Fracture of the humeral condyles in children

49 cases evaluated after 18–45 years

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We evaluated 49 children with fracture of the humeral condyles 18–45 years after the injury. 20 fractures with a displacement of 2–10 mm with no tilting of the osteochondral fragment had been treated without reduction and with good results. 16 fractures with marked displacement and tilting of the osteochondral fragment had been treated surgically, with good results. 13 patients had been treated for old, displaced fractures both operatively and nonoperatively, with poor results. Nonunion developed in 4 cases and aseptic necrosis in 6. Arthrosis of the elbow was found in cases complicated by aseptic necrosis and nonunion or in old fractures when resection of the humeral condyle was done, but it was never observed in uncomplicated fractures.

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Few long-term studies of fractures of the humeral condyles in children have been reported; the maximum length of follow-up ranges from 5 to 9 years (Hardacre et al. 1971, Holst-Nielsen and Ottsen 1974, Rutherford 1985, So et al. 1985, Van Vugt et al. 1988). We describe our results of treatment in 49 children reviewed after the end of skeletal growth, with an average follow-up of 31 (18–45) years.

Patients and methods

Between 1948 and 1975, 153 patients with fractures of the humeral condyles were treated at our department. Only 3 fractures involved the medial condyle.

43 patients who did not have sufficient radiographic documentation were excluded. Of the remaining 110 patients, 49 had a complete clinical and radiographic evaluation. Their average age at fracture was 7 (2–14) years, whereas the average age at follow-up was 38 (23–56) years. The average length of follow-up was 31 (18–45) years. Of the 48 fractures involving the lateral condyle, 43 were Milch type II injuries, whereas 5 were Milch type I (Milch 1964). 1 fracture involved the medial condyle. 36 were fresh injuries and 13 old ones (range 2–25 weeks). 26 fractures were markedly displaced with tilting of the condylar fragment, whereas 23 had a linear displacement ranging from 2 to 10 mm. In 2 cases there was also an olecranon fracture.

16 fresh fractures with tilting of the osteochondral fragment had been operated on with open reduction and K-wire fixation. Fractures with displacement of the osteochondral fragment less than 10 mm, without tilting, had been treated with a long-arm plaster cast for 6 weeks.

Old lesions were in 6 cases treated with excision of the osteochondral fragment, in 4 cases with open reduction and osteosynthesis with Kirschner wires, and in 3 with a plaster cast.

Results were evaluated with the rating system of Hardacre et al. (1971). An excellent result implied a full range of movement of the elbow, no symptoms, no deformity and only slight radiographic changes. A good result corresponded to less than 10 degrees of impairment of the elbow movements and/or a change in the humeroulnar angle of no more than 5 degrees with some radiographic abnormalities, such as a fish-tail deformity. Fair corresponded to loss of movement between 10 and 20 degrees for each of the elbow movements and/or a change in the humeroulnar angle of more than 5 degrees, albeit within the range of normal humeroulnar angle values. A poor result referred to a loss greater than 20 degrees for each of the elbow movements, a pathologic humeroulnar angle exceeding 5 degrees (Aebi 1947), pain, neurological deficit, nonunion, avascular necrosis or radiographic signs of arthrosis.

Figure 1.

A Milch type II fracture of the left lateral humeral condyle with a 10 mm displacement in a 7-year-old boy was treated in a plaster for 6 weeks.

34 years later, the lateral portion of the distal humeral metaphysis was irregular: the epicondyle was hypertrophic, an evident fish-tail deformity was present and the humero-ulnar angle measured 5 degrees less than in the right elbow. The patient had no complaints and the elbow had full range of motion.

Results

Of the 36 patients with a recent injury, 20 with a displacement of the fracture less than 10 mm were treated nonoperatively. 9 of these had an excellent result, 7 good and 4 poor (Figure 1). Of the 4 poor results, 3 were nonunions and 1 a cubitus varus. The 3 fractures with nonunion had an initial displacement between 9 and 10 mm.

All 16 cases with severe displacement and tilting of the fracture fragment were treated with open reduction and Kirschner wire fixation. The result was excellent in 9, good in 2, fair in 2 and poor in 3. The poor results were in 2 cases due to necrosis (Figure 2), and in 1 due to varus deformity. Of the 13 patients with old lesions, the result was good in 3 and poor in 10 (Figure 3).

Radiographic arthrosis was present in 10 patients. 5 of which had had excision of the lateral humeral condyle and another 5 had developed nonunion or aseptic necrosis (Figure 2). Mild radiographic irregularities were present in all the patients—for example, hypertrophy of the head of the radius or a fish-tail deformity.

Discussion

Fairly general agreement exists that recent fractures of the lateral humeral condyle with displacement 2 mm or less should be treated nonoperatively, whereas fractures with marked displacement and tilting of the osteochondral fragment should be treated surgically. The same general agreement does not exist when the fragment is displaced more than 2 mm but is not rotated. Some authors rec-

ommend open reduction and internal fixation (Flynn et al. 1975, Foster et al. 1985, Badelon et al. 1988), whereas others suggest closed reduction and percutaneous pin fixation (Jones 1967, Tachdjian 1972, Wilkins 1991, Mintzer et al. 1994). We observed healing of the fracture in 29 patients whose fresh fracture displacement ranged from 2 to 10 mm, and who had been treated with a long-arm plaster cast for 6 weeks. Only 2 patients had had a late displacement of the fragment in plaster, with no influence on their healing process. 3 patients had a nonunion but, in these cases, the displacement of the fracture ranged from 9 to 10 mm. Our findings indicate that condylar fractures in which the displacement ranges from 2 to 8 mm can be treated nonoperatively with good long-term results. Since other fractures in our series with an inferomedial displacement of the osteochondral fragment ranging from 8 to 10 mm healed without problems, we assume that other factors may play an important role in the development of nonunion. In fact, nonunion has been reported even in patients with minimally displaced fractures (Flynn et al. 1975).

Of the 16 surgically treated fresh injuries, 2 had a fair result and 3 a poor one, in 2 because of necrosis. Avascular necrosis of the humeral condyles has been previously reported in fresh injuries treated surgically (El Ghawabi 1975, Fowles and Kassab 1980, Foster et al. 1985, Papavasiliou and Beslikas 1985, Papavasiliou et al. 1987).

Fractures of the medial condyle are very rare (Chacha 1970, Fowles and Kassab 1980, Hanspal 1985, Bensahel et al. 1986, De Boeck et al. 1987).

Figure 2.

A severely displaced Milch type II fracture of the left lateral humeral condyle with tilting of the osteochondral fragment in a 6-year-old girl.

The fracture was treated by open reduction and fixation with a Kirschner wire and healed in good position. 10 years later, necrosis of the humeral condyle. The patient complained of a progressive valgus deformity which started at age 11; the humeroulnar angle measured 14 degrees.

At age 49, the valgus deformity had increased to 24 degrees and symptomatic arthrosis was present, as well as pain and paresthesia in the ulnar nerve territory. The radial head was hypertrophic and anteriorly subluxated.

Figure 3.

A severely displaced Milch type II fracture of the left lateral humeral condyle in a 3-year-old girl. The fracture had been diagnosed 3 weeks after trauma, and it had been simply treated by immobilization in a plaster cast for 6 more weeks.

37 years later, a stable nonunion of the humeral condyle was present, with a 22-degree valgus deformity and 30 degrees of limitation of extension. The patient was asymptomatic and worked as a housekeeper. In old lesions, a closed approach may give functionally good results.

Results are not always good in displaced fractures treated surgically because of disturbance to the vascular supply, with necrosis of the medial condyle. We had 1 fracture of the medial humeral condyle with marked displacement and tilting of the fragment. The patient was evaluated 28 years after the open reduction, and the result was poor because she had limited elbow movement and ulnar nerve compression.

In old lesions, our long-term results are similar to those previously reported (Jakob et al. 1975, Zionts and Stolz 1984, Dhillon et al. 1988). All patients treated with excision of the osteochondral fragment had very poor results and that treatment should be abandoned, as already pointed out by other authors (Böhler 1956, Jakob et al. 1975, Rang 1983, Wilkins 1991). In 3 patients, an open reduction had been attempted, but all of them developed aseptic necrosis. In 1 patient the humeral condyle was left with a severe displacement and tilting, and a stable nonunion developed. Therefore, we believe that the risk of aseptic necrosis is too high in old lesions treated by open reduction and internal fixation, and it would be preferable to leave the lesion untreated in order to achieve a better long-term result. In fact, our long-term results seem to indicate that nonunion may give better function than aseptic necrosis with a collapse of the humeral condyle. Good long-term functional results have previously been reported in nonunion (Smith 1973, Kalenak 1977).

Ulnar neuropathy has been reported in patients having progressive posttraumatic cubitus valgus, with an average interval of onset of more than 20 years. (Miller 1924, Gay and Love 1947). However, in our series, 6 patients with cubitus valgus ranging from 22 to 50 degrees did not develop ulnar nerve disturbances.

Only 2 patients had cubitus varus, and all our 12 cases of cubitus valgus were the consequence either of other complications or of excision of the lateral humeral condyle. The most severe deformities were observed in patients who had had excision of the humeral condyle and in patients with nonunion, whereas in aseptic necrosis of the humeral condyle the deformity was more moderate. A variation in the carrying angle within the range of normal values (Aebi 1947) was found in 13 patients. In half of them, the carrying angle tended to be varus in comparison to the normal side, whereas in the other half it tended to be valgus. Since the variation in the humeroulnar angle during growth was either in plus or in minus, we do not believe that it could be due to resid-

ual displacement of the fracture in the plaster cast before fracture healing. Moreover, a variation of the humeroulnar angle was also found in fractures perfectly reduced by open reduction, as reported by Holst-Nielsen and Ottsen (1974). We have observed a similar phenomenon in supracondylar fractures of the humerus in children, and we believe that it might be related to the effect of the initial trauma on the whole distal humeral growth plate (Ippolito et al. 1986, 1990).

A fish-tail deformity of the distal humeral epiphysis was present in about two thirds of our cases. Some authors believe that this deformity is due to a persistent displacement of the osteochondral fragment (Wadsworth 1964, Rutherford 1985), whereas others (Morrissy and Wilkins 1984) believe that a disruption of the nutrient artery of the intercondylar groove is the cause (Haraldsson 1959).We agree with the latter theory because none of the patients in our series who had a Milch I injury, with a fracture line crossing the articular cartilage more laterally to the intercondylar groove, far from the nutrient artery, had a fish-tail deformity.

The incidence of arthrosis was very low and was limited to the cases who had had excision of the humeral condyle, aseptic necrosis or nonunion. In fact, neither the patients who had had an operation for severe displacement of the osteochondral fragments, nor the patients who showed significant alteration of the articular surface of the distal humeral epiphysis due to marked fish-tail deformity, had radiographic signs of arthrosis, although several patients in our series were already more than 40 years old at follow-up. It may be that in nonweight-bearing joints like the elbow, even Salter and Harris type IV lesions do not predispose to posttraumatic arthrosis, as they often do in the knee and ankle areas (Perugia and Ippolito 1987, Caterini et al. 1991a,b).

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