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Research Article

**RADIOGRAPHIC AND CLINICAL RESULTS OF FRACTURE
SHAFT OF HUMERUS PRESERVED WITH A FUNCTIONAL
BRACE**¹Iqra Shahid, ²Dr Shafaq Naseer, ³Dr Fatima Akram¹RMU & Allied Hospitals²Holy Family Hospital, Rwp³Holy Family Hospital Rawalpindi**Article Received:** March 2020**Accepted:** April 2020**Published:** May 2020**Abstract:**

Aim: To determine the clinical and radiographic outcomes of patients treated with functional bracing for humeral shaft fractures.

Place and duration: Ganga Ram Hospital Lahore for one-year duration from March 2019 to February 2020.

Material and methods: 15 patients with a mean age of 43 (in the range of 18 to 67 years) who met the inclusion and exclusion criteria, initially stabilized with plaster of Paris U-slab for two weeks followed by the application of a functional brace. Clinical and radiographic assessments were done weekly for the 1st four-weeks after the start of orthotic practice, & every 2-weeks thereafter. Functional assessment was carried out in accordance with Hunter's criteria. Radiographic assessment was performed taking into account the formation of healing tissue, anterior / posterior, lateral and rotational angulations and shortening into consideration.

Results: Most patients (n = 13, 86.6%) attained union after an average of 14-weeks (range 12-20 weeks). 2 fractures (13.3%) did not join, and then underwent surgery. 9 (69.2%) patients were assessed as functionally excellent (G5) and four (30.7%) good (G3-G4) according to Hunter's criteria. The mean varus-valgus angulation were 9 degrees in patients with functional bracing, while the anterior posterior angulation was 10 degrees. One patient (7.6%) had a 2 cm shortening combined whose fracture was united with bracing.

Conclusion: Fractures shaft of humerus treated with a functional brace gave a high-union rate with excellent functional outcomes.

Key words: Shaft of humerus, Functional brace, outcome.

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INTRODUCTION:

Fractures of the humerus shaft account for 1% to 3% of all fractures and about 20% of all fractures containing bone. Radial nerve injury is a communal complication of brachial axis fractures happening in 18% of blunt injuries. Often, injuries to the radial nerve are associated with fractures of the spiral axis of the humerus in the middle third¹⁻². The methods of treating humerus fractures have improved significantly compared to their original definitions in ancient Egypt; though, the basic management principles remained consistent over time³. There is no evidence from randomized controlled studies that determine whether surgical intervention of humerus shaft fractures provides a better or worse result than any surgery⁴. Most closed fractures of the humerus can be effectively treated by closed methods; it is often reported that rates in the EU are over 90%. Multiple closed methods are available, including the employment of traction, as well as the use of the hanging arm cast, coaptation splint, Velpeau dressing, abduction humeral/shoulder spica cast, or functional brace⁵. Sarmiento and his colleagues first used functional brace in 1977⁶. This device consists of plastic front and rear covers fastened by Velcro straps. Functional bracing renders a high rate of union and seems to be a safe method of treatment for the majority of closed humeral fractures⁷. Functional reinforcement ensures a high binding rate and appears to be a safe treatment for most closed humerus fractures. This study aimed to assess the clinical and radiographic results of humeral bone fractures treated with functional orthopedic device.

MATERIAL AND METHODS:

This cross-sectional study was held in Ganga Ram Hospital Lahore for one year duration from March 2019 to February 2020. In this study, 15 patients of all ages, both sexual and isolated fractures of the isolated humerus, who reported within a week or earlier after injury were selected. All patients with multiple fractures, bilateral fractures of the humerus, pathological fractures, segmental fractures, delivery extension, open fractures associated with humerus fractures, "floating elbow" and patients with forearm bone, morbid obesity and unilateral fractures arms with poor patient compliance such as plexus injuries and mental retardation, and fractures with neurological disorders such as parkinsonism or epilepsy were not included.

The study protocol was approved by the hospital's ethics committee and written informed consent was obtained from all entities involved. A full neurological examination of the limb was performed and anterior-posterior and lateral x-ray of the humerus was taken. All fifteen fractures were initially stabilized with the help of Plaster of Paris (Gypsona- BSN Medical 6') U-slab under intravenous sedation with diluted Diazepam (Valium-Martin Dow) and Sosegan (Pentazocine HCl-Searle). After correctly placing the humerus, the cotton is wrapped around the shoulder and the elbow bends 90 degrees. The slab is applied to the shoulder and the forearm in a neutral position, from 6 inches to 8-10 layers wide. Two weeks after application of U slab, acute pain and swelling were reduced and functional brace was used. In order to leave the ankle area open and allow the elbow to bend to 120 °, support was used for all patients with measurements taken from the arm intact. Adhesive tapes are arranged according to soft tissue swelling and continuous reinforcement is used. The orthodontic appliance made of thermoplastic polyethylene, extending from the level of 2.5 cm below the armpit to the medial side to a height of 1.3 cm from the medial mediastinum and just above the acromion on the lateral side described by Sarmiento. A shoulder sling was used that held the elbow at a 90-degree angle. Patients were encouraged to perform active and passive movement exercises for all broken limb joints. For the first two consecutive weeks the baby carrier was used except when the patient was exercising. About a week after putting on the apparatus, pendulum exercises with an outstretched elbow began. Clinical and radiographic assessments were done weekly for the 1st four weeks after the start of orthotic practice, and every 2-weeks thereafter. The functional use of the orthopedic device ended with the appearance of satisfactory scar tissue, disappearance of pathological movement, and pain in the fracture line. Patients with radial nerve palsy were observed in a nerve conduction study (NCS) and electromyogram (EMG) taken after the sixth week, and repeated within 12 weeks unless improvement was seen. In these patients, a radial splint was immediately applied and passive hand and wrist exercises began. Functional and radiographic assessment was performed as part of patient observation. Functional assessment was compared to the intact page according to Hunter's criteria (Table 1).

Table1: Hunter Criteria

Grade	Description
G-I	Complete absence of shoulder & elbow movements & complete impairment in daily activities
G-II	Lesser degree of movement & important impairment in daily activities
G-III	Small impairment in daily activities because of restricted movement
G-IV	Mild restriction in movement not affecting daily activities
G-V	Full range of motion in shoulder & elbow

Radiographic assessment was performed taking into account tissue healing, anterior posterior, lateral and rotary holes, and shortening. Improvement that occurs within 16 to 24 weeks is called delayed union, and improvement only after 24 weeks, which is called non-union. Acceptable compensation of brachial axis fractures was considered a 3 cm shortening, 30 ° torsion angle and valgus, and 20 ° forward / backward angulation. All statistical analyzes were performed using SPSS Release 15. Calculated mean values and data shown in the tables when necessary.

RESULTS:

15 patients, 11 (73.3%) men and 4 (26.6%) with an average age of 43 years (range 18–67) completed the study. The right humerus was fractured in 10 (66.6%) patients, and 5 (33.3%) had a left humerus fracture. The causes of fractures were road accidents in 7 (46.6%) patients, a decrease in 4 (26.6%) patients, and physical aggression in 2 (13.3%) patients and sports injuries in 2 (13.3%) patients. The frequency and patterns of shoulder axis fractures are shown in Table 2.

Table 2: Frequency and patterns of humeral shaft fractures

Level of fracture	Number of fractures	Transverse		Oblique		Spiral		Comminuted	
		No.	%	No.	%	No.	%	No.	%
Proximal 1/3	04	02	50%	01	25%	01	25%	00	00
Middle 1/3	08	04	50%	02	25%	01	12.5%	01	12.5%
Distal 1/3	03	01	33.3%	01	33.3%	01	33.3%	00	00
Total	15	07	46.6%	04	26.6%	03	20%	01	6.6%

Most patients (n = 13, 86.6%) achieved union after an average of 14-weeks (range 12-20 weeks). Both fractures (13.3%) did not connect and then treated them with plaques and bone grafts. The two unbound fractures were a simple transverse fracture in the mid-3rd and an oblique fracture in the distal 3rd of the humerus. Varusvalgus and posterior / anterior angulation were measured in patients improved with functional braces on the final control radiographs. The mean angulation of the difference and valgus was 9 degrees (range 0-12 degrees), while the mean back angulation was 10 degrees (range 0-17 degrees) in patients with functional brace.

No patient had rotational deformity. None of these extensions were considered functional and cosmetically important. One patient (7.6%) had a 2 cm shortening in combination with fracture support and full length was obtained in all other cases. Radial nerve palsy was reported in only one patient (6.6%) in a spiral fracture in the middle 3rd of the body and healed spontaneously after the fourth month. Maceration occurred in three patients (20%) related to corset skin irritation. For these adventures dermatological and care products were used without support. In functional evaluation according to Hunter's criteria, after healing a fracture, 4 patients (30.7%) had a small range of motion and full range of motion that did not affect daily activity (Hunter G3-G4). (Hunter G5) was observed in 9 (69.2%) patients. The most common functional loss was limitation of shoulder abduction (average loss of 30 degrees) in 3 (23%) patients and external rotation (loss of 15 degrees) in 1 (7.6%) patients.

DISCUSSION:

Functional support has been recognized as the gold standard in the conservative treatment of shoulder fractures. In our study, we documented an attachment rate of 86.6% with functional orthopedic support. In the largest clinical analysis to date, Sarmiento reported that 922 patients treated with surgery for both closed and open humerus fractures 98% of all closed injuries and 94% of all open fractures were cured⁸. He concluded that a functional addition to the treatment of shoulder fractures is associated with a high binding rate, especially for closed fractures. Residual angular deformations can generally be considered functional and aesthetic⁹. In another study, 77% of the union index (46% of the union index in the proximal 3rd of the humerus, 81% and 86% in the middle and distal third row, respectively) was reported. However, in this study, while the splint was applied immediately after the injury, when the acute pain and swelling were reduced, we used functional support two weeks after sustaining the fracture¹⁰.

In our study, functional assessment after fracture healing was done according to Hunter's criteria, and 4 patients (30.7%) had 4 slight movement restrictions that did not affect daily activity (Hunter G3-G4) and full range of motion (Hunter G5) was observed in 9 patients (69.2%)¹¹. Ozkurt and Altay achieved an 80% binding rate to a functional cluster and reported that functional results were excellent in 20% (G5) and 80% of patients (G3-G4) according to Hunter's criteria. The sample size was 30 in the study and the mean follow-up was 20 months (range 10-58 months). In another study, radiographic and functional results of Kwasna *et al*¹². Radiographic and functional outcomes were very good in 31 patients (81.6%), good in 7 patients (18.4%) and

there were no complications associated with functional supplementation¹³.

In our study, the most common functional loss was limitation of shoulder abduction (30-degree average loss) in 3 (23%) patients and external rotation (15-degree loss) in 1 (7.6%) patient¹⁴. Sarmiento reported that loss of arm movement was greater than 25 degrees in only 2% of patients, while Fjalestad and Stromsoe reported loss of external rotation in 21 fractures (38%). In the case of poor rotation, fracture consolidation was often observed in the studies and a linear correlation was found between the loss of external rotation and clinical results. Rosenberg and Soudry treated 15 consecutive patients with humerus fractures with functional support and observed for an average of 30 months (range 12 to 57 months) and evaluated them with Constant and Oxford Shoulder Score. They concluded that the shoulder function in a damaged limb may continue to deteriorate, although the fracture connection is usually achieved after functional strengthening.

We documented nonunion in two patients (13.3%) with a middle third transverse fracture and a third distal oblique fracture, and both patients were intense smokers and repeated instructions. Decomas and Kaye noted risk factors associated with failure to treat humerus fractures after functional supplementation: obesity (37%); smoking history (53%); metabolic bone disease (32%); cardiovascular disease (37%); short oblique fractures (89%); open fractures (26%); and fractures of a third of the proximal shaft (68%). They advise these patients to advice on the possible risk of non-union due to functional enhancement, and consider the option of surgical fixation¹⁵. 24 In 44 (90%) of 49 patients treated by Rutgers and Ring, the loss of movement should not be more than 15 degrees for each patient. Four (29%) of the proximal third 14 fractures, 1 of 22 fractures in the mid-3rd (4%) and none of the 13 distal 3rd fractures failed. They concluded that proximal 3rd long oblique fractures may be higher than the average risk not associated with functional fracture enhancement. Despite the strengths of our research, some limitations should be mentioned. Our sample may not be large enough and the observation time was short. For this reason, we recommend a larger series of boxes with longer observations on this topic. Since there is very little research data on this topic so far, the need for further research cannot be overestimated.

CONCLUSION:

Fractures shaft of humerus treated with functional orthodontic brace gave a high union rate with excellent functional results. It ensures good alignment of parts and ensures fast and uninterrupted osteogenesis. Early introduction of functional activity along the limb seems to provide the desired physiological environment that helps in

healing quickly and preventing loss of labor. Its use, adaptation, non-surgical risk, economically beneficial and acceptance of this method of patient treatment are high. Since our results confirm the effectiveness of this method of treatment, functional brace should be taken into account only with very high rates of efficacy in the treatment of humeral diaphyseal fracture and low complications.

REFERENCES:

1. Updegrove, Gary F., Wassim Mourad, and Joseph A. Abboud. "Humeral shaft fractures." *Journal of shoulder and elbow surgery* 27, no. 4 (2018): e87-e97.
2. Swellengrebel, HJ Christiaan, David Saper, Paul Yi, Alexander A. Weening, David Ring, and Andrew Jawa. "Nonoperative Treatment of Closed Extra-Articular Distal Humeral Shaft Fractures in Adults: A Comparison of Functional Bracing and Above-Elbow Casting." *American journal of orthopedics (Belle Mead, NJ)* 47, no. 5 (2018).
3. Oliver, William M., Thomas H. Carter, Catriona Graham, Timothy O. White, Nicholas D. Clement, Andrew D. Duckworth, and Samuel G. Molyneux. "A prospective randomised controlled trial of operative versus non-operative management of fractures of the humeral diaphysis: the HUmeral Shaft Fracture FIXation (HU-FIX) Study protocol." *Trials* 20, no. 1 (2019): 475.
4. Nowak, Lauren L., Niloofar Dehghan, Michael D. McKee, and Emil H. Schemitsch. "Plate fixation for management of humerus fractures." *Injury* 49 (2018): S33-S38.
5. Sargeant, Harry William, Luke Farrow, Scott Barker, and Kapil Kumar. "Operative versus non-operative treatment of humeral shaft fractures: A systematic review." *Shoulder & Elbow* (2019): 1758573218825477.
6. Costa, Giovan Giuseppe, Domenico Costantino Aloj, Simone Cerbasi, Maria Rizzo, Alessandro Massè, Raffaele Pascarella, and Massimo Mariconda. "External fixation as a definitive treatment for humeral shaft fractures: radiographic and functional results with analysis of outcome predictors." *Journal of orthopaedic trauma* 33, no. 7 (2019): 354-360.
7. Bisaccia, Michele, Luigi Meccariello, Giuseppe Rinonapoli, Cristina Ibáñez-Vicente, Julio Ribes-Iborra, David Gomez-Garrido, Giuseppe Rollo et al. "Reliability and value of external modular fixation (Hoffmann II®) in the management of humeral shaft fracture." *Clin Cases Miner Bone Metab* 15, no. 3 (2018): 423-427.
8. Lodhi, Rizwan, and Syed Baqir Hussain Jafree. "Outcome in the Conservative Management of Shaft of Humerus Fracture in Functional Brace." *PAKISTAN JOURNAL OF MEDICAL*

- & *HEALTH SCIENCES* 12, no. 1 (2018): 340-342.
9. Wang, Qiuke, Jian Hu, Junjie Guan, Yunfeng Chen, and Lei Wang. "Proximal third humeral shaft fractures fixed with long helical PHILOS plates in elderly patients: benefit of pre-contouring plates on a 3D-printed model—a retrospective study." *Journal of orthopaedic surgery and research* 13, no. 1 (2018): 1-7.
 10. Raj, D. Vimal, and Anish Anto Xavier. "Functional and radiological outcome of intramedullary interlocking nail in the treatment of fracture shaft of humerus." *International Journal of Orthopaedics* 4, no. 1 (2018): 750-752.
 11. POINTS, TAKE-HOME. "Nonoperative Treatment of Closed Extra-Articular Distal Humeral Shaft Fractures in Adults: A Comparison of Functional Bracing and Above-Elbow Casting."
 12. Burki, Asad Ullah, Mubashar Ahmed Bajwa, Saman Mubashar Bajwa, Mudassar Ahmed Bajwa, Hafiz Azhar Hussain, and Syed Arsalan Haider Bukhari. "TREATMENT OF CLOSED HUMERUS DIAPHYSEAL FRACTURES USING A FUNCTIONAL BRACE." *Pakistan Armed Forces Medical Journal* 70, no. 1 (2020): 136-140.
 13. Patel, Ishani, Dhaval R. Modi, and Mansi Patel. "Functional outcome of humeral shaft fractures in adults treated with titanium elastic nailing." *International Journal of Research in Orthopaedics* 4, no. 4 (2018): 582.
 14. Zarkadis, Nicholas J., Emmanuel D. Eisenstein, Nicholas A. Kusnezov, John C. Dunn, and James A. Blair. "Open reduction–internal fixation versus intramedullary nailing for humeral shaft fractures: an expected value decision analysis." *Journal of shoulder and elbow surgery* 27, no. 2 (2018): 204-210.
 15. Athreya, Prasad Jankiram, Vanessa Abbott, Luke Elias, and Bijoy Thomas. "Evaluating the Outcome of a New Functional Brace for the Management of Humeral Shaft Fractures." *The Open Orthopaedics Journal* 13, no. 1 (2019).