

# Outcome of Operative Versus Conservative Management of Humeral Shaft Fractures: A Longitudinal Study

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## ABSTRACT

**Aim:** To compare the outcome of operative versus conservative management of humeral shaft fractures.

**Study design:** A longitudinal study

**Place and Duration:** This study was conducted at Civil Hospital Mithi District Tharparkar Pakistan from July 2020 to July 2021.

**Methodology:** The study included 30 patients having humeral shaft fractures who were divided into two groups. One group was managed conservatively whereas the other was managed surgically. The patients were followed up for 1 year and the clinical and radiological examination was performed to assess the complications and clinical outcomes.

**Results:** Most of the patients who have humeral fractures were because of roadside accidents. No significant differences were present in the time of union between both groups, similarly, elbow ROM at the fracture union was also not significantly different. However, malunion was more frequently observed in the conservatively managed group which was 12.7% as compared to the operative group which was 1.3%.

**Conclusion:** No significant difference was observed in reference to the timing of union between the two groups. All humeral fractures need an assessment before opting the conservative or operative management depending upon patient expectations and characteristics of fractures.

**Keywords:** humerus, fracture, operation, conservative management

## INTRODUCTION

Out of all the fractures, 3% of fractures occur in the humeral shaft. The fractures of the humeral shaft are classified into category A which occurs 63.3% times, category B which is 26.2% prevalent, and category C which is 10.4% prevalent.<sup>1</sup> Usually, most of the fractures i.e. almost 60% occur in the middle third diaphysis, 10% in the distal diaphysis, and 30 on the proximal side. As the severity of injury increases, the soft tissue damage and fracture severity also increase. Among all the fractures less than 10% are open fractures.<sup>2</sup> The distribution of age is bimodal as a peak is observed in the third decade in men having moderate to severe injury whereas in women a peak is observed in the seventh decade after a simple fall.

Among these fractures, half of fractures are treated conservatively, and the most common non-operative method which is used to treat most of the fractures is functional bracing.<sup>3</sup> The operative methods include external or compression plate fixation, or intramedullary nailing which are decided to depend upon the injuries and the properties of fractures. Different studies have been conducted to date to assess the efficacy of functional bracing which is considered as the gold standard treatment. A study conducted by Denard et al. reported that the patients who had surgical treatment experienced a significantly lower rate of malunion and nonunion when compared with individuals who were treated nonsurgically, whereas no difference was observed in the final range of motion between the two groups, and they concluded that compression plating might be more effective in treating these fractures in some specific clinical scenarios.<sup>4</sup> Another review reported that a higher rate of nonunion was observed in treating proximal third fractures whereas surgical fixation of these fractures exhibited a lower threshold.<sup>5</sup> Another study conducted in Finland suggested that the rate of surgery has been doubled in the past 20 years.<sup>6</sup>

The two most commonly used surgical treatments are intramedullary nailing and open reduction and plate fixation methods. Different studies have suggested the advantages and disadvantages associated with both techniques such as a study that involved 237 patients who exhibited a lower complication rate in terms of open reduction and plate fixation method.<sup>8</sup> The current

study was conducted to assess the functional outcomes of conservative and operative treatment methods of humeral shaft fractures during one year of follow-up.

## METHODOLOGY

This study was conducted in a longitudinal manner and included 30 patients having fractures of the humeral shaft. Permission was taken from the ethical review committee of the institute. The inclusion criteria were patients having closed fractures of the humeral shaft, the age range should be 18-65 years, and must have visited the hospital during the first two weeks of surgery. Similarly, the exclusion criteria had fractures of the humeral shaft which were extended into the articular region, had open shaft humeral fractures, patients were immunocompromised, had a pathological fracture, or their vascular injury which required repair. All the patients had given informed consent and a general physical examination and detailed history of every patient were recorded.

All the patients were randomly divided into two groups and one group was managed with surgery whereas the other group was treated by the conservative method, and their functional outcomes were assessed and compared. Patients who were managed without surgery were temporarily placed with a sling and splint when they were admitted to the hospital, and after 1 week, the splint was exchanged with a functional brace with which arm was encircled which included loop fasteners and two plastic sleeves which were joined by an adjustable hook. Patients were asked to slowly move the elbow and do different kinds of active exercises as the pain allowed them to gradually wean the functional brace. The group that was surgically managed, was operated on either anterolateral or posteriorly wherever the fracture was located. Locking or non-locking 4.5 mm plates were used to internally fix the arm. After surgery, patients were placed in a sling and were instructed to do ROM exercises from day 1 after surgery. Clinical and radiological examinations were conducted to assess the complications and union. Bridging the callus on two orthogonal views along with the fracture line disappearance was considered as the body union. In the case of radiographic evidence of angulation of fewer than 20 degrees in any plane, malunion was determined and was considered a dichotomous outcome. The

degrees of total motion arc in the elbow were documented to assess the elbow ROM in the extremity which was affected.

An elevated level of white blood cells and purulent discharge at the site of fracture indicated the existence of infection which was further proved by gram staining. If fractures fail to consolidate even after 6 months of injury, they were recorded as nonunion. Along with that, any additional complaints about the complications were also recorded during the follow-up if experienced any such as if the patients had experienced pain during movement or have a limited motion which could impact the daily life chores or had surgical scar which could result in dissatisfaction of cosmetic appearance. Similarly, the status of returning to work was also recorded of the patients who were employed when injured. The mean and standard deviation was recorded to assess the time of union and elbow ROM, along with summarizing the outcome, complication, and demographic data. SPSS version 23 was used for data analysis.

## RESULTS

No significant differences were observed between the studied groups with reference to age and gender. Similarly, the number of patients was almost the same in both groups who had comorbidities such as diabetes and hypertension. The average age of patients who were non-operatively managed was  $37.4 \pm 9.8$  years and in the other group it was  $37.9 \pm 14.02$  years, and the obtained P-value was 0.59. The median ages of both groups were 34, and 30 years respectively. It was observed that 60% of patients had road traffic accidents whereas the other reasons fell from height or a fall on an outstretched hand. No significant difference was observed in reference to the timing of union between the two groups which were  $11.7 \pm 2.8$  weeks ranging from 8 weeks in the group that had surgical treatment and  $12 \pm 2.8$  weeks ranging from 8 weeks in the non-operative group, and the obtained P-value between the groups is 0.8659. Similarly, elbow ROM of the operative group was 132 ranging from 25 to 150 degrees, and in the non-operative group it was 120.3 ranging from 80-180 degrees, and the recorded P-value was 0.5532. The rate of non-union was also similar in both groups i.e. 7% whereas malunion was more frequently observed in the group which didn't undergo surgical treatment i.e. 12.7% as compared to the operative group i.e. 1.3%, and the obtained P-value was 0.0011. Patients of both groups exhibited radial nerve palsies and were conservatively managed. The patients regained their complete function after three months of injury and didn't require any intervention. The time taken in radiological union by both groups is given in Table number 1.

Table 1: Time is taken for radiological union

Number of weeks	Operative treatment (%)	Conservative treatment (%)
8-10	33	33
11-13	47	53
14-17	13	7
$\geq 18$	7	7

Table 2: Range of shoulder motion

Range of shoulder motion (degrees)	Operative treatment (%)	Conservative treatment (%)
131-140	-	6
141-150	13	-
151-160	13	6
161-170	40	34
171-180	34	54

## DISCUSSION

The treatment of humeral shaft fracture via closed management is one of the most effective methods of fracture management and the technique has been critically evaluated by different research groups.<sup>8</sup> The gold standard technique to treat humeral fractures is functional bracing and is used as a standard against which all the other treatments are assessed and compared. Functional bracing has a higher success rate but is associated with a risk of

complications and patient morbidity.<sup>9</sup> It is important for an effective fracture management technique that it must restore physiological function and minimizes the loss of aesthetics. When humeral fractures are treated, the methods of treatment are dictated by anatomical factors as suggested by Mast et al. This is because humerus cannot bear weight and the compressive forces don't play a significant role in healing as they do in the healing of the tibia and femur.<sup>10</sup> Shoulder and elbow ROM must be actively preserved by functional bracing to stimulate healing and the process of osteogenesis. With operative management of fractures, plate fixation provides stability to the fracture and allows the early movement of adjacent joints which is why it is the treatment of choice.<sup>11</sup> Some studies were conducted to confirm that the functional outcomes of internal fixation are similar to the functional outcomes of intramedullary nailing. However, intramedullary nailing has more complications and requires more secondary procedures.

In our study, we observed that both techniques preserved the elbow ROM very well. Our data also exhibited similar outcomes of both groups in terms of acceptable elbow ROM. No significant differences were observed in terms of union time and infection incidence. After a fracture, all the radial nerve palsies were resolved and our data suggested that most of the radial nerve palsies were transient and didn't require any kind of intervention. An increased malunion incidence was observed in the nonsurgical management of fractures. A study conducted by Rutgers and Ring observed that the patients who were managed non-surgically had angular deformity more than 20 degrees in 9% of patients whereas we observed that 13% of patients had angular deformity more than 20 degrees as compared to the patients who had operative management.<sup>12</sup> No validated measurement outcome is present which could assess the hand and shoulder disability, which is usually assessed by the questionnaire designed by American shoulder and elbow surgeons. Elbow restriction after the surgery is usually observed. Nonsurgical treatment along with bracing is the most effective method but incidences of nonunion and malunion are more common in non-surgical management, and these require surgical interventions for the correction of these problems. The osteosynthesis of fractures of the humeral shaft requires the return of function of the upper arm without any complication as reported by literature.<sup>13</sup>

## CONCLUSION

No significant difference was observed in reference to the timing of union between the two groups. The advantages and disadvantages of both the treatment methods must be assessed carefully to design an appropriate treatment plan according to the expectations of patients and characteristics of fractures. Research must be further conducted to analyze successful outcomes, achieving optimal patient outcomes, and associated complications.

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**Conflict of interest:** None

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