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Outcome of delayed presentation of supracondylar humerus fractures in children

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Abstract

Introduction: There is no set protocol for treatment of supracondylar humerus presenting more than 6 days after injury. Older studies indicate treatment with traction or leaving them alone to malunite and treat with an osteotomy later in view of significant complications or attempting delayed treatment. The aim of the current study was to look at the outcome of supracondylar humerus fractures presenting after a delay of minimum 6 days.

Patient and Methods: A retrospective study of 14 pediatric patients with supracondylar humerus fractures was undertaken with review of patient's records and radiographs for pre-operative, intra-operative and post-operative follow up data. Delay between injury and presentation, need for open reduction, operative time and length of stay, post-operative complications, malunion, heterotopic ossification and neuro-vascular injury were evaluated. Patients were called for follow up to evaluate outcomes using the Pediatric Outcome Data Collection Instrument (PODCI) score.

Results: The average age of the patient was 8 years. The average time from injury to surgery was 7.2 days and the patients were in the hospital for 3.2 days (Range: 2 to 8 days). The average operative time was 67.5 minutes. Only two out of 14 patient's required open reduction while the others could be reduced closed. None of the patients developed heterotopic ossification, residual coronal plane deformities, iatrogenic nerve injuries or vascular compromise at the latest follow up. The overall outcome as assessed with PODCI scoring in 10 out of 14 patients was excellent. (91.5 out of 100)

Conclusion: Majority of supracondylar humerus fractures presenting late can be closed reduced and percutaneously fixed giving excellent clinical outcomes with no residual deformity and complications.

Keywords: Outcome, delayed presentation, supracondylar humerus fracture, children

1. Introduction

Supracondylar humerus fracture is the most common elbow injury in children¹. This fracture pattern is more likely to be complicated by neurovascular injury than any other elbow fracture because of the fracture itself or as an iatrogenic complication of treatment. The most common late sequela of supracondylar humerus fractures is loss of motion of the elbow. Late complications developing after injury include Volkmann contracture, a rare complication of supracondylar humerus fractures that can lead to severe functional deficit. Cubitus varus can occur as a result of initial fracture malunion, leading to late cosmetic and functional deformity. Some debate exists as to whether supracondylar humerus fractures should be reduced and pinned within 12 hours or can be treated in a delayed fashion up to 24 hours without the risk of increased complications like neurovascular injury, detriment in the treatment results, increased cost of care from a longer hospital stay, and incidence of heterotopic ossification.

Advocates for early surgical care cite ease of fracture reduction before maximum swelling has occurred and a decrease in neurovascular complications with earlier cessation of traction on these from the displaced fracture fragments. Also, there is a question of cost saving from an earlier discharge after quicker definitive treatment^[2, 3, 4]. But in a country like India where finding appropriate health care urgently and beliefs in alternative modes of therapy is rampant there is a higher chance of a delay in obtaining adequate treatment.

Many children are referred to our tertiary care institute after the initial treatment from various

parts of the state causing a delay of several hours or even days. Some seek alternative treatment from traditional bonesetters before presenting to the hospital and some present late on account of being in remote locations and poor access to transport.

The aim of the current study is to look at the treatment protocol and the outcome of treatment for supracondylar humerus fractures presenting after a delay of minimum six days.

2. Patient and Methods

A retrospective study was undertaken of patients (aged 0-16) who underwent closed reduction and percutaneous pinning (CRPP) or open reduction and internal fixation (ORIF) treatment for a displaced supracondylar humerus fracture presenting to our department with a delay of 6 or more days between March 2014 and February 2018.

Treatment in the emergency department (ED) consisted of providing adequate splintage if this wasn't already applied. Patients were scheduled for surgery on the next available trauma list. Surgical management proceeded through the same protocol of attempted closed reduction and pinning or open reduction and pinning, if the fracture could not be reduced closed adequately after 2-3 attempts. When an open reduction was performed, a lateral approach was used in all cases.

Radiographs were taken preoperatively, one week after injury, at 6 weeks and as needed during the follow-up period as per the existing departmental protocol. The time of immobilization ranged from four to six weeks and was decided at the discretion of the attending orthopedic surgeon. Patients were expected to follow-up for 12 weeks or until normal range of motion was achieved.

Excluded from the study were patients who were 16 years and older, had sustained an open fracture, were treated through a procedure other than CRPP or ORIF such as traction. After exclusions, 14 patients qualified for the study.

Patient demographic information, in addition to information regarding the time between the injury and presentation to our emergency department and the time to treatment, as well as data on the time of day that the injury occurred, the mechanism of injury, fracture type, radial pulse presence, nerve injury, associated injuries, treatment method, and length of hospital stay were collected from medical records.

Complications and functional status after treatment were analyzed, including length of time in cast and length of time until removal of pins, complications (including incidence of wire-track infection, iatrogenic nerve injury, compartment syndrome, loss of carrying angle, malunion and incidence of heterotopic ossification), and range of motion (full/near-full or limited) at the final follow-up visit. The patients were also recalled to the clinic and assessed using Pediatric Outcome Data Collection Instrument (PODCI) Score.

3. Results

Of the 14 children included in the study, 9 (64.2%) were males and 5 were females, with a mean age of 8.0 years (range 4 to 16 years). Patients with a delay of 6 or more days were included in the study with a mean delay from injury to presentation of 7.2 days (Range 6 to 16 days). The most common mechanism of injury was a fall on the outstretched hand, sustaining an injury on the involved elbow. The most common reason for the delay in presentation was initial neglect of the injury by family, followed by referral from a peripheral or rural hospital, and finally because some patients tried alternative forms of treatment with traditional

bonesetters.

5 patients had a Gartland type II supracondylar humerus fracture (36%) and 9 patients had a Gartland type III (64%). 12(85.8%) of the 14 patients could be managed with CRPP and only 2 (14.2%) required ORIF. Both patients who needed open reduction had a Gartland type III fracture and presented more than 10 days after injury. Two (14.2%) patients had two lateral K-wires, eight (57.4%) had two crossed K-wires and Four (28.4%) needed 3 lateral K-wires to stabilize the fracture. The average operative time for the group was around: 64.5 min (Range 40 to 120 mins). The mean time to union was 43 days (range 34 to 48 days) for all patients. The mean follow-up was considered as 4.3 months for the entire cohort, although 10 patients returned to the clinic for completing the PODCI score and were evaluated clinically at the time with a mean follow up of 34 months.

There were no cases of malunion (defined as >10 degrees of deviation in coronal plane), vascular injury, compartment syndrome or iatrogenic nerve injury in this cohort of patients. None of the patients had developed heterotopic ossification at the latest follow up. Only 3 patients had terminal limitation of flexion of >20 degrees. 10 Patients out of 14 completed the PODCI questionnaire, 5 completing the Paediatric Version and 5 completing the adolescent version.

The mean adolescent global functioning scale was 91 and normative score was 44 whereas the mean pediatric global functioning score was 92 and normative score was 48 implying an overall excellent outcome. The pain subscale was the only parameter which fared fairly in both groups with a mean of 77 in adolescent and 73 in pediatric group. The individual components of the PODCI score are outlined in table 1

Table 1: Mean PODCI scores for supracondylar humerus fracture patients at the latest follow up

	Mean score	Normative score
Adolescent upper extremity scale	93	39
Adolescent transfer & basic mobility scale	99	51
Adolescent sport and physical functioning scale	92	49
Adolescent pain/comfort scale	77	44
Adolescent happiness scale	84	51
Adolescent global functioning scale	91	44
Paediatric upper extremity scale	97	54
Paediatric transfer & basic mobility scale	100	53
Paediatric sport and physical functioning scale	98	56
Paediatric pain/comfort scale	73	36
Paediatric happiness scale	97	55
Paediatric global functioning scale	92	48

4. Discussions

The decision to treat supracondylar humerus fractures urgently is still a matter of debate among pediatric orthopedic surgeons, with several recent publications sitting on both sides of the fence. Mehlman *et al* [2], Walmsley *et al* [3], and Alcott *et al* [4] warn against delaying treatment for supracondylar humerus fractures beyond 12 hours as this may lead to increased need for open reduction and increased post-operative complications. On the other hand Dua *et al* [5], Leet *et al* [6], Iyengar *et al* [7], Gupta *et al* [8] and Prabhakar *et al* [9] have reported that delaying treatment for these fractures beyond 12 hours but within 24 hours, does not increase the

need for open reduction or increase the risk of complications such as stiffness, malunion, neuro-vascular injury. Carmichael *et al* ^[10] even looked at the quality of reduction in acutely treated vs those treated after a delay of 8 hours and found that the Bauman angle was restored to within 1.2 deg of normal side even in the delayed treated group. They concluded that delaying treatment for supracondylar humerus fractures until the next morning does not alter the outcome. Farrow *et al* ^[11] reported, in a meta-analysis involving 12 studies with pooled data, that there was no difference between early surgery and delayed surgery with regard to open reduction (primary outcome measure) and iatrogenic nerve injury, pin track infection, acute compartment syndrome, post-operative vascular deficit, re-operation, length of stay and residual deformity (secondary outcome measures). On the other hand, Louizo *et al* ^[12], in another meta-analysis of 5 nonrandomized retrospective series looking only at type III supracondylar humerus fractures, concluded that open reduction rate was significantly higher in the delayed treatment group.

While the debate continues for the most appropriate time to treat supracondylar humerus fractures, there is not much literature on what is the best treatment for those presenting late i.e. beyond 4-6 days. Devnani *et al* ^[13] presented their results in delayed presentation of supracondylar humerus fracture in 28 children presenting after a mean of 5.6 days and treated these with a traction protocol for an inpatient period of 18-21 days, rather than standard closed reduction and internal fixation. They reported cubitus varus of >10 degrees in 5 children that required corrective osteotomy. Tiwari *et al* ^[14] have reported on a group of 40 children with delayed presentation of supracondylar humerus fractures classifying their delays as 2 to 4 days, 5 to 7 days and greater than 8 days. They reported that in children presenting more than 8 days after injury, all needed open reduction. Compared to their study, our study reported much lesser need for open reduction, better outcomes as seen with PODCI scores, less limitation of range of movement and less residual deformity. Contrary to popular belief that supracondylar fractures presenting late should be left to malunion and treated with an osteotomy later, our study shows that standard intervention for this cohort produces good outcomes and no functional deficit.

The major limitation of the study is its retrospective nature which may induce errors in data collection and reporting. In addition, this is a very small cohort of patients for any meaningful statistical calculations and only 10 out of 14 patients returned to clinic for completion of PODCI scoring which further weakens the data.

The strength of the study is that this is the only study reporting on 14 patients who presented after a delay of 7 days since sustaining the fracture and had a good outcome after following the standard treatment guidelines.

5. Conclusion

We, thus conclude that, late presenting supracondylar fractures should be treated in the same way as early presenters in order to achieve a good outcome with no functional deficits.

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