Fractures of the proximal humerus in children

Nine-year follow-up of 64 unoperated on cases

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Fracture of the proximal humerus in children is rare. The records from 1976 to 1977 of 77 patients aged 0–15 years with a fracture or epiphyseal separation of the proximal humerus were reviewed. Totally, 64 of 72 patients had a follow-up examination (median observation time 9 years).

Twenty-one children had an epiphyseal separation and 51 a metaphyseal fracture. All but 1 were treated conservatively. Seven had slight sequelae at follow-up, i.e., transient pain or minor restriction of motion. The rest were asymptomatic. Full remodeling of fractures left displaced occurred in all the cases. No avascular necrosis or shortening of the humerus were found.

Nonoperative treatment is appropriate for proximal humeral fractures in children, even for those with extensive displacement.

Fracture and epiphyseal separation of the proximal humeral epiphysis in children are rare and represent only 3 percent of all epiphyseal fractures (Neer and Horwitz 1965). Earlier modes of treatment for full anatomic reduction of displaced fractures have been replaced by a more moderate strategy (Nilsson and Svartholm 1965, Baxter and Wiley 1986). However, only a few studies describe the final outcome, and these are mainly based on a relatively short follow-up after various regimes of treatment. Most earlier studies are hampered by lack of accuracy in the classification of the fractures, although this has been shown important in evaluating late results (Neer and Horwitz 1965). The most frequent complications are claimed to be angulation and shortening (Dameron and Reibel 1969).

We analyzed the end results of nonoperative treatment of proximal humeral fractures in children with emphasis on remodeling

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Patients and methods

All patients aged 0–15 years treated for epiphyseal fractures of the proximal humerus at Odense University Hospital between January 1, 1976, and December 31, 1977, were included in the study. From the computerized patient registration system, all the cases in the area serviced by the hospital were retrieved. The files contained 324 patients with fractures of the proximal humerus, 77 in children below the age of 15 years. Five children with pathologic fractures were excluded. Based on the radiographs taken at admission, all the epiphyseal fractures were classified according to Neer and Horwitz (1965) in four grades (Table II) and for epiphyseal separations according to Salter and Harris (1963). In all, 34 patients were girls and 38 were boys. The median age at the time of the accident was 11 years.

A total of 64 children had a clinical and radiographic follow-up examination 8 to 10 years after their injury (median 9 years); 3 had emigrated, and 5 refused to be examined. The radiographic examination included AP and axillary views in inward and outward rotation of both arms. Humeral lengthening, shortening (as measured from the coracoid to the medial humeral epicondyle), angulation, decrease in muscle strength, decrease in range of motion, or subjective discomfort compared with the uninjured shoulder were recorded.

Table 1. Incidence of fractures of the proximal humerus in children 1976–77

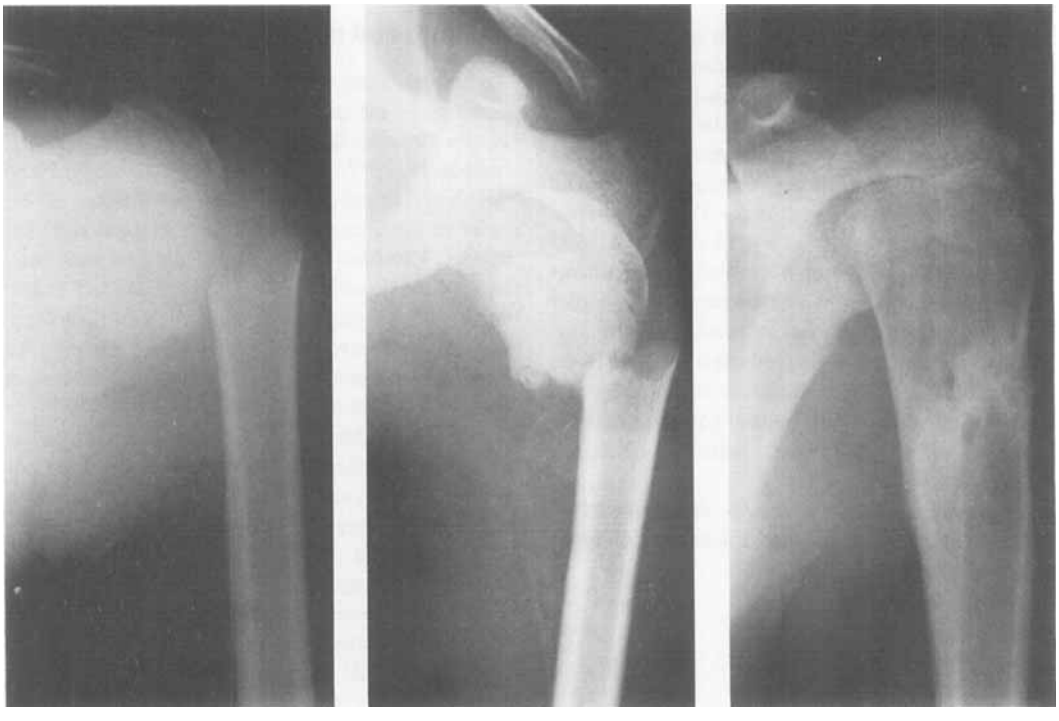
Age groups (yr)	0–4	5–9	10–15
Population at risk ($x10^3$)	17	17	18
No. of fractures	5	17	50
Incidence (n/10,000/yr)	1.5	5	14

Table 2. Seventy-two fractures of the proximal humerus classified according to type (Neer and Horwitz 1965) and duration of treatment (weeks)

Type of fracture	Dislocation	No. of patients	Median treatment
I	< 5 mm	35	3 (1–18)
II	< 1/3	17	3 (2–6)
III	1/3–2/3	10	4 (3–8)
IV	> 2/3	10	7 (3–12)

Table 3. Clinical and radiographic sequelae in 64 patients followed up after proximal humeral fracture or epiphyseal separation

Type of fracture	No. of patients with sequelae	Pain or discomfort	Restriction of motion	Weakness	Angulation			Thickening of humerus
					0°–9°	10°–19°	> 20°	
I	1	1		1	1			1
II	1	1	1		1			1
III	1	1			1			1
IV	4	4	3		1	1	1	4



A. Displacement at admission. B. Callus formation after 3 weeks. C. 10 years after injury.

Figure 1. The left shoulder of a 15-year-old boy who fell from a tree.

Results

There were 21 children with epiphyseal fracture-separation and 51 with fractures of the proximal metaphyseal humerus. All the epiphyseal injuries were Salter-Harris Type I or II. The annual incidence was 6.8/10,000, with a great variation among different age groups (Table 1). The incidence was lowest under the age of 4 and highest in children between 10 and 15 years. Most of the children had minimal displacement fractures (Grades 1 and 2), and only 10 had severe displacement.

In 51 cases a sling was the only treatment given, whereas 3 cases were treated with a cast and 18 with a hanging cast. Two children had a closed reduction followed by a hanging cast. Two others underwent an open reduction followed by treatment with a hanging cast in 1 and sling in the other. The period of treatment ranged from 1 to 18 weeks; it was longest in the group of children with displaced fractures (Table 2).

At follow-up, only 7 had slight sequelae, such as transient pain or discomfort, restricted range of motion, or muscle weakness (Table 3). All the patients were satisfied with the result. No shortening or angulation of the humerus was found. Four patients had a slight decrease in range of motion in abduction, but the restriction was less than 30°. A radiographic examination revealed only minor changes: in 6 cases slight anterior or varus angulation (Table 3) and in 7 cases thickening of the humeral shaft. There were no cases with malrotation or deformity of the humeral head, arthrosis, or osteonecrosis. The occurrence of sequelae was related to the grade of the fracture. Seven children had had complications, and 4 of these had a Grade 4 fracture.

Discussion

Fractures of the proximal humerus in children have a more benign course than in adults. The proximal humeral epiphysis is responsible for 80 percent of the humeral growth (Baxter and Wiley 1986), permitting a substantial remodeling capability (Figure 1). The age of the child may influence the eventual result, because remodeling capability decreases with age and reduced growth potential. In this study the 3 children with greatest angulation at follow-up were 11, 12, and 14 years of age at the time of the accident, and all had a Grade 4 fracture. The younger patients (below aged 8 years) with a Grade 4 fracture had corrected their deformity. This indicates that severely dislocated fractures have a more favorable prognosis in the youngest subjects. The capability to correct deformity is, however, also present in older children, although more low-grade.

The satisfactory final result in our series accords with other similar studies (Wahl (1982), Dameron and Reibel (1969), Hohl (1976), Nilsson and Svartholm (1965), Köhler and Trilland (1983), Ansorg and Graner (1978). The good prognosis of this fracture in spite of initially severe dislocation can partly be explained by the great mobility of the glenohumeral joint. A slight residual deformity may be adjusted by a wide range of movement in the joint (Hohl (1976). Further, very few four-fragment fractures with isolation of an avascular humeral head occur in this age group (Neer and Horwitz 1965, Wahl 1982). These factors together with the extraordinary remodeling capability of the juvenile proximal humerus can explain the normally favorable course of this fracture.

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