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Original Article

Comparison of Treatment Outcome of Humeral Shaft Fractures Treated with Functional Cast Brace and "U" Slab

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ABSTRACT

Objective: To compare the outcome of humeral shaft fractures treated by functional cast brace versus "U" slab in terms of union.

Study Design: Quasi-experimental study

Place and Duration of Study: Department of Orthopaedic Surgery/Traumatology Unit-II, Mayo Hospital, Lahore, Pakistan from Jul to Dec 2018.

Methodology: One hundred and four patients fulfilling inclusion criteria were included. Patients were randomised into two groups by random tables. Group-A patients were treated with a "U" slab outdoors, and Group-B patients were treated with a customised functional brace from the Orthopaedic workshop as indoor cases.

Results: The mean age of patients was 47.99±14.15 years, with minimum and maximum ages of 16 and 65 years, respectively. According to the operational definition, the union was achieved in 88(84.6%) patients. In Group-A, 38(73.1%) patients and in Group-B, 50(96.2%) patients had union. A significant association between union and study Groups was noted, i.e. Group B had a high union rate when compared to Group A, with a *p*-value of 0.001.

Conclusion: To conclude, in patients with humeral shaft fracture, a functional cast brace is a better choice for achieving union as it reduces the burden of non-union, and patients recover early, assessed by callous formation.

Keywords: Brace, Slab, Union, Humeral shaft fractures.

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INTRODUCTION

Fracture of the humeral shaft is one the most common presentations in the emergency department. It is common in all age Groups.[1] Mechanism and severity of injury/trauma vary depending upon the age of the patient, ranging from trivial trauma in the elderly to road traffic accidents/falls in the paediatric and adult population.[2,3] These fractures account for about 3% of all fractures. Humeral shaft fractures are most debated in terms of treatment as operative and non-operative. Both treatment modalities are being practised, but the standard management for humeral shaft fractures has historically been considered non-operative/conservative.[4] On the other hand, operative treatment is also advocated depending upon closed or compound fracture and operative treatment options include open reduction, dynamic or percutaneous helical plate, nails and external fixator.[5,6]

On the other hand, in non-operative treatment, there are higher probabilities for union with minor complications. It is a conclusive management procedure at the fracture site without disrupting the biological ecosystem.[7] It also has cost-effectiveness advantages, may be done in the outpatient department, and hospitalisation is not required. Numerous non-operative procedures, such as hanging casts, "U" slabs, and others, are used.[8]

Amongst the non-operative treatment options for humeral shaft fracture, conflict and debate have been generated about the better modality for management.[9] However, no definite answer could be found due to the paucity of evidence in the literature.[10] To address this controversy, we conducted this study in our population. This study aimed to compare the "U" slab with the Sarmiento technique (functional brace) as two different modalities of conservative management for humeral shaft fractures in terms of fracture union. The rationale of this study was that the brace was a better treatment option compared to the "U" slab in humeral shaft fractures due to the difference in the construction of the two non-operative modalities as contrary to cast, brace not only immobilises the fracture site but also allows movement at shoulder & elbow joints resulting in a lesser chance of joint stiffness that is an undesirable side effect limiting the rehabilitation later on.

METHODOLOGY

The quasi-experimental study was carried out at Unit-II, Department of Orthopedic Surgery and

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Traumatology, Mayo Hospital, Lahore, Pakistan after Ethical Review Committee approval (1665/ERC dated March 2018) from July to December 2018. The sample size was estimated by using the expected percentage of the union in both Groups, i.e. cast brace as 98.48% 7 and U slab as 79.4%.[6] The sampling technique was non-probability; consecutive sampling

Inclusion Criteria: Patients aged 16 to 65 years, of either genders with closed humeral shaft fractures without radial nerve palsy 5cm distal to the anatomical neck and 5cm proximal to the lateral epicondyle of the humerus on fresh X-rays and patients with Gustilo type 1 fracture were included in the study after informed consent.

Exclusion Criteria: Patients with numerous fractures, weak skin conditions assessed on clinical examination, bilateral fractures of the humerus and patients with polytrauma causing the patient to remain bed-bound were excluded.

One hundred four patients fulfilling the inclusion criteria were selected through emergency and OPD settings. After taking all ethical considerations and explaining the procedure to the patient, a written informed consent with demographic information, including body mass index and smoking habits, was taken from each patient participating in this study. Humeral shaft fracture was defined if there was a breach in the continuity of the humeral shaft as assessed on X-rays, preceded by a history of fall/trauma. The patients were randomised into two groups by random number tables (Figure-1).

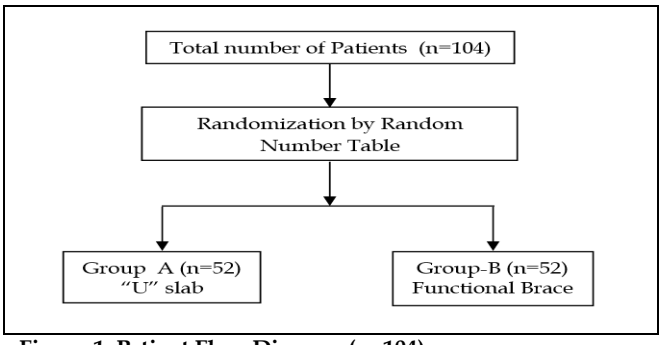

Figure-1: Patient Flow Diagram (n=104)

Group-A patients were treated with a "U" slab, which was applied in Accident and Emergency and followed up in OPD. In the "U" slab technique, the arm's weight and the cast align the bone, allowing room for the expected swelling after acute injury. The slab was supported in a triangular sling and was applied for six to eight weeks, depending upon the age of the patient and the nature of the fracture. In Group-B, patients were admitted to the ward for a customised functional brace (Sarmiento Cast) from the Orthopaedic workshop, which was then applied to the injured limb. In this technique, internal forces, with the help of functional orthosis, stabilise the fracture to reduce pain and aid recovery.

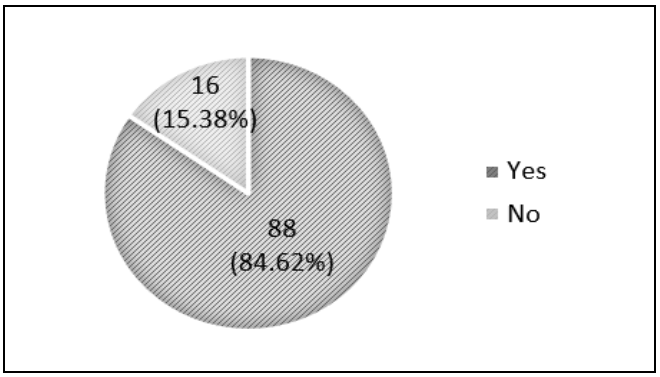

Figure-2: Distribution of Union in both Study Groups

All cases were discharged and followed up in OPD to assess the outcome. All patients were treated by a single consultant who had enough experience in using both modalities in the conservative management of humeral shaft fractures. All patients were followed up for 16 weeks, and union was measured both clinically and radiologically on a radiograph using anteroposterior and lateral views and was documented when there was callus formation.

Statistical Package for Social Sciences (SPSS) version 24.0 was used for the data analysis. Quantitative variables were expressed as mean±SD and qualitative variables were expressed as frequency and percentages. Chi-square test was applied to explore the inferential statistics. The *p*-value of ≤0.05 was set as the cut-off value for significance.

RESULTS

The mean age of patients in this study was 47.99±14.15 years. In this study there were 49(47.1%) male and 55(52.9%) female patients. A total of 22 (21.2%) patients were obese, and the rest of 82(78.8%) were not obese. According to the operational definition, the union was achieved in 88(84.6%) and 16 (15.4%) patients (Figure-2).

In Group-A, 38(73.1%) patients and in Group-B, 50(96.2%) patients had union (Table-I). On statistical analysis, we found a significant association between union and study Groups, i.e. Group B had a high union rate when compared with Group A, with a *p*-

value < 0.05. When data was stratified for age, gender, body mass index (BMI) and smoking, the union rate was higher in Group B when compared to Group A in each stratum, *p*-value < 0.05 (Table-II).

Table-I: Comparison of union in both Groups (n=104)

		Study Groups		Total	*p*-value
		Group-A "U" Slab	Group-B Functional Brace		
Union	Yes	38(73.1%)	50(96.2%)	88(84.6%)	0.001
	No	14(26.9%)	2(3.8%)	16(15.4%)	
Total		52(100.0%)	52(100.0%)	104(100.0%)	

Table-II: Comparison of Union in both Groups with respect to different Variables (n=104)

		Union	Study Groups		*p*-value
			Group-A	Group-B	
Age Groups (years)	16-40	Yes	7(50%)	15(93.8%)	0.007
		No	7(50%)	1(6.2%)	
	41-65	Yes	31(81.6%)	35(97.2%)	0.030
		No	7(18.4%)	1(2.8%)	
Gender	Male	Yes	20(69%)	19(95%)	0.026
		No	9(31%)	1(5%)	
	Female	Yes	18(78.3%)	31(96.9%)	0.029
		No	5(21.7%)	1(3.1%)	
Body Mass Index	Obese	Yes	2(28.6%)	14(93.3%)	0.001
		No	5(71.4%)	1(6.7%)	
	Non-obese	Yes	36(80%)	36(97.3%)	0.017
		No	9(20%)	1(2.7%)	
Smoking	Smokers	Yes	10(58.8%)	11(100%)	0.014
		No	7(41.2%)	0(0%)	
	Non-smokers	Yes	28(80%)	39(95.1%)	0.042
		No	7(20%)	2(4.9%)	

DISCUSSION

Fracture of the humeral shaft is a common orthopaedic surgical emergency. Injury mechanisms can vary as the humerus may be twisted by a fall on the outstretched hand, causing a spiral fracture; a fall on the elbow with the abducted arm exerts a bending force, likely to result in an oblique or transverse fracture. The treatment of such injuries needs to innovate as progress is made in non-operational and operational management.[11-13]

Multicentric research in India found that when the Sarmiento technique (functional brace) was used, union occurred in 98.48% of cases, averaging 10.3 weeks. On the other hand, by adding the "U" Slab, Denard demonstrated a union in 79 % of the cases only.[14] These results are comparable to our study, in which 96% of patients treated with a brace achieved union, and 73% of patients treated with a "U" slab achieved fracture union.

Over six months, a study in the Orthopaedic Department, Shaikh Zayed Hospital Lahore, reported the role of coaptation splints in treating humeral shaft fractures. It is a dependency traction method that involves placing a well-moulded plaster slab from the axilla, around the elbow and over the deltoid with the elbow flexed to 90 degrees.[15] Another study reported the same statistics as ours, i.e. there were 31 male and four female patients, with an average age of 42.5 years.[16]

Non-operative management of humeral shaft fractures is traditionally the main basis of treatment, although there may be some drawbacks. There are multiple choices for conservative treatment, such as a functional brace, "U"-slab and hanging cast. Nevertheless, the functional brace is a gold standard conservative treatment. In 10 to 30 % of patients, treatment with functional bracing may lead to losing some shoulder external rotation, flexion, and abduction. In less than 10 % of patients, elbow flexion/extension is impaired.[17,18]

A study was planned to see the role of a new functional brace for the management of humeral shaft fractures. A total of 12 patients out of 16 had radiological evidence of union, with the other 4 demonstrating significant callus with no complications of bracing treatment.[19] We in this study found that in "U"-slab, 38(73.1%) patients and in functional brace Group 50(96.2%) patients had union while 14(26.9%) in Group-A and 2(3.8%) in Group-B did not achieve union. A relatively large series of 620 patients with 97% union rates and high satisfaction rates with functional bracing was published by Sarmiento and colleagues. They demonstrated the advantages of functional bracing treatment because it leads to acceptable results with little morbidity,[20] which is almost similar to our study.

Therefore, by applying a functional brace compared to other conservative techniques such as "U"-slab, there is freedom of movement at the shoulder and elbow joints. Therefore, the range of motion at the end of the treatment is not affected at the shoulder joint. Because of the "U"-slab, which is not the case with a functional brace, there are more chances of elbow joint stiffness. The functional brace comprises plastic anterior and posterior shells held together with velcro straps.

CONCLUSION

Based on the findings of this study, we concluded that a better choice for achieving a high union rate is a functional cast brace in patients with Humeral shaft fracture. By using this method, the burden of non-union can be reduced, and patients can recover early.

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Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

AT & NA: Study design, drafting the manuscript, approval of the final version to be published.

OF & MOA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

FJ & NW: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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