X-RAY WORK IN A BASE HOSPITAL IN FRANCE: A FEW OBSERVATIONS OF A PRACTICAL NATURE.

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War X-ray work, except possibly in hospitals in England, differs essentially from peace-time work. Treatment need not be considered, except perhaps as an amusement for the radiologist when he finds himself, as he sometimes does, with very little to do.

The important thing for the radiologist to grip on to on being sent abroad is that rapidity in his work is the first thing required of him. The more cases he can handle in a given time, the more use he will be to his unit. He will soon find that the more efficient he becomes, the more work he will be asked to do, until in a rush he will get in one day more than he can possibly do in three; then it is that he realizes the importance of seconds saved in each case. Let him work as hard as he may, cases, on which X-ray reports have been asked for, will be evacuated before he can get them done. Rapidity in handling cases therefore is of the utmost importance.

To have a practical experience of War surgery is a great assistance to the War radiologist, as it enables him to know what the surgeon requires, and so he avoids wasting his own time on unnecessary work, and often saves the operator much trouble and annoyance. He must endeavour therefore to combine speed with accuracy, and to serve up to the surgeon the information he requires in as practicable a form as possible. As regards outfit he will probably have to take what is given him, although any reasonable indent is passed if the article can be obtained. The man who cannot work without a whole lot of special apparatus is usually not much use, even when his demands have been satisfied. The more simple the outfit the better, complication usually means time wasted in handling the cases. But, whatever the outfit be, it must be kept tuned up to the very highest pitch; if anything shows signs of getting out of order, it must be put right at once; there may be a rush of work the next day, and the machine will probably break down.

The table must be so arranged that the patient has not to be moved off the stretcher. This can easily be done by removing the top, and fixing a cross-piece of wood at either end, on which the handles of the stretcher rest. All the work can be done quite satisfactorily on a stretcher, and no time is wasted in lifting the patient on and off the table, an undertaking which is often troublesome to the radiologist, and painful to the patient.

A tube-box underneath the table, which can be easily and quickly moved, preferably with the foot, is necessary, as every case must be thoroughly screened, otherwise many foreign bodies will be missed. In a
X-ray Work in a Base Hospital in France

In the trunk, it depends upon the case, but often it will be necessary to screen the whole chest, abdomen, and pelvis: at all times it is better to err on the safe side. The overhead tube box is very rarely required, and unless it is part of the table is most unsatisfactory, as the floors of most hut hospitals are very lightly constructed, and anyone moving in the same hut causes the overhead tube to oscillate considerably.

Some form of apparatus for taking lateral heads is advisable: Major Higham Cooper's is quite satisfactory, and is easily used on a stretcher; antero-posterior heads can also be taken in it by removing the rubber cushion and using the underneath tube; the woodwork appears to stop very few rays. In the majority of cases, it is quite unnecessary to take plates, and it will be found that most surgeons prefer accurate markings to plates in all ordinary straightforward cases. Plates of a foreign body lying in the muscle of the thigh are of little use to the surgeon, but if the foreign body is marked in the manner to be described, the surgeon at once realizes where it is.

A foreign body should therefore, if possible, be marked on the skin; plates may be taken as well if desired, but the surgeon will probably be guided by the marks. The only exceptions to this rule are joints and head and neck cases, or where it is wished to show a fracture. Marks round joints and on the neck are apt to be misleading, as the slightest alteration in position upsets even the most careful marking. Plates have not this disadvantage to the same extent; two must always be taken, an antero-posterior and a lateral whenever possible.

Three colours are required for marking, say green, red and blue; green is used for antero-posterior, red for lateral, and blue for the nearest point on the skin when the foreign body is superficial. Ordinary microscopic stains do very well and should be kept in a small bottle with an India-rubber cork, the cork being used for making the mark.

The tube must be carefully centred so that the central ray passes vertically upwards through the exact centre of the diaphragm. A metal marker with a small ring at one end, of a suitable size to take the India-rubber cork of the stain bottle is required; it is an advantage to have the handle of the marker made out of a piece of brass tubing, as when the cut end of the tube is pressed up against the skin, it leaves a small ring depression which is easily distinguished and upon which the mark is placed.

The patient is lying on the stretcher, which is on the framework of the table; he must be placed absolutely flat on his back or abdomen according to circumstances, with the inner borders of his feet pointing directly upwards. In a very few cases it will be found that the patient cannot be got into this position, he must then be placed in some convenient position that can be described accurately, so that the surgeon may be able to place him in the same position again on the operating table, otherwise the
marking will probably only be misleading. He is screened and a foreign body found.

It is usually best to make the lateral mark first, as the second antero-posterior mark often involves moving the patient. The blunt end of the marker is placed up against the skin laterally opposite the foreign body at more or less the supposed depth. The tube is now moved longitudinally and the movement of the foreign body and the end of the marker compared; if the marker moves most it is too far from the screen and must be tried closer. Finally a position is found where the end of the marker and the foreign body move together when the tube is moved. The light is then turned on and the place marked in red. The diaphragm is now closed and the tube moved until the foreign body is in the centre of the circle of rays; the ring of the marker is then placed over the foreign body, the light turned on and a green mark made by pressing the cork of the stain bottle on the skin through the ring. Finally a second antero-posterior mark is made in exactly the same way, but with the marker underneath the patient, it is usually necessary to turn the patient or lift the limb in order to make this mark on the skin. If the first antero-posterior and the lateral marks come fairly close together it is not really necessary to make the second antero-posterior mark, as it will be so far away from the foreign body as to be practically useless to the surgeon. Sometimes in limbs it is advisable to make two lateral marks, one on each side of the limb. A little practice is required in judging the difference of movement of the foreign body and the end of the marker, but once this is acquired the method is very quick and very accurate. It is advisable to open the diaphragm pretty wide and take a good long sweep with the tube, as of course the greater the movement of the tube, the more accurately the depth of the foreign body is gauged. There are several instruments designed for getting the depth of the foreign body by screening, but they all take much longer to use, and to tell the surgeon that the foreign body is so many centimetres deep to the mark on the skin does not convey as much information to him as a lateral mark accurately placed.

The method of turning the patient so as to make the lateral mark in the same way as the antero-posterior marks certainly takes more time than the method described above, and the results are often inaccurate, as it is very difficult to say when the patient has been turned exactly through a right angle. If the foreign body is superficial, that is, not more than one centimetre deep, one mark on the skin is sufficient; it is easier in this case to rotate the patient or limb until the position is found where the foreign body appears nearest to the skin, the blunt end of the marker is then placed on the skin and the spot is found from which the foreign body is most easily moved. The tube is then moved and the movement of the foreign body and the end of the marker judged as an extra safeguard. The place is marked in blue. If the surgeon makes an incision through the mark towards the centre of the limb or trunk he will strike the foreign body.
The practice acquired in judging whether the point of the marker is above or below the depth of the foreign body is very useful in the removal of foreign bodies under the rays, and it enables the radiologist to assist the surgeon by removing any foreign bodies which cannot be got by the usual operation on account of their small size or the position they lie in. It is a good plan to explain the system of marking to each of the surgeons, and to put up in the operating theatre a notice explaining exactly what the different coloured marks mean. It also helps the surgeon if a rough drawing of the size of the foreign body is sent in on the report.

The arm will be found to be a difficulty often, as sometimes the foreign body is in an awkward place to get at, and in many cases the patient cannot place the limb in the position required, the only thing then is to take some convenient position and describe it carefully on the report.
Foreign bodies lying deeply in the trunk are best marked either on the back or front in the antero-posterior position, and the depth then worked out either by stereoscopic plates, if there is a likelihood of bone injury, or by the two photographs on one plate method, which gives the depth accurately and is quicker than the stereoscopic, or one of the methods of getting the depth by screening may be used if preferred.

In head cases antero-posterior and lateral plates are usually sufficient, but it is often very difficult to say from them whether the foreign body is inside the skull or not. If there is any doubt, or if a more exact localization is required, then two small plates must be taken, the first being a plan plate with the tube in the central position, the second with the tube movement of six centimetres, the estimated nearest point on the scalp being placed in contact with the cross wires. If the cross wires are marked on the skin it is very easy afterwards to mark the actual nearest point and give the depth, by using the same method as described below for eye work.

Eye apparatus.

Eye localization is a special branch of the work which the radiologist abroad may be called upon to do, and probably he will have no special apparatus. A simple form of apparatus which gives very accurate results can be made with the help of the hospital carpenter and a little ingenuity. The apparatus in use in this hospital was evolved from the idea of Major Higham Cooper's head apparatus, and was made in the hospital. It consists in a base board forty by seventy-five centimetres, on one end of which is fixed a tube box movable in a transverse direction six centimetres each side of the central position. Fifty centimetres from the anticathode
is fixed transversely at the other end of the board a solid upright frame holding an old full plate with two cross wires stretched across it, the horizontal wire being twenty centimetres above the base board. About five centimetres behind the glass plate are stretched two more cross wires corresponding to the two on the glass plate. On the top of the upright frame holding the glass plate is fixed a metal pointer with a universal joint so arranged that the point can be fixed in contact with the skin, just above or below the patient's eye when he lies in the apparatus. The tube with the tube box, in the central position is centred accurately on the two sets of cross wires so that when the anticathode is sighted from the other end of the apparatus through the glass, first come the nearest cross wires, then the cross wires on the glass, and these coincide accurately with the centre of the anticathode at the other end of the apparatus. The patient lies on his back on the table or stretcher with the side of his face to be photographed up against the glass plate, an arrangement of canvas straps is used to fix the head firmly, once he is in position. Under his head is placed the india-rubber cushion of Major Higham Cooper's head apparatus, which is blown up or deflated to raise or lower the head as required. Longitudinal movement is obtained by moving the whole apparatus on the table or stretcher. The patient's head is now arranged so that the centre of the front of his cornea coincides with both sets of cross wires when sighted in the same way as when the tube was centred, and it is fixed in that position. The metal pointer is lowered until it touches the skin either just above or just below the patient's eye, and moved laterally until it lies in the same antero-posterior vertical plane as the centre of the cornea, when it is locked in position. A plate is placed up against the back of the glass plate. The central ray now passes through the centre of the front of the cornea coincides with both sets of cross wires when sighted in the same way as when the tube was centred, and it is fixed in that position. From this plate we can say how far above or below the central corneal axis and how far in from the plane tangential to the centre of the anterior surface of the cornea a foreign body lies, simply by measuring the distance on the plate of the foreign body from the wires (a small correction must be made for the divergence of the rays if absolute accuracy is required). The tube box is now moved six centimetres, usually away from the patient's shoulder, and a second plate taken. By measuring the movement of the pointer and of the foreign body on the two plates, it is easy to calculate how much nasal or temporal the foreign body lies.

A simple method of finding out whether the foreign body is in the globe is to have a series of circles drawn on a piece of transparent paper corresponding to vertical antero-posterior sections of the globe at millimetre distances from the central vertical antero-posterior plane (for practical purposes the globe may be taken as a sphere having a diameter of twenty-five millimetres). The position of the cross wires must be marked in for each circle. The plan plate is placed on the corresponding circle (so many millimetres nasal or temporal) with the cross wires coin-
ceding with the cross wires on the paper. If the foreign body comes inside the circle it is inside the globe.

The details of constructing the apparatus have been left to the individual ingenuity, as so much depends on the material and workmanship available.

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Sizes of vertical antero-posterior sections of globe at millimetre distances from central vertical and posterior plane.

This article does not pretend to any originality, but it is an endeavour to explain the method used after a year's experience of X-ray work in a Base Hospital in France, in the hope that some of the ideas may be of use to the radiologist who is sent abroad. Acknowledgments are due to Captain B. T. Lang, R.A.M.C., for the idea of the pointer fixed on the eye apparatus, which is a great improvement on the old method of sticking a piece of fuse wire on the lower lid with plaster, and to Captain G. T. Loughborough, R.A.M.C., for the method of finding whether the foreign body is in the globe.