

Pediatric Lateral Condyle Humeral Fractures With and Without Associated Elbow Dislocations: A Retrospective Study

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Abstract

In the pediatric population, lateral condyle fractures are relatively common elbow injuries, but not nearly as common are traumatic elbow dislocations, and these 2 types of injuries in combination are even less common. Our literature search showed only 2 reports on these concomitant injuries.

In the study reported here, we evaluated a consecutive series of pediatric patients with lateral humeral condyle fractures with and without elbow dislocation and compared the groups' results.

In children, lateral condyle fractures are relatively common, accounting for 12% to 20% of pediatric elbow fractures,^{1,2} but not nearly as common are traumatic elbow dislocations, which represent only 3% to 6% of all elbow injuries.³ These 2 types of injuries in combination are even less common. The literature includes only 2 reports of elbow dislocations associated with lateral condyle fractures in children, emphasizing the rarity of this concomitant injury.^{4,5}

Lateral condyle fractures require accurate and timely diagnosis and appropriate treatment to prevent additional problems. Misdiagnosis and improper or inadequate treatment might result in serious complications with significant consequences for elbow joint function and neurologic function in the arm and hand.^{5,6} Delayed union, malunion, and tardy ulnar nerve palsy are the most common complications associated with this fracture. As the pediatric elbow is usually incompletely ossified when this fracture occurs, recognizing the injury and its severity requires a high index of suspicion and seasoned judgment in approaching treatment.

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Lateral humeral condyle fractures in and of themselves are significant injuries, as mentioned, but those associated with a concomitant elbow dislocation might present more problems and are certainly less common. Given recent involvement in the treatment of an associated elbow dislocation and lateral condyle fracture, it was thought that a review of the experience with these injuries at a single medical center, consisting of a full-service children's hospital and the county hospital, would be helpful in identifying treatment approaches and their outcomes.

The specific purpose, then, of this retrospective clinical and radiographic review was to evaluate the outcomes of treatment of patients with lateral humeral condyle fractures with and without elbow dislocations. Another purpose was to evaluate the incidence of elbow dislocation among patients with lateral condyle fractures presenting to a children's hospital and its affiliate county hospital over a specified period.

METHODS

We conducted a retrospective chart and radiographic review of 906 pediatric elbow fracture patients who had been admitted to or evaluated at Riley Hospital for Children and Wishard Memorial Hospital in Indianapolis, Indiana, between 1990 and 2006. We identified these patients with use of 4 different ICD-9 (*International Classification of Diseases, Ninth Revision*) codes. Inclusion criteria were children with lateral humeral condyle fractures with or without elbow dislocation. The medical records of these patients were then evaluated for various demographic data, including sex, age at presentation, presence or absence of dislocation associated with lateral condyle fracture, procedures performed, complications, and outcomes. No specific or standardized outcome instrument was used to assess technical results or patient satisfaction with treatment or functional outcomes. Information reflecting technical issues was derived from radiographic evidence of alignment and fracture healing as noted by clinicians and radiologists, and clinical results were obtained from the progress notes in the charts. A patient was considered to be in follow-up status until the fracture was radiographically healed, as determined by the clinician, and until the range of motion (ROM) was restored as close as possible to that of the uninjured side. The anatomical outcome of fracture treatment was based on

Table I. Summary of Condyle Study Results

n	118
Sex	65 boys (55%), 53 girls (45%)
Race	92 Caucasian (78%), 13 Black (11%), 11 Hispanic (9%), 2 Asian (2%)
Mean age at presentation (n = 83)	5.6 years (SD, 3.1 years; range, 0.5-16.6 years)
Elbow dislocations	10 (8.5%)
Perioperative complications	3 (2.5%): 2 reoperations, 1 pin-site infection
Fracture reduction problems	4 converted to ORIF (3.4%)
Procedures	63 ORIF with pins (53%), 12 CR with pins (10%), 3 ORIF with screws (2.5%), 5 CR with pins (4%), 35 cast without surgery (30%)
Stable elbows	118 (100%)
Avascular necrosis	None
Readmissions	3 (2.5%)
Adverse events	2 reoperations (1.7%)
Secondary surgeries	2 as above (1.7%)
Radiographic outcomes	All healed anatomically, no nonunions, no malunions

Abbreviations: ORIF, open reduction and internal fixation; CR, closed reduction.

clinician notes regarding both the clinical status of the arm and the radiographic appearance of the fracture as judged by clinician and radiologist. Categories of radiographic outcome were *healed and anatomical alignment, malunion, and nonunion*. Criteria for categorization were based on the usual parameters used by both clinicians and radiologists for this purpose.

Treatment decisions were usually based on amount of fracture displacement at initial presentation. Most undisplaced fractures and minimally displaced (<2 mm) fractures were treated nonoperatively or closed with a cast, unless follow-up showed a displaced fracture. Fractures

RESULTS

We identified 118 consecutive patients with lateral condyle fractures with or without ipsilateral elbow dislocations treated at the children's hospital and affiliated county hospital between 1990 and 2006 (Table I). Of these patients, 10 (8.5%) had a concomitant ipsilateral elbow dislocation. There were 65 boys (55%) and 53 girls (45%) (Table I). Of the 118 patients, 92 (78%) were Caucasian, 13 (11%) were Black, 11 (9%) were Hispanic, and 2 (2%) were Asian. At time of injury and treatment, mean age was 5.6 years (range, 0.5-16.6 years); mean age for patients with an associated elbow dislocation was 6.7 years.

“We found that treatment of minimally displaced or nondisplaced lateral condyle fractures in pediatric patients could be treated nonoperatively with excellent results....Operative treatment, however, is absolutely required for displaced fractures.”

displaced more than 2 mm were treated surgically, with reduction (closed or open) and fixation. In cases involving an associated elbow dislocation, the dislocation was treated first, with closed reduction; later, the lateral condyle fracture was treated surgically. Surgical treatment was terminated only when essentially anatomical reduction and stable fixation were noted visually or with confirmation using imaging intensification. The decision to use smooth pins (percutaneous vs buried) or screws was made by the attending surgeon. The distal ends of percutaneous pins protruded from the skin and were removed without anesthesia in the cast room after healing was documented on radiographs. Buried pins did not protrude from the skin and were removed with the patient under local or general anesthesia. All surgical patients had their arms immobilized with either a posterior splint or a long arm cast.

The Indiana University institutional review board approved this study with the restriction that patients would not be identified in any publications or presentations.

Thirty-five patients (30%) underwent only closed treatment, with a cast; the other 83 patients (70%) underwent surgical treatment (type depended on whether reduction was closed or open). However, all patients underwent fracture stabilization with some form of fixation. In 4 patients, closed reduction was unsuccessful and was converted to open reduction to achieve satisfactory alignment. Two patients who underwent open reduction presented with delayed union (as a result of prior treatment) or had non-significant radiographic signs of healing 3 months after the index surgery. Neither patient had an associated elbow dislocation.

As opposed to the overall study cohort, all patients with an associated elbow dislocation underwent open reduction and fixation of the lateral condyle fracture after closed reduction of the elbow dislocation. The vast majority of patients treated with both closed and open reduction then had splints placed for 3 to 4 weeks. External immobilization was continued after that only when there was a question about complete healing, but this situation was

Table II. Elbow Dislocation Group

n	10
Sex	9 boys, 1 girl
Race	9 Caucasian, 1 Black
Mean age at presentation	6.7 years (SD, 1.6 years)
Perioperative complications	None
Reduction problems	1
Procedure	10 open reduction and internal fixation with pins
Stable elbows	10
Avascular necrosis	None
Readmissions	None
Adverse events	None
Secondary surgeries	None
Radiographic outcome	All healed anatomically, no nonunions, no malunions

extremely unusual. Casts were on for 3 to 4 weeks or, if not healed within that period, until radiographs showed signs of healing. Treatment was considered complete when elbow ROM was within normal limits or similar to that of the uninjured side (Table II).

Surgical treatment had 3 complications: 2 displaced fractures (reoperations were performed to restore anatomical alignment) and 1 pin-site infection (percutaneous pin). All 3 patients required readmission.

Eventually, all fractures healed in essentially anatomical alignment. There were no instances of malunion or nonunion and no instances of avascular necrosis of the lateral condyle. There seemed to be no difference in outcomes between patients treated nonoperatively and operatively, including patients with a concomitant ipsilateral elbow dislocation. The only statistical difference between patients with and without elbow dislocations involved sex: Boys were more likely than girls to sustain this injury ($P < .05$). Although patients with a concomitant elbow dislocation were somewhat older (6.7 vs 5.6 years), age was not statistically significant. There was a statistical trend ($P = .089$) favoring closed reduction of elbow dislocations and open reduction and internal fixation/pins for the condyle fractures as the treatment of choice.

DISCUSSION

Epidemiologic analysis of this study confirmed that elbow dislocations associated with lateral condyle fractures occur more often in boys than in girls.^{4,5} Mean age at time of lateral condyle fracture was 5.6 years, similar to the age reported in other series.⁷ Mean age at time of lateral condyle fracture with an associated elbow dislocation was 6.7 years, less than what has been previously reported: 9 years⁴ and 12 years.⁵ In our cohort, the incidence of elbow dislocations and associated lateral condyle fractures was 8.5%.

Treatment of minimally displaced lateral condyle fractures is somewhat controversial. However, as the elbow structures in this age group are incompletely ossified, determining the amount of displacement can be difficult, and the amount can be misleading. Some surgeons advo-

cate nonoperative treatment for minimally displaced (<2 mm) fractures,⁸⁻¹⁰ others advocate open surgical treatment for even minimally displaced fractures in which the fracture line is clear,¹¹ and still others advocate open reduction and fixation for all fractures given the propensity for minimally displaced fractures to become displaced when treated closed and to lead to complications when not recognized early.¹² Complications most often associated with misdiagnosis or inadequate treatment include nonunion, malunion, avascular necrosis, and tardy ulnar nerve palsy.^{7,13} In the present study, however, we found that treatment of minimally displaced or nondisplaced lateral condyle fractures in pediatric patients could be treated nonoperatively with excellent results. No patient developed any complications, and results did not differ for patients treated nonoperatively and operatively.

Operative treatment, however, is absolutely required for displaced fractures. In addition, all our study patients with an associated elbow dislocation underwent open reduction and fixation of their lateral condyle fractures. As that is the case, no comment can be made about any attempt at closed reduction of the elbow dislocation and closed reduction without surgical treatment from this cohort. None of the traumatic elbow dislocations had an associated injury other than the lateral condyle fracture, and there was no subsequent instability of the elbow joint once the reduction had been achieved and the lateral condyle fracture healed. Although addition of an elbow joint dislocation would seem to indicate a more severe injury and perhaps a worse outcome, this was not found to be the case in our study. In fact, the results of nonoperative treatment of the elbow dislocations and surgical treatment of the lateral condyle fractures were universally good, and there was no difference among the groups. Our study results confirm the relatively benign effect of elbow dislocation associated with lateral condyle fracture when compared with isolated lateral condyle fracture, as evidenced by the excellent healing and alignment and lack of vascular and neurologic injury, as demonstrated in other studies.^{4,14-17} Previous research^{4,17} was based on 1 case study; other research¹⁴ involved fracture of the medial epicondyle. Few research studies have provided information on lateral condyle fractures, and even fewer have subdivided these injuries into those associated or not associated with elbow dislocations. Therefore, our somewhat limited research study provides insight into the rare association between these injuries. When children present with elbow injuries, medical professionals should keep this association in mind so they can ensure that appropriate (and enough) radiographs are taken for proper diagnosis and treatment.

The data available to us and authorized under our approval for this retrospective study were very limited. Specific follow-up data, including exact length of treatment and exact ROM measurements, were not extracted. As this information is important, it should be gathered in subsequent clinical studies.

AUTHORS' DISCLOSURE STATEMENT

The authors report no actual or potential conflict of interest in relation to this article.

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