

Fixation of proximal humerus fracture in adult by locking plate: Clinical study

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p>Aim: The present study aimed to examine the functional outcome of the locking plate in the proximal humerus fracture treatment. **Material and Methods:** The study consists of 20 patients diagnosed with NEER's 2 – part, 3- part, and 4 – part proximal humerus fracture. All the included patients were treated with internal locking plates. Based on the functional evaluation by Constant-Murley shoulder score and the assessment of radiological union foundation. **Results:** Excellent results were obtained in 45% of the patients, a good result was seen in 25%, 20% of the patients had fair results and the poor result was seen in 10% of the patients. The mean Constant-Murley shoulder score that was obtained in the present study was 75.04. **Conclusion:** It's concluded that there is a satisfactory functional outcome with the fixation of the proximal humerus fracture with locking plates. While using the plate fixation for fracture the plate position is of the utmost importance. Due to angular stability, the locking plates are the advantageous implants in case of proximal humeral fracture.

Keywords: Fracture, Locking plate, Osteosynthesis, Proximal humerus

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Introduction

In old age patients, the 3rd most frequent fracture is proximal humerus fracture. Of all the fracture of the body bone, the proximal humerus fracture accounts for up to 4 to 5% [1,2] Of all the type of humerus fracture the proximal fracture rates the most fracture of the humerus that accounts for 45%. In the old age population, there is a high risk of osteoporosis occurrence. The fixation of proximal humerus fracture in old patients is tricky and of high difficult levels [3,4].

The disintegration of the stretch hand is the most frequent mechanism of injury in elder women suffering from osteoporosis. In young patients, elevated energy trauma is the most common [5]. The maximal amount of the proximal humerus fracture are the displaced fracture that can be fixed with a non-operative method. This method provides diminished movements and little resistance to the movements of the humerus [6-8].

There are different techniques for the fixation of the humerus fracture: Open reduction, intermedialliary nailing, internal fixation with the proximal humeral plates, arthroplasty, and minimally invasive methods with pins or screws. The with the use of proximal humerus internal locking system there is the stability of the angulations and it also reduces the elevated impediment rates with fractures related to osteoporosis [9-11].

There are non-locking plates like cloverleaf plates and T plates. However, there use in the osteopenic bones they have elevated failure rates. Studies have also shown that there are high impediment rates up to 40% of subacromial impingement along with avascular necrosis and screw loosening. In the previous study done the authors have reported that when tension bend wiring is done in the management of proximal humerus fracture it does not provide any advantage [12,13].

With the use of intramedullary nails, there is a reduced lever but they are associated with high complication rates (31%). With the use of proximal screws, the chief difficulty seen is the loosening of the screws. As compared to the conventional plates the newly blades plates are inflexible, but there is a high failure rate due to inadequate hold and superior profile in the osteoporotic bones [14,15].

Owing to the anatomy of the proximal humerus the locking plates were designed accordingly.

The plates have a squat profile and they are biomechanically suited for the treatment of the proximal humerus fractures. The advantages are the great anchorage of the locking screw and the stability of angulations in weak osteoporotic bones. The other advantage of the plates is that they provide the additional little holes to fix the rotator cuff with suture [16].

The other advantage is to improve the pull-out strength there are numerous locking screw options in the locking plates. A previous study shows that there are very few complication rates and so it's extremely utilized. The present study was prepared to evaluate the complications and functional outcomes linked with the PHILOS plate utilized for managing displaced proximal humerus fracture.

Material and Methods

The present study is the prospective study done at the tertiary care medical institute for the period of one year from December 2018 to December 2019. The included patients were diagnosed with a fracture of proximal humeral fracture. A total of 20 patients were included in the study.

All the patients who were included in the study were managed with a Proximal Humerus internal locking plate. Neer classification was used for the classification of the fracture.

Inclusion and exclusion criteria were as follows: patients diagnosed with refracture cases, pathological fracture, presence of an open fracture, and patients with a fracture for more than 2 weeks old were excluded from the study while patients diagnosed with a fracture of proximal humerus neer type 2, 3, 4 and fracture with less than 2 weeks older of the humerus fracture were included in the study. All the included patients were of skeletal maturity age of 18 to 65 years.

Treatment of all the fracture was done by a senior orthopedic surgeon at Gujarat Adani Institute of Medical Sciences, Bhuj. To get a better intraoperative axillary view and anterior-posterior view patients were operated in the supine position with a deltopectoral approach.

Manual traction was done for the reduction of fractures and abduction was done to counterbalance the dragging of the deltoid muscle. First, the provisional stabilization was done with the help of K wires and the final fixation was done with the help of a locking plate.

Once the fracture is reduced, the proximal plate was applied on the lateral aspect of the proximal humerus and the first in the head portion the locking screws were inserted. While placing the locking plate the care was taken so that it is placed 5-6 mm distal to the upper end of tuberosity and the lateral to the tendon of bicep muscles.

To counteract the pull of the pectoralis major muscle in case of the medially displaced shaft, the first cortical screw of length 3.5 mm was inserted in the shaft portion. Following that, locking screws in the head was inserted. Postoperative x-ray was acquired in all patients.

During the study portion, a total of 20 patients diagnosed with proximal humerus fractures were included in the study. Out of a total of 20 patients, there were 16 men and 4 women. The mean age of the patients was found to be 42.5 years.

Postoperative protocol

The first dose of intravenous antibiotics was given preoperatively and the next four doses were given post-operatively, so a total of five days antibiotics were administered. Depending upon the pain and active ROM the pendulum exercise was started and the shoulder immobilizer was used. After the two weeks of periods, the suture removal was done.

Clinical and radiographic evaluation

With the help of Constant Murley's shoulder score, the functional evaluation was done. At the end of 2nd, 4th, 8th, and 12th week the follow-up was done and also at the end of 1 month.

With the collection of points at the end of the follow-up period, they were graded as poor with score 0-55 points, when the score was between 56-70 points it was graded as moderate and the score of 71-85 score is graded as a good score and it was graded as excellent for the score 86-100 points.

To assess the union of the fracture, the radiographs were taken at every follow-up period. Also, the radiographs were taken to assess the loss of reduction, any displacement of the fracture and varus-valgus angulations was also distinguished with the help of radiographs.

Callus formation, presence of bridging osseous trabeculae, and cortical continuity were measured as confirmation of radiological union. A humeral head-shaft angle is an angle amid the humeral shaft axis and head.

The Head axis was taken as perpendicular to a line among the adjacent lateral and medial points of the anatomic neck through the apex of the head. Evaluation between three fracture types was performed by ANOVA test and the level of significance was set at ≤ 0.05 .

Results

Clinical assessment as per Constant-Murley shoulder score was done. For a total of 20 patients, the standard union time was 3 months (range 2-5 months). On the whole mean score was 75.04. 45% (n=9) patients had excellent result, 25% (n=5) had good result, 20% (n=4) had fair result and 10% (n=2) had poor result. One patient had a varus fall which directs to Intra-articular screw penetration and two patients had superficial infection. The mean Constant-Murley shoulder score for 2-part fractures was 78.83, of 3-part fractures were 76.22, and 4-part fractures were 70.09. Constant-Murley shoulder scores for 2-part and 3-part fractures were significantly greater than those of 4-part fractures. difference between 2-part and 3-part fractures was not remarkable. Disparities between pain, activities of daily living, range of motion, and strength subcomponents of the Constant-Murley shoulder score between 2-part, 3-part, and 4-part fractures were also important.

Table-1: Distribution of patients according to fracture pattern.

Fracture pattern	No. of patient	Average constant score
2 part	8	78.83
3 part	7	76.22
4 part	5	70.09

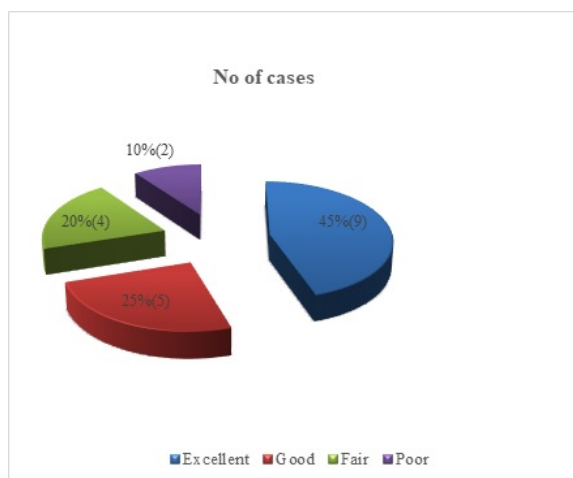


Fig-1: Distribution of Number of cases according to results.



Fig-2: Patient 1 Pre-Operative X-Ray, Patient 1 Post-operative 6 months X-Ray.

Fig-3: Patient one.

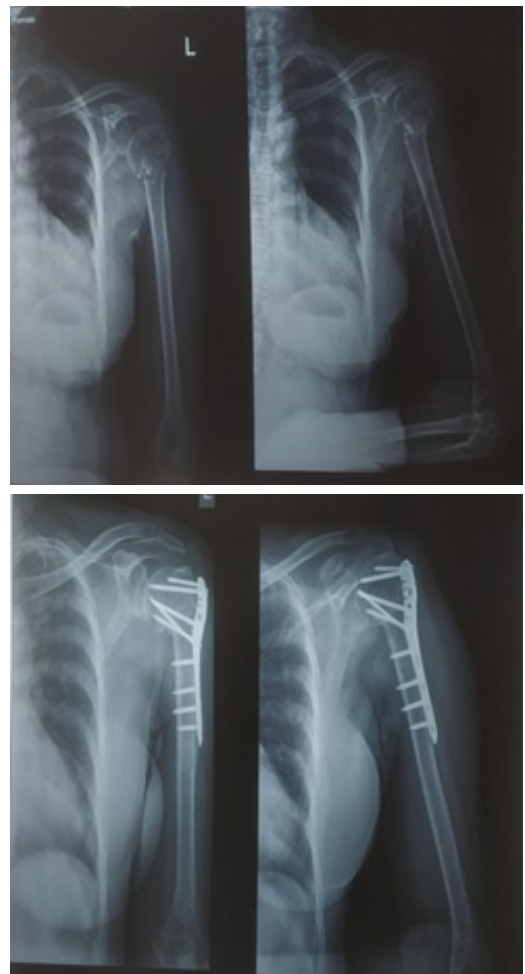


Fig-4: Patient 2 Pre-Operative X-Ray, Patient 2 Post-operative 6 months.



Fig-5 Patient two.



Fig-7: Proximal humerus locking plates with screws and some instruments.

Discussion

In various authors, there is always disagreement in the management of the proximal humerus fracture. For the displaced fractures the use of conventional plates and screws has been associated with unacceptable complications and results.

In the osteoporotic bones and metaphyseal bones, the benefit of the locking plate is the protected fixation with the angularly stable plates. The benefit of the locking plates is the multi-directional screws to endure the more angular and physiological load. There is numerous clinical study, that specifies the proximal humerus locking plates having a good effect in proximal humerus fracture.

In the present study, 45% ($n = 9$) of the patients had an exceptional result. On the whole mean Constant–Murley score was 75.04. Aggarwal *et al* [17]. in their study establish moderate to excellent outcome in 90% of patients. The mean age of the patients in this series was 58.51 years (range 23–81 years) and fracture types were Neer’s 2-part, 3-part, and 4-part fractures and fracture-dislocations.

The mean Constant score for 4-part fractures was 66 ± 12.61 and was significantly lesser to other types. In the present research, the assessments of subcomponents of Constant score demonstrate a significant difference between a 4-part fracture and the other two fracture types.

Parmaksizoglu *et al* [18] in their study demonstrated 68.7% excellent to good results. The mean age was 63 years (range 29–82 years) and fractures were Neer’s 3-part, and 4-part 31.8% ($n=10$). Patients have not accomplished the finest results.

The mean Constant score for 4-part fractures was 70.09 which were significantly lowered compared to 2-part and 3-part fractures. This finding is similar to the above-mentioned studies. Screw perforation happened in the present study in 1 case. Comparable incidence of screw perforation has been accounted for in various studies. No osteonecrosis happened in our series.

This could be due to the lesser number of patients in the 4-part fracture group. Also, a larger part of fractures in the 4-part group was in the surgical neck region and therefore had a low risk of osteonecrosis.

In the present study, various mal reduction of >20 degrees happened in 5% of cases ($n = 1$). All the patients with various mal reductions had a steady score of <70 . 5% of cases ($n=1$) had external infection. The drawback of this research is not having a control group. A randomized study comparing the outcome of other treatment modalities will almost certainly provide an improved guideline for the management of these fractures.

This study has some limitations. First of all, the results of the study cannot be extrapolated to the entire population, as its study was conducted at a single center.

Also, due to the limited research period, the study was conducted only during the spring months and may reflect results specific to this season. In the future, large sample size and large prospective cohort study should be planned to enhance the generalizability of the findings.

Conclusion

Due to numerous fracture treatment options, the management of proximal humerus fracture is varied. The most excellent functional concerns and reachable is osteosynthesis. It’s concluded that there is a satisfactory functional outcome with the fixation of the proximal humerus fracture with locking plates.

While using the plate fixation for fracture the plate position is of the utmost importance. Due to angular stability, the locking plates are the advantageous implants in case of proximal humeral fracture.

What does the study add to the existing knowledge

Fracture of the proximal humerus is still a debatable and controversial subject in orthopedics. Clinical evaluation, obtaining proper radiological views, age of the patient, and activity levels hold the key for a realistic approach, and proper surgical management of these complex fractures.

Author’s contribution

Dr. Vivek Amritbhai Patel Concept, study design

Dr. Vishal A. Pushkarna: Manuscript preparation

Dr. Dhruvin J. Patel: Manuscript preparation

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