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Fractures of the proximal humeral epiphysis

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Summary. *Twenty-two patients with marked displacement of a fracture of the proximal humeral epiphysis have been treated with closed or open reduction and fixation by Kirschner wires. At an average follow-up of 6.8 years there have been good functional results in almost all patients (91.1), with better results in patients under 13 years of age particularly with less residual displacement or angulation. Since there is a greater occurence of residual deformity and symetria and limitation of motion in older patients, a more aggressive approach to correct the initial displacement and angulation is warranted in those over the age of 13 years.*

Résumé. *Les auteurs présentent une étude rétrospective de 22 cas de fracture de l'extrémité supérieure de l'humérus, avec déplacement important, qui ont été traitées par réduction et synthèse par broches de Kirschner, à foyer fermé dans la plupart des cas. Malgré un taux élevé de complications lors du contrôle final (limitation de mobilité, dysmétrie et angulation résiduelle), et ceci après une durée d'observation moyenne de 6,8 ans, les résultats fonctionnels ont presque toujours été bons (91.1%). Les résultats les meilleurs ont été obtenus dans les cas qui n'ont présenté, après la réduction et la synthèse, ni déplacement latéro-latéral, ni angulation résiduelle. De même on constate des résultats uniformément bons chez les enfants de moins de treize ans. Les auteurs recommandent une attitude thérapeutique plus agressive chez les enfants de plus de treize ans, présentant une fracture de l'extrémité supérieure de l'humérus avec déplacement.*

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Introduction

Fractures of the proximal humeral epiphysis comprise 10% of shoulder fractures [14] and 0.45% of all fractures in children [8]. Fractures with marked displacement show a greater incidence of complications, although the general outcome is satisfactory [3, 9, 10, 11, 12].

This study describes the long term results of a series of such fractures with marked initial displacement.

Material and methods

Sixty-five patients with fractures of the proximal humeral epiphysis were treated from 1977 to 1988. Twenty-six of these had marked displacement and were treated by means of closed or open reduction with the use of Kirschner wire fixation.

Twenty-two patients were available for follow-up. The displacement was more than 50% of the bone diameter (Ogden types II and III) [12] and/or the angulation was greater than 30% in one plane. The average age of the patients was 13 years (range 7–19). Fifteen of the patients were male and 15 fractures involved the left humerus (Table 1). All the epiphyseal injuries were of the Salter-Harris type II. In 15 the metaphyseal fragment with the epiphysis was displaced posteromedially and in 7 the displacement was posterior (Fig. 1). In 2 cases there was a third anterolateral fragment of the proximal metaphysis also separated from the epiphysis (Fig. 2).

Six of the patients had no displacement on initial radiographs but shift occurred during the course of nonoperative management.

The angulation of the distal fragment of the fracture was varus in 14, valgus in 6 and extension in 2 patients.

Reduction was undertaken with a general anesthetic. Manipulation was by abduction and slight flexion, with stabilization by 2 or 3 percutaneous Kirschner wires passed from the lateral cortex of the distal fragment across the epiphysis into the humeral head [5]. In 3 cases the closed reduction was unsatisfactory and an open reduction was performed. Postoperatively a soft, Velpeau type bandage was used except for three patients in

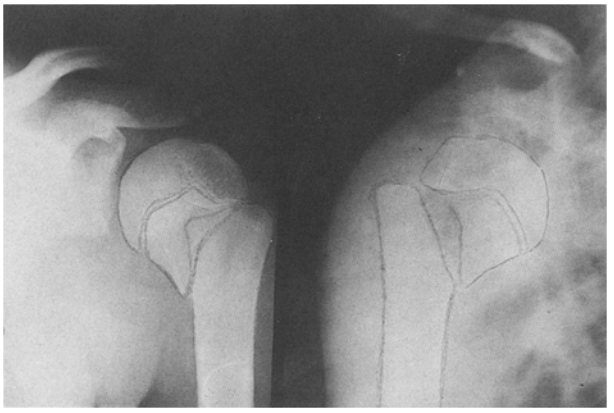

Fig. 1. Radiograph of the most common type of displaced fracture with the distal fragment anterolateral

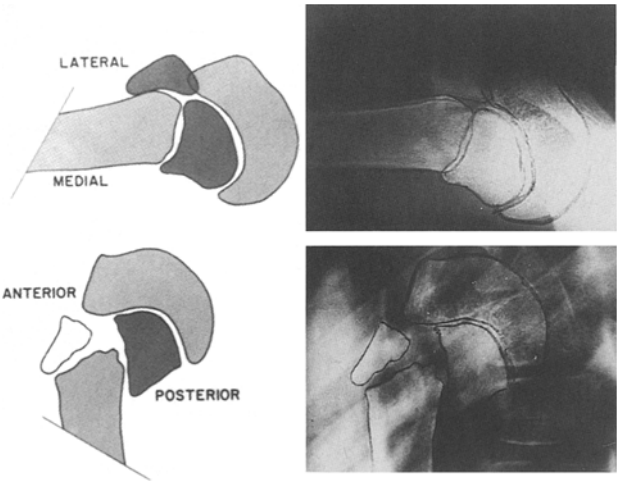

Fig. 2. Radiograph with an additional and separate anterolateral metaphyseal fragment

whom a thoracobrachial plaster was employed. Immobilization was for 32 days at which time the wires were removed.

Radiographic follow-up showed a residual lateral displacement and/or over 15 degrees of angulation except in 2 patients who had an anatomical reduction (Fig. 3).

Six patients had other fractures from the same injury. One had temporary paraesthesiae on the volar aspect of the index, middle, ring, and little fingers. No other neurological or vascular involvement occurred.

Results

The average follow up was for 6–8 years (range 2–11.4 years) Six patients had limited shoulder mobility in the affected shoulder compared to the other side; four were over the age of 13 years at the time of injury. Ten patients had a residual dysmetria (inability to arrest a muscular movement at a desired point

Table 1. Fractures of the proximal humeral epiphysis

Case Number	Age	Sex (1)	Side (2)	L-L displacement initial X-Rays (Ogden)	Angulation initial X-Rays (3)	Type of reduction (4)	L-L displ. postoperative X-Rays	Angulation postoperative X-Rays (Ogden)	Follow-up years	Pain	Final check up			
											Limited mobility	Dysmetria (cm)	Angulation X-Rays	Activity restriction
1[a]	15	M	R	III	VR/E	0	I	NO	11.4	NO	NO	1.0	–	No
2	15	M	L	II	VR/E	C	II	VR/E	4.1	NO	NO	4.0	VR/E	No
3	9	F	R	II	VR/E	C	I	NO	4.1	NO	YES	1.0	–	Yes
4	19	M	L	II	VL/E	C	I	NO	10.9	NO	NO	–	–	No
5	14	M	R	II	VL/E	C	II	VL/E	2.1	NO	YES	–	–	No
6	11	M	L	I	VR/E	C	NO	NO	2.8	NO	NO	–	–	No
7	17	M	L	III	VR/E	C	I	NO	5.9	NO	NO	–	–	No
8	10	M	L	II	VR/E	C	I	NO	7.2	NO	NO	1.0	–	No
9	13	M	L	II	VR/E	C	I	E	9.9	NO	NO	–	–	No
10	15	M	L	III	E	C	II	E	9.0	NO	NO	2.5	E	No
11	14	F	R	II	VL/E	C	I	E	10.2	NO	NO	–	E	No
12	8	M	R	III	VR/E	C	II	VR/E	11.1	NO	NO	–	–	No
13	15	M	L	II	VR/E	0	NO	VR/E	4.8	NO	NO	4.0	E	No
14	7	M	L	II	E	C	II	E	2.1	NO	NO	–	–	No
15[a]	10	M	L	II	VR/E	C	II	E	10.3	YES	YES	–	–	Yes
16	16	F	L	II	VL/E	C	II	E	8.0	NO	YES	1.0	E	No
17[b]	15	M	L	III	VL/E	0	I	NO	8.3	NO	NO	–	E	No
18	8	F	R	III	VR/E	C	I	VR/E	2.2	NO	NO	–	–	No
19	13	F	L	III	VR/E	C	I	VR/E	3.6	NO	YES	1.5	E	No
20	11	M	L	II	VR/E	C	NO	NO	6.6	NO	NO	–	–	No
21	13	F	L	III	VL/E	C	II	VL/E	2.1	NO	YES	1.0	–	No
22	15	M	R	II	VR/E	C	II	E	11.0	NO	NO	2.0	E	No

[a] Presence of a third fragment
[b] Interposition of tendon of long head of biceps
M, Male; F, Female; R, Right; L, Left; VR, Varus; VL, Valgus; E, Extension; O, Open; C, Closed

Ogden classification:
Grade I – Lateral displacement less than half the bone diameter
Grade II – Lateral displacement more than half the bone diameter
Grade III – Lateral displacement greater than whole bone-diameter

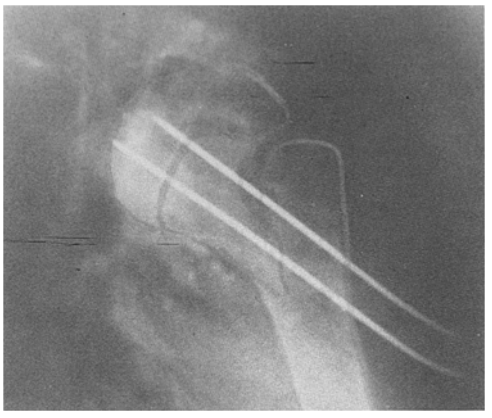

Fig. 3. Postoperative radiograph with residual lateral and varus displacement of the distal fragment and two Kischner wires in place

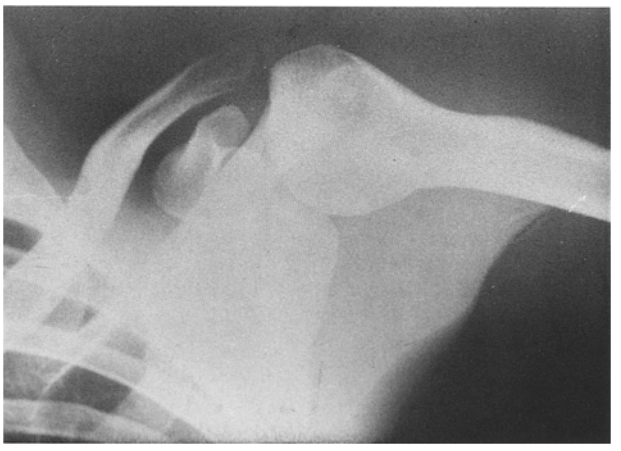

Fig. 4. Follow-up radiograph with slight residual varus angulation

which averaged 1.9 cm (range 1–4 cm). Six of these patients were over the age of 13 at the time of the injury (Table 1).

The radiographs at the last follow-up showed residual angulation in 8 patients (Fig. 4); all were aged 13 or more at the time of the injury. Of the 8 patients with marked angulation, 6 had reduced mobility or dysmetria at follow-up.

Two patients were aware of limitation of motion in everyday activities and both related this to a loss of strength. Three patients had slight discomfort with changes in weather and one reported pain in the shoulder region on carrying a weight.

Discussion

This study of fractures of the proximal epiphysis of the humerus shows good functional results in almost all patients. However, assessment of mobility, dysmetria and residual angulation shows one or more of these complications in 14 of the 22 patients. Reduced mobility is minor and well compensated. Dysmetria and residual angulation have only a slight functional effect.

The reduced mobility in 6 of 22 patients is greater than than reported by other authors [9, 10]. Open reduction has been associated with this complication [2] but this has not occurred in the 3 open reductions in this study.

A high incidence of dysmetria has been described by other authors [1, 2, 3, 12] and has been seen less commonly in younger patients [4]. It was noted in 10 patients of this series, 6 of whom were over the age of 13 at the time of injury. It was significant in 4 patients but tolerated well by all.

The position of the metaphyseal fragment with the epiphysis is usually posteromedial [6, 7, 9, 12, 13], but we have found 7 of the 22 patients to have the fragment posteriorly. The occurrence of a third fragment of the metaphysis separated anterolaterally from the epiphysis was seen in 2 patients (Fig. 2), and has not been previously described. It was present in the only patient who experienced pain in association with reduced mobility and a sensation of weakness. Shortening of the arm was not found.

Children under the age of 13 should be treated conservatively in spite of residual angulation or shortening. Patients over the age of 13 with marked displacement or angulation are likely to have residual loss of mobility and dysmetria, although with good functional results, unless an accurate reduction is obtained by initial treatment. A more aggressive approach is advocated in this group.

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