Acta orthop. scand. 52, 295–298, 1981

FRACTURE-SEPARATION OF THE LOWER HUMERAL EPIPHYSIS IN YOUNG CHILDREN

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Five fracture-separations of the lower humeral epiphysis, type II according to the Salter-Harris classification, are presented. The fracture line generally passes through the cartilaginous epiphysis, which does not show up in roentgenograms, and sometimes includes a laterally based metaphyseal wedge. This injury is often misdiagnosed as it is mistaken for other injuries of the elbow, especially fracture of the lateral humeral condyle.

The concomitant displacement of the radius and ulna in relation to the capitellar ossification center is the key to the diagnosis of fracture-separation of the lower humeral epiphysis.

Good results are obtained with treatment by closed methods if this lesion is correctly diagnosed.

Key words: children; distal humerus; elbow; epiphyseal plate injuries; fractures

Accepted 2.ix.80

Fracture-separation of the lower humeral epiphysis is a rare injury and may present some diagnostic problems due to difficulties of roentgenographic interpretation. This fracture may be easily mistaken for a fracture of the lateral condyle or for a traumatic dislocation of the elbow or for both of these lesions in association.

There is a paucity of literature on this subject (Ashhurst 1910, Marmor & Bechtol 1960, Kaplan & Reckling 1971, Mizuno et al. 1979, DeLee et al. 1980, Holda et al. 1980) and many texts discuss this lesion only briefly (McLaughlin 1961, Smith 1967, 1974, DePalma 1970, Sharrard 1971, Tachdjian 1972) or ignore it completely (Blount 1955, Rang 1974).

It is important to differentiate between fracture-separation of the distal humeral epiphysis and other injuries of the elbow, especially fractures of the lateral condyle, because of the different treatment methods.

Five cases of fracture-separation of the lower humeral epiphysis are presented here in order to emphasize the problems encountered in diagnosis and treatment of such injuries.

PATIENTS, METHODS AND RESULTS

From March 1969 to March 1979, five patients with acute fracture-separation of the lower humeral epiphysis were treated at our Hospital.

All the patients were boys who had fallen and all of the injuries were closed fractures of the left elbow. The ages of the patients ranged from 5 to 8 years.

Only in two of the five patients was the correct diagnosis of separation of the distal humeral epiphysis made. Both cases were reduced by closed methods (Figure 1) and in one of them (Figure 2) percutaneous Kirschner wires were used.

In two other cases the initial diagnosis was isolated fracture of the lateral condyle of the humerus; this diagnosis indicated treatment by open reduction. At operation, the fracture line was observed to pass through the junction of metaphysis and epiphyseal cartilage and, after reduction, two Kirschner wires were inserted through the lateral condyle (Figure 3).

In the fifth patient the initial diagnosis was dislocation of the elbow and a successful closed reduction was obtained (Figure 4).

There were no patients with neurovascular lesions, non-union or myositis ossificans and none of the patients who underwent open reduction developed a wound infection.

The patients have been followed up for periods ranging from 1–10 years and there have been no signs of deformity and in one patient only extension was restricted by 10 degrees.

0001-6470/81/030295-04 $02.50/0

Figure 1. Case 1.
A. Roentgenogram after injury.
B. Posterior displacement of the capitellum, radius and ulna. There is a posterior metaphyseal fragment.
C. Eight months after injury there is no deformity.

DISCUSSION

The first problem associated with fracture-separation of the lower humeral epiphysis in children is obtaining an accurate diagnosis. Diagnosis should be made roentgenographically and it is advisable, as is the case with all injuries around the elbow in children, to obtain a comparable roentgenogram of the opposite elbow to aid in the diagnosis (Figure 1A and B) (Marmor & Bechtol 1960).

The major ossification center present in the age group involved with distal humeral epiphyseal separation is the capitulum humeri while the other centers are small and, if displaced, are hard to distinguish.

The fracture line in fracture-separation passes through the growth cartilage but, at times, includes a laterally based metaphyseal wedge. The former can be classified as a type I Salter-Harris (Salter & Harris 1963) epiphyseal separation, the latter as a type II injury.

Sometimes it may be difficult to differentiate this injury from a fracture of the lateral condyle, from an elbow dislocation, or from both these lesions in association. The key to the diagnosis is the relationship of the capitellar ossification center to the ulna, radius and humerus. Normally,

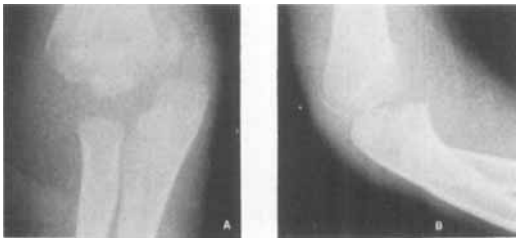

Figure 2. Case 2.
A and B. Posteromedial displaced fracture-separation.

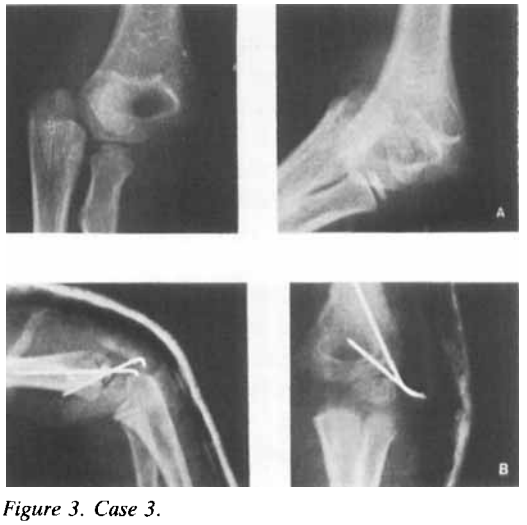

Figure 3. Case 3.
A. Roentgenogram after injury.
B. Two Kirschner wires were used as internal fixation.

Figure 4. Case 4.
A and B. Epiphyseal separation with lateral and posterior displacement of the capitellum, radius and ulna.
C and D. Roentgenograms 5 weeks after injury. Note the periosteal reaction on both sides.

a line drawn along the shaft of the radius will pass through the capitellum.

In a fracture of the lateral humeral condyle (Figure 5A), the axes of the humerus and the forearm bones maintain their normal relationship and the condylar fragment is displaced and often rotated by the pull of the strong forearm extensor group of muscles. A straight line drawn through the radius does not transect the fractured condylar fragment. The fracture line is through the cartilaginous epiphysis into the joint, a type IV epiphyseal injury and, if displaced, usually has to be replaced using open reduction and internal fixation to prevent non-union and to restore a normal joint surface.

In dislocation of the elbow (Figure 5B), the relationship between the ossification center of the capitellum and the humerus is unchanged and the axes of the humerus and the forearm bones are different. The line drawn through the radius does not transect the capitellar ossification center.

Elbow dislocations may sometimes be associated with a fracture of the lateral condyle (Figure 5C). In these cases the roentgenographic findings of both lesions are presented. There are differences in the axes of the forearm bones and the humerus and the loose fragment of the condyle is displaced and often rotated.

Fracture-separation of the epiphysis, when displaced, carries the radius and the ulna with it, producing, at first glance, the appearance of a dislocated elbow because there are differences in the axes of the humerus and forearm. The ossification center of the capitellum maintains its relationship to the head of the radius but not to the humerus and displacement does not occur since there is no loose fragment to rotate. A line drawn along the shaft of the radius will pass through the capitellum (Figure 5D).

Arthrographic studies have been proposed in order to differentiate between the various injuries described above (Mizuno et al. 1979) but we have not had experience with this technique.

Figure 5.
A. Displaced fracture of the lateral condyle.
B. Elbow dislocation.
C. Displaced fracture of the lateral condyle and associated elbow dislocation.
D. Case 5. Fracture-separation of the distal humeral epiphysis.

With regard to fracture-separation of the epiphysis it is recommended from personal experience and in the light of previous studies (Marmor & Bechtol 1960, Smith 1967, Kaplan & Reckling 1971) that treatment is by closed methods as in the case of supracondylar fracture. The method proposed by Ariño et al. (1977) using, after reduction of the fracture, two percutaneous Kirschner wires inserted from the lateral side, is the preferred technique. A posterior molded splint is used after reduction with the elbow in 90 degrees of flexion. The patient is admitted to the hospital in order for a careful check to be made of the radial pulse for the first 24 hours. The wires are removed after 3 weeks and the plaster slab is left on for 1 more week; by that time the fracture has consolidated and active rehabilitation of the elbow can be started.

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