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Functional outcome of operative vs conservative management of 4 part proximal humerus fracture: A prospective comparative study

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Abstract

Background: Proximal humerus fractures are most common injuries involving the shoulder next to clavicle. Most of the injuries are due to high energy impact occurring during RTA, fall from height, fall due to convulsion or epilepsy. Fractures are associated with severe comminution and collapse of articular surface leading to dislocation and severe pain, swelling. Generally, these Neers 4-part fractures are managed by surgery with PHILOS plate. However, in our study of 15 patients managed conservatively showed better results compared to patients managed operatively with PHILOS.

Methods: This is a prospective interventional study of 30 cohort cases of proximal humerus fracture – Neers 4 part. Patients willing for operations are treated with PHILOS and those non-willing and who were not fit for surgery were managed conservatively with sling. Early rehabilitation and pendulum exercises started at the beginning of 2-week post op. Patients were admitted and followed at our institution from 2015 to 2017. Outcome analysed at the end taking into consideration of clinical and radiological improvements. Functional outcome will be assessed by Constant Murley score at the end of study.

Results: In our series of 30 patients, majority of the patients were males, with RTA and fall from height in field being the commonest mode of injury in young population and domestic fall being the most common mode of injury in elderly. Fractures managed conservatively showed good range of shoulder movements with less complications compared to operated cases. However early mobilisation and pain management were seeming to be well with PHILOS in immediate post-operative days but shoulder strength and long-term pain controlled better in non-operative cases. Majority of the fractures united with a good to moderate outcome in 50% of the patients. Malunions were the only complications in non-operative cases and in PHILOS there were some incidences of screw perforation, AVN, plate impingement and infection along with malunion.

Conclusions: though many studies conclude Proximal Humerus locking compression plate is an advantageous implant because of its angular stability, particularly in comminuted osteoporotic bones in elderly patients, thus allowing early mobilization. It has many complications. In our study non operated Neers 4-part proximal humerus fractures did well at the end of study without suffering any complications. In fact, non-operated group was more confident in shoulder movements during physiotherapy. Hence, it's better to manage these fractures conservatively.

Keywords: Philos, Neers fracture, deltoid atrophy, stiff shoulder

Introduction

Proximal humerus fractures are more common fractures affecting shoulder joint next to clavicle. Approximately 4% of all fractures and 26% of Humerus fractures are fractures of the proximal Humerus^[1]. Poorly treated fractures result in severe disability of entire arm. Osseous architecture of the humeral head has been compared to egg shell. Central soft cancellous bone, particularly in elderly patients in Part 4 fracture has a reputation of fixation failure with PHILOS and other locking plates. Therefore, it has been a challenge to manage four-part fractures (13-16%) of proximal Humerus fractures^[2]. There are various methods of fixation of proximal Humerus fractures like Kirschners wire, external fixation, tension band fixation, Rush pins, intramedullary nails and plating^[3] but the complications with these methods are high, which include non-union, malunion, avascular necrosis, rotator cuff dysfunction/stiffness^[4]. The fracture of the proximal Humerus is a debilitating problem since the patient would be

unable to work and even carry out daily activities until the fracture heals. Hence this study aims at comparing the efficacy and complications of the proximal Humerus locking plates over conservative methods. Results in terms of functional outcome, pain, range of movements and ability to carry out the daily activities were measured at the end of 2-year follow-up.

Methods

The proposed comparative study is a prospective study. The subjects for the study will be the patients fulfilling the inclusion criteria admitted in our institution. During the period from November 2015 to November 2017. Operative cases were approached by deltopectoral approach. Fractures were anatomically reduced and fixed with PHILOS. All Patients of both groups were mobilized in the arm pouch and encouraged pendulum exercises in the second week. Sutures were removed on the 10th post-operative day. All patients followed up regularly at 3rd, 6th, 12th and 24th month and the following observations are made. Functional outcome was analysed using constant and Murley scoring system. Rate of occurrence of all complications were noted for each group.

Inclusion Criteria

1. All skeletally mature patients presenting with isolated proximal Humerus fractures according to NEER four-part fracture.
2. Willing for surgery and take part in study for PHILOS.
3. Patients not willing for surgery are followed for results of conservative management.

Exclusion Criteria

1. Patient refusal to take part in study.
2. Pathologic fractures from primary or metastatic tumours
3. Patients age less than 18 years.



Fig 1: Patient with proximal humerus fracture



Fig 2: Intra op image of deltopectoral approach and PHILOS fixation

Results

The present study involves 33 cases of proximal humerus fracture. However, 30 cases were available for final follow-up. We lost 3 cases due to unknown reasons. 15 patients were treated with PHILOS and 15 patients managed conservatively. **Age:** In our study the age distribution ranges from 21 to 60 years, the mean age was 41.1 years.

Table 1: Age wise distribution of patients

S. No.	Age in years	No. patients	Percentage
1	20 - 30	7	23%
2	31 - 40	7	23%
3	41 - 50	6	20%
4	51 - 60	6	20%
5	61 -70	4	13%

Gender wise distribution: in our study we noticed male predominance. Male to female ratio was around 3:1.

Table 2: Sex wise distribution of patients

S. No.	Sex	No. patients	Percentage
1	Male	22	73.33%
2	Female	08	26.66%

Mode of injury: In our study RTA is the major cause of injury. Others being fall at work and epileptic convulsions

Table 3: Mode of injury

S. No.	Mode of injury	No. of patients	percentage
1	RTA	15	50%
2	Fall	13	43%
3	Seizure	02	6.6%

Shoulder range of movements: Average degree of movements at the end of follow up recorded in both groups. There was no significant difference in Flexion, Extension, Adduction. Abduction of shoulder was more in patients managed conservatively. However internal rotation, external rotation was more in operated cases.

Table 4: Shoulder range of movements at the end of follow up

S. No.	Movements	Patients managed conservatively	Patients managed with PHILOS /Operation
1	Flexion	126 ⁰	119 ⁰
2	Extension	36 ⁰	40 ⁰
3	Abduction	115 ⁰	86 ⁰
4	Adduction	33 ⁰	30 ⁰
5	Internal rotation	44 ⁰	60 ⁰
6	External rotation	42 ⁰	60 ⁰

Average constant and Murley scoring: In our study patients managed surgically showed no significant difference in the results compared to non-operated patients at the of study. The mean constant score in operated cases was 57.8% and in non-operated cases it is 59.6%. The difference between the group was insignificant.

Table 5: Average Murley constant scoring in each group at the end of follow up

S. No.	Murley score	Patients managed conservatively	Patients managed with PHILOS /Operation
1	Excellent	2 (6.6%)	2 (6.6%)
2	Good	4 (26%)	3 (20.6%)
3	Moderate	6 (20%)	7 (23%)
4	Poor	3 (20.6%)	3 (20.6%)

Figures: Movements of shoulder after operative management



Fig 3: Flexion



Fig 4: Extension



Fig 5: Abduction



Fig 6: Internal rotation

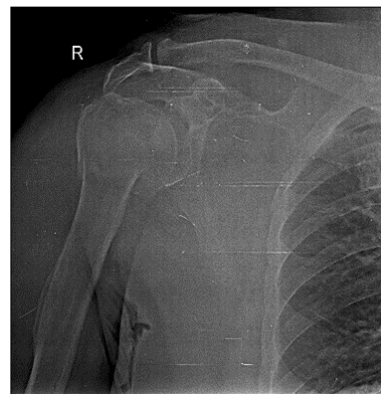


Fig 7: Fracture union with conservative



Fig 8: United fracture with PHILOS

Complications: more complications are seen in operated cases than with patients managed conservatively. Most of them related directly to the operative procedure itself and with the implant PHILOS plate, screws.

Table 6: Complications

S. No.	Complications	Patients managed conservatively	Patients managed with PHILOS /Operation
1	Pain – VAS score average	3	5
2	Infection	0	1 (6.6%)
3	AVN & Collapse of head	1 (6.6%)	3 (20%)
4	Screw penetration	0	2 (13.3%)

Complications of conservatively managed Neers part 4 fracture



Fig 9: Varus collapse



Fig 10: Loss of reduction



Fig 11: Non-union

Complications of operatively (PHILOS) managed Neers part 4 fracture



Fig 12: Valgus collapse after 3 months of fixation



Fig 13: Varus collapse after 3-month post operation

Malunion: In all Neers 4-part fractures irrespective of mode of management either conservative or operative it is very difficult to achieve near normal anatomical reduction of

proximal humerus. Due to strong muscle pull acting on greater tuberosity, lesser tuberosity, shaft, neck and head, malunion with irregular articular surface of some degree seen in all fractures. However radiological results of operated cases were seen better without bearing any effect on functional outcome.

Discussion

Proximal humerus fractures are more common fractures affecting shoulder joint next to clavicle. 4-5% of all fractures of long bones are constituted by proximal humerus fractures [1]. A study done by Palvanen *et al.* [5]. Determined that the trend in the fall and osteoporosis related proximal humeral fractures in elderly Finnish population would triple in the next three decades. There is always a controversy regarding conservative versus surgical treatment of type 4 proximal humeral fracture. Where varied results have contributed to the lack of consensus among orthopaedic surgeons. Till today there is no uniform guide line or consensus on treatment indications in 4-part fractures [6] and it is difficult to obtain and maintain an adequate reduction of the fracture in bones that are frequently osteoporotic [7]. Similar dilemma arises when a low demanding elderly patient seen with this fracture [8]. In many research studies it's been stated that Majority (80-85%) of these fractures can be treated conservatively. The remaining 15-20% are significantly displaced and require some type of internal fixation.

In our study conservative management includes shoulder immobilizer (sling, Velpau) for 2 to 6 weeks with a rehabilitation program that began with passive exercises at 1 or 2 weeks after immobilization. Fracture reduced with holding one hand anteriorly on the fracture site and then forceful flexion of the arm combined with adduction to disimpact the posterior impaction and to relax the pectoralis major muscle. The proximal shaft reduction tried with manipulative manure posteriorly and laterally [9]. Whereas operative management includes deltoid approach and fixation with PHILOS plate of appropriate length. In non-osteoporotic bones, open reduction and internal fixation with non-locking plates and screws for proximal Humerus fractures has shown to provide the strongest fixation as shown by Wijgman *et al.* [10].

Studies done by Van Den Broek *et al.* noticed better findings during evaluation with constant score in group of patients which had started physiotherapy and patient controlled passive mobilisation within 2 weeks of injury [11] we have observed similar benefits of early mobilisation in our study too.

It is a customary practice to consider conservative treatment for minimally displaced fractures according to the Neer criteria (< 1 cm displacement or < 45° angulation) [12]. One of the review studies done by Soler – Piero *et al.* Discussed about which type of displaced fractures are considered for surgical treatment and which fracture types benefit more from conservative approach [13] which has comparatively low inherent complications and risks [14]. They conclude in this review study that a significant difference between the outcomes for the three-part fractures compared with the four-part fractures seen with operative management. However, failed to see any significant difference among part 4 fracture managed operative vs non-operatively.

The average age in our series of 30 patients, ranging between 20 to 70 years was 41.1 years. Which is lower than the average age in other studies. The average age incidence in Gerber *et al.* Was 44.9 years [15]. Regarding sex incidence,

according to literature fracture of proximal humerus occurs more in males. Studies also reveal that male to female ratio being 1:0.8. In our series the male to female ratio is 3:2. Which goes with the above study.

The mode of injury observed in our series was road traffic accidents accounting for 50% (15 cases), 43% (13 cases) patients having a slip and fall and 6.6% (2 cases) occurred after seizures. These observations were found to be not in consistent with the studies in literature which revealed 45% road traffic accidents and 50% history of slip and fall^[10]. This can be attributed to the living style. In this study RTA is the major cause mainly two wheelers accident. This is followed by fall because most of the laborers work in field, climb tree and has fall.

The pooled rate of consolidation following conservative treatment in the review studies conducted by Soler – Piero *et al.* was 92.5%^[13]. This high percentage shows that PHFs tend to consolidate, even in patients with poor bone quality^[16]. The average time taken to unite in operated patients was 18 week and in conservative group it is 15 week. It is in par with the study conducted by Emrah Caliskan and Ozgur Dogan^[17]. Our study also shows range of movements at the end of follow up in comparison to the study conducted by above authors. In our study there was no significant difference in Flexion, Extension, Adduction between the two group. Abduction of shoulder was more in patients managed conservatively. This could be due to well preserved deltoid strength in non-operated cases. However internal rotation, external rotation was more in operated cases. This can be explained with release of soft tissues around proximal humerus during exposure at operation.

The average Constant and Murley score in our study was found to be 59.6 for patients managed conservatively compared to patients managed with PHILOS which is 57.8%. Review Study with meta-analysis done by Soler – Piero *et al.*^[13] documented a mean constant score of 54.9. which is in par with the above study. This also supports the conclusion given by Iyengar JJ *et al.*, stating there is no significant outcome difference at average constant score between the two group^[16].

Complications: Although the outcome achieved with conservative treatment for four-part fractures were worse than those obtained for minimally displaced and two-part fractures^[18], the surgical alternative is not risk-free. More complications such as incision infection, AVN and screw penetration were observed with operative treatment. Nonoperative treatment does not critically impair the blood supply of the humeral head, so the risk of avascular necrosis may be less. The rate of complications is high in part 4 fractures with locking plate^[19] and it can rise to 70% in non-locking plates^[20]. Rangan *et al.* reported that 28.8% of patients treated surgically experienced complications, compared with 18.4% of those treated conservatively^[21] the rate of malunion in the series of Okike *et al.*^[22] stood at 40% following surgery. In our study we noticed Deep infection in 1 case (6.6%). which was managed with debridement and antibiotic. 2 cases (13.3%) progressed to AVN at the end of study with subsequent collapse and screw penetration. Studies conducted by Lee C K *et al.* Have documented the manifestation of necrosis up to 3.5 years after the fracture^[23]. Kristiansen *et al.* in their study of 20 patients with proximal Humerus fracture treated with T-butress plate, found that only nine reported a satisfactory or excellent result and all four-part fractures resulted in poor outcomes^[24]. In 4-part

fractures, similar to our results, both Tamimi *et al.* and Lange *et al.* found no difference in the functional outcome between two groups, but they determined better radiological results in the operative group and fewer complications in the nonoperative group^[25, 26].

Limitations of study: we think Relatively small number of samples. Lack of age specific comparison is a significant drawback of this study. It could give clearer results if the age specific comparison of geriatric and younger patient were compared within themselves.

Conclusion

Nonoperative treatment in Neers 4-part proximal humeral fractures, particularly in elderly patients and osteoporotic fractures seems beneficial over surgery. Desired functional results can be achieved without obtaining radiological anatomical reduction in non-operative patients. Relatively less risk of complications makes conservative modality of treatment a wise option.

Declarations

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Conflict of interest: none

Ethical approval: taken

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