THE LOCALIZATION OF FOREIGN BODIES BY MEANS OF THE X RAYS.

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THE medical journals have recently contained many descriptions of new methods of localization. It is advisable in these circumstances to take stock of these and consider some points regarding their respective merits.

The object of the radiographer is to be able to state with the utmost precision the exact position of a foreign body, and to satisfy himself that, if an extraction does not result, he is in no way to blame. For this reason the method of examination chosen should be the most accurate, not the most rapid. It is often concluded that such and such a method is the best because of the ease and rapidity with which it can be executed. However quickly it may be possible for the radiographer to do his share of the work, if it is not accurate it is the worst possible method.

Considerable difficulties may face the radiographer, and he must to a certain extent depend upon the skill of the surgeon, but if he knows that he has made no mistake he need fear no criticism. It is advisable for him, however, to be present at the operation in order to see that the patient is placed in a similar position to the one which he assumed during the x-ray examination, and further so that he may draw the surgeon's attention to various necessary points. For instance, if a spot has been marked on the skin under which the bullet is said to lie at a stated distance, he must see that the skin is not stretched before the incision is made. A surgeon will frequently do this without thought, placing his thumb and forefinger on either side of the spot indicated. Further, if it is stated that a foreign body lies at a certain depth below a mark, that depth is vertical, and the information given will be of no value if the operator enters obliquely in order to avoid certain structures. The surgeon must, so to speak, focus the bullet in his mind's eye before the cut is made, as once the knife has entered the surface marking is lost.

Method of Right-angled Planes.

In this method two marks are made on the skin vertically over the shadow cast by a foreign body when examined both from the front and from the side—that is to say, at an angle of 45 degrees from each other. From each of these marks imaginary perpendicular lines are dropped and the foreign body sought for at the point where they intersect. The examination may be confirmed by taking two radiograms at right angles to one another. Acting on this principle, four marks can be made instead of two, the limb being examined from the front, from the back, and from both sides.

In order that these observations should be as accurate as possible, it has been suggested in recent articles in the BRITISH MEDICAL JOURNAL and in the *Archives of the Roentgen Ray* that a ring localizer should be employed. The limb is placed at first in a fixed position, and care is taken to ensure the beam being vertically below. The diaphragm is narrowed down, and when a small aperture alone remains and the foreign body is seen lying in the centre a metal ring, with an internal diameter of two-thirds of an inch, attached to a wooden handle, is slipped between the upper part of the limb and the screen. A mark is then made over the shadow of the foreign body. The ring is afterwards placed below the limb and another mark made. The process is repeated when the part to be examined has been rolled over at an angle of 45 degrees, and thus the four points desired are obtained.

The right-angled plane method has the disadvantage of being difficult to carry out when the foreign body is in a region other than a limb, and, further, although in many instances it may be entirely successful, it might be unfair to blame the surgeon for failing to find something which is supposed to be lying where imaginary lines intersect. This objection can be obviated by estimating the depth of the foreign body below a marked point, and, if the surgeon has been given this data, there can be no excuse for his failure. In the

description of the ring localizer, a way by which this could be easily accomplished was given. Shenton pointed out another method in the *Practitioner* several years ago. When he had obtained his first mark he rolled the limb over at right angles and placed the point of a probe, held parallel with the screen, in contact with the mark. Next, a piece of lead foil was slipped over the probe until its distance from the point was equal to that of the point from the shadow of the foreign body. This, of course, gave the depth.

The objection that the method already explained is of little use when a foreign body is embedded in other parts than a limb can be overcome by using in conjunction with, say, the ring localizer some contrivance that will indicate the depth below the surface by means of the relative amount of movement of two shadows when the tube is moved backwards and forwards or from side to side. The nearer a foreign body lies to the screen the smaller will be the amount of movement of its shadow.

Thus if a body is lying in the pelvis, and a wooden stick, to the end of which a metal knob is attached, is held to the side of the body, when the tube is moved the shadow of the foreign body and the shadow of the knob will both move in a direction opposite to the displacement of the tube. When the knob is placed in a position so that its shadow moves exactly the same amount as the shadow of the foreign body, a mark can be made under the knob, and the depth calculated. It is necessary to become familiar with this method before it can be executed with accuracy. In the article by Shenton, already referred to, the same principle was applied, but the pointer with the knob was clamped, and greater accuracy resulted accordingly.

Method of Triangulation.

In this method the tube is moved a fixed distance, and one or two plates taken, two shadows of the foreign body resulting. If the distance of the tube from the plate and the lateral movement of the tube are known, it is easy to reconstruct the various parts, and, by means of cross threads, which represent the rays proceeding from the focal point of the tube, to obtain the exact position of the foreign body. If the necessary precautions have been taken, there should be no possibility of error. The reason why this method is not more freely employed is because it has been stated that the localizer necessary is complicated, and the calculation a long one. This is a matter of opinion, and if a modification of the original Mackenzie Davidson localizer is used, it will be found that the operation required is simple. Moreover, all objections of this kind have been met by the radiometer of Hampson. He has drawn out a scale, and, if his instructions are followed, it is merely necessary to refer to it in order to know the exact depth of the foreign body below the point marked on the skin. The principle is that of triangulation, but the radiographer has had all the calculation already done for him, and if the tube is placed at a fixed distance below the plate, and moved laterally a fixed distance, the scale will give the depth according to the amount of movement of the shadow of the foreign body.

The modification of the cross-thread localizer mentioned is made by Butt and Co., of Wardour Street, and with it can be obtained a portable couch of value for field service. The apparatus consists of a couch with a crossbar tube holder and a plate-changing box with wires stretched at right angles over a vellum covering. The cross-thread localizer has an adjustable mirror below, a movable base, and a vertical scale carrying a T-piece. In addition, there are two metal mice carrying needles and threads, the latter being also attached to the T-piece, and a vertical millimetre scale with two sliding pointers, moving in different directions.

The tube must be placed within the box with the centre of the anticathode vertically over the point of intersection of the cross wires. Two exposures are made, the tube being moved 3 cm. to either side of the central position. The position of the cross wires must be marked on the patient's skin.

If the two exposures have been made on one plate, this is placed after development on the localizer, with the shadow of the cross wires superimposed on similar marks, scratched on the surface of the localizer. If two plates have been taken the shadows must be drawn on ground

glass or celluloid, which in their turn are placed on the localizer.

The T-piece of the vertical scale is fixed from the surface of the localizer at a distance corresponding to the distance of the anticathode from the plate. This is easily done, as the vertical scale can be moved from the couch to the localizer, on account of its movable base. On either arm of the T is a notch, through which the threads going to the needles on the mice are passed. These two arms are 6 cm. apart, that is, the distance through which the tube is moved between the exposures. The points of the threads attached to the mice are placed one over each shadow, in such a way that the threads cross, the right thread of the T-piece going to the left shadow, and vice versa. All that now remains to be done is to read off the measurements on the vertical millimetre scale. This should be placed on one of the lines of the quadrant which contains the shadow of the foreign body. The upper pointer should be made to touch the intersection of the threads. This gives the depth and distance in one direction, while if the lower pointer, which is set at right angles, is slid along to the other line, the reading in the other direction is obtained.

The distance of the foreign body from two fixed lines has now been ascertained, and as these lines are marked on the patient, and the depth is also known, a record can be given to the surgeon, such as: Depth of foreign body, 3.6 cm.; north, 2.6 cm.; east, 4.6 cm. The calculation can be made rapidly once the plates have been developed, and, if the surgeon desires to do so, he may place the two plates in the stereoscope, which enables the observer to get a most realistic view of the relative position of the surrounding structures.

These, then, are some common methods at our disposal for estimating the exact position of foreign bodies.

This is not the place to criticize them. Each radiographer must make his own choice, based on his own experience, and guided by his own opinion, as to whether the method of right-angled planes or that of triangulation is the more accurate.

Memoranda :

MEDICAL, SURGICAL, OBSTETRICAL.

A METHOD OF X-RAY LOCALIZATION.

LET me briefly describe the method of localization by x rays which I generally employ. Say, for example, that the foreign body is in the arm. If possible the arm is moved till the foreign body presents itself at the highest point—that is, nearest to the surface. If the part cannot be moved the tube is moved to obtain this information. When this highest point is determined, a metal pointer is pressed gently over the part, and presently an area is discovered when on pressure the foreign body will move. This spot indicates the nearest route to the foreign substance, and the depth can be easily estimated, a pencil mark made on the skin, and the necessary data given to the surgeon.

This method has proved of great value in the hands of Mr. Thring and Sir Alexander MacCormick, the two consulting surgeons connected with this hospital, and I feel sure is all that is necessary in 90 per cent. of the cases.

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AORTIC ANEURYSM: PARAPLEGIA: DEATH.

MY excuse for publishing the following case of aneurysm is that it was mistaken for an abscess by native attendants at the Union Poor House, Kingston. The length of time the patient lived after erosion of the bodies of the vertebrae is also a matter of interest.

The patient was a man aged 34. He had been a soldier in the West India Regiment. He was admitted with a very large circular tumour on the back, immediately below the left scapula. He suffered considerable pain for some months, during which time the tumour became somewhat smaller. Then, quite suddenly, he became com-

pletely paralysed in the lower limbs, and died three weeks later.

At the *post-mortem* examination, in which I was kindly assisted by Dr. Cato, of the Hospital, Kingston, it was found that the aneurysm extended from the arch of the aorta and occupied practically the whole thoracic aorta; three of the ribs were eroded through, and so were the bodies of the vertebrae, exposing the spinal cord for 2½ in. The sac was more than half-filled with laminated clot. The left lung was greatly compressed and was firmly adherent to the chest wall. The pericardium was half-full of fluid.

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LYMPHOCYTIC LEUKAEMIA.

A MARRIED man, aged 29, consulted me on October 14th, 1914, complaining of a sore throat. Both tonsils were slightly enlarged and injected. There were no other symptoms. A gargle and a mixture were prescribed and he returned after four days to say that he felt quite well. On October 21st he came again complaining of a sore throat. He appeared to be very ill; both tonsils were considerably enlarged, the right being larger than the left; both were inflamed. There was no exudate. The temperature was normal. I was struck by the appearance of the tonsils, which were gelatinous and "unhealthy-looking." I sent him home to bed. On the following day I painted both tonsils with tincture of iodine and gave him a mixture of liq. arsenicalis *miv* and potassium iodide *gr.v*. On the following day he was much better. A few small but tender glands could be felt at both sides of the neck. During the next nine days he improved in every way. He became stronger, and the throat symptoms disappeared. On November 5th he came to me again, complaining of a rash, consisting of spots covering profusely the front of the chest and abdomen; some were small petechial haemorrhages, but others were slightly-raised, irreducible, irregular, black patches, about the size of a fleabite. The tonsils were once again considerably enlarged, and had the unhealthy appearance previously mentioned. Both sides of the neck were swollen. Large and tender discrete glands were felt in both cervical regions. The liver and spleen appeared normal to percussion and palpation. There were no other physical signs apparent. The urine was normal.

I suspected a melanotic sarcoma with primary origin in the tonsils and secondary deposits in the skin. On November 12th I sent him to the Throat Hospital, Golden Square, where he was seen by Dr. Hope, who removed a gland from the neck and a piece of skin for microscopic examination. I understand that the patient bled profusely from the incisions. Dr. Hope kindly informed me that the pathological report suggested lymphadenoma with skin infection. It was arranged that the patient should see Dr. Hope at a later date in order to have his blood examined, but he became worse and was unable to keep the appointment.

From this time onwards until his death the symptoms became rapidly more serious and alarming. The tonsils suddenly increased in size and became black. The right tonsil ulcerated and fungated. A few days later the left tonsil went through the same morbid process. On seven occasions he lost a large amount of blood from the tonsils. The glands of the neck became more enlarged, painful, and tender, and large and tender glands could be detected in both axillae and groins. The rash spread to the back of chest and over legs, arms, gums, and the mucous membrane of the mouth. The spleen increased in size to approximately twice its normal dimensions. The liver was slightly enlarged. Sight and hearing remained unimpaired. There were no symptoms suggesting any morbid process proceeding in brain or kidneys. The patient died on December 13th in his sleep. At no time was he comatose.

A few days before death Dr. Bone of Luton, who met me in consultation, obtained a specimen of the patient's blood and very carefully worked out a blood count. The leucocytes were enormously increased, numbering 2,000,000 per cubic centimetre. The red cells numbered also approximately 2,000,000.

Luton. W. E. LEVINSON, M.R.C.S.Eng., L.R.C.P.Lond.