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An analysis of locking plate fixation in proximal humerus fractures: A tertiary care teaching hospital-based study

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Abstract
Background: Proximal humeral fractures are commonly presented in the orthopedic practice. The usual method of treatment was conservative in the past. However, the results and functional outcomes were not good. Proximal Humerus fractures have a substantial impact on personal function and well-being and are one of the leading causes of excessive mortality among the elderly.
Aims and Objectives: An evaluation and analysis of locking plate fixation in proximal humerus fractures in tertiary care teaching hospital.
Methodology: This was a cross-sectional study carried out in the patients of proximal humerus fracture at the department of Orthopedics of a tertiary health care center during the one-year period. During the one-year period there were 63 patients included into the study after written and explained consent. All patients undergone proximal humerus locking plate operations as per the standard operating protocols and procedures. All the necessary data like Age of the patients, sex, Outcome and any associated complications were noted. The data was presented in the percentages and in tabular form.
Result: The majority of the patients in our study, were in the age group of >60 were 40.98%, followed by 50-60 were 27.87%, 40-50 were 19.67%, 30-40 were 8.20%, 20-30-3.28%. The majority of the patients were Female i.e. 68%, followed by Male were 32%. The majority of the patients were improved 80%, 20% were associated with complications like Avascular necrosis in 10%, Screw cutout occurred in 7%, Revision surgery required in 3%.
Conclusion: Our study demonstrates that locking plate fixation gives good functional outcomes in treatment of proximal humerus fractures. In our study, there was no significant difference in the two approaches used for exposure. The most common age of fracture was >60 the majority of the patients were females most of the patients improved; Locking plate fixation was a good surgical option for the management of proximal humerus fractures except with some complications like Avascular necrosis, Screw cutout occurred, Revision surgery required etc.

Keywords: revision surgery, osteoporosis, fracture proximal humerus, proximal humerus locking plate, avascular necrosis of femur

Introduction
Stable minimally displaced fractures can be treated nonoperatively but the management of displaced fractures remain controversial with various modalities of treatment available. Locking plates provide stable fixation and enable early postoperative mobilization specially in osteoporotic proximal humerus fracture. Younger patients typically present with proximal humerus fracture following high energy trauma such as motor vehicle accident. An 80% of proximal humeral fractures are non or minimally displaced fractures - can be treated non-operatively. Non operative treatment and fixation using K-wires lead to stiffness and decreased range of motion. Humerus fractures have a substantial impact on personal function and well-being and are one of the leading causes of excessive mortality among the elderly [1–3] A humerus fracture is often caused by a fall directly on the shoulder or arm [4], and the proximal part of the humerus fracture is commonly encountered in patients with osteoporosis. Published epidemiologic studies have reported widely diverse incidence rates of humerus fracture [5-7] Approximately 20% of proximal humerus fractures require surgical intervention, and these surgically treated fractures are often 3- or 4-part fractures [8] The goals of surgery for proximal humeral fractures should involve minimal soft tissue dissection and achieving anatomic

reduction of the head complex with sufficient stability to allow for early shoulder mobilization. Surgical options include percutaneous Kirschner wires, T-plates, angled plates, cloverleaf plates, intramedullary nails, tension band wires, and primary prosthesis [9]. Locking plates are being increasingly used by surgeons for these fractures, especially in patients with poor bone stock. This article describes the bone quality of the proximal humerus and the various treatment options, in particular locking plate fixation. BONE Quality of The Proximal Humerus the cancellous bone mass in the proximal humerus reduces with age, and the trabecular network is limited in older patients [10]. This is due to decreased osteoblastic activity and occurs up to the ninth decade [11] This overall decrease in bone mass leads to a reduction in trabecular thickness and trabecular connectivity. Tingart *et al.* [12]. Compared the cortical thickness of the proximal humerus diaphysis with the bone mineral density (BMD) of the proximal humerus and found that a low BMD was highly predictive if the sum of the cortical thickness of the medial and lateral diaphysis cortices was 4 mm.

Material and Methods

This prospective study was conducted at a tertiary level hospital. PHILOS plates were used for internal fixation of displaced proximal humerus fractures Neer's type 2 part, 3 part and 4 part fractures. Random allocation was done for every case, on alternate basis; with first case falling into deltoid splitting group and second case into deltopectoral and then third into deltoid splitting. This was a cross-sectional study carried out in the patients of proximal humerus fracture at A tertiary care teaching hospital in North India in the department of Orthopedics during the one-year period. During the one-year period there were 63 patients included into the study after written and explained consent. All patients undergone proximal humerus locking plate operations as per the standard operating protocols and procedures. All the necessary data like Age of the patients, sex, Outcome and any associated complications were noted. The data was presented in the percentages and in tabular form.

Results

Table 1: Distribution of patients as per the age

Age	No of Patients	Percentage (%)
20-30	2	3.28
30-40	5	8.20
40-50	12	19.67
50-60	18	27.87
>60	26	40.98
Total	63	100

The majority of the patients were in the age group of >60 were 40.98%, followed by 50-60 were 27.87%, 40-50 were 19.67%, 30-40 were 8.20%, 20-30-3.28%.

Table 2: Distribution of the patients as per the Sex

Sex	No of Patients	Percentage (%)
Male	20	32
Female	43	68
Total	63	100

The majority of the patients were Female i.e. 68%, followed by Male were 32% as shown in Table 2 and Figure 1.

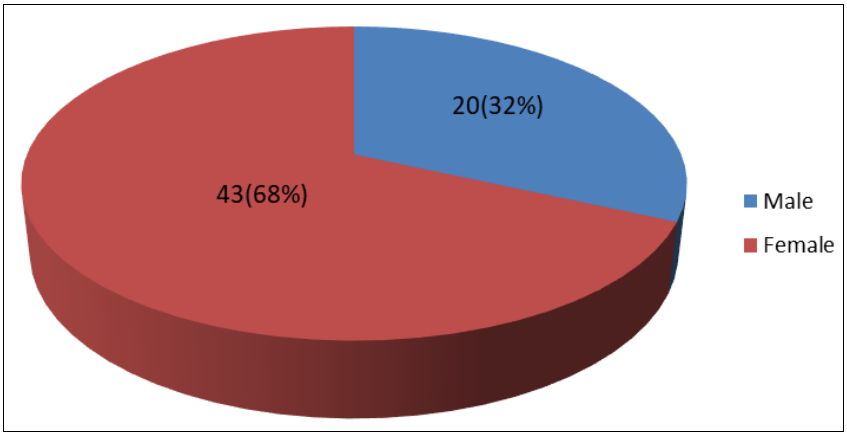

Fig 1: Distribution of the patients as per the Sex

Table 3: Distribution of the patients as per the Outcome

Outcome	No of Patients	Percentage (%)
Improved	50	80
Associated with Complications: a- Avascular necrosis b- Screw cutout c- Revision surgery	13 6 4 2	20 10 7 3
Total	63	100

The majority of the patients were improved 80%, 20% were associated with complications like Avascular necrosis in 10%, Screw cutout occurred in 7%, Revision surgery required in 3%. As given in Table 3 and Figure 2.

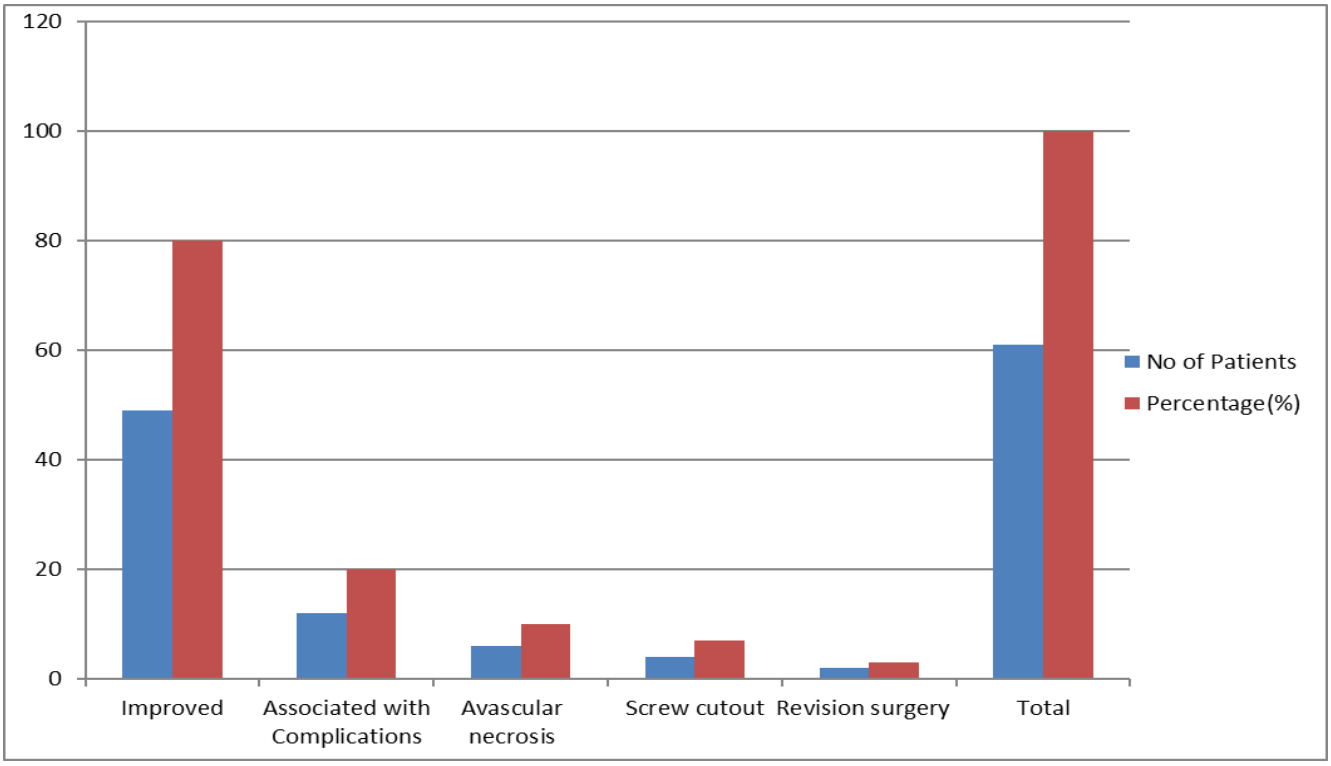

Fig 2: Distribution of the patients as per the Outcome

Discussion

Various fixation methods have been used in the past for treatment of proximal humeral fractures which showed variable outcomes. In a study by Sadowski *et al*., fixation with Plant Tan plates resulted in 100% complications especially in elderly osteoporotic bones, with penetration of the proximal screw being the most common complication. The conservative management for displaced or unstable fracture patterns has not been favorable, resulting in persistent pain, stiffness, and dysfunction [13, 14] Three- and4-part fractures of the proximal humerus often warrant operative intervention [15]. Various surgical treatment options exist, such as percutaneous K-wires, T-plates, angled plates, cloverleaf plates, intramedullary nails, tension band wires, primary prosthesis, and locking plate fixation [16]. Locking plates are widely used in the fixation of proximal humerus fractures [17, 18]. These plates were developed to provide angular stability and achieve a favorable screw–bone interface, especially in osteoporotic bone. The plate incorporates multiple locking screws in convergent and divergent directions to improve pullout strength and fixation strength [19]. This creates a fixed angled device that acts as a single unit that captures a volume of bone. It is positioned on the lateral cortex of the proximal humerus to provide intrinsic stability to an anatomically reduced proximal humerus fracture. Medial buttress plates would compromise the blood supply to the humeral head [20]. In our study we have seen that the majority of the patients were in the age group of >60 were 40.98%, followed by 50-60 were 27.87%, 40-50 were 19.67%, 30-40 were 8.20%, 20-30-3.28%. The majority of the patients were Female i.e. 68%, followed by Male were 32%. The majority of the patients were improved 80%, 20% were associated with complications like Avascular necrosis in 10%, Screw cutout occurred in 7%, Revision surgery required in 3%. These findings are similar to Neil G. Burke *et al*. [21]. they found that Locking plate fixation was associated with a high complication rate, such as avascular necrosis (7.9%), screw cutout (11.6%), and revision surgery (13.7%). These complications are frequently due to the varus deformation of the humeral head. Otherwise Locking plate fixation was a good surgical option for the management of proximal humerus fractures.

Conclusion

Our study demonstrates that locking plate fixation gives good functional outcomes in treatment of proximal humerus fractures. In our study, there was no significant difference in the two approaches used for exposure. Our results are comparable to various studies conducted by other authors which states that locking plates provide better functional and radiological outcomes as compared to other fixation methods like Tension band wiring, percutaneous K-wire fixation, non-locking plates, intramedullary nails. It can be concluded from our study that the most common age of fracture was >60 the majority of the patients were females most of the patients improved; Locking plate fixation was a good surgical option for the management of proximal humerus fractures except with some complications like Avascular necrosis, Screw cutout occurred, Revision surgery required etc.

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