

Functional Outcome Of Percutaneous K-Wires System In Elder Patients With Proximal Humeral Fractures

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Abstract

Objective: To evaluate the functional outcome of the percutaneous K-wires system in elder patients with proximal humeral fractures.

Method: This one-year observational prospective study was conducted on 68 patients aged 50 to 70 years with proximal humeral fractures, treated at the Orthopaedic Department of Benazir Bhutto Hospital, Rawalpindi. Participants with NEER two-, three-, or four-part fractures, capable of participating in follow-up assessments, were included. Percutaneous K-wire fixation was performed, and standardized postoperative care was administered. Chi-Square test and Pearson's Coefficient Correlation were used for the assessment of association.

Results: The mean age of the patients was 59.65 ± 6.47 years. Gender distribution revealed 29 (42.6%) male and 39 (57.4%) female patients. Assessing functional outcomes, 20.60% of patients exhibited an excellent outcome, 64.70% showed a good outcome, 11.80% displayed a fair outcome, and 2.90% experienced a poor outcome.

Conclusion: The use of K-wire fixation for humerus fractures produces exceedingly favourable outcomes in the post-operative context in elderly patients.

Keywords: humerus, K-wires, elderly .

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1. Introduction

Proximal humerus fractures are the 3rd most frequent non-vertebral fractures in elderly individuals and account for around 5.7% of all adult bone fractures.¹ Both the direct and indirect effects of osteoporosis and fractures caused by fragility are having a global impact, and more attention is being paid to the methods used to manage these fractures in the context of elderly, low-energy falls.² The overall non-operative and operative treatment of proximal humerus fractures continues to gain great attention in the literature as the population as a whole continues to age and a growing percentage of these individuals are considered bone density deficient.³

Osteoporosis is the most widespread underline cause in older individuals and high-energy trauma is the most common cause in younger persons, accounting for the majority of cases. Trauma typically involves a great amount of energy that is associated with dislocation.⁴ The majority of proximal humerus fractures, whether they occur in younger or older individuals, are stable and either slightly or not at all

displaced, making them amenable to non-operative treatment.⁵⁻⁷ These account for nearly 80% of all proximal humerus fractures. The remaining 20% of patients need surgical fixation to get improved mobility due to the serious nature of the fracture.⁸ There are many different operations management strategies mentioned in the literature, each with its own set of benefits and drawbacks. With contoured plating systems, Open reduction and internal fixation can be performed, which is useful for osteoporotic bones but comes at the risk of soft tissue damage (Muscles and Neurovascular Structure). Conventional / Locking screws and Plates can be inserted with careful surgical dissection in different areas of the humeral head.⁹ The axillary nerve and Circumflex Humeral Artery are prone to damage in this area.

Minimally invasive surgery and multidirectional locking screws on modern nailing systems make intramedullary (IM) fixation a viable option.¹⁰ The vascularity of the humeral head and surrounding soft tissues are protected during percutaneous K-wire fixation, however, this technique demands extensive



technical understanding of the fracture fragments, a long learning curve, experience and competence in closed anatomical reduction.¹¹

Neer's categorization makes a distinction between the number of displaced fragments and non-displaced fragments, where displacement is defined as more than 45 degrees of angulation or more than one centimetre of separation.¹² Fixation in a stable position is necessary for these types of fractures. Fixation for proximal humerus fractures includes screw fixation, k-wires, T-buttress plates, locking plates, conventional plates, and prosthetic replacements. Every preoccupation comes with its own set of complications. The proximal humerus has poor cancellous bone quality, particularly in older patients, resulting in a higher likelihood of failure of fixation when using a traditional plating approach.¹³

The k-wire has been used to prevent soft tissue damage and achieve stable fixation, so it lessens the likelihood of these problems, particularly in more senior patients who suffer from osteoporosis. Even a fracture with only a small amount of displacement can be treated with transcutaneous pinning to effectively mobilize the fracture in an elderly patient and, as a result, prevent shoulder stiffness. Fixing a highly comminuted fracture in an elderly patient with transcutaneous pinning can improve the patient's functional outcome. This study provides insight into the functional outcome and the management of fracture among elder patients of humerus encompassing the proximal region, with transcutaneous pinning.

2. Materials & Methods

The study design was an observational prospective investigation aimed at evaluating the functional outcomes of the percutaneous K-wire system in elderly patients with proximal humeral fractures. Ethical guidelines were strictly followed, and approval was obtained from the institutional review board. The duration of the study was 01 year, conducted from August 2020 to July 2021.

The study population consisted of elderly patients aged between 50 to 70 years who had presented with proximal humeral fractures at the Orthopaedic Department of Benazir Bhutto Hospital, Rawalpindi. Informed consent was obtained from all participants before their inclusion in the study. Patients were enrolled on a study using a

non-probability sampling technique. The inclusion criteria for this study consisted of skeletally mature individuals who presented with displaced proximal humerus fractures classified as NEER two-, three-, or four-part fractures in older patients and willing and able to participate in follow-up assessments. Patients with contraindications to percutaneous K-wire fixation or cognitive impairments hindering follow-up evaluations were excluded. All eligible patients underwent percutaneous K-wire fixation for their proximal humeral fractures. Skilled orthopaedic surgeons performed the procedure according to established protocols. Postoperative care, including standardized physiotherapy, was administered to all participants.

Functional outcomes were assessed using the Constant Shoulder Score, a validated tool for evaluating shoulder function. This scoring system comprised four components: pain, activities of daily living, range of motion, and strength. The scores ranged from 0 to 100, with higher scores indicating better shoulder function.

Data collection involved gathering baseline demographic information, fracture characteristics, and medical history from each participant upon enrollment. Follow-up evaluations were scheduled at specific time points postoperatively (e.g., 6 weeks, 3 months, 6 months, and 1 year). During these visits, the Constant Shoulder Score was administered, and any complications or adverse events associated with the K-wire system were documented. The final assessment was done one-year post-treatment.

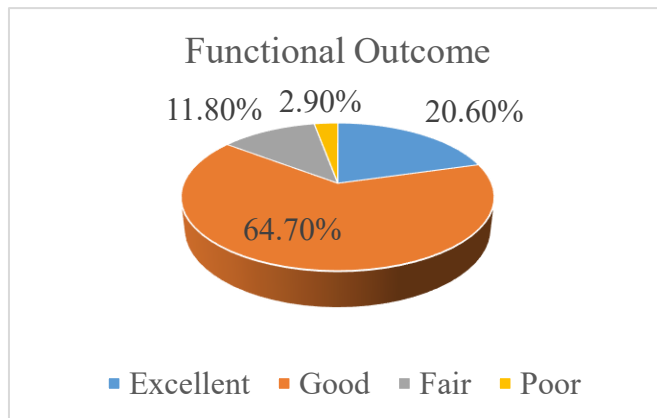
The sample size was calculated using the Openepi web-based sample size calculator. We took the previous frequency of 10% fair outcome, margin of error of 7.15% and confidence interval of 95%, the calculated sample size was 68. For statistical analysis, IBM SPSS 24 was used. Statistical analysis encompassed descriptive statistics to summarize baseline characteristics and functional outcomes. Chi Square test was used to assess the association between categorical variables while Pearson's Correlation Coefficient was used to assess the association between numerical variables keeping a P value less than 0.05 in either test.

3. Results

This study was conducted on 68 patients. The mean age of the patients was 59.65 ± 6.47 years. Regarding gender distribution, we observed that 29 (42.6%) were male while 39 (57.4%) were female patients.

Table 1: Demographics

Variables		Statistics
Age (Years)		59.65±6.47
Gender	Male	29 (42.6%)
	Female	39 (57.4%)
Aetiology of fracture	Road Traffic Accident	20 (29.4%)
	Fall	48 (70.6%)
Side of fracture	Left	13 (19.1%)
	Right	55 (80.9%)

**Figure 1: Functional Outcome**

The etiological factors involving fractures were road traffic accidents 20 (29.4%) and falls 48 (70.6%). The right side was the most common side of fracture in 55 (80.9%) while the left side was involved in 13 (19.1%) patients.

Table 2: Association Between Functional Outcome and Age.

		Age distribution		Total	P value
		50 to 60 years	61 to 70 years		
Functional Outcome	Excellent	8	6	14	0.04
		57.1%	42.9%	100.0%	
	Good	26	18	44	
		59.1%	40.9%	100.0%	
	Fair	1	7	8	
		12.5%	87.5%	100.0%	
	Poor	0	2	2	
		0.0%	100.0%	100.0%	
Total		35	33	68	
		51.5%	48.5%	100.0%	

According to the functional outcome, we observed excellent outcomes in 20.60% of patients, good

outcomes in 64.70% of patients, fair outcomes were observed in 11.80% of patients and poor outcome was observed in 2.90% of patients. We found a significant association between functional outcome and age groups, patients aged between 50 to 60 years showed a significantly higher frequency of excellent and good outcomes as compared to patients aged between 61 to 70 years ($P = 0.04$). The mean fracture union time was 14.46 ± 1.86 weeks. We observed a positive correlation between fracture union time and age, the union time increased in patients with increasing age ($r = 0.78$). Regarding the postoperative complications, only 3 (4.4%) patients developed superficial infection, malunion was observed in 1 (1.5%) patients and nonunion was observed in 1 (1.5%) patients.

Table 3: Correlation between fracture union time and age

Variables	Mean	Std. Deviation	P value	r
Age (Years)	59.65	6.478	0.0001	0.78
Union time (Weeks)	14.46	1.864		

4. Discussion

Nearly 4% of all fractures and 26% of humerus fractures are proximal humerus fractures. The distal radius fracture and the hip fracture are the primary and second most frequent fractures in the senior population, respectively. The head, larger and lesser tuberosities, as well as the proximal one-fourth of the shaft, are all parts of the proximal humerus. Osteoporosis is the primary cause of osteoporosis in elderly individuals, and high-energy trauma is the primary cause of osteoporosis in young adults. Dislocations are typically accompanied by high-intensity trauma.¹⁴

In our study, all patient categories, including osteoporotic patients with modest blood loss and brief postoperative hospital stays, were successfully treated using the k-wires technique, which consistently yields good results with incredibly low postoperative problems.

Most patients with proximal humerus fractures are over 60 years old, and osteoporosis is mostly to blame for these fractures in these individuals. Minimally displaced fractures respond well to conservative treatment in a sling followed by functional rehabilitation under

supervision, while displaced two and three-component fractures require reduction and stabilization.¹⁵

Since the majority of patients are elderly, there is a greater risk of infection and concomitant disorders preventing further surgery, whereas conservative treatment may result in malunion and stiffness, and open reduction may result in devascularization of fragments. When treating older patients with cardiovascular or pulmonary illnesses, in whom anaesthesia is extremely dangerous or contraindicated, closed reduction and percutaneous pinning procedures are used.¹⁶

In our study, all fractures were treated conservatively without the need for invasion, making the procedure highly minimally invasive with a very low risk of infection following surgery. Some surgeons choose an open reduction of these fractures followed by K-wire fixation, however this is counterproductive to the original intent.¹⁶

The only way to get the best K-wire fixation results for these fractures is to first do a conservative reduction using traction, manipulation, and abduction. The exceedingly minimal post-operative complications and stable repair of such fractures are both made possible by this.¹⁷

The K-wire fixation of such a fracture is incredibly affordable and accessible to the least qualified individual. Even though the rehabilitation and physiotherapy exercises for Kwire fixation are being postponed, the long-term outcomes are so encouraging that they negate the need for delay at the beginning of the activities.¹⁷

In our study, we enrolled 68 patients in the age group of 50 to 70 years. We observed that the female patients had higher frequency as compared to male patients. This higher frequency of female patients has been reported by various studies.^{13, 17}

We found that the functional outcome was excellent in 20.60% of patients while good outcome was seen in 64.70% of patients, fair in 11.80% and poor in 2.90% of patients, similar results have been reported by a study which showed that the majority of their patients had good functional outcome followed by excellent outcome.¹³ We found a significant association between functional outcomes and age groups. Patients in the age group of 50 to 60 years showed a higher frequency of excellent and good outcomes as compared to patients aged between 61 to 70 years.

The mean fracture union time in our study was 14.46 ± 1.86 weeks, having a positive correlation with increasing age ($r = 0.78$), similar findings have been reported by a study which showed that mean fracture

union time was positively correlated with increasing age.¹⁷

5. Conclusion

Percutaneous K-wire fixation emerges as a valuable technique applicable to specific patients dealing with fractures of the proximal humerus. This method demonstrates minimal post-surgical complications, coupled with a notably affordable expense, rendering it accessible even to the most financially disadvantaged individuals. This approach preserves the inherent biological soundness of the humeral head while ensuring anatomical alignment through the utilization of multiple K wires that offer angular stability. Moreover, it enhances the stability of fixation, particularly in cases of osteoporotic humeral bones. The strategic utilization of K wires interconnected with clamps and a fixator rod presents an economical strategy for averting complications frequently associated with K wires during the recovery phase. Consequently, it can be deduced that the employment of K-wire fixation for humerus fractures yields exceedingly favourable outcomes in the postoperative context.

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W.A, R.R.A, R.A, - Conception of study

W.A, R.R.A, R.A, - Experimentation/Study Conduction

W.A, R.R.A, M.Z.S -

Analysis/Interpretation/Discussion

W.A, M.Z.S, N.A, M.N.K - Manuscript Writing

R.A, M.Z.S, - Critical Review

R.R.A, R.A, N.A, M.N.K - Facilitation and Material analysis

All authors approved the final version to be published & agreed to be accountable for all aspects of the work.

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