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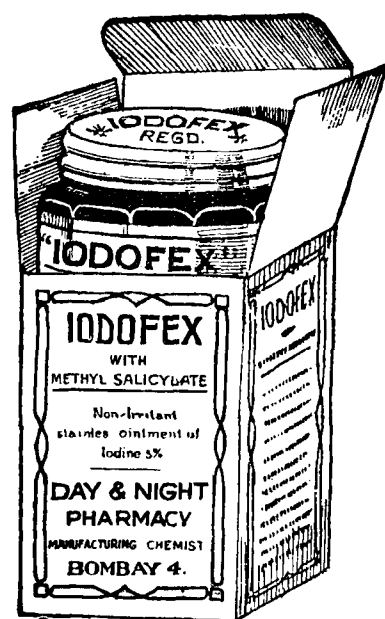
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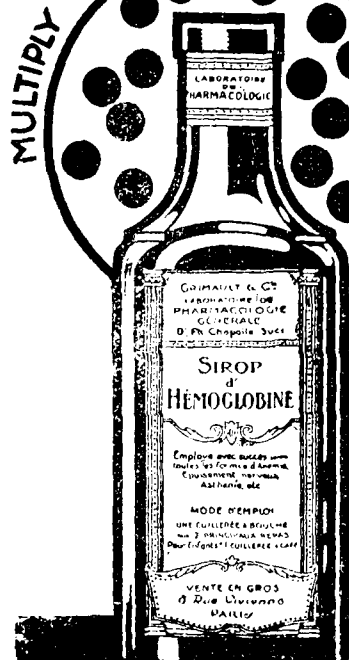
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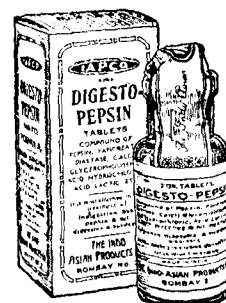
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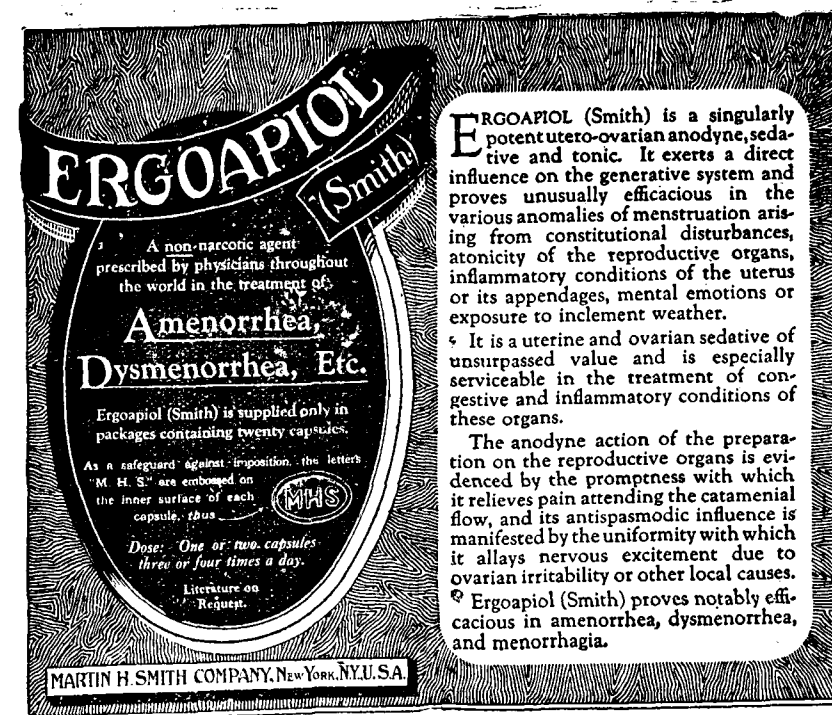
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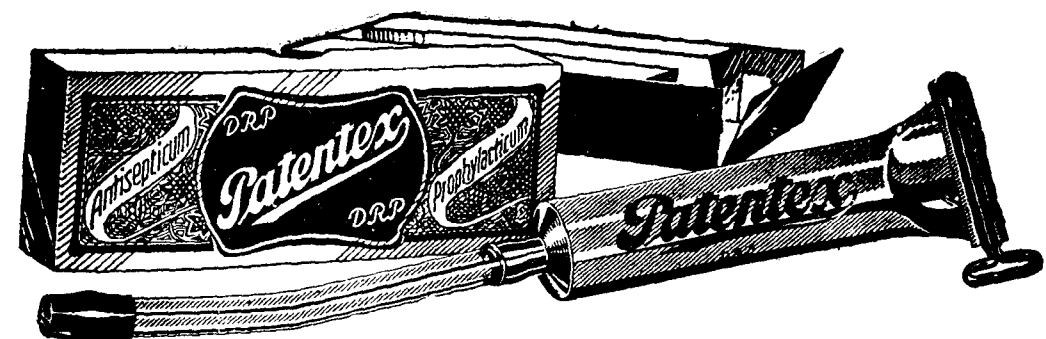
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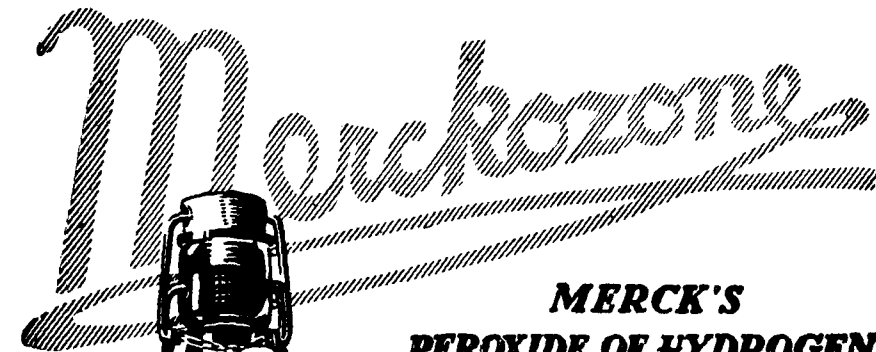
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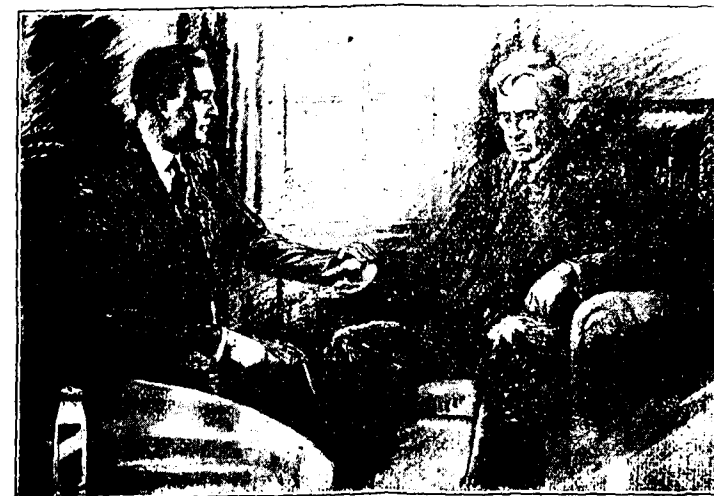
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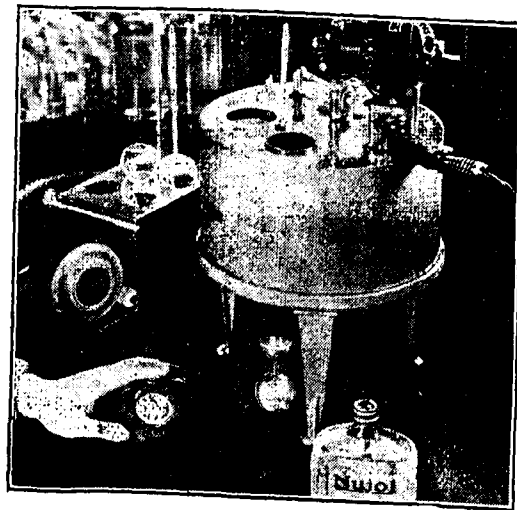
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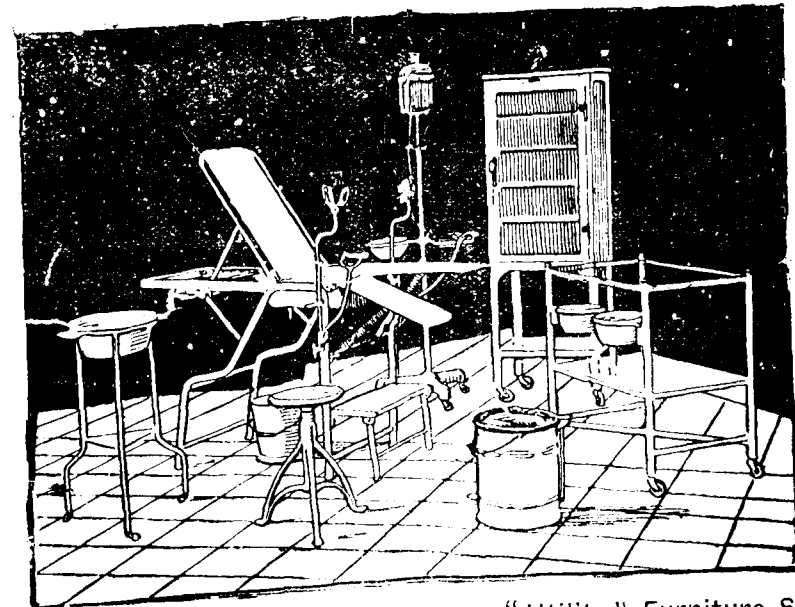
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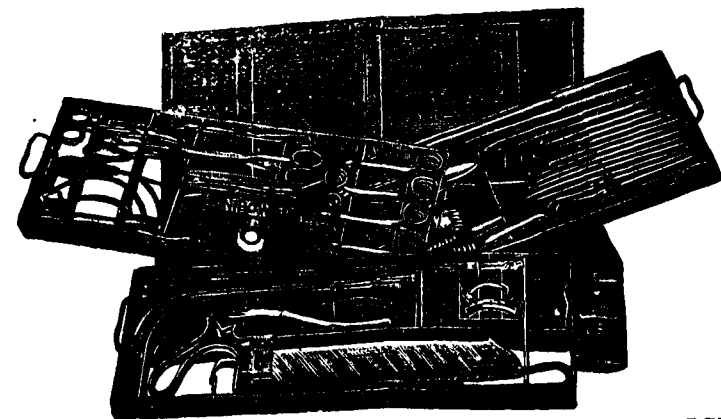
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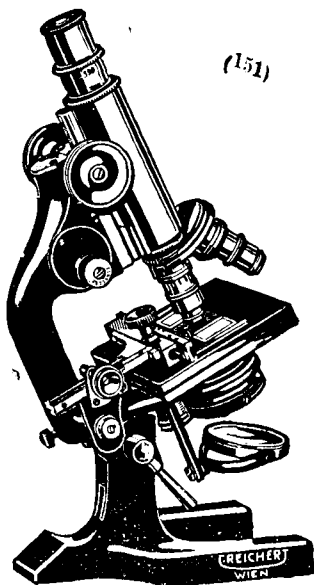
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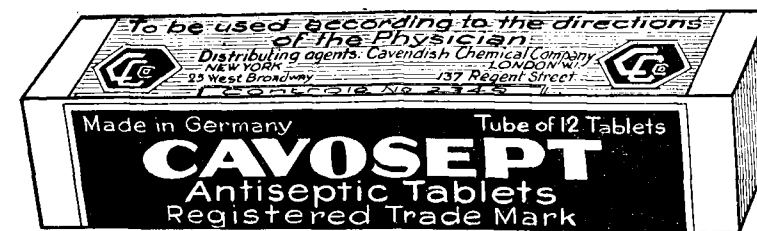
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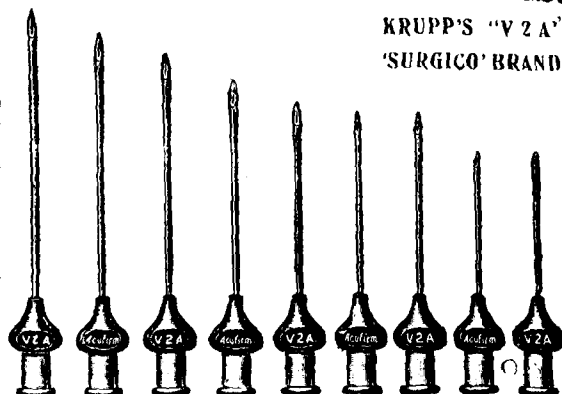
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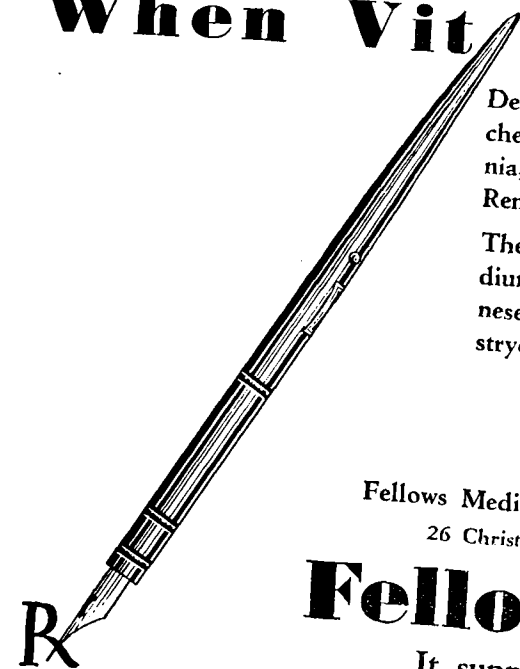
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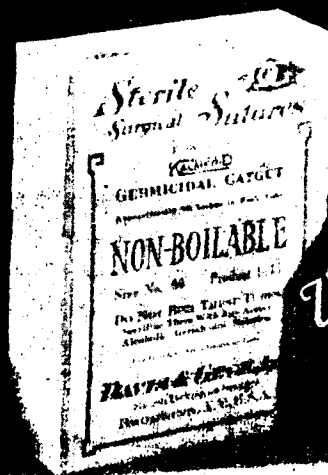
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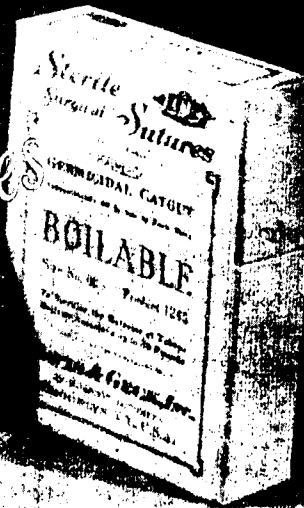
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Original articles

THE PRESENT POSITION OF RADIOLOGY AS REGARDS DIAGNOSIS AND THERAPY.

BY

DR. M. D. JOSHI, M.B.B.S., (Bomb.) D.M.R.E. (Camb.)

Radiologist to Wadia Maternity Hospital and Lecturer in Radiology, N. M. College, Bombay.

IT has now been proved beyond all doubt that Radiology is one of the most essential and important additions to our armamentarium of diagnosing and treating various Pathological conditions. Like all new discoveries and inventions, it has passed through the stages of ridicule, opposition, and suspicion, and its value and importance as a diagnostic and therapeutic agent is now fully recognised throughout the civilised world. As every new aid to diagnosis and therapy adds considerably to our power of fighting diseases, it is essential for all those who belong to the Medical profession to know what possibly can be achieved by Radiology to relieve the suffering humanity in order that they may be able to advise and guide properly those that seek their help and advice. It is the general practitioner who is the first one that is approached for such help and advice, and unless he has some idea as to how far the recently discovered methods are able to help his patients in various intractable

diseases, he is not in a position to guide his patients properly. It is with a view to supply such information for the general practitioners in India, that this article is written. Though most of the Universities in India have included a course of lectures on Radiology in their curriculum and though the majority of hospitals in India are equipped with X-ray apparatuses, the general practitioners especially in the mufussils, have a very faint idea if at all, about the possibilities of Radiology, and it is for their benefit that I would like to point out in brief the diseases where Radiology is especially useful.

The general practitioner is sometimes scared away by certain objections that are raised against Radiology. One of these objections is that Clinical Diagnosis is far superior to X-rays because it has been found in certain cases that the clinical diagnosis turned out to be true and X-ray diagnosis was disproved. But as we shall point out later on, Radiology is a science of interpretation of shadowgrams produced by X-rays, and if in any particular case the X-ray diagnosis was found to be mistaken, it must be remembered that the fault lies not in the science of Radiology, but it is the mistake in interpreting the shadowgram that is responsible for such errors. Such mistakes should not lead one to condemn the whole science of Radiology, but they should serve as a guide to the Radiologist to correct his methods of interpretation and to improve his technique. It is the duty of the Radiologist to see before giving his diagnosis that the conclusion he arrives at can explain most of the signs and symptoms of the case or at least that it is not directly antagonistic to the clinical data, in the particular case. Similar mistakes are sometimes found to occur with the use of the stethoscope or the microscope, but we never condemn these aids on that account and it is but reasonable that the whole science of Radiology should not be condemned because of a few rare mistaken interpretations.

The second objection that we often hear from old practitioners is that Radiology is depriving the young practitioner of his clinical acumen in diagnosis. They complain that no sooner the young practitioners come across a difficult case they at once refer it to the Radiologist without trying to diagnose it clinically themselves and then getting their conclusions verified by Radiology. It is argued that a mechanical agent like X-rays is slowly pushing into background the cultivation of keen observation power and education of senses that is essential for correct clinical diagnosis. But this is a fallacious argument. It is unreasonable to discard an efficient diagnostic agent like Radiology only because some practitioners do not try to exercise their faculty of observation and thinking. The same objection may be raised against the stethoscope, the thermometer, the microscope, and even the pathological laboratory because they are also more or less mechanical aids, and we rely on their accuracy.

But in all these instances the fault lies not with the science itself, but with those who fail to exercise their powers of observation and thinking. Radiology does not in the least come in the way of those who want to cultivate keen clinical acumen. On the contrary we believe that by enabling us to diagnose certain pathological conditions more accurately Radiology will also be immensely helpful in gaining a greater accuracy in clinical diagnosis also if properly utilised. Just as post mortem examination has added considerably to our accuracy in clinical diagnosis by visualising the actual internal conditions, so will Radiology be useful to us by visualising the different structures in the living body while they are actually functioning. Many new diseases, such as Perthes disease, Osgood Schlatters disease, Sacrolisation of the 5th Lumber Vertebra, and Diverticulitis, Calcinosis, Intervertebrales, Kummell's Disease and Kohlers Disease have been brought to light by Radiology, and a careful examination of the clinical signs and symptoms present in these diseases may hereafter enable us to diagnose them clinically also. But for Radiology this would not have been possible. So if properly utilised and interpreted Radiology is useful in arriving at an accurate diagnosis and also in improving our methods of clinical diagnosis by enabling us to correlate more accurately the clinical data with the pathological changes inside. Radiology saves us from many possible mistakes, solves many a difficult clinical problem, helps to direct the treatment to the proper cause, and saves the patient from laparotomy operations. It is always wiser to reform ourselves than to blame a useful diagnostic agent like Radiology, which adds so considerably to our accuracy.

RADIOLOGY AS A DIAGNOSTIC AGENT

Radiology is the science and art of interpretation of the shadowgrams, produced on the film by exposure to X-rays that have passed through the different parts of the human body. The human body as we know is made up of structures which differ widely in their density, and as denser structures obstruct the passage of X-rays, they are seen as white shadows on the film, and black on prints and on fluorescent screen.

Preparation of the patient:--Metals being opaque to X-rays, all metallic and opaque objects such as keys, coins, buttons etc. should be removed from the part to be X-rayed. Ladies should be asked not to wear ornaments and advised to wear saris and clothes without metallic embroidery when going for an X-ray examination. This saves lot of trouble and unnecessary exposure of parts. When an X-ray Photo of the abdomen is to be taken either for renal calculus or alimentary system, the patient should be given a laxative previous night or an enema in the morning and sent to the

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Radiologist on empty stomach. The patient should not take any metallic drugs on the day of the X-ray examination and any metallic ointments applied to the part to be X-rayed should be removed before taking the Skiagram.

Interpretation of Skiagrams. The greatest skill of the Radiologist lies in the interpretation of skiagrams. X-rays shows any change in the density and size of the internal organs, and also helps to investigate the movements of diaphragms, lungs, heart and the alimentary system. The chief task of the Radiologist is to be able to correlate the clinical signs and symptoms with the pathological changes that are revealed by a careful reading of the skiagram, and therefore no conclusions that are directly antagonistic to the clinical data should be accepted.

LOCALISATION OF FOREIGN BODIES.

Metallic objects like coins, keys, etc. swallowed by the patient, pins, needles and other sharp objects that may have accidentally broken or bullets and buck-shot in any part of the body can be localised by X-rays accurately by a preliminary examination under the screen and X-ray photos in different positions. Even the depth of the foreign body from the surface can be estimated by stereoscopic skiagrams and by the method of trianulation.

DISEASES OF BONES.

Bones, being the densest structures in the body are very well shown in skiagrams. In good skiagrams we must make out the cortex and the medulla and also the trabeculae in the cancellous ends of long bones. Soft pictures, taken with low voltages, which show the outline of the soft structures around are useful in determining the displacement or affection of bone in relation to the surrounding soft parts.

The following points should be carefully noted on film for bone diagnosis :—

- (1) The place where the infection starts, i. e., whether under Periosteum, or in Cortex, or in Medullary Canal.
- (2) The character of the destructive process.
- (3) The path of extension that is spreading in all directions or following the path of least resistance.
- (4) The character and situation of the new bone production.
- (5) The condition of the Cortex whether it is intact, destroyed as a whole or pierced by sinuses expanded or unexpanded.
- (6) The type of periosteal reaction whether it is parallel or perpendicular to the shaft.

(Beatjer & Waters.)

A proper knowledge of the sequence, extent and nature of these changes in various pathological conditions is the real key to Radiological diagnosis of diseases of bones.

Cartilage is not opaque to X-rays and therefore the epiphyseal cartilage, the joint-cartilage, the intervertebral cartilage, and the unossified portions of growing ends of long bones, are represented by blank dark spaces on the X-ray film. Upto the age of 25, the visualisation of the epiphyseal centres and their union with the shaft, serves as a very useful guide in finding out the age of the subject X-rayed. Diminution of the joint-space and intervertebral space shows destruction of the joint-cartilage or intervertebral cartilage.

*Fractures :—*For fractures it is always advisable to take photos in two positions. A negative diagnosis of fracture should never be given from screen examination alone. X-ray is especially valuable in diagnosing fractures of the vault and base of the skull, fractures of vertebrae, fractures of ribs and pelvic bones and in cases where the parts are swollen and tender and the bones inside cannot be palpated. It is found that the diagnosis of fractures of the carpal and tarsal bones remained undiagnosed in many cases before the use of X-rays. In diagnosing fissured fractures of the vault of the skull, care should be taken that the sutures and the grooves for the meningeal arteries should not be mistaken for fractures. Spina bifida or non-union of the vertebral spinous processes should not be mistaken for fractures. Transparent areas of lung-tissue and shadows of bronchioles, sometimes produce appearances resembling fracture of ribs, but the diagnosis should be made carefully after comparing the two sides and verifying the point of tenderness. In diagnosing fractures of long bones care must be taken that epiphyseal lines and ununited epiphyseal centres are not mistaken for fractures. A skiagram taken after the fracture is set is very useful in finding out whether the fractured segments are in good apposition, the formation of callus, and if the fragments are not in good position it helps the surgeon to re-set the fragments in such a way as to minimise deformity, shortening and subsequent impairment of movements.

*Inflammatory affections of bone :—*Inflammatory affections of bones are characterised by the fact, that infection travels along the line of least resistance, there is no sharp demarcation line between the affected and normal portions of bone, and by the presence of periosteal reaction as evidenced by deposition of calcium and new bone-formation under the periosteum. Where the causal infective agent is so virulent that there is no time available for the bone-tissue to re-act, we see marked rarefaction and destruction of bone, whereas when the process is subacute or chronic periosteal reaction and

sclerosis of bone are seen. In inflammatory affections such as osteomyelitis, osteitis or periostitis, X-ray is particularly useful in detecting the presence of and locating sequestra. Tubercular affections of bone usually start from joints and are evidenced by marked rarefaction of the adjacent bones also. Syphilitic periostitis is usually characterised by "lace-work type" of periostitis and marked sclerosis of bone.

Tumours of bone:—These are characterised by the fact that there is a sharp demarcation line between the affected and normal portions of bone, by the lesion being localised, and by the absence of periosteal reaction. The tumours usually diagnosed by X-rays are exostosis, eccondroma and enchondroma, osteoma, myeloma and myeloid sarcoma, periosteal sarcoma and secondary carcinoma. Enchondroma is distinguished from T. B. dactylitis by the absence of periosteal reaction. Myeloid sarcoma is characterised by expansion of cortex, and trabeculation seen in the tumour. Periosteal sarcoma is evidenced by deposition of bone at right angles to the shaft. Dermoid cysts, odontoid cysts, and tumours in connection with the jaw, maxillae, and orbits can also be definitely diagnosed.

Tumours of the pituitary body are evidenced by destruction of the sella turcica. Gliomata of brain are often evidenced by areas of rarefaction in the skull bones due to pressure. Tumours of the spinal cord can be diagnosed by injecting iodipin or lipidol through cisterna magna, and noting how far it comes down in the spinal column.

Localised destruction of bone may be due to gummata, tumour, or pressure atrophy and the diagnosis in such cases is arrived at by noting the presence or absence of periosteal reaction and by a careful consideration of the clinical data.

Osteo-malacia is characterised by absorption of calcium from bones, giving a striated appearance and the deformed shape of the pelvis. Fibrocystic disease is evidenced by rarefaction, cystic appearance and bending of bones. Paget's disease or osteitis deformans is marked by simultaneous rarefaction and proliferation in the same bone which presents a "wooly appearance" and the head looks like calcified curly hairs of a negro in the ski-agram. Acromegaly is diagnosed by the prominent frontal bosses, protrusion of jaw, long extremities, and clubbed phalanges. In Achondroplasia there is early union of the epiphysis with the diaphysis, so that the length of the long bones of the extremities suffers while the thickness remains normal. In Cretinism and Dwarfism all the dimensions of all the bones are proportionately smaller than nor-

mal and Cretinism is differentiated from Dwarfism by the presence of mental deficiency.

Joint affections in childhood:—Rickets is characterised by saucer-shaped expansion of the epiphysis and absorption of calcium from and bending of long bones. Scurvy can be diagnosed by the elevation of periosteum seen due to subperiosteal hæmorrhage. Congenital syphilis is diagnosed by periostitis which it produces. Tubercular affections of joints are characterised by diminution of the joint-space due to destruction of the articular cartilage, worm-eaten appearance of the articular ends of bones, and marked rarefaction of the affected and also neighbouring bones.

Diseases of joints:—X-ray records (1) displacement of articular surfaces (2) any change in the density of bones (3) destruction of the articular cartilage as evidenced by diminution of joint-space (4) presence of osteo-phytic growths (5) presence of fluid effusion as shown by wider separation of the articular surfaces (6) bony ankylosis. A careful consideration of these points helps to diagnose radiologically septic arthritis, osteo-arthritis, syphilitic arthritis and tubercular arthritis. Atrophic arthritis is evidenced by marked atrophy of adjacent bones. Gouty arthritis is diagnosed by rounded punched out depressions in the articular surfaces of bones without destruction of articular cartilage. Charcot's disease of joints is marked by marked destruction of joints and pathological fractures of bones without there being any rarefaction or pain.

Diseases of the Spine:—Spina bifida and other developmental anomalies are easily seen. Kyphosis and Scoliosis are also easily diagnosed. Tubercular disease of the vertebrae is evidenced by diminution of the intervertebral space due to destruction of intra-vertebral cartilage absorption of Calcium, and destruction of the body of the vertebrae. The presence of a paravertebral abscess can be diagnosed by the presence of a fusiform shadow around the vertebrae and the progress of the case and healing of the lesion is marked by the amount of calcification present, at the site of the lesion. Osteo-arthritis of the Spine (Spondylitis deformans) often gives rise to peculiar referred pain and is easily diagnosed even in early stages by the presence of osteo-phytic growths seen on the film. Calcinosis intervertebralis is evidenced by calcification of the intervertebral cartilages. The expansions of the Transverse Processes of the 5th Lumber vertebra and their union with the sacrum (Sacrolisation of 5th Lumber vertebrae) often produces symptoms closely resembling those of sciatica and the diagnosis of this disease became possible only after the use of X-rays. Cervical rib and abnormally large transverse processes of the 7th Cervical Vertebrae often produce symptoms of

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Osteo-malacia is characterised by absorption of calcium from bones, giving a striated appearance and the deformed shape of the pelvis. Fibrocystic disease is evidenced by rarefaction, cystic appearance and bending of bones. Paget's disease or osteitis deformans is marked by simultaneous rarefaction and proliferation in the same bone which presents a "wooly appearance" and the head looks like calcified curly hairs of a negro in the skiagram. Acromegaly is diagnosed by the prominent frontal bosses, protrusion of jaw, long extremities, and clubbed phalanges. In Achondroplasia there is early union of the epiphysis with the diaphysis, so that the length of the long bones of the extremities suffers while the thickness remains normal. In Cretinism and Dwarfism all the dimensions of all the bones are proportionately smaller than nor-

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Joint affections in childhood:—Rickets is characterised by saucer-shaped expansion of the epiphysis and absorption of calcium from and bending of long bones. Scurvy can be diagnosed by the elevation of periosteum seen due to subperiosteal hæmorrhage. Congenital syphilis is diagnosed by periostitis which it produces. Tubercular affections of joints are characterised by diminution of the joint-space due to destruction of the articular cartilage, worm-eaten appearance of the articular ends of bones, and marked rarefaction of the affected and also neighbouring bones.

Diseases of joints:—X-ray records (1) displacement of articular surfaces (2) any change in the density of bones (3) destruction of the articular cartilage as evidenced by diminution of joint-space (4) presence of osteo-phytic growths (5) presence of fluid effusion as shown by wider separation of the articular surfaces (6) bony ankylosis. A careful consideration of these points helps to diagnose radiologically septic arthritis, osteo-arthritis, syphilitic arthritis and tubercular arthritis. Atrophic arthritis is evidenced by marked atrophy of adjacent bones. Gouty arthritis is diagnosed by rounded punched out depressions in the articular surfaces of bones without destruction of articular cartilage. Charcot's disease of joints is marked by marked destruction of joints and pathological fractures of bones without there being any rarefaction or pain.

Diseases of the Spine:—Spina bifida and other developmental anomalies are easily seen. Kyphosis and Scoliosis are also easily diagnosed. Tubercular disease of the vertebrae is evidenced by diminution of the intervertebral space due to destruction of intra-vertebral cartilage absorption of Calcium, and destruction of the body of the vertebrae. The presence of a paravertebral abscess can be diagnosed by the presence of a fusiform shadow around the vertebrae and the progress of the case and healing of the lesion is marked by the amount of calcification present, at the site of the lesion. Osteo-arthritis of the Spine (Spondylitis deformans) often gives rise to peculiar referred pain and is easily diagnosed even in early stages by the presence of osteo-phytic growths seen on the film. Calcinosis intervertebralis is evidenced by calcification of the intervertebral cartilages. The expansions of the Transverse Processes of the 5th Lumber vertebra and their union with the sacrum (Sacrolisation of 5th Lumber vertebrae) often produces symptoms closely resembling those of sciatica and the diagnosis of this disease became possible only after the use of X-rays. Cervical rib and abnormally large transverse processes of the 7th Cervical Vertebrae often produce symptoms of

brachial neuritis by pressure on the brachial plexus and the diagnosis of this condition is made accurately with X-rays. Abnormal lumber ribs are also similarly easily diagnosed by X-rays.

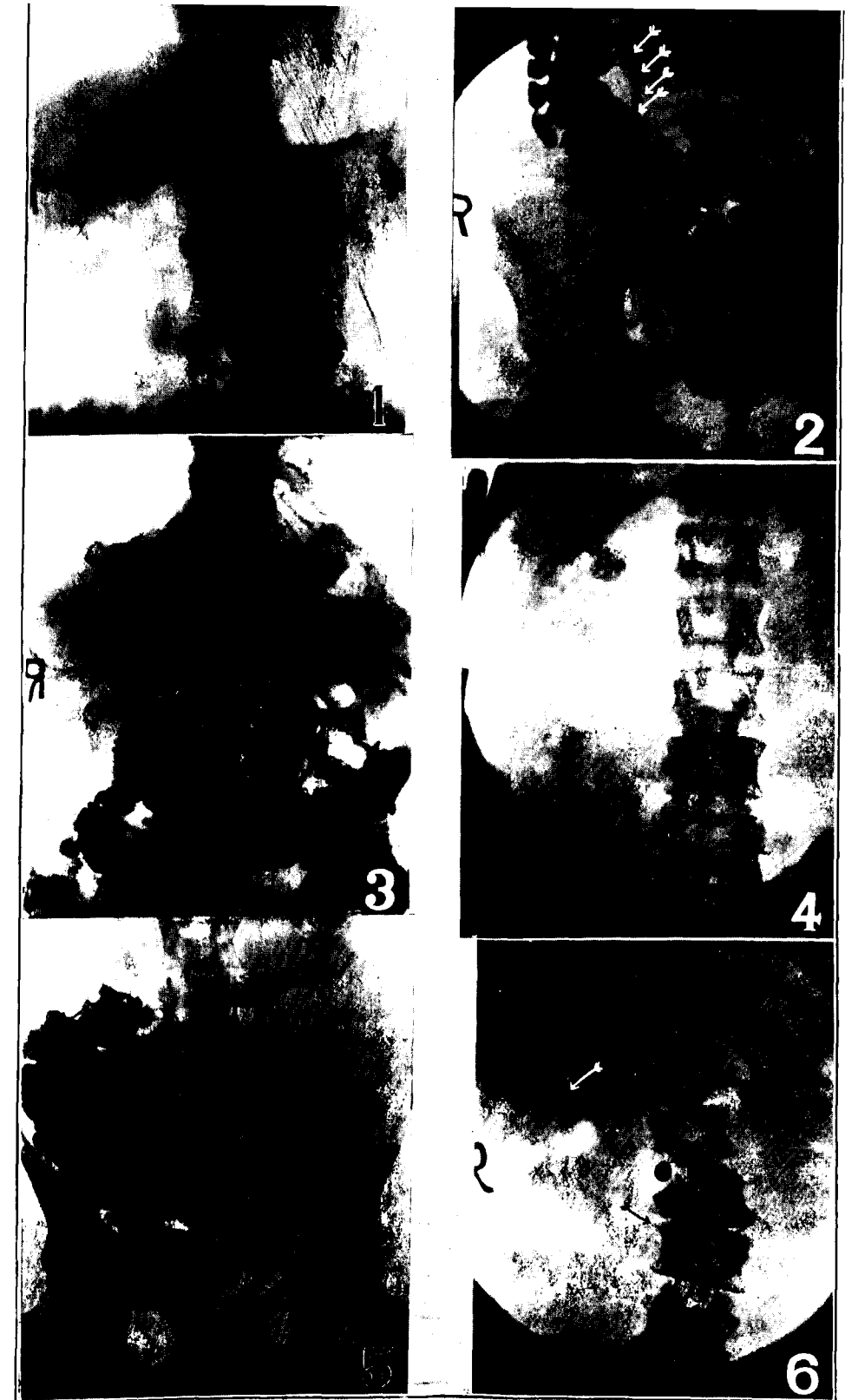
DISEASES OF THE CHEST

X-ray shows (1) affection of any of the ribs or thoracic vertebrae (2) thickening of the pleurae (3) effusion into the pleural cavity (4) any consolidation, fibrosis, or cavity formation in the lungs (5) movement of diaphragms and aeration of the lungs (6) condition of the bronchi and hilum-glands (7) size and shape of the heart and aorta (8) enlargement of the thymus and mediastinal glands or mediastinal tumour.

Every case of suspected lung-disease should be screened and also skiagrams should be taken with short exposures and with a film-focus distance of 150 cms. With proper technique and interpretation, X-rays reveal early tubercular affection of the lungs. Enlargement of hilum glands and hilar phthisis, though very difficult to diagnose clinically in early stages are readily diagnosed by X-rays. Bronchiectasis and bronchiectatic cavities are well seen. X-ray also helps greatly to diagnose subdiaphragmatic abscess, because in this condition the right diaphragm is higher than normal and does not move with respiration. Eventration of the left diaphragm is also diagnosed by X-rays.

X-ray Photos should always be taken before doing artificial pneumothorax to see that the other lung is absolutely normal and after doing it to see that the lung has collapsed properly and there are no adhesions. Teleroentgenography, that is photos taken with parallel rays at a distance of 6 ft. from the X-ray tube, is the method of choice at present for the diagnosis of diseases of heart and aorta, because we can thereby actually measure the size and shape of heart and aorta. In diagnosing aneurismal dilatation of aorta it is always advisable to take skiagrams in the oblique position also so that an enlarged gland may not be mistaken for aneurismal dilatation.

Often it is necessary to interpret X-ray findings in the light of the clinical data present. For example fibrosis of the lung may be due to fibroid phthisis and also syphilis, and clinical history and Wassermann reaction can alone decide between the two. Consolidation of the lung-tissue may be due to pneumonia, tuberculosis, syphilitic affection, or secondary cancerous deposits in the lungs, and a careful reading of the skiagram in the light of the clinical data can alone help in clearing up the diagnosis. Tubercular consolidation usually presents a "mottled appearance." It is always wiser to consider the clinical data and the X-ray findings together in order that there may not be any mistake.



sclerosis of bone are seen. In inflammatory affections such as osteomyelitis, osteitis or periostitis, X-ray is particularly useful in detecting the presence of and locating sequestra. Tubercular affections of bone usually start from joints and are evidenced by marked rarefaction of the adjacent bones also. Syphilitic periostitis is usually characterised by "lace-work type" of periostitis and marked sclerosis of bone.

Tumours of bone:—These are characterised by the fact that there is a sharp demarcation line between the affected and normal portions of bone, by the lesion being localised, and by the absence of periosteal reaction. The tumours usually diagnosed by X-rays are exostosis, ecchondroma and enchondroma, osteoma, myeloma and myeloid sarcoma, periosteal sarcoma and secondary carcinoma. Enchondroma is distinguished from T. B. dactylitis by the absence of periosteal reaction. Myeloid sarcoma is characterised by expansion of cortex, and trabeculation seen in the tumour. Periosteal sarcoma is evidenced by deposition of bone at right angles to the shaft. Dermoid cysts, odontoid cysts, and tumours in connection with the jaw, maxillae, and orbits can also be definitely diagnosed.

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ALIMENTARY SYSTEM

The diagnosis of diseases of the alimentary system is made by giving $2\frac{1}{2}$ ounces of pure Barium Sulphate in butter-milk, and noting the progress of the meal by taking photos at various intervals. The medium being fluid it takes the shape of the organ to which it passes and in this way pathological conditions of the oesophagus, stomach, duodenum caecum, appendix, colon, and rectal ampulla can be diagnosed.

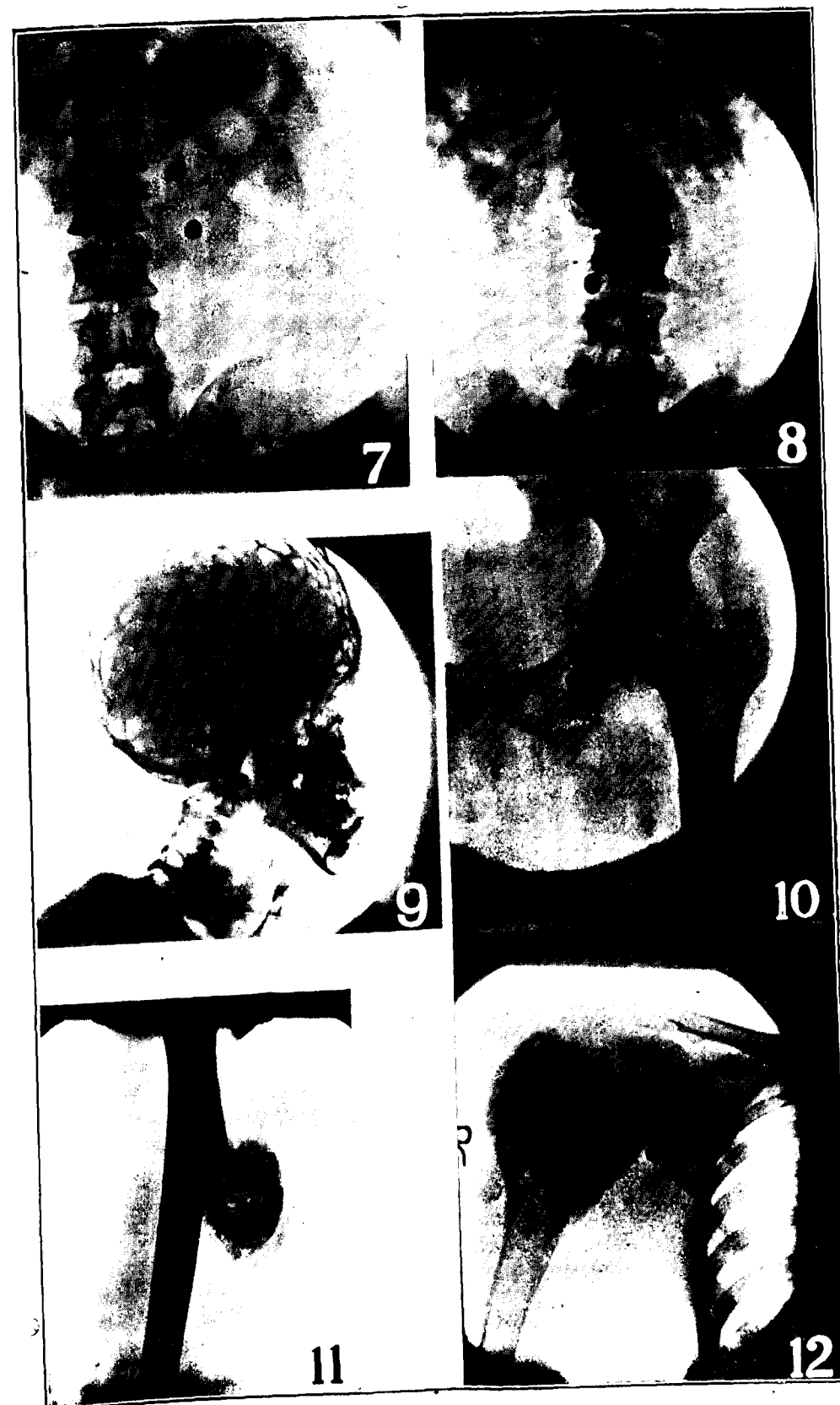
Oesophagus :—The symptom usually present in affections of the oesophagus is dysphagia. Dysphagia may be caused by intrinsic or extrinsic causes. It is therefore always advisable to take a photo of the chest before proceeding to investigate the condition of the oesophagus, in order to exclude aortic aneurism and intra-thoracic tumour. The condition of the oesophagus is investigated by asking the patient to swallow a bolus of thin Barium-meal and noting the downward passage of the meal under the screen and subsequently taking a skiagram. In *malignant strictures* the Barium is seen as a very narrow zigzag line at the site of the stricture, whereas a column of barium-meal is seen standing in the portion of the oesophagus above it. In *Syphilitic stricture* the picture presented is almost similar but the line of barium at the site of the stricture is not so ragged and irregular. In *Spasmodic strictures* (cardiospasm) the spasm is seen to pass away after a time especially after the patient takes warm water or milk. Laryngeal cancer sometimes gives rise to reflex spasm of the oesophagus which may be mistaken for a stricture. Diverticula of the Oesophagus can be easily diagnosed with X-rays.

Stomach :—X-ray gives us a clear idea as to the (1) size (2) shape (3) position (4) tone (5) peristalsis and (6) emptying of the stomach. Generally three or four photos are required at different intervals to determine these points, and the movements of the stomach and the tenderness to pressure of a suspected spot are determined on the fluorescent screen. Enlargement of the adjacent organs, such as spleen, caudate lobe of the liver, enlarged gall-bladder, cystic enlargement of the kidney, and the enlarged head of the pancreas, give rise to rounded smooth but persistent depressions in the outline of the stomach, and can therefore be diagnosed by properly reading a plate of the stomach after barium-meal. Gastric ulcer is characterised by hypertonicity, hyperperistalsis, a niche in the outline of the lesser curvature with an insisura at the corresponding part of the greater curvature, rapid emptying in early stages, and stasis when there is cicatricial contraction. A bubble of gas is seen on top of the niche when the ulcer is perforating. Pyloric ulcer is evidenced by persistent spasm at the Pylorus, stasis, atonicity dilatation, and ptosis of the stomach. A post-pyloric ulcer is evi-

denced by hypertonicity, hyperperistalsis, spasm at the pylorus, irregular filling of the post-pyloric portion, rapid emptying in early stages and stasis when there is cicatricial contraction present. Duodenal ulcer is characterised by hypertonicity, hyperperistalsis, persistent deformity of the duodenal cap, tenderness to pressure over the duodenal cap, and rapid emptying. Hyperperistalsis and rapid emptying of the stomach may be caused by inflammatory affection or neurosis of the stomach, or reflexly by inflammatory condition of the adjacent organs, such as Duodenum, gall-bladder, liver, appendix, colon, pancreas or spleen. Adhesions of the stomach can be well diagnosed with X-rays. Tumours in connection with the stomach wall are evidenced by a persistent irregular deformity in the outline of the stomach. Malignant tumours are characterised by deformity in outline and absence of peristalsis. Fibromatosis of the stomach, commonly known as leather-bottle stomach is diagnosed by X-rays long before any suspicion of its existence can be clinically entertained. Every case of so-called functional dyspepsia in those past middle age should be immediately directed to undergo X-ray examination to exclude this condition. Fibromatosis of the stomach is characterised by very rapid emptying of the stomach which appears like a rigid tube with patent pylorus and *absence of peristalsis*. Fibromatosis may be due to syphilitic affection or carcinomatosis, and clinical history and Wassermann reaction help to decide between the two.

Gall-bladder :—Chronic cholecystitis usually causes adhesions of the pyloric end of the duodenum with the under-surface of the liver and gall-bladder, so that it is evidenced on the film taken just after ba-meal by (1) the pylorus being pulled over to the right side (Hepato-fixation) (2) persistent pylorospasm with hypertonicity and slightly rapid emptying and (3) and a smooth sickle-shaped depression in the outline of the stomach near the pylorus. Gall-stones are visible as faceted ring-shaped shadows occurring in cluster, when they contain a sufficient amount of calcium. The gall-bladder can also be visualised by administering orally to the patient sodium-tetra-iodo-phenolphthalein and taking skiagram after 12 hours when the dye is secreted by the liver into gall-bladder. This is known as cholecystography. In very chronic inflammatory conditions of gall-bladder, the dye is not secreted into the bile and therefore the gall-bladder is not visualised. In such cases we have to rely on the findings of the stomach after ba-meal, and the non-filling of the gall-bladder also can be taken as an evidence of cholecystitis.

Cæcum and appendix :—Food reaches the cæcum and appendix normally after 6 hours. So a skiagram is taken 6 hours after ba-meal and the next one 24 hours after ba-meal. *Appendicitis* is characterised by (1) stasis in the terminal coils of the ileum (2) beaded



and adherent appendix (3) residue in the lower part of cæcum and appendix even after the ascending and transverse colon are empty and (4) tenderness to pressure over the appendix under the screen. It may reflexly cause hyperperistalsis of the stomach and spasm of the duodenal cap and therefore be mistaken for duodenal ulcer if subsequent skiagrams are not taken. *Chronic inflammatory condition of the cæcum* is also evidenced by (1) ileal stasis (2) irregular filling of cæcum (3) cæcal stasis or sticking of the barium to the cæcal mucous membrane and (4) cæcal adhesions. Adhesions of the cæcum and appendix are determined by taking a skiagram in the lying down position and noting whether they move up as they do normally. Inflammatory and tubercular affections of the cæcum and colon produce an almost similar X-ray picture and clinical history should be taken into consideration to distinguish between the two though generally speaking adhesions of the cæcum, and rapid emptying of the colon are points more in favour of tubercular affection.

Diseases of the Colon:—Ptosis, displacement, or any anatomical abnormality of the colon can be readily recognised in the skiagram. Chronic colitis is characterised by absence or irregularity of haustrations so that the colon looks more or less like a uniform tube and stasis. Ideopathic dilatation of the colon is characterised by marked stasis and great dilatation of the colon. Strictures of the colon are evidenced by marked stasis, dilatation of the proximal part, and the presence of a persistent narrow streak of barium at the site of the stricture. The margins of the streak of barium at the site of the stricture are smooth and regular in the case of Dysenteric or syphilitic strictures, whereas they are irregular and interrupted and zigzag in the case of malignant strictures. The age and clinical history of the patient should also be taken into consideration before giving the diagnosis. Diverticulities is evidenced by circular beads of barium seen outside the lumen of the colon. X-ray is also useful in diagnosing adhesions, ptosis, and similar affections of the colon, and the displacement of the colon often give us an idea about the size and shape of a tumour and its connection with kidneys, spleen or pelvic organs. Barium enema is also useful in diagnosing obstruction in the colon.

URINARY SYSTEM

As fecal matter often produces shadows very closely resembling renal calculi, special care should be taken in the preparation of the patient and an enema given before taking the photos. All varieties of renal calculi except those composed of pure uric acid are opaque to X-rays and are well shown in the skiagram. It is always advisable to take skiagrams of the whole urinary system even if the calculus is suspected only in the kidneys or bladder, because a stone in the

lower end of ureter may cause typical symptoms of renal colic and may be missed if a skiagram of the kidneys alone is taken. Gall-stones are likely to be mistaken for renal calculi, but gall-stones are ring-shaped, faceted, and multiple whereas the latter are usually of uniform in density and do not occur in clusters. Calcified tubercular glands or calcified spots in a tubercular kidney may simulate renal calculi. Phleboliths are likely to be mistaken for stone in the lower end of the ureter, but they produce round shadows of uniform density and lie along the lesser brim of the pelvis and therefore can be easily differentiated. As X-ray gives a fair idea as to the size and shape of the calculus, it is very useful in deciding whether a vesical calculus can be removed by lithotripsy or a supra-pubic operation is necessary.

Skiagrams taken with soft X-rays show clearly the outline of the kidneys, and this is useful in determining the size, and shape of the kidneys.

Formerly pyelography was done to visualise the ureters and calyces of the kidney by injecting an opaque solution into the ureters through bladder with the aid of cystoscopy. But now injections of ureselctan into the vein and taking subsequent skiagram has supplanted the old method of Pyelography. Ureselctan is secreted by the kidneys into the urine and is opaque to X-rays. Hence the shadow of the calyces and pelvis of kidneys and ureters is obtained giving us an idea as to their size and shape and the functioning capacity of the kidneys can also be gauged by noting whether a kidney fails to secrete it and its shadow is not obtained.

MIDWIFERY AND GYNAECOLOGY.

The normal uterus and its appendages are not seen in the ordinary skiagram. But any calcification in the ovaries, glands, or calcified fibroids, can be seen and diagnosed from the ordinary skiagram. The foetus in the pregnant uterus is seen only after the foetal cartilages begin to ossify and therefore pregnancy can be diagnosed by X-rays only if it is more than four or five months advanced. X-ray is useful in determining the lie and the size of the foetus, the relative sizes of the foetal head and pelvic inlet, twin pregnancy etc., and in determining whether an enlargement of the uterus is due to pregnancy or some other cause.

The size and shape of the uterine cavity and the patency of the fallopian tubes (important in treatment of sterility) can be visualised and investigated by injecting Iodipin or lipidol into the uterine cavity and fallopian tubes and then taking the skiagrams. The method is useful in diagnosing blocking of the tubes, and double uterus etc.

RADIOLOGY AS A THERAPEUTIC AGENT

The biological properties of X-rays and Radium-rays are utilised in the treatment of many diseases, which are very intractable either to medical or surgical treatment. Radium gives out three kinds of Radiations, known as Alpha, Beta, and Gamma rays. The Gamma rays are the most penetrating. The Alpha and the Beta rays are cut off by proper screens and the Gamma rays alone are used for treatment except in skin diseases, where Beta rays also are utilised. The properties of X-rays and Radium-rays are practically identical and the choice between the two is usually made according to convenience. The Gamma rays of radium are more penetrating and its dose can be more accurately determined, but it is very costly and has to be applied for a long time. Generally radium should be preferred for small localised lesions whereas it is more convenient to give X-ray exposures on extensive lesions like secondary carcinomatous glands.

Radiations of more or less penetrating power are selected according as the lesion is deep-seated, just palpable under the skin, or superficial. In the case of Radium this is done by choosing different filters and amount of Radium used. In the case of X-rays, superficial lesions such as skin diseases, soft X-rays are utilised by taking a voltage of from 80 to 100 K.V. and 1 mm. Al filter. This is known as *Superficial therapy*. Treatment of lesions like T. B. glands and goitre, which are felt just below the skin is known as *Medium therapy* and therein a voltage of from 120 K.V. to 140 K.V. and 3 to 4 mm Al filter are employed. *Deep Therapy* is the treatment of malignant glands, hard malignant masses, and deep-seated lesions and therein a voltage of from 160 K.V. to 200 K.V. and 0.5 mm & 1 mm. Al filter are employed. Some consultants are in the habit of directing the Radiologist to give what they call *Deep therapy* in each and every case where they think the X-ray treatment is indicated. There is a general misconception that every X-ray treatment is *Deep therapy*, but as we have already stated just now the kind of therapy employed depends entirely on the nature and depth of the lesion and it would be much better if the consultants leave it to the Radiologist to determine what kind of therapy should be given and whether to employ Radium or X-rays.

Recent advances in physics enable us now to measure accurately the quality and quantity of the Radiation given out by the X-ray tube and its comparison with standard Radium-radiation. X-ray radiation is now measured in R units. Dr. Kustner has invented an apparatus by which the X-radiation given out by a particular tube at the required voltage and with the proper filter and distance can be measured in R units per minute. The dose in R units, that is just

sufficient to produce erythema is determined and as the percentage of erythema dose that is required to treat different lesions has been already determined by biological experiments, the actual dose to be given in the particular case can be easily calculated in R. units. The following is the dosage in terms of U. S. D. that is usually recommended.

Unit skin dose (Erythema dose)	100 %
Castration " (Ovaries)	35
Sarcoma	60-70
Carcinoma	90-110
Dose stimulating carcinoma	35-40
Intestinal dose	135
Muscle dose	180
Tuberculosis	40

The dose which a deep lesion receives is always less than that received by the skin because some of the rays are absorbed by the tissues through which they pass. Prof. Helfelder has prepared elaborate devices by which the dose received by a deeper structure can be exactly determined in terms of the percentage of the dose received by the skin. In treating deep-seated lesions, Radiologist has to see that the diseased parts get the proper dose required without producing a burn of the superficial skin, and for this purpose he must choose different ports of entry by irradiating different fields on the skin at different angles.

The reaction of the treatment is seen after 8 days and the maximum effect produced is seen after 3 weeks. Therefore at least 3 weeks must elapse before two consecutive treatments if full dose is given. The patients also should be instructed to wait for results for at least 3 weeks so that they do not get impatient.

It is now well known that X-ray treatment is indicated in malignancy and the question is often put forth "Does X-ray or Radium cure malignancy?". Though cases treated in very early stages are known to have been cured and lived for more than 10 years without recurrence, it must be borne in mind that on the whole Radiotherapy in malignancy is only a palliative measure, and though the local lesion may disappear with treatment, the occurrence of metastasis cannot be prevented in many advanced cases. At the same time we assure our readers that X-ray or Radium does not in any case hasten metastasis as is alleged by some surgeons. Good results are obtained in cancer of cervix, breast, tongue, and rectum. Radium is preferable in the treatment of cancer of cervix and of tongue, whereas X-rays is suitable in treatment of secondary glands. The treatment relieves pain, checks bleedings and foul discharge if there is any and causes shrinking of the tumour.

Besides malignancy, X-ray and Radium are useful in many other conditions. X-ray or Radium treatment is now recognised as the treatment of choice in the case of tubercular glands, because the glands become fibrosed and shrink with a few exposures, the virus is killed and encapsuled and there is no danger of dissemination as in the case of treatment by operation. If the glands are caseating the fluid should first be aspirated, the glands treated with ultra-violet rays for a few days in order to allay inflammation if there is any, and then X-rays or Radium should be given. No unsightly scar is left after this treatment as in the case of operation.

X-ray and Radium are also useful in the treatment of uterine haemorrhage due to fibroids or climacteric period. With one or two treatments the bleeding is completely stopped, menses cease, and sterility is produced. In climacteric haemorrhage Radium is preferable to X-rays, because Radium acts more on the uterine mucous membrane and causes less damage to the ovaries, whereas X-rays act more on the ovaries and are likely to cause symptoms of neurosis due to ovarian deficiency.

In splenomedullary leukaemia X-ray exposure causes a remarkable reduction in the size of the spleen and in the number of myelocytes in the blood, but the improvement is only temporary and recurrences do occur and the effect of subsequent X-ray exposures is found to be comparatively less.

Eczema, psoriasis, lupus, rodent ulcer, keloids, fibroids, goitre and many other conditions can be treated with X-rays or Radium, but it is not possible in this small article to treat the subject in detail.

Though there are a few limitations at present to the therapeutic uses of Radiology, these are getting fewer with the advance in the physics and biology of Radiations and as there is still a vast field to be explored as regards the nature, constitution and effects of different Radiations, Radiotherapy has certainly a great future.

CONCLUSION.

We have so far outlined in brief the main indications for Radiology as an aid to diagnosis and therapy. The foregoing description will convince the general practitioner of the rationality of the Science of Radiology and we hope it will serve him as a useful guide in advising his patients. Physiotherapy is now coming into prominence and some of the Western authors predict that within a short time it will replace a good deal of radical surgery and prolonged treatment with drugs. A proper co-operation between the Clinician, Pathologist, and the Radiologist is sure to make possible a much more rapid advance in the realm of roentgenology and thus increase our means and power of relieving suffering humanity.

THE PROBLEMS OF RADIOLOGY IN INDIA.

BY

CAPT. P. B. MUKERJI, B. SC., M.B. (CAL.) F.R.C.S. (EDIN.)
D.M.R.E. (CAMB.)

*Radiologist, Patna Medical College Hospital and Lecturer in
Radiology, Prince of Wales Medical College, Patna.*

ETYMOLOGICALLY the word Radiology means that branch of science which deals with the application of radiant energy including roentgen-rays, radium, ultra violet rays, infra red and other spectral rays in the diagnosis and treatment of diseases. In common medical parlance, however, the expression is used when reference is made to the special practice of Roentgen-Rays and Radium only; the word 'Electrology' being limited to the use of the other radiations. Radiology has brought into the field of medicine a new natural force which is now widely used for both diagnostic and therapeutic purposes. This branch of science is a comparatively young one, the announcement of the epoch making discovery of X-rays having been made by Von Roentgen to the world only about thirty-five years ago (December, 1895.) The possibilities in medicine and surgery of these rays began to be investigated almost immediately upon Roentgen's announcement, which produced a sensation not only in scientific circles but also in the medical profession. The discovery produced such a profound effect on the trend of scientific thought at the time that many physicians, especially those who were interested in electricity, began to study the potentialities of the new rays and equipping themselves with the necessary apparatus for their production laid the foundation of a new avenue of medical speciality. Some of these pioneers in the budding science of Roentgenology gave up general practice of medicine and devoted their whole time to this new field of speciality.

The development of the science of radiology has been a rapid one and it is well known how it has come to be applied to almost every phase of medicine. It has grown up as a speciality in medicine in the true sense of the word like other specialities, such as, ophthalmology, bacteriology, venereology etc.; and in considering its position in the profession it must be remembered that it "is a kind of medical practice, and not simply a group of technical procedures." There are many physicians in India to-day who forget this fact and believe that "radiology is simply a group of technical procedures" and can be carried out by any one who possesses an X-ray apparatus and a room to accommodate it.

In assessing the true position of Radiology in the profession in India we are confronted with the following problems:—The essentials of a Radiologist, the difference between a Radiographer and a Radiologist, the relation of the Radiologist to the hospital, the status of the trained medical Radiologist, the requirements of clinicians from Radiologists and *vice versa*, the prospects and future position of Radiologists, the position of Radiology in the undergraduate curricula in the various Universities and the possibilities of post-graduate training of Radiology in India, the hospital X-ray policy, and lastly the future of Radiology as a speciality in India.

In discussing these various problems I cannot begin better than by quoting the following from the pen of A. E. Barclay, Lecturer in Radiology at Cambridge University:

"When X-rays were first used for the service of medical science they were looked upon as a new method for employing photography and likely to be of as much service, except in so far as the detection of fractures and pieces of metal was concerned. Any out of the way and useless room, preferably in a dark basement, was the place most suitable to house the apparatus and people who were to use it. This conception hampered the growth and utility of the greatest servant of diagnostic medicine that has ever come to the aid of man since he first learned to use his eyes for the detection of disease. It gave him a new sense, added eyes at the ends of his fingers, gave him sight through the depth of the tissues and in the last thirty years it has changed his whole conception of many aspects of anatomy, physiology and pathology. We are not at present concerned with what Radiology has accomplished, except in so far as to insist that it is hard to over-estimate the value of the X-ray department in the service of the patient. It has struggled upwards out of its cellars and today demands a place in the Sun. There is no part of a hospital's design that calls for more careful considerations, and none which will, if properly used, show such a good return for the time and money expended upon it. A poor and inefficient X-ray service inevitably hampers all medical and surgical work, sets it back a decade or more, whereas the really efficient Radiologist armed with the necessary though expensive equipment, can do a great deal in helping physicians and surgeons to maintain a high standard of progressiveness in the rapidly changing scenes of medicine and surgery. Generally speaking people get what they pay for in this world, whether it be in apparatus or in science, and something for nothing cannot be expected, even of a charity. If the best is to be had out of an X-ray service it must be paid for. Both the apparatus and housing are expensive, for the X-ray department must not only be properly housed and equipped but be centrally situated and not tucked away in any odd corner. More important than either of these factors, the man who controls the department must be a well trained and experienced medical man with a sound knowledge of clinical medicine and surgery. It goes without saying that he must know his own special line of work and be the best man procurable. It must be made worth his while not only to take the risks of his calling but also to make and keep himself abreast of his branch of medicine."

The foregoing introductory remarks about the early growth of Radiology will help us considerably in our discussion of the subject as it affects the scope and position of the speciality in India. But before entering upon a discussion of the subject proper it is essential to remove at the outset one or two misconceptions which still linger in the minds of the elders in the profession. The first of these consists in a proper understanding of the difference between the terms Radiographer and Radiologist. A Radiographer is a lay-assistant, a non-medical man, a technician, who has learnt how to handle an

X-ray equipment in order to obtain radiograms of the different parts of the human body or to carry on X-ray exposures as a therapeutic measure when the dosage and the factors with which to obtain it have been prescribed by a physician trained in the science of Radiotherapy. A Radiologist, on the other hand, is a medical man who has gone through a comprehensive course of training dealing with all aspects of X-rays and the other spectral rays that are used in medicine beginning with the apparatus necessary to produce them and ending with their action on human tissues, both physiological and pathological. A Radiographer always works under the direction and supervision of a Radiologist; and it will be easily seen from their respective qualifications that the former can never take the place of the latter.

The general attitude of the medical profession is now to recognise the practice of Radiology as the practice of a branch of medicine. This is true whether it is practised by specialists or by internists and other physicians who have trained themselves in the use of the X-ray and other spectral rays for the diagnosis and treatment of disease. Certain parts of X-ray work are entirely technical such as the actual making of exposures, developing and fixing the films, and so on. This part of the work is and can be done by non-medical technicians, or Radiographers. But when the results of this technical work are to be interpreted in terms of pathology it is obvious that a knowledge of pathology and of clinical medicine and surgery is essential. It is plain, therefore, that the examination of patients under the X-ray screen or the interpretation of Radiograms (or X-ray pictures as they are wrongly called) must be done by a medical man or a Radiologist.

Of late there has been a good deal of controversy in the Radiological press abroad with regard to the propriety of physicians sending their patients for examination by Radiographers; and various Roentgen Societies of Europe and America have made recommendations urging that non-medical technicians should not be permitted to make Fluoroscopic or Roentgenoscopic examinations, and that they should work under the direct supervision of a qualified Radiologist. Fortunately for India this question has never become an acute one because in this country very few non-medical men have attempted to settle in practice as X-ray experts.

After having noted the fundamental difference between a Radiographer and a Radiologist it is important to discuss what the essentials of a good Radiologist should be. It is becoming increasingly recognised that radiology is a medical speciality requiring on the part of those who practise it a broad general medical knowledge and prolonged and thorough training in the use of the Roentgen Rays, Radium, and other forms of Radiant energy in the diagnosis and treatment of disease. Martin summarises the qualifications of the

Radiologist capable of having charge of a radiological department of a hospital as follows:—

“(a) Possession of a degree in medicine from a recognised University.

“(b) A command of the best technical procedures used in the diagnosis of disease by Roentgen-rays.

“(c) A thorough knowledge of the accepted principles of Roentgenographic interpretation, with sufficient experience to insure a careful weighing of the data obtained on its merits. Constant contact with the rapidly changing radiological literature is necessary and a properly kept reprint file in the department is a most useful adjunct. A man who writes good scientific articles himself is usually familiar with the writings of others, and the radiologist who is often found in the autopsy room and at the operating table is likely to be one who places the correct valuation on Roentgen ray observations.

“(d) A knowledge of modern medicine sufficiently broad to make him a true consultant. Any physician on the staff should feel free to go to the Director of the department for advice when requesting Roentgen examinations with the feeling that his patients will thereby receive the most efficient service. Unnecessary and improperly ordered Roentgen examinations make up a large percentage of the work in many institutions. Free discussion of the observations after the work has been done is also often helpful.

“(e) A broad knowledge of radiotherapy backed up by a reasonable amount of experience. A familiarity with electrophysics, particularly as it deals with dosage measurements, is necessary, but it is more important that the radiotherapist be versed in the diagnosis, course, and prognosis under treatment of the various types of malignant and other conditions treated.

“(f) The ability and willingness to teach. Of course, the radiologist connected with a teaching hospital expects to devote a certain amount of time to lectures and demonstrations. It is desirable that his work be interlaced somewhat with the departments of Anatomy, Physiology, and Pathology, as well as with many of the clinical divisions. However, the man in the non-teaching institution can appreciably improve the standing of his department by so arranging his work that the interns receive regular instruction. Interesting radiological demonstrations should also appear on the programmes of the staff meetings at regular intervals. Such endeavours require extra effort but they invariably bear fruit.

“(g) Some familiarity with research problems. It is true that not every physician is fitted to do research work, but a surprisingly large number of radiologists have contributed some bit of knowledge of more or less importance to the speciality. Some have a mechanical tendency and have devised new techniques or improved apparatus; while others have delved into the biological problems of radiotherapy, or have collected clinical data. Most departments have adequate facilities for work of this sort and a certain amount of creative effort invariably tends to redound to the credit of the department as well as to the institution as a whole. No speciality offers more interesting problems for investigation than does radiology.”

Such are the qualifications which should be possessed by one who aspires to become a Radiologist capable of discharging his true functions and if every radiologist takes this high view of his obligations there is little doubt that he will be accorded the place even in hospital practice that he deserves, of acting as a consultant. The science of Radiology is in its infancy in India and so far it has not attracted the best amongst the young medical graduates to its practice; but when the status of the radiologist has been defined in respect to the whole practice of medicine and his position as a consultant on a par with his confreres in internal medicine and surgery has been assured there will be less difficulty in attracting really first class men and maintaining a steady progress of this important branch of medicine.

In the meantime it is not too much to expect that agencies such as the governing bodies of the big hospitals in the country and the heads of the medical departments in the different provinces and States in India will lend active encouragement to the establishment of radiological departments in charge of well qualified medical radiologists with a status on the hospital staff the same as that accorded to the visiting physicians and surgeons. The present policy of equipping every district hospital with a so-called X-ray unit and expecting the overworked medical officer in-charge who has probably had a course of training in X-ray work at Dehra-Dun some ten or fifteen years ago, to run the plant efficiently--requires revision in the light of new experience and in the interest both of the patients as well as of Radiology itself. The science of Radiology has grown tremendously in recent years; and it is absurd to expect general practitioners such as medical officers holding charge of district hospitals to keep abreast of all advancements and developments in a speciality of medicine, which is, above all, the most technical of all medical specialities. The natural consequence of this ill-conceived policy has been that in more than half the district hospitals provided with X-ray equipment the apparatus is lying out of order. The medical officers in charge of these hospitals have far too many other pre-occupations and have little time left at their disposal to keep their interest in X-ray work sustained. Besides they are liable to transfer to other stations and a new man may come in charge of a district hospital who is not trained in X-ray work. The solution of this problem lies to my mind in placing the X-ray Equipment in charge of Honorary Radiologists who would be permanent residents of the town and as such would take a lively interest in the working and development of the department. No other work of a medical, surgical or obstetric nature should be expected of them; and they should be encouraged to become experts in their speciality and keep themselves up-to-date in it by according to them a suitable status in

the staff of the hospital. If the X-ray department is to be of real value, a Radiologist specially trained in X-ray interpretation is essential. Without such a man, the utility of the department is limited to the simplest principles of the subject. An alternative solution is to employ a well trained Radiographer who will make the X-ray films and to have an experienced visiting Radiologist on an honorarium who will attend to the screen-examinations, interpretation of films, and general supervision of the department.

It would be interesting to quote here what the British Medical Journal wrote on the subject of "The status of the Radiologist" in its issue of 27th April, 1929:—

"Technique has been made so simple by the improvement in apparatus and tubes that the younger generations are unable to visualise the difficulties of the pioneers. Anyone with average intelligence and dexterity can, in a very short time, be taught how to produce good films of the various conditions. It is unfortunate that the public generally, many medical practitioners, and even a number of consultants still consider that the "picture" is all that is required, and are not prepared to look upon the radiologist as a consultant; they hold, in short, that it is the pictures which are paid for and not the opinion. The competitions of hospitals, and the status of the medical radiologists attached to them, are become increasingly important. No hospital now, cottage or otherwise, considers itself properly equipped without an X-ray department, but whether a duly qualified radiologist is in charge of the department is often a secondary consideration. There is also a definite tendency among the lay members of hospital committees to authorise payments for X-ray work done in the institutions, in fact to make money out of the X-ray work. None of these things are for the good of either the public or the medical profession. The profession, if united, could in a very short time considerably improve matters. It is in the interests of the profession that X-ray work should be in the hands of duly qualified and specially trained medical men and women, and that the status of such specialists should be exactly the same as that of others who devote themselves to special work. No lay radiographers should work in hospitals or in private practice except under expert medical control. If this was the rule, as it should be, the status of those devoting themselves to a most difficult branch of medical practice would become higher, the standard of Radiology would improve, and this work would attract more of the best students than it does at present." These remarks apply with as much force to conditions prevailing in India as they do in the United Kingdom and I would commend them to the careful consideration of those in authority who have the administration of the hospitals in this country under their charge.

Another aspect of the many problems that confront modern Radiology depends for its solution on a clear understanding of the relation between the clinician and the radiologist. The requirements of clinicians from Radiologists and *vice versa* need to be properly defined, if the best is to be had from their co-operation. Clinicians might require from the medical Radiologists what they would expect from other qualified specialists; the Radiologist in his turn, should be given, as would any other specialist, a careful excerpt of the clinical data, and usually an indication of the clinician's opinion, which would help him to elucidate the problem he is set. The important thing is that the clinician should take the radiologist into his confidence, and state in which directions radiological help was needed. Dr. G. B. Batten who thinks that there are many clinicians who act towards the Radiologists with perfect understanding, classifies others in the following categories :—

“(1) Those who regard radiology as a joke not worthy of their consideration.

“(2) Those who, while recognising the advantages afforded by Radiology, look upon it as an unimportant part of their investigations.

“(3) Those who, while valuing Radiology, belittle radiologists and imagine that they are doing well to withhold any knowledge of the case from them.

“(4) Those who want a radiograph taken, but desire to interpret it themselves, treating the radiologist as a mere photographer;

“(5) Others, more ignorant, who expect a non-medical photographer to report on X-ray photographs when he knows nothing of Anatomy or Pathology.

“(6) Those who desire the radiologist to interpret the films as pictures only, without expressing any opinion about the condition giving rise to the appearance.

“(7) Clinicians who leave too much to the radiologist, sending immediately to the X-ray department a fracture or a doubtful chest without first trying to learn anything about it themselves”.

While admitting that there is some truth in this classification it must also be acknowledged that an extraordinary change for the better has taken place in recent years in the relationship between the clinicians and the radiologists. As a proof of this change might be mentioned the alteration and improvement in the Request Forms with which patients used to come to the Radiologists ten years ago and those with which they come now. Not very many years ago it was quite usual to receive Request Forms as follows :—“X-ray this case; please”, “X-Ray the chest and give opinion”, “X-Ray of Abdomen desired” etc etc., but in recent years with the spread of the knowledge of the possibilities and limitations of X-rays, patients are coming with Request Forms properly filled in and containing a

short history of their case including their present complaints and indicating the lines on which X-ray investigations are to be carried on. The difficulties mentioned above were due in great part to the belief in public mind that X-rays revealed anything and everything. The importance of roentgenology has often been improperly interpreted by the public, and what is much worse, also by some doctors who believe or make their patients believe that with the aid of Roentgenology all occult diseases which are difficult to diagnose with clinical and laboratory methods may be diagnosed with ease by the aid of Roentgen examination. Roentgenology may render inestimable service to the physician but it is always and in every instance an auxiliary which alone, without a preliminary clinical examination by the physician, could not make a sufficiently clear diagnosis. Happily for the radiologists and the suffering public the medical profession of the present day has been educated sufficiently, through radiological articles published in medical journals and by making attendance at lectures on Radiology compulsory for students going up for final M. B., B. S., examination in most of the Indian Universities, in the direction of knowing what X-rays as a diagnostic agent can or cannot do. Another misleading error has taken root in the public mind and that is that every roentgenologist is endowed with the same skill and the same competency, the main deciding factor being what machinery he possesses. This wrong belief has to be exterminated and the public educated that this opinion is utterly wrong. The skill of a roentgenologist depends upon his experience, dexterity, logic and honesty, all of which qualities can be acquired only by long and indefatigable study. If such a skilled Radiologist did good work and at the sametime refrained from dogmatism in the absence of absolute certainty, his reputation among clinicians was secure.

Turning now to the question of systematic instruction in Radiology it is very encouraging to note that in almost all the Universities in India with Medical Faculties, attendance at a course of lectures in Radiology is enforced before the students are signed up. This is exactly as it should be. The course of lectures varies in different Universities. In some it comprises six lecture--demonstrations while in others at least fifteen attendances are compulsory. Speaking from personal experience as a teacher in the subject I would say that at least twenty lecture--demonstrations are necessary to lay the foundations of a useful knowledge of Radiology and Electrology in the senior students going up for the Final M. B., B. S., Examination. There is one aspect of Radiology in its relationship with the Universities and the Medical Colleges in India to which I would like to draw the attention of the authorities controlling these institutions. We have professors in almost every branch of medicine in Indian

Universities except in Radiology "although this is probably the best handmaiden the clinician ever had." The same state of affairs existed in such a progressive country as the United Kingdom till recently. Whilst in practically all countries in Europe and America there have been Professors of Radiology for many years attached to the teaching Schools and Universities there was no Professor of this subject in any of the English, Scottish or Irish Universities. It is only last year that the first Chair in Radiology in the United Kingdom was established by the appointment of Dr. J. N. Woodburn Morison M.D., F.R.C.P. Edin as Professor of Radiology in the University of London in connection with the Cancer Hospital, Fulham. Time has surely arrived when Indian Universities should consider whether the same practice could be followed in this country to the benefit of the Science of Medicine as a whole and in the interest of research in Radiology in particular. The future of Radiology in India rests in the hands of the radiologists themselves. If this special branch of medicine attracts some of the best graduates of our universities who would willingly put their whole energy in mastering the technical side of the subject as well as the art of interpreting skiagrams in terms of pathology, if true specialists in the subject with thorough training and wide experience are accorded the same status as is enjoyed by specialists in other branches of Medicine if Radiologists are provided with beds in hospitals for the practice of their speciality in suitable cases, if Radiologists keep themselves in constant touch with the clinical side of Medicine without degenerating into mere Technicians, and if they tackle new problems confronting their speciality in a true spirit of research—the future of the science has nothing to fear and medicine in India has everything to gain by the steady development of a speciality which "apart from operation, offers the only way of visualising the interior of the body."

Before concluding I would like to draw the pointed attention of the radiologists in India to one aspect of their work to which they have till now paid but scant attention. Radiologists are often heard to complain that they are saddled with unsuitable work i.e., with cases in which the diagnosis can be made clinically or in which the X-Rays could not be expected to offer much help. The remedy lies in the hands of the Radiologists themselves. If they undertake to educate the general practitioners on the capabilities and limitations of X-Rays both as a diagnostic and therapeutic agent by organising a few post-graduate lectures on Radiology "their burdens would be considerably lightened; they would probably get less work but they would have the satisfaction of getting suitable cases and their work would thus be more interesting."

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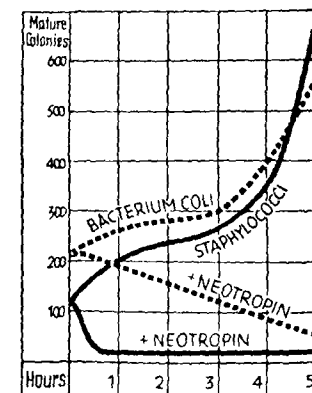
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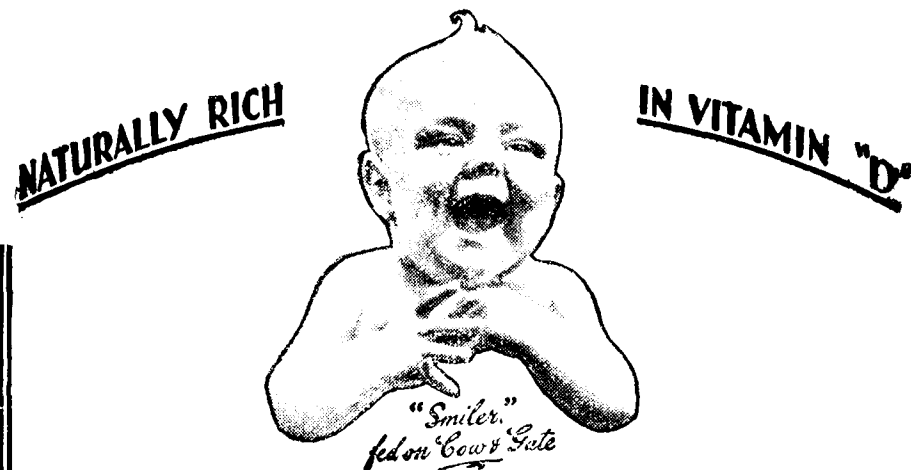
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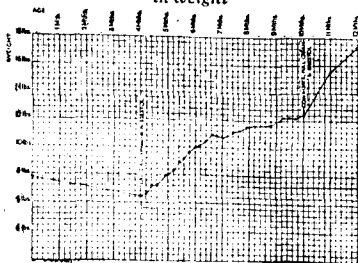
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RADIOLOGY IN DIAGNOSIS.

BY

CAPT. M. MUKHERJI M.B., (CAL.) D.M.R.E., (CAMB.)

CALCUTTA.

Introduction :—Man always strives to find out Nature's secrets, and when successful applies the knowledge for his welfare, in as many ways as possible. X-radiation has illustrated the truth of this statement in a remarkable way. Apart from therapeutic application for the cure or relief of disease, it has been used ever since its accidental discovery by Roentgen in November, 1895, as one of the diagnostic agents in medicine. Within a fortnight of the announcement of the discovery, the first "X-ray photograph" of the hand (i) was taken in January 1896, and the first renal stone (ii) was radiographed by Mc Intyre, a few months later, in the same year.

With improvement in apparatus and technique of radiography the diagnostic potentialities of this radiant energy have been used in later years in many arts and crafts, e.g., metallurgy, picture research and in the physical laboratories have been employed to determine the structural anatomy of various crystals.

It is not my intention to establish the indisputable and now well recognised fact that Radiology (in its restricted sense) is an important diagnostic aid, but to state the bare principles of Fluoroscopy and Radiography, to discuss the position of the medical Radiologist in the diagnostic art, and to make a brief survey of the attainments of this science in the investigation of diseases from a practical standpoint.

X-Ray Diagnosis :—Although this term has come to stay in medical literature all over the world, it is at best not an appropriate expression, for except in a very few cases, X-Rays do not diagnose the disease. Diagnosis is a very delicate and difficult art. It requires primarily methodical clinical observations, backed up secondarily by auxiliary examinations and then drawing some logical deductions as to the pathology of the morbid state under consideration. The final step in the process is simple, for one has now to find out a disease with the characteristic pathology of which, the deduced pathology in a particular case tallies most.

The value of any diagnostic method therefore, depends upon the facility and reliability, with which it can demonstrate the pathology of diseased state. X-rays have been of such immense value as a diagnostic method, because it *delineates in shadow* not only the organic pathological changes, but also the "disordered physiology"

super-human labour, and of self-sacrifice the importance of the subject has been universally well established, and an invaluable store of experience and knowledge laid by. Now-a-days many of the Universities of West have got post graduate courses, and some of the big X-Ray apparatus manufacturers also hold classes for medical men. In India there is no such Institution where medical men may undergo a special course of training, although it is essential to have specially trained medical men on the job, who alone could be entrusted to maintain, and improve the high standard of Radiology as a diagnostic aid. At least one well-staffed and properly conducted centre should be established in India.

Unfortunately, the status of the Radiologist is not an enviable one. He is very often regarded as nothing better than a superior class of photographer and electrician, not only by the general public but also by brother practitioners in medicine.

This treatment of an important member of the fraternity whose common object is investigation of diseases and alleviation of human suffering, has hampered the progress of Radiology as a whole (both diagnostic and therapeutic) in as much as he was kept out of the clinical side of the case in the first place, and latter on very rarely heard anything as to the further progress of the patient. It is only by checking up of results that we can truly evaluate any diagnostic method, evolve better technique, and learn correct interpretation.

The Radiologist should have---(and parenthetically must earn by conscientious work, and by avoidance of exaggerated claims as to the superiority of his art)--the co-operation of the clinician and the Pathologist, so that he gets opportunities for studying and following up the cases after they have passed through his hands. I need hardly mention that very often the surest diagnosis is reversed at the operation table, or in the post mortem room, and any medical man whose primary work lies in the investigation of diseases, can ill afford to absent himself from either of these two places. Confirmation of diagnosis is also a great boon. It creates self-confidence, and increases the diagnostic ability of the Radiologist and the reliability of his technique.

It is common knowledge that a position of responsibility makes a man very circumspect, and cautious in all his actions. The reverse is also true. If the Clinician regards the Radiologist as one whose findings are unimportant, to be accepted so long as they corroborate his own deductions, and to be unhesitatingly brushed aside if they are contrary to his (the Clinician's) a great incentive for good cautious work is lost for the Radiologist, and the progress of the science is delayed. Fortunately this spirit though present, is rare. In any case of contrary findings the Clinician and the Radiologist ought to

meet, discuss, and re-examine the case. Only by such procedure can the road be paved for rapid progress of the science. This is possible in an atmosphere of co-operation and mutual esteem.

The Radiologist is not an intruder on the preserved domains of the Clinician. He is a helpful neighbour with an identical mission in life. He is as much a medical man as any of his compeers. There is no reason why he should not take up cases independently for diagnosis by employing his special art, and his own clinical sense, afterwards referring the cases if needs be to eminent men in other branches of medicine for their valued opinion. In trying to specialise, the Radiologist has restricted himself and his activities to a harmful extent, for he is losing direct contact with the "patients," by which alone one can cultivate that primary essential in the art of diagnosis namely clinical sense.

The sooner the Radiologist left his shell the better for him, for his speciality, and for medicine in general. For this the public have to be enlightened of the fact that the Radiologist is a medical man first, and an X-Ray man afterwards.

In support of all that I have said in this section regarding the status of the Radiologist, and also to stimulate good diagnostic work by the junior radiologists of the present day, and the budding radiologists of the near future, I cannot do better than cite the examples set forth by such eminent men in this line as Drs. A.E. Bar-day, Gilbert Scott, Stanley Melville and Martin Handek.

They have been amongst the pioneers in this field; by their prolonged and painstaking work they (along with many others no doubt) have contributed very materially to the laying of the foundation of Radiological Diagnosis on solid rock; their opinion is so highly valued by their surgical colleagues that they would not hesitate to open an abdomen, or do thoraco-plasty merely on the radiological report. Yet even to the present day how eager all of them are to secure all the possible clinical information in every case, and they never miss an opportunity to verify their X-Ray findings by attending the operation theatre, or the post mortem room!

Radiology in diagnosis of the Normal.—Before passing on to the next, and the last section of this article that is Radiology in the Diagnosis of Disease it may not be out of place to note in brief how far Radiology has helped in giving us truer knowledge about *practical* "normals" as met with in every day practice of medicine, in contradistinction to the *theoretical* "normals" learnt in the dissection room. In this connection may I suggest that a series of X-ray demonstration of the normal human anatomy from the living may be profitably included in the curriculum for the students in the various

of many of the internal organs—not to speak of the structural changes in diseases of Bones.

Principles of Fluoroscopy and Radiography:—To clear many of the uncertain ideas as to how X-rays assist in diagnosis, it may not be irrelevant to state in brief the few underlying principles of the processes. They are:—

I. Whenever a body is interposed in the path of X-Rays, a portion of the rays will be absorbed in the body, and the remainder will pass out.

II. The amount absorbed depends upon the density, the atomic weight, and the volume of the body; the greater these are, the greater the absorption. Therefore if a limb is placed in the path of the rays the bone will absorb more than the flesh, and a thigh will absorb more than the fore-arm.

III. Whenever X-rays strike crystals of certain substances e.g. Barium Platino Cyanide, the crystals fluoresce. The fluorescence is directly proportional to the intensity of the X-Ray—i.e., brighter fluorescence for stronger X-Ray beam. If the limb is placed between an X-Ray bulb, and a screen made of this double cyanide, the surface of the screen where it is not against the limb will fluoresce very strongly: the fluorescence will diminish slightly over the part where it is against the fleshy portion of the limb, and will be very dim—i.e., dark, on that part of the screen which is opposite to the bone. In other words we get a picture of the limb on the screen delineated in shadow. This is Fluoroscopy and it enables us to appreciate gross features only.

IV. Photographic films are affected by X-Rays in a manner similar to that of light, so that if a photographic film is placed against the limb, we get a picture so to speak, wherein the light portion represents the bone the darker portion the flesh, and the darkest portion of the film the place where nothing but air intervened between the X-Ray bulb and the film. This is Radiography, and it enables us to appreciate minute details of structure.

V. As a corollary to the foregoing principles is this the fifth one namely—a shadow is seen by contrast only. For, supposing the bone absorbed as much X-Rays as the soft parts (which it very nearly does in diseases associated with extreme decalcification), one would get just a silhouette of the limb in which the distinction between bone and flesh would be lost.

This principle demands in some branches of radiography the administration of certain heavy substances—in a non-toxic form, or the injection of air in or about the organ, when such organ is non-opaque to X-Rays, to create an artificial contrast.

The Art and the Artist:—In order that radiology may be a reliable diagnostic adjunct, it is essential to have a standard of minimum requirements for both the artist and his art—that is, the radiologist and radiography.

First the skiagram should be in the photographic sense “contrasty” and as full of details as the part of the body would permit. In the early days when the power of the apparatus, and the speed of the photographic plate were very limited any X-Ray “picture” showing the bare outlines of the bones were considered satisfactory, and thus evidently the scope for diagnosis was very narrow indeed. In those very early days to get a radiograph of the hand as long as one hour's exposure was needed. But thanks to the spirit of co-operation prevailing between the radiologist, the instrument maker, and film manufacturer, very rapid strides have since been made in all directions so that at the present day even with a modest piece of apparatus it should be possible to obtain in fraction of a second, a radiograph of the chest showing the minute details of structure of the lungs. Generally the structure of bones, and outlines of the solid viscera ought to be easily discernible on the radiogram. Anything short of that should be considered useless for purposes of diagnosis.

But it is futile to expect assistance in diagnosis even from the technically most perfect negative; since it is not a picture of Mr. Tuberculosis of Lungs or of Miss Carcinoma of the Spine so that by merely looking at the “picture” any doctor would recognise the original.

The X-Ray picture on the contrary is a “shadowgraph” of the part, and to be of any service the shadow has to be interpreted in terms of pathology by one trained in that art. Obviously that demands on the part of the physician practising Radiology, an intimate acquaintance with the shadow-pictures of the normal in the first instance; secondly, a knowledge of the chief pathological changes in the various diseases, and thirdly, the ability to understand why and to what extent these changes alter the normal shadow. In other words, at least a working knowledge of applied anatomy, pathology and physiology, together with a general knowledge of medicine and surgery are essentials for a good Radiologist over and above his specialised knowledge of the science and art of X-Rays and photography.

This brings me to the next problem namely:—

The training and status of the Radiologist:—Up till only a few years ago there was no facility for systematised training in any institution or University. Naturally, all the older radiologists had to be self taught, working against heavy odds. As a result of their

medical Schools and Colleges? The importance of the subject is emphasised by Barclay in the *Journal of Anatomy*, April, 1920 where he says "the anatomy of the living and of the dead are two very different things and, to the medical student at any rate, it is the anatomy of the living that is of value."

We have got now through X-Ray examinations of a large number of healthy people of different bodily builds clearer ideas as to the normal variations in the size, shape, and position of the abdominal and thoracic viscera. This is known as "habitus." It has given us a new angle of vision whereby to judge when these organs are definitely abnormal.

Any senior Clinician who has been taking the help of the Radiologist, in his practice would surely notice on reflection, that in recent years there has been an appreciable "drop" in the number of "dropped" stomachs, and dropped colons.

Similarly with regard to the chest. Formerly many (I was almost going to say "any") chests were condemned as abnormal, or diseased because X-Ray pictures showed exaggerations of certain normal structures of the lung. This is not always a result of part or present disease but due to the breathing of air as it is, in every day life. It is possible to get an anatomically normal chest for skiagram in the ante natal state of human life, or in the problematical race of men living in the pure atmosphere of the high Himalayas, but obviously we cannot set up these *theoretical normals*, as standards whereby to judge "chest cases" as they crop up in daily practice, if they are sound or diseased. A very senior specialist in Radiology of the chest declares that he has not come across an "ideal chest" yet although he has been hunting for the same for years. Recognition of normals in chest, as now established by X-Rays has saved thousands of people in recent years from being branded with the stigma of tuberculosis.

Appearance of the centers of ossification in epiphyses, and the fusion of the latter with the diaphyses as seen on the X-Ray films of bones were relied upon very greatly in the past (with the help of the tables of average dates given in anatomical text books) to determine the age of a person. But X-Rays have shown frequently that there might be wide variations both individual and racial in this matter. Thus there cannot be an universal standard, and unless different tables are drawn up by a large number of X-Ray examinations, for the different races of the world, radiological determination of age will very often be erroneous. X-Rays have also revealed a discrepancy in the number, and arrangement of the ossific nuclei from that given in anatomy.

Radiology in diagnosis of the abnormal.—This section does not presume to deal with the X-Ray findings in the different diseases of the different systems. It is of the nature of an index noting in brief how far one can expect Radiology to help in the process of diagnosis, that is, its uses and limitations.

Injuries and diseases of Bones and joints injuries:—The man in the street knows now how fractures can be diagnosed by X-Rays. My only excuse for referring to this subject at all is to emphasise a few important points that are quite often lost sight of, even by some radiologists.

These are :

I. Fluoroscopy is useless for excluding or establishing fractures.

II. Radiography of the part from two different aspects must be done in every case for this purpose. If anatomical or surgical reasons do not permit this, the value of the finding is proportionately diminished.

III. Fractures of certain parts of the skeleton are sometimes impossible to detect by X-rays—as in the base of the skull, the lateral aspect of the ribs, and the posterior surface of the sacrum. The difficulty is accentuated in the case of the rib and the sacrum, by corpulence of the patient.

IV. It is useless to try to determine by manipulation under the screen if union of fracture has taken place. The only positive sign of union is the presence of bony continuity of the fragments—which can only be shown in a radiograph.

V. Stereoscopic radiography is of great help in truly judging the position of the fragments.

Diseases of Joints:—X-rays afford a comparatively easy means of distinguishing between intra,—and the extra—articular inflammations, and in conjunction with the clinical picture of the case, of determining the nature of the arthritis—whether infective, tubercular, neuropathic or rheumatoid etc.

Diseases and Tumors of Bone:—The value of X-rays in the diagnosis of these conditions is inestimable. Certain changes are produced in the texture, size and shape of the bones as results of infective, neo-plastic and constitutional diseases, which can be made out (apart from operation) by good radiography only.

A few important points should always be borne in mind in the radiographic diagnosis of bone diseases.

I. Inflammatory disease of bone is rarely if ever, limited to any one of the component structures. All of them are practically simultaneously affected, producing if I may coin the expression—a "periosteomyelitis".

II. Absence of pathological changes in the bone texture does not negative the possibility of acute osteomyelitis. It takes time for the pathological changes (hence—radiographical as well) to develop. Subsequent examination would reveal the changes, if the case is not quickly fatal.

III. In any case showing loss of bone structure the possibility of malignancy should be kept in mind, as the chances of saving life depend upon early detection of the malignant nature and employment of adequate therapeutic measures.

Incidentally it may be stated, that a case complaining of "aching pain in the bone" should be immediately sent for radiography of that bone, to exclude malignancy, as very often "aching" is the only symptom in the early stage of the disease.

Accessory Nasal Sinuses :—Radiographical investigation of these sinuses for infection or neoplasm is comparatively easy, but it is not always possible to say definitely from the film if the opacity observed is due to a chronically infected and thickened mucous membrane or to an accumulation of fluid.

In the case of the ethmoidal sinuses bilateral disease is difficult to detect when the sinuses are small; further it is not always possible to determine which group (the anterior, middle or the posterior) of cells is affected.

Mastoid air cells :—Although it is possible to obtain valuable information as to the presence and extent of infection in these parts radiography is very seldom resorted to, as the clinical signs are definite. It is impossible at times to diagnose a sequestrum because of the character of the cells, which are small, multiple, irregular and with thin intervening septa between each other. Radiography is useless before the 6th year of life as previous to that the cells are not aerated.

Diseases of lungs, pleura, and mediastinum :—Roentgenology of the chest is at once the most simple, and the most difficult work for the Radiologist: *simple*, because with a comparatively easy technique earliest tissue changes—before physical signs have developed—can be shown up in the radiograph, or wherefrom the deep situation of the lesion, or from the smallness in the size of the lesion the ordinary physical signs are masked by the surrounding healthy tissues; *difficult*, because nowhere possibly it is easier to make an erroneous diagnosis in the positive sense, that is detecting disease where none is present.—The need for correlation between the radiographic and the clinical findings, is the greatest in this field to avoid errors which are far-reaching in their consequences.

In any radiological investigation of the chest *fluoroscopy* is *essential*. The character of the diaphragmatic movement, effect of

inspiration and expiration on the illumination of the lung fields, changing of fluid levels in cavities or pleural space are all very important diagnostic *indices* that can only be studied on the screen. But by itself, *fluoroscopy* is *inadequate* for complete investigation since the finer tissue changes cannot be made out on the screen.

Intra-thoracic tumors of all sorts benign or malignant, extra, or, intra-pulmonary are being detected more often now, by radiography, than in the past by the other methods of examination. But it is only fair to emphasise at the same time that it is impossible to decide conclusively whether the opacity in the lung fields is an unresolved pneumonia, abscess, bronchiectasis, or malignant disease, from ordinary radiography—without accessory aids, such as injection of lipiodol, induction artificial pneumothorax etc.

Difficulty is equally great in determining the nature of a "mediastinal tumor"—by X-ray picture only, i. e., whether it is lymphosarcoma, lymphadenoma, thymus tumor, or an aneurysm etc.

By radiography, it is possible to obtain information only as to the nature of pathological changes in the lung tissues infiltration, or softening, or fibrosis etc. but it is impossible to be sure of the causative factor—septic, or tubercular. Similarly, the presence of fluid in the pleura is easily detected, but the nature of the fluid—serous, sanguineous, or purulent—cannot be determined.

Lastly, it is important to form a correct estimate as to how far radiology is of help in the diagnosis of pulmonary tuberculosis. The whole position is summarised thus by Dr. Melville :—

"(1) Definite infiltration can be demonstrated upon any X-ray film, at quite an early stage of the disease, and frequently before definite physical signs are evident.

(2) X-ray evidence extending over a period of some months, and *consistently negative* may be taken as conclusive evidence of the non-existence of pulmonary tuberculosis.

(3) In cases where physical signs are present it may be assumed that the initial stage has passed and in such cases, the X-ray picture will show as a rule much more extensive disease than can be demonstrated by physical examination. This is especially true in the presence of deep seated lesions, and where there is emphysema both of which are a handicap to the clinician."

Diseases of the Cardio-vascular system :—Radiography and fluoroscopy has been of *some* value as auxiliary aids in the diagnosis of diseases of heart and great vessels. But as yet it has not been possible to obtain infallible "radiological sign complexes" for the valvular or functional diseases of the heart. Certain shapes are associated with certain valvular diseases but as these diseases are very often complex it would be unsafe to diagnose a particular valvular disease from a particular cardiac silhouette alone.

In the accurate determination of the size of the heart X-rays have proved of better value. In the early stage of hypertrophy of left ventricle when clinical evidence is not forthcoming, radiography provides an easy and reliable method for detecting the condition.

Then again it is a sure and ready means of ascertaining the width of the aorta, though it may not be always possible to glean any information as to the cause of the dilatation—whether specific, arteriosclerotic or sequel of cardiorenal disease.

For the diagnosis of aortic aneurysms radiography lends an invaluable aid, since in many cases the clinical evidence is absent or inconclusive, but unfortunately the help is inconstant for at times the radiological signs are equally inconclusive. It is then extremely difficult to differentiate the condition from mediastinal tumors etc., and it taxes the skill and knowledge of the radiologist to an incalculable degree, to arrive at a decision.

DISEASES OF THE ALIMENTARY SYSTEM.

Salivary Glands :—X-rays are helpful in detecting calculi. These are mostly composed of calcium salts—and hence show well. Absence of shadow over the regions of the glands in a radiograph of the part, is a conclusive evidence against the presence of any calculus.

Teeth :—The potency of dental sepsis in the causation of a host of diseases is now well recognised. X-rays afford the only sure means of excluding, or determining the presence and extent of dental sepsis, for by no other method of investigation is it possible to examine the condition of the peri-dental, peri-apical, and intra-dental regions—wherein most often the infection lies. Whiteness of the teeth, and failure to express pus from between the gum and the teeth are no index of healthy teeth.

Besides spotting the site and extent of infection, X-rays also help in readily detecting odontomes and cysts very early in their course, so that surgical removal is possible without mutilation of the jaw, and subsequent disfigurement of the face.

X-rays are useful to the dentist to ascertain the condition of the teeth in bridge and crown work; to check up their work i.e., to be satisfied that the whole of a tooth has been extracted, or a root canal completely filled up, to find out if an unerupted tooth is present at all and if so its relationship to the neighbouring teeth.

One word of caution: dental radiography, particularly the interpretation, should not be left to the “rank and file” of the dentists. The taking of satisfactory films is a difficult job, and for the interpretation of the dental radiograms—a sound general radiological knowledge is an indispensable *sine qua non*.

Oesophagus, Stomach and Intestines :—Investigation of diseases of these organs by X-rays is at once very practical, and the results

reliable, but direct fluoroscopy or radiography is unavailing, since these organs are transparent to the rays and hence cast no shadow. So administration of opaque meal or opaque enema is necessary according to the case, to fill up the lumen of these viscera, and thus deduce by contrast, the nature of the boundary wall—wherein pathological changes start, and cause alterations in the normal outline. The basis of all contrast meals and enemas at present, is *chemically pure* Barium Sulphate.

The meal or the enema is not troublesome to the patient; and no risk attaches to the examination if the proprietary contrast meals now-a-days readily available everywhere—are used. The proprietary meals have a delicate flavour so that the most fastidious patients cannot have any objection.

Broadly speaking, the various pathological changes that take place in the wall of the alimentary canal may be grouped into three classes, each class producing its characteristic change in the barium shadow of the normal lumen.

First, addition of new tissue—will encroach upon the lumen, and hence will not allow any contrast medium in that part—producing a “filling defect.”

Second, subtraction of tissue from the wall will produce excavation—and thus the normal lumen will be enlarged in that region by the extent of the excavation—this local enlargement showing on the radiogram as a “budding” or “niche”.

Third, fibrosis produces changes in the normal form of the organ such showing up readily in the X-ray picture as deformed appearances.

Of course in the production of the deformities, and of the “niche” spasm is an important factor, but we need not enter into the *modus operandi* of this element, in such a broad discussion as the present one.

The above radiological changes are the so-called “direct signs” and, though requiring a lot of skill and experience for their detection and interpretation, are absolutely positive, and clinch the diagnosis. Apart from these there are other signs—depending upon changes in the functions of organs as results of disease, e.g., alterations in normal peristalsis,—which though not reliable for diagnosis by themselves, have a corroborative value in the presence of the direct signs, or a suggestive value in their absence demanding a very cautious re-examination of the case to elicit the direct signs.

Formerly great importance was attached to these indirect signs. They went to form radiological sign complexes which together with the clinical picture, were utilised in inferring the nature of the underlying pathology i.e., in diagnosis. But with better technique and better realisation of radiological changes

likely to occur in the pattern of the wall of these viscera as results of various diseases, more and more often the direct signs became detectable, and the indirect signs diminished in importance correspondingly. Even to this day, however, we are dependent on indirect signs alone for the radiological diagnosis of diseases in certain parts of the alimentary tract, appendicitis, colitis, tuberculosis of caecum etc.

Next to laparotomy, X-rays afford the most accurate information as to the presence or absence of diseases in stomach and intestines. Now-a-days in many hospitals all "stomach" cases are referred straight to the radiologist for diagnosis, and his report is taken as the last word in deciding upon the line of treatment.

The medical world is indebted to Radiologists like Handek, Berclay, Scott and Carman for elaborating the methods of X-ray diagnosis in gastro-intestinal diseases, to such a fine and precise art that speaking generally, at present it is possible to detect in the vast majority of cases small peptic ulcers, early carcinomatosis, tubercular and syphilitic affection, polyps and diverticuli—in fact the whole lot of diseases, the gastro-intestinal tract is liable to. Yet a small minority of cases remain where the direct and hence pathognomonic signs are not always possible to elicit; but it is hoped that with the advent of newer methods in technique this disability will soon be a thing of the past.

Fluoroscopy is of paramount importance in gastro-intestinal work. Not only the direct signs, but the indirect ones as well can be satisfactorily studied on the screen. Radiography may be dispensed with and diagnosis can be made only by screen examination by an experienced radiologist. In fact, in gastro-intestinal work the value of radiography lies *not* in demonstrating the alterations that cannot be seen on the screen but in corroborating the fluoroscopic observations and giving time to the Roentgenologist to come to a well reasoned conclusion.

Before bringing this chapter to a close, a few words on the usual manner of referring stomach cases to the Radiologist may not be out of place. Very often cases are sent with a chit with the few cryptic words "X-rays please". A short note of the important clinical features always helps the Radiologist to concentrate his efforts in eliciting the direct signs. Another more embarrassing situation is created by sending a case with a request for "a film of the stomach, duodenum, and gall bladder," or for "3 films, $\frac{1}{2}$ hr., 2 hrs., and 4 hrs. after Bismuth meal."

It is important to realise that X-ray picture shows two contours, and one aspect of an organ—which may be normal, whereas the abnormality may be present on the reverse aspect and hence missed if only one film is taken. It is true that *sometimes* in a routine

opaque meal examination of stomach and duodenum, signs suspicious of pathological gall bladder, or of gall stone are observed on the radiograph, but the absence of such signs in a radiograph of this region has no value whatsoever.

Retention of an appreciable amount of the opaque meal in the stomach five hours after ingestion is a sign of some diagnostic import but films taken at stated intervals have no diagnostic utility.

Pancreas:—Chronic indurative pancreatitis, and malignancy can sometimes be indirectly deduced by correlation of the clinical picture with the suggestive signs afforded by deformities of the pyloric end of the stomach, and of the duodenum, but as yet no distinctive radiological sign has been established for either of these two diseases.

Liver:—Certain conditions can be detected by X-rays such as hydatid disease, and local or general enlargements (if at all marked), but it is not possible to state with any degree of accuracy if the enlargement is obstructive, inflammatory, or neoplastic in origin.

Attempts have been made to diagnose radiographically subphrenic and sub-hepatic abscesses. The findings are not conclusive in many cases. The best that can be said in most cases is that "the appearances are consistent with" subphrenic or subhepatic abscess.

Gall Bladder:—Except for a small percentage of cases gall bladder and gall stone cannot ordinarily be detected by radiography pure and simple, since their X-ray absorption is the same as that of the surrounding tissue, and hence no shadow is cast. Whenever simple radiography reveals them—the gall bladder is pathological, and the stone has an appreciable amount of opaque calcium salts entering into its composition.

Disease of gall bladder or gall stone can sometimes be *suspected* during opaque meal examination of the stomach and duodenum from the behaviour of these organs, or from a defect in the contour of the duodenal bulb.

Radiography of the gall bladder region was practised in the early days on the off chance of detecting a stone, or a pathological gall bladder, but negative findings had no value. Attempts were made to visualise the gall bladder, by injection of air into the peritoneal cavity—and though comparatively satisfactory so far as the demonstration of disease was concerned, the method had to be abandoned because of certain difficulties and risks. At present a tetra-salt of iodine is administered either orally (safe method), or by injection into a vein, and radiographs are taken some hours afterwards. The dye is excreted by the liver in the bile, collects in the gall bladder where concentration of the dye takes place—allowing a satisfactory radio-

graphic delineation of the gall bladder, and the contained stones if any.

Very high hopes were entertained in the beginning—on the *rational* of the method described above, and from the results in the first few cases,—of this method proving consistently reliable in the detection of gall stones and pathological gall bladders. The net achievement has however been a raising of the percentage in which gall stones could be detected. The method cannot be depended upon for detection of pathological gall bladders since apart from many fallacies, obviously abnormal, gall bladders have cast shadows characteristic of the normal, and *vice versa*. So the present position of gall bladder radiography is more or less the same as it was in the past—namely it is corroborative of the clinical diagnosis in the case of positive findings; the negative radiographic results have no diagnostic significance.

Diseases of the Urinary system:—Apart from spotting a “stone” anywhere in the urinary system, radiography helps in estimating the size, shape, composition of renal stone, and in some cases of the function of the kidney as well.

The diagnostic value of X-rays in urinary calculi is truly great since except the very rare instances of *pure* xanthin and uric acid stones, all else are readily detected by the rays. It is important however, to remember that an X-ray picture is a projection on *one plane* of the shadows of substances that may lie at different depths from the film, thus rendering it impossible to judge from one picture alone if an opacity in any of the urinary areas (i. e. renal, ureteral, and vesical) is caused by an opaque body lying inside these organs or, external to them. Unless that is determined accurately which is possible only by modifications of the usual technique, and application of other accessory methods to which I would refer shortly, the diagnosis of urinary calculus is not justified in many cases from one film.

The modifications of the usual technique consists in the taking of one film in the lateral position, or of two films in inspiration and expiration. This does not require the assistance of a second medical man, but in the employment of the accessory methods i.e. passing of an opaque ureteral catheter, or ureteral or vesical injections of an opaque (to X-rays) solution, the services of an urological surgeon are indispensable. By such procedures only is accurate localisation of an opacity and differential diagnosis from various other opacities in these regions (e.g. gall stones, caseous deposits in Psoas Abscess, pancreatic calculi, atheromatous plaques in arteries, calcified glands etc.) possible.

Radiography of the urinary tract after injection of an opaque solution (usually of Sodium Bromide now-a-days) into the ureter and

pelvis or bladder is called pyelography or cystography. The term “retrograde pyelography” is now used to distinguish it from the latest method of intravenous pyelography, in which a non-toxic synthetic dye containing Iodine and sold under proprietary names of “Uroselectan” or “Abrodil,” is injected into a vein. The dye is excreted in urine which renders the kidneys, ureter and bladder opaque to X-rays. For the injection of this dye the assistance of a second medical man is highly welcome, though not essential, since about 100 c.c. of the solution is to be injected into a vein very slowly.

Attempts are being made to utilise the new method in estimation of the functional activity of the kidneys, by noting the excretion time. It is too early to say anything as to how far the new method will justify the expectations in this line, but it can be said that the intravenous pyelography has certain commendable features which make it an useful addition to the Radiologists’ store of accessory techniques.

These are:

- (1) Non-toxicity of the dye.
- (2) Freedom from pain to the patient and unpleasant after effects.
- (3) Simplicity of the injection not requiring the assistance of a skilful urologist.
- (4) Applicability of the procedure in the presence of vesical sepsis which would contra-indicate instrumentation for “retrograde pyelography.”

Besides the detection of calculi it is possible to distinguish certain diseases of the kidneys and bladder by Radiography, such as hydro, and pyo-nephrosis, new-growths cystic disease, early tuberculosis of kidneys, papilloma and diverticuli of the bladder. For this also pyelography and cystography are sometimes necessary for a correct diagnosis.

Before leaving this subject I think it is worthwhile to emphasise three points that are well known—but sometimes neglected in practice. These are:

- (1) Meticulous care in the preparation of the patient, and sticking to a standardised technique are essentials in producing a good reliable skiagram. “Flatus, faeces, and fluid” in the intestines, mask the kidney outlines, and hide the less opaque stones.
- (2) Fluoroscopy is not only useless, but positively dangerous for the Radiologist if he tries to hunt out a calculus, or to define the renal outline under the screen.

- (3) A final radiograph should always be taken immediately before the operation for the stone previously detected might have shifted from the pelvis or the ureter, into the bladder, in the interval between the first examination and the operation. This practice saves useless operation and incidentally the Radiologist also from unmerited blame.

Diseases of the central nervous system:—X-rays have not been of much help in this field. The only conditions which produce radiographic changes are tumors and hydro-cephalus, but by the time changes are produced in the calvarium the other clinical signs are definite, and the disease is too well advanced to need any auxiliary aid from Radiology, for diagnosis.

Sometimes a uretral tumor may be directly spotted by the calcareous changes it undergoes, but such calcification is rare. Tumors of the pituitary may be diagnosed from definite changes in the sella turcica.

There is however a limited range of usefulness for the X-rays when the question of locating the tumor arises with a view to operative interference. All cerebral tumors produce deformities of the lateral ventricles. For tumors on the silent areas of the brain the deformity can be made out by accessory method called "ventriculography"—which consists in drawing out a part of the cerebro-spinal-fluid and replacing it by air through a small trephine hole over the occipital lobe of the brain and then taking the radiograph. The site and extent of spinal-cord tumors can be made out by simultaneous injection into sub-arachnoid space of Lipiodol from above and of air from below, and taking a skiagram after the injections. It is superfluous to note that such diagnostic procedures are far from simple and safe. "The interpretation of the skiagrams is a matter of difficulty. Moreover, there are possibilities of fallacies even after the most skilled interpretation" (Redding).

Diagnosis of foreign bodies:—With a few exceptions to be mentioned later the presence of a foreign body in any of the systems can be detected and accurately located by X-rays. But for this much more is wanted than a simple examination under the screen, which appears to be the general impression.

A correct localisation of foreign body is the greatest boon for the surgeon and the patient alike; one is saved the annoyance of fruitless and prolonged search with the scalpel and the other the fruits thereof, namely slashing of the tissues and prolonged convalescence.

Cases of thorn in the hand or heel of a tiny fish bone in the gullet are frequently sent for X-ray examination but these are very often impossible to detect according to one of the

principles explained earlier in this article, namely a shadow is seen by contrast only. The shadow of the fish bone may be effectively hidden by any of the shadows of the bony parts in the neighbourhood of the gullet. In the case of thorns or splinters of wood no shadow is cast, since their X-ray absorption is practically the same as that of the tissues.

Cases of splinters of glass in the hands or heels are not however as frequently referred to the Radiologist through the mistaken belief that glass being a transparent substance will not show. Except the pure glass out of which the chemists' apparatus are made, all glasses cast more or less dark shadows according to the nature and proportion of the metallic salts in their composition.

A pin in the alimentary canal if it is end on with regard to the film can hardly be detected; the point-like shadow of the pin produced in this position, is easily missed in the medley of shadows invariably present in a film of the abdomen.

A foreign body in a bronchus cannot be seen, if it happens to be soft vegetable or animal matter (as occurs sometimes from food going down the wrong way). The presence of such a foreign body has to be inferred from the alterations produced in the X-ray illumination of the lung, as a result of obstruction to respiration.

X-rays in Midwifery & Gynaecology:—The chief diagnostic uses to which X-rays have been put in this branch of medicine are:—

- (1) Diagnosis of pregnancy (possible after the 4th month of gestation), when from various reasons the ordinary signs and symptoms are inconclusive, or unavailing,
- (2) Detection of twins, and their relative positions to each other.
- (3) Determination of the presentation,
- (4) Measurement of the pelvic brim,
- (5) Demonstration of the patency of the Fallopian tubes (by lipiodol injection through the uterus),
- (6) Exclusion of calcareous changes in fibro-myoma of the uterus before X-ray treatment of the same.

It is well to lay stress on the fact that X-ray examinations during pregnancy is *absolutely harmless* for both the mother and the foetus. There is already a lurking fear in the minds of the general public that such examinations destroy the foetus in utero, or induce abortion or miscarriage. Such baseless fears instead of being allayed, are aggravated if erroneous informations regarding the function of X-ray apparatus is published by qualified obstetricians, more or less in the following terms: "Nowadays *with* the Potter Bucky diaphragm there is no risk for the mother or the fetus in X-Ray

examination." A statement like this implies that X-rays wrought mischief before the advent of the Bucky diaphragm. This is not correct, for if X-ray examination were risky before, the risk instead of being lessened would be doubly accentuated by the diaphragm as it doubles the exposure to the rays. Thus, it will be correct to say that X-ray examination is *absolutely innocuous* as "now a days, *in spite of* the invariable use of Potter Bucky diaphragm which doubles the amount of X-rays received, there is no risk for the mother or the fetus!"

Before closing, I wish to state that consideration of space prevents me from discussing in this article some of the hindrances to the practice of Diagnostic Radiology in India, which I hope will form the subject matter of a future contribution.

For Healthy Nutrition

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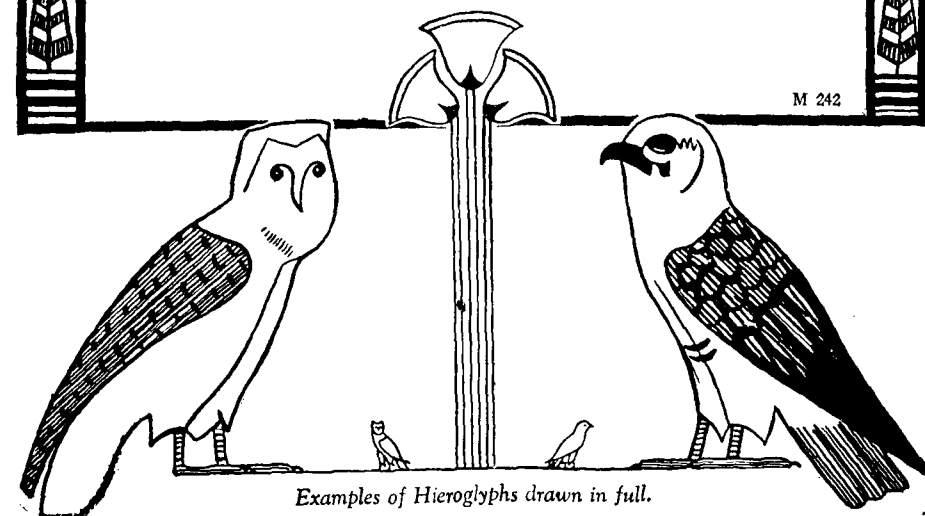
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PHYSICS OF RADIUM AND RADIUM THERAPY

BY

DR. M. J. S. PILLAI, L. M. & S. L. R. C. P. & S. (EDIN.)
 L.R.F.P. & S. (GLAS.) D.R.M.E. (EDIN).

Radiologist, Govt. X-Ray Institute, Madras.

THE following have been prepared for the benefit of the Post-Graduates to bring into prominence certain important factors which are absolutely necessary for the understanding and application of Radium Therapy.

I have tried to group most of the factors published by me in "Madras Medical College Magazine" and the "Organ of the Provincial Medical Association" etc.

Now to the subject and to be brief :—

The famous "Becquerel Burn" gave birth to Radium Therapy. In 1901 Becquerel was experimenting with a glass tube containing Radium and placed the tube in his waist—coat pocket, in which it was left for several hours. Two weeks later there developed a severe dermatitis on the skin in the neighbourhood of the pocket. This reaction drew the attention of the medical profession to the biochemical action of such radiations and upon this accidental beginning the medical application of Radium has been evolved.

As a knowledge of the Physics of Radium is essential to the understanding of the methods of its medical application it may prove instructive for readers to have placed before them in a concise form a few facts about this wonderful Element, which is proving so useful and has so great a future.

Radium is a metal of the Alkaline earths, similar to Calcium, Magnesium, Barium and Strontium, and its existence as an Element has been exactly ascertained by spectroscopic analysis. Its symbol is Ra and its atomic weight is 226.45, these figures having been obtained by Madame Curie. The melting point of the Element is 700°C.

Radiations from Radium are composed of three types, these having been designated Alpha, Beta and Gamma, by Sir Ernest Rutherford, who made the first analysis of these complex rays. They are emitted simultaneously, their relative proportions being approximately 10,000 : 100 : 1.

Alpha Rays.—Are atoms with a positive electrical charge. They are the least penetrating of the three types, having a velocity of a tenth to a twentieth of that of light. They are deflected by strong electric or magnetic fields, can be collected on wires negatively charged and the Radiations tested on a screen of zinc sulphide. As Alpha rays are absorbed by about three inches of air, thin sheets of

paper, rubber or metal, they are practically useless for the external treatment of patients.

Beta Rays.—Are similar to the Cathode Rays generated in an X-ray tube, but are more penetrating. They are negative electrons and consist of bundles of rays with velocities varying between 60,000 and 180,000 miles per second. By adopting filters of different densities the desired rays can be utilised for therapeutic purposes. It is usual to term the rays which are absorbed by 0.25 m.m. aluminium as "soft," those that cannot pass 0.25 m.m. copper as "medium" and the radiations that can pass through this thickness of copper as "hard." The "hardest" of these rays do not penetrate more than about three-eighths of an inch of human tissue; a filter of 4 millimeters of aluminium or 1 m.m. of lead will absorb practically all Beta Rays.

Gamma Rays.—Are similar to X-rays, although the hardest Gamma Rays are more penetrating. They are either vibrations of extremely short wave length, having the same velocity as light. It takes about six inches of lead to absorb these radiations, which are the most valuable from the medical point of view.

The intensity of the rays varies inversely as the square of the distance from the Radium. All the three types give off secondary radiations when they pass through or collide with any substance.

Methods of Application—Several methods are used in Radium treatment; there are.

- (1) Surface application, where the Radium containers are placed in close proximity to the skin or inserted in the natural passages.
- (2) Tele-Radiotherapy,* where a large quantity of Radium is enclosed in a "bomb" and the depth dose is given with the Radium at a short distance from the skin.
- (3) Interstitial, where needles and tubes containing Radium are imbedded in the tissues.

In all these methods filters of various substances are used to absorb radiation not required for the treatment of the lesion.

PREPARATION OF PATIENTS AND OTHER OBSERVATIONS.

1. The causal factors concerned in the lesion should first be removed. Any focal sepsis and other conditions retarding the progress under treatment should be attended to if satisfactory results are to be achieved.
2. The patient's general health is to be improved and brought into as fit a condition as possible before subjecting to irradiation, as.

* The Radium "bomb" apparatus in use in Madras will be described in a subsequent paper.

the power to combat the resulting reaction chiefly depends on the efficiency of the excretory organs.

Skin conditions such as Scabies, weeping Eczema, etc., should be attended to, as a healthy skin can stand a stronger dosage than an unhealthy one.

3. The blood should be examined for total and differential counts of the leucocytes, the number of R. B. C. and percentage of hæmoglobin, the resulting colour-index being noted.

During the course of treatment and after, several blood examinations should be made, as the condition found will decide the course of the further treatment.

4. A R.B.C. count of below 1 million per cc. is a contra-indication for irradiation and the treatment should be delayed till the count is brought up somewhere to about 2 millions.

5. In Leukaemia the reduction of W.B.C. to about 10,000 per cc. of blood should determine the discontinuance of treatment as the fall outlasts the treatment.

6. In lesions affecting the liver and the kidneys, efficiency tests should be carried out for the purposes of comparison later. Advanced lesions of the liver, the kidneys and the heart etc. are contra-indications for massive doses of Radium or X-Rays.

7. The bladder (urinary) should be kept empty before treatment to avoid intractable cystitis which sometimes follows in certain susceptible individuals. In cases accompanied by gastro-intestinal disturbances, the patients should be warned that the condition may be made temporarily worse, though there is no reason for unnecessary alarm.

8. No water or soap should be used over the irradiated part for 10 days and the exposed skin area should be protected against the Sun's rays. For the mild irritation of the skin sometime caused, Lanoline may be gently rubbed into the exposed area.

9. In irradiating the abdominal wall the linea-alba should be avoided in order that any subsequent operation may be carried out by opening through the central line without fear of the delayed or non-union of the skin, or other such complications which may follow if this precaution is not observed.

10. In the treatment of Asthma and allied conditions affecting the lungs and in the administration of massive doses in malignant lesions, the advent of protein shock should be anticipated and combated by intravenous saline injections, alkaline drinks and by the administration of Adrenaline Chloride and Glucose, accompanied by light, liquid, nourishing food given in small amounts at frequent intervals—iced, if necessary.

11. Chloretone in doses of 10 grains, to an adult, may be administered with advantage to overcome sleeplessness during the first 24 hours.

12. In the treatment of Goitre, when progress is slow, the presence of retro-sternal thyroid should be remembered.

13. The administration of mercury, arsenic and other metallic preparations should be suspended during the radiation treatment.

14. In cases of lesions of the pelvis situated in its depths, a combined treatment with Radium and Deep X-ray Therapy is productive of more beneficial results as compared with treatment with either alone.

15. The treatment for Menorrhagia should be carried out soon after the period is over, in order to avoid the usual reactionary excess which follows treatment when given immediately before the onset of the menses. Non-observance of this precaution has led to fatal results in patients bordering on life and death.

16. In general, a diagnosis describing the exact pathological condition of the tissue involved (e.g., Round cell Sarcoma, Squamous Cell Epithelioma, Columnar Carcinoma, etc.,) will greatly aid the proper application of Radium Therapy.

The nature of pathological tissue, the organ concerned in the lesion, the object aimed at (as for instance,

- (a) in delayed puberty, stimulative dose to the ovary is indicated,
- (b) in conditions requiring control of fertility, an inhibitory dosage is needed,
- (c) in menopausal conditions, complete sterility,
- (d) in tumours, a 'destructive' dose is called for,

the depth of the tissue involved, the condition of the skin, of blood and the efficiency of the excretory organs, etc., should be taken into consideration in fixing the correct dosage, to ensure satisfactory results, more particularly so in the bomb method of Radium treatment.

17. A regular team work consisting of a Physician, Surgeon, Pathologist, Serologist, Bio-chemist, Radiologist, Bacteriologist and Physicist in an atmosphere of sympathy and co-operation will greatly advance the cause of science in general and Radium Therapy in particular.

Basic principles involved in Radium Therapy.—The effect of irradiating living cells by Radium, if of sufficient intensity and

allowed to act for the required length of time, is to produce certain definite changes which have been classified into three phases:—

- (1) Increased cell activity accompanied by cell proliferation.
- (2) Arrest of cell activity and changes in staining reaction etc.
- (3) Degeneration and complete destruction of the cell.

The three phases are not necessarily noted in every case the transition from the stimulative to the destruction stage, depending entirely on the intensity of the stimulative stage, may be altogether absent.

Embryonic tissue, Pathological tissue, especially those with plenty of blood supply, yield readily to Radium Treatment. The cells undergoing karyokinetic changes are more vulnerable than those in the resting stage, are more easily stimulated, their vitality more quickly inhibited and degeneration is more easily induced.

It has been established that some tissues are more easily controlled and destroyed than others; a round celled sarcoma is much more readily affected than a Carcinoma; this response to irradiation is considerably modified by the nature of the resistance of the patient, the size and site of the tumour and its condition, whether ulcerated and infected or otherwise. The size and depth of tumour influence the dosage and technique of irradiation which must be exact to ensure an even distribution of its action throughout the tissues affected; the site of tumour and the extent of the involvement of tissues concerned, also decide the degree of influence of the irradiation. For instance, a rodent ulcer of skin is easily cured with a half strength plaque exposed for a few hours, whereas a rodent involving cartilage or bone is but rarely influenced. Again cancer of cervix, highly infected and badly ulcerated, rarely responds satisfactorily and if it does so, a necrosis sometimes occurs which opens up the uterine arteries with consequent severe haemorrhage. It is also noted that the epiblastic, mesoblastic, hypoblastic cells and the tissues derived from them, respond in different degrees to irradiation.

Lazarus Barlow found in his classical experiment upon the epithelium of the bowel and squamous epithelium of the rats' tail, that less damage was produced in the case of normal columnar, epithelium with a short exposure and a large quantity of Radium. The squamous epithelium responded exactly in the opposite direction. Basing his calculations on these data, Hayward Pinch has evolved a rough working formula for determining dosage, i.e., $D = Q \times T$, where D stands for dosage expressed in milligramme hours, Q for amount of radium bromide in milligrammes and T for length of exposure. 1.8 m.g. $\text{Ra Br}_2 \cdot 2 \text{H}_2\text{O} = 1 \text{ m.g. Ra SO}_4$. If the dosage decided is 3,000 milligramme hours, in the case of epiblastic tissue, it should be 50

milligrammes for 60 hours; in the hypoblastic tissue 150 milligrammes for 20 hours and in the mesoblastic tissue 100 milligrammes for 30 hours.

The principle of cross-fire treatment universally employed at the present time, with special reference to the growing edge of the tumour and the proper selection of dosage and screenage, has considerably increased the percentage of success in the treatment of Cancer. In fixing the correct dosage in the treatment of any particular conditions, the physical dose, the Biological dose, the dose quotient, the percentage depth dose, the effective dose, the appropriate or utility dose are all taken into consideration by Specialist in fixing the proper dosage.

For purposes of this paper, the percentage system of dosage and the details connected therewith, as also the sensitive co-efficient of tissue etc., need not be gone into at the present stage.

The other factors that enter into the consideration of dosage are the dispersive effects between the surface and deep layers, the absorbing capacity of the tissues, the scattering effects produced as the focal skin distance is varied, the size of the port of entry, the screenage employed and other concomitant factors. Again in dealing with secreting organs i.e., glands, it has been noted that a 100% dose causes destruction; 75 to 50% inhibits; and 32 to 25% stimulates. The ovary has been found to recover (after an inhibiting dose) in from 18 to 20 months. Mottrom of London, in watching the life cycle of cells under X-rays or Radium, found that the sensitivity of cells varied in accordance with:—

1. Structural character of cells,
2. Reproductive capacity of cell,
3. Power of growth in cell,
4. Nutrition of the cell,
5. Particular period of the life cycle of the cell.

In general the Radio-sensitivity is found to be greater in cells than greater reproductive capacity. The relative sensitivity of the different cells of the body to irradiation and other factors connected therewith will be discussed in a subsequent paper.

The tissues have been found to recover their resistance to radiation in the following order of time.

If 100% dose has been given to start with, it is noted that in 10 days the effect is reduced to 50%; in 30 days to 12%; in 40 days to 6%; and at the end of 50 days to 0. Basing the treatment on the above facts, there is one school of Radium therapy which believes and aims at destruction of pathological tissue en-mass in one dose and the second school, which, with a view to avoid many undesirable effects produced by such massive doses, emphasises repeated and

spread out doses at studied intervals, which produces identical results without the draw-backs of massive or intensive doses of short duration.

The more we study and understand the problems connected with Radiations, the more are we convinced that the application of Radiation therapy should not be taken light-heartedly by those who have not made a special study of the same.

In this connection the attention of the reader may be invited to the article on "The Radium Problem" containing the statement by the National Radium Commission, published in the British Medical Journal dated November 16, 1929 (pages 911 and 912). The following extracts are quoted:—

"*The Case for Radium.*—To sum up, a good case has been made out for the increased employment of radium. A new weapon, and a powerful one, has been placed in the hands of the medical profession, though how effective it may be it is impossible, as yet, to say. Nor is it yet established whether patients with malignant disease should be treated with radium alone, or with radium combined with surgery or X-rays. It is probable that a judicious use of all three methods may be required;

"*Skilled Handling essential.*—What is required at the moment is work, intensive, work in the many problems which present themselves combined with careful documentation of the methods used and registration of the results obtained. This calls for the close co-operation of physicists, clinicians, radiologists, and pathologists. Some brilliant work has already been done, but much more requires to be accomplished before the efficacy of radium can be finally established.

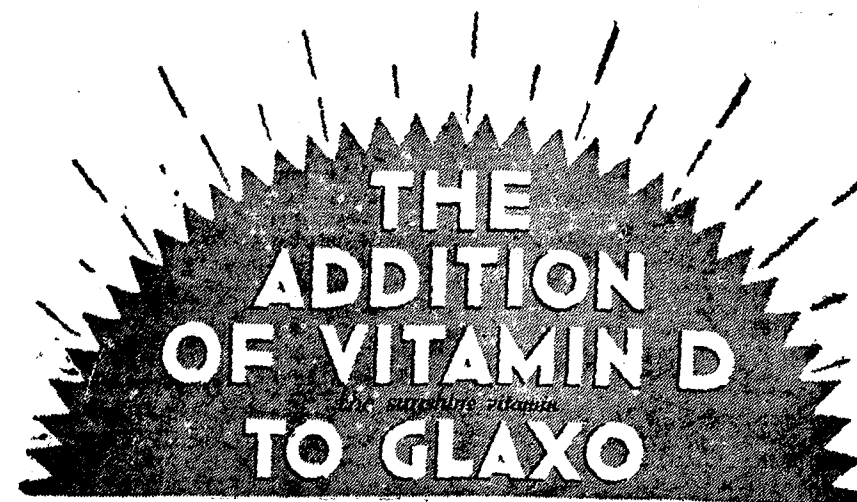
"Meanwhile, good and effective use can be made of a considerably larger quantity of radium, and this will shortly be available, as a result of the National Radium Fund. An even greater and more pressing need, however, is for more radium workers, trained in the highest standards of technique, and one of the first efforts of the Commission will be devoted to augmenting the supply of skilled personnel.

"It cannot too strongly be emphasised that, in unskilled hands (that is, in the hands of persons not fully trained in the best standards of technique), radium may be highly dangerous, both to the patients and to the operator.

"On the other hand, in radium, properly used, humanity possesses the best means at present available for combating certain form of cancer. * * * * *

With regard to the question of whether Radiation or operation is preferable, though the general opinion of the surgeon is that when a tumour is operable, operate, yet, the trend of opinion appears inclined in the direction of narrowing the limits for a radical operation and extending the field for radiation. This attitude is chiefly noted in America, Spain, France, Denmark and Germany where Radium Therapy has made great headway. In England, experienced surgeons are inclined to treat even early cases with Radium, especially so in the treatment of cancer of cervix where, when indicated, a combined treatment by Radium and X-rays produces very satisfactory results. The immunity experiments in mouse carcinoma by Russ and his co-workers and the appreciation of their inferential importance of the preliminary toning up the patient to increase his resistance; the improved methods adopted; studied dosage and the perfected technique; and the closer attention to the details enumerated elsewhere in this paper, are all conducive to the better utilisation of this powerful agent at our disposal for the relief of the suffering.

Radium Therapy is applied to various parts of the body in the several lesions calling for such radiation, the disposition of the needles, the implantation of the Radium seeds, the details of the Tele-roentgenological applications and other important considerations relative to this will be the subject of subsequent articles.



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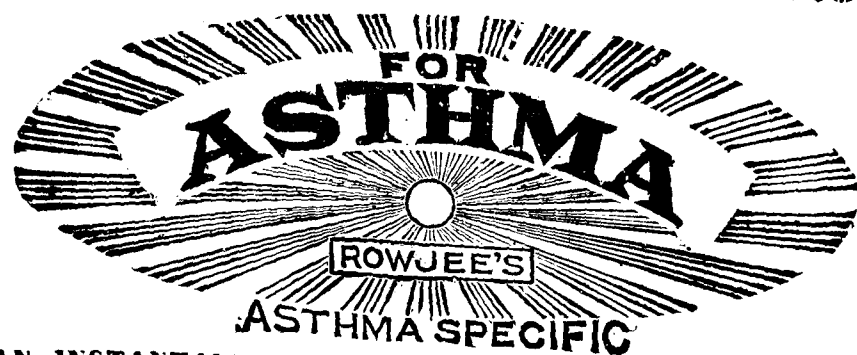
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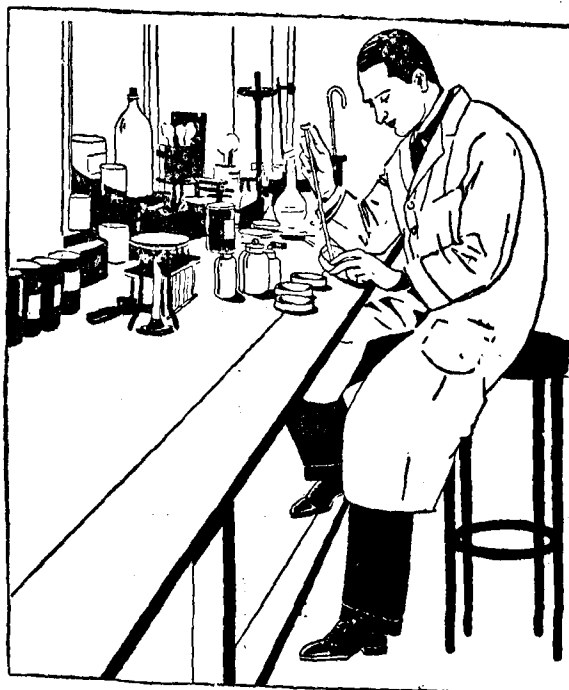
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THE TREATMENT OF CARCINOMA OF THE CERVIX UTERI.

By

DR. A. L. MUDALIAR, B.A., M.D., F.C.O.G.

(From the Giffard School of Obstetrics, Madras.)

CANCER of the cervix uteri is so much more common than cancer of any other organ, that it is desirable that the medical profession should be fully conversant with this condition, its early signs and symptoms and the method of treatment that should be followed. This disease is wide-spread—occurs amongst all communities and in all districts in this Presidency. Thus, while in 1929, 143 cases were admitted into the Government Hospital for Women and Children, Madras, in 1930 almost double the number sought treatment. As regards the age incidence, cancer tends to occur at an earlier age among Indians, the largest number of cases occurring in the age periods 35 to 45, while cases have occurred in girls of 20 to 25 years.

The treatment of cancer of the cervix or any other malignant condition extensively with Radium is of comparatively recent years. And it may be stated that considerable work yet remains to be done in standardising the method of treatment with Radium and in determining the most effective method of treatments as well as the dangers and complications and how best to avoid them. The haphazard manner in which Radium has been used and the lack of proper care in the details of the treatment have to a certain extent impeded the progress and it is now realised that the use of Radium requires care and certain technical skill to produce the best results.

It would be as well here to touch lightly on Radium, its character and properties. Radium is prepared from certain ores, the chief of which being Pitchblend which is an impure oxide of uranium found in large quantities in the Belgian Congo. Radium is a rare radio-active element with an atomic weight of 226 belonging to the alkali group of metals which include Barium, Strontium, Calcium and Magnesium. In its metallic form, it is a pure white metal, but on exposure to air quickly reacts with water to form Radium hydroxide. Hence only its salts are used for therapeutic purposes. There are three distinct sorts of rays given off by Radium, the Alpha Rays (A), the Beta rays (B) and the Gamma rays (V). It is the Gamma rays which we depend upon for therapeutic action. The unit of dosage is generally calculated by milligramme hours. A milligramme hour is the amount of Radiation given off by one milligramme of Radium element in one hour. There are two factors, one the Radium and the other, the time. If it is desired to give 1000

milligramme hours, it can be given in many ways, decreasing the one factor and increasing the other. Thus :

1000 milligrammes of Radium for 1 hour = 1000 milligramme hours.			
100	„	10 hours=	1000 „
10	„	100 hours=	1000 „

In early days large doses for short periods were given, but it has since been found that a smaller dosage with larger hours of exposure yields better results. Constant contact with Radium will produce the same disastrous results as exposure to the X-Rays. The strictest precautions should therefore be observed in handling Radium, its emanations or apparatus containing them.

The methods of treatment of uterine carcinoma vary widely in different clinics and there is considerable difference of opinion today as to which method of treatment yields the best results. Classifying the different methods broadly, the following methods of treatment are now in vogue :—

1. Operation.
2. Irradiation with :
 - (a) Radium.
 - (b) X-ray.
 - (c) Radium and X-rays.
3. Irradiation with operation which may be in one of three ways :—
 - (a) Operation and post-operative prophylactic irradiation.
 - (b) Pre-operative irradiation followed by operation.
 - (c) Pre-operative irradiation followed by operation and post-operative irradiation.

The question of operability is one about which there will always be individual differences of opinion. Heyman of Stockholm stated recently that he had three experts examine a case to decide what degree of the disease existed and they all disagreed. With some, if it can be demonstrated in any way that it is beyond the cervix, they will call it inoperable. Victor Bonney, on the other hand, would operate on cases which would be considered inoperable because there was definite invasion of the parametrium and vagina. On the other hand with the technique of pre-operative radium therapy, a larger percentage of cases are dealt with by radical surgery. Until the introduction of radiotherapy, only surgical interference of the most radical type offered any chance of cure for uterine carcinoma

Radiation therapy offered a new method of treatment for carcinoma and although at first the results were rather disappointing with improved technique and larger clinical experience, the end results are more satisfactory. With the introduction of Radium therapy, there is a free choice today between Surgery, Radiation therapy or Surgery combined with irradiation.

RADIATION THERAPY.

The technique of radiation therapy is by no means settled and here also there is divergence of opinion as to the dosage and method of application. It is as well to describe the different techniques adopted at the chief radium clinics.

The Heyman technique.—Dr. Heyman of Stockholm uses surface application to the growth of about 120 mgm. of Radium element on 3 occasions at intervals, the duration of each application being 19 to 21 hours.

1st treatment consists of :—

In the uterus (4 tubes) 40 mg. element for 19 hours = 760 mg. el. hours.

In the Vagina (12 tubes) 78 mg. element for 19 hours = 1480 el. hours.

2nd treatment a week later :—

In the uterus (1 tube) 43 mg. el. for 21 hours = 900 mgm.

In the vagina (10 tubes) 71 mg. el. for 21 hours = 1490 mgm.

3rd treatment three weeks after the 2nd treatment :—

In the uterus (1 tube) 38 mg. el. for 19 hours = 720 mgm.

In the vagina (10 tubes) 80 „ „ = 1520 mgm.

The total dose is thus 2380 mg. el. hours in the uterus and 4500 mg. element hours in the vagina. The filter used is the equivalent of 3 m. m. of lead in addition to which a secondary filter of thin rubber is used over the container which goes into the uterine cavity and one consisting of paper, cotton wool and oiled silk for the containers in the vagina.

The Brussels technique.—Here the cervix is dilated if necessary and the radium is inserted in tubes. Each tube contains 10 mgm. of Radium element filtered with 2 m. m. of platinum and special rubber. As a rule, one or two tubes are placed in the uterine cavity and one tube in each lateral fornix which is equivalent to 30–40 mgm. of Radium element. The Radium is applied for 12 to 15 days, the tubes being removed every 2 days, cleaned and immediately reintroduced.

The Paris Technique—In the Radium Institute of Paris, the amount of Radium is only 65 mgm. and this is applied for 5 or 6 days. The Radium is distributed in 6 tubes, three of which are placed in the uterus and three in the vagina and the tubes are taken out and replaced daily.

St. Bart's buried needle technique:—This method is at present not much in vogue. The total amount of Radium used is 50 mgm. of element distributed in 20 to 25 needles. After a preliminary cleansing the needles are placed in a circle round the growth at a distance of 1 centimetre. A few needles are also placed upward and afterwards towards the base of the broad ligaments. The whole vagina is then packed lightly with gauze wrung out in Navine. At the end of six days, the plugging and radium are removed and vagina douched daily for about 4 weeks.

The techniques which may be adopted will depend on the amount of Radium available and the method favoured. Certain points however should always be observed whatever technique be adopted.

(1) The vagina should always be douched and as far as possible all the discharge washed before radiation is done. After Radiation, douching is essential to prevent adhesive vaginitis. Saline is a good non-irritating fluid to douche besides its stimulating effect on the tissues. Where Radium is kept in for several days, it is always wise to remove it daily, douche and replace it. Otherwise, the offensive discharge accumulates and gives rise to fever due to septic absorption.

(2) It is always desirable to see if the cervical canal is patent and for this purpose the sound may be passed in if necessary—such that a pyometra may be detected and drained.

(3) It is better not to manipulate too much or to curette and only in cauli flower growths, the exuberant tissue may be removed by cautery.

(4) It is advisable to anaesthetise the patient for proper application of Radium.

Contraindication for irradiation:—There are certain contraindications to use of radiation which must be carefully borne in mind:—

(1) Anæmia with a red cell count below 3,000,000 and Hæmoglobin index below 50%. In these cases, radiation tends to produce a diminution of the R.B.C. and Leucocytes and may thus increase the anaemia to a dangerous extent. In such cases it is always desirable to improve the condition of blood by Haematinics and liver therapy before applying Radium.

(2) General emaciation and cachexia. This is more severe in neglected cases where secondary inflammation exists and in such

cases, rest, suitable diet, tonics and local therapy for a few days would enable the patient to stand the radiation. If Radium is indiscriminately applied, the emaciation and cachexia may increase and early death may result.

(3) Impaired nitrogen metabolism. Radiation as a rule, produces a rapid increase in the blood nitrogen which may assume dangerous proportions in the presence of an impaired nitrogen metabolism.

(4) The presence of inflammatory lesions or foul sloughing condition of growth or pyomen. Under such conditions the use of radiation aggravates the infection and may give rise to severe reaction.

(5) Complications in the urinary and rectal tract. Cases have occurred where in the presence of complications in the ureters and pelves of the kidneys, anuria has occurred ending in death of the patient.

(6) In the presence of amenorrhoea and pregnancy, the use of Radium is attended with risks particularly to the foetus. It has been found that Radium may adversely affect the growth of the foetus, produces deformities and in cephalic presentations, mental defects due to interference with the development of the brain.

Besides these contraindications, it may be stated that generally Indian patients, perhaps because of their poorer physique and vitality, do not stand the fairly large doses of Radium used for women in the clinics in the Continent. The reaction is more severe. There are also individual variations in susceptibility. In some cases, the local reaction is more severe. In others again the general reaction is great while in yet others Radium therapy has led to temporary mental instability. It is therefore all the more necessary in view of these vagaries to use smaller doses and watch the patient carefully.

Among the immediate reactions following the use of Radium may be mentioned, nausea, vomiting, rapid pulse, occasional rigors, severe pain, cold clammy sweats, giddiness, fainting and hurried respiration. How far some of these reactions may be due to mental over-anxiety and how far some of these may be due to a phenomenon akin to anaphylaxis, it is difficult to state. These symptoms however, do not last long and an injection of adrenalin with general restoratives improves the condition. In some cases the patient has a severe rigor, followed by a rise of temperature, severe proctites, anuria or irritability of the bladder. To some extent, a few of these symptoms were probably due to defects in the technique; with better screening and protection of the surrounding parts and prevention of the possibility of the Radium slipping into the vagina, complications such as proctites and bladder symptoms diminish in frequency.

Some of the local sequelae after Radium treatment may also be mentioned :—

- (1) Cicatrisation about the vagina leading sometimes to annular constriction of the vagina or to shortening and stenosis of the vagina.
- (2) Vaginites which may be purulent or adhesive. The Radium in these cases either because of the dosage or the defective screening or for other reasons, probably acts on the mucus membrane of the vagina and produces the complication.
- (3) Ovarian neuralgia. This troublesome complication occurs in some women in whom perhaps the growth has completely disappeared and no other signs or symptoms persist.
- (4) Fistulae, vesico-vaginal or Recto-vaginal. These are more likely to develop in late cases with extensive involvement of the anterior or posterior vaginal walls as well as the bladder or rectum. The effect of the Radium is to destroy the growth giving rise to a Fistula.
- (5) Radium burns. These are very resistant and last for months and are generally the result of slipping of the Radium tubes and could be prevented by adequate screening and the use of rubber tubes.

In conclusion, it may be stated that while Radium has undoubtedly a great future before it, in the treatment of malignant growth—particularly of the cervix and uterus, a great deal yet remains to be done to make it safe and certain for the patient. Perhaps the different types of carcinoma may have to be classified histologically into radio-sensitive and radio-resistant groups. The technique has also to be improved and the place of deep X-ray therapy after radiation, better defined. Despite these defects Radium has brought hope and salvation to many a woman who in former years was condemned to a lingering, painful end and refused admission to hospitals. Even in extreme cases the alleviation of symptoms is striking and if the profession would co-operate by sending in cases early enough to centres where Radium therapy is available, much more may be done to relieve the unnecessary suffering and favour a cure. The education of womenfolk to a better realisation of the significance of the early signs and symptoms of cancer is essential. And it is in these diverse ways that the large mortality consequent on this disease can be reduced.

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hilus. Consequently though the chest of the infant may show normal appearances in the skiagram, as the child grows "hilus opacities" become increasingly evident, so that a certain degree of "hilus shadow" can be considered normal for all practical clinical purposes. The hilus shadow is made up by a number of structures including ribs, vertebrae, bronchi, lymphatic glands, blood vessels, oesophagus and thoracic duct. It lies dumb-bell fashion opposite the second and third ribs in front. It is only when the shadow exceeds the normal limits extending into the perihilus region that a pulmonary lesion can be definitely diagnosed. A certain amount of arborization due to the bronchial net work is normal but signs of peribronchial thickening and beading are pathological. Deep punctiform shadows of calcified and fibrosing lymphatic glands in the hilus region are diagnostic of the old deposits of childhood. Blood being opaque to the X-ray vascular engorgement as during measles and whooping cough is apt to produce deep hilus shadows which should not be mistaken for tuberculosis. The right hilus shadow is usually larger than the left, the latter being partly hidden behind the base of the heart and blood vessels. The descending bronchial tubes on the right side usually give deeper shadows than those on the left.

Fluoroscopy is perhaps the quickest and most useful method of radiosopic examination of the contents of the chest. It gives information which a skiagram cannot give viz. the movements of the diaphragm and chest wall, the lighting up of the apices and the relative translucency of the lungs during inspiration and expiration. Unilateral limitation of movements of the diaphragm or ribs indicates disease on that side which can be confirmed by the relative opacity. In pulmonary tuberculosis the heart is often small, tubular, vertical, and median.

ABNORMAL APPEARANCES IN SKIAGRAMS.

The shadow given by tuberculous lung tissue is visible only when there is caseation or fibrosis. Mere infiltration without caseation especially when small in extent is often missed.

A ground glass appearance is usually due to thickened pleura (Fig. 2) or very thin layer of effusion. Slightly exaggerated hilus shadows with enlarged and calcified glands and some peribronchial thickening may not mean active or unhealed tuberculosis. Conditions of chronic bronchitis especially in people who have been inhaling the dust of cities or of various trades are apt to give these shadows.

There is absolutely no justification therefore for diagnosing active disease when such indefinite shadows are seen in skiagrams unless constitutional symptoms justify such a diagnosis. Such opacities no doubt constitute a record of the history of the patient since his birth. Diffuse opacities due to thickened pleura

SKIAGRAPHY IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS.

BY

RAO BAHADUR DR. M. KESAVA PAI, M.D.

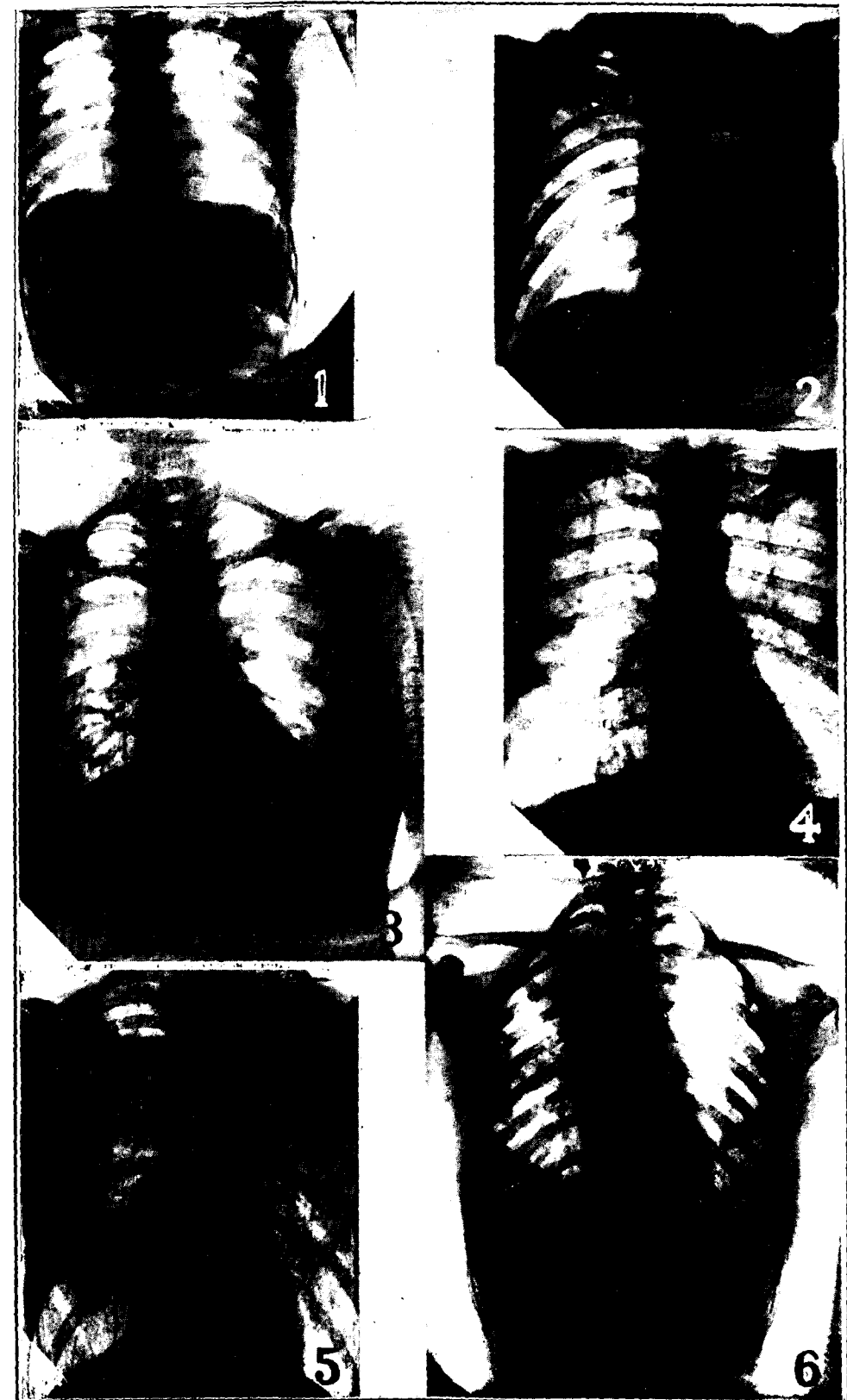
Superintendent, Tuberculosis Hospital, Madras.

THE importance of X-ray examination in the diagnosis of pulmonary lesions is becoming more and more evident especially in locating the deeper lesions and lesions more superficial but vague in character as judged by physical examination. Thus in the diagnosis of tuberculous hilus disease and of perihilus and peribronchial infiltrations, circumscribed pneumothoraces and pleural effusions, and of occluded cavities, the X ray has great advantage over our present day methods of physical diagnosis. It should however be borne in mind that skiagraphy has its limitations like any other method of diagnosis and to a person well experienced in physical examination, the X ray can but be one more help in the confirmation of diagnosis. Moreover there are other important conditions like diaphragmatic movements, pulmonary adhesions, displacement of the mediastinal structures etc., which can be diagnosed by skiagraphy and fluoroscopy much more easily and definitely than by any other method of examination. Above all skiagraphy is perhaps the best method of keeping permanent records of chest conditions at different times in the course of treatment, especially by artificial pneumothorax; thoracoplasty and other modern methods of surgical treatment of pulmonary tuberculosis.

X-ray findings must always be interpreted conjointly with the result of clinical examination. On the one hand it is not always possible to say that lesions discovered by skiagraphy are tuberculous in character and on the other there are several lesions detectable by physical examination but not by the X-rays. Thus anthracosis and silicosis, syphilis and actinomycosis, chronic fibrosis due to different causes, bronchiectasis etc., cannot with certainty be differentiated from tuberculous lesions whilst small and discreet soft deposits as in miliary tuberculosis, and fibrinous pleurisy tuberculous in nature cannot often be detected in the skiagram. Hence the importance of interpreting skiagrams in combination with clinical signs and symptoms and of the physician being made to read the skiagram in preference to the radiologist.

APPEARANCES OF THE NORMAL CHEST IN SKIAGRAMS

A strictly normal chest (Fig. 1) is exceedingly rare to find in the skiagrams of adult chests. Pathological research has proved that tuberculous pulmonary lesions either healed, healing or active are present in the vast majority of adults, especially in the region of the



pathological condition of the lungs and pleurae at different stages in the course of the progress or of the treatment of a case of pulmonary tuberculosis. In fact serial skiagrams have been of considerable value to pathologists and clinicians in tracing the origin and progress of lesions in pulmonary tuberculosis and thereby adding to and even revolutionizing our conceptions of the pathology of the lungs in tuberculosis of these organs.

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Fig. 1. Normal Chest—with the exception of the rather heavy hilus shadows on either side of the heart the other structures appear normal. The domes of the two halves of the diaphragm are regular in shape, the left being lower in level than the right.

Fig. 2. Pleurisy on left side with thickened pleura, giving a thick ground glass opacity continuous with that of the heart. Hilus shadows rather exaggerated on right side.

Fig. 3. Skiagram showing pleural rings well marked in lower half of the right lung and less so in the middle and lower zones of left lung. There is a certain amount of fibrosis in both the lungs.

Fig. 4. Lungs showing considerable fibrosis and calcification in the hilus and perihilus regions on both sides.

Fig. 5. Lungs showing a condition of advanced fibrosis with diffuse "striated" opacity in the skiagram on both sides.

Fig. 6. Chest showing a large tumour in the upper part of the mediastinum extending into the right apical region—probably a mass of enlarged tracheal nodes.

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Fig. 7. Lungs showing deep pigmentation and mottling in the region of the hilus glands and at both apices, with diffuse mottling in other parts of the lungs—a case of anthracosis, with no toxic symptoms of tuberculosis.

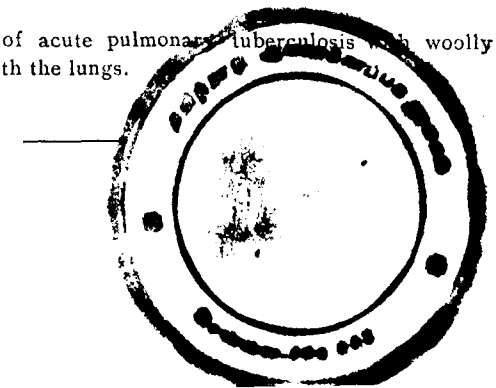
Fig. 8. Chest showing a complete pneumothorax on right side and flattening of the right half of the diaphragm by pressure of the intrapleural air. The right lung has been collapsed and pushed behind the heart.

Fig. 9. Chest in a case of chronic bronchitis with general emphysema of both the lungs. Note heavy hilus and peribronchial shadows due to peribronchial fibrosis.

Fig. 10. Skiagram of case of right hydro-pneumothorax. Note the straight and horizontal surface of the shadow due to effusion and the air above. The right lung is collapsed into a cake seen to the right of the cardiac shadow. Exposure given in erect position.

Fig. 11. Right lung shows basal implication with a large cavity containing exudate. Note the horizontal and straight level of the sputum within the cavity. Exposure in erect position.

Fig. 12. Chest in a case of acute pulmonary tuberculosis with woolly opacities in the greater part of both the lungs.



resulting from an old healed pleurisy, calcified lymphatic glands resulting from healed juvenile glandular tuberculous involvement, scars of healed lung lesions, peribronchial shadows due to chronic bronchitis, pleural rings (Fig 3) resulting from healed localized pleurisies or pneumothoracic conditions etc., should not be mistaken for active tuberculosis. A combination of skiagraphy and clinical examination can alone confirm the diagnosis. A combination of opacities described above is not incompatible with apparently perfect normal health.

It is in advanced pulmonary disease that the skiagram is of considerable value in locating and measuring the extent and nature of the lesion. It is quite a common experience to find that the skiagram shows a much more extensive lesion than one diagnosed by physical examination, that cavities are found where none could be diagnosed with our other methods of examination and that deep disease on the collateral side is often present when not diagnosed by precussion and auscultation. It is therefore very important in the application of artificial pneumothorax treatment that a skiagram of every patient should be taken and examined before deciding to apply the treatment. Pneumothorax collapse is a dangerous procedure to be adopted when there is active disease in the opposite lung.

The following lesions cast shadows in skiagrams:—calcified (Fig.4) and caseated areas, fibrosis (Fig.5) thickened pleura, pleural effusion, tumor (Fig. 6) deposits due to anthracosis, (Fig.7) silicosis etc.

Reduced density in skiagrams is due to pneumothorax (Fig. 8), emphysema (Fig. 9), Vomica etc.

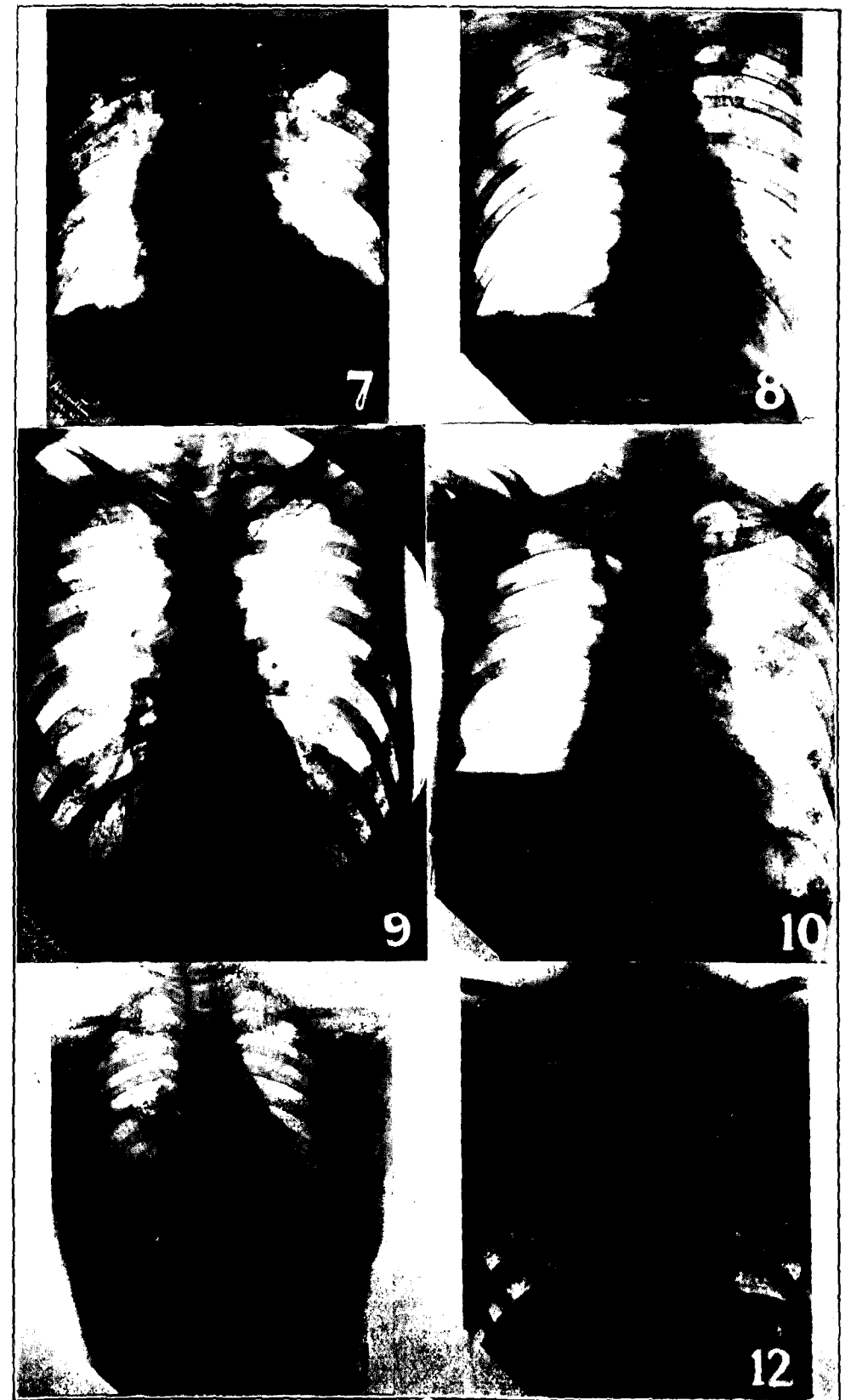
When pleural effusion shows a straight horizontal margin in the erect posture, it is due to hydro or pyo pneumothorax (Fig.10). Collection of liquid material in cavities (Fig.11) gives a similar appearance.

Fibrinous pleurisy and bronchial catarrh give no evidence in skiagrams, nor do loose tuberculous deposits in the grey stage before caseation.

Congestion of lung tissue gives a partial shadow. Woolly deposits (Fig. 12) indicate a recent active lesion, whilst a stratified appearance indicates fibrosis.

It is important to bear in mind that it is not possible to say if a lesion is definitely tuberculous in nature by the appearance in the skiagram, though by combining the clinical history, physical signs, microscopic examination of sputum and skiagraphy it is usually possible to arrive at a correct diagnosis.

The clinical importance and utility of skiagraphy is enhanced by the fact that it enables us to keep a permanent record of the



THE ROLE OF RADIOGRAPHY IN THE DIAGNOSIS OF DISEASES OF THE LUNG

BY

S. K. BASU M.B. Benares City.

MOST of us believe, if I mistake not, that Radiograms give earlier indications of pulmonary tuberculosis than the physical signs. Consequently we place greater reliance on radiography than on the physical signs in the diagnosis of early tubercle. I believe, it will be interesting to quote here a few of the most divergent opinions expressed by various authors on the role of Radiography in the diagnosis of Lung diseases.

Boney states that little help is derived from Roentgen Rays in the diagnosis of early tubercle.

Sir Douglas Powell and Hartley in their volume on "Diseases of the Lungs" state that in the majority of the patients in whom signs and symptoms suggested an early lesion, they derived no assistance whatever from X-rays.

Sir William Osler in his "Practice of medicine" says that "X-rays tell us no more than a careful clinical examination"

Kidd in Albutt and Rolleston's "System of Medicine" states that it is still a matter of doubt whether skiagrams or screen observations give as early or as trustworthy indications as the older methods of physical examination.

William of Boston's observations probably approach the truth more than any of those mentioned before. He says "I find that X-rays are of value not only in determining the extent of the disease but also sometimes in revealing its location where and when it would otherwise have been unsuspected.

He classifies the early cases of pulmonary tuberculosis into three groups.

(i) Those detected by the X-rays before auscultation and percussion yield any physical sign.

(ii) Those detected simultaneously by X-rays and by auscultation and percussion etc.

(iii) Those in which the causes of the physical signs are not ascertainable by X-rays.

The last class is as common as the first. X-rays examination of the chest should not therefore take the place of careful physical examinations.

Crocket in his book on "Physical examination of the chest" remarks "X-rays cannot enable one to detect the very earliest stages of tuberculosis. There must be sufficient increase in the amount of cellular elements present to produce a shadow before that can be done."

Absence of X-rays findings in a radiogram of the chest does not therefore exclude early tubercle.

Hence X-rays are not superior to physical signs in the diagnosis of all cases of early tubercle. It is only in a limited class of cases that X-rays are superior as a means of diagnosis of early tubercle. These are :—

(1) Cases of early tubercle complicated with bronchitis and hence the physical signs masked by the adventitious sounds of bronchitis.

(2) Cases with deep-seated and closed early lesion.

(3) Cases of Hilum tuberculosis.

(4) Cases of recrudescence of old lesion.

Apart from this a thorough X-ray examination helps us :—

(a) To verify and confirm the findings of our physical examination.

(b) To study in detail the condition (normal or pathological) of the various structures inside the thoracic cavity e.g. Heart Lungs, mediastinal glands, the diaphragm and its excursions etc.

(c) To detect the presence of abnormal structures, if any, e.g., fluid, Neoplasm, air or gas,

(d) To determine the nature and extent of the disease, whether active, quiescent or healed, thereby enabling us to find out the progress or otherwise of the lesion in all cases, and lastly

(e) To carry on the Artificial Pneumo-thorax treatment successfully

X-RAY THERAPY : ITS PRINCIPLES AND PRACTICE WITH SPECIAL REFERENCE TO DEEP THERAPY

BY

DR. K. P. MODY B.A., L. M. & S. (BOMBAY)

X-RAYS have been used in Therapeutics for a long time, ever since their discovery as Diagnostic agent. In the very early days, instruments were crude, methods of dosage unknown and results uncertain. Every operator had his own technic based on personal observation and experience. In spite of all these disabilities, results in certain class of cases were gratifying.

X-rays are similiar to Light waves, except that their wave lengths are much shorter, so that their effects on human tissues are much more profound and powerful. X-rays are not homogeneous they are not all of the same wave lengths. The long wave lengths have their maximum effect on the skin, the short ones on the other hand are very penetrating. Herein we find the secret of treatment. The wave-lengths are selected according to the nature and depth of the lesion. If a deep seated lesion is to be treated, the short wave-lengths have to be used and the long wave lengths have to be eliminated. The metal aluminium, when interposed in the path of Rays, has the property of cutting off the long wave-lengths. The thickness of the aluminium determines the quality of the rays. When very hard penetrating rays are required, as in the treatment of Malignant Disease, instead of Aluminium, Copper or Zinc is used. Inserting these filters in the path of the Rays does not solve the whole problem. We require a powerful apparatus. It is only comparatively recently that suitable apparatus has been manufactured. It is known that the higher the voltage at which X-rays are generated the greater the percentage of short wave-lengths is produced. This led to the making of high power generators and special tubes capable of withstanding a high voltage. The modern outfit generates 200,000 Volts. The Rays produced at this tremendous pressure are passed through 1 m. m. of ZN. or CU. being thus converted into a more or less homogenous beam, very penetrating and capable of producing deep effects. This then is the principle on which Deep Therapy is based.

It will not be profitable to go into technical details about apparatus and tubes. Modern apparati have reached a stage, if not of perfection, at least of marked precision, ease and flexibility of control and high power. Of the several types that we have on the market, two deserve special mention, the Water-Cooled Deep Therapy Unit of Victor's known for its tremendous power, and the

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Oil-Cooled Unit of Gaiffes' of Paris known for its extreme safety to operator and patient.

The Therapeutic indications determine the type and quality of Rays that have to be used. A rough classification for practical purposes may be made as under :—

I Cases requiring Superficial Therapy.

II " " Medium "
III " " Deep "

I. The long wave-lengths having their maximum effect on the skin, are utilised for Skin Diseases and superficial conditions. These rays are best produced at a much lower pressure, from 90 to 120,000 volts. They may be given unfiltered or with a. 5 m.m., filter of aluminium. The best results are obtained by using fractional doses frequently repeated.

II. This class of cases includes such conditions as T. B. Glds. Menorrhagia and Fibroids, enlarged Prostrates. Greater penetration and much greater intensity are required than in the preceeding group. The voltage applied is in the neighbourhood of 150,000 and the filtration is through 5 or 6 mm. of aluminium.

III. This is the most important group, and comprises the different kinds of Malignancies. Such cases require maximum penetration and intensity. The voltage is 200,000 and the filtration is through Cu or Zn. The modern X-ray Generator can develop a much higher voltage, the limiting factor is the X-Ray Tube which, as at present manufactured cannot stand a higher pressure than 200,000 Volts. Even if it could, it is a debatable point whether there would be any therapeutic advantage in producing a more penetrating ray. For all practical purposes, the present arrangement appears to be the Therapeutic optimum.

The treatment of Malignant disease is a very difficult subject. A malignant tumour, being a purposeless irrational, irregular reproduction of cells, serving no useful purpose, replacing, invading and destroying healthy tissues, naturally does become a vast and complicated problem. The cells have to be overwhelmed and destroyed. They vary in various stages of division and reproduction. They vary in their response to the rays. Some tumours are Radio-sensitive and others are Radio-resistant. Even the cells of the same tumour differ in their reaction to the rays, probably depending on their particular phase of development. Destroying just the sensitive cells, does not solve the problem, as those remaining overtake possession of the field and go on multiplying with full vigour and freedom. Nor is it doing any good to radiate short of producing cellular destruction and disintegration. The intensity of the radiation should be

powerful enough to kill the cells, not merely to subdue their activity. This sounds a simple proposition, but in reality it is a most complicated one, as healthy and normal tissues have to be considered as well, the skin, the muscles, important organs etc. We have to be careful that we do the minimum possible damage to them.

During the passage of the rays through all the intervening tissues, the greater percentage of rays get absorbed, and only a small percent of the energy reaches the deep seated growth. Moreover the skin can tolerate only a certain dose, which, if exceeded, would give rise to severe Dermatitis and ulceration. As only 20 to 30% of the total energy reaches the site of the growth, the rest being absorbed, the only way to produce a lethal effect is to give the radiations from different directions selecting a different area of the skin. Supposing the case is one of Carcinoma Cervix. The back and front of the Pelvis are mapped out into several areas. A full dose is given on each area, with the direction of the rays to the uterus and adnexa. The summation of this "Cross firing" is a lethal dose on the tumour, without undue damage to the skin and healthy tissues.

Method of Dosage.—In the early days, exposures were given empirically and the only guide was the clinical one, the visible effects on the pathology of the condition. Then were introduced "pastilles," by an eminent French skin specialist Saboraud. It is a piece of cardboard on which is spread out a paste Platinum Bar-Cyanide. The effect of the rays is to change the original colour of the pastille from green to brown. The intensity of the change is an index of the amount of radiation. It is an excellent method for superficial therapy but it is unreliable in Deep Therapy, as the heavily filtered and highly penetrative rays affect the colour in an uncertain way.

Just when we are dealing with Radiations of great intensity, are we confronted with the difficult problem of dosage. We have to be fairly accurate, if not quite precise, in dealing with a neoplasm. If the intensity is not sufficient, we are doing no good, we are probably doing harm, as insufficient radiation tends to make the cells radio-resistant. If on the other hand, we are over enthusiastic, we also do harm.

We owe it to the German School, particularly to Prof. Wintz and his co-workers at Erlangen to have established a more or less standardised system. The rays produce a definite reddening of the skin after 8 days, with subsequent bronzing. This is practically the maximum dose that the skin can tolerate without progressing to actual dermatitis. By experiments and research they have elaborated a system of dosage based on this phenomenon. Reckoning the

dose which causes erythema on the skin as 100 they found that Malignant cells require 90 to 120 %, T. B. Glands 33 % Ovaries 33 % These are values that have to be delivered not merely on the skin, but on the tumour or deep seated organ.

How is the Erythema dose determined? By means of experiment, guided by previous experience. An area of skin on the thigh is exposed, and the results noted. Personal factor enters into the evaluation of the type and degree of erythema, which detracts from practical value as a dosage standard. Individuals also vary in their reactions to the rays. To add still further to its difficulties, the erythema of some workers is more intense than that of the others. In spite of all these inaccuracies, the "Erythema" stands as the most practical method of dosage yet evolved.

There are several instrumental methods. As the effect of radiation depends on its wave-length, the spectro-meter becomes a valuable adjunct, as it measures the wave length. Another important accessory is the "Sphere Gap". It is a device for measuring the Voltage at which the X-ray tube is energised. It is very important in Deep Therapy to maintain 200,000 volts.

The French system of dosage is based on a very practical apparatus known as the Iontoquantimeter. It is based on the principle that air, ordinarily a non-conductor, becomes a good conductor when X-rays are directed on it. The apparatus is connected whilst treatment is going on, and the readings are made directly. Most French clinics have these quantimeters fixed up in the Treatment Cubicles.

An important data to be determined is what is known as the Depth Dose, that is to say, the intensity of the Rays below a certain level of the skin. These values are all charted out in scientific laboratories, and are available for reference. The intensity of the "Depth Dose" depends on :—

- (1) The Voltage
- (2) The Filter and
- (3) The Distance.

Every instrument is calibrated when sent out from the factory.

During what period of time should the full dose be given in Malignant Disease? At Erlangen it used to be the practice to deliver the full total dose at one sitting. The patient was under treatment for hours, a very exhaustive procedure producing considerable disturbance of the general health. They have now modified the technic and the whole dose is divided into 2 or 3 sittings. This is the usual German Technic. The French, on the other hand, divide the total dose into several sittings. The neoplastic cells are in different stages

of division and reproduction. In certain stages, the cells are radio-sensitive, in other stages they are radio-resistant. By hammering at the growth constantly in divided doses, it is hoped to catch the cells in their radio-sensitive stage. The same idea is underlying the recent modification in the application of Radium needles. Needles are now used in much smaller strength and for a longer time.

Workers in England favour the divided dose technic and though it may appear old fashioned, in some highly resistant tumours, the old method of small daily dose continued for about 6 weeks is revived. Every stage of cellular life is anticipated and attacked.

Results :—In skin diseases and non-malignant conditions the results are gratifying. Old eczematous patches of several years' duration disappear in a few sittings. In T. B. Glands, it is now no longer necessary to perform extensive dissections and disfiguring surgical operations. Excellent results are obtained in uterine bleedings with or without Fibroids.

As regards Malignant Disease, our ideas of treatment have undergone a radical change in recent years. In two important regions, Radiation Therapy has displaced Surgery. In cancer of the Tongue and of the Cervix uteri there is consensus of opinion that the best treatment even in early cases is Radiation Therapy, combined Radium and X-rays. Radium needles are embedded in and around the tongue, and are implanted in the cervix. Deep X-ray therapy is given to the neck and pelvis to deal with the Glandular area. In cancer of the Breast, opinion is divided. Operation in early Breast cases is so eminently successful, that I think it is a serious responsibility not to advise it in suitable cases. But even in Breast cases, Surgeons do not have the sole monopoly. It is a recognised practice to give a pre-operative as well as post-operative prophylactic course of Deep Therapy. In in-operable cases, Radiation is the only thing to do, combined in certain cases with Diathermy. The results in this class of cases are not in any way encouraging from the point of view of permanency of cure. All that we hope to do is to bring about amelioration of symptoms. The pain diminishes, there is some retrogression of the tumour relieving pressure symptoms, there is cessation of discharge or bleeding. These are not results to be scoffed at. The general well-being of the patient is improved, he is buoyed up with hope, and above all loses that wretched feeling of despair and despondency, which kills worse than the disease.

It may not be out of place to say a few words about Radium. There is no clinical difference between Radium and X-Rays. In Radium we have a much larger proportion of rays of extremely

short wave-lengths. This, however, does not necessarily mean greater clinical effects. On the contrary, such rays are too highly penetrative and so they pass through without being absorbed. In many respects, Radium scores over X-rays. Being available in the form of needles, it can be embedded in and about the diseased tissues, thus having a more direct and intimate effect. X-rays, on the other hand, have to traverse through healthy tissues, before it can act on the diseased tissues. Radium is thus an ideal agent for such accessible regions as Tonsils, Tongue and Cervix. But even in such cases, the embedding of needles is followed by Deep Therapy to the Glandular Area.

In what ways does Radiation produce its effects on malignant cells? According to some, the rays affect the metabolic rate of the cells in such a detrimental way, as to make their productive existence impossible. Others believe that Radiations bring about blockage of blood vessels and consequent necrosis of the cells. Whatever the local effects may be, the general body reactions play a very important role and consequently the local treatment should always be backed up by efficient measures directed towards raising the general tone of the system. In this connection, Ultra-Violet Rays form a valuable adjunct.

A great deal of valuable research has been done in recent years. Though technic and instruments have improved considerably there is scope for improvement in many directions. Let us hope that with better technic and in collaboration with Radium, treatment of Malignant Disease will reach a more satisfactory stage. To tackle this scourge in every possible way is to relieve humanity of a truly terrible curse.

X-RAY PELVIMETRY*

BY

DR. DHIRENDRA NATH BANERJEE M.B. (Cal.) : M.D. (Berlin),

AND

GONESH CHANDRA MUKHERJEE, L.M.F.

(From the Radiological Department, Chittaranjan Hospital, Calcutta).

UNTIL very recently Gynæcology had not been able to attract the serious attention of the Roentgenologist for diagnostic purposes, while in obstetrics, the diagnostic use of the X-rays have been extremely limited and that only in the determination of the presence or absence of the foetus.

Roentgen examination of the bony skeleton, at the present day has been regarded to be a form of coarse radiography and in big clinics have been entirely left in the hand of non-medical radiographers. Still the part of the bony skeleton forming the pelvis has not engaged the time of the radiologist. It is rather surprising that for outlining the inlet of the female pelvis no simple and accurate method has been devised.

Although very few workers have directed their attention over X-ray pelvimetry still the literature presents us with ample material for research. In recent times, only very few Roentgenologists, mainly the German and American workers seem to be interested in the X-ray measurement of the pelvis. Although this very interesting subject had engaged the early workers during the infancy of Roentgenology, but the insurmountable difficulties which they experienced was not in their applicability but in the inefficiency of the old type of the X-ray apparatus. In fact, this subject was taken in hand by the early roentgenologist even in the first year of the application of the X-rays in medical diagnosis. Fabre, Varnier and Bouchacourt (1900) tried to measure the conjugata vera by placing a rectangular metal frame round the pelvis. The modern powerful machines and the highly efficient X-ray tubes along with the extremely useful Potter-Bucky diaphragm make this subject without any technical difficulty.

The main difficulty lies in two factors.—

1. To keep the pelvic inlet parallel to the film surface and,
2. to minimise or rectify the magnification of the shadow in the skiagram.

* Paper read before the medical section of the Indian Science Congress, Nagpur, Jan. 1931.

1. The position of the patient at the time of exposure so as to keep the pelvic inlet parallel to the film surface may now be considered.

The recent conception is that the pelvic opening angle is defined as the angle formed by the anatomical conjugate (i.e., the joining line of the upper border of the symphysis with the promontory) with the sacral bone plate. This angle is found in children to be 70° – 80° , adult 90° – 110° , old 130° – 140° and in infantilism 65° – 80° (Schubert).

The pelvis must lie on the film so that, on the skiagram, the horizontal limb of the pelvic bones should so cover that the obturator foramen shall not be visible. This is maintained when the patient is placed in a half-sitting posture.

The difficulty was first experienced by Albert in 1896 who radiographed the pelvis by placing the woman in the semi-recumbent position, with the spinous process of the last lumbar vertebra and the upper border of the symphysis at the same level, thus making the plane of the pelvic inlet parallel to the surface of the film. The tube was centred perpendicularly over the pelvic inlet, parallel to the surface of the film. The measurements obtained from the resulting radiographs were checked against the target-film distance and the distance of the upper border of the symphysis from the film, for the distortion of the diameters in a radiograph depends on these factors.

With a limited means at his disposal, and because of the added technical difficulties resulting from the posture, the essential points on the radiograph were too indistinct for this method to be of any value.

2. The next difficulty is that the skiagram of the pelvis is always a magnified picture of the actual size. In order to estimate the extent of magnification various instruments and methods have been devised of which those of Druener, Heyneman, Kehrer, Dessauer, Warekros, Archangelski, Martius and others are more important.

The several methods advocated by the different workers may be summarised thus :

1. An exposure is made as usual and the magnification of the figure estimated geometrically.

2. By means of an instrument "planimeter".

3. By "weighing method"—One sample of paper of good quality and uniform thickness is selected. One figure of the pelvic inlet is drawn on this paper and the outline is cut out. This is weighed (say 2.3 gm) 10 sq. cm. of the same paper weighs (say 1.6 gm.).

The area of this paper (x) = $\frac{100}{1.6} \times 2.3 = 143.7$ sq. cm. Another

outline is cut out according to the figure of the X-ray film and the area of the same made out. The difference will give the magnification. (Chasses).

4. Photograph taken along with measuring rods placed inside the rectum or outside the pelvis. (Guttamann).

5. Comparative method as done by Pinard and Vernier by comparing the exposure of the pelvis in the living, with a normal specimen taken under identical conditions.

6. Teleroentgenographic method—By the modern apparatus it is easy to take skiagrams with a target distance of 7-10 feet. It is supposed that at a target distance of 7 feet the rays are almost parallel and so the shadow cast represents the exact size of the object. Although this is quite simple and often used as a routine method adopted in chest radiography, it offers great difficulty in cases of the pelvis specially in cases of advanced pregnancy.

7. Frame method of Hirsch.

8. Triangulation method based on mathematical measurements.

9. Method based on Mackenzie Davidson method of localisation of objects by a known tube displacement. This requires a rather costly apparatus, although this is fairly easy to carry out. There are several modifications of this method partly to simplify the technique and partly to avoid the costly apparatus. These methods advocated are those of Manges, Runge and Grunenhagen, Guilhert, Chamberlain, Newell, Levy-Solal, Klason etc.

10. Stereoscopic method. By this method various authors have tried to get the ideal Roentgen picture in which the maternal bony pelvis as well as the foetal head can be definitely and sharply outlined and their relative size can be accurately measured.

11. Plumb-bob method based on the same method as to measure objects in the eye.

12. Reduction of the film to the exact size by reducing to an extent so that two points placed at known distance comes to the same figure when reduced.

There are various methods advocated at different periods by different workers in order to obviate the difficulties arising in X-ray pelvimetry. The above methods can be grouped under three main groups:—

(a) Methods by means of which the patient is placed in such a way so that the pelvic inlet lies parallel to the film, and

the magnification due to projection corrected by suitable means.

(b) Methods similar to Mackenzie Davidson's method for localization of foreign bodies.

(c) Sterioscopic methods with special apparatus.

Of the first group again, workers preferred radiography either in the sitting posture or the lateral plane or both of these combined. Various workers have modified the position of the subject to suit the requirements.

In our experiments we have adopted the method of Thoms by placing the symphysis pubis and the spine of the fourth lumbar vertebra in the same plane measured by the pelvimeter from the surface of the Potter-Bucky diaphragm. We have found that the most convenient position for the patient is to sit and then lean backwards with the hands as support. The tube is centered on the point crossing the midline of the body with that joining the two anterior superior iliac spines.

We have tried nearly all the methods and found with the dry pelvis quite a variable result. Naturally, with a living subject this variation will be more pronounced which will be further enhanced by the presence of a good deal of soft tissue in case of a pregnant woman.

Our method consists in fishing out the best of all these methods with a further modification which is as follows:—

We have found with dry pelvis that even at a target-film distance of 7 feet the skiagram gives a decidedly magnified picture which is of course, much less than one taken at a distance of 2-4 feet. We have thus found that in all cases, including teleroentgenography mathematical correction is necessary. In order to obviate this we have used a brass flat rod with holes cut out at intervals of one centimetre with smaller holes at a distance of 0.5 Cm. This brass plate is placed over the thighs at the level of the symphysis while radiographing anteroposteriorly and placed along the spine, being placed over a folded piece of linen, so as to keep the same at the level of the spinous processes of the lumbar vertebra when radiographed in the lateral plane.

In both these instances the metal rod shows beautifully on the skiagram with the holes wider apart according to the distance from the centre. The different measurements can be read off with a scale and corrected by the measurement of the shadow of the metal scale in the skiagram.

The promontory is distinctly seen on the skiagram taken in a lateral plane along the foetal skull in situ. The symphysis often becomes difficult to localise in this plane.

By this method fairly accurate measurements of the conjugata vera as also other diameters of the pelvis can be obtained.

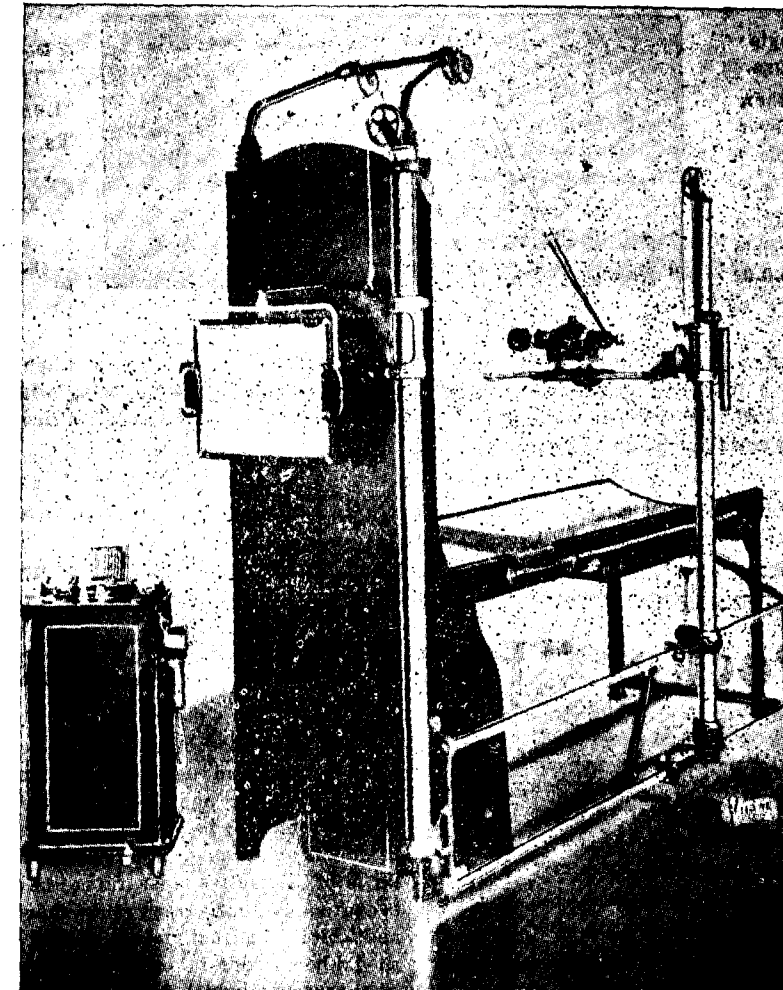
CONCLUSIONS

It has been observed that there are three main difficulties in X-ray measurement of the human pelvis. These are (1) the difficulty of having the pelvic inlet horizontal to the film at the time of exposure, (2) that the X-ray picture is a magnified shadow of the original and (3) the difficulty in exactly localising the promontory on the skiagram.

Keeping these points under consideration all the known methods of X-ray pelvimetry have been tried by us. A technique based on fishing out the best of all these methods with further modifications by us have been adopted both on dry pelvis and living women both non-pregnant and pregnant. Fairly accurate measurements of the conjugata vera as also other diameters of the pelvis can be obtained by this method.

Although this method is not claimed to replace clinical pelvimetry, still its utility is obvious in cases of contracted pelvis, or where it is not desirable to have manual examination due to sepsis in the external passages or where the practitioner is not an expert in gynaecological work.

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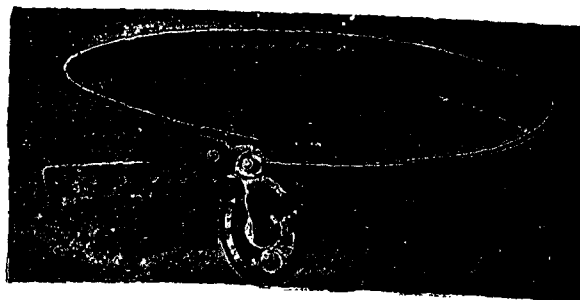
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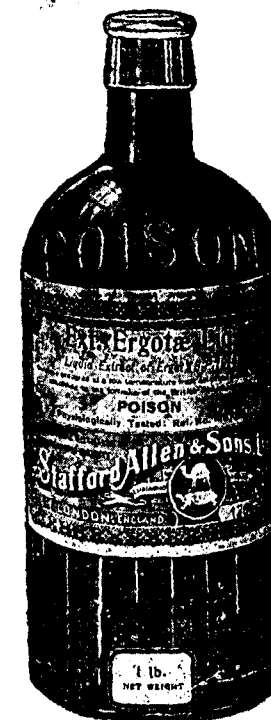
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THE FRACTIONAL X-RAY DOSE

BY

DR. H. C. MENKEL M.D., SIMLA.

THERE is a significant revival of interest among radiotherapists of experience in the former fractional dose method, which had been very largely abandoned by the younger men for the massive dose unit of Holznecht, Sabourand, Bordier, and others.

This reversion to the smaller dose and more frequent exposures is well represented by the revised teaching of Holznecht regarding the so-called cancer dose. He has definitely abandoned his advocated units in the treatment of cancer and now adopts the fractional dose technique. His newer teaching may have escaped attention, but it is so basically important that I am taking the liberty of quoting several paragraphs from the original article appearing in American Journal of Physical Therapy, March 1925. Holznecht then wrote:—

“It was a grave error to believe that all carcinomas react in the same manner to X-rays; even those histologically alike have different reactions. It has also been established that the rays applied in small doses do not stimulate growth, as was formerly supposed, but they do have as strong an effect as larger doses. Extremely strong doses on the other hand, are less effective. Moreover, it is not true that 100-110% of HED is the destructive dose for carcinoma; more than this cannot be applied, and several regions, such as the larynx, cannot be given even this amount. Therefore the dosage for carcinoma varies with the location of the disease and the term ‘carcinoma dose’ is meaningless. In its place one may use a term coined by Von Grodel, the ‘toleration dose’. The only thing left from former work is the technical principle that one should strive to apply the same dose to cells of all depths, and the clinical fact that out of one hundred operative cases of carcinoma of the uterus ten may be cured. If practical consequences are taken into consideration the following conclusion is reached: irradiation is indicated for inoperative carcinoma of the uterus, thyroid, breast, rectum, of which the last three only can be improved. All other carcinoma should not be touched. Serious consequences may result in carcinoma of the digestive tract through general impairment of the system.

Nather and Schinz experimented on animals with röntgen rays and discovered the advantages of several irradiations as compared with only one. In cancers of mice single treatments resulted in no cures, while scattered applications secured cures in two out of three cases. Alberti and Pelltzer, connected with the author's institute, and Regaud discovered that division of cells ceases immediately after

the application of average doses and several days later diseased cells divide which are particularly sensitive to the X-rays. If one is fortunate enough to strike the right day for the second irradiation the effect is two or three times as great as when the total dose is given in one sitting. It has also been shown in human beings that tumors which no longer reacted showed reaction when the dose was distributed over several days. Schwarz noticed this years ago in the treatment of a carcinoma. The difficulty lies in determining the correct interval of days.

A second new method was found through the efforts of Nather, Schinz, and Opitz. Animal experimentation demonstrated that irradiation of the surrounding region, in addition to irradiation of the tumor itself, produces better results than when the tumor alone is treated.

Both these methods simplify the technique. They were not put to use, however, until after the appearance of that excellent compilation, 'Effects of Small Doses' by Pordes, Nather, and Schinz. Thus two further errors were brought to light, first, the single application which prevented the cells of the tumor from healing, and second, the isolation of the tumor for the purpose of protecting the surrounding region. These two erroneous ideas were replaced by the technique mentioned above, repeated irradiations and the irradiation of the neighbouring tissue.

In conclusion, permit me to point out that these new biological, not technical, experiments show along what lines the future treatment of cancer should progress. There is no doubt that roentgen rays produce results. If one wishes to achieve more satisfactory results, one has to study cancer as the detective studies criminals. It is a goal which must not be sought by technical means only. Experimental research in the treatment of cancer by X-rays will disclose the point at which cancer can be destroyed. A little technique is of course essential, but it is the pathology of cancer which will lead the way to the treatment of this disease".

The observation here set forth represents a foundation for a more satisfactory therapeutic technique. First, it is essential to remember that not the rays which pass through the tissues, but those which are absorbed produce the desired therapeutic effects. A second important observation is that cells are most susceptible to the influence of X-rays at the stage of transition or mitosis. This emphasizes the necessity of frequent radiation to bring under influence the largest possible numbers of cells at the most vulnerable stage. Also considering that small doses frequently repeated produce an accumulative effect favourable to controlled inhibition of tissue growth, and that such dosage does not stimulate pathological tissue as

formerly thought, therefore, it would appear that the fractional dose method frequently repeated promises the better results.

The late Dr. William Benham Snow was for many years a staunch advocate of the fractional dose method. His personal experience as given in his own words is of great value. He wrote in *Physical Therapeutics*, August 1928, as follows:—"It becomes a patent fact that small graded doses of X-rays frequently repeated, acknowledging the cumulative effect, may be administered successfully and frequently until a dermatitis appears. At this stage of development a maximum effect is produced upon the tissues exposed. The cells in the field, including the diseased cells, which are of lower vitality, have been brought into a state to be destroyed if the process is continued. Under these circumstances the less vitalized, diseased cells will have perished and the normal cells of higher resistance will recover their full tone within a relatively short period of time. The X-ray erythema induced under these conditions will never be a condition to cause concern, particularly if the operator is conversant with the fact that, if an erythema shows a disposition to be severe, adequate application of reflected incandescent or carbon arc rays will completely check it. This has been verified by twenty-eight years' experience with the X-ray, an erythema never having occurred that could not be controlled. If the experience had been limited to occasional treatments during this period, it would not be significant, but, having averaged at least ten treatments daily for that period, there can be no question as to the reliability of the course pursued.

It matters not whether a condition under observation is one of the simple skin affections, a fibroid tumor, or a cancerous process, a uniform system of graded small doses will give the maximum curative and beneficial effects in all cases for which X-rays are indicated without the danger of producing an uncontrollable erythema."

The writer is persuaded that the young school of radiotherapists in India would find real therapeutic satisfaction in developing a technique based on these considerations.

ROLE OF RADIUM IN THE TREATMENT OF CARCINOMA OF THE UTERUS

BY

DR. J. N. KARANDE M. D., BOMBAY.

THE discovery of Rays by Roentgen followed by the discovery and isolation of Radium by the Curies, has put into the hands of medical men, agents the potentialities of which in the treatment of diseases were undreamed of. Dominici was the first to direct attention to the value of the Gamma rays in the treatment of deep seated malignant diseases. Those who have visited the wards for the incurable, can very well imagine how overjoyed these patients must have been to learn about the discovery of this new agent which held out hope of relief from the distressing symptoms if not complete cure.

In this article, I shall discuss the treatment of carcinoma of the uterus with Radium. Before considering the Physical properties of Radium I should like to mention some salient features of uterine Carcinoma.

Cancer of the uterus is divided into—

- (1) Cancer of the cervix.
- (2) Cancer of the Body.

(1) Cancer of the cervix is classified into (1) ulcerative leading to eating up of the cervix.

(2) Proliferative leading to formation of cauliflower growth.

(3) Endocervical.—This is the most dangerous type as the symptoms appear late, and the disease spreads rapidly to the surrounding parametrial tissue.

In this variety the cervix looks healthy. The extent of disease can be better appreciated by rectal examination. One can easily feel the enlarged, hard and fixed cervix, the thickened utero sacral ligaments and the infiltration of the surrounding tissues.

Cervical cancer is more common than that of the Body. It occurs between the ages of 40 to 50 years, though it may be seen in younger patients. I have seen two cases one at 28 and another at 32. Multipara form a majority of subjects suffering from this disease.

The symptoms in the early stage are unfortunately not so pressing. The patient may complain of irregular bleeding, brought about by coitus or joltings in a railway journey; or she may only complain of thin serous discharge. Pain is complained of only when the disease is far advanced. Hence the patients do not come for treatment during the early stage when the disease is within reach of permanent cure. The belief prevalent among the women that irregular bleeding is quite physiological during the period approaching

the climacteric, is to a great extent responsible for the non-recognition of this disease in the early stage. Ignorance, prejudices and wrong sense of modesty account for the high incidence of inoperable cases in this country. Medical students and nurses must be specially instructed to examine thoroughly cases of bleeding occurring in women past the middle age. In every such case cancer of cervix must be first excluded. Medical men should refuse to treat such cases before a thorough examination of such cases is made. Lantern lectures on this subject may be of great educative value and may go a long way in reducing the mortality rate from this disease.

Carcinoma of the body of the uterus.—This variety of uterine cancer occurs in multiparous women who have past the menopause. If a woman, who has no right to bleed, bleeds, suspect cancer of the body of the uterus. It is detected earlier as the patient realises the bleeding to be abnormal. It spreads to the surrounding tissues rather slowly.

Before the discovery of X-Rays and Radium, operation was the only treatment for cancer of the uterus. Werthum's operation has been recommended for cancer of the cervix. It is a formidable operation. It can be done only in selected cases; the operative mortality rate is high and in the hands of the inexperienced is very high indeed. Unfortunately in this country cases come late, consequently the number of operable cases is very small. Radium has definitely taken the place of this operation in recent years.

Treatment for carcinoma of the body is total hysterectomy together with tubes and ovaries and the affected glands. The operation is less severe and chances of cure are great. Rate of recurrence is also less. In this variety operation is the method of choice. Radium may be used if the patient refuses operation or is too weak to bear the operation.

Radium.—It is found in Belgium Congo, Colorado and in Cornwall. To get a gramme of Radium many tons of pitchblende have to be treated. The Atomic weight of Radium is 226.5. Radium continuously breaks into bodies of lesser molecular weight. It first breaks at atmospheric pressure and at ordinary temperature into gaseous state known as emanation gas; this in turn breaks into Radium A, which breaks down into Radium B, and this in turn into Radium C. C'

The Alpha and Beta rays from radium are not of any use in gynaecology. The Gamma rays, which have great penetrating power are utilised in the treatment of deep seated diseases like cancer of the uterus.

Radium is sold in the form of salt like sulphate or bromide or as emanation gas. The salts or gas are sealed in tubes and needles.

The needles are hollow and are made of platinum. The gas is first sealed in glass tubings and then put in these needles. Each needle contains 3.2 to 5 mg. of element. The thickness of platinum is 0.5 m. m.

As regards doses there is difference of opinion. Some use small quantity for longer hours, some prefer larger quantity for shorter time. Usually 50 mg. of Radium is used for 144 hours. The dose is expressed as $144 \times 50 = 7,200$ mg. hours. A thread is attached to each needle to make withdrawal easy. If gas is used it is expressed in milli curi.

The patient is given vaginal douches for three days previous to the treatment. It is of great advantage to have the patient under anæsthesia. The patient is put on the table in lithotomy position, the vagina is thoroughly cleaned and Tr. Iodine applied. The needles or tubes are then introduced into the cervical canal and the substance of the growth. The vagina is packed with gauze; the needles are kept for 144 hours. Some recommend 150 mg for 24 hours as against the first method where only 50 mg. are used.

There are different methods of applying radium e.g., intra-abdominal, indirect method etc., the one commonly used and which I have seen has been described above.

Radium is sometimes used in combination with X-rays. The technic is elaborate and requires trained hands. The iliac glands and the deeper tissues which may have escaped the action of radium, are exposed to X-rays from instruments of high voltage. This method is used on the continent with great success.

Some cases which look improbable at the first examination, clear up under radium treatment and then operation could be done with greater chance of success. Sometimes Radium is used after an operation to minimise chances of recurrence.

Indications for Radium therapy may be summed up as follows.

- (1) To control hæmorrhage from the growth
- (2) To influence directly a fungating, sloughing cervical mass.
- (3) To convert a border line into an operable case.
- (4) To control bleeding, arrest the malignant process, and prolong life in the inoperable cases.
- (5) To control foul smelling discharge and alleviate the pain in hopeless cases.
- (6) To prevent recurrence after operation.

Contra-indications are profound anæmia, presence of acute inflammation, fistulae, advanced necrotic changes resulting in formation of large cavities with hæmorrhage and free putrid discharge.

Results.—Unfortunately radium holds out hopes of cure in those very cases where operation also is equally effective. If one sees an early case, operation is the treatment of choice, as one does not know when the curative action of radium may begin and much valuable time will be lost. One may have to use radium if the patient refuses operation or if the patient is too weak to undergo the operation.

Radium as a palliative measure has been highly successful. The hæmorrhage and discharge cease within a week or two. The pain is also relieved, the growth or ulceration disappear by the end of five to six weeks. As a curative remedy radium has not yet been extensively used as Wertherm's operation rightly holds the field. Radium undoubtedly prolongs life and relieves the patient of her troublesome symptoms.

Operative and radium therapy for cancer of the uterus may be compared for the interest of the readers.

OPERATION.	RADIUM.
(1) Definitely prolongs life for more than five years if it is done in the early stage.	(1) Radium also gives equally good results in similar cases.
(2) Complete relief from symptoms.	(2) Radium is equally useful.
(3) Operation is only suitable for early cases only.	(3) Radium can be used to relieve the patient of her symptoms even in the later stages.
(4) Operative mortality is high and hence it is undertaken with great caution.	(4) No such risk.
(5) Patient has to be in the hospital for 4 to 5 weeks.	(5) Patient can go home at the end of a week.
(6) Curative effect prompt and certain.	(6) One cannot say when the curative action may begin hence it is not advised in early cases where operation will be definitely effective.

The readers of the *Antiseptic* may be interested to read the report on some of my cases treated with radium.

No. 1. Mrs. K. age 45 inoperable cancer of the cervix, fungating growth. I advised radium treatment. She got it done in one of the institutes here. I saw her a year after the treatment; she was free from her symptoms. The cervix looked perfectly healthy with speculum. She looked quite happy.

No. 2. Mrs. S. a Bengali lady aged 39. When she came first with foul discharge and pain she was suffering from inoperable endocervical cancer forming a crateriform ulcer. She was treated with radium from which she had relief; but unfortunately she came back after 8 months with pain in the liver region and extreme emaciation. There was no discharge per vaginum; the cervix was healthy in appearance. She had metastasis in the liver. Morphine could not relieve her of her pain! She left hospital soon after admission. She could not have lived much longer.

No. 3. Mrs. N. aged 49 came for foul discharge and a lump in the hypogastric region. On examination the cervix was found to be the seat of inoperable cancer; uterus was uniformly enlarged and soft. Provisional diagnosis of carcinoma with pyometria was made. On dilating the cervix and exposing the cavity no pus was detected. Now the diagnosis was clear that it was a case of carcinoma cervix with degenerating fibroid. To relieve the patient of the trouble some discharge Radium was tried. 10 Mg. of Radium were used for 24 hours. By the second week the discharge was much less. By the fourth week the cervix looked much better, the cauliflower growth had completely disappeared. A second dose was given after seven weeks of the first application. The fibroid was not in the least affected. Operation was suggested but she refused. I am told she is still alive after 1½ years of the treatment but she had an attack of hemiplegia!

No. 4. Mrs. A. A. Madras Brahman lady, age 50. Came for irregular bleeding. It was a border line case. As patient refused operation, she was given radium treatment. She is quite free from her trouble for the last six months.

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ULTRA-VIOLET RADIATION*

BY

V. C. SUDARSANAM, L.M.P., MADRAS.

THE Sun light forms the natural source of Ultra violet Radiation. The value of sun-light has been realised by mankind from the earliest of times. The Israelites, Egyptians, Arabians, Syrians, and Romans are all mentioned in the Bible as having worshipped the Sun. Even to-day the Sun is worshipped by the Persians, Mohammedans, and Parsis; while it is known to every body that the Hindu begins each day by prayers and thanksgivings to the Sun, as the giver of light and fertility. The well-known Sunday is so-called because it is dedicated to the Sun.

Since these early years of the Christian Era, until in quite recent years, we have entirely failed to make use of the knowledge gained and handed down to us by those older civilizations. But to-day we are entering into a new era in which nature's forces will be more properly understood and will be marshalled into use.

Hippocrates, the father of modern medicine, about (400 B. C.) practised in the island of Cos in the Greek Archipelago. He established a health temple to Aesculapius, God of the Sun, Medicine and Music. The priests in charge of the temple who were also physicians used the natural agencies of air, light and water in the cure of diseases, and the pursuit of both physical and mental culture. The beauty of the classic Greek form, both male and female has not been equalled since.

Since the decay of the Greek and Roman empires and up to about 50 years ago, the virtues of sun and air were forgotten.

In 1889, Widmark showed that it is the Ultra violet rays in the sunlight that cause erythema and pigmentation. It was Finsen, who in 1893, published his early experiments on the Physiological action of Solar Radiation and the rays from Arc lamps, and announced the results of his treatment of tuberculosis of the skin by means of the "Finsen Light".

On 1st May 1900, Finsen Light treatment was introduced into England.

In 1902, Bernhard of Samaden treated wounds and tuberculous lesions with sunlight.

In 1666, Sir Isaac Newton, discovered that sun light is composed of many different colours—Red, Orange, Yellow, Green, Blue, Indigo and Violet. In 1800, Sir William Herschel working on Newton's experiments noticed that when he placed the bulb of a thermometer

*A lecture delivered at the South Indian Medical Union, Madras

beyond the limit of the visible red rays the temperature continued to rise, and proved the existence of invisible Radiant Energy. These rays owing to their position in the spectrum were named "Infra Red" rays, and because of their properties they are also known as Heat Rays.

In 1801, Ritter found that silver Chloride was blackened by invisible rays situated beyond the violet region of the spectrum and concluded that some other invisible radiant energy is present in the ether. To these rays he termed the "Ultra Violet", owing to their position in the Spectrum. It is this portion of the sun's radiant energy that exerts the greatest therapeutic influence. The Solar spectrum can be divided into two main portions namely, visible and invisible. The visible spectrum is composed of the seven colours, red, orange, yellow, green, blue, indigo and violet, one colour gradually fading into the next.

Visible light can cause three different effects Viz., heating, illuminating, and chemical effects. Thus in sun-light there are some heat rays that are visible—and some—the infra red—that are invisible; and there are also some chemical rays that are visible—and others the Ultra Violet—that are invisible.

"Ultra Violet Radiation can be considered as formed of invisible rays whose frequencies are greater than those of the visible spectrum."

There is a great diversity of opinion as to whether natural sun-light or artificially produced ray is of the greater therapeutic value, but all are agreed that sun-light, together with pure fresh dry air free from dirt and smoke, such as can be obtained in high altitudes is better for general treatment than doses of artificially produced rays administered in the physician's clinics.

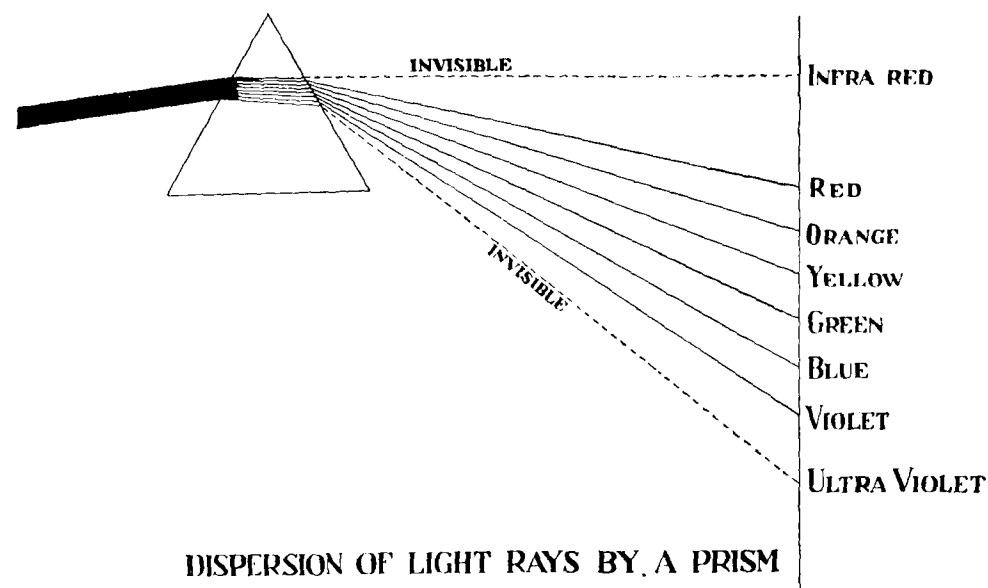
Impurities in the atmosphere, such as smoke, dust, though very minute generally absorb all the Ultra Violet Rays. Diffuse sun-light contains a large proportion of Ultra Violet Rays. Reflection increases the diffusion of light; hence an ideal place for natural Ultra Violet Radiation will be near large expanse of water or above stretches of snow,

An analysis of sun's radiation shows that it contains:—

Infra red rays	80 per cent.
Luminous or light rays	13 per cent.
Ultra Violet Rays.	7 per cent.

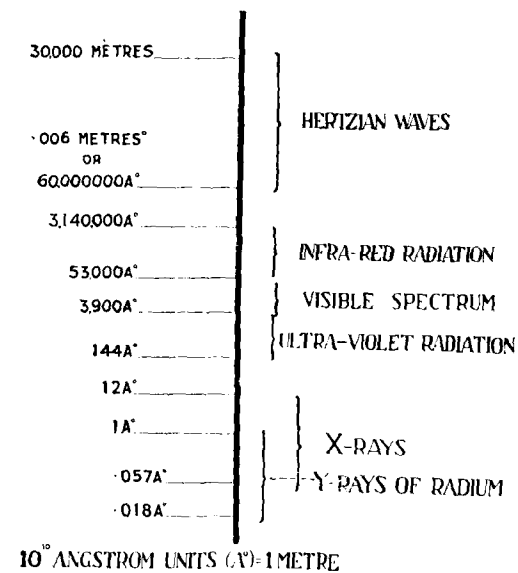
CHEMICAL AND PHYSICAL PROPERTIES OF ULTRA VIOLET RAYS.

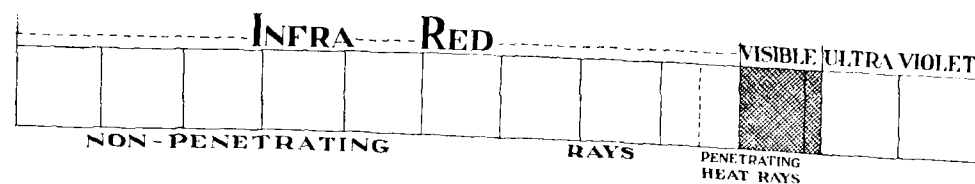
Chemical reactions may be divided into reactions of degradation synthetic reaction and double decomposition. A typical example of the degrading effect of light is when Hydriodic Acid is exposed to sunlight, the acid splits into Hydrogen and Iodine. It is because of



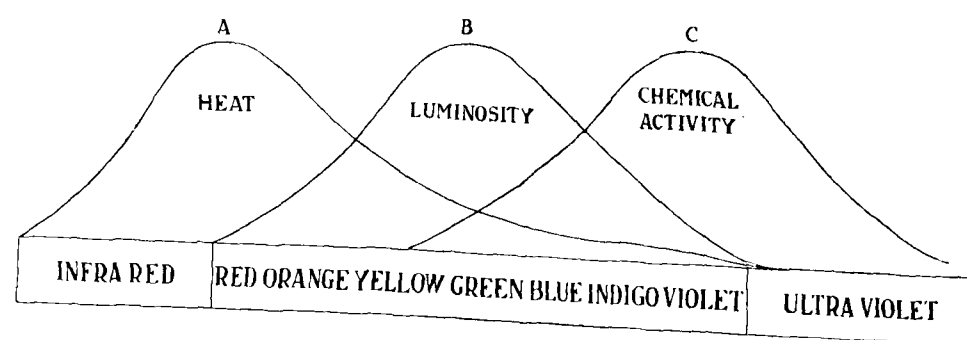
DISPERSION OF LIGHT RAYS BY A PRISM

SCALE OF RELATIVE WAVE-LENGTHS



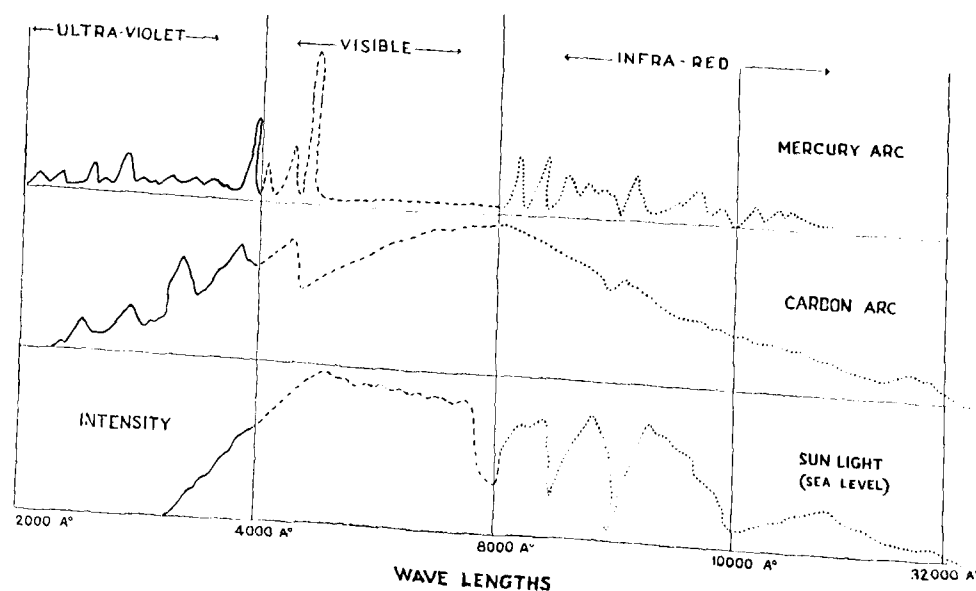


DIAGRAMS SHOWING RANGE AND PENETRATING POWER OF THE SEVERAL CLASSES OF RAYS



GROUPING OF LIGHT RAYS ACCORDING TO THEIR THERAPEUTIC ACTIVITY

SPECTRA OF COMMON SOURCES: DISTRIBUTION OF INTENSITY



this reaction that the acid is always stored in coloured bottles. If plates of silver, copper, tin, or lead, are suspended in water and exposed to Ultra Violet radiation, Colloidal solutions are formed. In the presence of light Chloroform is converted into Carbonyl Chloride (Phosgene) and Hydrochloric acid. A striking example of reaction of synthesis is the formation of Hydrochloric acid by the photo chemical combination of Hydrogen and Chlorine.

Halogenation or the introduction of halogen into organic chain compounds is probably the most valuable technical application of Ultra Violet Rays to induce or assist chemical action. Methane may be chlorinated to give successively Methyl Chloride, Methylene Chloride, Chloroform and Carbon tetra Chloride.

Amongst the various physical properties of the Ultra Violet rays we are more concerned with the absorption phenomena. Ozone absorbs ultra violet rays very strongly. It is present in very high atmospheric regions where it helps to shield the world from excessive ultra violet radiation. Water, smoke and dust particles all absorb ultra violet rays and this is the reason why the sun's rays in plains are so weak in ultra violet ray content. Fluorescent solutions and solids are opaque to the rays. Tap water absorbs a fair quantity of ultra violet rays while distilled water does not.

Glasses. The thickness of the glass and its chemical composition are important factors to determine the transparency to the Ultra violet rays. All glasses that contain metals of high atomic weight absorb most of the rays. Common glass absorbs all rays up to 2950 A.U. In this connection it is worth while to know something about the much talked of "Vita Glass". This glass was originally discovered by Lamplough, and he called it the "Vita" Glass. This glass contains a large proportion of Quartz and other ingredients that are not found in other glasses. This transmits rays up to 2750 A. U. and as such contains most of the Ultra Violet Rays present in sun-light. It is because of this property that it is being used in many of the modern hospitals and sanatoria.

Reflection of ultra violet rays.—Considerable absorption takes place when ultra violet rays are reflected. Snow reflects Ultra Violet Rays extremely well and this accounts for the development of snow blindness under certain conditions. Partial eclipse blindness is similarly due to the presence of Ultra Violet Rays of short wave length.

Fluorescence. In the presence of Ultraviolet rays a lighted candle glows a bright blue, sodium salicylate exhibits a strong violet fluorescence, quinine sulph, light blue etc.

Liver shows an intense yellowish fluorescence. Suprarenals, an orange red, and cerebral cortex, a yellow. Ultra violet rays when

passed through a filter containing the oxide of nickle affords a means of diagnosing small spreading ring-worm of the scalp and of accurately determining the extent of the scalp infection.

It is of greatest importance in distinguishing pearls: Japanese cultivated pearl gives a yellow fluorescence, oriental pearl bluish, artificial pearl no fluorescence. Fresh eggs give a reddish fluorescence, stale eggs a dirty violet fluorescence. It is also used in examining the old Parchments to estimate their age.

Biological Effects: The following are the three principal theories advanced to explain the mode of action of Ultra-violet radiation.

"(1) That the autonomic nervous system is directly influenced by the stimulation of the nerve ending in the skin, the nerves being stimulated by the oscillations of cells. There may also be direct photo-electric action on nerve endings. Dixon thinks that this nerve stimulation is due to fluorescent substances, such as quinioidine that occurs in the skin."

"(2) That the rays are able to penetrate as far as the capillaries of the corium, and that they are absorbed by the blood, where changes occur leading to widespread systemic reactions."

"(3) That some substance formed in the epidermis acts as a hormone."

Some believe that the skin fat is rendered photo active by irradiation, the body certainly has a curious characteristic smell, rather like that of burnt horn, after exposure to Ultra-violet radiation,—probably because of some chemical action taking place on the skin surface. Certain workers in this field consider that ferments are formed by the destruction of the superficial cells, while others think that some substance is formed from the breaking up of the Chromatin bands of the cell nuclei, or electrical state of protein is altered by Ultra-violet radiation, there being a change in Hydrogen Ion concentration. The Biological effects of Ultra-violet radiation on the skin is most marked. Nothing is felt by the patient during the exposure except a slight sensation of warmth due to the incandescence of the burner. There is no evidence of redness or other signs of inflammation at the time of the treatment. After a latent period of usually from 4 to 8 days, which is by no means constant, a feeling of heat is experienced by the patient. If the intensity and duration of radiation was sufficiently long and continued this feeling of heat increases and leads to much irritation. In this stage the irradiated part shows signs of feeble inflammation. This stage lasts for a few days depending entirely upon the dosage of the rays and sensitiveness of the patient.

Continued irradiation of the skin produces pigmentation. There is usually a fall of blood pressure after irradiation probably because

of the Vasodilation which follows the Erythema or because of sympathetic paresis.

Russel records a case where a fall of 20 m.m. of mercury occurred 5 minutes after irradiation by the mercury vapour lamp at 36 inches distance. Under the action of Ultra-violet rays the immunizing power of the body is increased due to the formation of anti-bodies in the blood. Diarrhoea and Bronchitis so frequently met with in rickety children are well controlled by general irradiation. Ultra-violet rays have an analgesic effect. This effect is supposed to be due to the action of irradiated inter-epithelial nerve fibrils. Sometimes a deep seated visceral pain is allayed by its application.

Effects on the skin:—The skin has got a protective function to perform, and this action is aided by the sebaceous matter that it contains. Regulation of heating mechanism of the body is done by it through the sweat glands. It is one of the important excretory organs, aiding in the elimination of waste products of metabolism such as, lactic acid, Urea and Carbon Dioxide. The various anti-bodies are also formed in the skin. It forms one of the channels for nutrition, for example Inunction of Cod-Liver Oil, Olive Oil etc. The skin is able to discriminate peripheral heat and cold, pain and tactile sensations. It protects the body from excessive Ultra-violet radiation. It is the site of the activation of hormones and vitamins. It is a highly sensitive organ and its condition can change or influence central nervous system. Example, shock after an extensive burn. Ultra-violet rays of shorter wave length are much absorbed by the skin. All rays shorter than three thousand are absorbed by a layer of epidermis. 1 m.m. in thickness. Ultra Violet rays are capable of penetrating the capillaries of the skin. Blood serum absorbs all rays below 3000 A and normal blood all rays with wave lengths less than 4500 A. Certain changes take place in the skin as a result of the absorption of ultra-violet rays. It has been proved that these rays convert the cholesterol in the skin into vitamin D which stimulates Calcium, Iron and phosphorus absorption. Pacini and others have found that there is at first a period of vasodilatation, which is soon followed by vaso constriction if irradiation is continued. Short exposures cause vasodilatation and longer exposures cause vaso constriction.

Erythema is one of the most important phenomena occurring in Actino Therapy. Erythema due to ultraviolet ray radiation always appears after a latent period. Fair people react more strongly than dark people. It is difficult to produce erythema in infants and over doses of rays must be identified by the following symptoms, viz., Loss of weight, Insomnia, and increased irritability.

Certain microscopic changes take place in the skin after irradiation. Russel says that on microscopic examination the irradiated skin reveals serous swelling of the deeper layers of the epidermis, the cell nuclei of the granular and malpighian layers being especially affected. Vesicles form and there is a migration of leucocytes into these two layers. The diameter of the capillaries increases to from two to four times their normal size. The blood stream slows down till it comes to a stand still in affected area. 24 hours later, there is active diapedesis from the non-thrombosed vessels with marked odema, and the reaction is at its height about thirty hours after exposure. When the exudation is sufficiently great to break continuity between the Stratum Corneum and the Stratum Granulosum, blisters occur. The thrombi in the superficial vessels are removed by Phagocytes. Some days later if the exposure has been sufficiently powerful to cause necrosis of the epidermal cells desquamation results.

Pigmentation. This occurs only when there has been a preceding erythema. In therapeutics the appearance of pigmentation necessitates the administration of longer exposures. All rays between 2,900 A and 3,300 A are capable of producing pigmentation. Pigmentation ensures the minimum amount of Ultra-Violet Radiation and therefore increased therapeutic action. The colour of the pigmentation varies according to the source of radiation. Thus Carbon Arc Lamp gives reddish brown, Mercury vapour lamp a more greyish colouration.

Ultra-Violet Rays confer immunity against skin diseases like Acne, Boils &c. Lack of Ultra-Violet Irradiation for the skin gives rise to avitaminic condition.

Effects on Bacteria:—Many of the bacteria are killed by the direct action of the Ultra-Violet Rays. Mere heat alone does not kill the bacteria. In 1890, Robert Koch showed that tubercle bacilli were killed by exposing them to sun-light for ten minutes. Waves of 2960 A and 2100 A are responsible for the bactericidal activity.

Ultra-Violet Rays are absorbed by the protoplasm of the organism, and in the wound one bacterium will protect another lying under it, so much so in irradiating a wound for example Lupus, the beneficial effects are more due to the increase in the bactericidal effects of the blood than the direct action on the bacterium.

Cardiovascular System:—During general irradiation of the body there is dilatation of the surface capillaries and a comparative dis-engorgement of internal viscera and vessels results. In patients with high blood pressure the blood pressure is reduced after irradiation and that relieved a great deal of the symptoms. In patients with heart lesions, the dilation of the surface capillaries, induces lowering

of blood pressure and consequently the heart's work is lessened and dyspnoea is often relieved.

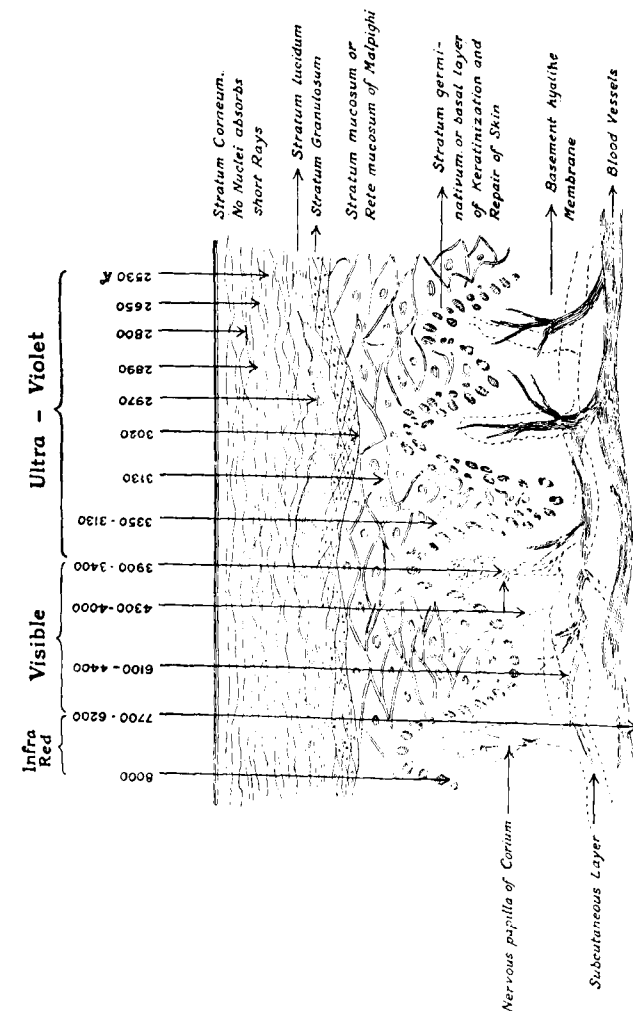
Effects on Blood :—Profound blood changes take place during irradiation. Blood serum and blood corpuscles absorb all rays less than 4500 A. How this energy is stored and carried is not yet well understood. But it is sufficiently proved that vitamin D is formed at the surface and carried to the internal organs by the blood stream. There is a slight increase in the red and white cells and in Haemoglobin; a diminution in the polymorphonuclear leucocytes; and an increase in the lymphocytes, and most markedly of all in the Eosinophilic cells. It is also known that the immunizing and bactericidal properties of the blood are increased, but the connection between these and the changes in the differential white count is not obvious, because it has always been thought that the polymorphs had the greatest bactericidal effect, and yet they are both actually and relatively decreased.

Effects on Metabolism :—Exposure to Ultra-Violet Rays influences Carbo Hydrate, fat, Protein and mineral Metabolism, but the exact process of its action is little understood.

Effects on Muscular and Skeletal Systems and growth :—Texture of the skin rapidly improves under irradiation. Flabby and wasted muscles soon regain their normal tone.

Calcium Metabolism :—There is an increase in the calcium content of the blood, and also an increase in the concentration of inorganic phosphorus, and it is due to these changes that Actinic therapy is so useful in the treatment of rickets. Calcium salts have a tonic action on the heart and an increase in the blood calcium has a stimulating effect on the heart. They stimulate the peripheral circulation and are responsible for vasomotor stability. Because of this property they are of value in the treatment of erythematous rashes. Adequate amount of calcium in blood is necessary in cases of bleeding to ensure clotting of the blood. Often the amount of secretion is reduced and Catarrh relieved. The phagocytic action of the leucocytes are stimulated and aid the absorption of exudates. Calcium salts reduce anaphylactic reactions. They improve the emotional tone and control the nervous and muscular irritability. Calcium and phosphorus are influenced by the rays of 3022 A to 2600 A. Irradiation should not be given, with the patient at a shorter distance than 36 inches from the lamp.

Effects on the Eyes :—Rays between 7600 A and 3800 A are capable of penetrating the crystalline lens of the eye. These rays are thought to produce chemical changes in the visual cells and the new product formed acts as a stimulant. All rays of 3080 A to 2950 A are



Vertical Section of the Epidermis and Papillae of Corium showing diagrammatically the Penetration of different Wave Lengths

absorbed by the lens and cause it fluoresce; and acts as protection to retina. The Cornea is most sensitive to Ultra-Violet Rays, all rays below 2950 Å being absorbed by it. Cloudiness of the cornea and desquamation of the epithelium results from exposure to Ultra-Violet Rays. The Conjunctiva is also affected. These superficial lesions clear up without any permanent damage to the transparency of the cornea. Cataract is supposed to be caused by the rays of longer wave lengths namely, the red and the near infra red; and Ultra-Violet Rays are not responsible for this condition as they are absorbed by superficial structures.

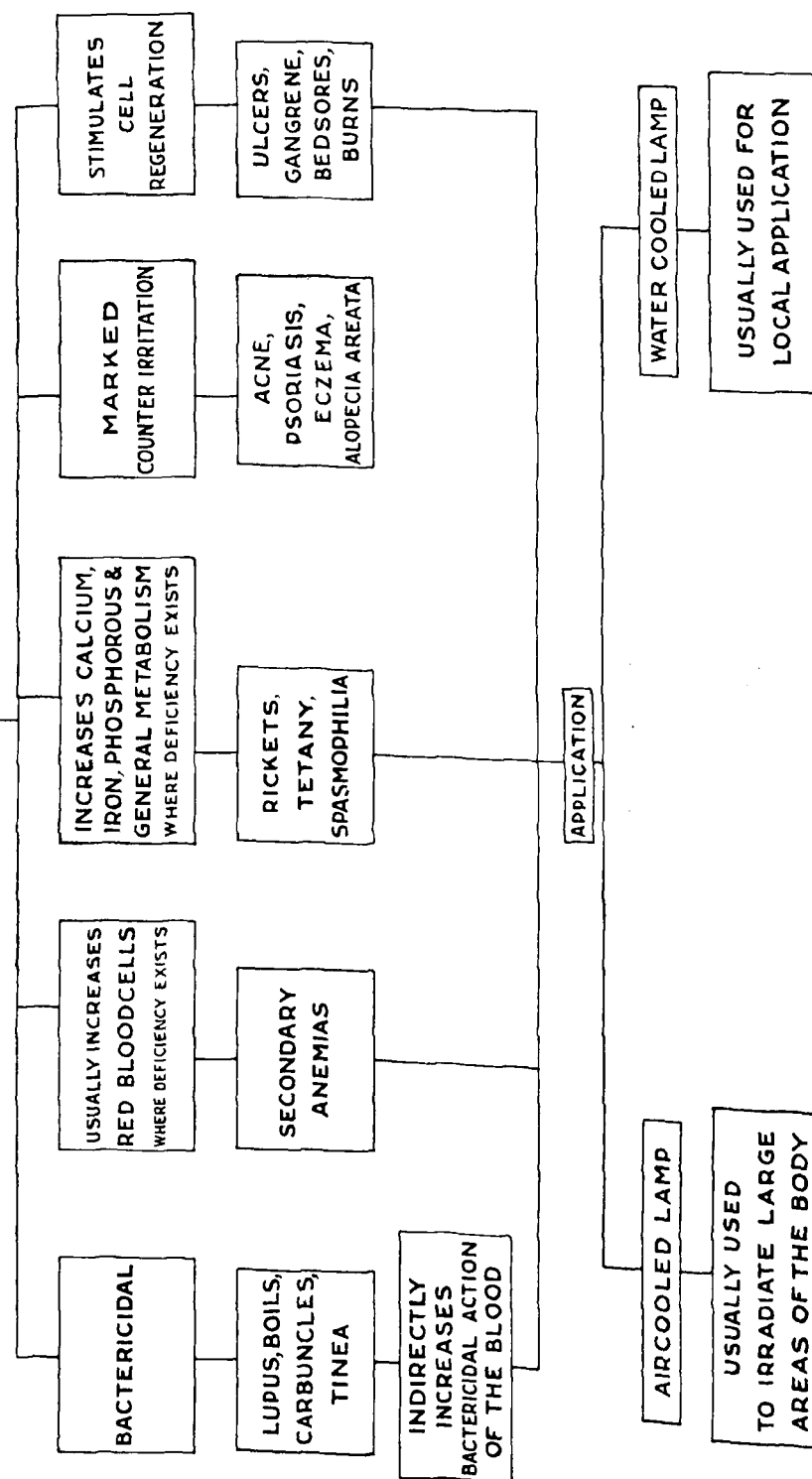
Effects on the Alimentary System:—Beneficial effects have been noted in cases of vomiting of pregnancy after irradiation, probably because Ultra-Violet Rays diminish the acid contents of the stomach. Reflex contraction of the involuntary muscles occurs under irradiation and this property has been tried in some cases of constipation with benefit. In these cases the action is brought about through the stimulation of the sympathetic system. Loss of appetite is sometimes relieved through stimulation of digestive glands under irradiation. Microbic infection of the bowel is decreased and thus many forms of diarrhoea can be controlled.

Effects on the Nervous System:—There is a well marked mental stimulation through its effect on the central nervous system. It also adds on the peripheral nervous system and has an analgesic effect. Through the sympathetic it influences the action of the Endocrine glands, Nervousness disappears and Insomnia is banished. The analgesic effect of the rays is more pronounced with the Carbon Arc and can be readily seen when cases of Herpes, Lumbago, or Neuralgia are treated.

CONDITIONS IN WHICH ULTRA-VIOLET RADIATION HAS BEEN TRIED.

The biological effects of the rays must be well understood before selecting cases for radiation. The Ultra-Violet rays are absorbed by the blood, and thus conveyed throughout the whole body. The general effect is undoubtedly an increase in the rate of general metabolism, the appetite is sharpened, the resistance of the body is increased: hence the value of this treatment after acute illness cannot be overestimated. The number of micro-organisms that infest the intestinal tract is lessened, absorption of food is facilitated, and Catarrh is lessened. Many obstinate cases of Auto-intoxication from the intestinal tract have derived much benefit. A few obstinate cases of constipation have been relieved. Anæmias are aided by stimulation of the hæmo-poietic system, and increase in hæmoglobin: rickets from the increase of calcium and phosphorus in the blood:.

ULTRA VIOLET RADIATION EFFECTS



and surgical tuberculosis and many infections by the increase of the bactericidal power of the blood, the lymphocytosis, and increase of dental resistance. Many on the continent consider Ultra-Violet Radiation valuable for its rejuvenating properties, probably because of the stimulation of the endocrine glands markedly the thyroid and sexual glands. Of late great value for Ultra-Violet Radiation in Dermatology has been claimed.

After all is said, no single therapeutic agent can be a panacea. Each has its own place in medicine, and a new method of treatment is brought into disrepute only when extravagant and unsubstantiated claims are made for it. Physiotherapy has got its own appropriate use in medicine. It is certainly not to be claimed that Ultra-Violet Radiation is the only method of curing diseases, but undoubtedly in a few conditions its action is specific, and it is able to effect a cure where other remedies have failed. However, it is certainly a valuable adjunct to other methods of treatment.

By virtue of Ultra-Violet rays properly and sensibly applied the dangers of motherhood in bones robbed of their salts, and teeth loosened in their sockets will be unknown. There will be no fear of children weakened in essential bone formation. Sunshine effect in bottles, cans and pills—sunshine by proxy—is due to that vital invisible rays—the 'light which shineth in darkness'.

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DIATHERMY IN ACUTE INFLAMMATORY CONDITIONS

BY

B. N. C. ROY, M. B.,

*Surgeon, Carmichael Medical College Hospitals, Calcutta,
Hon. Urologist, Howrah General Hospitals.*

SINCE about the year 1916 the American workers, of whom Byron Sprague Price was the foremost, were very enthusiastic in using Diathermy in acute infections, such as Lobar Pneumonia. The results were so encouraging that its use has now gradually been extended to almost all types of inflammatory conditions, arising from any cause what-so-ever and affecting any part of the body. It is usually given a chance, either as the primary or as an adjunct to the routine methods of treatment.

It is not my intention to enter into the details of the general principles and technique of Diathermy but I shall touch only those points that have direct bearings on the cases I am going to cite and I do it more as a matter of recapitulation.

The term Diathermy was introduced by Dr. Franz Nagelschmidt and is applied to the heat generated by high-frequency currents. The frequency is called high when it is unable to produce any chemical change in the tissues or to stimulate the muscle and nerve to give their customary responses. Such a frequency must be above 20 thousand per second and an absolutely safe one is considered to be a million per second as the muscle and the nerve responses are noticeable up to the frequency of 20,000 per second.

Physical Effects of Diathermy:—By Diathermy the heat is generated within the tissues. The high voltage enables the currents to pass along a direct path—from electrode to electrode, rather than the path of the least resistance-surface, etc. The tissues lying between the electrodes are heated in their entirety. The heat is generated so fast that it is impossible for the circulatory system to equalize the temperature immediately. The ordinary high-frequency of about one million per second is far too rapid to cause contraction of muscles, stimulation of sensation at the sensory nerve endings, or any movement of ions within the tissues. Therefore there is no ionizing effect, no contraction of muscles and no pain. On the other hand there is a distinct sedative effect due to specialized effect of Diathermy upon the sensory nerve endings and mechanically by relief of congestion, tension and pressure.

Local Effects of Diathermy:—In the skin under the electrodes very little effect is produced beyond a slight hyperaemia and increased activity of the skinglands. In the deeper parts in its pathway diathermy produces an acute temporary dilatation of the capillaries, which accelerates the flow of blood by diminished frictional resistance in the minute vessels and to the reduction of viscosity of the circulating fluid. The increased circulation in the diseased area leads to an outpouring of blood-serum rich in repair materials; thus the local resistance is enhanced. This also facilitates the cellular interchange of gases and fluids. Doubts are expressed by some as to its usefulness in tissues already passively congested. In passive congestion, a resistance to the circulation is encountered in the capillaries. Increased dilatation and the consequent revival of circulation improve the situation in every way. Of the different stages of congestion, the most painful stages are from the stasis onwards. In an inflammatory area, at first the toxins produce dilatation of the capillaries. Gradually the tone of the capillaries is lost and stagnation supervenes. This is particularly the stage when the help of Diathermy is most valuable. Diathermy brings back the tone of the capillaries as well as that of the lymphatics. The primary and the temporary dilatation followed by contraction are exactly the things needed at the time. This change prevents the settling and growth of bacteria. The bacteria are deprived of their food as no serum can stagnate there. On the other hand the fresh serum which brings in larger number of phagocytes and antibodies in the field has a deleterious effect on the growth of bacteria. The well-toned capillaries can squeeze out the irritants from the field and the high heat either kills the germs or prevents their growth (attenuation).

Systemic Effects:—Diathermy raises the body temperature to some extent—1.5 to 2.5 F. It lowers both systolic and diastolic blood pressure.

Diathermy develops a deep-seated and real heat within the tissues. It is the translation of electric energy into heat developing as it meets with opposition in its pathway through the tissues—the resistance. The heat may be sufficient to coagulate protein, but when a good machine is carefully handled, there is absolutely no danger in its application to normal living vascular tissue; because, the general circulation carries away and diffuses the heat. The actual amount of heat developed depends on the Ohmic resistance offered by the tissues included between the electrodes, the square of the current-intensity used and the time allowed to the current to pass. 100 mA for each square inch is a safe quantity. This limit must be adhered to particularly when applying diathermy to anaesthetic areas and to asthenic or unconscious patients. Ordinarily the best intensity is the one

which the patient can stand without much discomfort. But this rule cannot be applied to, when very big electrodes are being used.

It is feared that Diathermy in conditions where there is walled-in pus increases the drainage from that area and leads to dissemination of pus throughout the system. This may be so if it is done in the ordinary way, without proper adjustment of heat or current as the condition warrants. The same heat and current when properly adjusted will produce coagulation in the central area where there is no active circulation to carry away the heat. At the same time it brings about hyperaemia in the capsule and the surrounding structures which act as the protective barrier. Later on the coagulated debris with the entangled dead or attenuated bacteria, forming the central mass, will be liquified by the natural proteolytic enzymes. While the increased hyperaemia of the capsule and the surrounding structures will facilitate the growth of new capillaries in the heretofore impenetrable wall of the abscess cavity, and these capillaries in their turn drain away the liquified material from the central coagulated mass which should be absolutely aseptic and should be incapable of disseminating the infection throughout the system, what is more the slow and steady way in which it is absorbed, acts as the best form of auto-vaccine and helps the system to fight out the infection better. This, I could fully convince myself by experimenting on animals and applying it accordingly to patients where I invariably obtained the expected results.

It is also feared that in conditions where capillary and arteriole dilatation would increase the danger of haemorrhage as in pulmonary tuberculosis with cavity formation, gastric or duodenal ulcers, piles, etc., diathermy should be avoided. The objections, I believe, are rather theoretical than practical. Diathermy temporarily dilates the capillaries but its most important effect is the toning up of the capillaries and the smaller vessels. I have often found improvement and very good results after its use, in these types of cases, with no untoward results.

For a healing process we depend on the leucocytes and the immune bodies in the system. Anything that helps in attracting or concentrating these things to the affected part or the manufacture of these things in increased quantities to cope with the increased demand helps the healing process. Ordinarily what leucocytes are required for the healing of a local inflammation are always there in the system; for that no special manufacture is necessary. But what is required is some special means to attract or guide them or give facilities to them, as to make the area more approachable and permeable, by the formation of new capillaries and allowing more passage of blood. This is admirably accomplished by the application of Diathermy.

Mr. G.D.M., a merchant, age 45 suffering from an acutely inflamed ankle. The pain and the swelling have been lingering for the last three weeks and resisting all kinds of treatment. As there was some pain in the knee as well he was made to sit on a non-active electrode and place his left foot on the active one. He had altogether three treatments after which he had no pain or swelling and is continuing to be without trouble since 21st November, 1929 when he had his last treatment.

Mr. A.F.B., a teacher age 35, suffering, from sciatica, which was giving excruciating pain, inability to move about and absolute helplessness. The electrodes were so adjusted as to pass along the course of the sciatic nerve. It was on the left side. He had altogether six treatments and has been without any relapse since 31st August, 1928.

Mr. K. L. D, a broker, age 24, suffering from acutely inflamed piles with repeated haemorrhages. Physical examination revealed no external piles but he had several of them—internal ones, all round the rectum. He was advised open operation. He was given two exposures; after which he had no trouble of any kind. The treatment was discontinued and he was advised to come again if there be any trouble in future. This was on the 16th April, 1930 and he has not done so as yet.

Dr. O. U. a medical man, came on the 9th August, 1929 when he had an acute exacerbation of lumbago, shooting down the thighs, from which he had been suffering for 4 or 5 years. He became quite well after two exposures and continued to be well, and he wrote: "I assure you that I am doing very well."

Mr. N.D.M., a share broker, age 42, saw me on the 13th. December, 1929. He was a chronic sufferer from dysentery. For this as well as for pain in the liver region he had to undergo several courses of emetine injections which gave him relief but not of a lasting nature. The relapses became more and more frequent and the condition of his heart gradually became such as it was dangerous to push more emetine which was the only thing that had been giving him relief. For three days the pain again aggravated. The liver became very tender. These three days he could not lie down and had very little sleep. He looked very pale and desperately ill. Had a temperature of 103° F. The skin over the liver area was shiny, reddish and swollen. Liver could be felt two inches below the costal margin. Blood examination—R.B.C. 4,200,000., W.B.C. 15,000, No M.P. found. X-Ray examination showed a dense area at the right lateral portion of the liver. The whole thing could be completely controlled in seven days' time and with seven exposures, without the aid of any drug what-so-ever.

Mr. G. C. K. a shop keeper, age 26 years. This case was very similar to the one mentioned above. It was feared that unless operation was performed immediately there was every chance of its bursting and producing general peritonitis. The temperature from 104° F came down to 100° F, the pain and other troubles were considerably relieved after the first exposure. He had altogether eight treatments and had been doing well since September, 1928.

Mrs. B, wife of a medical man, age 30 years, suffering from acute pain with a lump formation at right iliac fossa. The temperature, varying from 100 to 103° F. Leukocytosis was a little over 19,000. She had been suffering for about two months as she stubbornly refused, from the beginning, to be operated upon. The fever came down to normal after two exposures. The pain and the lump took altogether six treatments to disappear. She has been keeping well since Sept. 1929.

Mr. G.B.C., a landlord and merchant, age 48 years. He used to suffer off and on from dysenteric attacks and get relief after a few injections of emetine. This time too he had been suffering for about three weeks and emetine injections gave him relief. The only thing remaining was a sharp sickening pain at spot little above the navel and which used to grow worse at the desire of motions. It was in the transverse colon which could be felt thickened. Every time this thing continued till he got the next acute exacerbation. Emetine was ineffective to do away with this. For the radical cure of that inflamed spot I advised him Diathermy. He was given three exposures in July 1930 and since then he has had no further trouble.

Mrs. R.S., age 25 years, had whitlow of the right thumb. One treatment was enough to make it subside.

I shall deal with Pneumonia and a few other acute conditions in a separate article.

It is impossible in a small compass like this to cite the various types of acute inflammations where one should get remarkable improvement under diathermy. I admit that there are lots of technical difficulties about this method of treatment. Before beginning the treatment one should be absolutely certain about the actual state of affairs, for which purpose skiagraphy is most valuable.

I have intentionally left out the chronic conditions as they require a little more explanation as regards the mode of action and the methods of treatment, in order to follow the steps easily. But at the same time I must confess that the subject I dealt with in this paper is not complete, unless I do this latter one also, which I hope to be able to do shortly.

SURGICAL—DIATHERMY—ITS CLINICAL SIGNIFICANCE

BY

DR. KAKU M. HIRANANDANI, C.M.S.L.C.P.S. (BOM.), C.R.X.I. (BAGDAD),
P.G.M.R.E. (LIVERPOOL), L.M. (ROTUNDA), L.A.H. (DUBLIN).

Hyderabad, Sind, India.

THIS is the modern method of treating some surgical affections. It is a method though under trial, has in certain cases given very encouraging results, and that the future results with the advancement of science seem to be very hopeful. Diathermy sometimes called Thermo-Penetration literally means heating through or across. The word "Diathermy" covers the application of high frequency alternating currents or rather electrical oscillations in the domain both of medicine and surgery. In medical diathermy the temperature of the tissues is within the physiological limits. In surgical diathermy the temperature exceeds the physiological limits, leading to destruction of the tissues so called "Electro Coagulation and necrosis of the tissues by heat." The Surgical diathermy differs from the cautery in which destruction is limited to cautery-point, whereas there is increased and deeper destruction of the tissue in surgical diathermy.

Physical Principles.—When an electrical current is passed through a body or through a medium which contains solutions, dissociation to a certain extent into ions, certain chemical and thermal effects are produced. The heat is in proportion to the resistance of the medium and the intensity of the current. If an ordinary current alternating or direct is applied to the human body by putting two electrodes at two different points of the body, the application soon becomes unbearable for the patient as a result of chemical reactions initiated relatively by small amounts of current and the pain produced by strong applications.

The use of ordinary electrical current owing to its influence on chemical relations of the molecules, is therefore contra-indicated for production of thermal effects in the body. The chemical effect of the molecules is distinguished by the peculiarity, that it is dependent on the direction of the current in such a way, that one part of dissociated molecular particles follow the direction of the current, while the other takes the opposite direction. If the current is reversed the direction of the chemical processes is also reversed. But if the direction of the current were changed frequently and quickly, one might reach a point, when the reversion of the current takes place, before any chemical change took place. What then remains is only an oscillation of atoms and molecules, within the limits of their peculiar

structure. Such oscillations could be produced by the discharge of condenser with the desired effect of increased internal temperature without harmful or painful effects. The absence of painful sensations is due to rapid oscillations of the current preventing the occurrence of ionic effects. *Diathermy is really a high frequency current, i.e., currents which reverse their direction many thousands of times per second.* The currents having a periodicity of less than 130 cycles per second are referred to as "Low frequency"; the periodicity in most common use in diathermic treatment is well in excess of 1000 cycles per second.

The principle on which all high frequency apparatus used in therapeutics is based is the disruptive-discharge of the *Leyden Jar or Condenser* causing the current to oscillate rapidly. The frequency and duration of the oscillations depend upon the capacity and size of the condensers, the resistance, and the amount of self induction in the circuit. The three chief methods used to procure these high frequency currents are the *D'Arsonval*, the *Oudin*, and the *Telsa* each having its own advantages; but the modern science has led to great many improvements. The general principle of diathermy plants is this—A spark gap, condensers and induction coils are connected with one another in due regard to the required effect. The current supplied to the primary from the main must be *alternating* so that the currents may be induced in the secondary coil. By means of two electrodes connected at the end of the plant the high frequency currents of about 500,000, oscillation per second can be obtained and regulated. The greater the intensity of the oscillations and greater the resistance, the greater the amount of the heat generated in the tissue. The resistance is determined by the size of the electrodes. If two fairly *equal sized electrodes* are used it is called medical diathermy on account of uniformity of the heat. But *when two different sized electrodes* are used, the resistance at the small electrode is very great, and the amount of heat produced is such that it leads to coagulation and necrosis of the tissue at the point of contact, which we call "Surgical Diathermy."

In the old "Arsonval" plant the voltage accompanying the oscillating currents ranged as high as 1000, Volts, whereas in the new diathermy plants it ranges about 100 Volts and at the same time a greater intensity, as during each phase of main alternating current a great *many groups* of electrical-oscillations are generated in the *spark gap*, whereas in the Arsonval type there is only one group.

Method of application.—The patient is put on special Diathermy couch. I prefer flat table. The passive or indifferent electrode is connected to the patient's body preferably thigh by means of pad of

white lint, and soaked with 5—10 per cent salt solution. The indifferent electrodes are usually sheets of metal (Lead) cut to various sizes and shapes. The pads of lint are folded evenly in several layers of moist lint and fixed by means of bandage. The usual size of indifferent electrode should be about 6 inches × 8 inches. It is called indifferent as no effects are produced there. The indifferent electrode must make even and firm contact with skin of the patient at all points and the pads covering it must not become dry but be all the time of operation wet.

The active or effective electrode is attached in the Vulcanite handles. There are various sizes and shapes (knife, needles, discs, buttons) which the operator can select for himself. The wires connecting the active and passive poles should be well insulated and secured.

Precautions for the operator.—To have comfortable position and stand on some insulating material such as lead rubber board, to avoid shock. To have the area of operation well illuminated. To be firm and steady with the instrument i.e., active electrode while the current is on. The instrument must be in firm contact with the part to be treated and should not be removed till the current is switched off. To use the gloves. Lastly to be quick and sharp in shouting to the assistant at the Switch-Board when to put, *off or on* the current. A little delay means lot of danger. The active electrode to be removed after the current is switched off.

Assistants—One is required to control the Switch board and put "off and on" the current as is told by the operator. Second is required to hold the electric light so as to make the field of operation fully illuminated. Third is required to directly assist the operator in mopping, steadying the head of patient and holding the gag in case of mouth operations etc. This assistant is in great danger and has to guard his hands with lead, rubber gloves etc.

The regulation of the current. The assistant on the switch Board should switch on the current gradually from zero until to the degree required. It should be switched off immediately sparks begin to appear, and before the active electrode is removed by the surgeon.

Anaesthesia—In certain *small localised* conditions Local anaesthesia of novocaine is used and in some cases where the patient is not nervous, the operation of Diathermy could be finished without any anaesthetic. Such sort of treatment is unpleasant. Mostly one has to use the general anaesthetic and the choice of anaesthetic lies in *Chloroform* only. A good anaesthetist is a great boon in these cases.

Preparation of the Patient.—This is done like the ordinary routine of preparing the patients for any other operation. Enema, purge and fast etc.

Contra-Indications—Venous thrombosis, advanced arterial sclerosis, acute hæmorrhagic conditions gastric or pulmonic and disordered heart are unsuitable cases.

Precautions for the patient—Any metallic substances, such as keys, coins, hat-pins, metallic armlets or wristlets etc. should be removed. The patient's hands are tied to the sides of the table with bandage, so as to prevent them from moving should the patient come round from the anaesthetic during the period of operation. All this makes the field of operation undisturbed both for the operator and his assistants and also for the patient and thus saves a great deal of time.

After-Treatment—It all depends upon the nature of the case; but in general, rest, and unirritating diet, with soothing mouth washes and dressings need to be laid stress on. As after S-diathermy the parts treated naturally slough away, so constant change of dressings and soothing applications such as Boric solution grs. V to 1 oz. become necessary. In some cases, solutions of Hydrogen Peroxide are beneficial. In cases with foul breath, I prefer to use weak solutions of "Fecto", a preparation of Messrs Parke Davis & Co. The general condition of the patient should not be neglected but improved by suitable, tonics and gradual return to more nutritious diet.

Complications—Obstruction of the glottis may occur resulting from oedema in the neighbourhood of operated area. Preliminary tracheotomy is advisable in cases of growths in the region of larynx and oesophagus where pressure obstruction may be expected. Haemorrhage if it occurs can be treated on general surgical principles; septic Broncho-pneumonia is not uncommon in cases of mouth and must be guarded against and treated in the usual way by making the patient sit up in bed etc.

Advantages of surgical-Diathermy—(1) The operation is bloodless.

(2) There is comparatively little or no shock.

(3) Sterilisation of the parts treated as a result of increased heat produced.

(4) Dangers of metastasis are practically nil due to blockage in all the vascular areas produced by processes of coagulation: thus preventing the absorption of septic materials.

(5) Inaccessible tumours with surgeon's knife, become accessible with diathermy electrode.

(6) Inoperable and advanced cases given up by the surgeon can be taken up and treated by this method.

(7) The operation is easily and quickly done, and does away with preparation of a surgical theatre and its paraphernalia.

(8) Postoperative adhesions are rare.

(9) Rapid convalescence and less bothersome after-treatment as compared with surgical operation.

(10) Diathermy operations are not so mutilating and the scar produced after separation of the slough is denser and thicker. Thus acting as a barrier to the process of surviving malignant cells and the tissues.

(11) The active electrode of S. D. is brought in contact with the diseased part first before the current is "switched on" Whereas in ordinary cautery—the "Cautery-point" is heated by the flame first before it is brought in contact with the diseased tissue.

Drawbacks of surgical Diathermy.—(1) Destruction of important blood vessels and nerves; the pain resulting from the destruction of the nervous tissue is annoying and constant.

(2) Secondary haemorrhage from important blood vessels, which have been overheated; hence the importance of *preoperative ligature* of big blood vessels.

(3) Formation of Keloid in operations on skin surfaces.

(4) Destruction of periosteum when operating on tissues close to bone; hence the importance of reminding the above facts during an operation of surgical diathermy.

(5) Inability of the surgeon to see the important blood vessels and nerves only.

(6) It is the *primary focus* that is only accessible to diathermic treatment, but not the secondary such as Glands.

Efficiency of the operation—It depends upon the following conditions.

(1) Efficient apparatus.

(2) Good illumination and complete exposure of the area of operation.

(3) Steadiness of the surgeon and promptness of the assistant at the switch board.

(4) Proper preparation of the patients, specially the proper application of the passive electrode in addition to other necessary preparations.

Uses of Surgical Diathermy—The surgical diathermy is used for the destruction of diseased tissues whether they be of benign or malignant.

nant type. Though it is mostly used for malignant diseases, or in accessible areas by the knife, such as mouth tongue, nose, bladder etc., yet in general terms it can be used for any type of diseased tissue such as warts, moles, naevi, papillomas, chronic and malignant ulcerations including rodent ulcers, various, malignant and inoperable growths, and independent swellings etc., too numerous, to mention. But it is the primary focus that is accessible to diathermy and not the secondary which has either to be removed by knife or treated by deep X-ray therapy.

But this varies under certain conditions, and the surgeon is the best judge, sometimes certain growths with limited margins can be treated in their secondary extensions but no hard and fast rules can be laid down. Patients' condition has got to be taken into consideration from its general outlook, and then the prognosis as to its being favourable or otherwise, before surgical diathermy can be limited in its extensions. It is not like the medical diathermy and the high frequency which are so extensively used.

Since surgical diathermy has come into use: Radium treatment, surgery knife, X-ray therapy, have all to be divided, and some times combined so as to see at which stages of the disease they can be advantageously applied.

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RADIUM IN THE SERVICE OF SURGERY

THE discovery of radium by Curie and Becquerel in 1898 revolutionised physical science and opened up fields of fresearch. It has also brought us nearer to realisation the hope of finding a cure or cancer.

To go into the physics of radium is beyond the scope of this short article. We leave our readers to refer to authoritative works on the subject. Our purpose here is only to demonstrate how radium acts on a cancer cell and how this action is made use of in surgery.

Our knowledge of the life-history of the cancer cell is very meagre and almost the only known fact which is of any use for our present article is that it is constantly dividing and that it is this constant division that renders the tumour susceptible to the action of radium. The minute mechanism of this process is obscure. It seems highly probable that the gamma rays destroy the chromatin which at first condenses and then fragments to be later absorbed by the cytoplasm which then itself dissolves. So far as is known at present the action is strictly intracellular and no indication has been discovered of any toxic substance which can pass from cell to cell.

Another known fact is that the sensitivity to irradiation is a specific property of the individual cell and that such tissues as the epithelial tissues, the lymphoid tissues, and the generative cells are radio-sensitive while the connective tissues, muscles and nerve are highly insensitive. Tumours which show rapid division are sensitive while those of slow growth such as fibromas and Lipomas show no reaction to therapeutic doses. This however does not mean that the connective tissues are unaffected. They are affected but in an entirely different manner. Following the application of a single large dose, or repeated doses, permanent changes occur which manifest themselves only very many years after.

The problem of dosage will therefore be seen to be of the utmost importance, for on the one hand too small a dose will fail to destroy the cancer cells, while too large a dose will injure the cells of the connective tissue. As a rough guide it is taken that the energy irradiated during the decay of 1 millicurie of radon, or, the energy irradiated from 1 m. grm, of radium in 5.5 days, is capable of destroying all cancer cells within a sphere having a radius of 5 mm. As, however, the energy absorbed by a cell is inversely proportional

to the square of its distance from the source of radiation, it is obvious that the irradiation at the centre is excessive while the cells at the surface receive only a lethal dose. To obviate this and to get uniform dosage, various devices are in use.

One method is to concentrate a large quantity of radium—about 4 grams—in a bomb and to keep this at such a distance that the effect of the law of the inverse square is reduced to a minimum. A better effect is obtained if the bomb is kept in constant movement, or if it is moved at intervals so that the radiation enters the tumour from different directions. This however is a costly and wasteful method. A more effective method is the use of radium needles on a moulded support. These needles are platinum tubes with walls 0.6 mm. thick and containing radium sulphate, so packed that each centimetre of the tube contains milligram of radium element. The needles are so arranged that a really uniform dose is given to the underlying region. Far more efficient and economical is the introduction of platinum needles or seeds containing radium or Radon into tissues. The arrangement is so made as to get the best results bearing in mind one of the most important factors—effect of crossfire. This last method, in fact, is identical with introducing a diffuse bomb with wide distribution of foci so small as to be individually weak, and yet so many as to be collectively powerful.

For many years the surgical use of radium was almost limited to the cervix uteri and skin. But realising that early failures were due to faulty technique surgeons nowadays are using radium for the cure of cancer in practically every part of the body. Apart from faulty technique there are four other causes of failure. They are: the one unsolved way be too large for uniform radiation: the tumour may not be radio-sensitive; the surrounding tissues may be as sensitive as the tumour making treatment difficult and secondary deposits may be present.

It is a common experience to find that cancers of the skin and mucous linings of cutaneous orifices are all very sensitive to radium and in cases of limited extent 90 per cent are capable of being cured. Even in extensive and inoperable cases local cure can be expected in 40 per cent. If secondary deposits appear in the gland direct surgical treatment is better because of their extent. Glandular organs such as the breast respond very satisfactorily to radium inserted either as needles or as seeds, but as in this case diffusion is rapid can never be certain that a local cure will not be followed by secondary deposits elsewhere.

The type of tumour has also got a great deal to do with cure. Thus, of epitheliomas of the skin, the baso-cellular type (Rodent ulcer) respond more readily and the squamous type is more resistant, while intermediate forms show a variable reaction. Sarcomas also react in a very variable manner. Lymphosarcomas and Sarcomas of a myeloid type disappear rapidly, but both are liable to produce secondary deposits. Myelomas react well and do not produce secondaries, but spindle celled sarcomas show an indifferent reaction. Other malignant tumours of mixed structure are on the whole resistant, but in a variable degree.

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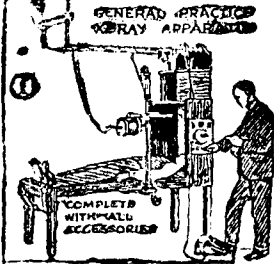
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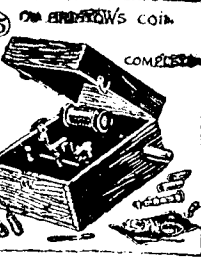


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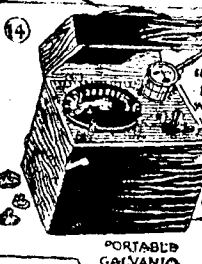
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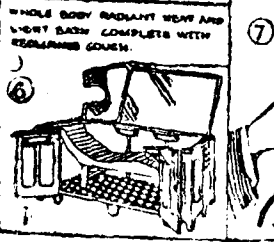
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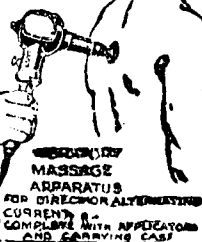
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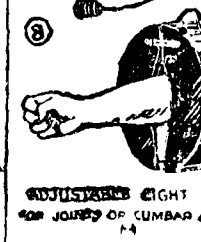
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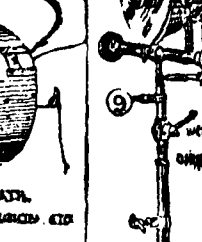
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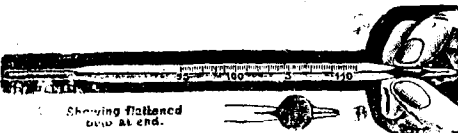
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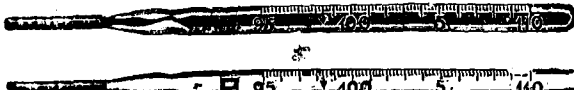
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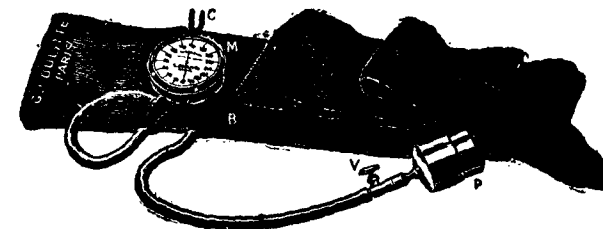
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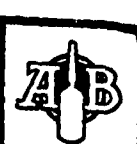
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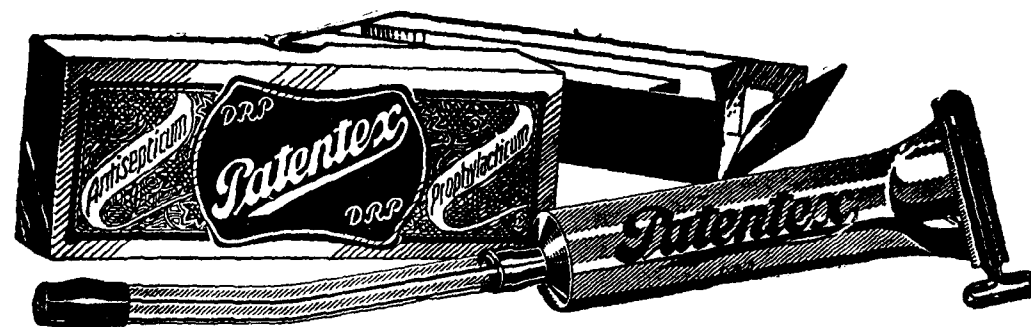
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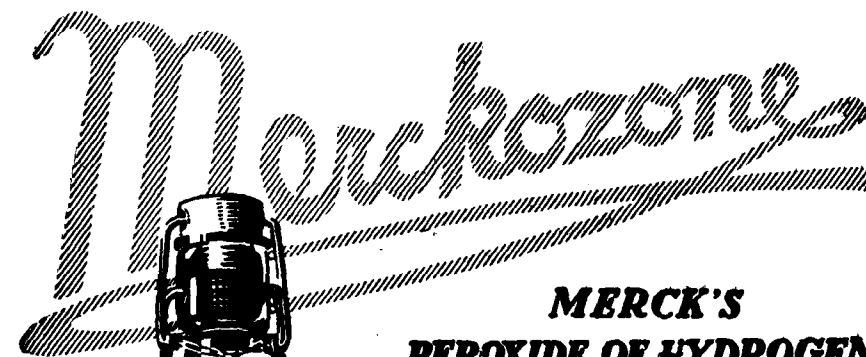
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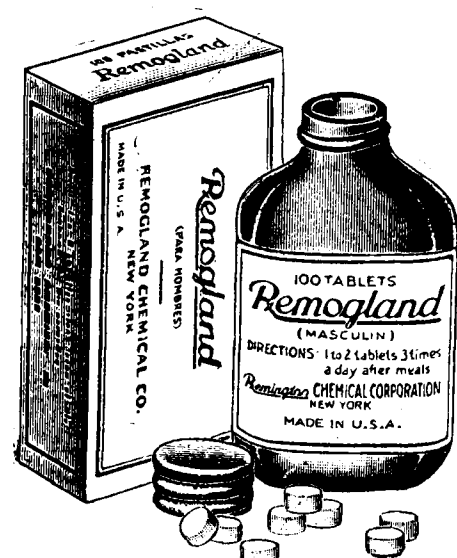
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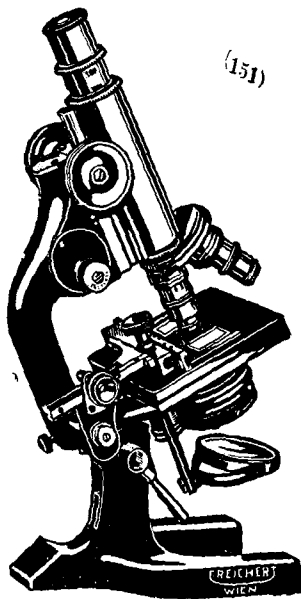
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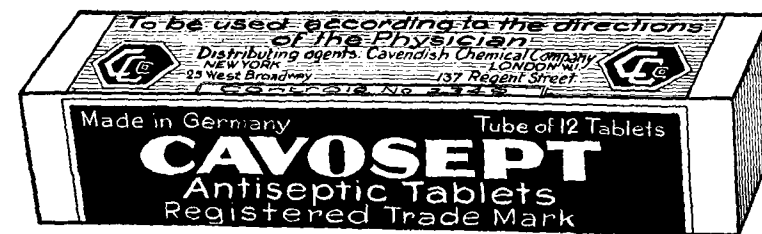
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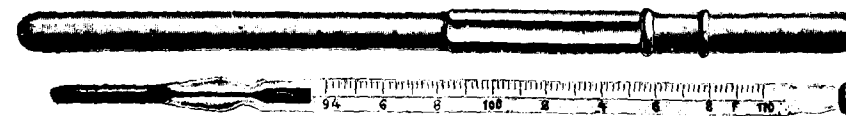
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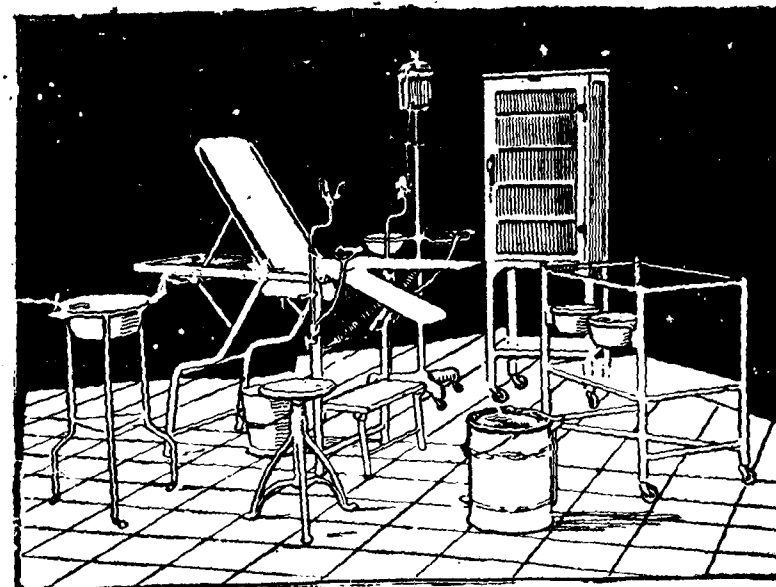
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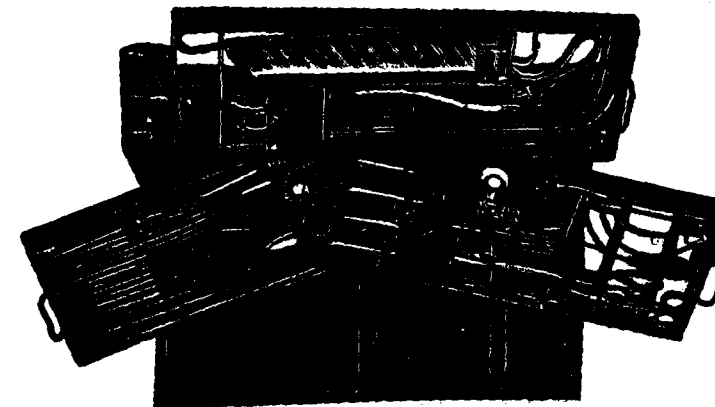
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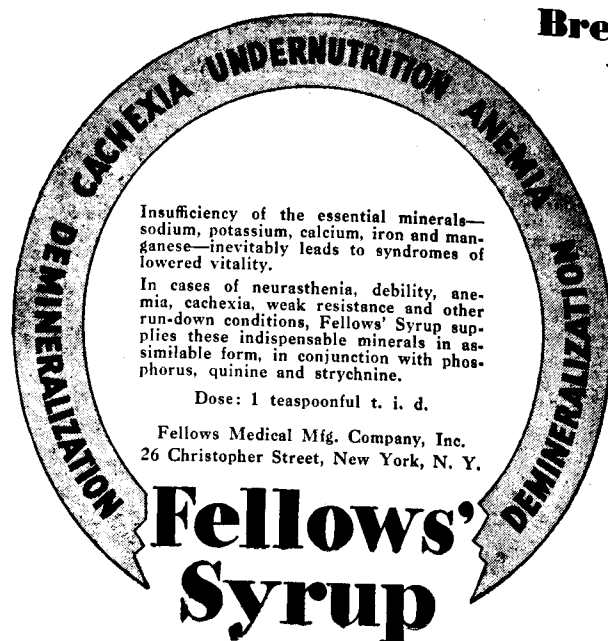


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[No. 8

Original articles

CALCIUM—ITS IMPORTANCE IN MEDICINE*

BY

DR. EDWARD PODOLSKY, M.D.,

Brooklyn, New York.

Among the most important of all the chemical elements in their relation to the problem of building and maintaining human health is calcium. Calcium is an element very essential to man, whose daily requirements of this substance is between '4 to '8 grams a day. With the exception of bone (which is the reservoir of calcium and phosphate) calcium is distributed evenly throughout the body tissues.

The calcium ions of the blood form a part of the balanced system of ions, which, reflected in a similar balance in the tissues, controls the degree of irritability of all muscle and nerve tissues of the body. In this way the proper action of the beating heart, contracting muscle, and functioning nerve is assured.

Calcium also plays a definite role in the clotting of the blood. In the curdling of milk, indispensable for infant nutrition, the calcium ions combine with the casein, hydrolized from caseinogen by rennin, to form insoluble calcium caseinate.

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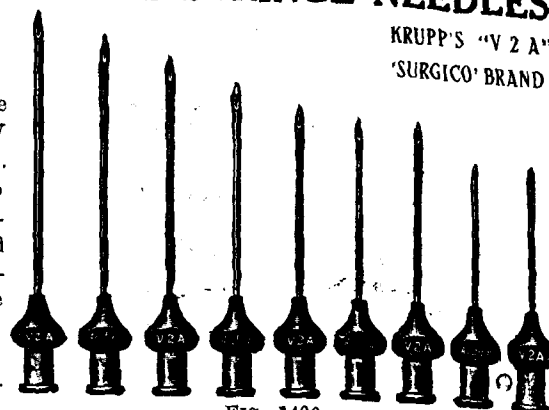
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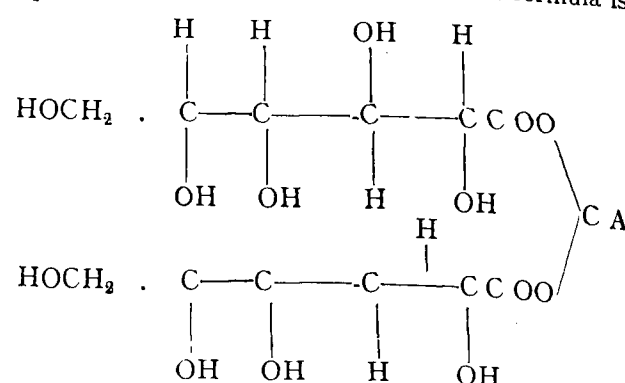
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The insolubility of certain calcium salts renders them useful as supporting and protecting structures. It seems agreed at the present time that bone formation is no mere precipitation of insoluble organic salts in a receptive matrix. Any drain of calcium from the blood is at once responded to by solution of bone.

Calcium in the form of lactate has been and still is one of the favourite forms of administering this drug. However, within recent years a new salt of calcium, namely, calcium gluconate, has come to the fore in calcium therapy, and this salt is gradually replacing calcium lactate as a means of administering the element. There is no doubt that in time the gluconate of calcium will become the favorite means of imparting calcium.

The formula for calcium gluconate is $\text{Ca} \left(\text{C}_6\text{H}_{11}\text{O}_7 \right) 2\text{H}_2\text{O}$. The molecular weight is 448.33. Its chemical composition is as follows: Calcium 8.95%; gluconic acid equivalent to 87.04%; water of crystallisation 4.02%. It is readily soluble in hot water, but only soluble to the extent of about 3% in cold water. However, it has a tendency to form supersaturated solutions. The structural formula is :



Within the past few years many investigators throughout the world have been devoting themselves to the study of the therapeutic applications of calcium in a great variety of pathological conditions. In tuberculosis, particularly, it has been found that calcium has a favorable effect on the tuberculous process as well as on certain of its complications. Intravenous injections of calcium chloride have been recommended highly for diarrhoea which is a very unpleasant complication in this disease. The profuse sweating, vomiting and blood spitting have also been benefitted to an appreciable degree. In glandular tuberculosis some physicians have noted a rather marked improvement following intravenous injections of calcium chloride.

Calcium has also been found useful in checking the dry cough of tuberculosis; in those cases with profuse expectoration, the cough, however, is checked more slowly. Where the sputum is thick, viscid,

and tenacious, it soon becomes more liquid and much easier to expectorate, and gradually becomes less in amount.

One of the most striking results from the use of calcium is the change which is brought about in the tubercle bacilli in the sputum. These organisms, which possess the typical morphological characters of the Koch bacillus before treatment is begun, soon become changed and lose to a marked degree their acid-fast character, retaining the carbolfuchsin stain irregularly and become granular and fragmented.

Some of the cardiologists who are interested in the latest advances in the treatment of heart disease have noted a synergistic action between calcium and digitalis; that is, calcium acts as a means of intensifying and prolonging the action of the digitalis, so that less of the heart tonic is required in order to derive any benefit from its action. For some time it has been noted that calcium has a somewhat digitalis-like action on the heart.

Calcium has been found to have a remarkable influence on the kidneys. In œdema the urine output is increased and the nitrogen elimination is reduced by about half. The calcium acts mostly on the capillaries of the kidneys and thus effects the change.

On the blood vessels calcium exerts a rather remarkable influence. It has been known for quite a long time that calcium is needed in blood clotting. For this reason injections of calcium salts is resorted to in order to control haemorrhage. This is done by the calcium decreasing the permeability of the blood vessels.

On the stomach the action of calcium is rather definite. Intravenous injections of calcium chloride almost invariably increases the acidity of the gastric juice and correspondingly accelerates the mobility of the stomach. In this way digestion is materially aided by an increase in both the flow of the gastric juices as well as in increase in the action of the stomach itself.

A condition which calls for rapid and intensive calcium action is tetany. The various forms of tetany with increased neuromuscular irritability, convulsions, etc., are associated with a marked decrease in the blood calcium. Intravenously administered calcium temporarily raises the calcium level of the serum and aborts the attack.

The striking action of calcium injections has often been observed in asthmatic attacks. Here the action of calcium seems to be due to its general sedative action. Calcium equalizes the excessive preponderance of potassium in the body fluids which is said to be responsible for the spastic contraction of the bronchioles and thus for the asthma.

For the very same reason calcium has been used in hay fever, urticaria and mucous colitis all due to some excessive irritability of the body. In the form of the lactate or rather better still, the gluco-

nate, calcium may be given over prolonged periods of time with an improvement in the condition, and a possibility of ending off any future attacks. In salvarsan reactions calcium may be given both as a curative agent and as a means of preventing the very disagreeable reactions which sometimes follow the administration of this drug in the treatment of syphilis.

Calcium has also been tried in a variety of infectious diseases, such as typhus, epidemic encephalitis, scarlet fever, etc. Nothing very remarkable has been observed, although it must be said that the calcium does exert a calming influence on the fever in these diseases, and thus it makes the patient more comfortable.

In the field of toxicology it has been found that calcium is most promising in certain types of poisoning, particularly with oxalic acid, arsenic, chinidin and cocaine. More will have to be done in order to establish this chemical more firmly as an antidote in cases of poisoning.

Lately, intravenous injections of calcium have been found to be of great value in controlling pain, particularly the very annoying pain of acute epididymitis. Here it acts almost as if by magic. Quick relief is experienced with a single injection.

High blood-pressure is still a great problem and many clinicians are constantly on the outlook for new remedies to bring down an abnormally high pressure. Dr. Kylin particularly has championed the application of calcium therapy in this disease. He assumes that essential hypertension is intrinsically a vagotonic neurosis; aside from many other symptoms this type of high blood pressure shows a characteristic displacement of the potassium and calcium values in the blood serum in favour of the potassium. As a result the potassium-calcium quotient becomes larger than normal, a proof that cellular fluids have lost their proper balance of ions. In consequence, there occurs a hypertonic condition of the arterioles which calcium is said to be able to correct.

Calcium may be administered either orally or through hypodermic injections. In cases when prompt action is desired an intravenous injection preferably of calcium gluconate is given. For administration by mouth the various salts of calcium are available, as, for calcium lactate for urticaria, calcium chloride for colitis, diarrhea, etc., calcium bromide as a sedative action, etc. The inhalation method for administering calcium in asthma is not of any value.

Although calcium is a chemical with which the medical profession has been acquainted for some time, its fullest therapeutic applications have not as yet been made. From the earliest times the value of the tonic properties of calcium have been appreciated; then its value in controlling haemorrhage was recognized. Later, its action on the nervous enervation of the bronchioles in asthma became

known. Today, there is hardly a field in therapeutics in which calcium is not being tried, and in quite a few instances its value has been demonstrated in the most unusual disorders. There is no doubt that continued research will bring out the value of calcium even more strikingly.

CALCIUM CONTENT OF THE BLOOD—IN HEALTH AND DISEASE.*

BY

J. L. SALDANHA, M.B., B.S. (BOM.),

Pathology School, Grant Medical College, Bombay.

Calcium plays an important part in the economy of the human organism. Quantitatively speaking it heads the list of the other inorganic elements of the body amounting, as it does, to about 88 % of the bone-ash. As a flouride it is found to impart the characteristic hardness to the enamel of the teeth. It regulates the permeability of the capillary endothelium, coagulates milk by the formation of a caseinate, is necessary for the conversion of prothrombin into thrombin in the process of coagulation of shed blood and for the conversion of myosinogen into myosin in initiating the process of rigor mortis. Structures acting rhythmically are known to require a definite amount of concentration of certain inorganic elements, and in this calcium plays a very important part. Renin is only able to function in the presence of calcium in the process of coagulation of milk, and its presence is also necessary for the activation of trypsinogen. An important part played by calcium is the maintenance of the stability of the nervous system, diminution of the concentration of the element beyond a certain point manifesting itself acutely in the form of tetany. The whiteness of grey hair is said to be augmented by its inorganic content, principally in the form of calcium phosphate and calcium carbonate, which are found in large quantities as age progresses (Morse).

The calcium content of the various structures of the body varies a great deal. As already stated it forms about 88 % of the bone-ash. Milk contains about 60 mg. % in the form of chloride, bile 11 mg. % as bilirubinate, saliva 9 mg% gastric juice 6 mg %, and pancreatic juice 7 mg%. Blood plasma contains 11 mg%, serum 10 mg%, and the red blood corpuscles probably a trace. The content of the cerebro-spinal fluid is about 5.3 mg % and that of the aqueous humour 6.2 mg %. About 90 % of the calcium is excreted via the faeces while the remainder is excreted via the urine. The kidney tissue, muscle and lung are said to contain 8, 5, and 1 mg% respectively in the form of calcium oxide.

*Specially contributed to the "Antiseptic."

For a long time it was considered that the calcium content of the serum was identical with that of the plasma. It has now been definitely proved that the content of plasma is slightly higher (about 1 mg %) than that of the serum, but bears a definite ratio to that of the serum. In view, however, of the numerous difficulties encountered in preventing the blood from clotting for the estimation of the content of the plasma as compared with the ease with which the content of the serum can be estimated it is usual to estimate the content of the latter for all routine purposes.

The method of estimation in common use is the one elaborated by Kramer and Tisdall (1921) or some modification of the same. The only reagent that is postulated to be quantitatively accurate in this method is a deci-normal solution of potassium permanganate from which a 1/100 normal solution is made for the actual titration.

The method is as follows: 2 cc of distilled water are pipetted into a 15 cc. centrifuge tube to which is added 2 cc of serum of the blood on which an estimation is to be made. To this is added 1 cc of a saturated solution of ammonium oxalate whereby the calcium is precipitated. After mixing the contents the mixture is allowed to stand for half-an-hour or more, at the end of which the tube is centrifuged at about 1500 revolutions per minute for 5 minutes. The supernatant fluid is removed by simply inverting the tube and the precipitate, after the fluid has completely drained off is mixed with 4 cc of ammonia water (2%), and centrifuged for 5 minutes. This 'washing' ensures the removal of any excess of ammonium oxalate. The supernatant fluid is removed as before and after it has been completely drained the precipitate is dissolved in 2 cc of approximately normal sulphuric acid. The tube with its contents is then heated in a boiling water bath for 1 minute after which it is titrated against an N/100 potassium permanganate solution to a definite pink colour (i.e. a colour which persists at least for 1 minute), from a burette graduated in 0.02 cc. A small correction is necessary for the amount of potassium permanganate that is required to colour an equal quantity of a blank fluid. The number of ccs of permanganate used, minus the quantity required for the blank, multiplied by 10 equals the number of mg of calcium per 100 cc of serum.

The average calcium content of serum works out at about 10 mg%. Vines found that the average calcium content of the blood when shed was equal to 6.74 mg %: that with the onset of the process of clotting this content gradually increases till with the completion of the process the content attains a maximum of 10.74 mg %. From observations of this type and others of similar nature it has been found that only a part of the calcium in the blood is in an inorganic form,—the rest being in some occult form, and that the latter becomes free in the serum in the process of clotting. What exactly this

combination consists of is not definitely known but it has been postulated that it probably consists of a combination with some specific organic radicle. The cerebrospinal fluid, the aqueous humour and the oedema fluids which may severally be regarded as filtrates of the blood contain only the inorganic moiety of the blood calcium. By means of dialysing membranes the occult calcium can be separated from its inorganic counterpart, though given sufficient time the whole of the occult calcium ultimately diffuses through these membranes and can be recovered and estimated in the dialysates. How much of the inorganic moiety is in an ionised (? active) form is not definitely known.

The calcium content of the serum or plasma is found to be remarkably constant not only for human beings but for a large variety of the vertebrates, its maximum variation being only about 1 mg % in 24 hours. This constancy is found to be dependent upon a number of factors the chief of which are (1) the integrity of the parathyroid apparatus, (2) the supply of calcium in the diet, (3) factors influencing its absorption and assimilation, (4) the acid-base equilibrium of the blood, (5) certain physiological states and (6) the disturbance of any one or more of these factors (disease).

Since the isolation of the parathyroid hormone by Clark and Collip (1925) it has been definitely established that these glands mainly control the calcium level of the blood. Hypocalcaemia or hypercalcaemia can now be induced at will either by removal of these glands or the administration of parathormone respectively. Hypocalcaemia is met with in the following diseases: Parathyroid tetany, rickets, osteomalacia, nephrosis, and non-tropical sprue (steatorrhoea with megalo-colon). (In osteomalacia, however, the calcium content of the blood is sometimes normal and at times actually above normal). In all these diseases, except Nephrosis, a lowering of the serum calcium to about 5 to 6 mg.% results in tetany. As tetany however is encountered in a number of other conditions in which the calcium content of the blood is not lowered it is reasonable to assume that there must be a combination of some other factors for the genesis of this syndrome. And it has now been established that "Tetany may occur with any condition where there is low blood calcium or even a normal blood calcium with a prolonged negative balance (i.e. the output of calcium being greater than the intake) provided the PH of the blood and its phosphorus content be not considerably lowered" (Meakins). As a clinical entity hypercalcaemia is met with in the disease known as Generalised Osteitis Fibrosa,—a disease which is easily confused with osteomalacia on account of its greater frequency in women and the softening of the bones that takes place, a condition brought about by hyperplasia or hyperfunctioning or tumour formation of the parathyroids.

Symptoms of hypercalcaemia, as noted when induced by repeated injections of parathormone, consist of loss of appetite, weakness, vomiting, diarrhoea, intravascular clotting and death (of the animal).

As regards supply of calcium, milk is regarded as the most potent source, the next potent source being eggs. There are also a number of cereals and vegetables which show high calcium content, namely, oatmeal, turnips, cabbage, and whole wheat flour. Potatoes contain but a small quantity and meat very little.

Absorption and assimilation of calcium from the diet is greatly dependent upon its vitamin content, principally vitamin D or its equivalent namely radiant energy which can generate ergosterol from the cholesterol content of the skin. When the supply of calcium is deficient administration of vitamin D or radiant energy can maintain and even raise the calcium level of the blood presumably by mobilising the calcium from the bones which are regarded as depots of calcium.

Calcium is absorbed in the blood through the intestines in the form of calcium phosphate. This salt by the action of carbonic acid of the blood is converted into the more soluble calcium bicarbonate and calcium hydrogen phosphate. It is therefore easy to see that acidemia will tend to increase the number of calcium ions in the blood and alkalemia tend to operate in the opposite direction.

As regards physiological states the calcium content of the blood of infants and children is found to be higher than that of adults by 1 to 2 mg %, the reason for this being obvious. In pregnancy some observers hold that the content is slightly lowered; while others state that it is slightly raised. In parturition it is stated the content shows a slight increase, probably, it is surmised owing to the production of lactic acid generated by the muscular efforts of the mother. During lactation the tendency seems to be on the lower side. No observations on a large scale are available as to the content of calcium at menopause and senility; but presumably it is not appreciably altered.

The content of this element in the various diseases has already been considered. It may be mentioned that in parathyroid tetany the calcium content of the blood is found to be the same as that of the cerebro-spinal fluid. In other words, the occult calcium does not yield its inorganic moiety in the process of clotting, but undergoes some change by which it is held in the clot. This type of tetany can be relieved temporarily by the administration of calcium, and more permanently by parathormone with or without calcium. In jaundice though the bleeding and coagulation time are both increased estimation of serum calcium does not show any appreciable reduction. One of the explanations given of this anomaly is that probably less ionised calcium is available for coagulation owing to its partial fixation by excess of bilirubin. But this explanation

does not seem to be wholly satisfactory (Harrison). This same author very ably summarises the findings in certain diseases in which one would expect an alteration in the calcium content of the blood states "When making requests for analysis (of calcium) it should be remembered that normal values (total calcium) are the rule in Urticaria, Angioneurotic oedema, asthma, the purpuras, hæmophilia, pregnancy, eclampsia, jaundice of all types, sprue, coeliac disease and bone diseases (except rickets)."

SUMMARY.

1. The part played by calcium in the body is summarised.
2. A simple method of estimating calcium in the blood is reproduced.
3. Factors responsible for the maintenance of a constant level in the blood are noted.
4. Diseases in which the calcium level of the blood is altered are summarised.

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CAUSATION OF VESICAL CALCULAS*

BY

LIEUT. COL. K. G. GHARPUREY, I.M.S.,

Civil Surgeon, Ahmednagar.

The causation of a stone in the bladder is still obscure though there are definite conditions both constitutional and environmental that are associated with it. These conditions may certainly be called predisposing factors, though what the actual exciting cause is, still remains unsolved. Thus as regards age incidence, it is well known that it is extremely common in children in the first ten years of life, and it diminishes from childhood to 25 or 30 years and then it increases again till it is relatively common in elderly persons. So it can be presumed that there are certain factors which affect children more and so excite the formation of a stone.

As regards climatic conditions, it is well known that stone is very common in Arabia and certain parts of India where the climate is very hot causing excessive perspiration. In such conditions, the urinary secretion is very scanty and concentrated and the formation and growth of a stone is very much facilitated and accelerated, if once a concretion, however small, forms and remains in the kidney or the bladder. However, in such climates, every one does not suffer from

*Specially contributed to the "Antiseptic."

a stone in the bladder, so that though climate predisposes, there must be some other cause that leads to the formation of a stone or that excites the precipitation of some salts normally dissolved in the urine. It is a recognised chemical phenomenon that in saturated solutions, if a small crystal is put or anything that does not dissolve and can act as a nucleus forms, precipitation of the dissolved salt occurs on this body and accretionary growth goes on. Similarly once a nucleus of a stone forms, one can easily understand the development of the stone to any size in such hot climates where urine is highly concentrated and precipitation of urates and phosphates occurs with facility. If a foreign body is introduced in the bladder and remains there, formation of a stone occurs on the same principle, the urates and phosphates depositing on this foreign body.

Apart from the temperature of the air, the character of the drinking water has also some influence on the occurrence of stone. Thus, even in cold climates, like that of England, stone in the bladder occurs. But its occurrence is restricted to certain areas only as the Eastern countries and the lake districts of England. Here the drinking water contains deposits and dissolved salts, mostly of calcium, far more than in other parts of the country. These salts are drunk with the water and the blood throws them out through the kidneys. Hence the urine contains more dissolved salts than normally and given a chance for the first concretion to form, deposition of saturated salts and consequently growth of the stone occurs. The amount of water imbibed has some effect in making the urine less or more concentrated, thus keeping the dissolved salts up to varying degree of saturation in the urine. But even in these parts of the country some very few suffer from stone in the bladder, indicating that the exciting cause for the first concretion to form must be something different from the common factor of drinking water.

The kind of diet eaten by the people is considered, now-a-days, to have some connection with the causation and incidence of stone. Colonel Mac Carrison I.M.S., has been able to produce stones in the kidney in experimental animals, by feeding them on diets deficient in certain vitamins. This is also supported by the fact that under the same climatic conditions stone is much more common amongst the poorer classes whose nourishment is not good and whose food is naturally deficient in the various vitamins separately as well as proportionately. But it should be noted that amongst poor classes only some children suffer from stone in one family though all the children in that family live practically on the same diet and eat the same kind of foodstuffs. This indicates that diet may be a predisposing cause but the exciting cause is something different which picks out some children only living under the same conditions.

To explain these variations or individual susceptibilities one has to think about the formation of the first deposit of a stone, which may occur either in the kidney or on the mucous surface of the bladder. The convoluted tubules of the kidney are considered to secrete urea, urates and other salts into the renal tubules. If a little of the renal epithelium or the mucous surface of the bladder is abraded or denuded, it is very easy for a deposit to occur on this rough surface from an urine saturated with salts, and once a nucleus is formed, further growth of the stone goes on. Children, especially those of the poorer classes, are very susceptible to Acute Infectious diseases in India, in which the kidneys and the bladder are not uncommonly affected, causing Nephritis and Cystitis. In the inflammation of the lining epithelium of these organs slight roughening or an abrasion should be enough to start a stone. In children one hardly ever gets a history of the pain so typical of the renal Calculus. So may it not be that in children a Vesical Calculus starts in the bladder itself as cystitis in a common complication or sequelæ of acute infectious fevers in children. The infantile mortality in India is generally very high. The children are ill-nourished and the poorer classes live under unhygienic conditions. The mortality is mainly due to the acute Fevers to which they are very susceptible. Some of those that survive these fevers have their bladder or kidneys disabled and these are the children that suffer from Vesical Calculus afterwards. This will explain the higher incidence of stone in children compared to other ages. Deficiency in certain Vitamins in diet specially of the anti-infective or Vitamin A will also render a child more susceptible to acute infective fevers which, damaging the lining epithelium of the kidney or bladder, helps in the formation of a stone. This might explain the occurrence of stone in experimental animals fed on diets deficient in Vitamins.

The prevalence of stone in the various decades of life will be found somewhat proportionate to the general death rates in those decades and hence to the incidence of disease at those periods. From a record of 369 of my stone cases where the age and other details are more or less definitely given the age percentages work out as follows:—up to ten years 62%, between ten & thirty years 6% and over thirty 32%. From tabulating the records of deaths in Ahmednagar Municipality, by age, for 3 years to get an average, it is found that deaths under 10 years are 40%, between 10 & 30 years 6% and over 30 years 54%. This last figure of 54% naturally includes all old men and deaths occur from various causes in such old men.

If infectious and acute fevers, in which damage is done to the kidneys or bladder, are considered to be the exciting cause of stone, it will explain, why persons, living under the same conditions, are not equally susceptible to this affection. The formation of a stone

depends on their susceptibility to such fevers with consequent damage to the lining epithelium of the bladder or kidneys. If there is no damage there will be no stone. If the damage gets healed up and the stone is removed completely or passes out, there will not be any recurrence of stone in the person. Otherwise if the other factors like diet, climate, and water were the main causes, a person who once had a stone should continue to have it again and again as these factors remain the same and are constant in most persons's lives. But usually recurrence occurs only if some bit of the stone is left behind on which growth occurs or, according to this theory, if another lesion in the kidney or bladder occurs due to another attack of an acute infectious fever.

Stone is very common in Sindh and the Punjab and the sufferers from it are not only ill-nourished wasted children but well developed children and well built grown up persons. One can account for the formation of a stone in such persons on the history of their having suffered from an acute or infectious fever some time before, which damaged their bladder or kidney and started the formation of a stone. The damage is recovered from but the stone grows in size by the deposition of the salts in the urine which is concentrated due to climatic conditions though the general health is not materially affected. I have removed stones from children under one year of age who have been fed only on mother's milk. The mother and the child looked well nourished thus excluding faulty or insufficient dieting. But the child gets stone because it suffered from an acute fever from which it recovered, but the mucous membrane of the bladder was damaged enabling the first deposit to occur and so a concretion to form. The condition of most children one operates on is not inferior to that of other children of the same age living under same conditions. In Sindh and the Punjab, certain tracts in which provinces are notoriously malarial, may it not be that repeated and constant attacks of Malaria during the Malarial season damage the lining of the urinary organs at some part in some persons to start a stone; and though the person gets over the malaria and regains his health in the remaining months of the year, the growth of the stone continues and the person, though apparently in good health, suffers from stone. May it not also explain the very great frequency of stone in these hot provinces where extreme heat is always preceded by a severe malarial season.

My experience of stone cases, though not very large, is fairly big to make one think about the various factors in the causation of vesical calculus. I have operated on more than 400 stone cases by the various methods, most of them by crushing. I have seen or operated on stone in Arabia (Aden and Muscat), in Sindh, in the Deccan and Khandesh in the Bombay Presidency.

One might just as well ask what is the practical use of this theory even if it is considered to be right? If the formation of a stone is based on the considerations that I have put forth, then the question of prevention of stone in the bladder has to be looked at from quite a different angle of vision. Problems of climate and drinking water cannot be changed or tackled easily in huge areas or districts affected with stone though the results or bad effects consequent on them can be alleviated to some extent. Dietic considerations in poorer classes are more an economic than a medical problem. But Public Health is now-a-days dealing with epidemic and infectious diseases and interesting itself in Infant Welfare, and the problem of prevention of stone in the bladder is more correlated to these than to any other factors. Prevention of liability to infectious or acute Fevers in children is certainly a very big problem but that is the thing to be done if one wishes to see poor little fellows rid of this agonising disease. In acute fevers also, the probability of the bladder or the kidneys being affected should be kept in mind in stone ridden districts, and medical treatment of such diseases be directed to prevent the complications of cystitis and Nephritis by flushing and disinfecting these organs by adequate medication, whenever such cases come to the hands of Medical practitioners. And in these methods lie, in my opinion, the prevention of Vesical Calculus.

PULMONARY LEPROSY*

BY

DR. SAILENDRA NATH CHATTERJI, M.B., D.T.M.,

Assistant Research Worker in Leprosy, Calcutta School of Tropical Medicine and Hygiene, Calcutta.

Leprosy of the lungs though not very common, still one should be on his guard to differentiate it from pulmonary tuberculosis. Because if a case is encountered in general practice it is likely to be mistaken for tuberculosis of the lungs, for the signs and symptoms of the former closely simulate the clinical picture of the latter. About a year ago we had a case of pulmonary leprosy which for some time escaped the detection of many physicians in Calcutta. History of the case runs as follows:—

The patient, a Bengali Hindu, now aged 30, noticed in his childhood one depigmented patch on his right thigh where he could not feel well. But that was not taken into account by his guardians being assured by several doctors who were consulted from time to time, and they did not apprehend anything so serious as leprosy. Later on, during last year, several erythematous patches appear-

*Specially contributed to the "Antiseptic."

ed on the face and the case was diagnosed as one of syphilis and W. R. proved to be positive (3-10) in spite of a negative history. So the doctor in charge prescribed mist Hydrarg et Pot. Iodide and gave one injection of Novoarsenobillon. These measures instead of abating the condition caused an exacerbation. But still under the impression of syphilis the medicines were prescribed in increased doses and as a result the patient started having temperature, new eruptions began to appear and one day the patient had had haemoptysis. So a senior doctor was called in and a diagnosis of pulmonary tuberculosis was made which was confirmed by the bacteriological examination of sputum—"acid fast bacilli found." The diagnosis alarmed the patient very much and he despaired of his life. As the patient's condition did not improve within a few days, another doctor was called in for consultation and he advised the patient to have the opinion of Dr. Muir for his skin lesions. On examination Dr. Muir diagnosed the case as cutaneous (B2) type of leprosy, in the reacting phase and complicated with pulmonary lesions of leprosy. Thereafter the patient under a changed treatment, made rapid improvement and he had a sigh of relief when his conditions began to improve. The following were our findings in this patient.

Thickened erythematous patches on the face, body and extremities. Nodules over eyebrows and cheeks; ears were enlarged and thickened. Keratosis of the skin over the extensor surface of the right leg. Anaesthesia on the dorsum of hands and feet and lower part of legs. Peroneal nerves were tender. Kahn test was found negative. Smear from the right ear was strongly positive (+++), acid fast bacilli were found in bunches. Smear from nose was negative. The sputum of this patient was injected into guineapigs intraabdominally but the result was negative.

Since then the patient is taking special treatment. The nodules have disappeared, erythematous patches have faded away and he has got better sensations on the hands and feet. The ears are still slightly thickened and smear from the right ear is positive (++) but the acid fast bacilli are found in a granular degenerated condition. The patient had had no haemoptysis since then and he has gained in weight by 6 lbs.

DISCUSSION.

Apparently the lesion which was first noticed on the patient's right thigh was the herald spot of leprosy and had it been diagnosed at that stage most of the sufferings of this patient and the confusions of opinions of the attending physicians could be avoided. When erythematous patches began to appear the patient was having a slight reaction due to some sort of indisposition and the prescription of

Potassium Iodide at that stage was a dangerous mistake. Subsequent increased doses of iodide gave a bigger reaction causing an exacerbation of all the signs and symptoms and the lungs were also involved. So the patient had had high temperature, cough, patchy dullness and moist sounds in the lungs and to add to the clinical picture of pulmonary tuberculosis the sputum was full of acid-fast bacilli. But the number of bacilli found were so very numerous that it was not compatible to the sudden onset and short course of the disease; specially the bacilli were found in big bunches while in tuberculosis they are more scanty and scattered. Although the clinical picture of the patient simulated pulmonary tuberculosis his general condition was quite the opposite. With a clinical picture like this (that is a patient with such a big lesion in the lungs from where innumerable bacilli were coming out with sputum) a case of pulmonary tuberculosis would have been much prostrated, but in this case the patient was not so run down, he could walk about without feeling tired but the wrong diagnosis only depressed his mind for a while. Moreover the diagnosis was further helped by intraabdominal injection of sputum into guineapigs for in a case like this the biological test would be negative while in a case of tuberculosis the injection would be followed by generalised tuberculosis in guineapigs. Therefore if the possibility of pulmonary leprosy be kept in mind, the differentiating points, as mentioned, together with the skin lesions will at once put the attending physician on the right track.

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ANKYLOSTOMIASIS AS AN INTERCURRENT DISEASE IN LEPROSY *

BY

DR. ASHUTOSH RAY,

Asst. Medical Officer, Purulia Leper Colony.

It is undisputed that vitality plays the most important role in leprosy, and it is also undisputed that Syphilis is taken to be the most prominent factor to weaken the vitality and to make a proper field for the micro-bacterium leprae to thrive on. This is the idea that the leprologists stick to the serological test for syphilis of every leper before the actual anti-leprosy treatment is begun. Of the other factors emphasis should be given to Ankylostomiasis and with this idea I have endeavoured to show that its high percentage, in spite of some treatment, is sure to influence its evil effect to retard the progress of the antileprosy treatment.

* Specially contributed to the "Antiseptic."

In Purulia Leper Colony, the biggest in India with 750 inmates every one including the healthy boys and girls (healthy children of leper parents) had been getting H. W. treatment once a year in April. But as many positive cases were found even with the usual annual treatment and as also it was experienced that not only the progress of the antileprosy treatment is hindered by its infection but also the "Burntout" symptoms of leprosy with sepsis get worse and worse till the last, it was decided to improve this side of treatment with regular examination of stools. A 'Hook-worm Laboratory' was opened in 1929, specially for examination of stools for H. W. ova. This gave facility to the writer to examine properly and to keep a good record of the cases. In that year (1929) to examine all the inmates was impossible in addition to the other works though it was proposed. So during the annual examination the medical superintendent made a big list of suspected cases, who were examined in 1930 after the usual annual treatment. The positive cases were examined repeatedly and treated till they became negative. The figures are:—

The number of patients examined—552.*			
do	do	positive	218 or 39.5 %
Results of the treatment—			
The number became negative after 1 treatment 127			
do	do	do	do 2 do s 62
do	do	do	do 3 do 21
do	do	do	do 4 do 4
do	do	do	do 5 do 3
do	do	do	do 10 do 1

*-these are mostly males

In 1931, it was decided not to administer the annual treatment and the policy of finding out the positive cases and examining and treating them till they become negative was adopted. All the positives found in this year are not yet negative. They are being examined and treated. The figures are:—

The number of patients examined—302*			
do	do	positive	126 or 41.6 %
Results of the treatment			
The number became negative after 1 treatment 36N & 44s			
do	do	do	do 2 do s 10N & 10s
do	do	do	do 3 do 3N & 16s
do	do	do	do 4 do 2N & 2s
do	do	do	do 5 do 0N & 3s

* these are all females.

N for Negative
s for Still positive.

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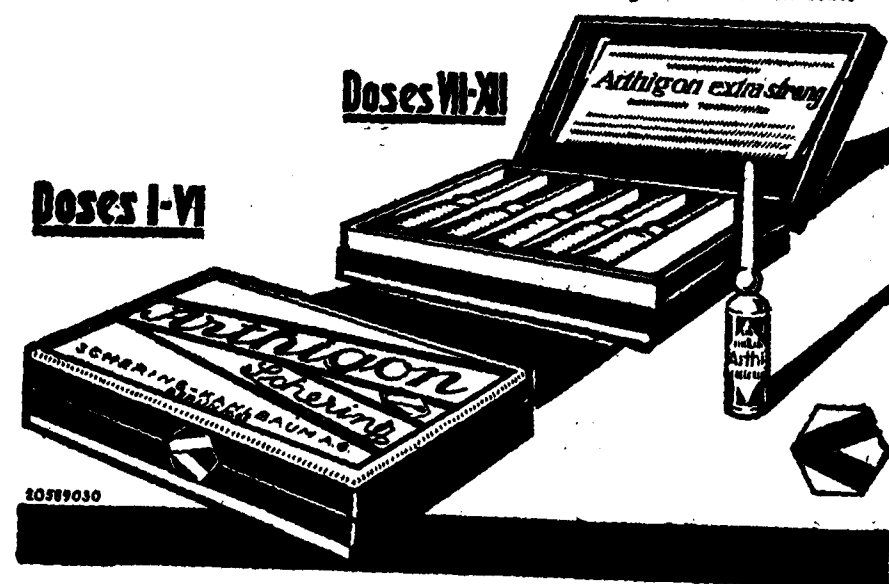
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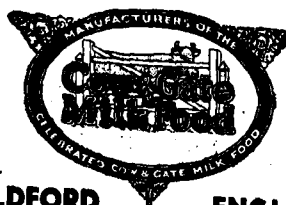
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As a result of this procedure of repeated examination and treatment it has been repeatedly seen that infectious cases who do not respond well to antileprosy treatment often make good progress. One case in particular a B3 now C3 (late skin case) was practically given up as a hopeless case with prolonged fever and wasting. Now, having been rendered H. W. negative over a year, he is an active member of the institution and is responding to the antileprosy treatment splendidly. It has also been seen that when the lepers with trophic ulcers get sepsis of the limbs, some of them do very well with vigorous H. W. treatment which while making them free from H. Worm infection, gives them a new energy to fight against the sepsis. Some cases, almost ready for amputation have cleared up after H. W. treatment.

Summary.—(1) Due to its high percentage importance should be given to detect this infection before the actual antileprosy treatment is begun. In fact, stool of every patient should be examined as a routine test.

(2) This infection retards, as much as that of any other inter-current diseases, the progress under treatment. In septic cases also this infection hinders recovery. So ankylostomiasis should be thought of when sepsis cannot be overcome.

(3) In spite of the difficulty of the following up cases to make them negative, it is worth doing. This helps the special antileprosy treatment to progress very well.

(4) The idea of making every one free from infection by a single treatment is not always possible. So, whenever possible, mass treatment should be replaced by individual treatment.

SILICOSIS

BY

MR. K. B. MADHAVA, M.A., A.I.A., (Lond.),
Professor of Statistics, Mysore University.

The appointment by the Mysore Durbar of a technical committee of medical men and mining engineers to go into the question of the prevalence and the prevention, of silicosis on the Gold Fields in Kolar offers itself as a suitable occasion to review the state of our knowledge at the present time of this most important occupational disease. It had long been known that miners engaged in metalliferous mining in hard rock were prone to suffer to a greater extent than did the general population, from chronic diseases of the lungs or respiratory organs. This excessive incidence of lung disease has been the subject of serious attention, and of official investigation in almost every important mining area, but the earliest note was taken by the Government of the Transvaal who not only investigated the nature, prevalence, causation and prevention of this disease, but secured before 1902 statutory benefits and other modes of compensation to persons suffering from this disease and to their dependents. Nevertheless when we are told that "our ten years of ignorance, our further ten years of partial resolution, hesitation and tentative improvements, our eighteen years of increasingly energetic effort to deal with this problem, make up the common story of such things the world over", and when we read that millions of poor and industrious workers engaged in hundreds of common occupations are affected by this disease and its hideous consequences, it is easy to realise how much it contributes to the sum total of human suffering in the world. It is no surprise therefore that the International Labour Office seriously examined this problem, and the Records of the International Conference held at Johannesburg during the fortnight 13-27 August 1930 (proceedings of which are now available in the International publication Series F-No. 13. Geneva, 1931) bring up to date our information on this most important disease in Great Britain, Dominions of Australia, Canada, South Africa, on the Continent in Italy, Germany, Belgium and Netherlands, in the United States and other countries by the most eminent medical authorities and industrial hygienists in those countries.

Silicosis is now admitted to be a pathological condition produced by silicon dioxide reaching the lungs (a) in a chemically uncombined condition, (b) in fine particles of the order of less than ten microns, and (c) in sufficient amount, and over a certain period of time, which two factors may however, be reciprocal variants. There is experimental evidence that the solubility of silica in the tissues is

* Specially contributed to the Antiseptic.

an essential factor in the causation of silicosis, and the infection of the lung with *B. tuberculosis*, or other pathogenic organisms, whether it occurs before, simultaneously with or subsequent to, the development of silicosis, alters the disease and influences it unfavourably, tuberculosis infection being particularly unfavourable. Macroscopically the changes observed are (1) in the early stage: a variable number of palpable pearly-white nodules up to 2-3 mm in diameter on the pleural surface of the lung. On section, the cut surface of the lung is studded with pigmented foci, widely scattered, a moderate proportion of which are only just palpable. The tracheo-bronchial lymph nodes are slightly enlarged and deeply pigmented, and may exhibit foci of fibrous induration. (2) in the later stages: the fibrotic nodules are increased in number, size and density, and coalescence of these may be found. The tracheo-bronchial lymph nodes may be smaller in size than those in the early stage but are fibrosed. Microscopically the changes are (1) development of fibrous tissue within accumulations of phagocytes and formation of nodules of hyaline, (2) the extension of these hyaline nodules at their periphery, and (3) degenerative changes in these foci. For the diagnosis of silicosis although the employment, history, symptoms and physical signs are sufficient guides, radiological findings are also consulted. The disease has been well mapped out and the course of infective process followed so well that it is now possible to adopt several simple and useful preventive measures: use of water and exhaust draught, ventilation, provision of dust traps and masks etc. in the mines, but it is of course with the treatment and compensation from a medical point of view, with the rehabilitation schemes in after-care that a great deal of work remains to be done, and is also hard to be done. The interests of the present writer as an Actuary lie with the silicosis statistics, with the expectation and progression of the disease, with the valuation of the cost of such benefits and monetary compensation as laws provide for the afflicted, and with the burdens which they impress on the State, society and industry.

The most complete and satisfactory statistical account of the incidence and progress of silicosis is available from the analysis of the experience among the gold mines of the Witwatersrand in the Union of S. Africa. It is impossible to summarise the comprehensive work by Mr. D. S. Fraser, Actuary, and Dr. L. G. Irvine, Medical Officer of the Miners' Phthisis Board, Union of S. Africa, and reference must of course be made to the original paper contributed to the International Conference, referred to above, for fuller details. It is possible to state however, that four independent variable factors—occupational and hygienic, selection of standards for diagnosis, general physique of the workers, and the number of miners working at each year of underground service—profoundly affect the number of

cases, percentage and incidence, of the disease from year to year. In regard to mortality, the differences between the ante-primary, primary and secondary stages are well marked, and reveal that a low rate of progression is accompanied by a rather higher rate of mortality. It is also observed that the mortality is very heavy for some years following certification, but the survivors after a number of years are subject to lower rates and may be complicated not by tuberculosis. In any case silicosis constitutes an occupational disease which involves reduction of working capacity. Consequently in S. Africa, where the subject has occupied a great deal of the attention and time of the legislature during the last 20 years, the first Act of Parliament dealing with Miners' Phthisis so called, was enacted in 1911 and since then 8 other Amending Acts have also been passed. Such a legislative history in itself proclaims that the problem of compensation has proved to be a difficult one. And the standing difficulty is that the "injury" from silicosis is not a stationary one, but one which tends to worsen, as time passes on in the most erratic and acute forms, so much so that the problem is not so much what the afflicted is like at the moment but what he may become. Mr. Spence Fraser has computed that the average expectation of life of an early case of the disease when first noticed to be about fourteen years, during which period the problem is as much medical as economic—that of finding a suitable alternative employment, or having adequate compensation. In the earlier stages, where further employment is still possible in a less hazardous occupation, a lump sum award—made up of 12 times that part of his month's earnings which does not exceed £ 29 3s. 4d., 6 times that part which lies between that amount and £ 37 10s., and 3 times the part which exceeds this latter figure—is made. In the latter stages where definite and permanent invalidity has set in, monthly allowances computed somewhat as above is paid not only to the miner, but to his wife, and (dependent) children. The provision of compensation and the expenses for carrying out various other functions—e.g. Sanatorium treatment—are provided out of a Fund contributed mostly by employers and partly by state subsidy, which is under the control of the Miners' Phthisis Board. The number of miners and the number of widows who have been awarded compensation up to 1929 are respectively 13,866 and 5,093, and the total amount paid is £702,036 (Natives) and £11,208,015 (other miners). The computation of the outstanding liability, and the adjustment of adequate levy on industry are problems of intricate technical ability for which there is a qualified Actuarial service in the Union. It is therefore with great interest—and also with some anxiety—that we await the report of the prevalence and proposals for prevention, cure and compensation of this disease in Mysore.

RACIAL IMMUNITY AND THE DISTRIBUTION OF DISEASES.*

BY

DR. ANIL CHAUDHURI M. SC., M.B., D.T.M.,

Government Research Scholar, Calcutta Medical College.

The question of the presence or absence of Racial Immunity is at present arresting the attention of the Medical Biologists and Eugenists. The presence of individual immunity is never doubted. Therefore what can be present in an individual can be present in a large number of persons is the natural logical outcome. But can we use the term in a still more broad sense, that immunity can be present or absent in a particular race? Before answering this question we should first define what we precisely mean by the term 'Race'. Boule says, "we must really impress on our minds the fact that the 'Race' by which we mean the continuity of a physical type transmitting blood-relationships, represents an essentially natural group, possibly having, and as a rule, actually having nothing in common with the people, the nationality, the language and the customs, which correspond to purely artificial groupings of no anthropological significance and connected only with those historical events of which they are the products." On the other hand Professor Haddon says. "The term 'race' is employed in various senses, but usually to connote a group of people who have certain well marked characters in common. What these characters are, or how many characters are to be taken into account is usually a matter of individual opinion. If all fair-skinned people are grouped under the term white race, this will include long headed, and broad headed groups, or the term "Race" may be applied to one of these Groups. Race names such as Nordic or Alpine are mostly convenient abstraction helping us to appreciate broad facts. A race type exists mainly in our minds." Thus we see, we cannot accurately define what we really mean by the term 'race'. It will be still more difficult to find out the presence of immunity in a particular race.

Many proofs are forthcoming however, that antibodies found in the blood, can be transmitted along Mendelian lines. Rich, on the other hand, experimented with guinea pigs. Those guinea pigs, whose blood was deficient with complement, were more prone to disease and the whole race subsequently died from this cause. The complement character was shown to be controlled by selective mating. It followed the Mendel's law strictly.

Iso-agglutinin is still another factor which has also been shown to conform to Mendelian doctrine. Recently, evidences are put forth

*Specially contributed to the Antiseptic.

to link Iso-agglutinins with various constitutional disorders and surely, it will become more important in the light of studies on 'Racial Immunity,' if it can be substantially proved that there is a good connection of blood groups with disease. Synder has studied several hundred cases of Epilepsy, Insanity and Feeble-mindedness amongst both Whites and Red Indians but he has not been able to draw any relation between blood groups and these diseases. I am also a total failure in my attempt in correlating blood groups with such diseases as Malaria, Kala-Azar etc., which are more prevalent in Bengal.

On the other hand, if the distribution of diseases is studied, it becomes quite apparent that a particular disease is always prevalent in a particular tract, or affecting a particular group of people, suggesting the presence of the phenomenon of Racial Immunity. Thus *Tænia Saginata* is mostly seen in Africa amongst the Masai people. *Tænia Solium* is found in Germany and Russia. *Diphyllobothrium Latum* is common in Russia, Sweden etc. In Australia and Iceland and amongst the Patagonians the Hydatid disease is very prevalent. Lathyrism is very common in C.P. and some portions of U.P. in India. Favus is mostly seen amongst the Pathans and common in Calcutta amongst the Armenians and the Persian immigrants. In Europe, Jews are mostly affected. During my tour in the Mayurbhunj district, I have seen a kind of ulcer, locally known as 'Chuâriâ ulcer' which mostly affects the primitive tribes the Kharias, Bathuris etc, of the place. Similarly Leprosy is another disease which is found in large numbers amongst the people in a low stage of civilisation. The indigenous populations of Central Africa, India, Southern China, Malaya, Oceania, and South America are commonly affected, though it is now pervading more and more into the civilised areas. Veld sore is prevalent in South Africa, Mesopotamia-Palestine, and in India. Undulant fever is an infectious disease which is known by the names Malta, Neapolitan, Gibraltar, Mediterranean, and Cyprus fever from the geographical distribution. It is also found in some parts of India. Yellow Fever is a disease of the west coast of Africa and tropical America caused by a filtrable virus which is transmitted by *Aedes Aegypti*. In Africa and America, Trypanosomiasis is strictly limited, causing a great havoc on the population. Arctic Hysteria is very common amongst the Siberian aborigines and Running Amuck amongst the Malay people.

Let us now turn our attention towards those great diseases such as Malaria, Leishmaniasis, Cholera, Filariasis, Beri-Beri and Epidemic dropsy, which are causing heavy casualties year after year.

Kala Azar is present throughout Bengal up to Dibrugarh, along the Ganges and delta right up to Bihar. It is also found in some parts of Orissa, Madras and Southern India. In China, Egypt,

Turkistan and the whole of the Mediterranean coast line, it is also prevalent.

Malaria though widely distributed over all the parts of the tropical and sub-tropical world is very common in India. Submountainous regions and greater part of Bengal are hyper-endemic zones. Certain parts of Bihar and the Punjab and districts of Burdwan, 24 Pargannahs etc. in Bengal and areas of tea plantations are endemic. The rest of India is of low endemicity or least malarious. Places above 5000 ft. sea level are non-malarious but below this are extremely malarious. Round the Ganges area, large part of East Bengal, certain parts of Madras are however, malaria-free. In the Punjab epidemic form of Malaria is common.

Cholera is an endemic disease of India. There are 3% per thousand deaths every year in India and 1·2% deaths in a bad year. In Bengal Epidemic mortality is four times greater than that of Endemic mortality. Endemic Cholera may be found in other places, apart from India, in Indo-China, Burma, Turkistan etc. But in India, Bengal and Bihar, Eastern part of United Provinces, coastal parts of Madras and Bombay act as endemic foci; The Punjab, Northern part of United Provinces and Central India are epidemic places.

Filarial infections in India commonly occur along the coast and the course of the great rivers, except the Indus.

Beri-Beri and Epidemic dropsy occur mostly in the rice growing areas of the tropics.

From the few examples of the distribution of diseases, as shown above, it becomes quite evident that apparently 'mass immunity', as we should call it, instead of Racial immunity is, as if working silently in order to preserve the humanity from unforeseen disaster. For instance, if we take up the question of immunity and Malaria, we should see that in spite of the enormous incidence and world wide distribution of this disease, it is absolutely impossible to be definite about the presence or absence of Malarial Immunity, which different theories hold the field according to the judgment or experience of able observers. On the whole, it may be accepted that there is evidence in favour of acquired immunity. If there were no immunity of some sort, one might expect the whole of India to be a dismal desolate tract and a big grave-yard under the Sepulchral monument of the hoary-headed Himalyas. Old Pre-Dravidian Races, such as, Sontals, Gonds etc. have acquired immunity against Malaria owing to the universal infection of the infants. The Aryans (that is later immigrants) could not develop immunity to a greater extent.

Apart from the question of Immunity, the diseases try to limit themselves to a certain tract or amongst a certain group of peoples, due to the following causes:—

- (1) The habits of the people.
- (2) The social custom.
- (3) The nature of diet.
- (4) The environment and climate.

The habits of the people.—The Pathans, the Armenians and the Jews are very dirty in their habits and that is why they are so commonly affected with Favus. Walking on damp soil, bare-footed has caused so wide an infection of Hook worm disease in India. Persons who deal with horses and in India who deal with hides get Veld sore.

The social custom.—In Iceland, Australia and Patagonia, the dogs are infected heavily with *T. Echinococcus*. To the peoples of these places the dog is a constant companion and it looks after the sheep and draws sledges. Nomadic habit with dogs and living in the same room with them cause human infection in these areas. Women are more infected than men as they have to look after the dogs. Promiscuity and greater sociability have caused Leprosy to spread far and wide amongst the Primitive tribes. The ebb and flow of the Cholera-tide is solely due to the big religious migrations (pilgrimages). Apart from the small centres such as Turkeswar, Kalighat etc. there are big centres for pilgrimage such as at Hardwar, Allahabad, Gangasagar and in the case of the Muhammedans there is Mecca pilgrimage or Haj pilgrimage.

The nature of diet.—The Russians and Swedish eat uncooked fish and that is why they are infected with *Diphyllobothrium Latum*. *Tænia Saginata* is common in Africa because the Africans take uncooked beef, and *Tænia Solium* is common in Germany and Russia as the peoples in those places take uncooked pork. Malta fever is prevalent in those places where unboiled goat's milk is used. Khesari Dal is largely used in C. P. and U. P. as a common article of diet and for this reason Lathyrism is seen in those areas. It is a well known fact that rice-diet is the cause of Beri-Beri and Epidemic dropsy in the tropics.

The environment and climate.—Many diseases are directly or indirectly dependent on the meteorological conditions. The local flora and fauna throw their influences in three ways—(1) as a factor of alimentation (2) by their bad and poisonous effects and (3) by acting as carriers or intermediate hosts for various kinds of parasites.

Before finishing up this paper we should touch a few out standing problems. Mongols as a whole are regarded as a pathological race. In way of direct proof, some scientists put forward the disease Mongolism, which brings forth exact resemblance to Mongolian

features. But how far this is a truth, it requires further confirmation. Lastly, India is accused of contributing a large number of diseases to the world. This is the case especially with Cholera. It is said that every pandemic when studied can be traced back to India and particularly to the delta of the Ganges, which may be considered the enduring focus of the disease. However, it has yet got to be proved substantially that India contributes Cholera to the world.

In conclusion, we must say that researches on racial immunity are not at all forthcoming. It is an absolute necessity in the world of administrative Medicine and a useful requisite for the determination of the standards of fitness of a particular race.

QUERY.

To,

The Editor,

The *Antiseptic*, Madras.

Sir,

The following observation appears to be worthy of publication.

Mrs. J., a patient of mine, shows symptoms of Quinism namely giddiness, headache, noises in the ears and dimness of vision even with a tiny dose of Quinine whereas the same given by intra-muscular injection has no ill-effect whatsoever.

As a rule, I would not dare inject a subject of idiosyncrasy but in this case injection was given at the time of the first attack without any inconvenience while mixture given for the treatment of relapse brought about the above train of symptoms.

Can any one of your readers explain the anomaly?

Yours truly,

K. V. ADALJA.

Cases & Comments

AN INTERESTING CASE OF PSEUDO OR FALSE PREGNANCY.

BY

CAPT. SHYAM LAL, B.A., M.B.

Civil Surgeon, Ballia.

About 3 months ago I was called to see a rich marwari woman who was supposed to be pregnant for the last eight months, or eight months and a half to give my opinion as to whether she was pregnant or not.

Age:-45 years.

History:-She was the wife of a rich marwari: Twenty-seven years ago, a girl was born to her, who grew up, but afterwards died leaving one son and one daughter who were brought up and looked after by the rich marwari as his own children; had given birth to one son before this girl, but unfortunately he died in infancy and she gave birth to no issue since 27 years. Previous deliveries normal; menstrual periods regular, general health good. There always existed a strong desire for a child chiefly a male one. The woman missed two periods, some eight months ago and it was generally taken for granted that she was pregnant.

Unfortunately after two months she again began to menstruate. This greatly disturbed both the wife and the husband; and I was then called to see the woman who was supposed to be about the middle of the 4th month of pregnancy.

I examined her externally as no internal examination was allowed. I could not feel any enlargement of the uterus. I told the husband that it did not look a case of pregnancy; but however to be more sure, he should get her examined internally by a Lady Doctor. She was examined by a Lady Doctor who assured her that she was not pregnant. On the other hand to please her, some native dhais assured her that she was pregnant; and she believed and months passed on under the belief of pregnancy.

Menses became regular, but she had breast changes: milk could be pressed out from the breasts. She also began to feel foetal like movements; abdomen began to enlarge, but nothing as compared

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to what ought to be in a case of pregnancy. When I saw her last three months ago, the condition was.

- (1) No foetal heart sounds,
- (2) No uterine souffle,
- (3) No foetal parts could be made out.
- (4) Abdomen enlarged just like a pregnancy of four months.

I again assured the husband and the wife that there was no pregnancy, but still they were not inclined to believe it. The husband used to argue.

- (1) how could breast changes be possible without pregnancy?
- (2) what was it the woman was feeling as moving from one side to the other?

He also argued that the child could not grow and consequently the enlargement of the abdomen is not as ought to be as she was losing good quantity of blood every month at the time of menses.

No argument could dissuade them from the belief. Now they would not allow the Lady Doctor to examine her internally.

Though the full term is over and it is now nearing the twelfth month, yet they are labouring under the same slowly dying belief.

AN INTERESTING CASE OF ANURIA

BY

S. B. MUKERJEE,

Civil Medical Officer, Kurseong.

Fr. S. E. M. about 25, recently out from Belgium, joined the St. Mary's College a few weeks ago. He was known to be of rather silent habit and recently had news of a sad bereavement. He went out for a lonely walk of some miles' distance and did not complain of any illness before starting. On his return he complained of ill-defined pains over the body. But it was excruciating in the lumbar region and the head (headache). I was told that since the beginning of his illness he has been gradually losing coherence and at times did not respond. He has had practically no nourishment and the little that was tried was rejected. I saw him after about 36 hours since on-set. He looked seriously ill. He was more somnolent than semi-conscious, his decubitus was flexion on one side. Pressure did not elicit any tenderness but his groans were expressive. There was a slight rise of temperature. The neck was freely mobile. Signs of Hypertonus of muscles were absent. On enquiry I learnt that he had had no stool or urine for these 36 hours. The bladder was not dull. Of three suggestions Cerebral Malaria, Meningitis and threatened Uraemia, the last was given court and recourse was had to hot

saline enemas, counter-irritation and heat application to lumbar area and mild diuretic, considering the tendency to vomiting. With uncertain diagnosis a guarded prognosis (so often an embarrassing question) was given. If the patient passed urine it was hoped that things would be better. He passed urine after 12 hours of above regime and made steady improvement. A case of anuria with threatened uraemia caused by chill of the kidneys during a strenuous exercise in the fickle climate of these hills. It was not known, though, if he had been a kidney case before. The urine test was said to show no albumen.—*Ref: Langdon Brown.*

A CASE OF ALJID MALARIA

By

S. M. ROY, L.M.P.,

Pukurpar P. O., Dt. Pabna.

Case No. I.

I was called to see a case of suspected "Cholera" at noon on 20th June. The village is 4 miles away from my dispensary. On my arrival, I found the patient, a Mohammedan of 25 years old in a semiconscious state with unbearable pain around the umbilical region.

History:—At about 6 A.M. that morning the patient complained of a sharp pain around the umbilicus. He had had a number of liquid motions and also had vomited several times. In my presence he passed one bile-tinged motion and vomited once. There were urticarial rash around the umbilicus. The attending doctor suspected the case to be one of "Cholera".

Physical Examination:—The patient was cyanosed and pulse less at the wrist. Extremities were cold. Tongue was dry. Marked degree of cyanosis in the finger tips and lips. No enlargement of Liver and Spleen. Heart was beating 120 per minute.

Symptoms:—Intense thirst, vomiting and purging but both were bile-tinged. On inquiry, I heard he had got a slight rise of temperature in the morning at about 8 A.M., but I found the axillary temperature below 97°F and cramps in the extremities.

Diagnosis:—Difficulty arises in coming to the proper diagnosis. It was not a case of "Cholera" because of bile-tinged excreta. There was no anuria.

Treatment:—An alkaline mixture and calomel in fractional doses with sodium bicarbonate with menthol and camphor were prescribed. An injection of Quinine Byhydrochloride gr. 7½, atropin gr. 100 and adrenalin chloride mX, the three together were given. Within half an

hour after that injection extremities got warmer and radial pulse improved. There was no opportunity of taking blood films. After one hour I injected 25% 20cc grape sugar solution (Merck) with strophanthin 1/500 intravenously. Alkaline mixture and calomel in divided doses were continued. On the next day another injection of Quinine gr 7½ with adrenalin 0.5 cc. was given and oral administration of Quinine was continued. * He made an uninterrupted recovery.

Urticarial rash is the most interesting feature in this case of algid Malaria from the onset of this disease.

Case No. II.

A CASE OF "QUININE AMAUROSIS"

A girl, aged 14 years, came to my dispensary on 27—11—'30 with the following history:—The mother of the girl stated that her daughter got malarial fever off about four days' duration two weeks ago. She had a rise of temperature every day 103°F to 104°F with intermission. During intermission she took Quinine tablets gr. iii each up to three tablets every three hours from the third day up to 3 tablets per day. In this way she altogether took eight tablets. On the fifth day she became quite blind and could not distinguish between night and day even. When she came to my dispensary I examined her eyes but could not find any abnormality except complete loss of vision.

Treatment—I prescribed an alkaline mixture as follows:—

R	
Liquor amoni. citratis	... 3ii
Pot. citras	... gr. x
Sodi Bicarb gr.	... gr. xx
Spt. amon aromatic	... mx
Sodicitras	... gr. xv
Hexamine	... gr. v
Tint. Card Co.	... mv
Aqua Chloroform	... 3i
Fiat mist.	T. D.
Signa.	... 3i td

The patient took this mixture for one week but it did not at all produce any improvement about her eye-sight. Then I dilated the pupils with atropin drops and injected her intravenously about 4 cc. of 4% solution of Sodium bicarbonate on the ninth day of her visit. Alkaline mixtures were also continued orally. On the 12th day she began to see things hazy. On 13th day I gave her another injection of 6 cc. and increased the dose by 2 cc. every fourth day up to 6 injections. After 6 injections her eye-sight became quite clear. In the meantime I advised her to take plenty of milk and other nutritious diet.

I ask my fellow brethren whether she became quite blind by Quinine or by malarial parasites, although she had taken Quinine in former attacks of malarial fever without any loss of vision.

ASCARIASIS, TWO CASES SHOWING UNUSUAL SYMPTOMS

BY

NABADWIP CHANDRA DUTTA.

Sub. Asst. Surgeon Burmachra T. E. Sylhet Assam.

CASE NO. 1

One morning in March last I was called to see a married girl aged sixteen who had had vomiting and purging with rice water stools all night.

She had been to the bazaar the previous day, and on hearing that there had been cholera cases in the bazaar and in a village two miles off I thought of cholera as a diagnosis. She was prostrated and extremely weak with sunken eyes, anxious expression and weak voice. Her axillary temperature was subnormal, pulse feeble, and Hb. 60%.

I gave essential oil mixture by mouth, saline intraperitoneally, and atropine gr. 1/150 by subcutaneous injection. The purging stopped and general condition gradually improved, but vomiting persisted. When she was able to talk she told me that she had had amenorrhoea for two months and had a feeling of heaviness in the lower abdomen, and also complained of itching round anus and vulva, and at tip of nose.

For a few days I gave Tinct. iodine and Acid. hydrocyanic to stop the vomiting but without success, and then I tried as a last resort santonin on night followed by Magnes. sulphate next morning. Thirtyfive round worms were passed, and at 10 A.M. menstruation began. From that time there was no further vomiting, and after a few days treatment with an arsenic tonic she was discharged cured.

CASE NO. 2

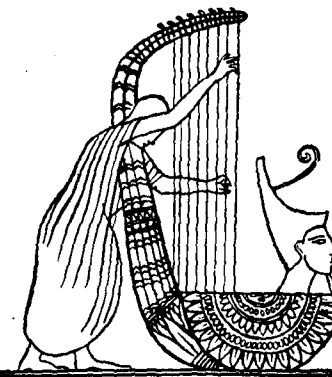
I was called one morning to see a Brahmin girl aged 10 years who complained of great thirst, vomiting, and extreme burning sensation on body and limbs. Her temperature was 106 degrees, and she was very restless.

A blood slide showed malarial parasites, and she was cold sponged and given Quinine sulphate grs. 5; Caffein citrat. gr. 1½; Aspirin grs 5. and later the following mixture,

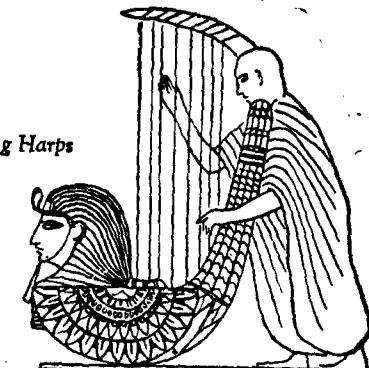
R

Quinine sulphate.	...	grs. 3
Acid. hydrochlor. dil	...	ms. 8
Magnes. sulphate.	...	grs. 20
Vin. ipecac.	...	ms. 5
Tinct. Digitalis	...	ms. 3
Syrup. Aurant.	...	ms. 15
Aq. Chloroform.	ad	oz. ¼

By midnight her temperature was normal and pulse strong, but vomiting and burning sensation continued. She had had three doses of the above medicine and this was continued. Next day her temperature was normal, but other symptoms continued. At midday a round worm was vomited, and in the evening I gave Santonin followed by Magnes. sulphate next morning. Thirteen round worms were passed, and from that time she had no more vomiting or skin burning, and was discharged cured.



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[No. 8

THE ALL-INDIA OPHTHALMOLOGICAL CONFERENCE.

The Second session of the All India Ophthalmological Conference was held at Bangalore, during the last week of July 1931, the details of which appear elsewhere in this issue.

As Dr. Banaji rightly remarks, facilities for the treatment of eye diseases are poor and inadequate in India and greater is the need therefore for treatment of eye diseases considering their widespread nature and the alarming effects they have on the population of this country.

The 1911 Census reports record a total of 443, 653 as the number of blind in India, and it is about 141.6 per 100,000 of the population. Later records show 170 per 100,000 in Bijapur Dist. and 400 per 100,000 in Sind Dist. exclusive of the large number partially sighted. The estimated proportion per 100,000 for the whole of India is 260. (League of Nations CH. 686 March 12, 1928). But one cannot rely much on these Census figures as they always understate the positions. It appears not unlikely that the true ophthalmic condition of India would be represented by figures showing one and half million totally blind persons, and in addition to these, four and half millions with more or less impaired sight.

Some of the common causes of blindness in this country seem to be granular lids, (Trachoma) cataract and glaucoma, while smallpox continues to take a heavy toll. Among children and infants, ophthal-

mia neanatorum. and keratomalacia (a deficiency disease) contribute much to blindness.

As may be seen from the figures quoted above the number of blind in this country is really appalling, and it is time that active steps are taken to prevent blindness in India.

Considering the nature of these ailments, two things are necessary to combat these evils, (1) prevention, (2) active and energetic treatment at the earliest onset of the disease. It is essential that active propaganda must be undertaken, and the people must be made to understand the seriousness of neglecting eye diseases and the usefulness of proper treatment in time. Conditions which may directly or indirectly result in impaired or loss of vision and knowledge concerning all matters relating to the cure and use of the eyes must be well driven home in the minds of people, by way of practical demonstrations, cinematograph, handbills, posters etc.

As regards medical aids, it requires a clever medical man specially trained in ophthalmic medicine and surgery to render proper and efficient treatment to the diseased eyes.

Major portion of our patients attending an eye clinic in the city come from village parts, under great strain and expense to get their eyes treated. In some cases the journey to the city clinic becomes a great difficulty owing to poverty and as such the affected people spend the rest of their lives in darkness.

So far, all the ophthalmic hospitals state or private are situated either in cities or head quarter towns, and in mofussil, the poor villagers are practically prevented from resorting to these institutions for reasons obvious. The rural practitioners are not well versed in nor are they sufficiently equipped for the treatment of eye diseases. The present training in ophthalmology in the Medical Colleges and Schools in this presidency is not adequate enough to carry on ophthalmic relief in rural areas.

We would therefore suggest the formation of well equipped ophthalmic relief centres for groups of villages headed by one trained specialist in ophthalmic medicine and surgery, and a travelling unit for the treatment of minor ailments, propaganda works and to direct more serious cases to relief centres. Such a measure we think if properly adopted would not only give relief to many of the sufferers in remote places, but will also relieve the congestion in the City Hospitals, thus giving time and opportunity for the staff in the city clinics to carry on research work in Ophthalmology.

PROCEEDINGS OF CONFERENCE SOCIETIES ETC. THE ALL-INDIA OPHTHALMOLOGICAL CONFERENCE

The second session of the All India Ophthalmological conference was held on Monday the 20th July 1931 at Bangalore under the presidentship of Dr. B. P. Banaji of Bombay.

The conference was opened by Sir Mirza M. Ismail, Dewan of Mysore.

A large number of members from all over India attended the Congress, and Madras was represented by Drs. G. Zachariah, E. V. Srinivasan and V. D. Nimbkar.

Dr. B. K. Narayana Rao, of the Minto Ophthalmic Hospital, welcoming the gathering on behalf of the reception committee made a brief reference to the origin of this new movement in India. He said that such a movement had been long overdue, in view of the fact that eye diseases formed a very considerable portion of human sickness in this country and that few other countries offered so much scope both for the study of ophthalmology and for its practical demonstration. It was also felt that the contribution made to scientific knowledge by the eye surgeons of India had by no means commensurate with the opportunity they had. True it is that services of enduring value have been rendered on the operative side of our science by eminent members of the Indian Medical Service, but on the scientific side much remains yet unexplored. Such exploration can proceed satisfactorily only when there is a central organisation to encourage effort to co-ordinate experiment and study and facilitate the exchange of information and ideas.

Before declaring the conference open Sir Mirza M. Ismail said somehow India, in spite of the unfortunate fact that it is the home of many a devastating disease has contributed very little to medical research, and expressed the view that the facilities for the treatment of eye diseases in India were extremely inadequate.

Dr. P. Banaji, the President, described the progress made in Ophthalmology in recent years, and said :

"The discoveries in Ophthalmology, together with the discoveries in Pathology and Bacteriology have achieved most satisfactory results in curative and preventive work. For instance, in countries like England, thanks to preventive measures and the skilful treatment of affected eyes, the blindness attributed to smallpox has been almost done away with. Trachoma has been practically eliminated from the British Army and the Poor Law Schools of London by maintaining scrupulous cleanliness and by segregation. The attention of

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European Ophthalmologists is directed to the prevention of certain eye diseases by the avoidance of over crowding, and the improvement of hygienic conditions. Sternuos work is done in India by Hospitals to combat blindness, but the effort so far made barely touch the fringe of the problem. Whilst curative ophthalmic science is pouring its blessings on the victims of blindness in Europe, Indians, thousands and tens of thousands wait in vain for relief."

"India is a land of villages and the poverty of the people is such that many of the villagers when they go to presidency ophthalmic hospitals for treatment have to spend on travelling the whole saving of a life time. The least that the All India Ophthalmic Society can do is to bring this appalling fact to the notice of the government and public. The only solution that comes to my mind is the establishment of permanent travelling dispensaries managed by surgeons trained to do eye operations visiting particular localities in certain seasons of the year."

"Regarding preventive measures against eye diseases we should take particular note of myopia. It is essentially a disease of civilization and increases by close work such as reading and writing. Among the Parsees, with almost cent per cent. literatures, there are about 30 per cent. of myopes. As compulsory education comes into vogue myopia is bound to increase in India. Those who are responsible for school education should see that book work is avoided as much as possible and the gramophone and the cinematograph should be used more largely to impart knowledge. This should be done in addition to good lighting arrangements and the use of proper types in books. I shall not mention the other preventible diseases. The prevention of such diseases is a question for the state, and let us hope that in the near future a Ministry of Health, including one or two ophthalmic surgeons will take up this question, which affects the economic welfare of the nation.

The Ophthalmological Society should exert its utmost to develop the spirit of research amongst its members. The amount of clinical material at our disposal is colossal."

It has been proposed to hold the 3rd Ophthalmological Conference at Calcutta, and it is hoped to be attended by Dr. A. Fuchs the illustrious son of the late Earnst Fuchs of Vienna.

Medical News and Notes

PROGRESS OF MEDICAL SCIENCE

NOTES FROM THE CONGRESS OF GERMAN SURGEONS.

The inevitable horrors attendant on war, the immensity of the sufferings invariably entailed by it, not unnaturally cause many persons—probably the overwhelming majority—to regard it as an unmitigated curse and the greatest scourge of humanity. While others, considering it from another angle, regard the war as a powerful lever of social evolution and a potent factor of progress.

However this may be, it is certain that medical science, especially surgery, has benefitted in no small measure from the ghastly experiences of the Great War, which gave it one of the most fruitful impulses it has ever received. Without such an impulsion humanity would almost certainly have had to wait many long years for several startling discoveries that have revolutionised our outlook on the treatment of disease. It seems as though, by the operation of some mysterious law, the seed of a new fertile harvest of hope sprouts from out of the appalling holocausts of the battlefield, and that fearful tribulations must first be inflicted in mankind in order to stimulate the spirit of resourceful inventiveness to detect new means of mitigating and healing suffering.

An instance of the practical working of this inventive mind was furnished by Professor Kuttner, of Breslau University, at the congress of German surgeons held at Berlin in April 1931, in dealing with the consequences of the Great War for the nervous system of many of its survivors. It is safe to say that no part of the human organism suffered from the war to the extent of the nerves and that no trouble, being so deep-seated, is so difficult to cure as nerve trouble to which undeniable truth a vast multitude of victims can testify. Hence "surgery of the nerves" must needs be an absorbing theme, affecting as it does a very large number of our unfortunate contemporaries. But the sufferers are by no means confined to those who have had personal experience of the battlefield, and they are constantly becoming more numerous for reasons that are probably inherent to our civilisation. The subject is thus bound to arouse widespread interest. Professor Kuttner, in the course of his lecture, pointed out that the expe-

riences of the Great War rendered a fundamental revision of pre-existing theories concerning the structure and functions of the peripheral nervous system inevitable. Experience has proved that the restoration of nervous functions is seldom obtained quickly, and in a great many cases may be a matter of years. Nervous diseases are frequently so painful that there is a natural tendency on the part of the patient to regard a surgical intervention as the most efficacious method of treatment, simply because it is the most rapid. Professor Kuttner, however, who undoubtedly speaks with authority, does not share that view and tells us, on the contrary, that "conservative" methods have proved so beneficial that an operation need only be resorted to in extreme cases. To-day medical science approaches the subject of the treatment of nervous disease along various roads. One of the methods to which it has recourse, and which was undreamt of not so very long ago, is that of transplanting and implanting nerve substance: sometimes, indeed, other tissues are inserted in the diseased part. Professor Kuttner, however, was careful to stress the fact that time is an essential factor in any such treatment, which usually requires some years before complete success can be hoped for. But if science is still unable to indicate, to the unhappy victims of nervous affections, a short cut to health or anything resembling a magical remedy for their troubles, it certainly is in a position to hold out to them a surer prospect of ultimate recovery than was possible at any previous time. And this, assuredly, is no small mercy.

Professor Sauerbruch, the celebrated surgeon of the Charité Hospital in Berlin, was instrumental in providing the most spectacular feature of the congress in question. Professor Sauerbruch told his hearers the story of a young girl, who as a result of severe influenza suffered acutely from heart trouble. An X-ray examination disclosed a swelling on the right side of the pleura. A short time previously another patient suffering from similar complaints had been operated on, and the Professor naturally expected to find the same kind of tumour, which was in the nature of a vesicle, this time. As a matter of fact a tumour was discovered immediately above the heart, and it was punctured, but without result. The Professor then proceeded to make a second puncture, whereupon a thin jet of blood spurted from the wound and increased in volume every second in a truly terrifying manner. There could be no possible doubt that it was a case of aneurism of the heart, and the patient might easily have bled to death within a few minutes. A less experienced surgeon might have lost his head, with fatal consequences, but Professor Sauerbruch is made of sterner stuff. For him to move his finger into the right ventricle of the heart, where he could feel the blood effervescing and bubbling, and for his assistant to draw some threads

around it, was the work of an instant. The flow of blood suddenly stopped. The diagnosis of a vesicular tumour, based on the X-ray examination and the analogy with the previous case, had proved to be erroneous; this time, as we said, it was a case of aneurism. But thanks to the operator's presence of mind the patient was saved, and Professor Sauerbruch was able to present her to the congress in the best of health and spirits. All of which shows us once more how much is unforeseen, and what an important element luck still remains, despite all progress in the methods of diagnosing and how greatly life and death of a patient depend on the presence of mind, rapidity of decision, and skill of the surgeon.

Another interesting case was described to the congress by Dr. Mehrkorn, who some time before operated a patient who had swallowed a razor-blade. The latter sat in the œsophagus, and it was necessary to extract it through the ribs of the thorax. To appreciate the importance of this operation, it should be borne in mind that œsophagotomy continues to present some of the most difficult problems confronting modern surgery. Here again we see how much may depend on the boldness and dexterity of the operator in a word, on his personality.

No meeting of doctors can fail to arouse general interest, and German doctors have unquestionably contributed their share of food for reflection for the public, even if they failed to satisfy certain exaggerated *desiderata* and to fulfil some expectations that had been pitched too high. About the same time as the German surgeons met in Berlin, the congress of German physicians assembled at Wiesbaden. Professor Kuttner's pronouncement in favour of "conservative" methods of treatment, to which we referred above, was re-echoed at the latter congress by Professor Von Bergmann who declared that the "simple and old-fashioned" treatment of Basedow's disease yielded such excellent results that he was unable to share the "enthusiasm of surgeons"—an enthusiasm, we would add, which Professor Kuttner's address showed to be not unanimously felt by surgeons themselves. Modern methods of diagnosis, according to Professor von Bergmann, are in a state of evolution, or, rather are being revolutionised; this statement should be read in connection with Professor Sauerbruch's experience as described by him to the congress of surgeons in Berlin, which certainly appears to demonstrate that the present methods are susceptible of improvement. But perhaps the greatest—at any rate the most palpable progress accomplished by internal medicine, as distinct from surgery, has been in the domain of tropical diseases such as malaria and sleeping-sickness. When comparing the results achieved in regard to these redoubtable foes of mankind with the conditions

prevailing but a relatively short time ago, we may surely speak, as Professor von Bergmann did, of "a veritable triumph" of medical science.—*Transocean Service, Berlin.*

NOTES

BY

COL. FROILANO DE MELLO, NOVAGOA.

Concentrated and purified antityphoid serum. Technique of preparation. Clinical essays. E. Grasset. (Compt. Rendus Sec. Biol, CVL. 1931 n° 10)

From 1927 the author has prepared an antityphic serum with strong therapeutic properties. His actual serum is polyvalent (Eberth, Parat. A. B. C.), concentrated and purified.

The author exposes his technique of preparation: strains possessing a maximum endotoxic power are selected. Agar cultures aged 48 hours are submitted to 58° during 30 minutes, and successively to 4 congelations during 24 hours each. The product is submitted to the action of formol at 7/1000 in order to obtain an anatoxin. The hyperimmunisation of horses is made by a series of injections of polyvalent antigens: 10, 20, 35, 50, 75, 100, 150, 200, 250, 300, 350, 400, cc. The injections of antigen added to 0,5 to 1/1000 of tapioca are made every 7—10 days. 1cc. of such serum neutralises in guinea pig 1000 doses of Eberth bacillus.

For human clinic the serum is submitted firstly to a precipitation by sodium sulphate according to the method used for the concentration of antitoxins and seric englobulin is eliminated by a precipitation by 11, 5% of NOH. A new addition of sulphate precipitates the pseudoglobulin. The experimental dosages show that euglobulin and seroalbumin contain insignificant doses of antibodies, which are extremely abundant in pseudoglobulin.

The serum has been tried in 600 patients. No shock is noted. The action is evident after some hours: progressive disparition of intoxicating symptoms, such as delirium, prostration, adinamy, meningeal troubles. The temperature comes down in 24 to 36 hours after injection. Practically 3—4 intramuscular injections of 20—40 cc, given with an interval of one or two days, definitely check a Typhoid case.

Seric reactions are nil.

As typhoid gives such strong contingent to morbidity and mortality in India, serotherapy such as advocated by the author should be tried here. (Research work of South African Institute of Johannesburg.)

Treatment of diphtheric carriers by oxyquinolein. Lisbonne Deveze, Labrague-Bordenave (Archives de la Soc. des Sci. med. et Biol. de Montpellier et du Languedoc Medit 11. Fas LLL. Mars 1930)

Powder of sulphate of oxyquinolein 1 gr, mixtured with bismuth carbonate 100 gr, insufflated in the throat. Sometimes the authors have employed 2 gr of oxyquinolein for 100 gr. of bismuth. The bacilli of Loeffler disappear between 4—10 days. In one case only the germ persisted till the 16th day, disappearing afterwards spontaneously.

Evolutive cycle of Eberth and Paratyphic bacilli in vitro and in vivo, Hauduray (*Bull of Academy of Medicine* 1. VI. 30)

The author states that under the influence of bacteriophage Eberth bacillus and specially the Paratyphic bacilli suffer a mutation into invisible germs traversing the filters and that these forms may assume the bacillary stage, their ancestor.

A new conception results from these statements explaining that many polluted waters or even convalescents of these diseases which do not show any bacillus of these groups may convey the disease through this filtrant virus.

The same author in a very interesting paper on this subject (*Presse medicale* 9. VII. 30) states the existence of septisemias caused by this filtrant form of Eberthellas which after successive subcultures give the typical form of the bacillus.

Treatment of purulent collections by local proteinotherapy. Sezary & A. Durmy (*La Semaine des Hop. de Paris* VI. 5 15. 111. 1930)

Results of the experiment of the authors treating acute or sub-acute purulent collections with injections of Witt's peptone at 10% and instillation of a peptone creme at 10% in the cavities. Treated 65 cases of bartholinites, buboes, of soft cancer, hydrosadenites, abscesses, with 7 failures; in another series 10 cases with 5 failures.

In buboes and bartholinitis wonderful successes or complete failures; results always satisfactory in abscesses. The cure is generally rapid 5-10 days for bartholinitis; 10-20 for buboes; 8—15 for abscesses.

Surgical intervention is so avoided except for buboes. The results are worthy of interest on aesthetical point of view.

The mode of action is by protein shock.

Microscopical and chemical examination of sputum in patients suspected of pulmonary silicosis. Policard, Magnin and Edme Martin (*Presse medicale* 28. VI. 30)

The study of leucocytes in sputum does not give any reliable test on silicosis: The presence of cells filled with mineral particles is very frequent. These particles are coloured in black or yellow and sometimes are angular and transparent. Some of them are birefringent specially after microincineration and this constitutes a mineralogic character of silica. More rarely the cells show very small black granules of fuliginous nature and even ferric pigments. The quantity of these cells has no relation with the duration of the exposure to work on mines etc, and it seems that these particles once inhaled remain in the lung.

The study of ashes gives interesting results. Those with more than 10 years of work give 10 to 13%, those with less than 10 years 8%, those suffering from plain tuberculosis 6 to 7%.

In conclusion, the chemical or microscopical study of sputum does not give better elements for diagnosis of silicosis than the anamnesis.

Lipoids and anaphylactic states—a new antianaphylactic method R. Mercier *Presse medicale* 13. VIII. 30.

Discussion on genesis of anaphylaxis: Personal experiments. The most interesting statement is: since December 1929 the author uses the lipoids extracted from 60 cc. of blood obtained by veinopuncture. He injects 21 ampoules of the emulsion of these extracts, 1 per day containing 1 cc. of this emulsion. From 6th day there is generally an evident amelioration and cure has been noticed at the end of the treatment without any shock, sometimes with slight local reaction in the first 5 or 6 injections, in nearly 300 patients with eczema, hay fever, asthma, and one case of epilepsy which seemed of anaphylactic origin.

An objective symptom of chronic appendicitis. Buchmann (from Rostov. s. Don) *Presse Medicale* 13. VIII. 30

After a study of 3500 patients the author calls the attention of practitioners to the following symptom found in almost all his cases: active pupillary dilatation on right eye in chronic appendicitis.

This symptom has already been described by Moschkowicz, later on by Baillarger (1850) et Roque (1869-73) on other internal affections, specially pulmonary and pleuretic tuberculosis, showing in this way the relations between pupilla and the internal organs.

The author says that such dilatation disappears 2½ to 7 months after the operations.

Large discussion on physiopathology of this symptom.

Treatment of diphtheria bacilli carriers by ultraviolet Rays, F. Herve (*Journal de medecine de Bordeaux et du sud-Ouest* CVII n° 14 20. V. 1930)

Since 2 years the author treats systematically the diphtheria bacilli carriers by a local application of ultraviolet rays, daily or thrice a week during 2 to 10 minutes. 5 cases reported with encouraging results and without danger. 6 to 11 applications have been necessary to complete sterilisation of rhynopharynx.

Infantile asthma. H. Haibe (*Bull de l'Acad Royale de Med de Belgique* 26. V. 29)

Cuti reactions show that in the majority of case infantile asthma is provenient from a sensibilisation to proteins absorbed by respiratory viae and that among those microbic proteins are mostly responsible rendering such asthmas of a more severe prognosis than other asthmas.

Tuberculosis and syphilis have no role in this ætiology. Generally coryzas, tracheites, bronchites, sometimes bronco-pneumonias, whooping-cough, measles are the predisposing causes. Bacteriologically pyogenic microbes such as staphylococcus and streptococcus are found in bronchi and cuti R to their toxins are strongly positive.

A combined therapeutic of antiviral therapy and vaccinotherapy prevents recidives of the coryzas and desensitizes the organism. The method is very simple and assures the cure of 95% of cases with such aetiology.

On the existence of inapparent typhus exanthematicus in man. Ramsine (*Arch. Inst Pasteur de Tunis* XVIII n° 3 e 4 Nov 1929).

Studying an endemic focus near Belgrade the author finds Felix-Weill R. position in some apyretic cases, apparently healthy. The inoculation of their blood to guinea pig showed evidence of inapparent infection in those cases.

Nicolle (ibid) analyses in detail this paper, shows the importance of this fact in epidemiology and advises that practically one should consider infective all the persons of an inveterate focus of this disease.

Agranulocytosis and its treatment. R. Leuchtenberger (*Therapie der Gegenwart* 4 XXI. April 1930 analyse Pr. Medicale 26-VII-1930).

The modern tendency to consider agranulocytosis as a syndrome and not an autonomous disease as it was first considered by Schultz is accepted by the author. After a long discussion on aetiology and

pathogeny, the author points out the therapeutic means employed for cure :

(a) radiotherapy of the bones which has already given good results to Friedmann. The author confirms this opinion but Reye, Schultz, Aubertin, Levy have observed failures :

(b) Blood transfusion has given ameliorations and even cures to Zilowsky, Otto Hoche, Yogic, Splenger, negative results to Bautz, Feer.

(c) leucogen injections (therebentine, milk etc.) seem less successful.

Special care is recommended in arsenobenzol agranulocytosis. As leucopenia is the first sign of this disease, blood counts are necessary to stop immediately the treatment where leucopenia is noticed.

Preventive vaccination against pneumonic plague by respiratory viae Nicolle, Durand, Conseil (Academy of Science 27-1-30)

A severe epidemic of pneumonic plague having been developed in the tribu of Douiret, South Tunisia, the authors have employed with some success moreover the subcutaneous vaccination, the introduction of vaccine by nose. It seems that we possess by this method a means of preventing pneumonic plague against which every essay of vaccination had hitherto failed.

Anatoxic action of urotropine in vivo Urtaikine (Rev. of Microbiology Epidemiology Parasitology Saratev IX. 2. 1930).

After the studies of Ramon it has been proved that all toxins may be transformed into anatoxins and that such transformation may be obtained by certain substances of the group aldehyde and urotropin. The present work is an essay of neutralisation of the toxin in vivo. Pigeons inoculated with D. L. M. of diphtheric toxin survive when urotropin is injected intravenously and cure when the dose of toxin is diminished, whilst controls die.

The neutralisation of the toxin by urotropin is produced only when the toxin penetrates slowly in the circulation in order to allow a close contact between the toxin and the urotropin.

This neutralisation is of anatoxic nature
(in Russian ; resumé in French).

Gleanings from Medical Press

SURGERY.

Hematuria.—James S. Sargent (*Wisconsin Medical Journal*, July, 1939) says that in only four out of every 100 patients with true hematuria, is it necessary to go outside the common diseases of the urinary tract to find the cause. It is imperative to note that these include, among other things, all cases of "essential," or "idiopathic," or meaningless (if such there be) hematuria. This certainly can be of but little comfort to those of us who still have the feeling that one or two spells of hematuria, especially when they apparently clear up so nicely on medication, can be of no particular importance to the patient. It is, therefore, apparent that approximately 60 percent of cases of hematuria occur in diseases in which, through the other and more commanding symptoms, the underlying pathology is readily recognised. In the remaining 40 percent of cases of hematuria we are confronted with an underlying disease (tumour of the kidney or of the bladder) quite free from other signs or symptoms until well advanced and often beyond hope of effective treatment.—*Int. Nat. Jour. of Med. Surg.*

Acute Transient Epiphysitis of Hip Joint.—Acute transient epiphysitis is given by O. L. Miller, Charlotte, N. C. (*Journal A. M. A.*, Feb. 21, 1931), as a common cause of hip complaint in children. It is usually provoked by mild trauma. It may be suspected in a child complaining of pain about the hip if he has diseased tonsils or has recently had an acute infectious disease. Eighty per cent of his cases were associated with diseased tonsils. Carefully made roentgenograms will show small abscess formation and absorption about the epiphyseal line.—*Northwest Medicine.*

The Paralysis of Pott's Disease by Dr. Edward A. Rich, Ticoma, Washington, *Journal of Bone and Joint Surgery* Volume 12, No. 1 January, 1930.

The writer outlines in a general way four types of paralysis resulting from tuberculosis, spondylitis. While the occurrence of severe Pott's disease, which results in the deformity commonly known as the humpback, is rapidly disappearing from our clinics because of prophylaxis, we do see severe paralyzes resulting from this disease.

In America this decrease has been rather rapid, but in Europe surgeons are still treating many terminal Pott's palsies because of the economic conditions. European surgeons were slow to take an interest in America's stabilizing spine operations which undoubtedly, have prevented a great many cases of severe deformity, a high percent of which results in paralyses.

The writer outlines the paralyses as follows:

Type one is described as due to edema and is caused by a severe sudden tuberculosis involvement of the spine and completely paralyzes the affected limbs and body. The prognosis in this type is favorable, and, under proper treatment, normal function of the legs will return.

In type two, the spinal cord is interfered with from angulation due to a severe deformity. The prognosis in this type is also favorable. Case Report: Boy, age 13. Under proper treatment on a Bradford frame, an effort was made to hyperextend the spine thirteen months. An operation was then done in which a hemilaminectomy was done with relief of the constriction of the cord. After surgery, recovery was rapid—patient was able to walk in seven months.

Type three, paralysis from abscess pressure. The prognosis in this type is favorable. About two-thirds of the palsies of Pott's disease are caused by this abscess pressure. A case reported in this group, in which there was an abscess with draining sinuses, was treated over a long period of time and placed on a frame after a special apparatus had been incorporated in plaster above and below the kyphosis used to increase hyperextension. After several weeks, improvement of the paralysis was noted, and at the end of the year was pronounced paralysis-free.

Type four he describes as paralysis from pachymeningitis. The prognosis in this type is not favorable. It is a slow progressive palsy in which the thickened membranes may be a primary source of pressure on the cord. Laboratory reported villus pachymeningitis. One case reported showed that in spite of all the conservative treatment later followed by laminectomy, did not respond to treatment and developed tuberculosis meningitis and died.

In conclusion, the writer advises conservative treatment rather than surgical measures in these old neglected types of Pott's disease that have become paralyzed.—*J. Oklahoma State Medical Association*.

Inflamed Bursæ About the Shoulder Joint.—Sterling Bockoven (*United States Veterans' Medical Bulletin*, July 1, 1930) suggests that in the treatment of inflammatory involvement of the bursæ

about the shoulder joint it is necessary to keep in mind the pathology that is present. In the acute stage, if a serous, hemorrhagic or purulent exudate occurs within the bursa, it must sometimes be aspirated and drained. In the majority of cases, immobilization is the treatment of choice, with early gentle passive and active motion to prevent formation of adhesions. In the subacute stage, where adhesions are already forming, diathermia is of great value. Manipulation is necessary to break down adhesions which have already formed, but great force should never be used. Following this, early passive and active motion, as well as diathermia and massage, are important. The arm is immobilized in abduction and outward rotation and a well fitting splint is essential for this reason. As passive motion is started, the amount of abduction and outward rotation may be gradually lessened as the development of the abductors and outward rotators permits, this being necessary to maintain the position gained. Care must be used in the amount and range of motion, as a recrudescence of symptoms may be brought about by incautious manipulation or active motion at this time. Diathermia is a valuable adjunct in this type as well as in long-standing cases because of its tendency to soften adhesions and to promote the absorption of of calcareous deposits.—*Int. Jour. Med. & Surgery*.

Emphysema of head and neck complicating Tonsillectomy:

—Three cases of emphysema complicating tonsillectomy are reported by Frederick H. von Hofe, East Orange, N. J. (*Journal A. M. A.*, Sept. 27, 1930). It seems possible that this condition may be brought about as follows: 1. The air may enter the tissue following perforation of the tonsillar fossa bed. 2. The air may enter the tissue following perforation of lung vesicles. 3. It is possible that air may enter the tissues after being forced into Wharton's duct and thence diffused.—*Texas State Journal of Medicine*.

Elephantiasis Cured by Surgery.—The tropical disease called elephantiasis gets its name from the enormous enlargement of the limbs which it so often causes. The scientific name of the disease is filariasis, because it is caused by a worm called filaria, the larvæ of which make their way into the human body from the bites of certain mosquitoes. Once in the body they multiply and may become so numerous that an accumulation of them in one place may interfere with the circulation of lymph. As a consequence, the limbs and sometimes other parts of the body increase enormously in size.

Dr. F. W. O'Connor and his colleagues at Columbia University have been investigating the possibilities of relief for this condition by means of surgery. As reported in the *Science News Letter*, a small area where the pain was most intense was often found in these