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**Dr. Vijay Krishnan K**  
AJ Institute of Medical Sciences,  
NH 66, Kuntikana, Mangalore,  
Karnataka, India

**Dr. Sudeep Shetty**  
AJ Institute of Medical Sciences,  
NH 66, Kuntikana, Mangalore,  
Karnataka, India

**Dr. Bhaskar Bhandary**  
Associate Professor, AJ Institute  
of Medical Sciences, NH 66,  
Kuntikana, Mangalore,  
Karnataka, India

**Corresponding Author:**  
**Dr. Vijay Krishnan K**  
AJ Institute of Medical Sciences,  
NH 66, Kuntikana, Mangalore,  
Karnataka, India

## Study of functional outcome following proximal humeral internal locking system plating for displaced proximal humeral fractures

**Dr. Vijay Krishnan K, Dr. Sudeep Shetty and Dr. Bhaskar Bhandary**

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### Abstract

Proximal humerus fractures accounts for about 4 to 5% of all fractures. They are the third most common fractures in the elderly population after hip and distal radius fractures. Regarding the treatment of proximal humerus fractures, controversies still exists whether to do conservative or operative management. Various operative procedures are carried out, a recent trend in internal fixation has moved on to locking plates. The present study is undertaken to evaluate the functional outcome and complication of proximal humerus fractures treated by philos locking plate. This is a prospective study involving adults (>18yrs) with proximal humerus fractures admitted to AJ Institute of medical sciences and research centre, Mangalore. In this study period, 30 cases of fractures of the proximal humerus were treated by open reduction and internal fixation with Philos locking plate were evaluated. In our series, the majority of the patients were males with road traffic accidents being the commonest mode of injury involving 2 part, 3 part and 4 part fractures of proximal humerus and fracture-dislocations. The fractures united in all 30 patients. Among the 30 patients 2(6.7%) patients had an excellent outcome, 10(33.3%) patients had a good outcome, 13(43.3%) patients had a fair outcome, and 5(16.7%) patients had a poor outcome according to constant and murley scoring system. In conclusion, Philos locking plate is an advantageous implant in proximal humeral fractures due to angular stability, particularly in comminuted fractures and in osteoporotic bones in elderly patients, thus allowing early mobilization.

**Keywords:** Proximal humerus fractures, philos locking plate, open reduction and internal fixation

### Introduction

The field of orthopaedic surgery has been in the vanguard in creating new information, establishing new principles of treatment and solving both new and old problems of the musculoskeletal system. Fractures of the proximal humerus is still unsolved fractures in many ways. Disagreement exists regarding the reliability of classification system. The indication for surgical management continues to be modified. Fixation techniques are myriad and none is ideal for all cases. Fractures of proximal humerus are not uncommon, especially in the older age group. They have been reported to account for 4% of all fractures about 85% of these fractures are minimally displaced or undisplaced and are effectively treated symptomatically with immobilization followed by early motion. The remaining 15% of fractures are displaced unstable and may have disruption of the blood supply. The treatment of these fractures is therapeutic challenge. Displaced and unstable extra-articular fractures are most commonly treated by operative reduction and fixation using various technique Three and four part fractures (13-16% of proximal humerus fractures) have been a challenge to achieve stable fixation the treatment is more controversial for articular fractures, which carry a high risk of the humeral head necrosis. In neer's classification, these are two part anatomical neck, three-part and four-part fracture and those with dislocation of the head of humerus. A review of published result suggests that there is no universally accepted form of treatment. Conservative management may be associated with nonunion, malunion, and avascular necrosis resulting in painful dysfunction Proximal humeral fracture, whether caused by trauma (or) related to osteoporosis, requires carefully planned, individual treatment. Difficulties have been multifactorial, including osteoporotic bone, angular instability, implant impingement, loss of reduction and backing out of screws.

The indication for fixing such a fracture depends on the fracture pattern, quality of bone and the age and activity of the patient the goal is to achieve near-anatomical reduction and stabilization so as to achieve early mobilization. The incidence of proximal fractures is 26% of all humerus fractures. They occur most commonly in the elderly. In younger patients, high-energy trauma is the cause and displacement is often more severe. A wide variety of treatment options have been described beginning with percutaneous fixation, non-absorbable rotator cuff-incorporating sutures and the use of tension band devices, intramedullary nails. Methods of open reduction and internal fixation with the more contemporary use of locking plates advocated recently. The role of hemiarthroplasty in the treatment of these fractures has also been advocated in both the acute setting and as a delayed procedure. Current therapeutic options for proximal humerus fractures are humerus nails, plates, tension band wiring, and percutaneous (or) minimally invasive technique such as pinning, intramedullary flexible nails, screw osteosynthesis and hemiarthroplasties. The choice of technique and devices depends on the quality of bone, soft tissue, age and reliability of patients. However, the goal of proximal humerus fracture fixation should be stable reduction allowing early motion of fracture. PHILOS plate provides rigid fixation and more angular stability this study is conducted to analyse fractures of the proximal humerus that were treated with the proximal humeral internal locking system (PHILOS) plate and document their clinical and functional outcome.

## Materials and Methods

### Source of the data

Adults (>18yrs) with proximal humerus fractures admitted to A J Institute of medical sciences and research centre, Mangalore.

### Method of collection of data

This is a clinical, prospective and observational study which includes patients with proximal humerus fractures admitted and examined according to protocol, associated injuries noted. Clinical and radiological evaluation done. Fractures classified Using Neer's classification. A routine investigation carried out to get fitness for surgery. Patients will undergo Open reduction internal fixation with philos locking plating for the sustained fracture under general anaesthesia. Postoperative physiotherapy is followed according to protocol, to evaluate the functional outcome. Patients will be followed up at 6 weeks, 12 weeks and at 6 months. A minimum of 30 cases will be studied without any sampling procedure.

### Inclusion criteria

All skeletally mature patients presenting with displaced proximal humerus fractures according to NEER two, three and four-part fracture. Patients with associated dislocation of the shoulder.

### Exclusion criteria

Pathologic fractures from primary or metastatic tumours. Patients age less than 18 years. Open fractures. Poly trauma. Failure of conservative treatment. Four-part fracture in elderly (>65 years). On admission of the patient, a careful history was elicited from the patients and or attendants of injury and the severity of trauma. The patients were then assessed clinically to evaluate their general condition and the local injury. The general condition of the patient and the vital signs were recorded. Methodical examination was done to rule out

fractures at other sides. The local examination of the injured shoulder was done for swelling, deformity, loss of function and altered attitude. Any nerve injury was also looked for and noted. Local neurologic deficit of the axillary nerve was also assessed by looking for anaesthetic patch over the lateral aspect of shoulder. Radiograph of proximal humerus i.e., antero-posterior view and axillary view, were taken and fractures were classified according to Neer's classification. Next, the limb was immobilized in U-slab and arm-pouch. The patient was taken for surgery after routine investigation and after obtaining physician fitness towards surgery. The investigations are as follows: Hb%, urine for sugar, FBS, blood urea, serum creatinine, HIV, HbsAg and ECG.

The consent for surgery was also taken from the patient and attendants after explaining the procedure and possible complications. Limb was shaved from shoulder to hand including axilla 1 day before the surgery. Injection Tetglobe and antibiotics were given 1 hour preoperatively.

## Operative Techniques

General anesthesia was used in all patients.

### Patient position and draping

Patients placed in a supine position on the operating table with wedge a sandbag under the spine and medial border of scapula to push the affected side forward while allowing the arm to fall backward. Drape the arm free, because it will have to be moved during the approach.

## Surgical Approaches

The surgical approaches used is the Deltopectoral approach. Deltopectoral approach: Incision starts just above the coracoid process, which is palpated in the deepest point in the clavicular concavity distally towards acromioclavicular joint. An 8 to 10cm incision started from just above coracoid process advanced following the line of deltopectoral groove. The internervous plane is between the deltoid muscle, which is supplied by axillary nerve and the pectoralis major muscle, which is supplied by the medial and lateral pectoral nerves. Retract pectoralis major medially and deltoid laterally, splitting the two muscle apart. The vein is retracted either medially or laterally. The short head of biceps and the coracobrachialis must be displaced medially before access can be gained to anterior aspect of shoulder joint. Beneath the tendons lie the transversely running fibers of subscapularis muscle. Apply external rotation to the arm to stretch the subscapularis, bringing the muscle belly into wound and making its superior and inferior borders easier to define. Pass a blunt instrument between the capsule and the subscapularis, then divide the subscapularis in from insertion onto to the lesser tuberosity of the humerus. Incise the capsule longitudinally to enter the joint wherever the selected repair must be performed.

## Procedure

All patients received a prophylactic dose of 4.5 gm of piperacilin-tazobactam intravenously preoperatively. The operation was done in a supine position with small sandbag under shoulder, under general anesthesia. Through deltopectoral approach, the fracture was exposed and reduced with minimal soft tissue dissection. Briefly, the anatomical relationship between humeral head and greater tuberosity was reduced and fixed temporarily with K wires. In case of obvious rotation or displacement of the humeral head, a joystick technique was used. Then the shaft fragment was

reduced by abduction, traction and rotation of the arm. Reduction was checked under an image intensifier. Definitive fixation with locking plate was done with plate positioned lateral to bicipital groove sparing tendon of long head of biceps and 1cm distal to greater tuberosity. The screws were chosen according to preoperative planning, and all the four head screws were supposed to be inserted to the head fragment. The inferior screws supporting the humeral head were considered critical. Proximal locking screws were inserted to hold the humeral head, which are multidirectional screws with the tips of the screws staying 5–10 mm away from the articular surface. All proximal locking screws were placed in a unicortical fashion through an external guide and confirmed to be within the humeral head with intraoperative fluoroscopy. AP (internal and external rotation) views and axillary views 90 degrees to each other were used to visualize screw placement. The distal shaft screws were placed bicortically. A minimum of three bicortical screws were used. Fluoroscopic images were taken to confirm satisfactory fracture reduction, plate positioning and proper length of screws in the humeral head. In case of severe comminution or instability, the rotator cuff, the greater tuberosity, and the lesser tuberosity were fastened to the plate using non-absorbable sutures. The range of motion of shoulder was checked on the table for impingement. The wound was closed under negative suction, which was removed after 48 hours.

### Post-operative management

All patients are immobilized in an arm pouch with cuff and collar sling. Appropriate antibiotics and analgesics were used. Immediate post-operative radiographs were taken to determine the bone alignment and maintenance of reduction. Sutures are removed by 12th day. Passive range of motion

and pendulum exercises are begun immediately depending on pain.

### Follow up

All patients were followed up at 6weeks, 12 weeks and at 6 months.

### Exercise regime post philos plating

#### I. POD 1 TO 3 Weeks

Post-operatively arm pouch was applied for all patients for 3 weeks. Post-op day 1 patients were started on pendulum exercises with an arm pouch.

#### II. 3 Weeks TO 6 Weeks

At 3 weeks arm pouch was removed and started on active assisted external rotation to neutral and active assisted flexion.

#### III. After 6 Weeks

Patients were allowed full range of movements.

### Functional results

Final results are assessed using the Constant and Murley scoring system.

### Constant and murley scoring system

This scoring system consists of four variables that are used to assess the function of the shoulder. The right and left shoulders are assessed separately the subjective variables are pain and ADL (sleep, work, recreation/sport) which give a total of 35 points. The objective variables are range of motion and strength, which give a total of 65 points. Altogether a total of 100 points.

Category Score	
Pain	(15 points)
None	15
Mild	10
Moderate	5
Severe	0
Activities of daily living	(20 points)
Activity level	
Full work	4
Full recreation / sport	4
Unaffected sleep	2
Positioning	
Up to waist	2
Up to xiphoid	4
Up to neck	6
Up to top of head	8
Above head	10
Range of motion	(40 points)
Forward elevation	
0° – 30°	0
31° – 60°	2
61° – 90°	4
91° – 120°	6
121° – 150°	8
151° – 180°	10
Lateral elevation	
0° – 30°	0
31° – 60°	2
61° – 90°	4
91° – 120°	6
121° – 150°	8
151° – 180°	10

<b>External rotation</b>	
Hand behind head with elbow held forward	2
Hand behind head with elbow held back	2
Hand on top of head with elbow held forward	2
Hand on top of head with elbow held back	2
Full elevation from on top of head	2
<b>Internal rotation</b>	
Dorsum of hand to lateral thigh area	0
Dorsum of hand to buttock	2
Dorsum of hand to lumbosacral junction	4
Dorsum of hand to waist (third lumbar vertebra)	6
Dorsum of hand to twelfth dorsal vertebra	8
Dorsum of hand to interscapular region (DV 7)	10
<b>Strength</b>	<b>35</b>

Difference between both the shoulders are calculated and it is graded accordingly

- <11 Excellent
- 11-20 Good
- 21-30 Fair
- >30 Poor

**Instruments**



**Fig 1:** Philos instruments-(1)5,6,7,8,10,12 hole philos plate, (2) locking and cortical screws, (3) depth gauge, (4) drill sleeve, (5) drill bit, (6) locking and nonlocking screw driver, (7) sleeve guide



Plate Positioning



Fixation of plate and screws

**Intra Operative Images**



Draping and incision



Confirmation of reduction under c arm

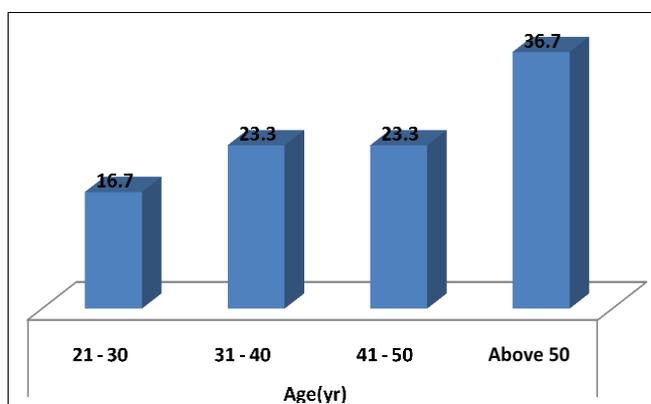
**Results**

Thirty patients with closed displaced proximal humerus fracture were treated by open reduction and internal fixation with PHILOS plate. The following observations were made from the data collected during this study.

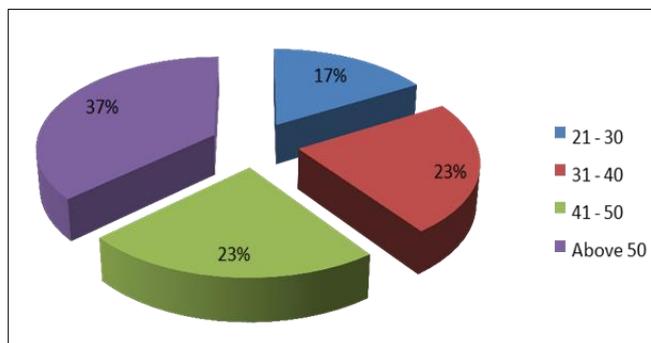
**Table 1: Age Distribution**

Age in year	Frequency	Percent
21 – 30	5	16.7
31 – 40	7	23.3
41 – 50	7	23.3
Above 50	11	36.7
Total	30	100.0

The majority of the patients i.e. 11 (37%) were from age group of 51-62 years followed by 7 patients (23%) in 41-50 years followed by 7 patients (23%) in 31-40 years and 5 patients (17%) in 21-30 age group. The average age of patient was 43.7 years.



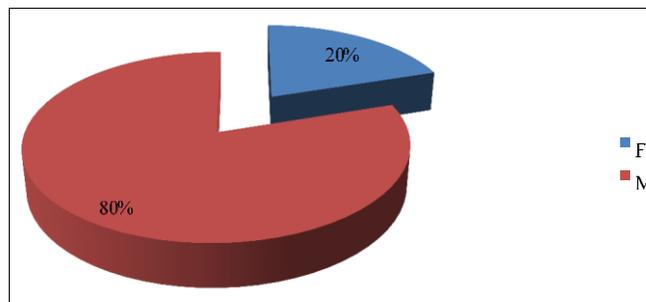
**Graph 1: Age Distribution**



**Table 2: Sex Distribution**

Sex	Frequency	Percent
F	6	20.0
M	24	80.0
Total	30	100.0

The majority of the patients were males i.e. 80% and 20% were females. Male: Female sex ratio is 4:1

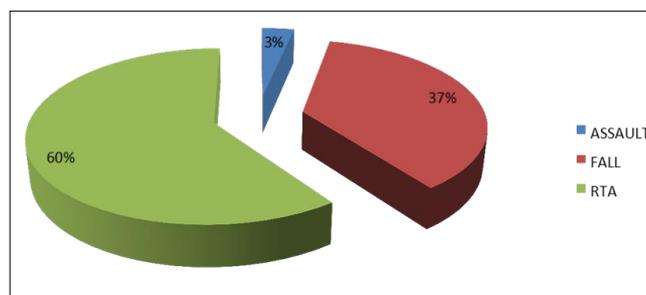


**Graph 2: Sex Distribution**

**Table 3: Mode of Injury**

Mode of injury	Frequency	Percent
Assault	1	3.3
Fall	11	36.7
RTA	18	60.0
Total	30	100.0

In majority 18(60%) of cases the mode of injury was RTA. These were high energy trauma directly or indirectly to shoulder. 11(37%) of the cases were due to fall and 1(3%) due to assault.

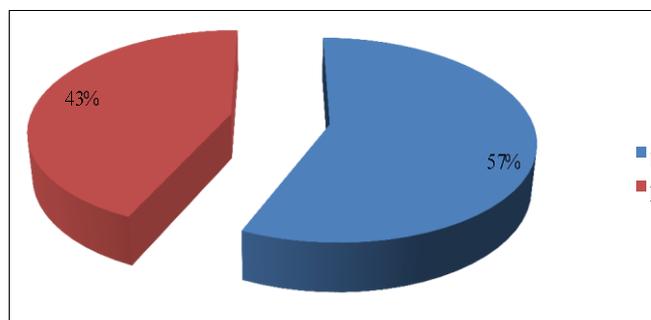


**Graph 3: Mode of Injury**

**Table 4: Side Affected**

	Frequency	Percent
L	17	56.7
R	13	43.3
Total	30	100.0

The fracture occurred right in 13 patients (43%) and left side in 17 patients (57%)

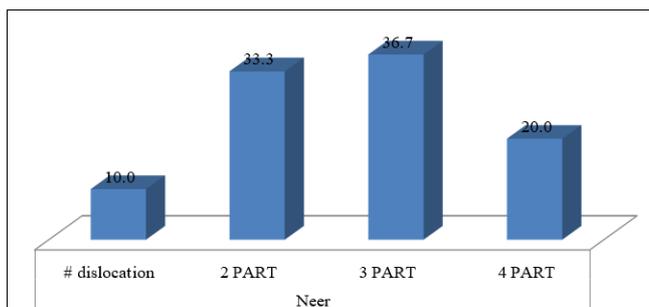


**Graph 4: Side Affected**

**Table 5: Fracture Pattern**

Fracture pattern	Frequency	Percent
# dislocation	3	10.0
2 PART	10	33.3
3 PART	11	36.7
4 PART	6	20.0
Total	30	100.0

In our study, we had 10 cases (33%) with 2 part fracture surgical neck humerus and 11 (37%) cases with 3 part (greater tuberosity and surgical neck) fractures. 6(20%) cases with 4 part (greater tuberosity, lesser tuberosity and surgical neck). 3(10%) cases with fracture-dislocation.

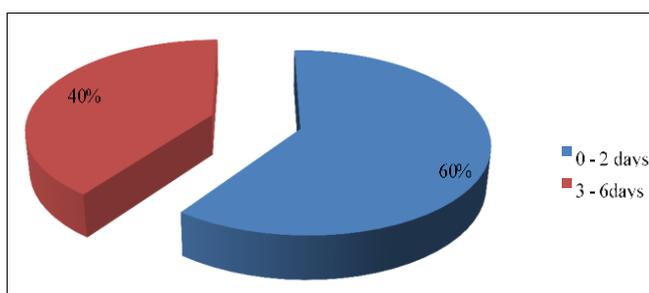


**Graph 5: Fracture Pattern**

**Table 6: Timing of Surgery**

Timing of surgery	Frequency	Percent
0 - 2 days	18	60.0
3 - 6days	12	40.0
Total	30	100.0

In 18 patients (60%), surgery was done within 2 days after admission. But in 12 patients (40%), surgery was delayed upto 6days due to underlying co-morbidities like uncontrolled diabetes mellitus, hypertension, etc.

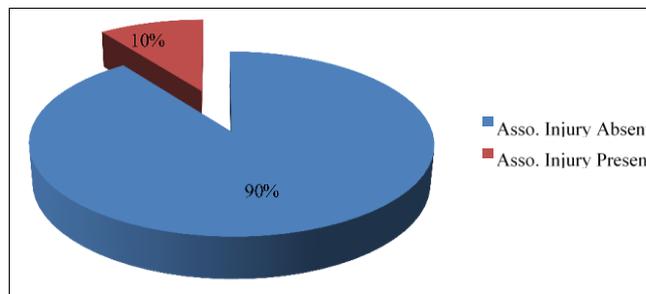


**Graph 6: Timing of Surgery**

**Table 7: Associated Injuries**

Associated injuries	Frequency	Percent
Absent	27	90.0
Present	3	10.0
Total	30	100.0

In 3 patients (3%) had associated injuries even though polytrauma cases were excluded in the study. 27 patients (90%) did not have any other injuries



**Graph 7: Associated Injuries**

**Method of treatment**

All patient underwent open reduction and internal fixation with philos plate.

**Time of surgery**

The average interval between admission and surgery was 2.06 days.

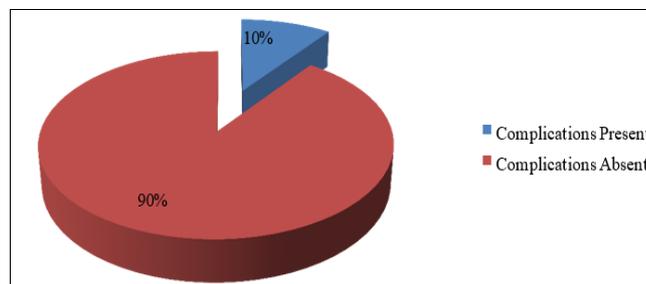
**Stay in hospital**

The average hospital stay in our study was 7 days.

**Table 8: Complications**

	Frequency	Percent
Present	3	10.0
Absent	27	90.0
Total	30	100.0

There were 3 (10%) cases with varus malunion, but all patients had a comparatively fair functional range of movements.



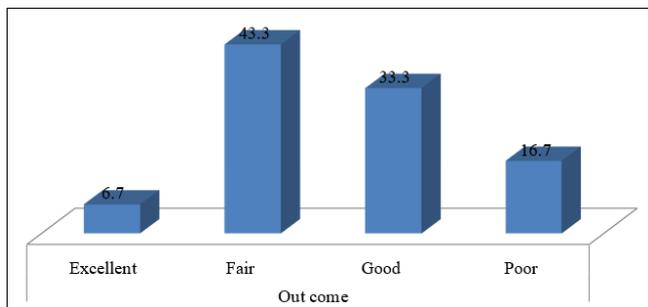
**Graph 8: Complications**

**Functional Results:** All fractures united by 8-12 weeks interval. The final results were evaluated by constant and murley scoring system

**Table 9: Results according to constant and murley score**

	Frequency	Percent
Excellent	2	6.7
Fair	13	43.3
Good	10	33.3
Poor	5	16.7
Total	30	100.0

In our study, 2 (7%) case had an excellent result, 10 (33%) had a good result and 13(43%) had a fair result. 5(17%) had a poor result and there was no case of failure.



Graph 9: Results according to constant and murley score

**Discussion**

Displaced proximal humeral fractures are a challenge for orthopaedic surgeons. Undisplaced fractures can be treated conservatively. There are many options for the management of proximal humeral fracture, which includes percutaneous pinning, intramedullary nailing and hemiarthroplasties. Even if the injury is thoroughly understood, the management of displaced proximal humeral fractures is often difficult.

Outcome depends on restoration of anatomical alignment. If fracture is treated conservatively, a functional deficit will certainly develop and may be associated with pain. The external support is difficult to apply in case of proximal humeral fracture.

Many studies have shown that the displaced fracture of the proximal humerus have a poor functional prognosis when left untreated because of severe displacement of fragments.

In some studies, the objective functional results of conservative treatment have been unsatisfactory. The fractures are defined by variety of classification systems. The difficulty in accurately classifying the fracture creates problems in reporting outcome and also none of the system gives clear prognosis and direction of treatment.

Fixation of proximal humeral fractures with plates and screws has been associated with complications such as pullout of screws in osteoporotic bone, subacromial impingement and avascular necrosis of the humeral head due to excessive periosteal stripping. Studies have reported a high incidence of fixation failure following use of T buttress plates in fixation of proximal humeral fractures.

Even the newer implants like Polaris nail, plan tan humerus fixator plate had higher failure rates in elderly patients with osteoporotic bone.

Overall, open reduction and internal fixation, although not in all institution, have yielded satisfactory results. The best results are obtained if the fracture is well reduced and planned rehabilitation program followed. It must be the goal to select fractures for open reduction and internal fixation which can be anatomically reduced. This is dependent on various factors such as type of fracture, the quality of the bone and the technique of reduction and fixation.

This study was conducted to assess the functional outcome following Neer two part, three part, four part and proximal humeral fracture dislocations treated by open reduction internal fixation by philos locking plate.

**1. Age Incidence**

In our study, all patients between the age of 18 to 65 years were included. Mean age group of patients treated with PHILOS was 43.7years. The maximum age was 64 years and the minimum age was 21 years.37% of the patients were above the age of 50 years.

- Rizwan Shahid *et al.* study in 2008, the average age was 60 years

- The average age of incidence in David S. Thyagarajan’s study in 2009 was 58years. Neer original study of 300 patients, average age was 55.6 years

**2. Sex Incidence**

In the present study male: female ratio was 4:1.24(80%) patients were males in contrast to 6 (20%) females. This is in contrast to female preponderance as observed by various other authors. In our study 80% were males and 20% were females.

**3. Side Involved**

In the present study out of 30 cases, left humerus fractures were seen in 17 cases and right side were seen in 13 cases. That is 57 % of fractures were seen on the left humerus as compared to 43%, that were seen in the right humerus.

C. Gerber reported, in their series of 34 fractures 16 were on left side and 18 were on right side

**4. Mode of Injury**

Major cause of fracture in our study was road traffic accident in 18 cases (60%), in 11 cases (37%) the mode of injury was fall and 1 assault (3%). Herbert Resch *et al.* in their study of 27 patients with 3 part and four part fracture, 24 patients had history of high energy trauma.

**5. Time of Surgery**

The average interval between fracture and surgery was 2.06 days in our study. Average interval between fracture and surgery was 3.2 days in Gerber C. *et al.* study. 21 of 27 patients in Herbert Resch *et al.* study the operation was done within first 4 days.

**6. Type of Fracture**

In our present study, we had considered displaced proximal humerus fractures– Neer’s 2 part, 3 part, 4part fractures and fracture dislocations We had 10(33%) cases of Neer’s 2 part fractures, 11(37%) cases of Neer’s 3 part fractures and 6(20%) cases of Neer’s 4 part fractures and 3(10%) fracture dislocations.

**7. Complications**

Among the 30 cases that were operated in our study, we had complications in 3(10%) cases. All three patients had varus malunion. There was no case of avascular necrosis of humeral head or impingement. Secondary displacement and malunion occurred at the surgical neck. It usually involves anterior angulation and varus deformity, decreasing neck-shaft angle <120°. In all the cases, it was probably due to comminution which may go for impaction at the fracture site after reduction leading to varus malunion. The incidence of avascular necrosis ranges from 8% to 35% in different studies. We had no case of avascular necrosis. Comparatively, we also had less chance of stiffness because of extensive and planned physiotherapy with stable fixation

Complications	Frequency	Percent
Present	3	10.0
Absent	27	90.0
Total	30	100.0

In Moonot *et al.* study in 2005,7 patients developed complications like nonunion and avascular necrosis of humeral head, malunion, impingement, broken distal screw and prominent proximal screw.

In Rizwan Shahid *et al.* study in 2008, there were 4

complications like nonunion and impingement In David Thyagarajan’s study in 2009, 3 patients had complications like stiffness.

system. Among the 30 patients 2(6.7%) patients had an excellent outcome, 10(33.3%) patients had a good outcome, 13(43.3%) patients had a fair outcome, and 5(16.7%) patients had a poor outcome.

**8. Functional Outcome**

It was assessed using the Constant and Murley scoring

**9. Correlation between fracture type and outcome**

		Outcome				Total
		Excellent	Fair	Good	Poor	
Neer	# dislocation	0	0	0	3	3
		.0%	.0%	.0%	100.0%	100.0%
		.0%	.0%	.0%	60.0%	10.0%
	2 Part	1	2	7	0	10
		10.0%	20.0%	70.0%	.0%	100.0%
		50.0%	15.4%	70.0%	.0%	33.3%
	3 Part	1	7	2	1	11
		9.1%	63.6%	18.2%	9.1%	100.0%
		50.0%	53.8%	20.0%	20.0%	36.7%
	4 Part	0	4	1	1	6
		.0%	66.7%	16.7%	16.7%	100.0%
		.0%	30.8%	10.0%	20.0%	20.0%
Total	2	13	10	5	30	
	6.7%	43.3%	33.3%	16.7%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	

All 3 patients with fracture-dislocation had a poor outcome. Out of 10 patients with 2 part fracture, 1(10%) had an excellent outcome, 7(70%) had a good, 2(20%) had a fair outcome. 1(9.1%) patient with 3 part fracture had an excellent outcome followed by 2(18.2%) with a good

outcome,7(63.6%) with fair outcome and 1(9.1%) with poor outcome out of 11 patients. 1(16.7%) patient with 4 part fracture had good outcome followed by 4(66.7%) with the fair outcome and 1(16.7%) had a poor outcome out of 6 fractures.

Type of fracture	Number of cases	Percentage	Average constant score	Inference	Complications
2 part	10	33.3	17.3	Good	1
3 part	11	36.7	23.7	Fair	2
4 part	6	20	27	Fair	Nil
Fracture dislocations	3	10	43	Poor	Nil
Total	30	100	27.7	Fair	3

As displayed, among the 30 patients in our study, 10 patients had Neer’s 2 part fracture with an average constant score of 17.3, which was good and only 1 complication. 11 patients had Neer’s 3 part fracture with an average constant score of 23.7, which was fair.6 patients had Neer’s 4 part fracture with an average constant score of 27, which was fair and 3 patients with fracture dislocations had an average constant score of 43, which was poor. This correlation indicated that, more

complex the fracture, the function outcome was affected, and the simple fracture had a better functional outcome. These findings are comparable to earlier studies done by P. Moonot *et al.* 2005, David S. Thyagarajan; 2009<sup>[48]</sup>, Rizwan Shahid *et al.*;<sup>[49]</sup> 2008, Jan-Magnus Björkenheim, 2004<sup>[50]</sup>.

**10. Correlation between age and functional outcome**

		Outcome				Total
		Excellent	Fair	Good	Poor	
Age(yr)	21 - 30	2	0	3	0	5
		40.0%	.0%	60.0%	.0%	100.0%
		100.0%	.0%	30.0%	.0%	16.7%
	31 - 40	0	2	2	3	7
		.0%	28.6%	28.6%	42.9%	100.0%
		.0%	15.4%	20.0%	60.0%	23.3%
	41 - 50	0	4	2	1	7
		.0%	57.1%	28.6%	14.3%	100.0%
		.0%	30.8%	20.0%	20.0%	23.3%
	Above 50	0	7	3	1	11
		.0%	63.6%	27.3%	9.1%	100.0%
		.0%	53.8%	30.0%	20.0%	36.7%
Total	2	13	10	5	30	
	6.7%	43.3%	33.3%	16.7%	100.0%	
	100.0%	100.0%	100.0%	100.0%	100.0%	

Out of 11 patients above 50 years, 3(27.3%) had a good outcome, 7(63.6%) had fair and 1(9.1%) had a poor outcome. Out of 19 patients less than 50 years, 2(10.5%) had excellent

outcome, 7(36.8%) had good, 6(31.5%) had fair and 4(21%) had a poor outcome.

Age	Number patients	of	Percentage	Average constant score	Inference
<50 years	19		63.3	24	Fair
>50 years	11		36.7	25	Fair
Total	30		100	24.5	Fair

As shown above, among 30 patients in our study, 19 patients were below 50 years and 11 patients above the age of 50 years. We observed that the average constant and murley score had increased as the average age of the patient in the study increased. These findings are comparable to earlier studies done by P. Moonot *et al.*; 2005, David S. Thyagarajan; 2009 [48], Rizwan Shahid *et al.*; 2008 [49], Jan-Magnus Björkenheim, 2004 [50].

### 11. Correlation with p-Value

	Fishers exact test	
	p-value	
Age(yr) * Out come	.044	sig HS
Sex * Out come	.805	
MOI * Out come	.406	
Timing of Sx * Out come	.768	
Side * Out come	.769	
Asso. Injury * Out come	.807	
Neer * Out come	.003	
Complications * Out come	.501	

### Conclusion

The present study was done to evaluate functional outcome following surgical management of displaced proximal humerus fracture by philos locking plate.

In our study of 30 patients with displaced proximal humerus fractures treated with proximal humeral internal locking system plating, we conclude that the functional outcome is much better in patients with 2-part and 3-part fractures, and not good in complex fractures and fracture-dislocations. The advantage of this fixation is it allows early postoperative mobilization of the affected shoulder and better functional outcome of the affected shoulder, as compared to conservative management, where patients affected shoulder is immobilized for long periods. Among the 30 patients on 3(10%) had complications, and all were varus malunion. Our study also concluded that the older the patient the functional outcome of the affected shoulder was fair at the end of 6 months.

Proximal Humeral Internal Locking System (PHILOS); In this system, locking of the threaded heads of the screws in the plate itself provides for a construct with angular and axial stability, eliminating the possibility of screw toggling (windscreen wiper effect), or sliding of the screws in the plate holes.

Coupled with a divergent or convergent screw orientation, this makes for much-improved resistance to pull out and failure of fixation. Also, whereas conventional plating systems depend on compression between the plate under the surface and bone for stability, this is not the case for the PHILOS. This lessens the chance of stripping the thread in osteoporotic bone, as the plate/bone interface is not loaded along the screw axis. This also allows for a more biological fixation as the underlying periosteum and blood supply to the fractured regions are much less compressed.

To conclude, the Philos locking plate is an advantageous implant in proximal humeral fractures due to angular stability, particularly in comminuted fractures and in osteoporotic bones in elderly patients, thus allowing early mobilization.

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