South African Medical Journal
Suid-Afrikaanse Tydskrif vir Geneeskunde
P.O. Box 643, Cape Town Posbus 643, Kaapstad

Cape Town, 3 March 1956 Weekly 2s. 6d. | Vol. 30 No. 9 | Kaapstad, 3 Maart 1956 Weekliks 2s. 6d.

SUPRACONDYLAR FRACTURE OF THE HUMERUS *

BERNARD POLONSKY, M.CH.ORTH. (L'POOL), F.R.C.S. (EDIN.)
Johannesburg

I make no apology for attempting to survey the treatment of so common a fracture as the supracondylar fracture of the humerus. The results of poor or indifferent treatment are so disastrous that a proper insight into the management of this fracture is essential not only for the surgeon, but the general practitioner who will very frequently be called upon to deal with it.

Supracondylar fracture of the humerus is an injury of childhood, caused by a fall on the outstretched hand and occasionally by a fall on the point of the elbow. The largest number of cases occur during the 6th year and 50% of cases occur between the ages of 5 and 7 years.

Clinical examination of a supracondylar fracture with the common displacement reveals the following features:

(a) The elbow is markedly swollen, the degree of swelling varying with the degree of displacement and the time which has elapsed since injury.

(b) The lower end of the anteriorly displaced upper fragment can often be palpated beneath the skin. The elbow is carried backwards and laterally owing to the backward and lateral displacement of the lower fragment.

(c) When there is over-riding of the fragments, measurements taken from the tip of the acromion process to the lateral epicondyle reveal appreciable shortening compared with the normal side. The relationship of the 3 bony prominences of the elbow, however, remains normal. This finding rules out the possibility of a posterior dislocation of the radius and ulna.

In all cases a very careful examination must be carried out immediately for nerve damage or vascular injury. The presence or absence of neurovascular injury must be recorded before any attempt at manipulation of the fracture is carried out. This will obviate any later question of such a complication having resulted from the manipulation.

X-ray examination will reveal not only the type of displacement and its extent but also whether there is an extension of the fracture line through the epiphyseal cartilage-plate of either of the condyles. The amount of serration of the fracture surface should also be noted because of its influence upon attempts at reduction and the maintenance of reduction of the displaced fragments. It is important to note the amount of medial or lateral displacement of the lower fragment. A lateral view will reveal the amount of anterior displacement of the upper fragment. The relationship of the distal fragment and the forearm, which are one, to the upper fragment in regard to the amount of rotation of the lower fragment is often demonstrable in this lateral view. The significance of the rotation of the lower fragment on the upper is usually better appreciated after the posterior displacement has been reduced, when the upper fragment can still be seen to project obliquely forward.

Approximately 20% of supracondylar fractures will not reveal any displacement; 75% will reveal posterior displacement of the lower fragment. Of this 75% group, in half the cases there will be no appreciable lateral or medial displacement; of the remaining half, marked lateral or medial displacement occurs, in equal proportions. The lower fragment is displaced anteriorly in 5% of cases; this fracture is usually caused by direct violence, due to a fall on the point of the elbow—the so-called flexion type of supracondylar fracture.

Complications. The danger of the supracondylar fracture lies in the associated damage to the brachial artery, with resultant spasm of the arterial tree to a greater or lesser extent, and the possible sequela of Volkmann's ischaemia.

The other danger of this fracture if the first complication has been obviated by adequate treatment, lies in the frequency with which limitation of movement of the elbow joint and deformity of the elbow joint results, in consequence of inadequate reduction of the displacement.

Other subsidiary complications may arise, e.g. ulnar, radial or median nerve palsy. These are usually caused by trauma from the fractured bone ends, sustained at the

* A paper presented at the South African Medical Congress, Pretoria, October 1955.

moment of impact. And finally, myositis ossificans may be a complicating factor as a result of injudicious passive movements.

TREATMENT

I wish to enlarge on the methods adopted (1) to avoid impending circulatory impairment, and (2) to procure satisfactory reduction of the fractured fragments, and a functionally useful elbow joint.

I have records of 4 cases of supracondylar fracture which presented with extreme displacement of bone ends, absence of the radial pulse, marked swelling of the elbow, coldness of the fingers and hand, and cyanosis of the fingers and hand in 2 cases and pallor of the fingers and hand in 2 cases.

This is the type of case where treatment is most urgent if a catastrophe is to be avoided. In 2 of the patients, a meal had been consumed 1½ hours before the accident. It is well known that the emptying time of the stomach after a fracture may be delayed up to 12 hours or even 24 hours. An attempt should immediately be made to pass a stomach tube. This will be found to be a most difficult procedure in a young child, but will usually be successful in inducing vomiting.

Where it is possible to pass a stomach tube, the stomach should be washed out, but here a note of warning must be added. Even if the stomach has been washed out, the greatest care must be exercised in the administration of the anaesthetic; I have on two occasions experienced further vomiting, with the danger of inhaling stomach contents into the trachea. Intratracheal intubation, with a cuff sealing off the lumen of the trachea, is by far the safest way to administer the anaesthetic.

The displacement of the fracture ends is reduced and the circulaion of the limb assessed.

In this type of case the displacement is always extreme, and it appears to me that the more extreme the displacement, the easier is the reduction and the more stable are the fragments after reduction. One can almost compare this type of supracondylar displacement with a dislocation which stays 'put' once it is reduced.

In all 4 cases reduction of the displacement caused immediate improvement in the colour of the hand and fingers, and the return of fairly brisk blanching to pressure of the finger-tips. In 2 cases the radial pulse remained completely impalpable, returning in one case after 7 days, and in case 2, a weak radial pulse could only be felt 6 weeks later. In none of these cases was there any evidence later of a Volkmann's ischaemia or motor or sensory impairment. The return of the radial pulse *per se* would appear to be of little significance compared with the return to the fingers and hand of normal colour and blanching.

It is conceivable that a case may arise where severe damage done to the brachial artery causes extreme spasm of the collateral arterial tree. In such a case it is possible that reduction of the displacement will not cause an adequate circulatory return to the fingers, and sympathetic anaesthetization followed by exploration and stripping of the artery or arteriectomy may be necessary. It would, however, be reasonable to say that, in the vast majority of cases, immediate and adequate reduction of the displacement by non-operative measures will be successful in restoring the circulation to the limb. It is important in this respect not to flex the elbow too much, as with increasing swelling of the elbow joint within the next 48 hours, impairment of the circulation may again arise, should the elbow be too much flexed, or should the brachial artery or collateral circulation be impeded by plaster of paris.

I make a particular point of never applying a circular plaster to the arm. A posterior slab alone is applied in the maximum degree of flexion consistent with the efficiency of the circulation. I also make a particular point of having no bandaging in the cubital fossa, but applying the retaining gauze bandage from forearm to arm across the cubital fossa, thus leaving the space free of any bandage whatever in front of the cubital fossa.

The arm is then elevated and the circulation watched carefully. At the slightest sign of circulatory impairment or excessive swelling any constricting bandage is divided and the flexion of the elbow diminished. The circulation of the limb takes pride of place and all other considerations, such as position of the fracture, are of secondary importance.

Reduction of Fragments. In my experience open reduction has never yet been necessary. Reduction must be by manipulative methods; it is an almost universal experience that open reduction leads to a good radiological but poor functional result.

Reduction should be carried out urgently before swelling of the elbow occurs because, once there is much swelling of the elbow, reduction is difficult and the retention of the reduced position still more difficult since the surgeon is unable to flex the elbow to a sufficient extent.

Anatomical reduction is most desirable, for it will lead to bony union, with the return of normal function, in the shortest possible time; but, though most desirable, it is very frequently not possible. The following conditions, however, must be fulfilled:

1. There must be no angulation in the antero-posterior or lateral views. Angulation in the A.P. view will lead to either cubitus varus or cubitus valgus deformity of the elbow joint with its resultant sequelae of delayed ulnar neuritis and cosmetic unsightliness. Angulation in the lateral view will lead to limitation of flexion or extension of the elbow joint.

2. There must be no residual rotation of the lower fragment. If angulation and rotation at the site of fracture are avoided, the functional result will be good.

In children under the age of 10 years, where most of these fractures occur, extensive re-modelling takes place at the site of union with the passage of years, resulting in marked anatomical improvement. The anterior spur becomes smaller and relatively higher up as growth proceeds at the lower humeral epiphysis, in this way diminishing the bony block to flexion; likewise the medial and lateral spurs become smaller or completely absorbed. Angulation at the site of fracture, however, is never corrected by re-modelling, nor is unreduced rotation.

Many supracondylar fractures after initial good reduction will show change of position after subsidence of swelling and will require to be re-manipulated. This should not be delayed longer than 5 to 7 days because

after this time the fracture rapidly shows signs of commencing union, and sub-periosteal new-bone formation may be seen radiologically as early as 8—10 days.

A significant relationship exists between the character of the line of fracture and the reduction. A serrated transverse fracture properly reduced will remain in alignment if immobilized with the forearm flexed at a right angle, irrespective of the amount of supination or pronation. On the other hand, an oblique fracture line with an anteriorly displaced upper fragment presents a serious problem, for the displacement frequently recurs after the reduction because of the lack of serrations on the fractured surface.

Immobilization of the elbow in flexion with semi-pronation of the forearm relaxes the pronator-flexor group of muscles and lessens the tendency to re-displacement. The elbow, however, must not be flexed until traction has been exerted on the fracture fragments and over-riding has been overcome. Any medial or lateral displacement which may be present is then corrected. Persistent rotational displacement can be overcome by fixing the upper fragment manually or by abduction of the shoulder during the manipulative procedure. The rare type of 'flexion' supracondylar fracture is immobilized with the elbow in extension.

Satisfactory reduction of the fracture having been obtained, the elbow is immobilized in the manner already described. Immobilization is continued for 4—6 weeks until union is complete. Movements of the elbow are then allowed to recover slowly of their own accord, with particular avoidance of passive movements, passive stretching and massage of the elbow. The carrying of heavy weights and hanging from overhead beams are two forms of passive stretching which must be rigorously avoided.

It has been my experience that by following these simple precepts a satisfactory result can be procured.

REFERENCES

Attenborough, C. C. (1953): J. Bone Jt. Surg., **35B,** 386.
Siris, I. E. (1939): Surg. Gynec. Obstet., **68,** 201.