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Original article

Proximal ulnar osteotomy in the treatment of neglected childhood Monteggia lesion

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ABSTRACT

Introduction: The aim of our study was to analyze medium and long-term results of proximal ulnar osteotomy with and without ligament injury in neglected Monteggia injury in children.
Material and methods: This retrospective, multicenter study included 28 patients. Clinical criteria concerned the range of motion, pain and MEPI score, and radiologic criteria comprised of Storen line, head-neck ratio, radial neck angle, and signs of osteoarthritic remodeling.
Results: Twenty-eight patients were reviewed, at a mean 6 years' follow-up (range, 2–34 y). Sixteen had proximal ulnar osteotomy without ligament reconstruction, and 12 had associated ligamentoplasty. Both groups showed significant clinical and radiological improvement, with no significant difference. Patients operated within less than 1 year had better clinical and radiographic results. There was no correlation between age at surgery and quality of results. The 5 patients who underwent condyloradial pinning showed early recurrence of dislocation and osteoarthritic remodeling. The three cases of Bado type-3 lesion had early recurrence of dislocation.
Discussion: Proximal ulnar osteotomy gives good long-term results in Bado type-1 lesions, regardless of age, if performed before 1 year, in the absence of osteoarthritic remodeling. Associated ligamentoplasty does not seem to be useful.
Level of evidence: IV (retrospective).

1. Introduction

Management of chronic Monteggia lesion [1] is complicated by fibrosis preventing any reduction by external maneuver after 3 weeks' evolution [2,3]. The most widespread attitude is currently open reduction of the radial head associated to posterior (or, depending on the type of dislocation, anterior) opening wedge ulnar osteotomy with or without annular ligament reconstruction [4]. In France, this procedure was promoted by Bouyala [5]. Data are scant for long-term outcome [6]. Annular ligament reconstruction is controversial. The present multicenter retrospective study compared results for the Bouyala procedure with versus without plasty of the annular ligament of the radial head in evolved radial head lesion (Monteggia lesion), assessing the benefit of associating ligamentoplasty to ulnar osteotomy.

2. Material and method

A multicenter retrospective study was conducted in four pediatric orthopedic surgery departments, including patients who had undergone open reduction of radial head dislocation associated to proximal ulnar osteotomy for posttraumatic Monteggia lesion treated more than 3 months post-trauma, with a minimum 2 years' follow-up. Twenty-eight patients were recruited, who had been operated on between 1976 and 2009 (16 female, 12 male), all with at least 2 years' follow-up. Mean age at trauma was 5 years (range, 17 months to 12 years). Mean trauma-to-diagnosis interval was 7.4 months (3–36 months). Mean postoperative follow-up was 6 years (2–34 years). Mean age at follow-up was 12 years (4–43 years).

The Monteggia lesions were classified on preoperative AP and lateral elbow radiographs following Bado [7] (Table 1): 25 type 1 (anterior dislocation of the radial head) (Fig. 1), no type 2 (posterior dislocation), 3 type 3 (lateral dislocation) and no type 4 (dislocation of the radial head with associated fracture of both forearm bones).

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Table 1
Composition of the 2 groups of patients.

	Ligamentoplasty group	No-ligamentoplasty group
Number of patients	12	16
Boys	5	7
Girls	7	9
Mean age at trauma	6 y 9 months (3–12 y)	5 y 2 months (17 months-9 y)
Mean age at surgery	7 y 7 months (4–12 y)	6 y 7 months (4–9 y)
Trauma-to-surgery time	8.5 months (3–44 months)	10.5 months (3–30 months)
Bado 1	11	14
Bado 2	0	0
Bado 3	1	2
Bado 4	0	0
Mean FU	7 y 9 months (2–34 y)	5 y 0 month (2–19 y)

Fig. 1. Five-year-old boy consulting for unexplained anterior swelling of the anterior left elbow and flexion deficit. Elbow injury sustained during a fall from height four months previously. The radiograph shows anterior dislocation of the radial head (Bado type-1 lesion) with calcification of annular ligament remnants.

Mean posterior displacement angle was 6° (0°–29°) and mean varus 4° (0°–23°). In 4 cases, there was preoperative radial head growth disorder, in 8 cases ectopic ossification and in 1 case, capitulum hypoplasia.

Surgery used Boyd's posterolateral elbow approach [8]. The humeroradial joint was cleansed of fibrosis and annular ligament residue hindering radial head reduction. Proximal ulnar osteotomy was performed using an oscillating saw. The osteotomy opening allowed reduction via the interosseous membrane and was determined so as to enable reintegration of the radial head. Some teams used bone grafting of the osteotomy site. The osteotomy was then fixed in reduction by a one-third-tubular plate (Fig. 2). Radial

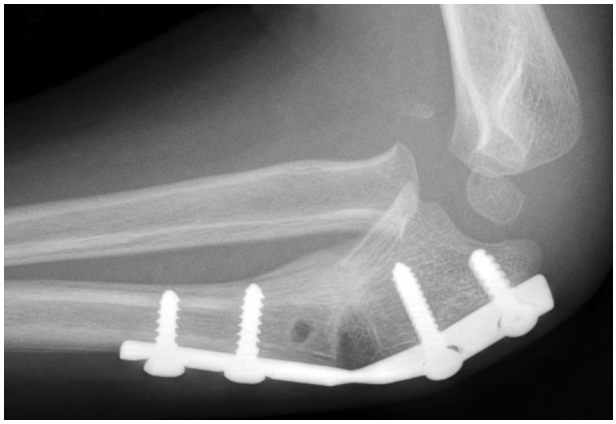

Fig. 2. Radiograph 6 weeks after open reduction of the radial head with hypercorrective ulnar osteotomy, bone graft and ligamentoplasty.

head stability was tested in all axes of elbow motion before closure. In some cases, Bell-Tawse annular ligament reconstruction was associated in the same step [9], depending on the surgeon's school of thought. Five patients underwent condyloradial pinning for residual intraoperative instability. The limb was immobilized in a brachial-antebrachial-palmar cast, with the forearm in neutral pronation-supination or supination, depending on the preoperative assessment results, for 4 to 6 weeks. The plate was removed as of the 6th postoperative month.

Pain, ranges of motion, stability, discomfort in everyday life and Mayo Elbow Performance Index (MEPI) [10] were assessed at last follow-up, as were radial head or capitulum deformity, osteoarthritic remodeling, frontal radial neck angle and radial head hypertrophy following Kim et al. [11]. Radial head dislocation or subluxation was assessed by tracing the Storen line, representing the radial axis [12]. Radiographic results were classified in 3 categories: good (complete reduction of the radial head without osteoarthritic remodeling of the elbow) (Fig. 3), mediocre (persistent subluxation, osteoarthritic remodeling of the elbow) and poor (dislocation of the radial head).

Osteochondral radial head lesions were found intraoperatively in 4 cases with more than 1 year's trauma-to-surgery interval. Eight patients underwent ligamentoplasty using tricipital fascia (including 4 pediculated grafts) and 4 using antebrachial fascia (including 1 pediculated). Six patients had osteotomy site bone graft.

Statistical analysis used the Wilcoxon test and Spearman correlation test. The significance threshold was set at 5%.

3. Results

At last follow-up, flexion and extension showed significant improvement ($P < 0.05$) as did MEPI, especially as regards of the range of motion and stability ($P < 0.01$) (Table 2). Patients operated on less than 1 year post-trauma showed clinically significant improvement in flexion and MEPI ($P < 0.01$), unlike those operated on later, the difference between these 2 groups being significant ($P < 0.05$) (Table 3).

Table 4 presents the evolution of the various radiographic parameters. Mean radiologic consolidation time was 9 weeks. There was 1 case of non-union despite bone grafting, due to failure of osteosynthesis. Radiologic results were good in 20 cases, mediocre in 4 and poor in 4. There was a significant correlation between the quality of radiologic results and time to surgery ($P = 0.038$).

There was no correlation between the age at surgery and the quality of radiologic or clinical results.

All the cases of recurrence of dislocation or subluxation were early, during cast immobilization or as of cast ablation (and ablation of any condyloradial pin). All 3 Bado type-3 patients showed early recurrence of dislocation; they had not had ligamentoplasty.

Patients were grouped according to associated annular ligamentoplasty (Table 5). Both groups showed significant improvement