



## Outcome Of Conservative Treatment Of Closed Fracture Of Shaft Humerus In Adult Patients

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### Abstract

**Background:** Fractures of the humeral shaft accounting for approximately 3% of all fractures in adults and for 20% of all humeral fractures. There is a wide array of good options for their treatment and controversy over the best methods. Appropriate non-operative and operative treatment of patients with humeral shaft fractures, however, requires an understanding of humeral anatomy, the fracture pattern and the patient's activity level and expectations. Many of these fractures are still being treated conservatively using functional (Sarmiento) bracing or a hanging arm cast. Although non-operative treatment has demonstrated successful outcomes, Union is achieved in 10 weeks in more than 94% of cases.

**Aim and Objectives:** The aim of this study is to emphasize on the benefit and good outcome of conservative treatment for properly selected cases to decrease the cost and avoid the complications of surgery.

**Materials and Methods:** This prospective study was conducted at post graduate department of Orthopaedics, Govt. Medical College Srinagar. During the period of one year from January 2019 to December 2019 a total of 28 patients with fractures of humeral shaft were included in this study.

**Results:** In our study 25 (89.29%) of fractures had union with an average time of 7 weeks without any complications. 2 (7.14%) of fractures progress to delayed union and the fracture took 13 weeks to get safe union clinically and radiographically. 1 (3.57%) of patients progress to non-union with fracture line visible even at 18 weeks after cast application. In assessing the function 19 (67.86%) of fractures had grade V function, 6 (21.43%) had grade IV function, 2 (7.14%) of fractures had grade III function especially the shoulder joint and elbow joint and 1 (3.57%) of fractures had grade I.

**Conclusion:** Conservative treatment is one of the most effective methods of treatment and the operative treatment can lead to adverse effect on the outcome in case of bad judgment and should be limited as much as possible to specific indications.

**Keywords:** Humeral shaft fractures, modalities of treatment, conservative treatment, and angulations deformities

### Introduction

Humeral shaft fractures are common fractures of the diaphysis of the humerus that occurs at the mid shaft of the humerus usually occurs due to a direct blow to the upper arm. Most frequently fractures are a result of trauma such as fall, motor vehicle accident. In elderly it can occur from a standing fall on the

outstretched arm. Fractures of the humeral shaft account for roughly 3% of all fractures [1]. Although a shaft humerus fractures could happen in persons of any age or gender, but peak incidence occurs in males 21-30 and females 60-80 years of age.

Treatment of these injuries continues to evolve as advances are made in both operative and non-

operative management. There is a wide range of good options available for their treatment and controversy over the best methods for different situations (Chapman, 2003) [2]. Humeral shaft fractures often present a challenge, especially with regard to deciding between surgical intervention and a conservative approach to treatment. Making the best decision requires careful consideration of a variety of factors as extent of the injury, associated level of osseous destruction, patient comorbidities, lifestyle and level of demand with regard to joint function. Although the outcome after surgical treatment has shown excellent results, conservative treatment is a valid treatment option that has also shown good clinical and radiographic results.

Goals of humeral shaft fracture management are to establish union with an acceptable humeral alignment and put back the patients to their prior level of function. Many conservative methods have been described for the treatment of humeral shaft fractures [3]. As Hanging arm cast, Coaptation or U-shaped brachial splint, Velpeau dressing, Abduction humeral splint/shoulder spica cast, Skeletal traction and Functional brace. With each of these different treatment modalities good to excellent results have been reported, functional fracture bracing has become the most common treatment for closed humeral shaft fractures [4].

**The hanging arm cast:** The hanging cast was first recommended by Caldwell in 1993 as an ambulatory device in the treatment for fractures of the shaft of the humerus. This is a “classic” treatment method as evidenced from the De Mourgues [5] and Babin [6] publications, but it was still used in 50% of patients treated conservatively in a 2003 French multicenter study [7]. The fracture is reduced because of the traction induced by the weight of the long-arm cast (1–1.5 kg). Patients must be able-bodied and well-informed, so as to let the casted arm hang, carryout pendulum movements of the shoulder and let the cast rest on their chest at night. The cast is worn for at least 6 weeks. Union is obtained after an average of 52 days (7.5 weeks). The non-union rate is between 2 and 5% [5-7]. There is a risk of shoulder and particularly elbow stiffness developing, along with neck pain due to the weight of the cast.

**Coaptation splint:** The U-shaped coaptation splint with collar and cuff is indicated for the acute treatment of humeral shaft fractures with minimal

shortening. A carefully molded plaster slab is placed around the medial and lateral aspects of the arm, extending around the elbow and over the deltoid and acromion (Fig. 3). The forearm is suspended by a collar and cuff. The splint should hang free of the body. The patient is instructed in range of motion exercises of the shoulder, elbow, wrist and hand. Similar to the hanging arm cast, the coaptation splint is frequently exchanged for a functional cast brace 1-2 weeks after injury as the patient’s pain permits Hunter [8].

**Thoracobrachial immobilization:** A stockinette Velpeau shoulder dressing was used for immobilization of the shoulder girdle. This over-the-shoulder device is inexpensive, comfortable and easily applied (Fig. 4). This device is most useful in non-displaced or minimally displaced fractures in children or the elderly are unable to tolerate other methods of management.

**Shoulder spica cast:** The indications use of a shoulder spica cast are unclear. The primary indications may be when closed reduction of the fracture requires significant abduction and external rotation of the upper extremity. However, when this uncommon situation occurs, operative management is frequently performed.

**Skeletal traction:** Skeletal traction is rarely indicated for the treatment of closed or open humeral shaft fractures. The historical indications for use of skeletal traction are now considered indications for operative intervention. When indicated, skeletal traction is applied through a transolecranon Kirschner wire or Steinmann pin. The pin should be inserted from medial to lateral to minimize the risk of ulnar nerve injury, Terry Canal [9]

**Functional bracing:** The humeral functional brace was first described by Sarmiento *et al* [10]. A functional brace is an orthosis that affects fracture reduction through soft-tissue compression. Use of this device maximizes shoulder and elbow motion. This brace initially was custom made and designed as a wraparound sleeve. However, current braces are prefabricated and consist of an anterior shell (contoured for the biceps tendon distally) and a posterior shell (Fig. 5). These shells are circularized with Velcro straps, which can be tightened as swelling decreases. The humeral fracture brace can be applied acutely or 1-2 weeks after application of a

hanging arm cast or coaptation splint. The brace is worn for further 6 weeks Solomon<sup>[11]</sup>.

### Materials And Methods

This prospective study was conducted at post graduate department of Orthopaedics, Govt. Medical College Srinagar. During the period of one year a

total of 28 patients with fractures of humeral shaft were included in this study. All the selected patients fulfilled inclusion criteria. Among 28 patients 21 (75%) were male and 7 (25%) were female patients. The age group of the patients range from 18-80 years (Table 1).

**Table 1: Demography of patients**

Parameters	No. of patients	Percentage	
Gender	Male	21	75.00
	Female	7	25.00
Age group	18-30 years	9	32.14
	31-40 years	6	21.43
	41-50 years	4	14.29
	51-60 years	2	7.14
	61-70 years	3	10.71
	71-80 years	4	14.29
	Mode of trauma	Road accidents	17
	Fall	7	25.00
	Sports	3	10.71
	Others	1	3.57
Laterality	Left	18	64.29
	Right	10	35.71

### Inclusion Criteria

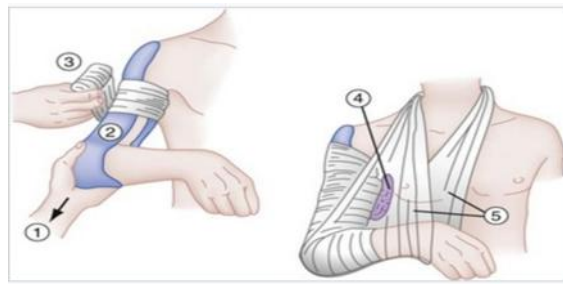
1. Age >18 years
2. Deviated humeral shaft fractures
3. Prior consent from patients

### Exclusion Criteria

1. Age < 18 years
2. Open fractures
3. Pathology fractures 2
4. Fractures with incomplete treatment
5. Complicated by nerve injury
6. Previous disease in the limb that could influence the results
7. An immature skeleton

The application method of the “U” shaped coaptation slab was standard. The patient was seated on a stool or table with backrest, leaning to the injured side to expose the axilla. Keeping the elbow at 90 degree flexion and assistant holding it a single layer of cotton from the shoulder to four inches distal to the elbow was applied. The arm was encased in six inch, eight layers slab that passed from the mid clavicular region around the shoulder, down the arm, under the elbow and up the medial aspect of the arm just below the axilla. Roll bandage was used to retain the slab and to mold it to the contours of the arm (Figure 2). No anesthesia was used and the treatment was on outpatient basis.

**Fig. 2: Application method of the “U” shaped coaptation slab**



All patients were assessed the following day for the proper fitting plaster, position of the limb, neurovascular status was checked and the humeral shaft radiologically examined. Then the patients were discharged and were advised to follow-up at every two weeks until union evident clinically and radiographically. At the follow-up of two weeks, if there was much pain or any degree of mal-alignment, we shift to POP cast, which is applied according to these rules:

1. The elbow must be in flexion 90°
2. The POP cast extends from the mid-palm to the fracture level or not more than one inch above
3. The sling must be fixed at the level of the wrist with mid-pronation forearm
4. The POP must be light and never be distracting force consist of 4-6 (6 inch) Gypsona wrapped over single layer of cotton
5. To correct lateral angulation, the loop should be placed on the dorsum of the wrist, to correct

- medial angulation, the loop should be placed over the volar side
6. Along sling should be used to correct posterior angulation; short one, to correct anterior angulation
7. The arm must be continuously dependent
8. Early, active, vigorous, exercises of the longitudinal muscle of the arm (4-6 times daily) are imperative
9. Systematic resistant exercise of the fingers and thumb are essential

Then we follow the patient clinically and radiographically every 2-4 week and until the fracture had united and the limb functions were restored. If there was no pain in association with fracture distraction we shift to functional brace. Treatment was assessed by Alignment, Rate of union and Limb functions

The limb functions were determined by assessing the pain and the return of the movement at the shoulder, elbow and the hand and the final use of the limb and graded as in Table 2.

**Table 2: Limb function grading**

Grade	Parameters
I	Pain and total restriction preventing all activities
II	Less pain and severe restriction preventing or severely impeding daily activities
III	Restriction permitting daily activities with some difficulties
IV	Minimal restriction not impeding daily activities and no pain
V	No restriction of activities and no pain

**Results**

In our study no correlation was found between sex, type of fracture, effect of manipulation and the rate of union. All fractures getting sound union were assessed for deformity in coronal and sagittal planes

by goniometer. In coronal plane 7(25.00%) of fractures were initially un-displaced, 12(42.86%) had varus angulation, 9(32.14) had valgus angulation and at union 10(37.71%) of fractures were un-displaced, 14(50.00%) had varus angulation and 4 (14.29%) had

valgus angulation. In sagittal plane 9 (32.14%) of fractures were initially un-displaced, 3(10.72%) had anterior angulation and 16 (57.14%) had posterior angulation and at union 15 (53.57%) of fractures united without displacement, 2 (7.14%) with anterior angulation, 11 (39.29%) with posterior angulation.

In our study 25 (89.29%) of fractures had union with an average time of 7 weeks without any

complications. 2 (7.14%) of fractures progress to delayed union and the fracture took 13 weeks to get safe union clinically and radiographically. 1 (3.57%) of patients progress to non-union with fracture line visible even at 18 weeks after cast application (Table 3).

**Table 3: Distribution of patients according to the rate of union**

Parameters	No. of patients	Percentage
Union	25	89.29
Delayed union	2	7.14
Non-union	1	3.57

In assessing the function 19 (67.86%) of fractures had grade V function, 6 (21.43%) had grade IV function, 2 (7.14%) of fractures had grade III function especially the shoulder joint and elbow joint and 1 (3.57%) of fractures had grade I (Table 4).

**Table 4: Distribution of patients according to functional grade**

Grade	No. of patients	Percentage
I	1	3.57
II	0	0
III	2	7.14
IV	6	21.43
V	19	67.86

## Discussion

Conservative treatment of humeral shaft fractures represents an effective method of fracture management and has sustained critical evaluation throughout the literature and appreciable results can be obtained.

In our study out of 28 fractures 25 (89.29%) of fractures had union with an average time of 7 weeks without any complications which is comparable to the previously done study by Hunter with one exception, all patients younger than age 40 recovered full extremity function by 10 weeks. In older patients, functional return was slower. Hunter<sup>[8]</sup> reported 60 humeral shaft fractures treated with a coaptation splint. The arm was suspended by a collar and cuff

after application of the splint. Treatment success was based on fracture union, residual deformity and limb function. Fifty-six fractures (93%) united; all had less than 30° angulations. The average time to union was 40 days for males and 42 days for females. There was no correlation between healing and patient sex, fracture level, or need for fracture manipulation. All patients younger than age 40 recovered full extremity function by 10 weeks. In older patients, functional return was slower. The authors concluded that a coaptation splint could be used effectively to treat patients with humeral shaft fractures.

There was a tendency to residual varus angulation whether the fracture was manipulated or not. The deforming force was sufficient to produce varus angulation from the undisplaced position and in 1

case, to swing a valgus angulation into a varus position. Therefore it did not merely exaggerate the preexisting angulation, but must have resulted from the application and maintenance of the slab and POP cast. The force producing the posterior displacement could not always be overcome by the conservative treatment, thus resulting in 2 fractures with initial posterior angulation uniting with increased posterior deformity and 1 initially undisplaced fracture unite with posterior angulation. Our treatment considerably improved the fracture in view of deformities of angulation. The U slab and the POP cast act as a dynamic rather than a static splint, correcting angulation to less than 30° in coronal plane and less than 20° in sagittal plane. All our fractures except one resulted in union with two fractures taking more than usual time for union, our study showed the same results as shown by previous study by Winfield et al and Zagorski et al.<sup>[12, 13]</sup>.

Balfour *et al.* (1982)<sup>[14]</sup> reported 42 patients with a humeral shaft fracture treated with a functional brace. Forty-one fractures (97%) united. The time to union averaged 54 days. Varus deformity averaged 9°. Deformity in the antero-posterior plane averaged 6.2°. Thirty-eight patients (90%) had full motion of the shoulder and elbow 4 months after fracture.

Manipulation of the fracture was not required and did affect neither the rate of union nor the final position, as the cast appeared to be capable of correcting angulation deformities. Perfect anatomical reduction was found not to be essential for satisfactory limb function, which was present with varus angulation and posterior bowing. This supports the findings of Kennermann<sup>[15]</sup> and Muzahimn<sup>[16]</sup> who noted good functional results in the presence of residual coronal and sagittal plane angulation, providing the deformity did not exceed 30°. The incidence of delayed union compares favorably with other reported series, although the definition of delayed union is variable.

Our study has proven that conservative treatment has much less complications in comparison with operative treatment and the results are supported by Stern et al. through their study results in 1984.12 Stern and colleagues in their study reported 70 humeral shaft fractures stabilized with several types of intramedullary devices between 1970 and 1981. Complications developed in 47 (67%) of the fractures; 45 (64%) required at least one additional operative procedure<sup>[17]</sup>. Therefore we should not

operate on fractures of the shaft unless there is clear indication.

## Conclusion

Conservative treatment is one of the most effective methods of treatment and the operative treatment can lead to adverse effect on the outcome in case of bad judgment and should be limited as much as possible to specific indications.

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