SURGICAL PROCEDURES IN GENERAL PRACTICE

This is one of a series of articles contributed by invitation

FRACTURES OF THE SHAFT AND SUBCAPITAL REGION OF THE HUMERUS

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Any of the three types of violence—direct, indirect, or muscular—may cause a fracture of the humerus at any level. Thus a direct blow on the arm may be followed by a fracture at the site of injury, or a fracture at any level may follow a fall upon the outstretched hand. Or, again, a fracture may result from excessive muscular strain, as in the tear fracture of the great tuberosity, in which this portion of the bone is pulled away from the head of the humerus. As a rule, fractures towards either end of the shaft are caused by indirect violence, whereas those occurring towards the middle of the bone may be either of the direct or indirect type.

Fractures of the upper part of the shaft are classified into two main groups: (1) fractures of the anatomical neck, in which the lesion lies external to the articular surface of the head, usually passing through the substance of the tuberosities; (2) fractures of the surgical neck, in which the fracture line is placed below the level of the tuberosities.

FRACTURE OF ANATOMICAL NECK

This type of fracture is seen usually in the elderly patient as a result of indirect violence following a fall on the hand. The fragments are generally impacted, although non-impacted fractures are also seen.

Signs of the Impacted Fracture

In this, the more common type of fracture of the anatomical neck, the presence of impaction between the fragments may lead to great difficulty in diagnosis without the help of a good x-ray photograph. Following a fall on the outstretched hand the patient complains of some pain and tenderness in the region of the shoulder, with slight swelling in the injured area and a restricted range of voluntary movements. On passive rotation of the arm the shaft and head of the humerus move in one unbroken mass. On such clinical evidence a mistaken diagnosis of bruising of the shoulder may be given, and the patient be advised to massage the shoulder and to use the arm freely in order to prevent the formation of adhesions. Such a course of treatment, although based on a wrong diagnosis, is often successful, and the presence of the fracture may not be appreciated unless an x-ray examination is carried out at a later date. This fortunate result can only occur if the impaction remains firm, but if during the massage and active movements disimpaction occurs, then all the usual signs of fracture become apparent.

Treatment of the Impacted Type

As the patients are elderly disimpaction of the fracture and correction of any deformity should be avoided, unless there is such severe malunion that the subsequent movements of the joint would be gravely restricted. As a rule the extent of the impaction is not equal over the whole line of the fracture, being deeper on the inner than on the outer aspect. It follows that some degree of deformity

is present in almost every instance, but not to such a degree as to cause any serious limitation of the range of movement in the joint.

Treatment therefore should consist in the protection of the impaction until union is complete, when any restriction can be diminished by active use of the joint, assisted by gentle passive stretching. A firm triangular sling is applied to the limb, supporting the elbow and preventing the constant strain of gravity, which might cause disimpaction, the hand and wrist being left free for active movements. As an additional safeguard, when the patient is nervous, the arm may be bandaged to the chest by a binder, after a firm pad of wool or felt is placed in the axilla. Fixation is maintained for two weeks, after which the patient is advised to use the arm and is encouraged by gentle massage of the whole of the shoulder girdle.

Signs of the Unimpacted Fracture

The signs present in a case of this type of fracture of the neck of the humerus are very similar to those of displacement of the upper epiphysis. In each the shaft of the humerus is displaced forwards and upwards in front of the small fragment, which can be felt under the tip of the acromion process. In each the arm is slightly shorter than the normal when measured from the acromion process to the external condyle, while the elbow on the affected side is carried behind the mid-plane of the body.

Treatment

The treatment is based on the impossibility of controlling the small upper fragment, which, because of its muscle attachments, is rotated outwards and upwards. As a result of this rotation the rough upper end of the lower

FIG. 1.—Fracture of the anatomical neck with dislocation of the head.

fragment lies against the articular surface of the head of the humerus, which is separated from it by the capsule of the shoulder-joint. Approximation of the two broken surfaces is only possible by abduction and external rota-

tion of the lower fragment. Under anaesthesia the arm is pulled outward from the side into a position of abduction and external rotation, when locking of the fragments can be felt. The arm is then maintained in this corrected position for two weeks until consolidation of the fracture has begun, when gentle movements may be started and the position of adduction gradually assumed. Some little difficulty is met with in after-treatment, which may be prolonged.

FRACTURE OF ANATOMICAL NECK WITH DISLOCATION OF HEAD

A rare but exceedingly troublesome complication of fracture of the anatomical neck of the humerus occurs when the upper capital fragment is dislocated from its position in the glenoid cavity (Fig. 1).

Clinical Signs

With such an extensive injury there is great swelling, pain, ecchymosis, and tenderness round the region of the joint, while the patient supports the injured limb with the other hand. X-ray photographs will demonstrate the lesion and indicate the new site of the head of the humerus.

Treatment

Owing to the presence of a fracture through the neck of the humerus it is evident that reduction of the dislocated head into the glenoid cavity cannot be accomplished by any of the ordinary methods of rotation or by extension of the limb. Its replacement, however, is possible by open operation—an extremely difficult procedure—or, more simply, by extension of the limb in the vertical direction.

Reduction by Manipulation.—Under full anaesthesia extension is applied to the limb in an almost vertical direction above the head. Slow steady traction in this direction is continued until the dislocated upper fragment slips back into the glenoid cavity. Occasionally, during the extension of the arm, assistance to the replacement can be given by the fingers, which press the head gently into position through the skin of the axilla. For success of the manoeuvre reduction must be attempted within one week of the injury. If a greater interval has elapsed reduction by this method is difficult or impossible. After reduction the fracture is treated as already described. The two raw surfaces are interlocked so that the limb may be brought down to a position of 50 degrees' abduction, at which redisplacement is improbable. Later the range of movements is restored by active use.

OLD FRACTURE DISLOCATION

When the displacement has been present for months, or years, the head of the humerus is usually united firmly to the side of the shaft. The arm is held away from the side, and movements between the humerus and the scapula are lost. Reduction of the displacement is then impossible, and the only indications for active treatment are the presence of signs of pressure on the nerves or vessels of the axilla, or limitation of movement of the joint.

Treatment

When the signs of pressure on the axillary contents are slight considerable improvement often follows a gentle manipulation of the shoulder under anaesthesia. If, however, the signs of pressure are outstanding features such treatment is useless, or even dangerous, and relief is only possible by removal of the head of the humerus.

The operation is a very extensive and difficult one, with the possibility of injury to adherent vessels or nerves, but if carried out slowly and carefully the result is satisfactory. After removal of the head of the humerus the stability of the shoulder is definitely diminished. Passive movements are free, but stable active movements are negligible. The operation does, however, succeed in its object of relieving the pain or swelling of which the patient complained, and to that extent it is advisable.

FRACTURE OF SURGICAL NECK

A fracture of the shaft of the bone occurring in the upper sixth and below the epiphyseal line is described as a fracture of the surgical neck. It may follow on direct or indirect violence, and, unlike fracture of the anatomical neck, usually occurs in vigorous adult life, and is not as a rule impacted.

Clinical Signs

In addition to the usual signs of fracture, such as pain, swelling, ecchymosis, and spasm of muscle, the upper end of the shaft can be felt lying in front of the head, forming a mass on the anterior aspect of the joint, which rotates at the line of fracture without movement of the head.

Treatment

If displacement of the fragments is not present treatment should consist in fixation. For this purpose the wrist is slung from the neck by a halter, the elbow being flexed to right angles, the weight of the forearm acting as a steady extending force on the arm. Lateral movements of the fractured surfaces are prevented by the use of three moulded metal splints, which enclose the shoulder and arm down to but not including the elbow-joint. This protection is maintained for six weeks, when the splints may be removed, movements being restored by voluntary effort, the range increasing with the diminution of tenderness in the fracture.

When displacement is present reduction under full anaesthesia is simple by the application of steady traction to the limb in slight abduction. Locking of the fragments can be appreciated, and redisplacement is unlikely as the fractured surfaces are usually more or less transverse at this level. When the reduction is satisfactory the arm can generally be adducted without risk of redisplacement, fixation with three metal splints forming an adequate protection and preventing any recurrence of deformity.

FRACTURE OF GREAT TUBEROSITY

Owing to its protected position under the muscular mass of the shoulder-joint, fracture of the great tuberosity is not, as a rule, caused by direct injuries to this region, but follows overaction of the abductor and rotator muscles, which are inserted here. The fracture is usually present as a single lesion, but it may be accompanied by dislocation of the head of the humerus.

Signs

The diagnosis rests on the radiographic appearance, and in the absence of a dislocation little can be elicited clinically beyond the presence of swelling and tenderness under the acromion, with pain on passive movements of the arm. When dislocation is also present this lesion may overshadow the comparatively small fracture, and considerable disability results from the treatment of the injury as a simple dislocation without recognizing the existence of the bony lesion.

Treatment

As it is impossible to control the detached fragment and bring it into apposition with the body of the humerus, it is necessary that the rough surface of the humerus should be brought into contact with the broken tuberosity. This is easily done by abduction and external rotation of the arm to an angle of 80 degrees. In this position replacement is complete, and if it is maintained for three weeks voluntary movements can be instituted and the normal range of movement restored.

FRACTURE WITH DISLOCATION

Here the head of the humerus lies in the subcoracoid region, from which it can be replaced in the glenoid cavity by rotation or by slow steady traction. If the dislocation were the sole lesion after-treatment would consist in the fixation of the arm to the side until the torn capsule had healed.

Rest in adduction, which would be ideal in the treatment of a simple dislocation of the shoulder, produces

of greater weight than this is not only inadvisable but in some cases positively dangerous. Non-union is reported as a common sequel of fracture of the shaft of the humerus by the same surgeons who advocate strong extension as the means of reducing the displacement.

Treatment

The weight of the forearm is used by slinging the wrist from the neck by means of a halter, the elbow being kept at a right angle. By this simple means the full length of the arm is obtained, but only if the lateral movements of the rough bony ends are prevented. In most fractures of the humerus the line of fracture is not transverse, so that locking of the fragments is not usually possible. There must therefore be a continuation of the action of the weight of the forearm if full length is to be maintained.

The diagram (Fig. 2) shows the simplest and most efficient method of producing both of these actions on the fractured bone. The wrist is slung by a halter from the neck, while the broken humerus is protected by three

FIG. 2.—Front and back views of splinting for fractured shaft of the humerus.

a wide separation of the detached tuberosity. It is therefore necessary to rest the arm on a frame in a position of 50 degrees' abduction for at least two weeks, when the angle of abduction can be increased to 75 degrees, at which the arm is maintained for a further period of two weeks before the resumption of voluntary movements.

FRACTURES OF SHAFT OF HUMERUS

In considering the treatment of fractures of the shaft of the humerus, whether transverse, oblique, or spiral, one is apt to think of fractures of the femur. In each there is a single bone, a fracture of which leads to shortening of the limb with overlapping of the two fragments. Although the conditions are similar up to this point, the analogy cannot be followed any further. In fractures of the femur the shortening is maintained by the protective spasm of muscles which are powerful enough to support body weight, whereas in the case of a fractured humerus the resistance to reduction is much less.

In fractures of the humerus extension with weights, pulleys, or elastic is never necessary. Full length of the arm and correct alignment can be obtained by using the weight of the forearm as an extending force. The use

metal splints, surrounding the limb from the top of the shoulder to the level of the epicondyles. In following such a method no triangular sling is used, as this would support and lift up the elbow-joint, thus destroying the extending force of gravity. In the case of a man the shirt must not be tucked into the top of the pants, an arrangement which is similar in action to the use of the triangular sling. The patient is encouraged to stand up or sit upright without any support under the elbow, and at night correction is continued by propping him up in the semi-erect position.

If straight splints are used for the lateral protection of the bone, union with deformity will almost certainly result. The reason for this is clear: a straight splint applied on the outer aspect of the arm touches the bulge of the shoulder-joint and the external condyle of the humerus, leaving the middle of the bone unsupported unless this be pulled towards the splint into a position of deformity. If, however, mouldable metal splints are used these can be twisted on their long axis so that they lie on top of the acromion, on the outer aspect of the shoulder-joint, and towards the back of the bone at its lower end. The small splints used on the inner and anterior aspect

are given a similar twist, so that the bone is supported in its whole course and its normal alignment retained.

Treatment is continued in this way for six weeks, when, as a rule, the splints may be removed and the patient encouraged to use the arm for small active movements, the sling usually being retained as a support for another three or four weeks. Complete consolidation of the humerus is to be expected in nine or ten weeks, and a full range of movement very soon after this. Occasionally there is some restriction of movement in the shoulder, a condition which may require a course of physiotherapy.

COMPLICATIONS OF FRACTURED HUMERUS

Non-Union

The occurrence of non-union following a fracture of the humerus can be attributed to any of the usual causes, such as want of fixation of the fractured bone, want of apposition, or the presence of pathological changes in the bone, but in many instances non-union is directly due to an error in treatment.

There are two common causes of non-union which are not sufficiently recognized: (1) the widespread removal of partially detached fragments of bone in a compound fracture; (2) the application of excessive traction to the fractured bone, producing wide separation between the fractured surfaces.

Treatment.—The treatment of non-union depends largely on the length of time that has elapsed since the occurrence of the fracture. When this period does not exceed five months union frequently follows the use of efficient treatment, as for a recent fracture, reinforced by the stimulation of passive venous congestion at the site of fracture. The method is simple: a thin rubber band is placed round the arm, next the skin, above the site of fracture before the splints are applied, and each day this band is tightened for three periods of half an hour, without interfering with the fixation of the splints. The congestion must be of such a degree that the hand becomes swollen and bluish but not painful. This method is continued for at least three months before deciding whether union will occur or not. If, however, more than six months have elapsed bone grafting holds out the only hope of union and should be carried out without delay.

Nerve Involvement

Any of the nerves in the arm may be involved at the time of the fracture or at a later date, either through injury by the rough bone ends or through compression in callus or scar tissue. The musculo-spiral nerve, on account of its position close to the bone, is involved more often than either the median or the ulnar nerves.

Signs.—When the function of the musculo-spiral nerve is lost all the muscles on the extensor aspect of the forearm lose their power of voluntary contraction, with or without paralysis of all or part of the triceps, according to the site of the lesion.

Treatment.—When the clinical examination indicates that such an injury is present the paralysed muscles must be protected from overstretching by placing the hand and fingers on a long curved splint, the wrist being held in dorsiflexion with the metacarpo-phalangeal and interphalangeal joints in slight flexion. Gentle massage is given to these protected muscles, the progress of the nerve injury being gauged by repeated electrical examinations of the paralysed muscles. If from such examinations it is evident that the nerve is torn, an operation for nerve suture or nerve-freeing should be carried out without delay. Very occasionally, when there has been widespread

destruction of nerve tissue as in a severe compound fracture, it may be impossible to perform a satisfactory suture of the divided nerve, and improvement in the function of the hand may only be possible by transplanting the tendons of some of the flexor muscles of the forearm to the dorsum so that they act as extensors rather than flexors of the wrist and fingers.

Nova et Vetera

SURGICAL FORCEPS DOWN THE AGES

The History of the Forceps: An Investigation on the Occurrence, Evolution, and Use of the Forceps from Prehistoric Times to the Present Day. (With a Summary in Danish.) By Vilhelm Moller-Christensen. (Pp. 298; 441 figures. A Chronological Table. 20s. net.) London: Humphrey Milford; Copenhagen: Levin and Munksgaard. 1938.

Dr. Vilhelm Moller-Christensen says that he invented a pair of forceps when he was an assistant physician in Denmark in 1931. Curiosity led him to inquire into the history of forceps, and like most people he thought there were only a few varieties. Investigation soon showed him his mistake, and he has since travelled far and read much to produce this book on their history and evolution.

The result of his inquiries has been to show that forceps were in use long before the invention of scissors, and that they are found in Egypt and Mesopotamia about 3300 B.C. The different types evolved were employed for epilation, for the removal of foreign bodies, and for dealing with the smoky wicks of the oil lamps then in common use. The epilation forceps were used alike by men and women, forming a part of their toilet sets. Everyone seems to have carried such a set, for there must have been many who preferred to pluck out their hairs with a pair of forceps rather than be shaved with a flint or bronze razor. Two different types were developed—the Cypriot and the Mycenaean—about a thousand years later. Dr. Christensen thinks they were not known to the Egyptians, but years later the Mycenaean type found its way to Italy and Scandinavia. Thanks to the work of Dr. J. S. Milne the surgical instruments of Greece and Rome are fairly well known. Dr. Christensen has consulted his book and is able to show from personal examination that a pair of bronze forceps in the Copenhagen Museum is more likely to have been used for drawing the stumps of teeth than as epilation forceps, as was stated by Dr. Milne.

Surgical forceps have not undergone any great change during the last 5,000 years, though it was a long time before the blades were ridged, an improvement which materially increased their gripping power. It was longer still before they were provided with a ring or slot to keep them closed and make them self-adherent. When Dr. Christensen was in England he visited the British Museum and the Wellcome Medical Institute. Of the twenty pairs of forceps in the British Museum collection he thinks that seventeen are incorrectly described as to their use. For some reason he did not see the fine examples in the historical collection of surgical instruments at the Royal College of Surgeons in Lincoln's Inn Fields, where he would assuredly have been very welcome. Neither has he read the late Mr. Alban Doran's article on the development of the pressure forceps—Webber, Koeberlé, Péan, and Spencer Wells—which appeared in the *British Medical Journal* in 1915 (1, 555); indeed, there is no mention at all of Spencer Wells.

The book is very useful as a guide to a minute subsection of medical history. There are many illustrations, a chronological table showing the approximate dates of different types from prehistoric times to A.D. 1000, a bibliography, and indices of persons and subjects.