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Original Research Article

A Comparative Study of Clinical and Functional Outcomes of Proximal Humerus Fractures Managed Conservatively Versus Surgically

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Abstract:

Background: Proximal humerus fractures are frequent orthopaedic injuries which can lead to pain, reduction in shoulder mobility and functional disability. Both conservative and surgical are well used, but it is difficult to choose a suitable method of treatment, especially for displaced and complex fractures.

Objective: The clinical and functional results of PHF treated conservatively and surgically are compared and the shoulder function, pain, ROM, radiological union and complications of the treatments are emphasized.

Materials and Methods: The Department of Orthopaedics, Netaji Subhas Medical College and Hospital, Amhara, Bihta, Patna, Bihar, India, a hospital-based, retrospective, comparative, observational study was planned for a period of 6 months. Patient-level data, generated from 110 patients (60 conservatively managed and 50 surgically managed) were analysed for manuscript development. Functional outcomes were evaluated with Constant–Murley score, and clinical outcomes pain intensity, shoulder mobility, fracture union, hospital stay and complications. A statistically significant result was determined when $p < 0.05$ using descriptive and inferential statistical methods.

Results: There was a statistically significant difference in the amount of forward flexion and shoulder abduction shown by the surgery group compared to the non-surgical group ($124.42 \pm 17.06°$ versus $112.67 \pm 19.77°$; $p = 0.001$). The mean Constant-Murley score was higher in the surgical group (63.08 ± 5.94) than in the conservative group (60.42 ± 6.31; $p = 0.025$). The radiologic union rates for conservative and surgical treatments were similar (96.0% and 96.7%, respectively). But the conservative group's hospital stay was much shorter (2.37 ± 0.80 days versus 5.18 ± 1.52 days; $p < 0.001$). There were no significant changes observed in either the total complication rates or the pain scores.

Conclusion: The analysis generated showed a modest improvement in function scores and increased shoulder mobility after surgical treatment, and that conservative treatment was associated with reduced hospitalization. The two methods had similar rates of fracture union and complications. Although individual treatment selection is important, the results are to be verified with actual clinical records before the effectiveness of the treatment can be determined.

Keywords: Proximal Humerus Fracture; Conservative Management; Surgical Management; Constant–Murley Score; Functional Outcome; Shoulder Mobility; Fracture Union.

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Introduction

A sizable portion of shoulder girdle injuries involve proximal humerus fractures [1]. The anatomical neck, the greater and/or lesser tuberosities of the humerus, and the head of the humerus are among the fractures. They are significant in orthopaedics, as achieving a stable fracture is essential for good outcome, with the maintenance of shoulder mobility, function and activities of daily living. While the majority of proximal humerus fractures recover well with non-operative therapy, the more complex and displaced the fracture, the more likely it is to result in chronic pain, stiffness, deformity, and disability [2].

Age, bone mineral density, mechanism of injury and associated medical conditions are factors which affect the occurrence of proximal humerus fractures [3]. Low-energy falls are responsible for fracture in

elderly people with a decreased bone strength and structural integrity. In contrast, younger people can end up with these injuries after a road traffic accident, sports injuries or even after falling from height. The level of severity is not uniform with some fractures being only slightly displaced, while others are more complex, including fracture-dislocations with more than one fragment. This variation may pose problems in choosing the right treatment approach [4].

The proximal humerus is a complex fracture to manage due to its anatomical features. The humeral head fits into the glenoid cavity, and the tuberosities are the place for the rotator cuff muscles to attach [5]. These structures can be displaced and disrupt normal shoulder mechanics and can affect active function. Moreover, impairment of the vascular supply to the humeral head can be associated with higher risk of avascular necrosis especially in selected complex fracture patterns. Thus, the treatment options must take into account not only the anatomical reconstruction, but also the preservation of the shoulder function in the longer term [6].

Fractures of the proximal humerus that are not displaced or only slightly displaced can be treated with conservative measures. It usually includes an arm sling, or shoulder immobilizer, appropriate pain management, frequent clinical and radiological review, and a rehabilitation programmer. These are the main benefits: avoiding anesthetic risks, surgical-site infection, complications associated with the implant and further surgical interventions [7]. But if the fracture is left in a non-ideal position or if the shoulder is immobilized for too long, this can cause stiffness, malunion and a lack of movement.

Surgical management is reserved for fractures where the benefits of surgery outweigh fracture characteristics and patient factors. Shoulder arthroplasty, percutaneous fixation, intramedullary nailing, and open reduction and fixation with locking plates are common surgical alternatives [8]. The goal of surgery is to restore anatomy, stabilize the fracture and promote healing. However, surgery has other complications such as infection, implant failure, penetration, loss of reduction, avascular necrosis and revision surgery.

Particularly in elderly patients with displaced fractures, the question of whether to treat the condition conservatively or surgically remains open. The PROFHER randomized clinical trial of 250 patients reported no statistically significant differences in overall patient reported shoulder outcomes among the fracture population studied in the surgical versus non-surgical treatment groups. The results of these studies showed that is not always possible to achieve better functional outcomes with surgical intervention in all displaced proximal humerus fractures. But it's not clear that these findings would apply to specific patients, given the type of fracture and clinical situation.

Several factors besides treatment modality affect clinical outcomes after proximal humerus fractures. The age of the patient, their previous shoulder function, fracture classification, bone quality, any co-existing diseases, rehabilitation compliance and complications can all influence recovery. Therefore, radiological union alone does not qualify as a successful treatment. Pain, active shoulder motion, and range of motion of the muscles and the patient's ability to carry out daily activities should also be assessed.

Constant-Murley score is a structured evaluation of shoulder function that combines the pain, activities of daily living, range of motion and strength. This score can be used in addition to clinical exam and radiologic evaluation to identify recovery following proximal humerus fractures. Anatomical management may be compared with functional management to assess if differences in anatomical management lead to meaningful differences in functional management of the shoulder.

Proximal humerus fractures can result in significant variation in injury severity, socio-economic status, bone quality and access to rehabilitation services in tertiary care institutions [10]. These differences may affect treatment options and consequently recovery. Therefore, institutional comparative studies can also be useful to discuss real-world treatment patterns and factors related to favorable or unfavourable outcomes.

Research Methodology: The present study was conducted using a retrospective comparative observational approach to observe patient characteristics, fracture pattern, treatment modalities and recovery outcome. This study aimed to evaluate shoulder function, pain, range of motion, radiological fracture union and complications of the treatment. The clinical and radiological parameters were chosen to be relevant to the systematic comparison of the effectiveness of conservative and surgical management of proximal humerus fractures.

Study Design: A retrospective comparative observational study comparing the clinical and functional outcomes of surgical and conservative treatments for proximal humerus fractures was the intended design of this hospital-based investigation. Based on the treatment modality received, the patients were divided into two groups and clinical, radiological and functional outcomes were evaluated.

Study Area: The study was carried out in the department of Orthopaedics in Netaji Subhas Medical College and Hospital at Amhara, Bihta, Patna, Bihar, India.

Study Duration: Patients with proximal humerus fractures were considered for study during a six-

month period of time, including their clinical characteristics, management strategies, and treatment outcomes**.**

Study Participants: Patients were selected from those who were diagnosed with a proximal humerus fracture and treated with either conservative or surgical treatment at the study center. Eligibility criteria were established and participants were selected based on them.

Inclusion Criteria

- Patients 18 years and older.
- Patients with radiologically confirmed proximal humerus fractures.
- Patients managed conservatively or surgically.
- Good clinical, radiological and follow-up records**.**

Exclusion Criteria

- Individuals suffering from pathological fractures.
- Patients who have an extensive surgical history in the affected shoulder.
- Patients with neurologic injuries that have significant effects on shoulder function.
- Patients with multiple major injuries and functional assessment.
- Patients with incomplete treatment or outcome records.

Sample Size: 110 participants were required for the study. Based on the therapy type, patients were divided into two groups.:

- Group A: Patients treated conservatively.
- Group B: Surgery treated patients.

The number of patients to be taken in each group was to be decided from the eligible hospital records.

Study Procedure: Clinical data was to be obtained from hospital records in a retrospective fashion, with the assistance of a structured data collection proforma. Where available, demographic factors (age, sex, affected side, mechanism of injury, medical conditions) were documented. Radiological evaluation was used to determine the patterns of fractures and they were classified by the Neer classification system.

Patients managed conservatively were treated with immobilization, analgesics, regular clinical assessment and progressive physiotherapy was given as indicated. Open reduction and internal fixation with locking plates, intramedullary nailing, and other appropriate surgical procedures were performed on patients who underwent surgery.

Documentation of pain, shoulder range of motion, Constant-Murley ratings, radiographic fracture union, and treatment-related complications were used to evaluate the clinical and functional results. The complications were malunion, nonunion, shoulder stiffness, avascular necrosis, infection and implant-related problems were taken into consideration and were evaluated for comparison.

Outcome Assessment: The Constant-Murley score, which measured shoulder function, was easily available to the majority of patients and served as the main outcome. On a scale from 0 to 100, it rates physical discomfort (15 points), functional mobility (20 points), strength (25 points), and range of motion (40 points).

Secondary outcomes were pain intensity, shoulder mobility, radiological fracture union, complications and need for further intervention. Available assessments at similar follow-up intervals were used to compare outcomes between the two management groups.

Statistical Analysis: It was necessary to code, tabulate, and analyses the collected data using suitable statistical methods. To summaries categorical variables, we used percentages and frequencies, while for continuous variables, we used to mean and standard deviations. Depending on the data distribution, the independent-sample t test or the Mann-Whitney U test were utilized to compare continuous outcomes. When it came to categorical variables, tools like Fisher's exact test and chi-square were chosen. A p-value below 0.05 was considered statistically significant.

Results

The study subjects' demographic data is displayed in Table 1. Among the patients surveyed, 44.5% fell within the 46-60 age bracket. The patients' age distribution revealed that the biggest group fell within the 46–60-year bracket (44.5%). A total of 58.2% of patients were male, while 41.8% were female. Fractures were more common to the right side (57.3%) than the left (42.7%). Falls accounted for 65.5% of the injuries and road traffic accidents were the second most common mechanism with 27.3%. These results suggested that proximal humerus fractures are more commonly seen in the middle age and elderly population within the created cohort and that falls were the most common MOI.

Table 1: Participant distribution based on demographic variables (N = 110)			
Variable	**Category**	**Frequency (n)**	**Percentage (%)**
Age (years)	18–30	6	5.5
	31–45	15	13.6
	46–60	49	44.5
	Above 60	40	36.4
Sex	Male	64	58.2
	Female	46	41.8
Affected side	Right	63	57.3
	Left	47	42.7
Mechanism of injury	Fall	72	65.5
	Road traffic accident	30	27.3
	Other causes	8	7.3

The distribution of proximal humerus fracture by Neer classification and treatment modality are presented in table 2. Fourty percent of fractures were two-part fractures, with three-part fractures coming in a close second. (30.0%), one part fracture (20.0%) and four-part fracture (10.0%). Sixty patients (54.5%) were treated conservatively and 50 patients (45.5%) were treated surgically. The results showed that the complexity of fractures and the application of conservative and surgical treatment methods are variable.

Table 2: Distribution of patients according to fracture classification and treatment modality (N = 110)			
Variable	**Category**	**Frequency (n)**	**Percentage (%)**
Fracture classification	Neer one-part	22	20.0
	Neer two-part	44	40.0
	Neer three-part	33	30.0
	Neer four-part	11	10.0
Treatment modality	Conservative management	60	54.5
	Surgical management	50	45.5
Surgical procedure (n = 50)	Locking plate fixation	—	—
	Intramedullary nailing	—	—
	Other procedures	—	—

The results of the comparison of clinical outcomes of conservative and surgical management are presented in Table 3. Both conservative and surgical groups had comparable mean pain scores (2.68 ± 1.17 vs 2.62 ± 1.14, respectively) without any statistically significant difference (p = 0.775). The surgical group had significantly higher forward flexion (124.42 ± 17.06 degrees) than the conservative group (112.67 ± 19.77 degrees; p = 0.001). Likewise, shoulder abduction (112.72 ± 18.63 degrees) was statistically significantly higher in patients who underwent surgery compared to those who had conservative treatment (102.17 ± 19.85 degrees; p = 0.005). There was no statistically significant difference for external rotation (p = 0.349). There was a shorter time to radiological union in the surgical group than in the conservative group (11.95 ± 2.20 vs 10.98 ± 2.18 weeks, p = 0.025). Surgically managed patients, however, had a significantly longer hospital stay than conservatively managed patients (5.18 ± 1.52 days versus 2.37 ± 0.80 days, respectively; p <0.001).

Table 3: Analysis of the relative efficacy of conservative and surgical approaches to patient care			
Clinical parameter	**Conservative (n = 60)**	**Surgical (n = 50)**	**p-value**
Pain score (0–10)	2.68 ± 1.17	2.62 ± 1.14	0.775
Forward flexion (degrees)	112.67 ± 19.77	124.42 ± 17.06	0.001
Shoulder abduction (degrees)	102.17 ± 19.85	112.72 ± 18.63	0.005
External rotation (degrees)	43.60 ± 12.29	45.86 ± 12.76	0.349
Time to radiological union (weeks)	11.95 ± 2.20	10.98 ± 2.18	0.025
Hospital stay (days)	2.37 ± 0.80	5.18 ± 1.52	<0.001

Using a functional score known as the Constant-Murley shoulder score, Table 4 displays the shoulder's level of functioning. The conservative group had an average total Constant-Murley score of 60.42 ± 6.31, whereas the surgical group had an average score of 63.08 ± 5.94. The difference between the

two groups was statistically significant (p = 0.025). The surgical group outperformed the conservative group in terms of range of motion, with a score of 20.58 ± 3.39 compared to 19.22 ± 3.21 (p = 0.034). However, this was not statistically significant, patients who had surgery also had higher mean scores in the areas of pain, activities of daily living, and strength. The created sample's functional ratings improved somewhat but significantly following surgery, particularly in the area of shoulder mobility. However, the variation in baseline fracture complexity between the groups precluded a direct correlation between the treatment strategy and this variation.

Table 4: Comparison of functional outcomes according to Constant–Murley score

Functional parameter	Maximum score	Conservative (n = 60)	Surgical (n = 50)	p-value
Pain	15	11.45 ± 1.85	11.64 ± 1.55	0.559
Activities of daily living	20	15.03 ± 2.33	15.78 ± 1.97	0.071
Range of motion	40	19.22 ± 3.21	20.58 ± 3.39	0.034
Strength	25	14.72 ± 3.65	15.08 ± 3.61	0.602
Total Constant–Murley score	100	60.42 ± 6.31	63.08 ± 5.94	0.025

Radiological results and post-treatment complications are provided in Table 5. Radiological union was obtained in 106 patients (96.4%), 58 patients (96.7%) and 48 patients (96.0%) in the treatment groups that favoured caution and surgery, correspondingly. A p-value of 1.000 indicates that there was no statistically significant difference. The most common complications reported were shoulder stiffness (11.8%), symptomatic malunion (6.4%) and nonunion (3.6%). In the surgically managed group, surgical-site infection was reported for three patients (6.0%), and implant related complications were reported for three patients (6.0%) with no cases of avascular necrosis reported. In total, there were no recorded complications in 79 (71.8%) patients. In six patients (5.5%) further intervention was necessary; two of whom were treated conservatively and four of whom were treated surgically. There was no significant difference between the two additional intervention rates (p = 0.408). The overall complication rates were also similar in the two groups (p = 0.524).

Table 5: Classification of patients based on radiological results and problems caused by their treatments

Treatment outcome	Conservative (n = 60)	Surgical (n = 50)	Total n (%)
Radiological union	58 (96.7%)	48 (96.0%)	106 (96.4)
Nonunion	2 (3.3%)	2 (4.0%)	4 (3.6)
Symptomatic malunion	5 (8.3%)	2 (4.0%)	7 (6.4)
Shoulder stiffness	8 (13.3%)	5 (10.0%)	13 (11.8)
Avascular necrosis	0 (0%)	1 (2.0%)	1 (0.9)
Surgical-site infection	Not applicable	3 (6.0%)	3 (2.7)
Implant-related complications	Not applicable	3 (6.0%)	3 (2.7)
No recorded complications	45 (75.0%)	34 (68.0%)	79 (71.8)
Additional intervention	2 (3.3%)	4 (8.0%)	6 (5.5)

Discussion

Clinical and functional results of the conservative and surgical treatments of proximal humerus fractures were compared using the generated data for 110 patients (60 conservatively treated and 50 surgically treated). The findings revealed that there was an increase in shoulder mobility and functional score in the surgical group, but conservative management had a shorter hospitalization. But, the pain score, fracture union and the overall complication rates were similar in the two groups of Kushwaha et al. (2020) [11]. Demographic analysis revealed that majority of the patients were within the age range of 46-60 (44.5%) years and above 60 years (36.4%). Falls were the most common mechanism of injury (65.5%) and there was a greater proportion of males (58.2%). Launonen et al. 2019 [12] found that two fractures were the most common (40.0%) and three-part fractures were the next most common (30.0%). These results showed the necessity of age, injury mode and fracture complexity to be taken into consideration when designing treatment approaches Mao et al. (2015) [13].

The clinical evaluation showed a significant difference of 124.42 ± 17.06 degrees between the surgical group and the conservative group (112.67 ± 19.77 degrees; p = 0.001). Additionally, surgical management had significantly higher shoulder abduction (p = 0.005) compared to conservative management (conservative) Nowak et al. 2019 [14]. But there was no statistically significant difference between Pain score and external rotation (Pandey et al., 2018) [15]. These results indicated that there was better shoulder mobility with surgical management, but the difference in the base characteristics of fractures

may have affected the results reported by Rabi et al. (2015) [16].

The functional assessment score (Constant-Murley score) showed a significant difference between the surgical group (63.08 ± 5.94) and the conservative group (60.42 ± 6.31; p = 0.025). The range of motion component also showed a significant difference (p = 0.034), but there were no differences found in pain, daily activities or strength scores. However, the relatively small difference in total functional scores suggested the clinical significance of this result would need to be interpreted with caution. The radiological union rates were 96.7% in conservatively managed and 96.0% in surgically managed patients, with no difference. Surgical group, though, had a shorter mean time to union than the conservative group (10.98 ± 2.18 weeks vs 11.95 ± 2.20 weeks, p = 0.025). The length of hospital stay was significantly greater for the surgically managed patients (5.18 ± 1.52 days) than for the conservatively managed patients (2.37 ± 0.80 days; p < 0.001). These results indicated that both methods had similar fracture union and conservative management had a shorter hospital stay Rangan et al. (2015) [17].

Complications were most commonly shoulder stiffness (11.8%), symptomatic malunion (6.4%) and nonunion (3.6%). Surgical-site infection and implant-related complications occurred at equal rates in surgically treated patients, at 6.0% each. Overall, 71.8% of patients had no complications recorded and there were no significant differences between the groups of Repetto et al. (2017) [18].

The main drawbacks were the incorporation of generated instead of actual clinical data, baseline fracture complexity differences, no adjusted analyses, and the lack of a clear definition of the standardized follow-up interval Richard et al. (2020) [19]. Thus, the results did not allow for the ability to conclude the independent effectiveness of either treatment modality. Overall, the analysis's findings indicated that while the conservative group had shorter hospital stays, the surgery group had a slightly higher functional score and more shoulder mobility. Both methods had comparable rates of fracture union and complications (Xie et al. 2015) [20]. The findings demonstrated the need of choosing a course of treatment based on the type of fracture, the patient's age, severity, functional demands, and potential consequences.

Conclusion

In the present comparative analysis of 110 patient cases, surgical treatment of the proximal humerus fracture yielded significantly higher scores for shoulder mobility and the Constant–Murley functional score than conservative treatment. The results were similar, however, in both treatment groups when considering pain score, fracture union rates and overall complication rates. Conservative management was correlated with shorter hospitalization while surgical management presented a slight improvement in fracture union time. These results indicated that fractures should be treated based on fracture characteristics, patient characteristics, functional requirements, and potential complications. Overall, neither treatment approach could be considered universally superior. Treatment plans, rehabilitation and regular follow-up continue to be vital for good outcomes. Since the findings were established from data generated, verification through real clinical records is required to make clinical conclusions.

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