

Internal fixation of forearm fractures in children

Fourteen children with severely displaced diaphyseal fractures of both bones of the forearm treated with open reduction and internal fixation were reviewed; these operations represented 9 per cent of all the diaphyseal forearm fractures in children during a 9-year period. The mean age of the patients at the time of the injury was 12 (7–14) years; they were reexamined 8 (5–11) years later, all after cessation of growth.

At follow-up, limited pronosupination, observed in 8 patients, was associated with a fracture of the proximal third of the forearm; limited motion of the radiocarpal joint, in 2 patients, was associated with shortening of the ulna. Only 4 patients complained of pain or were aware of restricted motion, and the average function was good.

Open reduction and internal fixation is indicated in displaced fractures of the forearm even in children.

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Many authors have reviewed the results of closed treatment of fractures of the forearm in children (Evans 1945, Evans 1951, Hughston 1962, Blount 1967, Thomas et al. 1976), but only a few have paid attention to function in terms of radioulnar motion in relation to the residual deformity at the fracture site (Daruwalla 1979, Fuller & McCullough 1982, Alpar et al. 1982, Creasman et al. 1984). Alpar et al. (1982) suggested a more active policy in fractures in which adequate alignment cannot be achieved and maintained by closed methods. However, hitherto only one detailed analysis of the effects of open reduction and internal fixation has been reported (Nielsen & Simonsen 1984).

We have reviewed results of open treatment of forearm fractures in children.

Patients and methods

Between 1971 and 1979, 192 children with diaphyseal fractures of both the radius and the ulna were treated at our department. Open reduction and internal fixation were performed in 18 (9%) of the children in whom acceptable reduction was not achieved or could not be maintained (complete displacement and/or angulation and rotational malalignment) (Figure 1). One of the fractures was a severe open fracture (Case 7). Small compression plates, one-third tubular plates, and intramedullary Kirschner wires were used (Müller et al. 1979) (Table 1).

In 1984, 14 patients, all after cessation of growth and all but 2 males, attended a personal follow-up examination. The mean age of the patients at the time of injury was 12 (7–14) years, and the follow-up time was 8 (5–11) years (Table 1). The postoperative immobilization in plaster averaged 6 weeks. Kirschner wires were removed after 6 to 8 weeks, plates and screws after 6–14 months.

At follow-up, the patients were assessed for persisting symptoms, abnormal physical signs, and the range of movement. Anteroposterior and lateral radiographs of both forearms were obtained.

Results

Ten patients were good, i.e., subjectively asymptomatic with normal or only $\leq 20^\circ$ restricted joint mobility (Table 1). Four patients were satisfactory with slight pain on exercise and $\geq 20^\circ$ restricted motion.

Decreased range of forearm rotation was observed in 8 patients; the site of the fracture was in the proximal or middle third in all but 1 of these. Slight angulation was seen in 9 patients, and 5 of these had limited forearm rotation; the angulation affected both the radius and the ulna in 2 of these cases, only the radius in 1, and only the ulna in 6 cases (Table 1). In three ulnas, 5 mm of shortening was observed both clinically and radiographically. Slight limitation of radiocarpal extension-flexion was observed in 5 patients, and 2 of

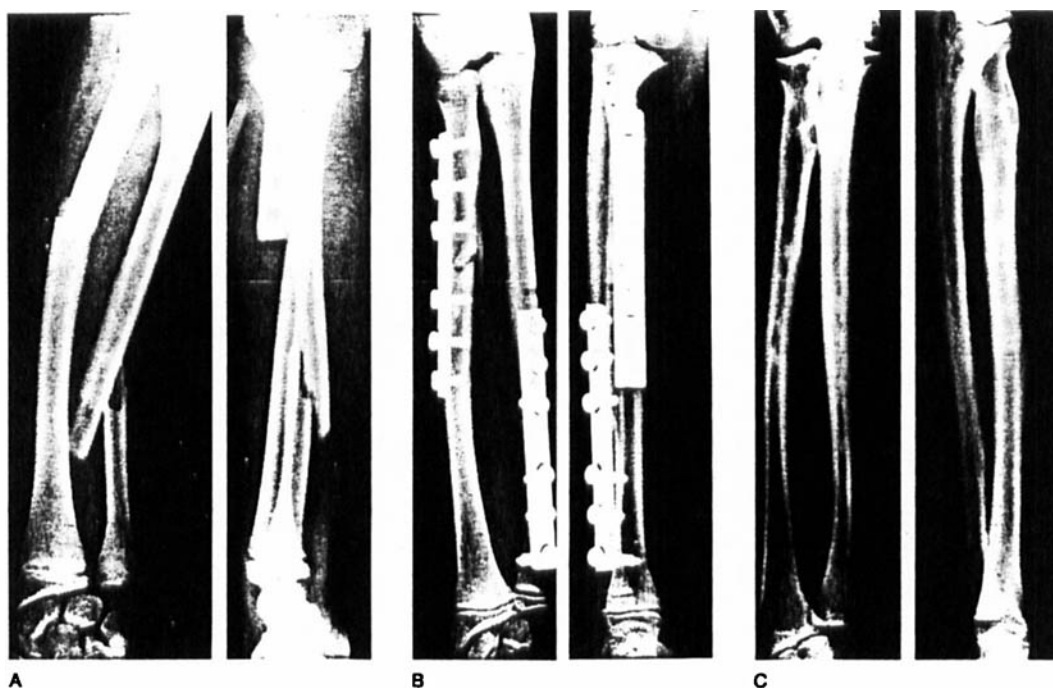


Figure 1. Case 5. Fracture of the forearm in a 14-year-old boy treated by internal fixation after unsuccessful close reduction. A. Displaced fracture. B. 3 weeks after open reduction and internal fixation with AO plates. The plates were removed after solid union at 7 months. C. Follow-up after 8 years. Forearm rotation was reduced by 40 degrees.

Table 1. Clinical data, anatomic, and functional results in 14 operated on forearm fractures in children

Case	Sex	Subjective result ^a	Postinjury growth (cm)	Location of fracture ^b		Fixation ^c		Years	Follow-up		
									Angular malalignment		Limitation of forearm rotation ^d (degrees)
				radius	ulna	radius	ulna		radius	ulna	
1	M	G	8	P	M	P	P	5	0	0	0
2	M	G	35	D	D	K	—	10	5	10	0
3	M	G	10	M	M	P	P	6	10	10	20 p
4	M	G	10	P	M	P	P	5	0	5	20 p
5	M	G	21	P	D	P	P	7	0	0	20 p
6	M	G	26	D	D	K	K	5	0	20	0
7	M	G	48	D	D	K	K	10	0	7	0
8	F	G	16	M	M	P	P	11	0	10	20 p
9	M	G	13	M	M	P	P	5	0	5	10 s
10	M	S	8	M	M	P	P	8	0	5	20 p
11	M	G	11	P	P	P	P	7	0	0	10 s
12	M	G	12	D	D	K	P	10	15	0	0
13	M	G	14	M	M	P	P	8	0	0	0
14	F	S	42	P	P	K	K	10	0	0	40 p, 10 s

^a G=good, S=satisfactory.

^b D=distal, M=middle, P=proximal.

^c K=2 Kirschner wires, P=plate.

^d p= pronation, s=supination.

them had ulnar shortening. The grip strength of the injured dominating hand was less than the strength of the contralateral one in 5 patients out of 8.

Two patients had scars exceeding 5 mm in width, and 1 of them regarded the cosmetic result as poor. There was one refracture after removal of the plates. Growth disturbances or infections did not occur. None of the patients complained of sensory disturbances.

Discussion

There are controversial opinions about the need of operative treatment of forearm fractures of children. Many earlier authors condemned open reduction and internal fixation (Evans 1951, Hughston 1962, Blount 1967, Thomas et al. 1976), whereas a less dogmatic point of view is emerging with open treatment if adequate alignment of fractures has not been achieved or maintained (Feldkamp & Daum 1978, Daruwalla 1979, Fuller & McCullough 1982, Alpar et al. 1982, Creasman et al. 1984, Nielsen & Simonsen 1984).

In our series, only the most severe fresh frac-

tures of both radius and ulna with unacceptable reduction results were operated on, closed treatment still being our policy. Fractures of the distal third of the radius and ulna led to fewer problems than more proximal fractures, as has been reported by Fuller & McCullough (1982) and Creasman et al. (1984). In all the cases but 1 with restricted rotation, the site of fracture was in the proximal or in the middle thirds of the ulna and radius. Shortening of the ulna seemed to occur easily and must be avoided; 2 patients out of 3 with ulnar shortening had an impaired range of movement of the radiocarpal joint. Impaired rotation was not always due to a residual angulation, but was also seen after fractures healed in exact anatomic position.

In conclusion, our results of open reduction and internal fixation were satisfactory in relation to the severity of the fractures, and no severe complications occurred. It appears unlikely that closed management could have given as good a functional recovery for these patients. Consequently, we see no reason to refrain from open treatment in children with severely displaced fractures of the forearm.

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