

Treatment Outcomes of Paediatric Supracondylar Type II Humerus Fracture: Plaster Cast versus Pinning

Abstract

Background: There is increasing trend of orthopaedic surgeons for closed pinning of type II supracondylar fractures. In this study, the result of treatment of closed reduction and casting in comparison with pinning is evaluated.

Method: In a retrospective cross-sectional study, 39 children aged 3-11 years with Gartland type II supracondylar fracture who were treated with closed reduction and pinning were compared with closed reduction and casting by using demographic information and measurement of Baumann's angle, and in hospital stay, by easy non-random sampling method and in 4 weeks follow-up.

Result: By using the independent sample T-Test, there was a significant difference between the time duration of hospital stay and type of treatment and it was significantly lower in the group who had undergone treatment with closed reduction and casting [p value < 0.005, Mean, SD: 37.43 +- 6.42]. There was no significant difference between the Baumann's Angle in the two groups.

Conclusion: No significant difference in the radiographic outcome of the two types of treatment was observed after four weeks of follow-up.

Key Words: Humeral fractures, Fracture fixation Internal, Closed fracture reduction, Treatment outcome

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Introduction

Supracondylar humerus fracture is one of the common fractures in children accounting for 60% of fractures around the elbow ⁽¹⁾. This type of fracture has many complications, including nerve damage, vascular damage, Malunion, and compartment syndrome. In Malunion, cubitus varus is the most common ⁽²⁾. In the past, this fracture was more common in boys, but now it is almost equal and is more common in summer ⁽³⁾.

There are two types of humeral supracondylar fractures: is extension type which includes 95% of cases where the distal part is displaced and angulated posteriorly, and we usually see this type when the child falls on the hand with the extended elbow. In the less common type, the flexion type [2-5%], the distal part is displaced and angulated anteriorly and occurs as a result of direct trauma to the distal humerus or falling on the hand with a flexed elbow ⁽⁴⁾.

The Gartland's Classification is the most common classification of Humerus supracondylar fractures ^(5, 6).

The treatment of type Gartland I, III, and IV are clearly defined. For the treatment of type I, there is immobilization and casting, for the type III, percutaneous closed reduction and percutaneous pinning or open reduction and pin fixation are proposed and type IV is treated surgically, but there is a difference of opinion about the treatment of type II ⁽⁷⁾.

Treatment is done for type II in two ways. The first method is closed reduction and pinning, and the second method is closed reduction and plastering or splinting. General Anaesthesia is required if the close reduction and pinning is performed, and there are surgical complications such as damage to the nerves

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and arteries of the area during the operation, pin infection, bone infection and surgical scar. But closed reduction and plastering or splinting can be done under sedation and there is no need for re-surgery to remove the pin. The casting, however, has higher chance of displacement in cast and swelling complications when elbow is kept in flexion^(8, 9). Casting, however, has higher chance of displacement in cast and swelling complications when elbow is kept in flexion. Due to the high prevalence of this fracture in children, choosing the treatment method with the best results and the least complications is very important and, in this study, two treatment methods of close reduction and pinning [Group 1] vs. close reduction and plaster casting or casting [Group 2] for type IIA fractures have been investigated.

Methods

In a retrospective cross-sectional study, we identified 296 children aged 3-11 years with supracondylar humerus fracture who referred to Kashani Hospital in Isfahan between years 2018-2019 by using the hospital HIS system. There were 68 children with Gartland type II

fracture and 3 of them were type IIB. 26 other patients who did not have good follow-up radiographs were excluded from the study. Finally, 39 patients with Gartland type IIA fracture (Figure 1) were entered to the study by using the census method of sampling. Demographic information including the patient's age and sex, date of admission and the number of in-hospital stays days were recorded by reviewing the patient's files.

Based on the type of treatment, patients were divided into two categories: treatment with closed reduction and pinning [group 1] (Figure 2) which included 17 cases who all of them had a fixation with 2 lateral pins, and treatment with close reduction and casting [Group 2] which included 22 cases. Then the patient's AP and lateral radiographs immediately after reduction and 4 weeks later were examined by 2 trained clinical medicine students. The Baumann's angle was evaluated by them in AP graph and the anterior humeral line was evaluated in lateral X-Ray graph to see if it crosses the middle third of the capitulum and the reduction was good or not⁽¹⁰⁾.

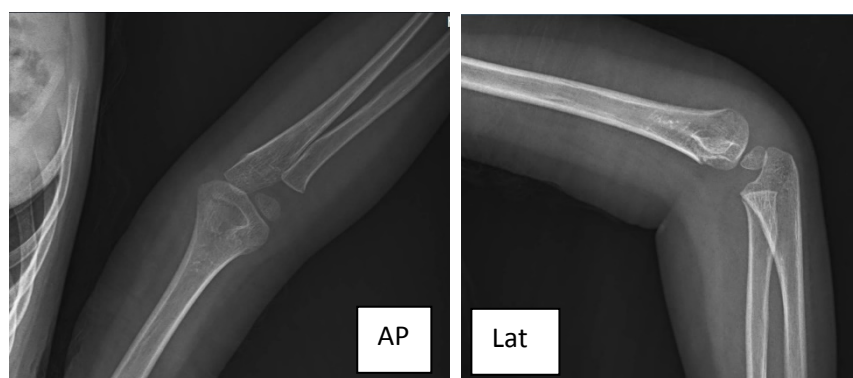


Figure 1. AP and Lateral view of a type IIA supracondylar humerus fracture

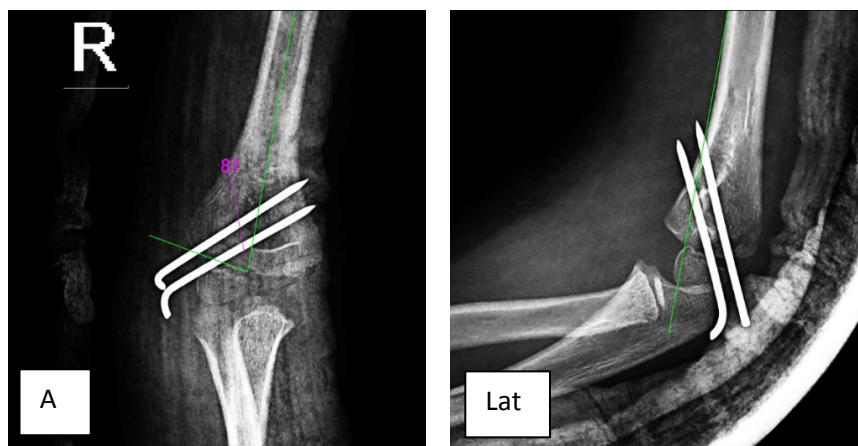


Figure 2. AP and Lateral view of a type IIA supracondylar fractured elbow treated with closed reduction and pinning

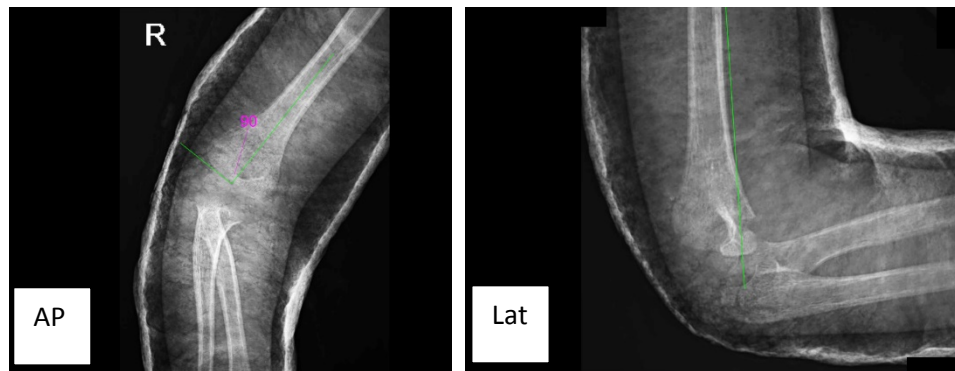


Figure 3. AP and Lateral view of a type IIA supracondylar fractured elbow treated with closed reduction and casting

The normal Baumann's Angle was considered to be 72 ± 4 and the difference of more than 6-10 degrees of this number was considered abnormal ⁽¹¹⁾. Then the obtained information was entered in SPSS-v23 software and analyzed by using Independent Sample T-test and Chi-square tests.

Results

Thirty-nine children included 24 boys [61.5 %] and 15 girls [38.5 %] were studied with the Demographic information, Baumann's Angle mean age of 6.3 years [SD: 2.52].

in degrees and hospital stay of patients are shown in Table 1. The duration of hospital stay is reported as hours instead of days. We also checked the months of admission. ⁽¹³⁾, (33.3%) were admitted to the hospital at spring season.

By using the independent sample t test, there was a significant difference between the hours of hospital stay and type of treatment and it was significantly lower in the group who had undergone treatment with close reduction and casting [p value <0.005, Mean, SD: 37.43 +- 6.42].

Table 1 Demographic information, Baumann's angle and duration and hospital stay of patients based on the type of surgery

	Number of cases [percent]	Age Mean [SD]	Sex Count [percent]		Side Count [percent]		Baumann's angle degree Mean [SD]		Hospital stay[hours] Mean [SD]
			boy	girl	right	left	After reduction Mean [SD]	Follow up	
Close reduction and pinning [Group 1]	17 [43.6%]	6.88 [2.870]	10	7	6	11	74.11 [7.367]	73.06 [8.474]	59.3 [25.65]
Close reduction and casting [Group 2]	22 [56.4%]	5.95 [2.214]	14	8	13	9	76.41 [8.683]	73.68 [6.259]	21.8 [13.99]
total	39 [100%]	6.36 [2.529]	24 [61.5%]	15 [38.5%]	19 [48.7%]	20 [51.3%]	75.44 [8.110]	73.41 [7.210]	38.2 [27.18]

There was no significant difference between the Baumann's Angle degrees in 2 groups. Also, in two cases anterior humeral line doesn't intersect the middle third of the [capitulum](#)- one of whom underwent closed reduction and pinning and another one had closed reduction and casting. There was no difference between these 2 cases and other children in Baumann's Angle after reduction and follow up] and duration of hospital stay [p value>0.05].

Discussion

Studies to date have compared different treatments for type IIA supracondylar humerus fractures [close reduction and casting with close reduction and pinning] with different results but there was no agreed solution ⁽¹²⁻¹⁶⁾. In this study, we revealed that there is no significant difference in the outcome of 2 types of treatment (Baumann's angle degree), so we did not have a significant difference in mal union, but we had a significantly lower hospital stay in group 2 who had treatment with close reduction and Casting.

Abzug et al. reviewed the concepts about treatment of supracondylar fractures in 2012 and reported that most displaced injuries required surgical interventions and closed reduction and percutaneous pinning remains the mainstay of surgical management and type II fractures are managed surgically. It is mentioned that most type II fractures are managed primarily with closed reduction and pin fixation. The main reasons for choosing this type of treatment are inability to maintain adequate reduction in a cast or splint, poor patient adherence to follow-up instructions, and inability to distinguish a type IIA fracture from a type IIB fracture ⁽¹⁷⁾.

In the study of Miranda et al., 56 children including 33 boys and 23 girls with supracondylar humerus type II fractures were studied. These patients were divided into 2 groups with small differences in age and sex, a group of 23 people who underwent surgery and pinning and a group of 33 people who were treated with closed reduction and

casting. In that study, closed reduction and casting were recommended as a suitable treatment for supracondylar humerus fracture compared to pinning due to fewer complications and shorter hospital stay ⁽¹⁸⁾. This result is parallel to our finding.

However, the study of Mr. Khan et al. suggests closed reduction and pinning in supracondylar humerus fracture safely and economically and with better results compared to casting. In this study, which was performed on 40 children with supracondylar humerus fracture, 20 children were treated with pinning and 20 children with casting. Outcome measures were according to Flynn criteria that are functional and cosmetic factor based on loss of elbow motion and carrying angle in degrees respectively. The results are as follows: In the pinning method, 65% were treated with excellent results, 20% with good results and 15% with poor results. In plastering method, 20% excellent result, 40% good result, 10% good result and 30% poor result have been reported ⁽¹⁹⁾. We think this considerably poor casting result is because it assessed the function which is lacking in our study.

Ladenhauf et al. in 2014 reviewed the indications for surgery in paediatric displaced humerus fractures and found that closed reduction and percutaneous pinning are the preferred treatment options for most of these fractures and there is a great controversy for ideal pin configuration. They also mentioned that the placement of a medial pin carries the risk of iatrogenic ulnar nerve injury, whereas lateral pinning carries an increased risk of median neuropathy. They recommended, to stabilize the fracture with two or three lateral pins ⁽²⁰⁾. It is notable that all of our patients who had a fixation with close reduction and pinning [group 1] were treated by 2 lateral pins.

The necessity of fixation was discussed by Ariyawatkul et al. at the year 2014 by evaluating the results of pinning versus conservative treatment. They mentioned that classification into modified type IIA and IIB is very helpful for orthopaedic surgeons in determining the most suitable treatment

strategy. Finally, they recommended that, in type IIA patients with lateral capitulum-humeral angle [LCHA] difference or shaft condylar angle [SCA] difference from the uninjured side less than 18°, Kirschner-wire fixation is deemed essential. In the case of type IIB fractures, fixation was recommended in all patients because of the unstable reduction from loss of Baumann angle [BA], LCHA, and SCA⁽²¹⁾. This recommendation is same as our finding because all of our patients were classified as type IIA.

Kropelnicki et al. recently [2019] reviewed the different aspects of supracondylar fractures and gave a guide by using the current evidence including the British Orthopaedic Association Standards for Trauma [BOAST] 11 standard. They mentioned the subtypes of extension type as these can be sub classified into type IIA [no rotational deformity] and type IIB [rotational deformity present] injuries. In the management section it is discussed that Gartland type IIA fractures may require manipulation under Anaesthesia if there is significant posterior displacement or evidence of medial comminution, as the latter can predispose to various deformity. But almost all Gartland type IIB [and all Gartland type III] injuries require closed reduction and percutaneous pinning [or, rarely, open reduction] to hold the fracture in a reduced position⁽²²⁾.

In another article, Al-Algawi et al. [2019] discussed the treatment of type III supracondylar fracture. They compared open and closed methods of reduction with 2 cross k-wire fixation and finally recommended that closed reduction technique was preferred because it required less hospitalization time and resulted in almost no visible surgical scars⁽²³⁾. The limitations of our study are its retrospective nature; being only 1-month radiographic follow-up, study with no functional assessment.

Conclusion

In this study, we revealed that there is no significant difference in the outcome of 2 types of treatment but we had a significantly lower hospital stay. Respecting the other

studies, this article recommends that the radiographic results were the same in both closed reduction and casting vs. close reduction and pinning after in four-weeks of follow-up.

Conflict of interests

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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