

Outcomes of Pediatric Supracondylar Fracture Treated Within or After 24 Hours of Injury

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Received 2015 April 29; Revised 2015 December 11; Accepted 2015 December 21.

Abstract

Background: Supracondylar elbow fracture (SCEF) is the most common fracture in the elbow region in children. Considering its high prevalence and the potential complications, proper management of this condition is paramount.

Objectives: The aim of this paper is to report the results of an assessment of timing for SCEF surgery and the prevalence of related complications.

Patients and Methods: We retrospectively reviewed the outcomes of patients with SCEF who presented to our tertiary care pediatric emergency department between September 2013 and March 2014. We reviewed their charts to assess several clinical parameters, including age, sex, Gartland classification of SCEF, weight, comorbidities, treatment intervention, physiotherapy, and the extremity involved. The children were divided into two treatment groups: 1) early, if treated within 24 hours after injury; and 2) late, if treated 24 hours or later after injury. Perioperative complications and short-term outcomes were compared between the two groups.

Results: Of the 24 patients reviewed, 16 were in the early group and 8 were in the late group. There were no significant differences between the two groups regarding perioperative complications such as pin tract infection, iatrogenic nerve injury, compartment syndrome, or range of motion after six months of follow-up (P value = 0.227).

Conclusions: A delay in surgery for more than 24 hours after injury does not influence the perioperative complications and clinical results for displaced supracondylar humeral fractures in children. We conclude that night operations can be avoided.

Keywords: Supracondylar Humeral Fracture, Surgery, Orthopedic Emergency

1. Background

The supracondylar fracture is the second most common upper extremity fracture in pediatrics, accounting for 75% of elbow fractures in children. It mostly occurs in children 5 to 8 years old, predominantly affecting boys and the left elbow (1). Considering the high prevalence and the potential complications of this fracture, the treatment approach requires special attention. The special anatomic structure of the elbow renders it prone to post-traumatic swelling, neurovascular injury, and compartment syndrome after a supracondylar fracture (2, 3). Hence, according to some older studies, the supracondylar fracture is considered an orthopedic emergency and it is recommended that treatment take place in a short period of time after the fracture occurs (4). However, this hypothesis has been questioned in recent studies that reported no significant difference in complication rates (5, 6).

2. Objectives

In this study, we aimed to present our experience in the treatment of this condition in children and compare the

outcomes in two groups of patients with a supracondylar fracture who were treated either within or after 24 hours of the injury.

3. Patients and Methods

A retrospective review was performed to assess children < 12 years of age with a supracondylar fracture who were admitted and treated in Imam Khomeini complex hospital between September 2013 and March 2014. Twenty-four patients were evaluated after surgery. Patients were sorted into either the early or late group, depending upon the time of presentation in our emergency department after the fracture occurred. The patients who came to our emergency ward before 24 hours had passed made up the early group, and those who came after 24 hours were in the late group.

Patients who were treated before, such as with closed reduction, who were treated at another center, and who did not have a post-operative follow-up were excluded. A thorough history was taken and a physical exam was performed at the time of admission. Relevant radiographic studies were obtained and the fractures were classified

based on Gartland classification. In the Gartland classification system, type I fractures are essentially non-displaced. Type II fractures are displaced with a variable amount of angulations, but the posterior cortex of the humerus is intact. Type III fractures are completely displaced, with no cortical continuity. Type IV fractures (described by Leitch et al. (7) as fractures with multidirectional instability) are considered to be totally displaced. Surgery was performed based on Gartland classification (8). First, closed reduction would be attempted. In the case of anatomic reduction, the bones were fixed by two lateral Kirschner wires. If anatomic reduction was not obtained, an open reduction with a posterior approach was implemented with fixation by two lateral Kirschner wires. All the patients had a long arm cast for 4 - 6 weeks after the procedure and the pins were removed upon cast removal.

The patients underwent control radiography post-operatively and were revisited one week, three weeks, two months, and six months after the surgery. Demographic data including age, sex, fracture mechanism, time of injury, time of admission, fracture side, associated injuries, past medical history, dominant hand, and laxity were gathered. All patients underwent pre- and post-operative radiographic studies. Range of motion (ROM) was assessed during each visit. Six months after surgery, all patients were evaluated for pin site infection, the need for a second surgery, development of compartment syndrome, elbow range of motion, patient satisfaction, and the need for physiotherapy. The required data were gathered from inpatient and outpatient hospital and clinic documents. Outcomes were assessed at the last follow-up with a physical exam and a questionnaire such as range of motion, pain, daily activity limitation, and parent satisfaction. Data were presented as mean (SD) and percentages. Student's t-test was used to compare pull out forces and the chi-square test. If the number was below 5, we used Fisher's exact test to compare the failure mode between the two groups. A P value < 0.05 was considered statistically significant.

4. Results

Of the 24 patients included in the study (Table 1), 15 (62.5%) were male and 9 (37.5%) were female. The mean age was 4.95 years (standard deviation: 1.85 years; range: 3 - 8 years). The right hand was dominant in 19 patients. Fractures were on the right side in 13 patients and on the left side in 11 patients. Statistically, a non-dominant hand fracture is more common (CI=95%). All fractures resulted from falling and were of the extension type, but the elbow position at the time of trauma was unknown.

In our study, 13 patients had generalized laxity and 11 patients did not. According to the Gartland classification

Table 1. Comparison of Various Characteristics of the Early and Late Groups^a

Characteristic	Early Group	Late Group	Total
Mean age, y	4.8	5.0	4.95
Gender			
Boy	5	10	15
Girl	3	6	9
Dominant hand			
Left	0	5	5
Right	8	11	19
Gartland classification			
III	3	8	11
IV	5	8	13
Treatment			
CRIF	5	9	14
ORIF	4	6	10
Laxity^b			
Yes	3	10	13
No	5	6	11
Post-op physiotherapy			
Yes	2	6	8
No	6	10	16
ROM			
Full	6	14	20
Decreased	2	2	4

Abbreviations: CRIF, closed reduction and internal fixation; ORIF, open reduction and internal fixation; ROM, range of motion.

^aThe early group shows the number of patients that was treated before 24 hours and the late group represents the number of patients that was treated after 24 hours.

^bGeneralized laxity in physical examination.

system, 11 patients had a type III injury and 13 patients had a type IV injury (Table 2).

Eight patients (34%) presented and were operated on within 24 hours of the injury (early group), and sixteen patients (66%) presented after 24 hours (late group). Fourteen patients had closed reduction with percutaneous pinning, and 10 patients underwent open reduction and fixation by pins.

Eight patients attended physiotherapy sessions after cast removal with an average of 10 sessions. Overall, 4 patients (2 in the early group and 2 in Late group) had decreased flexion ROM after 6 months with an average flexion loss of 20 degrees. There was no statistically significant difference between the early and late groups (P value = 0.227). Two of the patients with decreased ROM were treated with CRIF, and two were treated with ORIF.

Table 2. Patient's Details

Patient Number	Age, y	Gender	Dominant Hand	Generalized Laxity	Gartland Type	Fracture Side	Treatment	Early/Late	Physiotherapy	Range Of Motion
1	7	Girl	Right	No	3	Left	Orif	Late	No	Full
2	4	Girl	Right	No	3	Left	Crif	Early	No	Full
3	5	Girl	Left	No	4	Right	Crif	Late	No	Full
4	5	Boy	Right	Yes	3	Left	Crif	Late	No	Full
5	4	Girl	Right	Yes	4	Left	Crif	Early	Yes	Full
6	3	Girl	Right	No	4	Right	Crif	Late	Yes	Decreased
7	8	Boy	Right	No	3	Left	Crif	Late	No	Full
8	3	Boy	Right	Yes	4	Right	Crif	Late	No	Full
9	8	Boy	Right	No	4	Right	Crif	Early	No	Full
10	5	Boy	Right	Yes	4	Right	Crif	Late	No	Full
11	3	Girl	Right	Yes	3	Left	Crif	Late	Yes	Decreased
12	6	Boy	Right	Yes	3	Left	Crif	Early	No	Full
13	8	Boy	Left	No	3	Right	Crif	Late	No	Full
14	7	Boy	Right	No	4	Right	Crif	Early	No	Full
15	3	Girl	Left	Yes	4	Right	Crif	Late	No	Full
16	4	Boy	Right	Yes	4	Left	Orif	Late	Yes	Full
17	3	Boy	Right	No	4	Right	Orif	Early	No	Full
18	4	Girl	Right	Yes	3	Right	Orif	Late	No	Full
19	5	Boy	Right	Yes	3	Left	Orif	Late	Yes	Full
20	4	Boy	Right	Yes	3	Left	Orif	Early	No	Decreased
21	8	Boy	Left	No	4	Right	Orif	Late	Yes	Full
22	3	Girl	Right	No	4	Right	Orif	Early	Yes	Decreased
23	3	Boy	Left	Yes	4	Right	Orif	Late	No	Full
24	6	Boy	Right	Yes	3	Left	Orif	Late	Yes	Full

Pin tract infection occurred in one case that was treated with CRIF in the late group. The cast was opened, the pins were removed, and the patient was treated with a long arm splint and oral antibiotic therapy. He did not have non-union or any decrease in ROM in the follow-up.

In our study there were no neurovascular injuries or instances of compartment syndrome. One patient had severe swelling under the cast and suffered from a lucid blister. After opening the cast, he was treated with a long arm splint for four days and then with a cast for three weeks.

At the 6-month visit after surgery, one patient complained of pain at the end of the flexion. After physiotherapy the patient's condition improved.

5. Discussion

In previous studies, a supracondylar elbow fracture was considered an orthopedic emergency requiring treatment in a short period after the time of fracture. This is largely due to the special anatomic structure of the elbow and the risk of swelling and consequent compartment syndrome after the fracture (8-11). However, this hypothesis has been questioned in recent studies that reported no sig-

nificant difference in complication rates after early or late treatment.

Mayne et al. reviewed 115 cases with a supracondylar elbow fracture (SCEF) during a 4-year period in the UK and reported no difference in the outcome of those who got treatment in under 12 hours and those who were treated 12 hours or later after injury (5).

Similarly, Sibinski et al. studied 71 patients with SCEF who were treated within or after 12 hours of injury. They reported no statistically significant differences in the need for open reduction and hospital admission duration. However, neither of the studies provided data on ROM and non-union rates (6).

In 2010, Cashman et al. (12) reported 399 patients with type II Gartland classification of SCEF who had closed reduction and pin fixation surgery. No significant difference was found in patient outcomes for those who had surgery within or after 24 hours of injury. Cashman et al. also performed a retrospective study and compared two groups of patients that underwent surgery either the night of admission or the next morning. They reported no significant differences in the results and complications of the surgery (12).

In our study, there were 4 patients who had a decrease

in their range of motion. Two of them underwent surgery within 24 hours of injury, and two of them underwent surgery 24 hours or later after injury. In these 4 patients, 2 were treated with a closed reduction and pin fixation and 2 were treated with an open reduction and pin fixation. It is possible that open reduction versus closed reduction acting as a confounding factor, but due to the limited number of cases we couldn't statistically resolve this problem. There were no cases of compartment syndrome, neurovascular complication, delayed union, or non-union.

The main limitation of the study is its retrospective design, which is more prone to bias compared to a prospective study design. Another limitation is the small number of patients reviewed, which could also cause the study's results to be prone to bias, so if we design the prospective and clinical trial survey we can't judge better about the result.

In conclusion, emergency surgery or night surgery of a supracondylar fracture does not appear to provide any benefit compared to delayed surgery. For this reason, we recommend that such surgeries be performed the next morning to provide an optimal operational situation. This can decrease stress for the patient, the patient's family, and the surgeon regarding the outcome of the operation.

Acknowledgments

We would like to acknowledge Sorena Keihani for his critical editing of the English grammar and syntax of the manuscript and his assistance in the statistical analysis.

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