ORIGINAL ARTICLE

Distal humerus lateral condyle fracture in children: When is the conservative treatment a valid option?

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Introduction: Distal humerus condyle fracture in children is rare. These fractures often mislead the emergency physician or surgeon. However, treatment adapted to the degree of displacement achieves excellent clinical and radiographic results. The objective of this study was to clarify indications for conservative treatment of lateral humeral condyle fracture in children.

Materials and methods: Twenty-two children who had sustained lateral humeral condyle fracture between January 2007 and January 2010 were reviewed in April 2010. At this consultation, the children underwent clinical and radiological examination. The Hardacre functional score was used to determine objective clinical outcome.

Results: Conservative treatment was exclusive to cases of lateral condyle displacement equal to or less than 1 mm. All other fractures were managed by surgical open reduction and fixation using cross-pinning. There was no statistically significant difference in clinical or radiological outcome between conservative and surgical management.

Discussion: Lateral humeral condyle fracture is difficult to diagnose in children. The majority of poor results reported in literature relate to inadequate initial treatment. Given a radiological aspect of hemorrhosis of the elbow, the emergency physician prescribes multiple X-ray views of the affected elbow (anteroposterior, lateral and internal oblique). The clinical aspect of lateral humeral condyle fracture is often characteristic (ecchymosis facing the head of the radius). Nondisplaced or minimally displaced lateral humeral condyle fracture can be managed conservatively under close survey. However, secondary displacement under the cast is often difficult or impossible to detect, and outpatient surgery is therefore being increasingly indicated in our department.

Level of evidence: Level IV.

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KEYWORDS
Distal humerus fracture; Humerus lateral condyle fracture; Children; Closed treatment; Humerus

Introduction

Lateral humeral condyle fracture in children is rare, at 5 to 20% of pediatric elbow fracture [1–3], in second place
between supracondylar and medial epicondylar fracture [3,4]. Such Salter III or IV fractures sometimes show little or no displacement, which may mislead the emergency or orthopedic physician [1,2]. Complications include secondary displacement, nonunion and epiphysiodesis of the distal extremity of the humerus. They are thus a severe form of elbow fracture, taken very seriously by physicians [5–7]. Treatment adapted to the degree of fracture site displacement, however, ensures excellent clinical and radiological results, while minimizing complications [4].

Management of fractures showing little displacement remains controversial. The present study sought to determine indications for conservative treatment of lateral humeral condyle fracture in children, by a retrospective review of our experience.

Material and methods

Between January 2007 and January 2010, 28 fractures of the lateral humeral condyle, in 27 children, were managed in the pediatric orthopedics department of the Mother and Child Hospital (Dupuytren University Hospital, Limoges, France). Twenty-two of the children (22 fractures) were seen at more than 5 months’ follow-up; four (including one child with right elbow fracture followed by left elbow fracture 3 months later) could not be traced or could not attend the control consultation, and were excluded from the study.

Preoperatively, the fractures were classified according to Lagrange and Rigault [8–10]. We preferred this classification to Milch’s, which is generally used in the literature, since Pennington in 2009 showed the latter to give very low inter- and intraobserver correlations [11]. Type I corresponds to little or no displacement, type II to moderate lateral translation with or without tilt of the fragment, and type III to major tilt or rotation of the fragment on its axis (Fig. 1). Classification was based on the typology attributed by the surgeon in the surgical or emergency report. X-rays were then reviewed to measure the space between the bone fragments on AP and lateral views. Later X-rays revealed signs of secondary displacement, nonunion, hypertrophy or osteonecrosis of the lateral humeral condyle. The Baumann angle was calculated from the latest X-ray views (Fig. 2).

Follow-up included bilateral comparative examination. Mobility angles in flexion-extension and pronosupination, humeral-radial angle and surgical scar length were recorded, along with any aspect of lateral condyle hypertrophy. Children and parents were questioned on subjective results in the fractured elbow. Clinical results were categorized as excellent, good or bad according to their Hardacre score [2,12]: “excellent” implying no elbow mobility deficit, frontal deviation or residual pain; “good”, a mobility deficit < 15° with slight frontal deviation and no residual pain; “bad”, mobility deficit > 15°, major frontal deviation, or persistent pain.

For statistical analysis, quantitative variables were expressed as mean ± standard deviation or median with range, and qualitative variables as percentage. Group comparison used Chi² or Fisher exact tests, depending on the theoretical sample size, for qualitative variables and Student t or Mann-Whitney tests for quantitative variables. The significance threshold was set at 0.05 in all cases. Analysis used Statview 5.0 software (SAS Institute, Cary, NC, USA).

Results

The 22 children included in the study comprised 13 girls (59%) and nine boys (40%); mean age at fracture, 4.6 years (range, 2–7 yrs). Thirteen fractures involved the nondominant (59%) and nine the dominant side (41%). All patients were treated by a senior specialized pediatric surgeon.
Review of the surgical and emergency records found seven Lagrange type I fractures (32%), nine type II (41%) and six type III (27%).

Type I fractures had a mean 0.7 mm (σ: 0.5) gap between fragments on AP and 0.2 mm (σ: 0.5) on lateral views. Radiologic hemarthrosis was systematic. The gap between fragments never exceeded 2 mm. In two cases, the fracture was visible only on AP view. All type I fractures were managed conservatively, by at least 6 weeks’ immobilization in a long-arm cast in neutral pronosupination and 90° flexion. No secondary displacement was found in this group.

Type II fractures had a mean 2.1 mm (σ: 1.1) gap between fragments on AP and 2.8 mm (σ: 1.3) on lateral views (range, 2-4 mm).

Type III fractures showed rotation of the fractured lateral condyle on AP view, with associated elbow dislocation in two cases.

In types II and III, management was by open surgery, using two crossed nails after reduction and visualization of the trochlear line. The patients were then immobilized for 6 weeks in a long-arm cast. Nails were surgically ablated at a mean 8 weeks, under general anesthesia.

Mean clinical and radiological follow-up was 15.7 months (σ: 12.4). At FU, mean elbow flexion was 135° (σ: 5.5), extension 6.7° (σ: 1.8) and humeral-radial angle 6.7° (σ: 1.8°). Late X-ray found consolidation in all cases. Mean Baumann angle was 70° (σ: 2.2).

Two groups were formed for comparison of clinical results according to type of management: a Conservative group, composed of children with type I fracture, and a Surgical group (types II and III).

The Conservative group comprised seven children and the Surgical group 15. The groups were comparable for age (P: 0.1), gender (p: 0.4) and mean FU (P: 0.1) (Table 1). There was no significant difference in recovery of flexion and extension, humeral-radial angle, Baumann angle or Hardacre score (Table 1).

There were no complications in the Conservative group. In the surgical group, there were two cases of hypertrophic scar (13%) and one of clinical and radiological hypertrophy of the lateral humeral condyle, with associated reduction in humeral-radial angle (7%).

**Discussion**

Lateral humeral condyle fracture in children is difficult to diagnose [2]. Most of the poor results reported in the literature were due to defective initial management [13]. The present study confirmed the good clinical and radiological results obtained with optimal treatment. Type II and III fractures on the Lagrange and Rigault classification should systematically be managed by pinning under open surgery [1], but with certain limitations. The first limitation lies in the definition of type I: is a 2 mm displacement type I or type II [1]? A review of our own departmental records revealed increasing resort to surgery for lateral humeral condyle fracture in children, with conservative management reserved for fractures in which the gap between bone fragments did not exceed 1 mm; when the gap was of at least 2 mm, surgery was systematic. The second limitation concerned follow-up: the children were systematically seen at 1 and 2 weeks to check for secondary displacement; on reviewing the X-rays, however, the gap between bone fragments could not be measured, either on AP or on lateral views. Secondary displacement is difficult to demonstrate, especially as it is progressive. Certain authors recommend removing the cast at each follow-up consultation, so as to be able to have good quality X-ray [2]. However, the fracture is still fresh, the elbow painful and the risk of secondary displacement is considerable; in children, moreover, cast ablation is often poorly tolerated. In case of conservative management, we therefore recommend renewing the cast at 2 weeks’ FU to enable control imaging. According to Launay, conservative treatment should be indicated only where good compliance with treatment and follow-up is assured [4].

The present study found comparable clinical and radiological results in both conservatively and surgically treated fractures. Associated elbow dislocation did not appear as a factor of poor prognosis, unlike in Sharma’s report [14]. The most frequent drawback of surgical treatment lies in the aspect of the surgical scar, which is often hypertrophic on the lateral side of the elbow and tends to lengthen with growth. Certain authors recommend percutaneous pinning in type I fracture, to limit the problems associated with conservative and surgical treatment [15]. According to Launay, however, in 70% cases of percutaneous pinning of the lateral humeral condyle, fracture site reduction is deficient and secondary open surgery for osteosynthesis is required [4].

Finally, it seems clear that, in lateral humeral condyle fracture in children, the result basically depends on good diagnosis. The present study found variable fracture site displacement depending on the AP and lateral radiographic incidence. Twenty-eight percent of type I fractures were vis-

<table>
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<th>Table 1</th>
<th>Comparison of clinical and radiological results according to treatment strategy.</th>
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<td>Conservative group (n = 7)</td>
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<tr>
<td>At last FU</td>
<td>Flexion (degrees)</td>
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<td></td>
<td>Extension (degrees)</td>
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<td>Humeral-radial angle (degrees)</td>
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<td>Baumann angle (degrees)</td>
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<td>Hardacre score (percentage)</td>
<td>Excellent</td>
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<td>Good</td>
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<td>Bad</td>
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Characteristic clinical aspect of lateral humeral condyle fracture (subcutaneous spread of fracture hematoma).

The present study has certain limitations. The design was retrospective, and the series was small, weakening the statistical power. Comparison was between conservatively and surgically managed groups, which differed, however, in the degree of initial displacement. Even so, the clinical and radiological results were comparable, whichever the treatment strategy. A prospective randomized study is therefore mandatory in case of doubt as to diagnosis or treatment. Meyer stressed the characteristic clinical aspect of the hematoma in lateral humeral condyle fracture, initially located on the lateral side of the elbow as a localized tumefaction opposite the head of the radius (Fig. 3) [16].

Disclosure of interest

The authors declare that they have no conflicts of interest concerning this article.

References