should be possible to put out all the lights by a master switch hanging from the ceiling, which may be operated by the radiographer as he stands at the x-ray machine. If the surgeon cannot see clearly he must wait until his accommodation improves, and on no account ask the technical assistant to make the screen brighter. He must realize that even under the best conditions there are very definite limitations to the use of the screen. It is possible to view most of the bones of the extremities in antero-posterior and lateral projections, but in some instances, with fractures in the vicinity of the shoulder-joint or hip-joint in heavy subjects, fluoroscopy is useless.

Under suitable conditions we have determined that a single exposure of 12 seconds, the usual limit of the time clock, is sufficient to show alignment. The total time of screening for each case has been fixed at one minute, thus allowing five attempts to be made to achieve reduction. In the event of a house-surgeon failing to complete reduction the case is referred to the surgeon in charge. No one is allowed to screen for more than 5 minutes daily.

The radiographer in attendance at the operation is instructed never to permit free use of the tube, but to set the time clock for relays of 12 seconds' exposure, allowing an interval of 2 minutes between each, and never exceeding a total screening time of one minute without warning the surgeon. The total screening time for each case is recorded in a book, which the surgeon is asked to sign. Subsequently the entries are checked by the radiologist.

Before applying plaster to the limb the position of the fragments is checked by clinical inspection of the whole limb in a good light, and the findings are verified by radiography. Satisfactory films should show true antero-posterior and lateral projections of the joint above the fracture, the fracture site, and the joint below. Only in this way is it possible to judge the alignment of the distal joint surfaces on those above. In some instances in which there is pre-existing deformity it may be necessary to make a comparison with the opposite side. These precautions are essential, for it is very easy to miss considerable deformities by radiographic methods alone, especially when the limb is encased in plaster.

During radiography the surgeon must on no account hold a cassette in place or stand in the path of the x-ray beam, for a single exposure exceeds the tolerance dose of 0.2 r. As a measure of general health, all members of the surgical staff engaged in the accident service are advised to have blood counts at three-monthly intervals.

These views have been summarized in the form of provisional regulations on the screening of fractures. A printed copy is hanging in the surgeon's room, where it may be seen by new-comers. Another copy has been issued to all radiographers.

Our experience to date shows that the scheme is working very well, although there remain details to be worked out. The records in the radiographers' book may ultimately yield useful information as well as provide a check on the amount of work done. Already they have shown that in 3 out of 5 cases in the hands of the senior surgeon the total screening time was under 6 seconds in each case, reduction being subsequently verified by films, whereas the junior surgeons screen for much longer periods. No one has screened for more than one minute.

Conclusions

In proper hands the viewing of fractures with the x-ray screen to observe alignment after manipulation is a safe procedure, providing that it is carried out under well-defined conditions over which there is adequate control.

On no account must fractures be actually manipulated under the screen.

An account is given of the provisional regulations which have been accepted by the surgical staff of the Radcliffe Infirmary. It is hoped that others will be tempted to put forward their views and that ultimately general recommendations will be framed to help the surgeon. Later it may be possible to develop apparatus which will enable the work to be carried out under ideal conditions for the protection of the operator.

I wish to acknowledge the help of Mr. J. C. Scott, surgeon in charge of the accident service, and his assistants; and to thank Messrs. Philips Metalix for full details about the Miller fluoroscope. Eastman dental films were used to make the physical measurements. I am indebted to Dr. J. F. Brailsford for his encouragement to proceed with this paper, to Dr. G. Spiegler for his criticism of the physical experiments, and to Dr. A. E. Barclay and Dr. H. Courtney Gage for personal communications about their own experiences.

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A SIMPLE METHOD OF REDUCING MID-SHAFT FRACTURES OF THE HUMERUS

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Generally speaking, fractures of the middle third of the humerus present little difficulty in securing accurate reduction. There are, however, cases which defeat the efforts of the most experienced manipulator. Considering the close relation of the musculo-spiral nerve to this part of the humerus, it is conceivable that over-energetic attempts at reduction could account for some of the cases showing damage to this nerve. There is a tendency to accept a reduction with varying degrees of displacement providing alignment is good. This is often seen in the simple transverse fracture showing backward and upward displacement of the lower fragment. A simple method of reducing fractures of the shaft of the humerus is here described whereby the likelihood of these complications arising is minimized. Two illustrative cases are recorded.

Details of Method

The patient is seated on an adjustable stool (theatre type), facing the head end of the operating table, with hand in pronation resting on the edge (Fig. 1). An ordinary adjustable stand, the type generally used for holding a gravity reservoir, is placed behind and on the injured side, with the hook of the movable rod over the point of the shoulder. Strong 2-inch webbing fitted with a buckle is passed under the axilla and hung on the hook of the stand. Protective felt is placed in the axilla to prevent pressure. The movable rod is now adjusted until the shoulder girdle is well supported. By moving the operating table backwards or forwards the arm is brought to the perpendicular, and by moving the table up or down the forearm is brought at right angles to the upper arm. Strong cord, threaded through protective felt, is placed round the forearm close to the elbow-joint, and 15 to 20 lb. is fixed to it. The position of the limb is then rechecked, and the weight is allowed to exert traction for from twenty to thirty minutes. No anaesthetic is necessary, as the patient stands the

procedure without undue discomfort. In exceptional cases, requiring manipulation at the point of fracture, a brachial block is used.

X-ray control of reduction is desirable if available, but it has been found that reduction is usually complete after

FIG. 1.—Showing patient's position and apparatus required.

twenty minutes, and in the cases recorded check radiographs were deferred until the following day. It may be noted that the whole procedure can be carried out in the x-ray room without upsetting the routine of that department.

With the weights still in position some form of immobilization is applied. As a primary method the plaster slab is the most satisfactory, because, if necessary, this can be continued to an abduction shoulder spica or the limb be further immobilized on any of the many abduction frames. Fig. 2 shows the method of applying the slab.

FIG. 2.—Immobilization by plaster slab. Note the circular turns of plaster bandage carried well up into the axilla.

height at which the sling is tied. These restricted movements, along with active movements of the wrist and fingers, are begun early.

Post-reduction radiographs are taken as soon as is convenient, and if reduction is not satisfactory the weights can be reapplied without removing the plaster casing. So far I have found that once reduction is complete there is little tendency to redisplacement.

Illustrative Cases

Case 1.—A lance-corporal was admitted with a history of injury to the right arm sustained by a fall while engaged in physical training. Clinically he showed a gross angulation deformity of the mid-shaft of the right humerus, with shortening of one and a half inches. Dorsiflexion of the wrist was not possible. One attempt at reduction had been made before admission. Treatment was carried out by the method described. At eight weeks clinical union was sound, with steady improvement of the injury to the musculo-spiral nerve.

Case 2.—A soldier was admitted giving a history of injury to the left arm sustained in a motor-cycle accident. Clinically he showed a fracture of the mid-shaft of the left humerus, with the lower end of the upper fragment palpable anteriorly and with $3/4$ inch shortening. There was no evidence of musculo-spiral involvement. One attempt at reduction was made before admission and one in hospital by a colleague. Treatment was carried out by the method described, except that a brachial block was used. At seven weeks clinical union was sound, and a radiograph showed good callus formation.

Summary

A simple method for reducing fractures of the mid-shaft of the humerus is described. It is designed to secure accurate apposition of fragments, with minimum trauma to soft tissues. General anaesthesia is not necessary, and only in exceptional cases is a brachial block required. A minimum of apparatus is needed, that suggested being standard equipment of any hospital.

SNEEZING, AND DISINFECTION BY HYPOCHLORITES

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While the photographic technique developed in America (Jennison, 1941) and recently used in this country (Bourdillon and Lidwell, 1941) has shown that many thousands of droplets are emitted during a vigorous sneeze, few quantitative studies of aerial infection from sneezes have been recorded. Winslow and Robinson in 1910 published a useful review of earlier work and described some quantitative tests of their own on the spray emitted in speaking and coughing, but the only quantitative data we have seen on sneezes are the observations of W. F. and M. W. Wells (1936), made with their air centrifuge. They showed that 50 sneezes from a group of subjects in an air-conditioned room sent up the count of " α streptococci" from 0 to 220 per cubic foot. The following notes describe a brief quantitative study of the number of bacteria-carrying particles given out during sneezing, of their rate of disappearance from the air in a closed room, and of the rate at which they are killed by a hand spray, using sodium hypochlorite.

Technique

A small room of 816 c.ft. capacity (11 ft. 6 in. by 7 ft. 6 in. by 9 ft. 3 in. high) contained a table, two wooden chairs, and heating-pipes. The floor and table were oiled to keep down dust, the door and window were kept shut so far as was possible, and the air in the room was circulated, partly by convection from the hot-water pipes, but chiefly by a 12-inch electric "table" fan pointing upwards at 45 degrees from one corner of the floor and running at about half-speed. The air was sampled through two glass tubes (diameter 1 inch) leading from points about 1 ft. 6 in. above the table through one of the walls