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ORIGINAL STUDY

Short intramedullary wiring for displaced metaphyseal fractures of the radius in children

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There is still debate about the proper treatment of completely displaced metaphyseal fractures of the distal radius in children. Although historically these fractures were treated by closed reduction and casting, some authors have reported that up to 25% of these injuries re-displaced early in the cast despite good initial reduction.

Since 2000 we have used closed reduction and percutaneous stabilisation with a short intramedullary wire, using a percutaneous technique, in children with completely displaced metaphyseal fractures of the distal radius. We retrospectively analysed the records of 100 children who were treated in our departments during a six-year period (2000-2005). Of these, 45 had early re-displacement of their fractures after an initial conservative treatment.

Our results suggest that closed reduction and short intramedullary wiring of these injuries allows adequate stabilization, maintains the alignment in the cast, reduces the need for follow-up radiographs, with a low rate of infections and complications, while healing occurs.

Keywords : distal radius fractures ; metaphyseal ; children ; percutaneous wire fixation.

INTRODUCTION

Injuries to the forearm in children are very common ; complete fractures of the distal metaphysis of the radius account for 60 to 75% of them. Traditionally, these fractures have been treated by closed reduction and casting, but, due to the intrinsic instability of these fractures in the cast, even with a good initial reduction, maintenance of alignment may be difficult and redisplacement and malunion have been widely described. As a result, many authors prefer the surgical treatment to prevent this complication (*3,6,9,10*).

In our view, formal fixation of these fractures is preferable ; a short percutaneous intramedullary pinning combines non-invasive closed reduction with a minimal internal fixation. The use of percutaneous wiring has been recommended by many authors (*2,4*), but the indications vary. Proctor *et al* (*8*) advocate fixation in all cases in which a perfect

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Fig. 1. — Preoperative radiograph (PA view) of a 9-year old boy who sustained a displaced metaphyseal fracture of the distal radius and an undisplaced fracture of the ulna.

reduction cannot be achieved, Prevot *et al* (7) recommend fixation in cases of instability or irreducibility ; Gibbons *et al* (4) use fixation in fractures with an intact ulna.

We report our results with short intramedullary pinning in 100 patients treated in our center, in 55 of them as a primary treatment and in 45 after displacement in the cast.

PATIENTS AND METHODS

From 2000 to 2005 we treated 100 children with fractures of the distal radius. All had a completely displaced metaphyseal fractures of the distal radius ; 25 (25%) also had a fracture of the ulna (Fig. 1). We excluded open fractures, physeal injuries and pathological fractures. There were 65 (65%) boys and 35 girls, with an overall mean age of 9.1 +/- 2.3 years. The right side was predominant (75 patients) ; the fracture affected the non-dominant limb in 25 cases only. The mechanisms of injury were : fall (88%), tripping (10%) and road traffic accident (2%). Concomitant injuries were a closed fracture of the femur (2%) and a fracture of the distal ulna (25%) ; in 73% of the patients the distal radius fracture was the only injury. Forty-five (45%) children were initially treated by closed reduction and above-elbow casting in other hospitals, then referred to our department owing to re-displacement within the first week after the injury and considered unacceptable. The mean time between injury and surgery was 8 +/-1 days. The other 55 children (55%) were treated in our institutions by reduction and inmobilization in a plaster cast.

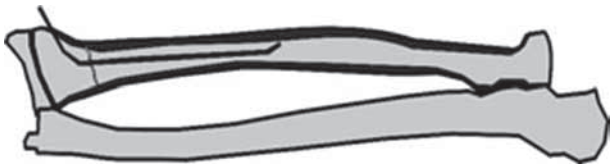

Fig. 2. — Schematic drawing of the intramedullary wiring

All children were treated surgically in our institutions within three hours after admission and after informing the parents about the different treatment options.

Operative technique (Fig. 2)

Under general anaesthesia, the entire upper limb was prepared, draped, and placed on a hand table. The fracture was first reduced under fluoroscopy guidance ; a small incision was then made 1 cm proximal to the distal radial physis, the cortex was perforated using a 2.5 or 3 mm Kirschner wire. A 1.6 or 2 mm K-wire – depending on age – with a slightly bent extremity was then introduced into the medullary canal across the fracture and pushed cranially up to 6 or 7 cm above the fracture site. We cut the wire straight under the skin and left it in the subcutaneous tissue. Finally, the limb was inmobilised in an above-elbow plaster cast with the forearm in a neutral position.

The mean operating time was 29 minutes (20-38). The mean radiation time was 1 minute and 15 seconds. The ulna was not fixed if fractured.

We now tend to systematically use a 2 mm K-wire.

The patients were generally discharged by 24 hours, after radiographs were obtained. Two or three weeks later, they returned for removal of the cast and cleaning of the wound. Mobilisation of the hand, wrist and elbow was encouraged to avoid stiffness. The pins were removed without any problem two or three weeks later, depending on the age of the child and the status of the callus formation, without using any type of anaesthesia. All patients were followed up clinically and radiologically at two or three weeks (removal of the cast), 6 weeks, three months (Figs. 3 & 4), and thereafter at yearly intervals until the end of their growth.

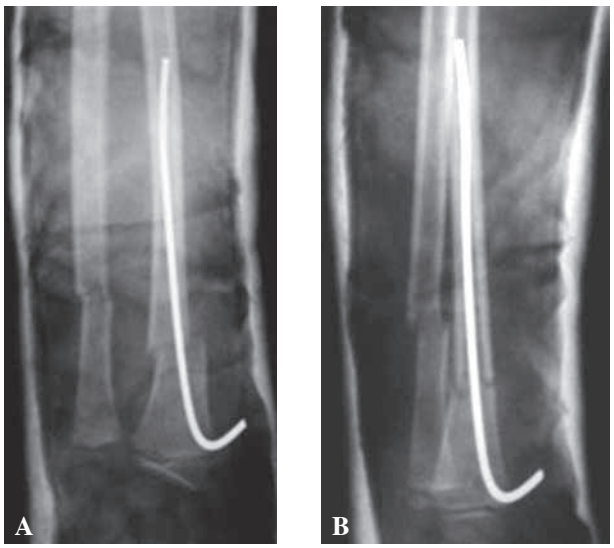

Fig. 3. — Same patient as figure 1 : radiographs after operative treatment. A : PA view ; B : Lateral view.

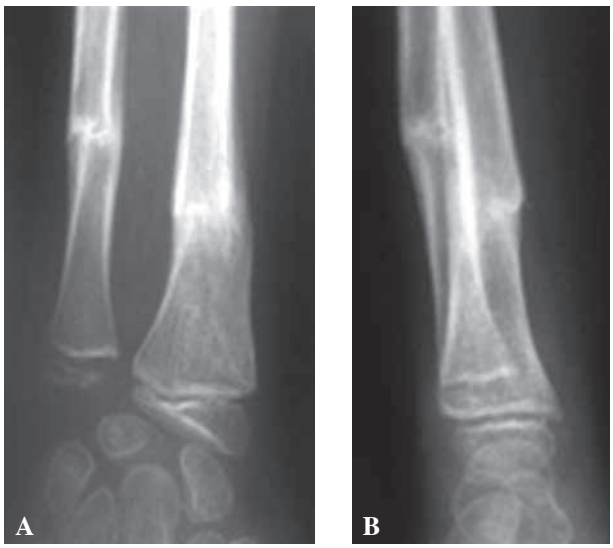

Fig. 4. — Same patient as figure 1. Radiographs three months after treatment, showing healing of the fracture in good position. A : PA view ; B : lateral view.

Table I. - Rating of results

Grade	Wrist movement	Radiological features	Symptoms
Excellent	normal range of movement	anatomical position	none
Fair	< 10º restriction in one plane or < 20º restriction in all planes	minor irregularities	intermittent and/or minimal pain
Poor	> 20º restriction in any plane	malalignment and deformity	permanent and/or severe pain

RESULTS

The postoperative course was uneventful in all children. Radiological signs of consolidation were noted at six weeks, and healing of the fracture was achieved three months after the injury.

Most of the patients showed complete clinical and radiological recovery with a normal range of movement of the wrist and forearm. The results were excellent in 92% of the cases and fair in 8% according to the scale described in Table I. The final range of motion of our patients was 71 +/-5º flexion, 70 +/-6º extension, 22 +/-7º radial deviation, 36 +/-8º ulnar deviation, 84 +/- 9.2º supination and 90 +/-3.4 of pronation.

Radiological records were complete in all cases. The radial length and radial inclination were almost normal during all the follow-up. We only had four cases of dorsal angulation up to 15°, without clinical relevance.

Finally, we found no differences in the clinical measurements between the 45 patients initially treated by a cast and the others who received inmediate surgical management.

Complications

We noted two superficial infections over the wire, which were successfully treated with antibiotics, two cast sores over the head of the ulna which healed without any problem, and we noted no migrations of the pins. We also had two neurapraxias of the sensitive branch of the radial nerve, which had recovered at 6-months follow-up.

DISCUSSION

The optimal management of completely displaced metaphyseal fractures of the distal radius in children is controversial. These fractures have a high tendency to re-displace despite satisfactory initial reduction (*4,6,10*). We used to treat this injury with closed manipulation and casting, but although this method has been shown to give good results, loss of reduction in the cast is a well-known complication ; in the past, we had to operate many fractures in children despite a good initial reduction (*10*). For this reason, we now treat these fractures with short wire percutaneous fixation, with excellent clinical and radiological results and a very low rate of complications.

McLauchlan *et al* showed in their study that supplementary percutaneous fixation results in a significantly better maintenance of the alignment of the fracture, reducing the need for follow-up radiographs and providing very good results, compared with the closed method of treatment (*6*). We share this view, and we use a similar treatment with modifications in the surgical technique, the point of entry and the length of the pin.

Delgado-Brambila *et al* reported good results and a very low morbidity in 105 patients, but the surgical technique was quite different, using two pins in the radius and always pinning the ulna (*2*).

Complications from the use of percutaneous wires have been rare and minor, as also reported by others (*2,3,5*).

We consider that one of the key points explaining the good results obtained in our series, is the short inmobilization time (two or three weeks) in a cast and the early recovery of active movement of the upper limb, earlier than reported by other authors (*4,6*).

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