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Paediatric radial neck fractures: One-step percutaneous reduction and fixation

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ABSTRACT

Introduction: Dislocated radial neck fractures of the third and fourth degree, according to the Judet classification, are rare events in children. These fractures account for 1% of all paediatric fractures. Their relatively low incidence is inversely proportional to the serious morphofuntional alterations that can follow without treatment.

Materials and methods: Nine paediatric patients with an average age of 9.1 years (range 6–12 years), with radial neck fractures of the third and fourth degree, according to the Judet classification, were treated between 2010 and 2011. All patients underwent percutaneous reduction and fixation using only one K-wire by the same surgeon in a surgery time of 20 min (range 15–25 min). The average follow-up was 26.6 months (range 12–36 months), with X-rays and clinical evaluations conducted at four time points. The results were assessed radiologically (Métaizeau classification) and clinically (Mayo Clinic Elbow Performance Score).

Results: X-ray results (according to Métaizeau) were excellent in eight cases and good in one case. Clinical results were excellent in all cases. There was only one minor complication: a superficial skin infection that was treated with an oral antibiotic.

Discussion: The purpose of this study was to evaluate the results achieved in our hospital with a percutaneous reduction and fixation technique using only one K-wire in children with dislocated radial neck fractures of the third and fourth degree. The results obtained indicate that a single percutaneous surgery act that circumvents further operations is the best option for these patients.

Conclusion: Although the number of patients in the study was small, the results are encouraging and support the continued use of this one-step percutaneous reduction and fixation technique.

Introduction

Radial neck fractures are rare events; they account for 1% of all paediatric fractures and about 5% of elbow injuries. The ossification centre of the radial head appears at about 4–5 years of age, while the complete fusion of the head with the metaphysis of the radius occurs between 14 and 17 years of age [1]. The physiological orientation of the radial head presents a lot of anatomical differences: in the frontal plane, the lateral angulation is between 0° and 15° (average 12.5°) and in the sagittal plane, it is between 10° in the anterior direction and 5° in the posterior direction (average 3.5° anterior) [2].

The main mechanism of radial neck fractures is an outstretched arm trauma. In a fall with the elbow extended, the force that the capitulum of the humerus normally applies to the proximal radius may result in a fracture that can include dislocation of the radial head. These fractures are classified according to Judet's classification [3] (Table 1) (Fig. 1). Most radial neck fractures are minimally angulated (I–II) and are usually managed conservatively [4]. Severely angulated fractures (III–IV) are rare and require surgical treatment with closed or open reduction and internal fixation; several techniques are described in the literature [5–9]. Open treatments give an anatomical reduction of the fracture, but may compromise the vulnerable blood supply to the radial head. Other risks of this treatment include early physeal closure, abnormal radial head enlargement and periarticular ossification [10]. Percutaneous reduction and leverage fixation techniques for radial head and neck fractures in children have been further developed since their introduction by Feray in

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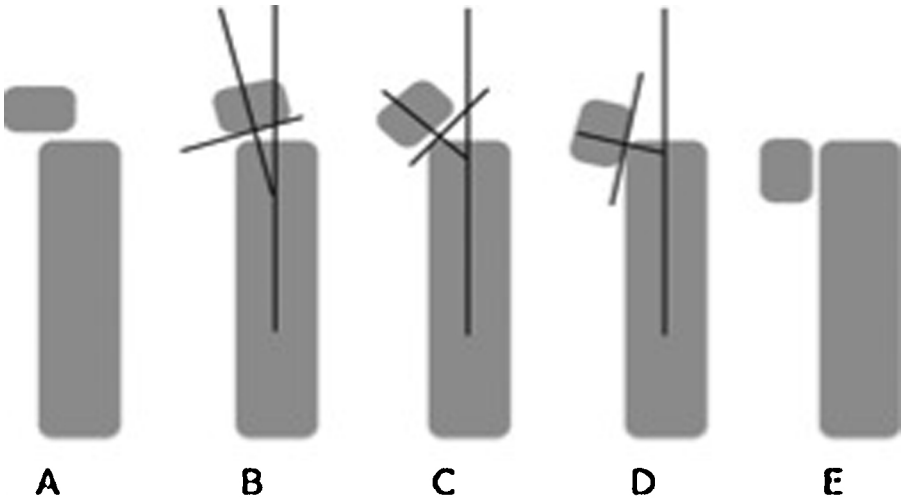

Fig. 1. Judet's classification.

Table 1
Judet's classification.

Type	Description
I	Compound fractures or angulation "ad latus"
II	Angulation less than 30°
III	Angulation between 30° and 60°
IVa	Angulation between 60° and 80°
IVb	Angulation more than 80°

1969, and are a less traumatic option [11–13]. The Métaizeau technique was introduced in the 1980s and has achieved excellent results, but it can be associated with complications, such as the risk of proximal physeal injury, extensor pollicis longus damage and superficial radial nerve injury at the pin insertion site [14–18].

This is a retrospective study of our experience using a modified percutaneous reduction and temporary leverage fixation method, similar to the one described by Cha et al. [19].

Materials and methods

Nine paediatric patients (five male, four female) with an average age of 9.1 years (range 6–12 years) with isolated radial neck fracture with a dislocation angle >50° were treated between 2010 and 2011. All fractures were closed with no associated vascular or neuronal injury. All procedures were performed by a single surgeon in a surgery time of 20 min (range 15–25 min).

Fig. 2. Preoperative AP rx (grade IVb).

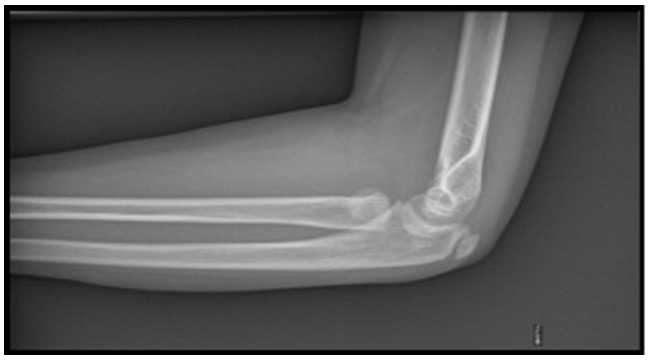

Fig. 3. Preoperative LL rx (grade IVb).

Two cases were classified as grade III (mean angle 52.5°; range 50–55°), four cases as grade IVa (mean angle 68.75°; range 60–75°) and three cases as grade IVb (mean angle 81.7; range 80–85°) (Figs. 2 and 3). The growth plates of all patients were open. All operations were performed within 12 h after injury. The elbow was immobilised with a splint during the time between the injury and surgery.

Surgical technique

Depending on patient age and size, a 1.4 mm or 1.8 mm K-wire was used. The K-wire was inserted percutaneously about 1 cm above the head of the radius from proximal to distal, to avoid cutaneous tractions of the wire, after stabilisation. Then, under the guide of the image intensifier (used during all passages), the wire was introduced by hand in the fracture site, passing under the annular ligament (Fig. 4). When the wire was inside the fracture site, it was used as a lever with fulcrum in the canal like the Kapanji's technique used for distal radial fractures to reduce the dislocation of the fracture. When reduction was obtained, the wire was advanced to the level of the radial tuberosity, which is an area rich in spongious bone that provides better stabilisation. The wire should not pass the medial cortex of the tuberosity to avoid a hyperostosis. Once stabilisation was achieved, the stability in prono-supination was tested and the