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Research Article

Comparison of Surgical and Non-Surgical Treatments for Proximal Humerus Fractures: A Cross-Sectional Study

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Abstract

Background: The proximal humerus fracture (PHF) is one of the most common fractures of the upper limbs. PHF is more common in older people, usually following a fall, whereas in younger people this form of fracture is typically caused by high-energy trauma. There are several treatment options for PHFs, including surgical and non-surgical procedures. Our aim was to compare the outcomes of surgical and non-surgical treatment methods in Iranian patients with PHFs.
Methods: Sixty patients with PHFs participated in this single-center cross-sectional study. Medical records were reviewed and evaluated according to demographic characteristics, underlying diseases, type of treatment, complications, need for reintervention, and Constant score.
Results: The mean age of the patients was 45.65 years. Among those older than 50 years, women significantly outnumbered men (66.7%, P = 0.009). Thirty-one patients received surgical treatment, while 29 patients received non-surgical care. The Constant scores of patients who underwent surgery were considerably higher than those of non-surgical patients [mean ± standard deviation (SD): 80.41 ± 1.89 versus 69.82 ± 1.82, P = 0.009]. This significant relationship was observed only in the age group of 18 to 49 years.
Conclusion: Overall, the complications arising from both surgical and nonsurgical treatments were not statistically significant; however, patients under the age of 50 and men had higher Constant scores, indicating better clinical outcomes.

Keywords: Shoulder Fractures; Humeral Fracture; Treatment Outcome; Cross-Sectional Studies

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Background

Proximal humerus fractures (PHFs) are among the most common upper limb fractures (1). These fractures account for approximately 5-6 percent of all adult fractures and 50% of humerus fractures (2). In recent years, the prevalence of PHFs has increased. One of the most important reasons for this is the improvement in the quality of life (QoL) and life expectancy of older people, as well as advances in diagnostic methods (3). In the United States (US), 250 out of every 100000 people suffer from this type of fracture. PHF often occurs in people over 80 years of age and is usually due to falls, especialy in osteoporotic people. In younger individuals, this type of fracture is typically caused by high-energy trauma (4-8).

There are several treatment options for PHF, including surgical and nonsurgical treatments. Despite the introduction of various surgical options, nonsurgical treatment is still the preferred method. PHFs are classified based on the number of displaced fragments (9). Neer suggested that fractures with three or more fragments probably required surgery (9). The most common surgical option was locking plates, followed by inverse total shoulder arthroplasty and intramedullary nailing (8). On the other hand, fractures associated with vascular damage that cannot be supported by collateral vessels also require surgery. Vascular injury that can lead to avascular necrosis of the humeral head or nerve damage are important complications of PHF (10-13). Complications such as failure to heal, nonhealing, or limitation of shoulder motion are also seen in these types of fractures (14).

Recently, inverse shoulder arthroplasty has replaced hemiarthroplasty and is being used more frequently (15). PROFHER's 2018 study showed that there was no significant difference between the outcomes of operated and nonoperated patients (16). However, outcomes concerning the QoL are conflicting, with EuroQol-5 Dimensions (EQ-5D) criteria favoring surgical treatment, while employing 15 dimensional health-related quality of life (15D) criteria shows nonsignificant differences (17).

Considering the importance of PHFs and the limited availability of sufficient data on treatment options, especially in the Iranian patient population, the aim of this study was to evaluate and compare the outcomes of both surgical and non-surgical treatment methods.

Methods

This cross-sectional study was conducted between March 2019 and September 2021 at 5th Azar Hospital in Gorgan City, Golestan Province, Northern Iran.

Patients: In this study, all patients admitted to our hospital with a diagnosis of PHF between September 2014 and April 2018 were considered as target cases. The inclusion criteria were: obtaining informed consent, a definitive diagnosis of PHF on radiograph, completion of all treatment protocols, and being over 18 years of age. The exclusion criteria included pathologic fractures, neuromuscular disease, concurrent head trauma, admission to the intensive care unit (ICU), and failure to complete the treatment course.

Study Design: The medical records of the participants were reviewed. Basic information such as demographic

data, type of treatment performed, need for a second surgical procedure, underlying diseases, prescribed medications, type of fracture, and smoking history was collected. A telephone interview and invitation to the medical center was conducted. The patients underwent a physical examination. Complications such as limited joint motion, nonunion, malunion, infection, and nerve or vascular damage were assessed. The type of fracture was determined based on radiographs and Neer's classification. Finally, patients were scored using the Constant scoring tool. With this scoring tool, higher scores indicate a better prognosis, and it decreases with age (18).

This study was conducted in accordance with the Helsinki Research Declaration and approved by the local Ethics Committee of Golestan University of Medical Sciences, Gorgan (registration ID: IR.GOUMS.REC.1400.354).

Statistical Analysis: Statistical analysis was performed with SPSS software (version 16, SPSS Inc., Chicago, IL, USA); mean, standard deviation (SD), frequency, and percentage were used to describe the data. To compare variables, we used chi-square, Student's t-test, analysis of variance (ANOVA), Kruskal-Wallis, and Mann-Whitney tests as appropriate. The normality of continuous variables was checked with the Shapiro-Wilk test. The statistical significance level was set at 0.05.

Results

Out of 240 patients admitted, approximately 100 patients met the inclusion criteria, and 60 [32 women (53.3%) and 28 men (46.7%)] of these patients agreed to participate in the study. The mean age of the patients was 45.65 ± 1.83 years (range: 18-78 years). Patients were divided into two age groups: 18-49 (55%) and ≥50 years old (45%). Among those aged 50 years and older, the proportion of women was significantly higher (66.7%, P = 0.009), with mean ages for men and women being 39.71 ± 1.52 and 52.42 ± 1.94 years, respectively.

High-energy trauma, such as falls from a height of more than 3 meters and accidents, accounted for 63.3% of PHF cases. Fractures caused by high-energy trauma were more common in individuals younger than 50 years compared to older patients (69.7% versus 55.6%, P = 0.258). A total of 31 patients were treated surgically, while 29 patients were treated nonsurgically. Among the surgical group, 21 of 31 patients had high-energy trauma (67.74%), compared to 17 of 29 patients (58.62%) in the nonsurgical group (Table 1).

Table 1. The frequency of injury type and relationship with treatment method

Treatment method	Kind of trauma (frequency)		Total	P-value
	High-energy	Low-energy		
Surgical	21	10	31	0.464
Non-surgical	17	12	29	

The fracture pattern, treatment method, and patient's Constant score are shown in table 2. All patients with fractures with minor displacement or bipartite fractures involving the lesser or greater tuberosity were treated nonsurgically. In contrast, all patients with PHF dislocations underwent surgery. No significant association was found between patient age and Neer fracture classification (P = 0.866).

No inverse shoulder arthroplasty, hemiarthroplasty, or total shoulder arthroplasty was performed during this study. The surgical method used in the patients, their complications, and the mean Constant score are listed in table 3. No significant association was found between the choice of surgical or nonsurgical treatment methods with patient age or sex (P = 0.105 and P = 0.782, respectively).

There was a significant association between the presence of underlying disease and age. The mean age of patients with underlying disease was 61.60 ± 1.79 years, while those without underlying disease had a mean age of 37.67 ± 1.55 (P < 0.001). There was no significant association between smoking and the method of treatment (P = 0.766).

The study found a strong significant association between patients' gender and age and surgical outcomes (according to Constant score). Patients under 50 years of age (P < 0.01) or men (P = 0.01) had better clinical outcomes (Figure 1). According to the Constant score, the surgical patients had significantly better outcomes than nonsurgical patients (mean ± SD score: 80.41 ± 1.89 vs. 69.82 ± 1.82, P = 0.009). This significant association was observed only in the 18-49 years age group (P = 0.029).

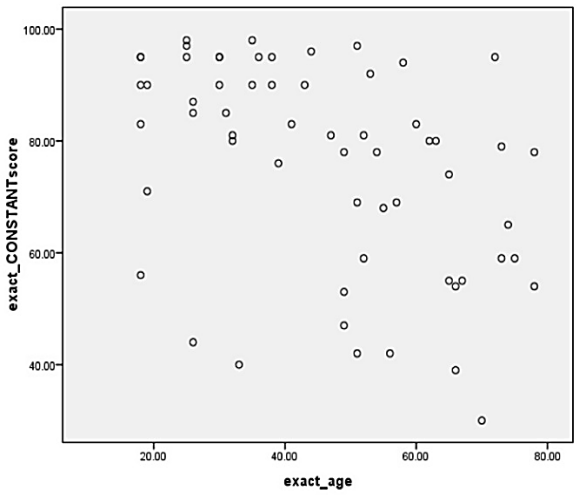

Figure 1. Distribution of Constant scores of patients according to age

Table 2. Fracture distribution according to treatment method, rate of complications, mean age, and average Constant score based on Neer's classification

Type of fracture	Total number	Treatment method	n (%)	Number of patients with complications	Average Constant score	Age (year) (mean ± SD)
Non-displacement	6	Surgical	0 (0)	0	0	46.66 ± 1.66
		Non-surgical	6 (10.0)	3	72.66	
2 parts with surgical neck involvement	18	Surgical	11 (18.3)	4	76.00	44.66 ± 1.75
		Non-surgical	7 (11.7)	2	75.71	
2 parts with greater tuberosity involvement	3	Surgical	0 (0)	0	0	41.00 ± 2.27
		Non-surgical	3 (5.0)	2	74.66	
2 parts with lesser tuberosity involvement	1	Surgical	0 (0)	0	0	32.00 ± 2.35
		Non-surgical	1 (1.7)	0	78.00	
2 parts with dislocation	2	Surgical	2 (3.3)	0	89.00	41.00 ± 3.11
		Non-surgical	0 (0)	0	0	
3 parts with greater tuberosity involvement	21	Surgical	14 (23.3)	4	80.35	46.23 ± 1.85
		Non-surgical	7 (11.7)	3	66.85	
3 parts with lesser tuberosity involvement	3	Surgical	2 (3.4)	0	84.50	38.00 ± 2.40
		Non-surgical	1 (1.7)	1	69.00	
4 parts	6	Surgical	2 (3.3)	1	92.50	55.50 ± 2.30
		Non-surgical	4 (6.6)	4	49.75	

SD: Standard deviation

Table 3. Distribution of complications, mean age, and mean Constant score in surgical procedures

Type of surgery	Total number	Complications	Frequency (number)	Average Constant score	Age (year) (mean ± SD)
ORIF + plate	21	+	8	76.61	47.09 ± 1.57
		-	13		
ORIF + screw	1	+	0	98.00	19.00 ± 2.50
		-	1		
ORIF + nail	3	+	0	88.00	42.33 ± 1.50
		-	3		
ORIF + anchor	2	+	0	90.00	22.00 ± 5.65
		-	2		
CRIF + pin	4	+	1	85.50	31.50 ± 2.70
		-	3		

ORIF: Open reduction and internal fixation; CRIF: Closed reduction and internal fixation; SD: Standard deviation

For patients over 50 years old, those undergoing surgery had a lower percent of complications, though this difference was not statistically significant (Table 4).

Table 4. Distribution of clinical complications by treatment methods and age group

Age group (year)	Complications	Treatment method		Total number	P-value	
		Surgical	Non-surgical			
18-49	+	15	5	10	0.419	0.073
	-	14	9	23		
≥ 50	+	4	10	14	0.085	
	-	8	5	13		
Total		31	29	60		

One of the most important issues in patients' clinical outcomes is the need for reoperation. In both treatment groups, the majority of patients did not require reintervention (P = 0.17) (Table 5).

Table 5. Frequency of reintervention by treatment method

Treatment method	Need for reoperation or reintervention	n (%)	Total number	P-value
Non-surgical	+	4 (13.8)	29	0.170
	-	35 (86.2)		
Surgical	+	1 (3.2)	31	
	-	30 (96.8)		

Discussion

This was a cross-sectional study of 60 patients with PHF. According to our results, the need for surgery increases in older patients and in cases of complex humeral fractures. The complications arising from both surgical and nonsurgical treatments were not statistically significant. However, for patients younger than 50 years, surgical methods resulted in significantly better outcomes than nonsurgical methods. In addition, the likelihood of humeral fractures increased with age, especially among women.

In 2014, Mao et al. conducted a systematic review comparing surgical and nonsurgical treatment methods for PHFs. They analyzed 6 studies with a total of 287 patients and found no significant difference in clinical outcomes between the two groups, although QoL, as measured by EQ-5D, was higher in patients who underwent surgery. This difference was not observed using the 15D criteria (17). It is important to note that reverse shoulder arthroplasty was not included in these studies. This surgery is now more widely used and preferred over earlier methods. In addition, the mean age in the studies reviewed by Mao et al. was over 70 years. Our study found no significant difference between surgical and nonsurgical outcomes at ages older than 50 years.

A previous review by Soler-Peiro et al. reported that most three-part PHFs treated nonsurgically achieved fracture consolidation with a low rate of malunions and moderate to good functional outcomes with few complications. In contrast, four-part PHFs treated nonsurgically also had a high consolidation rate and a lower rate of malunions but resulted in poor functional outcomes with few complications (19).

Sabharwal et al. reviewed seven studies involving 528 patients, finding that patients who underwent surgery had better long-term clinical outcomes. However, in general, there was no significant difference between the outcomes of surgical and nonsurgical methods. The need for reoperation was higher in patients who underwent open reduction and internal fixation (ORIF) than in those who did not (20).

A 2015 study in China showed that complications such as osteoarthritis (OA) and nerve damage were significantly lower in patients who underwent surgery. These patients also reported a significantly higher QoL (21). Given that complications such as OA can cause chronic pain and are associated with a high risk of depression and lower life expectancy, longer follow-up periods may provide clearer results.

Age is one of the most important factors in choosing a PHF treatment method. Boileau et al. conducted a study of young people with PHF in Canada and concluded that surgical treatment might be more logical for young, physically active individuals, especially in cases of complex fractures or disrupted blood supply to the humeral head (22).

When a nonsurgical approach is chosen, patient cooperation is essential. The proximal humerus is challenging to stabilize due to multiple forces acting on it. For this reason, physicians resort to methods that are difficult for patients to tolerate, such as airplane splints or shoulder spica casts (1). The better results observed with the surgical method in our study may be due to noncompliance with these protective recommendations in the nonsurgical group.

With the introduction of inverse shoulder arthroplasty, the number of patients with PHF undergoing surgery has increased dramatically. A study conducted in Germany showed that the number of PHF surgeries increased by 39% between 2007 and 2016 (23). In addition, a systematic review showed that the inverse shoulder arthroplasty method improved patients' Constant score and clinical outcomes compared with other surgical methods (24). A recent study by Soleymani et al. in Iran reported that the age, severity of fracture, and underlying comorbidities affected the PHF outcome (25).

Limitations: This study has some limitations that may affect the generalizability of the results. First, the sample size was relatively small, which may limit the statistical power of the study. Second, the study was conducted in a single center, which may restrict its applicability to other populations or settings. Third, none of the patients received more recent surgical methods, such as inverse shoulder arthroplasty. Finally, the follow-up period was relatively short (approximately 12 months), and longer-term outcomes were not evaluated.

Conclusion

PHFs occurred more frequently in individuals over 50 years of age, especially women. Overall, the complications

arising from both surgical and nonsurgical treatments were not statistically significant; however, patients who were men or younger than 50 years of age had better clinical outcomes with the surgical method.

Conflict of Interest

The authors declare no conflict of interest in this study.

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