of the distal oesophagus is lined by an atypical or embryonic type of epithelium. This type of epithelium is also susceptible to inflammation and ulceration, which may resemble an ordinary chronic peptic ulcer of the stomach, termed the "Barett ulcer".

In the presence of an inflammatory complication, the presence of a gastric lined segment of the oesophagus is not recognisable by x-ray methods and may also be overlooked at oesophagoscopy. When discrete ulceration and or stenosis is observed by these methods at some distance proximal to a typical hernial sac, the presence of a gastric lined segment should be suspected.

In the presence of a direct hiatus hernia, peptic ulceration of a discrete nature may occur and be localised to the terminal part of the oesophagus without diffuse involvement of the distal oesophagus and independent of gastric hyperacidity.

When discrete ulceration is present in the terminal part of oesophagus in association with a hiatus hernia, a Barett type of epithelium must be suspected, since ulceration may occur at distal margin of the gastric-lined segment, and terminal part of oesophagus may be lined by a mixture of squamous and Barett type of epithelium for a short distance immediately proximal to the (true) stomach.

19 radiographs, 2 figures.

S. N. Deboo, Bombay.

K. T. Evans. Peptic ulceration associated with prednisolone Therapy. *Br. Jour. Radiol.* June 1958, Vol. 31, Pages 307-312.

Peptic ulceration has been shown to occur during prednisolone therapy. An investigation was carried out to determine the presence of peptic ulceration in patients receiving prednisolone therapy. Barium meal investigations were carried out on 23 patients who were being treated with it for various medical conditions. Some patients had dyspepsia or gave a history of bleeding, but majority were symptomless at the time of the examination. Single examinations were done on those without symptoms, where as repeated examinations were carried out on those having peptic ulcers, to assess progress. 3 cases are described with representative histories.

Of the 23 patients investigated, six have been shown to have peptic ulceration. The ulcers demonstrated have all been in the prepyloric region or in the duodenal cap, on the whole have been large, and quite unlike the type usually seen. Generally the symptoms have been mild and not in keeping with the appearances radiologically.

There has been considerable variation in the reported incidence of peptic ulceration in patients with rheumatoid arthritis treated with cortisone or cortico-trophin. This can be explained partly by the fact that the ulcers may be quite symptomless or the symptoms may be so mild as to be dismissed. The first indication of the appearance of an ulcer may be sudden spontaneous haematemesis or perforation.

Thirteen out of the 23 patients receiving prednisolone therapy had rheumatoid arthritis. Of these 13 patients five had peptic ulceration. These findings suggest that patients with rheumatoid arthritis treated

with prednisolone therapy have a high incidence of peptic ulceration. The author summarises that although the present series investigated is small, the incidence of ulceration would be found to be higher, if all cases receiving prednisolone therapy were radiographed.

8 radiographs.

S. N. Deboo, Bombay.

J. V. Sparks. Some post-operative findings in hiatus hernia. *Fac. Jour. Radiologists.* April 1958, Vol. 9, 84-89.

In this article, the author gives the post-operative results of 389 cases of hiatus hernias, of these there were 333 cases of type I hernia (Harrington's classification 1940) and 56 cases of type II hernia. In only ten of these there was a gastric or duodenal ulcer demonstrated. The majority of cases were treated by means of hiatal repair through a left thoracotomy. Where stricture was present, an oesophago-gastrectomy has often been necessary.

The preoperative complications were (1) oesophagitis and stricture (2) gastric or duodenal ulcer (3) neoplasm (4) aspiration pneumonitis (5) other diseases. The post-operative complications were (1) post-operative wind and dysphagia (2) leakage from the suture line (3) lung changes (4) recurrences through the hiatus—there were 38 recurrences through the hiatus, 5 recurrences through the dome, (5) incomplete reduction—as a result of shortening of the oesophagus or of the abnormal size of the hiatal opening, (6) a recurrence has been found in cases where an oesophago-gastrectomy has been performed in children. Six cases were found subsequently to have developed a herniated knuckle of colon lateral to the stomach.

(7) pain in the wound due to severance of intercostal nerves (8) occasionally pylorospasm relieved by belladonna.

Following repair in 312 cases, there were 6 deaths. Oesophago-gastrectomy was performed in 72 cases mainly complicated by stricture formation with 13 deaths. In 6 cases, all under 15 years of age, the colon herniated through the left dome some months after the resection.

14 radiographs, 4 tables.

S. N. Deboo, Bombay.

Charles H. Brown and William C. Strittmatter. Obstructive lesions of the duodenum distal to the Bulb. *Radiology*, May 1958, 70, 720-728.

Because of the proximity to many vital structures, the duodenum is subject to multiple lesions, both intrinsic and extrinsic, which may be grouped into 3 major categories (1) congenital (2) extrinsic and (3) Intrinsic. The congenital ones are (a) Occlusion by superior mesenteric artery (b) obstruction at ligament of Treitz (c) Jejunal volvulus (d) congenital band (e) Malrotation of small intestine (f) annular pancreas. The extrinsic ones are (a) abdominal aneurysm (b) pancreatic lesions benign and malignant (c) enlarged mesenteric nodes (d) retroperitoneal tumours. Intrinsic ones are (a) ulcers—duodenal and duodenitis (b) neoplasm benign and malignant.

The symptoms are those of obstruction, and thorough roentgen examination of the area is the only method of making a pre-operative diagnosis. Obstruction of the 2nd part of duodenum resembles pyloric obstruction, except that with the former there is a large dilated bulb proximal to the site of the block. Most lesions occurring in this area cause only partial or intermittent obstruction. The fourth part of the duodenum at the

ligament of Treitz is the most fixed portion of the gastrointestinal tract, and pressure from any cause at this location may result in obstruction.

In some cases, especially those in which the lesion occurs in the region of the ampulla of Vater, it is impossible to distinguish intrinsic from extrinsic disease. A large duodenal bulb may be the only roentgen sign of an obstructing lesion distally. Frequently the exact cause of the obstruction can be determined only at operation.

In addition to above 3 groups namely congenital, extrinsic and intrinsic, there is a fourth group of unknown factors such as Lupus erythematosus. The cause of the dilatation of the duodenum in these patients is not known, since no obstructing lesion has been found. Collagen deposits in the submucosa, vascular changes associated with lupus erythematosus or a localised neurogenic phenomenon, seem most likely causes of the dilatation and ileus.

Resection of the duodenum is rarely considered for benign lesions, and may not always be possible for malignant lesions. In the treatment of benign and malignant disease for which only a palliative procedure is possible, a duodeno-jejunostomy is preferable to a gastro-enterostomy.

14 radiographs.

S. N. Deboo, Bombay.

M. G. Desai. Varying radiological appearances in the terminal ileum associated with Crohn's disease. *Fac. Jour. Radiologists*, April 1958, Vol. 9, Page 99-105.

A brief review of the literature of Crohn's disease is given, and pathology is discussed. The disease can be divided into 3 stages, the acute, sub-acute and the chronic, but

segments at different stages of activity may coexist. It is not confined to the ileo-caecal region, the jejunum or the colon may be affected, and a disease of similar appearances had been described in the oesophagus, stomach and rectum.

The varying radiological appearances in Crohn's disease in thirteen patients are given (nine females and 4 males, whose ages ranged from 16-40). All cases were proved by operation and histology. In this review, the following radiological appearances were encountered.

(1) Narrowing of the ileum—this was seen in 9 cases, and is one of the best radiological signs. Many authors are of the opinion that narrowing of the bowel may disappear in the acute phase, but that it persists when the disease is of long standing.

(2) Dilatation of the terminal ileum, although involved by Crohn's disease—this was seen in 2 cases.

(3) Ulcer crater in the terminal ileum—this was seen in one case.

(4) Small rounded translucent areas in the terminal ileum due to polypoid changes in the mucosa of the terminal ileum, and associated with ulceration—this was seen in one case.

(5) A 'skip segment' in the terminal ileum—this was seen in one case.

(6) Normal appearance of terminal ileum although involved by Crohn's disease—this was seen in one case.

(7) A deformity of the caecum—this was seen in nine cases. This is an important and occasionally the only, radiological sign. Recurrence of the disease is about twenty per cent, the most frequent site being proximal to the anastomosis, this may be due to undiagnosed 'skip lesions or recurrent

foci. 2 different appearances were encountered in the ileum proximal to anastomoses (ileocolostomy). (1) narrowing of ileum proximal to anastomosis (2) loss of mucosal pattern and ill defined outline of ileum proximal to anastomoses.

The filling of terminal ileum should first be attempted by barium enema, sometimes filling is seen after evacuation. When unsuccessful, a barium meal study be undertaken, the safest procedure is to use both methods.

9 radiographs.

S. N. Deboo, Bombay.

Felix, G. Fleischner and Paul Mandelstam. Roentgen observations of the ileostomy in ulcerative Colitis. Radiology. April 1958, 70, 469-480.

The complications of ileostomy including skin excoriations, fistulas, prolapse, retraction, and the syndrome of obstruction with prestomal ileitis and fluid and electrolyte imbalance is termed ileostomy dysfunction. This ileostomy dysfunction constitutes an ever present threat to patients with an ileac stoma. In this paper, the etiology of ileostomy dysfunction and measures for its prevention are discussed. The histories of 5 patients with severe ileostomy dysfunction are presented.

In a well functioning stoma, the transit through the small intestine occurs in normal time, the prestomal loop is normal in width, and Kerkrings's folds extend down or almost to the stoma.

In a patient with ileostomy dysfunction, the radiological signs of incomplete, or more rarely, complete intestinal obstruction are often present on plain roentgenograms in supine and erect positions. If barium is given by the mouth and through the ileostomy

stoma, the transit through the small intestines is grossly delayed, the prestomal ileum is markedly widened, the diameter ranging from 4 to 10 cms. There is either absence of Kerkring's folds, or if present at all, they are shorter, more widely spaced than normal. In no case did they reach the stoma. In none of the patients with ileostomy dysfunction, were formed faeces encountered in the prestomal ileum. Borderline conditions may occur, where the prestomal loop is intermediate between the normal narrow loop with regular pattern and the grossly dilated loop with complete effacement of all folds and retention of large liquid masses.

The question arises as to whether the severe inflammatory changes observed in the prestomal ileum represent aggravation of residual disease or a new non-specific ileitis. In the great majority of cases, however the abnormalities in the prestomal ileum are not due to preexisting disease, but are non-specific in nature, apparently the result of prestenotic stagnation, and are part of the syndrome of ileostomy dysfunction. It is noteworthy that ileostomy dysfunction may occur at any time in the life of these patients, no matter how many asymptomatic years have elapsed since the last episode of difficulty.

In the clinical management, both medicine and surgery play important roles, and it is often difficult to determine initially whether non-operative management will prove satisfactory.

S. N. Deboo, Bombay.

B. Strickland. Skeletal manifestations of Gaucher's disease with some unusual findings. Br. Jour. Radiol. May 1958, Vol. 31, 246-253.

The author reviews the literature of Gaucher's disease and reference is made to unusual findings. Four adult cases of Gaucher's disease are described.

Clinically there is an enlarged spleen, hepatomegaly, enlarged lymph glands, pingueculae in the eyes, a typical skin pigmentation on the exposed parts of the body, hemorrhagic episodes with epistaxis or bleeding from the gums, anemia. Rarely spontaneous fractures may follow minor trauma or a unilateral limp may develop as a result of aseptic necrosis of the femoral head.

There are 3 forms, the early juvenile or adolescent form in which there are usually no radiological evidence of bone changes. With the progression of the juvenile form, osteolytic lesions become evident. Finally osteosclerotic changes become added, giving the fully developed complex pattern.

The most common radiological finding is widening of the lower ends of the femora, the so-called Erlenmeyer flask, hock-bottle or club deformity. This is a fusiform swelling on the medial aspects of the femora above the epicondyles. It is bilateral and symmetrical. The medulla may be widened with cyst-like spaces and irregular areas of rarefaction, possibly associated with patches of osteosclerosis. Any bone in the body may be involved. There is a generalised osteoporosis, destruction of the spongiosa with formation of worm eaten defects widening of the long bones, and compression of the diseased bones especially the head of the femur. Involvement of the vertebral body may lead to collapse and gibbus deformity. The skull may show a punctate porosis in the vault. Pathological fractures may occur especially in the weight bearing bones such as femur and tibia, but also in other bones. Aseptic necrosis of the femoral head and neck is a well recognised complication.

In children skeletal changes are usually absent, and in general it seems that the disease must be present for many years before changes in bones become apparent on

x-ray films. In young children, therefore, radiography of the skeleton will usually not be helpful in the diagnosis of Gaucher's disease.

2 of his cases showed the presence of a periosteal reaction, a finding hitherto regarded as exceptional. One case showed an unusual foam-like bone pattern of peculiar uniformity.

8 radiographs.

S. N. Deboo, Bombay.

A. G. M. Davies. The bone changes of Madura Foot. Observations in Uganda Africans. Radiology. June 1958, Vol. 70, 841-847.

The radiological picture in 21 patients with Madura foot is described in this article, and reports of 2 rarer manifestations of disease are cited.

The clinical course is classified by Abbott according to the colour of the grains into yellow, black and red mycetomas.

The radiological picture was characteristic even when the clinical picture was atypical. In these cases, some swelling of the deep tissues of the foot was a constant feature, and in some, surface nodules could be seen. The area most heavily infected was usually in the 2nd row of tarsals and in the bases of the adjoining metatarsals. The bones showed both destructive and productive changes. There was an erosion of the cortex from without of the affected bones, and the formation of crypts representing the mouths of sinuses. There is almost always a periosteal reaction and this characteristically is ragged. It usually takes the form of spicules of bone projecting perpendicularly to the line of the cortex. The "onion peel" type of periosteal reaction is rare. The spongiosa of the affected

bones is almost invariably denser than normal. Within the sclerosed spongiosa and sometimes extending through to the cortex, multiple sinuses are often seen, as round or irregular translucent areas from 3 to 10 mms across. In places these sinuses have joined up and the bone seems to be disintegrating. The bones distal to those primarily involved, are commonly osteoporotic. As the disease progresses, the bones shrink in size, and the gaps between them increase. Sequestra are usually not seen.

Three stages of Madura foot can be recognised radiologically in Uganda, first the stage of early invasion with formation of swellings and sinuses in soft tissues, second, the attack on the cortex from outside, and third a break-through with rapid spread of disease throughout the whole bone.

5 radiographs, one figure.

S. N. Deboo, Bombay.

George W. Henry, Ivar J. Larsen, and Steele F. Stewart. The roentgenologic criteria for appraising the human back as an asset or liability. Am. Jour. Roentgenol. April 1958, 79, 658-672.

Backs have been graded by the writers as (1) Good risk, where there are no demonstrable defects (2) fair risk, where defects are present but are such as to permit labour, but not for continued heavy low back work. (3) poor risk where defects are present rendering inadvisable lifting or heavy labour.

Anatomically functional units are the base, fulcrum and levers. Base is the pelvic ring. Sacral spina bifida may be considered a basal defect. The most insignificant fulcral defect is (1) lack of development or lack of fusion of the tip of an articular facet. (2) Assymetric facet—when this exists, there are zygapophyseal degenerative changes, thin

discs and vertebral body spurs. Appreciable or 90 degree assymetry is deemed a fair risk. If accompanied by even minor body spurs, the risk is considered poor. (3) Spondylolysis and spondylolisthesis, in the fulcrum of the last 3 lumbar vertebrae. This places the individual in a poor risk group. The levers consist of vertebral body, disc and pedicle—called weight-bearing arm, and the laminae and spinous processes, transverse processes and the rib cage in dorsal region—called motor or force arms.

One of the commonest pathological changes is a difference in vertebral height, usually at one margin of projection more than another, producing a wedge, resulting in fatigue, decreased efficiency and even pain. Common causes are fractures, followed by destructive disease and congenital anomalies. Complete healing of the old fracture is considered of minimal significance. Wedging in upper lumbar spine with an associated kyphosis or scoliosis would place the case in a poor risk group. A degenerated disc in an elderly working male is fairly common, not associated with low back pain. In young persons however, such change predisposes him to hernia of nucleus pulposus. Narrowing of discs plus spurs carry serious significance in young persons. Small Schmorl's nodes are considered to be of little importance, but if they are present throughout several areas of fairly extensive degree, the risk is presumed to be fair.

Failure of fusion of spinous process results in spina bifida occulta. A small defect is a

normal variation. A long defect involving the upper half of sacrum and or the L 4 and L 5 or more has seemed to be significant. Such an anomaly places the person in the fair risk category. Associated assymetry of facets or spur formation would change this to a poor risk group. Occasionally an anomalous overdevelopment of spinous processes which gives a "clasp knife deformity", is seen, this places the person in a poor risk group.

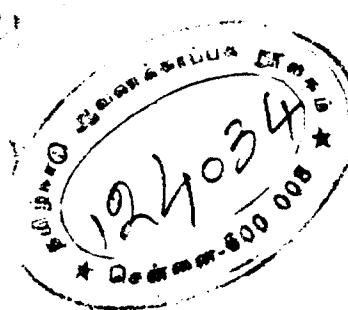
Presence of one or 2 articulations between transverse processes of the lowest lumbar vertebrae and the sacral alae is seen, evidencing a dysgenic back. Finding of unilateral or bilateral articulations is cause for classification as a poor risk. If one or both sides are solidly fused, the anomaly is considered to be without significance.

Where there is scoliosis, with rotation, wedging or spurring of vertebral bodies, these have been rated as a poor risk. Minimal or mild scoliosis without wear and tear phenomena calls for a fair risk classification.

Spinal surgery, evidence of previous myelography as manifested by opaque oil, generalised demineralisation, Tuberculosis or osteomyelitis, Marie-Strumpell spondylitis carry poor risk classification.

It is to be reiterated that the critical area of concern lies at the L4-L5 and lumbosacral level.

S. N. Deboo, Bombay.



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