FUNCTIONAL HUMERUS BRACE VS U-SLAB IN HUMERAL SHAFT FRACTURES: A RANDOMIZED CONTROL TRIAL

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ABSTRACT

OBJECTIVES: To evaluate and compare the functional outcome in humeral shaft fractures after treatment with U cast and functional brace.

STUDY DESIGN: A Randomized Controlled Trial

PLACE AND DURATION: The study was conducted over a period of 6 months in Benazir Bhutto Hospital Rawalpindi, Orthopaedics Department from 1st Nov 2012 to 31st May 2013.

METHODOLOGY: 280 patients of either gender from 20-60 years of age with closed Humeral Shaft Fractures were included in the study. All patients were treated in OPD by trainee researcher under supervision. Patients were divided in 2 groups on the basis of lottery method. In group A functional brace was applied and in group B conventional U-cast was applied. Functional outcome was assessed in terms of subjective evaluation by using Hunter's criteria at 06 weeks by the researcher trainee.

RESULTS: A total of 280 Patients were included in both groups. In Group A Hunter's score was G-1 in 4 patients (1.4%), G-2 in 6 patients (2.1%), G-3 in 7 patients (2.5%), G-4 in 39 patients (13.9%) and G-5 in 84 patients (30%).

In Group B Hunter's score was G-1 in 8 patients (2.9%), G-2 in 14 patients (5%), G-3 in 41 patients 14.6(%), G-4 in 45 patients (16.1%) and G-5 in 32 patients (11.4%).

CONCLUSION: Functional Outcome after the treatment of Humerus in patients treated with Humerus brace is better than functional outcome in patients treated with conventional U cast.

KEY WORDS: U cast, U-slab, Functional brace, Humerus fracture

INTRODUCTION

Humeral shaft fractures account for 1-5 % of all fractures[1]. There is bimodal distribution with peaks primarily in young males 21-30 years of age and a larger peak in older females from 60-80 years of age[2]. As the age increases, the etiology of fracture changes from high energy trauma in young to overwhelming low impact trauma, such as simple fall, in the elderly. Humeral shaft fractures in young are often part of multiple traumas as a result of their mechanism[3]. Classically the humeral shaft fractures can be classified on the basis of various factors that influence the treatment such as (a) Fracture location; (b) direction and character of fracture line; (c)associated soft tissue injuries(open or closed); (d) associated periarticular injury involving glenohumeral or elbow joint; (e)associated nerve injury;(f)associated vascular injury;(g)intrinsic condition of bone[4].

Patient usually presents with pain, swelling, deformity and shortened extremity. Anteroposterior and lateral radiographs are often all that are required to diagnose a fracture[3].

Conservative treatment is not only important from a historical perspective but also continued to be mainstay of treatment for isolated humeral shaft fractures with overall good results.[1]

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The most common conservative methods that have been used for this purpose are Desault or Velpaue bandages, abduction splints, U-casts, hanging casts, and functional bracing.

The functional bracing has been so widely accepted as the best conservative method, that it is considered as the gold standard of humeral shaft fracture treatment for many authors[5].

Functional bracing is being used for non-operative treatment for humeral shaft fractures because of its ease of application, adjustability, allowance of shoulder and elbow motion, relatively low cost, and reproducible results. Initially popularized by Sarmiento in 1977, the functional brace works on the principles of the hydraulic effect of the brace, active contraction of the muscles, and beneficial effect of gravity[6].

Functional bracing of closed humeral shaft fractures results in high fracture consolidation rates, good functional outcomes and reduced health care expenditures compared to surgical treatment[5]. Movements of shoulders and elbow can be set free in early stages with brace treatment, and complications like stiffness in elbow and shoulder joints, and subluxation of the shoulder as a result of atrophy of the deltoid muscle can be prevented. With the stable reduction ensured with the brace, active movement is started in early period, blood circulation is increased in the fracture area, micro movements enhance bone production, and range of motion can be conserved in the neighboring joints[7,8].

Currently, the practice of applying U cast is more common as it is cheap so patients are more adaptable to it despite its complications. The rationale of this study is to advocate the frequent use of functional humerus brace in shaft of humerus fractures which promises early joint movements, early union and less complication. Previously, no such study has been conducted on comparison of functional humeral brace with conventional U-Cast by using Hunter's criteria[9].

METHODOLOGY

The study was started from 1st November 2012 to 31st May 2013 in the Accident & Emergency Department of Benazir Bhutto Hospital Rawalpindi, which is affiliated with Rawalpindi Medical College. This department covers all the peripheral areas of Rawalpindi district, as well as referrals from adjacent districts. On an average, more than 2000 patients are seen in the Accident & Emergency Department per week.

It was a Randomized Controlled Trial (RCT) study. Patients presenting in the Accident and Emergency (A & E) were selected for study on the basis of non-consecutive probability sampling. Inclusion criteria were adult patient of all age groups with unilateral closed mid-shaft fracture of humerus of any type. Patients with bilateral humerus fractures, neurovascular disturbances, open fractures and operative indications were not included in the study.

280 patients of either gender from 20-60 years of age with closed Humeral Shaft Fractures were included in the study. Patients who gave informed written consent were included in the study. Patients were divided in 2 groups on the basis of lottery method. In group A functional brace was applied and in group B conventional U-cast was applied. Brace was worn 24 hours a day. Braces manufactured from thermoplastic polyethylene extending in the medial aspect from a level of 2.5 cm below the axilla to a level of 1.3 cm over the medial epicondyle, and extending in the lateral aspect from immediately over the acromion to the lateral epicondyle of the humerus was applied to all the patients with the help of the measures taken from the intact arm, so as to leave the antecubital region open, and to allow flexion of the elbow up to 120°. Adhesive bands were arranged according to the swelling in the soft tissues and brace was used continuously. Active and passive exercises of the hand, wrist, elbow and shoulder were immediately started with the use of functional brace; however, abduction and active lifting of the shoulder was not allowed till satisfactory healing tissue was observed in order to avoid angular deformities. The patients were recommended to sleep in head-up position with the purpose of preventing varus deformity that might develop particularly in transverse fractures. Functional outcome was assessed in terms of subjective evaluation by using Hunter's criteria at 06 weeks by the researcher trainee under supervision.

Functional outcome will be measured by using Hunters Criteria[8] i.e.

G1: Complete absence of shoulder and elbow movements and complete impairment in daily activities

G2: Lesser degree of movement and important impairment in daily activities

G3: Small impairment in daily activities because of restricted movement

G4: Mild restriction in movement not affecting daily activities

G5: Full range of motion in shoulder and elbow

Follow up was ensured by taking telephonic contacts of the patient.

Data Analysis Procedure

Data was collected in the form of variables and analyzed on SPSS version 10. Frequencies and percentages were calculated for qualitative data i.e. gender, grades of functional outcome. Mean and standard deviation were calculated for quantitative data i.e. age. For functional outcome Chi square test was applied to compare between two groups. A p-value < 0.05 was considered statistically significant.

RESULTS

A total of 280 patients presenting in Accident & Emergency Department, who gave informed written consent and met the inclusion and exclusion criteria were included in this study. In Group A 140 patients were treated with Functional Humerus Brace and in Group B 140 patients were treated with Conventional U-cast. Out of total 280 patients 165 patients were male (58.9%) and 115 patients were female (41.1%) Mean age of patients was 35.28 years (range 20-60 years) and mean standard deviation was 10.527(Mean ± SD = 10.527).

Out of 280 patients Hunter's Score was G-1 in 11(3.9%) patients, G-2 in 20 patients(7.1%), G-3 in 48 patients(17.1%), G-4 in 84 patients(30%) and G-5 in 117 patients(41.8%).

In Group A Hunter's score was G-1 in 3 patients (1.4%), G-2 in 6 patients (2.1%), G-3 in 7 patients (2.5%), G-4 in 39 patients (13.9%) and G-5 in 85 patients (30%).

In Group B Hunter's score was G-1 in 8 patients (2.9%), G-2 in 14 patients (5%), G-3 in 41 patients 14.6(%), G-4 in 45 patients (16.1%) and G-5 in 32 patients (11.4%).

TABLE - I: CROSS TABULATION GROUP A AND GROUP B

Hunters Score	U-slab	Functional Humerus Brace
G-1	8	3
G-2	14	6
G-3	41	7
G-4	45	39
G-5	32	85

TABLE-II: CHI SQUARE TEST-FOR COMPARISON OF FUNCTIONAL OUTCOME BETWEEN GROUP A AND GROUP B

	Value	Df	Asymp Sig(2 sided)
Pearson Chi Square	52.356	4	.000
Likelihood ratio	55.903	4	.000
N of valid cases	280		

.0% have expected count less than 5.
The minimum expected count is 6.00.

DISCUSSION

Functional bracing has essentially replaced all other conservative methods and has become the "gold standard" for non-operative treatment because of its ease of application, adjustability, allowance of shoulder and elbow motion, relatively low cost, and reproducible results. Initially popularized by Sarmiento in 1977[6]. This is the concept behind Sarmiento et al description of functional bracing in that the fracture is stabilized by the surrounding soft tissues via the brace while realignment is obtained through the effect of gravity. Additionally, elbow and shoulder ROM is actively preserved with functional bracing and stimulates Osteogenesis and healing[10]. Functional humerus brace still remains the treatment of choice for most of the fracture of humeral diaphysis with high rates of union and excellent functional outcome[11]. At our institution, the treatment of humerus shaft fracture was used to be U-cast and hanging arm cast. Functional bracing was a new method for us to follow. But as we started treating our patients with the functional bracing, the results in terms of functional outcome by using Hunter's criteria were so encouraging that it is now being frequently for fracture of humerus shaft.

Initially U-cast is being used for first seven days for pain to subside followed by functional bracing for 06 weeks[9]. Our aim was to compare the functional outcome of functional brace with U-cast in humerus shaft fractures. Fracture union both clinically and radio logically was not assessed that requires a follow up of 03 to 06 months which was not part of this study.

In our study 59.9% patients were males and 41.9% were females. The age of patients range from 20 to 60 years with mean age 35.28, however this range was not consistent with a study by J.J. van Midden drop et al[12]. in which the range was from 17 to 86 years and mean age was 52.7 years. Although the maximum age limit in our study was 60 years, most of the patients treated were younger than 50 years. These results might differ due to smaller number of patients included in the study.

The Hunter score in our study Group A was G-1 in 4 patients (1.4%), G-2 in 6 patients (2.1%), G-3 in 7 patients (2.5%), G-4 in 39 patients (13.9%) and G-5 in 84 patients (30%).In the study by Bulent OZKURT et al[7] 80% patients have Hunter's score G-3 and G-4 and 20% have G-5 and the results are quite similar. The most frequently seen functional losses in our patients were restriction in shoulder abduction and restriction in external rotation which is similar to the functional losses in a study by Bulent OZKURT et al[7]. During the initial phase of our study, we had to apply U-cast for initial 07 days for pain and swelling to subside followed by functional humerus brace for a period of 06. Active and passive exercises of the hand, wrist, elbow and shoulder will be immediately started with the use of functional brace; however, abduction and active lifting of the shoulder will not be allowed till satisfactory healing tissue will be observed in order to avoid angular deformities. The patients will be recommended to sleep in head-up position with the purpose of preventing varus deformity that might develop particularly in transverse fractures. This led us to modify this routine in the later part of our study.

Our early experience with this technique was very encouraging, as we were able to achieve excellent functional outcome (Hunter's Score G-5). These results made us to modify our treatment protocol for fracture humerus shaft, and the number of surgeries for humerus shaft fracture further decreased in our department.

Out of total patients, 05 patients not completely treated with this method due skin and soft tissue complication and were excluded from the study. This is consistent with the study of Jawa et al.[13,14] In another study by Rutgers and Ring[12] cutaneous complication rate was reported to be 4%.

The patient with segmental humerus shaft fractures was also included in the study but they were quite resistant to the application of functional brace foot. We applied functional brace, eventually they lost follow-up at 3rd or 4th week when there Hunter's score recorded was G-3.

The limitation of this study is its short duration of 6 months. Although the functional outcome can be well assessed, but long term results require a regular long term follow-up till the fracture is united clinically and radiologically. The position in which functional brace is worn and movements of abduction and heavy weight lifting is avoided to prevent angular and varus deformity to improve the functional outcome. If the patients are not compliant and they do not follow the bracing program properly, there is every chance of loss of grade of functional outcome. Therefore a long term study is needed.

Although Functional bracing method has now been recognized in the world as the 'gold standard', very few people really know the proper technique in our setup. The health department should take measures to arrange workshops where the proper technique should be taught to doctors, orthotics and physiotherapists especially in the remote areas. The electronic and print media should also play their part in creating awareness among the patients that result of conservative treatment of fracture shaft humerus in terms of functional outcome. The loss of motion at shoulder and elbow joint hamper daily activities especially in old age.

An important factor that may help in improving patient's compliance is that all the patients should be called for regular follow up. During the initial phase of our study, we used to call one or two patients every day for assessing functional outcome. Later on we started to call them on the same day and found it very helpful as it gave them opportunity to see other patients with similar problems, and to share their concerns with others. Another important thing that has already been mentioned is that one should try to use functional brace as advised.

CONCLUSION

The results of functional humerus brace in terms of functional outcome are better than conventional U-Cast. Functional humerus brace is one of the best conservative methods for treatment of closed uncomplicated fracture of shaft of humerus. More awareness about the use of functional humerus brace should be advocated in order to improve the functional outcome and early return to daily activities.

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