IRAETC Medical Bulletin

ISSN (e): 2959-3115

Volume: 1 (2023), Issue: 2 (Jul-Aug)

OPEN ACCESS

iraetcjournals.com

Evaluation of Non-Surgical Conservative Management of Humerus Fractures: An Innovative Approach

Sofikul Islam[1*], Munzur Rahman[1], Ataul Haque[2], Mohammad Rajib Mahmud[3], Asadujjaman Azad[4], Mahfuzzaman[5], Abu Zahid Ph.D[6]

[1]Assistant Professor, Department of Orthopaedic Surgery, Rajshahi Medical College Rajshahi, Bangladesh

[2]Medical Officer, Department of Orthopaedic Surgery, Joypurhat 250 bed District Hospital, Joypurhat Shador, Rajshahi, Bangladesh

[3]Jr Consultant, Department of Orthopaedic Surgery, 250 Bedded Bongamata Sheikh Fazilatunnesa Mujib General Hospital, Sirajganj, Bangladesh

[4]Medical Officer, Department of Orthopaedic Surgery, Divisional Police Hospital, Rajshahi, Bangladesh

[5]Jr Consultant, BIHS General Hospital, Dhaka, Bangladesh

[6]Associate Professor, Department of Anesthesiology, Rajshahi Medical College, Bangladesh

Original Research Article **DOI: 10.62469/tmb.v01i02.001**

Corresponding Author:
Sofikul Islam

Citation:
Sofikul Islam *et al.*, (2023); Evaluation of Non-Surgical Conservative Management of Humerus Fractures: An Innovative Approach. iraetc med. bull; 1(2) 29-34.

Abstract: ***Background:*** Humerus fractures are a common orthopaedic injury that can lead to significant morbidity and disability if not managed appropriately. In low-resource settings like secondary-level hospitals in Bangladesh, surgical interventions may not always be feasible due to limited resources and infrastructure. Therefore, the exploration of conservative management approaches becomes crucial to ensure optimal patient outcomes. ***Objective:*** The objective of this study is to assess the outcomes of conservative management in humerus fractures at Department of Orthopaedic Surgery, Rajshahi Medical College Rajshahi, Bangladesh. The study aims to evaluate the effectiveness of conservative treatment methods and their impact on pain reduction, functional improvement, and overall patient satisfaction. ***Materials and Methods:*** A prospective study was conducted on 74 cases of humerus fractures treated conservatively at Department of Orthopaedic Surgery, Rajshahi Medical College Rajshahi, Bangladesh. From October 2022 to June 2023. morphologically as simple (28), intermediate (17), and complex (29) based on the Garnavos classification. Outcome measures included pain levels, range of motion, radiographic assessments, and patient-reported satisfaction scores. ***Results:*** A total of 74 patients (60 males and 14 females) underwent extension casting treatment for humeral fractures. The patient's age ranged from 19 to 70 years (mean age: 45.5 years). The majority of patients (58) received treatment on the day of the injury, while 16 experienced delayed treatment. The fractures were classified topographically as P (13), M (25), D (17), PM (10), and MD (9). The average duration of full-length casting was 5 weeks, with conversion to above-elbow casts when necessary. All fractures showed union within 8 to 18 weeks, with an average union time of 10 weeks. Radiographic assessments showed satisfactory fracture healing in 90% of patients. Patient satisfaction scores indicated a high level of contentment with conservative treatment. ***Conclusion:*** This study highlights the efficacy and feasibility of conservative management in the treatment of humerus fractures. The findings suggest that conservative approaches can be a viable and effective alternative in resource-constrained healthcare settings, providing satisfactory pain relief, functional improvement, and patient satisfaction.

Key Words: Conservative management, Humerus fracture, Orthopedic injuries.

|| IRAETC Publisher || **Publication History** - Received: 17.05.2023 || Received: 17.05.2023 || Accepted: 21.07.2023 || Published: 28.07.2023 ||

INTRODUCTION

Humeral shaft fractures are a common occurrence, accounting for 1-3% of adult fractures. However, the management of these fractures has changed over time, driven by advancements in surgical safety and techniques [1]. While fractures resulting from low-energy trauma can be successfully treated with conservative methods, the preference for surgical intervention often disregards this evidence [2].

It is often driven by the desire for a quicker return to normal activities. Interestingly, humeral shaft fractures tend to unite well due to their excellent blood supply and good soft tissue cover, as long as an orthopaedic surgeon doesn't intervene [3]. Various non-operative methods have been mentioned in the literature, but functional bracing has emerged as the dominant approach, despite the potential drawbacks of residual deformity and joint stiffness [4].

The Covid-19 pandemic has further highlighted the need to minimize aerosol-generating procedures, leading to renewed interest in non-operative methods [5]. In this context, it is important to explore and showcase new methods to improve conservative fracture care. This paper focuses on the biomechanics, technique, and outcomes of one such method: extension casting for humeral shaft fractures.

MATERIAL AND METHODS

A total of 74 patients were included in the study, selected based on intact radiological and clinical records. The inclusion criteria for patients were based on the topographic Garnavos classification (M, MP, MD) and morphologic classification (S, I, C). All patients were treated with extension casting, which involved keeping the elbow in extension and the forearm in supination.

Assessment criteria for this study were as follows:

Time to union: This was determined clinically by the absence of tenderness and abnormal movement at the fracture site. Radiologically, the union was defined as the presence of cortical continuity or bridging across at least three out of four cortices, as observed on anteroposterior and lateral views.

Alignment and deformity: Angles were measured between the axes of the proximal and distal fragments to assess alignment and deformity.

Movement: The range of motion for each joint was expressed as a percentage of normal movements on the opposite side to evaluate functional outcomes. The measurements for shoulder movements on the opposite side were added together. For example, if a patient had 180 degrees of flexion, 50 degrees of extension, 150 degrees of abduction, 40 degrees of adduction, and 80 degrees of internal and external rotation, the combined movement would be 500 degrees. If the affected shoulder had a total range of motion of 450 degrees, the range of motion would be 90% of the normal side. The same formula was applied to evaluate elbow and wrist movements.

The casting procedure involved the patient sitting comfortably, with the option of administering a local anaesthetic block if needed. A stockinette was applied from the metacarpophalangeal joint to the axilla, with an additional 25 cm added at the proximal end. The upper part of the stockinette was split, and the two ends were tied across the neck like a necklace to prevent slippage of the straight extension cast, especially in obese patients. Light padding was used over the stockinette, and a plaster of Paris or fibreglass plaster cast was applied. The cast was kept as light as possible to minimize distraction without compromising its strength, typically using two layers of fibreglass or four layers of conventional plaster. The forearm was placed in full supination with the palm facing forward to stretch the interosseous tissues and ensure a good range of motion after casting, as well as to facilitate the assessment of reduction and carrying angle during reduction manoeuvres.

The cast extended from the anterior fold of the axilla to the distal part of the forearm in cases with Garnavos topographical P, M, PM, and MD classifications. For MD-type fractures, the cast extended from just above the deltoid insertion to the distal forearm, while in D cases, the proximal extent of the cast was just proximal to the deltoid insertion . Patients were encouraged to initiate early and active shoulder movements, including abduction and forward flexion, using a "rifle butt movement manoeuvre." This approach also helped prevent hand swelling, and patients were instructed to regularly exercise their hands.

RESULTS

A total of 74 patients, including 60 males and 14 females, were treated using the extension casting method. The age of the patients ranged from 19 to 70 years, with a mean age of 45.5 years. Out of these, 58 patients received treatment on the day of the injury, while 16 patients had delayed treatment ranging from 2 to 11 days due to various reasons. Regarding topographic classification, there were 13 P, 25 M, 17 D, 10 PM, and 9 MD fractures. Based on the morphological classification according to Garnavos, there were 28 simple (18 St and 10 Ss), 17 intermediate, and 29 complex fractures.

The full-length cast was applied for a period of 4 to 6 weeks, with an average duration of 5 weeks. All casts were converted to above-elbow casts when the fracture became sticky. Radiologically, all fractures united within a range of 8 to 18 weeks, with a mean time to union of 10 weeks. Fluffy callus formation was observed at an average of 35 days, and bony union occurred at an average of 10 weeks across the patient series.

Table 1: Angulations and Composite Movements

Type	Number of Cases	Mean Union Time (weeks)	Mean angulation sagittal plane	Composite Shoulder Movement (as a percentage of opposite side)	Composite Elbow Movement (as a percentage of opposite side)
P	13	12	6	90%	98%
PM	10	13	8	94%	98%
M	25	8	6	94%	97%
MD	9	9	10	92%	94%
D	17	9	12	94%	93%
S	28	12	7	92%	98%
I	17	11	11	93%	93%
C	29	9	9	92%	94%

The table provides information on the number of cases, mean union time, mean angulation in the coronal and sagittal planes and the composite shoulder and elbow movements for different topographic or morphologic types of fractures.

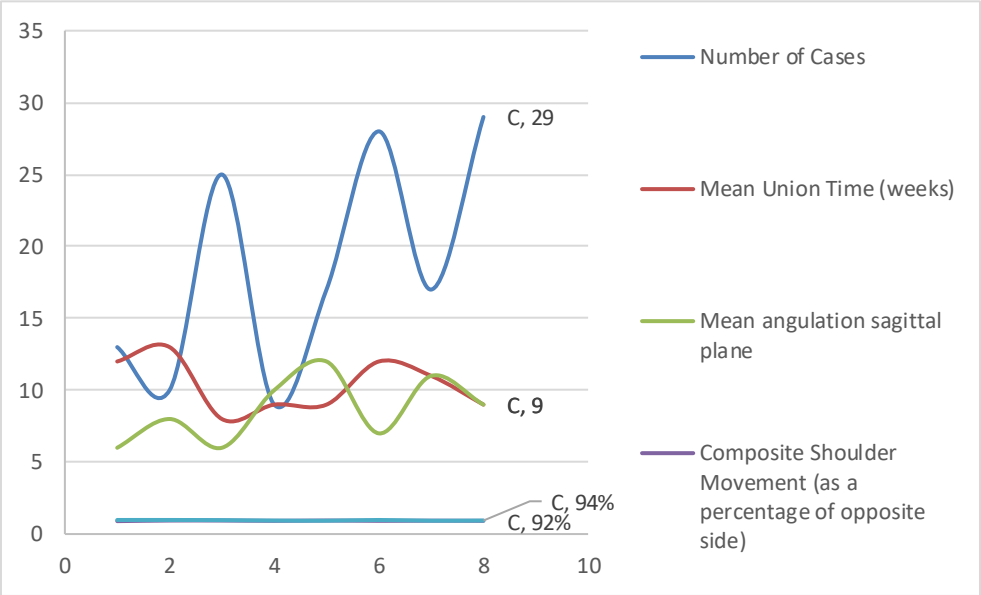

Figure 1: Composite movements represent the combined shoulder and elbow movements expressed as a percentage of the opposite side.

From the data provided:

- Fracture types P, PM, and M have relatively shorter mean union times (ranging from 8 to 13 weeks) compared to the other types.
- Fracture types MD and D have slightly longer mean union times (9 to 10 weeks) compared to types P, PM, and M.
- Fracture types S, I, and C have mean union times ranging from 11 to 12 weeks.
- The mean angulation in the coronal and sagittal planes varies among the fracture types, with no significant differences between them.
- The composite shoulder movement is generally high, ranging from 90% to 94% of the movement of the opposite side, indicating good shoulder function.
- The composite elbow movement is also relatively high, ranging from 93% to 98% of the movement of the opposite side, indicating good elbow function.

These results suggest that the different topographic or morphologic types of fractures show similar mean angulations and composite movements, indicating good functional outcomes for the patients. The data can be used to assess the expected range of motion and guide treatment decisions for patients with humeral fractures.

In terms of functional outcomes, the final assessment revealed that shoulder function was 92% of the normal side, elbow function was 94%, and wrist function was 100% compared to the opposite side. The restriction of external rotation

was less than 10% on average compared to the normal side. Coronal plane deformity ranged from 6 to 20 degrees, with a mean of 7 degrees, while sagittal plane deformity ranged from 4 to 10 degrees, with an average of 5 degrees. These deformities did not have a significant impact on function. The angulation of MD fractures was not significantly different.

Table 2: End Point Pain and Function Scores for Different Types

Type	Pain VAS Score (Day 1)	Pain VAS Score (Day 7 at Union)	ADL Recreational Activity at Union
P	7	3	8-10
PM	8	2	6-8
M	6	2	8-10
MD	7	3	8-10
D	8	3	8-10
S	8	3	8-10
I	7	2	6-8
C	8	3	8-10

The table presents the endpoint pain VAS scores on day 1 and day 7 at the time of union, as well as the level of ADL recreational activity at the union for different topographic or morpho-graphic types of fractures.

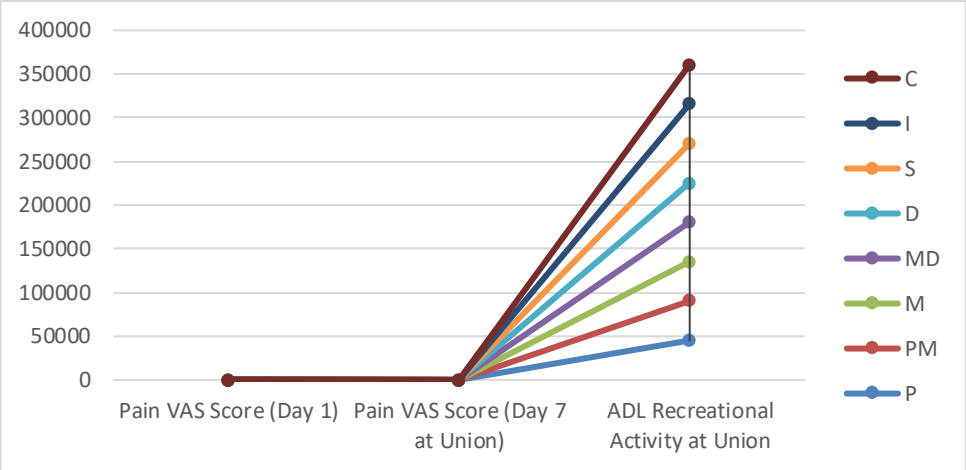

Figure 2: Function Scores for Different Types

Figure 3: The progress of union in a transverse humeral fracture in an extension cast.

Table 3: Biomechanics of Fracture Immobilization

Position	Biomechanics
Extension	- Biceps acts as a taut belt, facilitating humerus reduction.
	- Relaxed triceps provides support without deforming forces.
	- Sleeve phenomenon recreates Starling's law.
Flexion	- Biceps muscle is totally relaxed, offering poor support.
	- Stretched triceps behaves like a bowstring, causing angulation or overlap at the fracture site.

In extension, the biceps muscle is stretched passively, allowing it to act as a relatively taut belt that aids in reducing the humerus. The triceps, particularly the medial and lateral heads, continue to support the fracture site without exerting deforming forces due to their relaxed position. This configuration creates a sleeve phenomenon within the cast, which helps recreate Starling's law.

Complications encountered during the study included three cases of cast slippage in relatively obese patients, which were attributed to mild flexion of the elbow during cast application. Additionally, two cases of complex regional pain syndrome were reported. No cases of radial nerve palsy induced by the cast application were encountered, as cases of trauma-induced radial nerve palsy were excluded to avoid bias in the results related to wrist and elbow range of motion. The absence of cast-induced radial nerve palsy could potentially be attributed to less pressure from the fracture callus due to a relaxed triceps muscle. However, further investigation with a larger sample size would provide more clarity on this finding.

DISCUSSION

The treatment of humeral shaft fractures has been a subject of debate, with both operative and non-operative approaches being utilized. This study adds to the existing body on the effectiveness of non-operative treatment methods for humeral shaft fractures [6].

The findings of this study are consistent with previous research that has demonstrated favorable outcomes with non-operative management. Cong, Z *et al.* [7] reported excellent results and comparable complication rates between non-operative and operative treatments for humeral shaft fractures [8]. These studies, along with the current study, provide evidence that non-operative treatment can be a viable option for patients with humeral shaft fractures.

The use of functional bracing has gained popularity as a non-operative treatment method for humeral fractures. Sarmiento *et al.* conducted a significant study on 620 humerus fractures treated with a functional brace, reporting a low non-union rate of 2.5% and an average healing time of 9.5 weeks [5]. These findings support the efficacy of functional bracing in promoting fracture healing and achieving successful outcomes.

However, it is important to note that external rotation of the shoulder joint can be a potential complication associated with functional bracing. Fjalstead *et al.* found that 38% of patients treated with this method experienced significant external rotation of the shoulder joint [9]. This highlights the need for careful monitoring and follow-up during the treatment process to address and manage any potential complications.

The current study adds to the existing literature by evaluating the outcomes of extension casting as a non-operative treatment method for humeral shaft fractures. The results showed high rates of fracture union, satisfactory functional outcomes, and minimal deformities. These findings support the use of extension casting as an effective alternative to functional bracing and surgical intervention in select cases [10].

Functional outcomes were also favourable in this study. The assessment of combined shoulder, elbow, and wrist movements revealed that the patients achieved a high percentage of the normal range of motion compared to the opposite side. The shoulder function was 92% of the normal side, while the elbow and wrist functions were 94% and 100%, respectively. This suggests that extension casting allows for satisfactory functional recovery, enabling patients to regain a significant degree of mobility [11].

Furthermore, the study evaluated the presence of deformity in the coronal and sagittal planes. The average angular deformities observed were minimal, ranging from 6 to 20 degrees in the coronal plane and from 4 to 10 degrees in the sagittal plane. Importantly, these deformities did not significantly affect the functional outcomes of the patients [12]. This finding suggests that despite the presence of some residual angulation, patients were able to achieve satisfactory joint mobility and function.

Regarding complications, a small number of cases experienced cast slippage, which occurred primarily in relatively obese patients. This issue may be mitigated by modifying the cast application technique, ensuring proper immobilization and stability. Additionally, two cases of complex regional pain syndrome were reported, highlighting the importance of close monitoring and timely intervention to address potential complications associated with any treatment modality.

Notably, no cases of cast-induced radial nerve palsy were encountered in this study. The absence of such complications may be attributed to the specific casting technique employed, which avoided excessive pressure on the fracture callus and accounted for the relaxed triceps muscle. However, it is important to acknowledge the need for further investigation with a larger sample size to validate these findings and explore the potential risk factors for nerve-related complications.

CONCLUSION

Extension casting demonstrated positive outcomes in the non-operative management of humeral shaft fractures. The study showcased high rates of fracture union, satisfactory functional outcomes, and minimal deformities. These findings support the use of extension casting as a viable treatment option, particularly in cases where surgical intervention may not be necessary or desirable. Orthopaedic surgeons must consider the benefits of non-operative methods, taking into account individual patient characteristics, fracture patterns, and associated risks, to provide optimal care and achieve favourable outcomes for patients with humeral shaft fractures.

REFERENCES

1. Haghpanah, S., Nasirabadi, S., Ghaffarpasand, F., Karami, R., Mahmoodi, M., Parand, S., & Karimi, M. (2013). Quality of life among Iranian patients with beta-thalassemia major using the SF-36 questionnaire. *Sao Paulo medical journal*, *131*, 166-172.
2. Garnavos, C. (2015). Humeral shaft fractures In: Court-Brown CM, Heckman JD, Mc-Queen MM, Ricci WM, Tornetta P 3rd. editors. Rockwood and Green's Fractures in adults.
3. Prakash, L., & Dhar, S. A. (2022). Non operative management of fractures of the humerus Evaluation of a new extension casting method. *Acta orthopaedica Belgica*, *88*(1), 151-159.
4. Papasoulis, E., Drosos, G. I., Ververidis, A. N., & Verettas, D. A. (2010). Functional bracing of humeral shaft fractures. A review of clinical studies. *Injury*, *41*(7), e21-e27.
5. Sarmiento, A. (2008). Functional bracing of fractures of the shaft of the humerus. *Orthopedic Trauma Directions*, *6*(01), 33-37.