

## SOME RECENT X-RAY WORK.

By WILLIAM S. HAUGHTON, M.B.

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I HAVE once more to thank the Academy for their kindness in allowing me to bring forward a communication on Röntgen Photography. Since my last communication before the Academy on this subject, a good deal of very satisfactory work has been done, and many possibilities opened up, but it is only my intention this evening to briefly outline the more important recent successes of the process.

In my last paper before the Academy I divided the cases in which the process was applicable into three classes, according to the measure of success which might be expected in each class. Since then the process has proved its utility in so many additional conditions we must now considerably augment this list.

The following may be taken as fairly comprehensive :—

### *In First Class.*

*Surgery*, under which we include—

1. Normal changes in bone.
2. Congenital and acquired deformities in bone.
3. Fractures.
4. Dislocations.
5. Epiphysiary separations.
6. Diseases of bone.
7. To study results of operations in bone.
8. Location of foreign bodies.
9. In military surgery.
10. Calculi.

*In the Second Class.*

*Dental Surgery*, under which we include—

1. Normal eruption of teeth.
2. Abnormal eruption of teeth.
3. Caries.
4. Abscess.
5. Exostosis.
6. To study results of treatment.

*In the Third Class.*

*Medicine*, under which we include—

1. Changes in the heart and great vessels.
2. Pulmonary conditions.
3. Pleurisy with effusion.
4. Some of the changes in gout, rheumatism, syphilis, tuberculosis, rickets, osteomalacia, acromegaly and Charcot's disease.
5. To study effects of treatment.
6. Calculi in gall bladder, kidney, and urinary bladder.

*In the Fourth Class.*

Therapeutic action of the rays.

*In the Fifth Class.*

Pathological action of the rays.

*In the Sixth.*—Anatomy.

*In the Seventh.*—Physiology.

*In the Eighth.*—Obstetrics and gynaecology.

*In the Ninth.*—Medico-legal evidence.

*In Surgery.*—Here we have to study the normal changes in bone, and I have observed that young bones are very transparent, those of adults present a minimum opacity, while in old age increasing transparency is the rule—conditions intimately dependent on the amount of bone salts present, the transparency of age being doubtless due to senile decay

and atrophy—conditions familiar in intra-capsular fracture of the neck of the femur in the aged.

The relative transparency of soft tissues is also being carefully investigated, and up to the present the most accurate results I have seen are those of my friend Mr. Henly, who finds bone four times as opaque as fat, and muscle two and a half times. Characteristic changes also occur in the cancellous tissue at different ages—in the young a linear formation being the rule, highly suggestive of the histological structure of growing bone in the ossification of epiphysary cartilages.

In *Congenital and Acquired Deformities of Bone*, conditions such as talipes and syndactylism may be examined in the living, bony deformities observed, and the necessary operation planned, whether it be tenotomy, osteotomy, or excision; while the many deformities due to *tight boots* may now be correctly examined and the treatment guided.

In *Fractures* splendid results have been obtained, and the frequency of certain unsuspected conditions determined, the process providing a ready and accurate diagnosis, and indicating prognosis and treatment while avoiding the shock of anæsthesia, besides useless and often dangerous manipulation; providing also an accurate record to protect the interests of the patient and surgeon, which is invaluable also for teaching purposes.

In my own experience I find that in Collis's fracture the ulnar styloid process is torn off in more than half the cases examined (61 per cent.)

"X-rays" have dealt the "bone-setter" a deadly blow, showing up his methods in a clear and unmistakable light; and, unless the public really wish to be "gulled" by this kind of "pirate," there is no reason why they should be so any longer, in the light of modern days!

To guide the treatment of *sequelæ in fractures* such as

false-joint, fibrous union, or fibrous ankylosis in joints, to plan the operation for "wiring," and to overhaul one's treatment in fractures, is now also rendered a much easier matter.

In *Dislocations*.—Here, too, applies all that has been said of fractures. But in both classes of injuries it is of the utmost importance to skiagraph a case very early—as soon after the injury as possible—as only on these conditions will the process furnish *grounds for exact* diagnosis, prognosis, and treatment.

My experience in "X-ray" work leads me to believe that many cases prove to be "simple dislocations" which are suspected of being either fractures or fractures complicating dislocation by epiphysary separations in the young.

Thus if the skiagraph be appealed to early in such cases, the correct treatment of an early reduction is suggested, and complete recovery will result.

In all such cases a "central skiagram" of the opposite limb is advisable, and, in addition, an extensive knowledge of the skiagraphic appearances of ossifying epiphyses in the young is indispensable for correct interpretation.

In *Epiphysary Separations* I need only refer you to Poland's splendid treatise on the subject, in which he pays a just tribute to the aid skiagraphy has been in the correct interpretation of the various injuries included under this head.

With regard to *Bone Disease*, it is only necessary to state that in most cases the extent of the disease may be correctly arrived at, and the necessary operation planned in such cases as tubercular disease, necrosis and new growth; such as osteomata, enchondromata, and osteo-sarcoma.

A good deal may also be done in the diagnosis of gout from chronic rheumatic arthritis.

In the localisation of *Foreign Bodies*, everyone is now

so familiar with this aspect of skiagraphy that I shall only mention one or two points.

In military surgery, as I have mentioned elsewhere, it has provided the operator with a probe which is *exact*, which is *painless*, which is *aseptic*. And in this connection I may mention that my friend and pupil, Major Battersby, of the R.A.M. Corps, has kindly furnished me with an extract from his experiences with the process recently in the Soudan, which I hope to have the pleasure of communicating to you when showing some of his skiagrams of the wounded after the battle of Omdurman.

Many excellent and accurate instruments for localisation have been devised, only two of which I shall mention—the Mackenzie-Davidson “localiser,” and Wm. M. Sweet’s “apparatus.” Both depend on the displacement of the tube producing two shadows of the foreign body, and by a simple process of triangulation results within a single mm. may be obtained.

With Sweet’s apparatus recently I located a grain of shot in the eyeball, getting the following measurements, *i.e.* :—

- |     |      |   |                                     |
|-----|------|---|-------------------------------------|
| 15  | mms. | - | Behind centre of cornea.            |
| 7.5 | „    | - | Below horizontal meridian.          |
| 2   | „    | - | To nasal side of vertical meridian. |

The tissues of the eye were, however, so lacerated and so much hæmorrhage was present that enucleation was almost a foregone conclusion.

In *Dental Surgery* the conditions of normal and abnormal eruption of teeth, caries, abscess, and exostosis, besides the result of certain treatment, may be observed with much speed and accuracy, as the skiagram negative can be developed in the dark room, and examined within twenty minutes after the photograph is taken.

In *Medicine* a good deal has been done, and more will soon be established. Changes in outline of the heart and thoracic

aorta, changes in the tissue of lungs and pleura, may be observed, besides some of the physical conditions in pleural and pericardial effusion and empyema.

In early *Phthisis* much information may often be obtained as to area of consolidation, and that, too, sometimes before bacilli appears in the sputum or physical signs reveal consolidation, as mentioned by Bouchard and other observers.

Patches of consolidation in the apex of either lung being shown as dark spots, and cavities as dark circles, with transparent centre, unless filled with pus, when they are dark all over.

In the treatment of cardiac disease where dilation or hypertrophy are present, the size of the heart may be watched from day to day, and measured if necessary, thus putting a gauge on the value of certain lines of treatment.

The observations on the effects on Bacteria are so conflicting I will not trouble you with them.

In connection with the *Pathological effects of the Rays*, we must admit that there is a certain but extremely small risk of dermatitis. Those who suffer most are X-ray workers themselves, from their frequent exposure. But very few cases are recorded where harm resulted except from ignorantly protracted exposures.

The dermatitis may affect the skin, hair, nails, and conjunctiva, causing, in some cases, shedding of hair and nails; but recovery is rapid when the cause is removed. Ulceration is extremely rare, and only follows exposures of an hour or more.

In *Anatomy and Physiology* the "X-rays" render some help. In the former, to study *anastomosis* and *ossification*, and in the latter, the movements of the heart and diaphragm.

In *Medico-legal Evidence* real benefit has accrued to both patient and surgeon, and I need only cite the following applications to convey an idea of the utility of the process:—

1. To prove the presence or absence of a *bone injury* or of a *foreign body* in criminal or civil cases.
2. In an action for malpractice.
3. For purposes of identification.
- 4 To prove the age of a *fœtus*, and whether it had *breathed*.

In conclusion, allow me to convey to you my appreciation of the patience with which you have listened to my paper, which I fear has occupied your time too long.

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#### NOTES ON SOME RECENT X-RAY WORK IN THE SOUDAN.

Major Battersby, who was recently in charge of the X-ray apparatus in the Soudan, regrets that a prior engagement prevents him being here to-night. He has kindly given me a short abstract of some of his work with the late Nile Expeditionary Force in the Soudan.

His headquarters were at Abadieh, a small village on the Nile, about 1,250 miles from Cairo, and 9 miles north of Berber. During the months of July, August, and September the shade temperature varied from 100 to 120° F., and severe dust storms were of almost daily or nightly occurrence, coupled with which no ice was procurable for the development of photograph plates. Consequently under such trying climatic conditions, both radiography and photography were carried out with great difficulty.

As a precautionary measure before leaving Cairo, Major Battersby had the boxes which contained his coils and batteries covered with thick felt, and by keeping this wet every two or three hours the trying journey through the desert was safely accomplished, and the insulation of coils preserved.

Photograph I. shows Nile at Abadieh, about  $\frac{3}{4}$  of a mile broad.

II. Severe dust storm at 2 o'clock in the day.

III. Method of generating electricity by means of a small dynamo and tandem bicycle.

IV. Ten inch field service induction coil at work.

V. Modification of Mr. Mackenzie-Davidson's localising apparatus, specially made for Major Battersby and used by him for first time on field service in the Soudan.

By this method he was enabled successfully to localise with mathematical precision two large conical bullets which had entered in front near shoulder, and in each case were localised behind near shoulder blade. In another case the patient, who was also wounded at Omdurman, was hit 1 inch below and 1 inch behind the anterior superior spine of his left ilium. When examined at night the screen (with a lateral view) distinctly showed the bullet, which next day was accurately localised in pelvic cavity.

After the battle at Omdurman there were 121 British officers, non-commissioned officers and men wounded. Of this number there were 21 cases that could not be accurately diagnosed by ordinary surgical means. By the help of the Röntgen rays, which was used about sixty times, the bullet was either found or its absence demonstrated in 20 out of the 21 cases, the odd case being so ill with a severe bullet wound of lung, that it was not considered judicious at the time to examine him.

Skiagram I.—Bullet wound back of left hand. Metacarpal bone of middle finger injured, but no bullet present, consequently no probing resorted to. Illustrates case of spent bullet which had not lodged.

II. Bullet through outer and inner side of left arm, and a third wound near inferior angle of left scapula. Three pieces of bullet found at outer side of humerus; no bullet seen in chest, therefore no necessity to probe for it.

III. Skiagram taken through chest without removing dressings and bandages. Wound of entrance was near tip of



right shoulder behind the acromial end of clavicle. Front view revealed the bullet at right angles to axillary margin of scapula, about 2 inches below glenoid cavity. Outer tip of bullet just touching axillary border, probably in sub-scapular space. This case was localised by Mr. Mackenzie-Davidson's method and easily extracted.

IV. Bullet wound at inner part of left supra-orbital ridge. The projectile was supposed to be lodged at back of orbit, as the eyeball was protruding, and the sight destroyed. When studied closely the skiagram shows outlines of the bones of upper part of face, including orbital cavity, as well as fleshy parts of forehead and nose, but no trace of bullet. The eyeball was enucleated a few days afterwards, but no foreign body was found. Injury evidently produced by spent bullet, which drove a splinter of bone into the eye.

V. and VI. Bullet wound, left thigh. Front view shows bullet projecting from outer side of femur, about the middle of the shaft. Side view reveals projectile lying parallel with shaft on upper side.

VII. Shows the result of a bullet wound of left leg. The skiagram was taken some time after the injury, and shows clearly the fracture of both bones, the tibia especially being very severely damaged, and suffering from necrosis. Several splashes of lead are also seen in the wound.

VIII. Bullet wound, left ankle. Front view shows bullet with broad end towards inner side. Skiagram reveals bullet in joint between astragalus and scaphoid. Bands of lead plaster also visible. Bullet readily extracted.

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DR. SCOTT considered the reducing to figures the comparative lengths of exposure of different tissues was very interesting.

DR. LANE JOYNT said that the question of causing dermatitis was most important. Recently some purely electrical experimenters had endeavoured to show that dermatitis is produced by any high electrical discharge quite independent of the X-ray tube. In the

*Electrical Review* some time ago reports showed that one might exceed about 500,000 volts, and get to 1,000,000 volts; that the risk of brush discharges in the neighbourhood was very great, and that dermatitis frequently followed, and could be produced at will by any X-ray tension or power. He thought that a good deal of false blame had been laid to the charge of the X-rays; he himself had never seen a case of dermatitis.

DR. E. J. McWEENEY said that he should be glad to know what effect caseous material had upon the rays, and what effect upon the rays calcification had? Again, what amount of opacity calculi of different kinds had? Was it possible to get shadows from those soft cholesterin and cholesterin pigmentary calculi found in the gall bladder? He had seen some X-ray photographs of tuberculous subjects in which the bones showed a remarkable amount of transparency, which might be due to the anatomical fact that the spaces in the cancellous tissue were larger than normal or to a smaller deposition of lime salts.

DR. MAUNSELL would like to know if in the skiagraphs of Potts' fracture Dr. Haughton had found that the astragalus was dislocated slightly backwards as well.

DR. KNOTT said that in cases of epiphysary disjunction the solution of continuity always ran through the bone near the cartilage.

DR. HAUGHTON, referring to Dr. McWeeney's remarks, said that he had been unable to obtain any good photographs of tubercular consolidation in the apex of the lungs owing to the movements of respiration. Caseous material was rather transparent, considerably more so than pus, the latter being nearly as opaque as water. In calcareous deposits very considerable opacity resulted, as the calcareous salt contained lime whose atomic weight is about 40, and the higher on the atomic scale the greater the opacity. Phosphatic calculi were rather transparent, oxalic were the most opaque, and uratic intermediate. Cholesterin was extremely transparent. Regarding the relative transparency of tubercular cases in comparison with normal, strumous subjects were often found with very transparent bones, probably due to a condition of malnutrition. There seemed to be possibly a smaller deposition of lime salts, perhaps associated with an enlargement of the cancellous tissue; but he himself thought the cancellous tissue presented a normal outline, while the transparency was greatly increased. In reply to Mr. Maunsell, he (Dr. Haughton) had not observed dislocation backwards in Potts' fracture.