

A STUDY COMPARING THE OUTCOME OF GARTLAND TYPE IIB AND TYPE III SUPRACONDYLAR HUMERUS FRACTURE BY NON-OPERATIVE VS OPERATIVE TECHNIQUE

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ABSTRACT

Aim: The aim of the present study was to compare the outcome of Gartland type IIB and type III supracondylar humerus fracture by non-operative vs operative technique.

Methods: This was an observational study that includes both conservative and operative cases conducted in the Orthopaedics department of BRD Medical College Gorakhpur, U.P. (India) during August 2021 to July 2022. Total 56 patients (cases) enrolled for the study, out of which 14 cases were treated conservatively and 42 cases by operative methods. 37 cases underwent closed reduction, and 5 cases were managed by open reduction and k-wire fixation. It was a hospital-based study, and all the patients were selected after fulfilling the Inclusion criteria.

Results: There were 23.21% cases in the age group 2-5 years and 50% cases were belonged to the age group 6-10 years. The majority of the cases in this study were from the age group 6-10 years. There were 25% cases were females while 75% cases were males. 57.14% cases were having left side involvement and in 42.86% cases have right side participation. The most of the cases had a left-sided involvement. 46.42% cases got injured due to slip, 41.08% cases due to fall from height and 12.5% cases were from the trauma (RTA cases). The most of the recorded cases were from the injury due to slip. In this study 44.64% cases were Gartland type II B fractures and 55.36% cases belonged to Gartland type III fractures. 80.36% cases had an excellent functional outcome after one year follow-up and 19.64% cases with good functional outcome.

Conclusion: Treatment of supra-condylar fracture of humerus in children requires methodical or standard reduction techniques followed by casting or k wire fixation. In our series, Gartland type III is most common supracondylar fracture of humerus, with posteromedial displacement most common. X-rays have given early and accurate knowledge necessary for planning and management of supra-condylar fracture of humerus. In this study, we could find that nearly half of total number of cases of Gartland type IIB are manageable by conservative cast. There was significant remodelling of fracture supracondylar humerus.

Keywords: Supracondylar humerus fracture, Gartland classification, Mayo Elbow Performance Score

1. INTRODUCTION

Supracondylar humeral fractures (SHF) in children are the most common injuries of the elbow.^{1,2} The current literature on SHF suggests that percutaneous pinning should be used for most of the extension-type fractures, even for the minimally displaced ones.^{2,3} According to some authors, closed reduction and immobilization is associated with a significant percentage of early and late complications, including Volkmann ischemic contracture and cubitus varus.^{4,5}

The Gartland classification modified by Wilkins is the most frequently used classification system for extension Type SCHF.⁶ Type I fractures, according to the Gartland classification, are either not or minimally displaced (<2 mm). Type II fractures are displaced (>2 mm), but the posterior cortex is intact. Type IIA and type IIB subgroups were determined according to whether there is rotation or not in Type II fractures.⁷ Type III fractures are completely displaced fractures.⁸ The treatment of Gartland Type I and Type IIA SCHF are conservative, while the treatment of type III fractures is surgical. However, there is no definite consensus for Type IIB fractures.⁹ Inadequate reduction and rotation in SCHF cause various deformities in the elbow.¹⁰ While France et al¹¹ state that inadequate reduction may cause problems after conservative treatment, Hadlow et al¹² state that surgical treatment is unnecessary in Type II fractures and may cause some complications.

The treatment of supracondylar fractures of the humerus among children becomes a challenging task because of complications like neurovascular injury, malunion, myositis ossificans etc.^{13,14} Several approaches have been developed in past for a wide range of non-surgical and surgical methods to aim at restoring normal elbow anatomy such as long arm plaster cast immobilization, axial traction applied with tape or a trans-olecranon pin, external fixator application, pinning after open reduction, and percutaneous pinning.¹⁵ The Aim of treatment of Gartland type II B and type III fractures of supracondylar humerus is to re-establish the anatomy of the distal humerus perfectly with an adequate stability to permit early painless, functional elbow with maximum range of motion and coronal & sagittal plane alignment.¹⁶ To avoid complications of supracondylar fractures of humerus, one must achieve anatomical reduction with the use of closed or open methods.¹⁷

The aim of the present study was to compare the outcome of gartland type IIB and type III supracondylar humerus fracture by non-operative vs operative technique.

2. MATERIALS AND METHODS

This was an observational study that includes both conservative and operative cases conducted in the Orthopaedics department of BRD Medical College Gorakhpur, U.P. (India) during August 2021 to July 2022. Total 56 patients (cases) enrolled for the study, out of which 14 cases were treated conservatively and 42 cases by operative methods. 37 cases underwent closed reduction, and 5 cases were managed by open reduction and k-wire fixation. It was a hospital-based study, and all the patients were selected after fulfilling the Inclusion criteria.

Source of data:

All patients with type II B and type III fracture supracondylar humerus in the pediatric population admitted to the Orthopaedics emergency and outpatient departments of Orthopaedics, BRD Medical College Gorakhpur, U.P. (India) and associated Nehru Hospital, Gorakhpur, U.P. (India) were examined by a thorough general and local examination.

Inclusion criteria: In this study the following inclusion criterions were considered.

1. Children with age < 12 years (between 2-12 years).
2. Closed fractures.
3. Gartland type IIB and type III fractures.
4. Cases without any neurovascular deficit.
5. Cases without compartment syndrome.

Control:

1. Radiography of opposite elbow was considered control.

Exclusion criteria: The following exclusion criterions were considered.

1. Gartland type I fractures and type IV fractures.
2. Patients with prior elbow pathology, e.g., stiffness, and infection.
3. Associated with other fractures around elbow.
4. Bilateral involvement.
5. Open injuries

Method of collection of data:

1. Patients attending outdoor patient department & Emergency of Nehru hospital.
2. From the currently operated patients.
3. Detailed history, age, mode of trauma, onset of symptoms.
4. Clinical & Radiological presentation at the time of admission.
5. Serial radiological follow up at 1 week, 3 weeks, 3 months, 6 months and 1 year

Written Consent:

All patients who participated in this study were explained about the injury, diagnosis, various management options, Complications of non-operative treatment and operative management, pre-operative and post-operative complications, injury to surrounding structures, infection, compartment syndrome, anesthesia risks, limitations of range of motion.¹⁸

A written consent for surgery was collected from all the patients who were included in this study. All consent was obtained before the conservative management & surgery. Patients and their attendant were well informed about the advantages and disadvantages of the procedure. Risk benefit ratio was also mentioned to them.

Pre-operative Treatment: A digital X-ray of the injured elbow were taken in AP and lateral views, and fracture was classified based on Gartland classification. Patients were considered for routine operation theatre profile. A pre-anesthetic evaluation was performed cases which went for operative management. Informed and written consent was taken. All the patients were at first tried for closed reduction under fluoroscopy, if adequate reduction could be obtained, then an above elbow pop posterior cast was applied in 90-degree flexion at elbow. Repeat AP & lateral views of affected elbow were taken, if adequate reduction is maintained, then patient is managed conservatively. If fracture is displaced then they go for operative treatment. Operative treatment either by closed reduction with percutaneous K-wire or open reduction with internal fixation with K-wires was used whenever an endeavor of closed reduction failed to achieve near anatomical reduction.¹⁹ Parental routine antibiotics were given 1 hour before surgery The cases were admitted in the ward of Department of Orthopaedic, BRD Medical College Gorakhpur, U.P. (India).

Pre-operative Rehabilitation:

The following pre-operative rehabilitation was performed to the patients.

1. Limb elevation & active finger movement was advised to patients while awaiting surgery.

2. All patients were encouraged for post-operative rehabilitation care. All the standard protocols were performed during the surgery, which is listed below;
Anesthesia: General/ regional as according to suitability of patients or choice of anesthetist.
Position of Patients: Supine position on operation table.

Techniques:

Conservative Management:

This method was adapted in 14 cases. Longitudinal traction was given with elbow in extension and supination. Similarly, an assistant should give counter traction on the proximal portion of the arm. Continuing traction and counter traction together correct medial or lateral displacement by applying valgus or varus force, respectively at the fracture site. After that, posterior displacement and angulation have corrected by flexing the elbow and simultaneously applying posteriorly direct force from the anterior aspect of the proximal fragment and anteriorly directed force from the posterior aspect of the distal fragment. The Adequacy of the reduction was checked under fluoroscopy checked with two views. Radial artery pulsation was checked and an above elbow POP posterior cast was applied after performing X-rays. If reduction is acceptable in check x-rays, then after one week POP casting is done for the two weeks. If fracture is still displaced in any of the two views, then patient goes for k wire fixation under general anesthesia.^{20,21}

Operative procedure:

With general anesthesia, place the patient supine, with affected upper limb free of the table, on a broad arm board. Then clean and drape the part.²⁰



Figure 1A & 1B: Conservative management

Post-operative assessment:²²

- 1) The patients were allowed to sit up on their beds after 6 hours of surgery & assessed for any iatrogenic nerve injuries.
- 2) First postoperative dressing and pin site dressing was done after 1day.
- 3) Patients were encouraged to start active finger movement.
- 4) POP posterior cast & pin removal done at 3 weeks.
- 5) True AP & Lateral views of affected elbow were done

- 6) Elbow mobilization is done & patient is encouraged to gain full range motion at elbow.
- 7) The patients were followed up on the basis of clinical examination, range of elbow movement, any varus or valgus deformity of elbow.

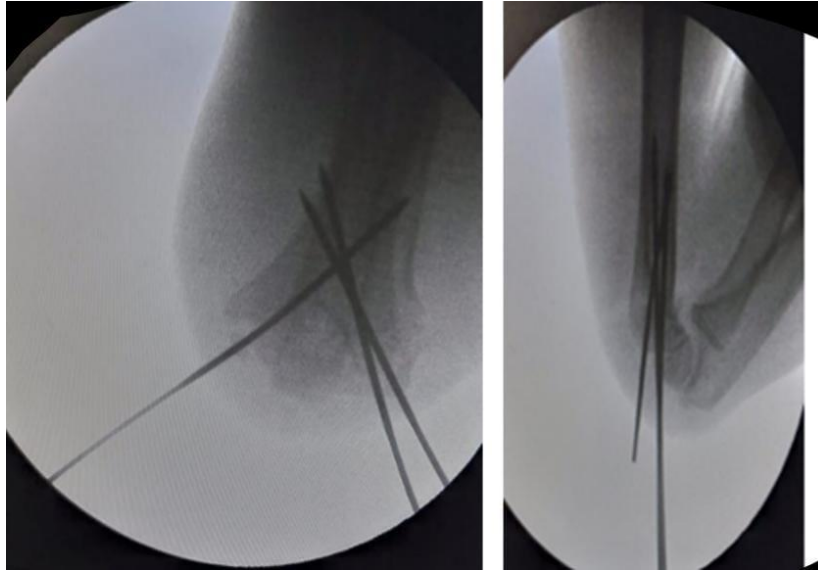


Figure 2: Post operative assessment

3. RESULTS

Table 1: Demographic data

Age group (Years)	Number	%
2-5	13	23.21
6-10	28	50.00
10-12	15	26.79
Sex		
Female	14	25.00
Male	42	75.00
Affected side		
Left	32	57.14
Right	24	42.86
Types of Injury		
Injury due to slip	26	46.42
Injury due to fall from height	23	41.08
Injury due to trauma	7	12.50
Types of Injury		
Type II B	25	44.64
Type III	31	55.36

There were 23.21% cases in the age group 2-5 years and 50% cases were belonged to the age group 6-10 years. Similarly, 26.79% cases were concerned to the age group of 11-12 years. The majority of the cases in this study were from the age group 6-10 years. There were 25% cases were females while 75% cases were males. This study showed male dominance. 57.14% cases were having left side involvement and in 42.86% cases have right side participation. The most of the cases had a left-sided involvement. 46.42% cases got injured due to slip, 41.08% cases due to fall from height and 12.5% cases were from the trauma (RTA cases). The most of the recorded cases were from the injury due to slip. In this study 44.64% cases were Gartland type II B fractures and 55.36% cases belonged to Gartland type III fractures. The incidence of Gartland type III fractures were higher than Gartland type II B fractures.

Table 2: Outcome distribution according to Flynn Criteria

Outcome after 6 months	Number	%
Excellent	37	66.07
Good	15	26.79
Fair	4	7.14
Poor	0	0.00
Final Outcome		
Excellent	45	80.36
Good	11	19.64
Fair	0	0.00
Poor	0	0.00

After 6 months, 66.07% cases had an excellent functional outcome, 20.79% cases with a good functional outcome and 7.14% cases with a fair functional outcome based on Flynn’s criteria. 80.36% cases had an excellent functional outcome after one year follow-up and 19.64% cases with good functional outcome. In this follow-up none of the case was in the category of fair or poor functional outcome.

Table 3: Distribution of cases based on their complications in conservative, closed and open reduction cases

Types of Cases	Complication	Number	%
Conservative closed reduction	None	14	25.00
Closed reduction with percutaneous K-wire fixation	K-wire migration	2	3.56
	Superficial infection	4	7.14
	None	31	55.35
Open reduction with K-wire fixation.	K-wire migration	0	0.00
	Superficial infection	1	1.78
	None	4	7.14

K-wire migration was observed in 3.56% of cases managed by closed reduction and percutaneous k-wire fixation and in 0% in those with open reduction with K-wire fixation. While superficial infection was 7.14% in open reduction cases and it was 1.78% in closed reduction cases. There were no any complications seen in conservative cases.

4. DISCUSSION

In this study of supracondylar humerus of fracture in pediatric population, the collected data were compared with the studies of other co-workers to verify our results. The success of this study has provided satisfactory long-term outcomes with proper early follow up and care. To achieve the successful results many similar studies outcomes have been compared. This is a novel study in the term of sample size, comparison of conservative, closed and open reduction methods used. In the literature, very few comparative studies have been mentioned. Supra-condylar fractures of the humerus are most common fractures in the first decade of life (children) accounting for 60% to 75% of all elbow fractures in children.

There were 23.21% cases were in the age group 2-5 years and 50% cases were belonged to the age group 6-10 years. Similarly, 26.79% cases were in the age group of 11-12 years. This finding has strong correlation with the finding of other studies conducted by Smajic et al²³ and Guvenet al.²⁴ In this study, obtained data have demonstrated the distribution of cases based to the side affected. The 57.14% cases were having left side involvement and in 42.86% cases have found right side participation most of the cases had a left-sided involvement. The study conducted by Carvalho et al²⁵ showed equally involved right and left side. In this study, 46.42% cases were got injury due to slip [during playful activities], 41.08% cases had injury due to fall from height and 12.5% cases were found injured from the trauma cases (RTA). The most of the recorded cases were noted from the injury due to slip fall category. This data has strong co-relation with following other studies by Bellanet al²⁶ and Smajic et al.²³

The higher incidence of Gartland type III fractures were found in our study. In this study 44.64% cases were recorded to Gartland type II B fractures and 55.36% cases were belonged to Gartland type III fractures. The incidence of Gartland type III fractures were higher than Gartland type II B fractures. Carvalho et al²⁵ found 15% Gartland Type II B and 85% Gartland Type III B. After the 6 months follow-up, 66.07 % of cases had an excellent functional outcome, 26.79% cases had a good functional outcome and 7.14% cases had a fair functional outcome based on Flynn's criteria. Similarly, after one year follow-up 80.36% cases had excellent functional outcomes, 19.64% of cases had a good functional outcome and none of the case fell in the category of fair or poor functional outcome. Range of motion has shown betterment in further follow-ups at one year leading to an improved functional outcome.

In these categories only two types of complication were found one was outward K-wire migration and other was superficial infection [i.e. erythema around pin site with serous discharge, heals by 5-7 days]. In this study, the distribution of cases on the basis of complications has recorded and found outward K-wire migration in 3.56% of cases and superficial infections were found in 8.92% of cases. Superficial infection was treated by pin site dressing and oral antibiotics. Most of the cases have not found any complications. Reisoglu et al²⁷ found 7 in open reduction and 6 in closed reduction. Finally, each study has its own limitations and drawbacks. Measurements of carrying angle and Bauman's angle with the use of arthrometer may have some error along with the clinical assessment. A good sample size also plays a crucial role in the data analysis and prolonged follow up were needed for excellent results.

5. CONCLUSION

Treatment of supra-condylar fracture of humerus in children requires methodical or standard reduction techniques followed by casting or k wire fixation. In our series, Gartland type III is

most common supracondylar fracture of humerus, with posteromedial displacement most common. X-rays have given early and accurate knowledge necessary for planning and management of supra-condylar fracture of humerus. In this study, we could find that nearly half of total number of cases of Gartland type IIB is manageable by conservative cast. There was significant remodelling of fracture supracondylar humerus.

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