THE CONTROL OF THE UPPER FRAGMENT

IN HIGH FRACTURES OF FEMUR AND HUMERUS BY
A NEW FORM OF PELVIC-FEMUR SPLINT AND
ARM SPLINT.¹

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AT Fulham Military Hospital, London, we have had many opportunities of treating fractured femurs and also of seeing the results of treatment in other hospitals, as shown by cases which have been transferred to us. The number of cases which come to amputation from sepsis or which join up in bad position with stiff joints is very great. For instance, during last June we had 20 fractured femurs sent over to us from France, where they had been in special hospitals from one to five months; of these, some were in fairly good position and not very septic, several of them were more or less united in bad position, and most of them had sequestra due to trauma and inefficient drainage. It is the fractures of the femur in its middle third that I wish especially to deal with. Ten of the 20 femur cases admitted in June were those of fractures in the upper

FIG. A.—Pelvic-femur splint.

FIG. B.—Arm splint.

third; of these, 3 were in good position and only slightly septic, 2 were in fairly good position but septic, 5 were in bad position, and of these 3 were very septic. Therefore, 50 per cent. were in bad position and 50 per cent. were very septic. These results should be capable of improvement.

Fractures of upper third of femur.—The position or displacement of the fragments in fractures of the upper third of the femur, as a rule, is as follows: (1) The upper fragment is abducted and flexed by the glutei and ilio-psoas muscles; (2) the lower fragment is displaced backwards, upwards,

and inwards by the hamstrings, quadriceps and adductor muscles. The powerful adductor magnus being an exceedingly important factor, there is also some rotation. This deformity is typical; the main causes producing it are the direction of the fracturing force and the action of the muscle groups.

The essentials of correct treatment rest on an adequate consideration of the anatomical factors and the principles of

FIG. C.—Radiograms of fracture (compound) of right femur at upper third, with abduction of upper fragment. After application of pelvic-femur splint adduction and fixation of upper fragment with good alignment are seen to result.

surgery, the latter including arrest of hæmorrhage, establishment of efficient drainage, provision for antisepsis, general care of the patient, massage, &c.; I want, however, to draw special attention to the anatomical factors. The fragments should be brought into correct alignment, the muscle groups placed in a condition of physiological rest, and the limb securely fixed in order that there may be no movement of the fragments or spasm of muscles; at the same time any interference with the circulation of the limb should be avoided.

Hitherto it has been taught that in fractures of the upper third "the upper fragment, being short, cannot be controlled." Therefore attempts have been made to procure alignment by abducting the lower fragment. *This method is wrong in principle.* I have taken measurements of a great many men and find that the distance between the symphysis pubis and the adductor tubercle is on an average two inches greater in the abducted position than when the knees are side by side. Hence in the abducted position of the fractured limb the adductor group of muscles have a greatly increased pull and are in a condition of spasm instead of physiological rest. Therefore, although the two fragments are brought parallel to one another, an X ray examination in many cases reveals the fact that the upper end of the lower fragment has now moved upwards a distance of about two inches and takes up a position near the lesser trochanter. An amount of extension that can be applied with safety fails to correct the shortening. Unless the two ends of the bone were impacted what has been accomplished is increased overlapping of the fragments and not an elongation of the adductor muscles. It occurred to me that if the upper fragment could be controlled and the abduction overcome the fragments could be brought into proper alignment with the limb and the muscles in a nearly normal position.

Pelvic femur splint.—With the above principles in view I designed a new appliance which I have called a pelvic-femur splint.

It consists of a grip with two pads (Fig. A, 1) which fit the pelvis; modified Thomas' frames for both lower extremities are hinged on to the pelvic grip (2). The pelvic grip can be adjusted to fit any pelvis comfortably and securely. The pelvis and upper part of the femur on each side are grasped by the pelvic pads. The abducted upper fragment can be controlled and adducted to its normal position quite easily. (See radiograms, Fig. C.) The amount of pressure required is regulated and the fragment kept in position by a fly nut

¹ Being part of a paper read at the Section of Surgery of the Royal Society of Medicine on Dec. 4th, 1918.

working on a screw (Fig. A, 3). Both limbs can be put up in the iron frames in the ordinary way. The upper fragment having been brought into proper position, the lower one can be placed in correct alignment by abducting or adducting, raising or lowering as required while on the splint, the latter working on hinges or joints (near 2, Fig. A). Any backward displacement can be corrected by manipulating the small wooden splint by means of screws (Fig. A, 4). Adequate extension can be applied. If much extension is found to be necessary an adjustable piece similar to that used in the arm splint (Fig. B) can be fitted from the pelvic pad to the axilla on each side; hence the upward thrust of the extending force will be partly taken by the axillæ and trunk and the pelvic calliper grip not displaced.

All these manipulations should be done on an X ray couch (if necessary under an anæsthetic) so as to see that the ends of the bone are in actual alignment, not merely supposed to be so. Having completed all manipulations necessary the binding screws are firmly adjusted. The pelvis and lower limbs can be suspended by means of pulleys on a frame—the patient's body raised as needed for convenience of nursing, the prevention of bedsores, &c. Many patients complain that splints fitted with a ring around the thigh as in a Thomas' splint, cause much discomfort. With this splint there are no bands encircling the limb; hence, no interference with the circulation occurs, which is a very important factor, especially in septic cases.

The splint can be easily applied with a minimum of movement. When it is applied the fragments of the bone are securely held in proper anatomical position; the muscles are at rest. All necessary dressings, nursing, &c., can be carried out, and if any movement of the patient is necessary he is moved as a whole and not in parts.

FIG. D.—G.S.W. of right arm, compound fracture, displacement, upper fragment abducted. After application of arm splint the fragments are shown in good alignment.

The iron leg portion of the splint can be raised at right angles to the operating table, and thus out of the way should any operative procedure be necessary, the upper fragment being perfectly controlled by the grip pad, the lower steadied by an assistant.

The splint is made double to ensure steadiness and to enable the patient to be moved easily. The final result is that the patient lies with the fractured thigh in its proper position comfortably beside the healthy limb. In all cases skiagrams are necessary—both antero-posterior and lateral—in order to show whether the fragments are actually in correct position.

The splint is useful in all fractures below the great trochanter where there is abduction of the upper fragment,

but its use is not limited to compound fractures of the femur. It would be of great value in treating fractured pelvis, intra-capsular fractures, and anterior poliomyelitis to give rest to paralysed muscles.

Arm splint.—An efficient splint for the upper extremity should be firmly fixed to the patient's body so as to carry the limb and keep the fracture in proper position and at rest. Usually the splint hangs on the limb instead of supporting it.

The splint for the upper extremity which has been designed by me consists of two parts (Fig. B). One fits firmly on to the trunk (1); the other carries the limb (2). The upright trunk part is fitted to the hip with an adjustable piece which allows its upper forked end to be securely fitted into the axilla (3). This part is fastened round the body by two straps. To the upper end of the fork the part which carries the limb is attached by joints (4), which allows the arm to be abducted to any desired angle and retained there. The centre of movement passes through the head of the humerus. By releasing a set screw (5) on the tubular piece the hip portion can be turned round; the limb attachment is then turned completely over; hence the splint can be used for right or left limb equally effectively. The splint can be adjusted so as to support the shoulder in any desired position. The forearm can be placed in either the semi-prone or supine position. Provision is made for any necessary extension. When properly fitted the patient carries the upper extremity with the whole weight supported by the body; hence the limb is kept quite steady and at rest. Dressing of wounds, massage, &c., can be carried out without interfering with the splint. (See radiograms, Fig. D.)

After much careful observation of many cases I have designed these two splints, one for each extremity, and have proved that both appliances are efficient, easy to apply, and give great comfort to the patient. I hope that their use in treatment of such cases may help to produce better results in the future. In conclusion, I desire to express my warmest thanks to my colleagues, especially to Lieutenant-Colonel C. T. Parsons, for valuable help and encouragement; to Dr. Florence Stoney for her great assistance with the X rays; to the staff of the Kensington War Hospital Supply Depot; and to Messrs. Arnold and Sons, who made the splints for me.

MENINGOCOCCUS BRONCHO-PNEUMONIA IN INFLUENZA.

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THE epidemic of influenza which has visited this country during the later months of the year 1918 has been characterised by an unexampled severity due to pulmonary complications. In the cases of broncho-pneumonia, which have been responsible for most of the deaths in this epidemic, the lungs are invaded not by Pfeiffer's bacillus alone, but by that bacillus aided and abetted by one or other of the many organisms which inhabit the respiratory tract, such as pneumococci, streptococci, diphtheria bacilli, and, in the cases which I am about to describe, meningococci.

Sometimes these secondary organisms are, by themselves, of low virulence; the pneumococci are very often of the fourth group, and the streptococci frequently belong to the *viridans* type, but when they join forces with the influenza bacillus and follow its lead in a descent upon the lungs they can play a deadly part.

Bacteriological Findings.

Between Sept. 25th and Nov. 23rd, 1918, cultures were made, after death, from the lungs and from the heart's blood of 36 American soldiers who had died from broncho-pneumonia. These men, for the most part, had been taken ill with symptoms of influenza a week or 10 days before admission to this hospital, while they were on board transports crossing the Atlantic.

In films prepared from the lungs of some of them the only organisms to be seen were Gram-negative diplococci in enormous numbers, the majority of them lying within polynuclear cells. In one or two instances they were so numerous that there was hardly a cell that did not contain some. Plate cultures were made post mortem from the lungs of all the cases; numerous colonies of Gram-negative cocci were obtained in 11 of the 36, and in three instances