Supracondylar Fractures of the Humerus in Children

REASONS FOR UNSATISFACTORY RESULTS

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SUMMARY

Between 1970 and 1972, 231 children with supracondylar fractures of the humerus were treated at Groote Schuur Hospital. Of these, 225 had sustained an extension-type fracture.

The fractures were graded according to their appearance on X-ray film into grades I, II and III according to their severity. A sample follow-up of children who had sustained grade I fractures was carried out, while 85% of the children with grade II fractures and 80% of those with grade III fractures were followed up.

Results were classified as excellent, good, and unsatisfactory. The reasons for the unsatisfactory results were analysed.

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Supracondylar fracture of the humerus is the most common type of elbow fracture in children. It accounts for between 50% and 60% of elbow fractures, and is seen most frequently in children between the ages of 4 and 10 years. Males predominate, and the left arm is involved about twice as frequently as the right arm.[1]

The possibility of deformities in the elbow and the potential neurovascular complications that result, make this a serious injury.

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Mechanism of Injury and Classification

The more common **extension type** accounts for approximately 95% of cases — in this series 97%. It is caused by a fall on the outstretched hand with hyperextension of the elbow. The distal fragment is posteriorly displaced.

The **flexion type** is rare, and accounts for the remaining 3 - 5%. It is caused by a fall on the elbow in flexion, with resultant anterior displacement of the distal fragment.

Fractures are classified according to degree of displacement on X-ray film:

Grade I: Fracture without displacement.

Grade II: Displacement in one or more directions, but partial contact remaining between the fragments. The displacement may be posterior, anterior, medial, or lateral, and the rotation or tilt (angulation) may be medial or lateral.

Grade III: Complete displacement and loss of contact between fragments.

PATHOLOGICAL ANATOMY

Extension Type

In the sagittal plane the fracture line traverses obliquely upward and backward, and in the frontal plane it is frequently transverse. The distal fragment is displaced proximally and posteriorly by the fracturing force transmitted upwards through the bones of the forearm and because of the pull of the triceps muscle. It is often tilted laterally or medially and rotated medially.

In grade III fractures, the lower end of the proximal fragment projects anteriorly, pierces the periosteum and forces its way into the brachialis and biceps brachii muscles. The periosteum is stripped from both the anterior surface of the lower fragment and the posterior surface of the upper fragment. There is much local bleeding and swelling.

Diagnosis

The diagnosis is made from the history, clinical findings and X-ray film appearances. When in doubt, X-ray films should be done of both elbows for comparison.

Treatment

Treatment of grade I fractures consists of the application of a collar and cuff, and a plaster of Paris backslab.

Grade II and III fractures require: (*i*) manipulation under anaesthesia followed by immobilisation in a collar and cuff and backslab or gutter; or (*ii*) Dunlop traction; (*iii*) skeletal traction; (*iv*) closed reduction and fixation with Kirschner wires; (*v*) open reduction and internal fixation;[2] or (*vi*) manipulative reduction followed by fixation in plaster with the elbow in full extension and the forearm in supination.[3]

Results

The results are classified into 3 groups.

Excellent:[4] Normal shape and movements, apart from 5° change in carrying angle and 10° limitation of flexion.

Good: Reduction of carrying angle from 5° to 10°, but not beyond cubitus rectus and restriction of flexion by 10 - 20°.

Unsatisfactory: Alteration of carrying angle by more than 10° with obvious varus deformity and restriction of flexion.

PATIENTS AND METHODS

A follow-up study was done of 231 children between the ages of 2 and 13 years who sustained supracondylar fractures of the humerus between 1970 and 1972, and were treated in the Orthopaedic Department of Groote Schuur Hospital by a variety of Registrars at different stages of training.

The purpose of the study was: (*i*) to ascertain the results obtained using our current method of treatment; (*ii*) to analyse the causes of permanent deformity/disability of the elbow after supracondylar fracture, and (*iii*) to assess what degree of imperfect reduction can be accepted which will not cause permanent deformity/disability.

Of the 231 children, 225 had sustained the extension type fracture, while the remaining 6, who had sustained the flexion type fracture, were excluded from the study. The shortest follow-up was 9 months, and the longest 3 years and 9 months.

RESULTS

Distribution of Age, Sex and Site of Injury

There were 8 patients aged 2 years, 13 aged 3 years, 26 aged 4 years, 33 aged 5 years, 28 aged 6 years, 30 aged 7 years, 29 aged 8 years, 24 aged 9 years, 18 aged 10 years, 9 aged 11 years, 5 aged 12 years and 2 of 13 years, 133 of whom were males.

The left arm was affected in 146 patients, and the right arm in 79.

Associated Injuries

There were 2 patients with associated fractured distal radial epiphyses, and 1 patient with fractured distal radius and ulna. One patient suffered circulatory embarrassment — absent radial pulse with poor capillary circulation, followed by open reduction and fixation, and the brachial artery was found to be stretched over a spike of bone.

One patient had associated ulnar nerve palsy, as was the case with another patient after open reduction (both recovered).

Classification of Fractures into Grades

There were 85 grade I fractures, 104 grade II fractures, and 36 were classified as grade III—a total of 225.

Follow-up Findings

The results of follow-up examinations done on a sample of 50% of grade I fractures, 85% of grade II fractures and 80% of grade III fractures were as follows:

Grade I: All results were excellent.

Grade II: Seventy-two results were judged as excellent (85%); 5 were good (6%); and 7 were unsatisfactory (9%).

Grade III: Sixteen results (62%) were excellent (4 open reduction); 4 were good (15%); and 6 were classed as unsatisfactory (1 open reduction) (23%).

DISCUSSION

Treatment of all the fractures consisted of collar and cuff with or without a backslab for grade I fractures. Grade II and grade III fractures were all manipulated under anaes-

thesia — either general or regional. They were then immobilised in a collar and cuff with the elbow flexed at least to 90°, with or without a backslab. Check X-ray films were taken and the fractures remanipulated if necessary. Those who had very swollen elbows were admitted to the ward for 24 - 48 hours so that the circulation could be observed.

In the grade II group, one facture was treated by open reduction and fixation with Kirschner wires. In the grade III group, 7 fractures were treated by open reduction and fixation with Kirschner wires.

Fractures were immobilised for between 3 and 4 weeks, after which time most patients had very stiff elbows. Some were sent for physiotherapy—this did not, however, seem to hasten improvement in the range of movement. I feel that physiotherapy is not necessary in these fractures.

Functional Disability

In none of the patients followed up was there any real functional disability, other than 5 - 15° lack of flexion of the elbow.

Analysis of Unsatisfactory Results

In grade II there were 7 unsatisfactory results (9%), of which 4 showed a varus deformity — reappraisal of the check and follow-up X-ray films revealed a medial tilt of the distal fragment in all of these. In 3 there was a valgus deformity. Rescrutiny of the X-ray films revealed a lateral tilt of the distal fragment.

In grade III there were 6 unsatisfactory results (23%). All 6 had a varus deformity of the elbow, and here again, check X-ray films showed a medial tilt of the distal fragment (including 1 open reduction).

This study confirms that the only deformity found after treatment by closed manipulation was the alteration in the carrying angle.[5] Cubitus varus is caused by medial angulation of the distal fragment while cubitus valgus is caused by lateral angulation of the distal fragment.[6]

It is interesting to note what degree of deformity was accepted in the postreduction X-ray film to give an excellent result.

Posterior displacement: as long as there is even the slightest apposition, it is sufficient.

Shortening: virtually any amount is acceptable.

Medial or lateral shift results in no deformity nor disability.

Posterior angulation: It would appear that up to 15 - 20° posterior angulation of the distal fragment is acceptable.

Suggested Method of Treatment

The fracture should be reduced under anaesthesia in supination. The carrying angle of the good elbow is noted and the fractured elbow corrected to the same carrying angle. The elbow is then flexed to just beyond 90°—the elbow is not just a simple hinge. When the elbow flexes, the forearm and hand will naturally deviate laterally because of the normal cubitus valgus. This position must be obtained with the fractured elbow. A collar and cuff is applied as well as a backslab, moulded into a gutter, which is open anteriorly.

The radial pulse should be checked, but I have found that the pulse is often not present after the manipulation, but will return within half an hour. More important, though, is the capillary circulation to the fingers.

If reduction of the supracondylar fracture is not possible, or proves to be difficult, or if the elbow is too swollen, the child should be admitted into the ward and the arm placed in Dunlop-type skin traction. This is invariably successful and the fracture will reduce during the course of a few days. After about 10 days, the traction can be removed, and the arm placed in a collar and cuff and a backslab gutter.

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