



## Comparison of outcomes after fixation of proximal humerus fractures in elderly to non-elderly patients using locking plates

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### Abstract

The use of locking plate technology for the fixation of proximal humerus fractures has been increasing. Purpose of this research was to analyze the comparison of functional outcome in elderly ( $\geq 65$  years of age) to non-elderly patients ( $< 65$  years of age) who had sustained a proximal humerus fracture and were subsequently treated with locking plate technology. Retrospective database of all patients with proximal humerus fracture who had undergone surgery using locking plates was obtained. Patients' charts were retrospectively reviewed to analyze presentation, type of injury and management for the proximal humerus fracture. All available follow up data was reviewed. A total of 49 patients met the inclusion criteria for the study. They were divided into two groups: Group A ( $< 65$  years) and Group B ( $\geq 65$  years). Constant score questionnaire was completed for all these 49 patients. Level of significance for the differences in functional outcome between the two groups was calculated using unpaired t-test. The results were statistically significant for the functional outcome between the two groups indicating that younger patients function better with the use of locking plate technology. Of all the 49 patients about 85% of the patients had an excellent/satisfactory functional outcome as suggested by the constant score. These results favor the use of locking plate technology in the fixation of upper humerus fractures.

**Keywords:** Functional outcome; proximal humerus fractures; locking plate.

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### Introduction

The proximal humerus has been traditionally considered an anatomic area prone to osteoporotic fracture following low-energy trauma in the elderly patient, and as the population continues to age, there will likely be an increase in the incidence of these fractures [1]. Younger patients are subjected to proximal humerus fracture mostly following high energy trauma/mechanisms. Proximal humerus fractures account for 4-5% of all fractures and depending on several factors they can be treated non-operatively or operatively. Treatment is guided by multiple factors including displacement of fracture fragments, the baseline functional status of the patient, hand dominance, and age [2, 3]. Non-operative treatment is preferred for fractures that are stable and not or minimally displaced. Osteoporosis, comminution, short-segment fracture length, and displacement complicate stabilization, fracture healing, and functional results [4-12]. Displaced, unstable fractures can be treated operatively using different types of fixation techniques which include: closed reduction and percutaneous pinning, locking plate (LP) and screw fixation, intramedullary nailing (IMN), tension band wiring, hemiarthroplasty, or a combination of techniques. Most recent advances in management of these kinds of fractures have resulted

in open reduction internal fixation (ORIF) with the use of locking plate technology. ORIF can help in maintaining stability and allow the patient to begin early mobilization and hence early rehabilitation thereby reducing the time required to be bedridden and subsequently avoiding any complications that may arise due to immobilization.

The purpose of this study was to compare the outcome following ORIF surgery using locking plate technology in elderly (more than or equal to 65 years of age) to non-elderly patients (below 65 years of age). Constant shoulder score system for the assessment of functional outcome has been considered fit and has a good correlation and agreement with other scoring systems such as ASES (American shoulder and elbow surgeons) shoulder score and HSS (hospital for special surgery) shoulder score. It has been recommended for its high correlation coefficient [13].

### Materials and Methods

This study was conducted in Department of Orthopedic Surgery at South-East University affiliated Zhong Da hospital, Nanjing, Jiangsu, PR China. A retrospective data of all patients with a proximal humerus fracture within the time period of January 2008 to December 2012 was collected.

Patients' files were retrospectively reviewed to analyze history at presentation, mechanism, type of injury, type of treatment given to them and their condition at follow up. Keeping in mind the objective of our study all patients who underwent any treatment other than ORIF using locking plate technology were excluded for the study. This study was approved by the institutes' editorial board.

During the time period of January 2008 to December 2012 a total of 221 cases of trauma/injury to the humerus were recorded. Out of these 221 cases, patients that accounted for proximal humerus fractures were recorded to be 124. Of the 124 cases sustaining injuries to the proximal humerus fracture leading to fracture 91 patients were treated operatively using locking plate technology. The other 33 patients were treated by other means using different surgical techniques such as arthroplasty, operatively with other means (such as percutaneous pins) or some of them even being managed conservatively.

On inquiry (follow up) 12 out of the 91 cases treated by locking plate technology died (? natural/unnatural death). 31 patients were lost to follow up and the remaining 49 patients in all were available for inclusion in our studies. These 49 patients were divided in to two groups: Group A (patients younger than 65 years of age) and Group B (patients that were 65 years of age or older). Group A consisted of 26 patients and Group B comprised of the remaining 23 patients. All patients were followed up for more than one year and constant score questionnaire was completed for all of these patients.

### Surgical technique

All surgeries were performed under general anesthesia using a deltopectoral approach. Fracture site was exposed through this approach and reduction was achieved with the help of K-wires and confirmed using intra-operative fluoroscopic images. After having achieved a satisfactory reduction the K-wires were replaced with locking plate and screws. Following fixation, fluoroscopy images were obtained (anterior-posterior views and lateral views) to confirm appropriate reduction of bone fragments, plate position and screw length.

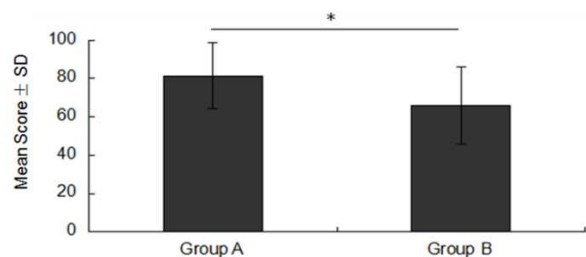
### Statistical analysis

Differences in functional outcome (as seen on the constant score questionnaire) between the two groups (Group A and Group B) were assessed by calculating the level of significance (p-value) for the differences

in mean between the two groups. A p-value of < 0.05 was considered to be of statistical significance. The unpaired t-test was used to compare the differences in mean between the two groups. The statistical analysis for the study was performed using the IBM SPSS Statistic 20 software.

### Result

Of the 49 patients 26 were younger than 65 years (Group A) and 23 (Group B) were older than or equal to 65 years. Mean  $\pm$  SD of the functional outcome for Group A (N=26) was calculated to be  $81.35 \pm 17.246$  and for Group B (N=23) Mean  $\pm$  SEM of the functional outcome was  $65.74 \pm 20.075$  (figure 1). The difference in mean between these two groups was  $15.61 \pm 5.331$ . The difference in mean was compared using unpaired t-test and the p-value for the test was recorded to be 0.0053. Results of this study were statistically significant for the differences in mean between the two age groups which indicates that patients younger than 65 years of age had a better functional outcome when compared to older patients ( $\geq 65$  years of age) (Fig. 1). A total of 42 patients (85.71%) had an excellent or satisfactory result but in 7 (14.28%) the outcome was poor (Table 1).



**Figure 1:** Independent sample T test for two groups. \*p<0.05, with a statistical significance between two groups.

**Table 1:** Age related constant scores

Constant score	Number of patients (%)		Total
	Group A	Group B	
>75(excellent)	20(71%)	8(28.6%)	28(100%)
50 to 75 (satisfactory)	5(36%)	9(64.3%)	14(100%)
<50 (poor)	1(14.3%)	6(85.7%)	7(100%)
Total	26(53%)	23(46.9%)	49(100%)

Z = -2.729 p = 0.006

### Discussion

Treatment of proximal humerus fractures treated with locking plate technology can lead to a good functional outcome with the use of correct surgical technique, also depending on the surgeon's skill to

perform the procedure correctly [14]. Previously many studies have used the constant score for the assessment of shoulder function [2, 14-19]. In a study conducted by Ye et al a mean DASH and Constant scores for all 89 patients were 19.6 and 66.6 points, respectively, when calculating functional outcome in patients older than 50 years of age [15]. This was similar to our study (the mean for elderly patients was 65.74). Previously conducted studies have shown that locked plating technology for proximal humerus fractures is beneficial for both the elderly and non-elderly patients [20]. Some complications following the use of this technology have been reported: hardware failure, hardware removal, intra-articular hardware, varus deformity, infections, osteonecrosis, subacromial impingement and fixation revision [17-19, 21-24]. Most of these complications occur due to fracture type and is not an implant specific problem [25]. In contrast to this Koukakis et al stated that the plate design provides a stable fixation with a good functional outcome and reduces the chances of hardware problems [23].

Locking plate technology for the fixation of proximal humerus fracture is a very effective method to obtain a good functional outcome. In this study about 85% of the patients treated via this method had an excellent or satisfactory outcome (Table 1). Moonot et al showed similar results [19]. Previously conducted studies have shown that locking plate technology has been proved to be equally efficient for both the young and old patients [20]. But our studies demonstrate that younger patients function better in comparison to the older patients with the use of this technique (Figure 1). These results suggest that the use of locking plate technique in the fixation of proximal humerus fracture has a favorable outcome in both the age groups with the younger age group having a tendency to have a better outcome in comparison to the older age group patients. The shortcoming in this study is the limited data which could affect the result. Also the clinician based constant score could bias the results. Large scale studies, multicenter data and multiple scoring systems to assess the functional outcome could help in determining a better and more efficient outcome.

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