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**Dr. Gadhamsetty Sai Ganesh**  
M.S, Department of Orthopedics,  
Saveetha Medical College and  
Hospital, Thandalam, Chennai,  
Tamil Nadu, India

**Dr. Harish Babu**  
M.S, Department of Orthopedics,  
Saveetha Medical College and  
Hospital, Thandalam, Chennai,  
Tamil Nadu, India

**Dr. Nissanth Chandrsekharan**  
M.S, Department of Orthopedics,  
Saveetha Medical College and  
Hospital, Thandalam, Chennai,  
Tamil Nadu, India

**Vishnu M**  
M.S, Department of Orthopedics,  
Saveetha Medical College and  
Hospital, Thandalam, Chennai,  
Tamil Nadu, India

**Dr. Yeshwanth Subash**  
DNB, (Ortho), MNAMS  
Department of Orthopedics  
Saveetha Medical College and  
Hospital, Thandalam, Chennai,  
Tamil Nadu, India

**Corresponding Author:**  
**Dr. Yeshwanth Subash**  
DNB (Ortho), MNAMS  
Department of Orthopedics  
Saveetha Medical College and  
Hospital, Thandalam, Chennai,  
Tamil Nadu, India

## Prospective study to assess functional outcome in proximal humerus fracture treated using philos

**Dr. Gadhamsetty Sai Ganesh, Dr. Harish Babu, Dr. Nissanth Chandrsekharan, Vishnu M and Dr. Yeshwanth Subash**

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### Abstract

**Introduction:** Proximal humerus fractures are 2nd most common fractures of upper limb and 3rd overall. Proximal humerus fractures which were stable and minimally displaced were treated conservatively, unstable fractures (3 part, 4 part) were treated with ORIF with Plate osteosynthesis. ORIF with PO allows early mobilization with stable fracture construct. Stability is contributed by the fixed angle construct of the prosthesis. This is a prospective study aimed at knowing the functional outcome in proximal humerus fractures treated with PHILOS plating system.

**Methods:** Prospective study done at tertiary center from June 2020 to November 2021. Over a period of 1.5 yrs. All patients were operated by the same surgeon with standard surgical procedure. Total number of patients were 30. They were graded at 3 months and 6 months and 1 year using constant murley scoring and VAS scoring.

**Results:** There were 24 males and 6 female's average age being 40.53 yrs, right side being most commonly affected side. Average surgical time was 77.8 min (63 to 92min) average surgical time being 77.8min average blood loss being 257ml, average constant murley score was at 3 mo. was 22.5 at 6mo 56.05 at 1yr 73.3 score at 1 year has increased significantly from 3mo to 1yr ( $p < 0.05$ ).

**Conclusion:** This study concludes that proximal humerus fractures treated with Philos plating system allows stable internal construct allowing early mobilization at shoulder joint, with less postoperative complications.

**Keywords:** Proximal humerus, neer's classification, philos plating, constant murley score

### Introduction

Proximal humerus fractures are second most common fractures of upper limb and third overall [1, 2]. Many classifications were utilized to characterize proximal humerus fractures, for example, AO classification (fig 1), Neer'S classification (fig 2). Most ordinarily utilized is NEERS classification. According to neers classification proximal humerus is isolated into 4 segments (humeral head, greater trochanter lesser trochanter and humeral shaft) and grouped in number of parts displaced. Displacement is viewed as  $> 1\text{cm}$  of partition and  $> 45^\circ$  of angulation [3]. 1 part and 2 part fractures were typically steady and negligibly dislodged and can be dealt with U slab application and immobilization with arm sling [4, 5, 6]. Early mobilization and physiotherapy within 3 to about a month has been related with preferred utilitarian outcomes over delayed immobilization most common complications related with the conservative management are malunion, subacromial impingement, avascular necrosis of humeral head, stiffness, rotator sleeve deficiency [7, 8, 9]. Unstable breaks (3 part, 4 part) were treated with ORIF with Plate osteosynthesis. The fundamental point of treatment is to accomplish easy and practical shoulder by reestablishing anatomy and providing stability, ORIF with PO permits early preparation with stable crack develop.

A wide range of procedures have been utilized for the fracture fixation like closed or mini-open reduction and percutaneous fixation, Closed or open reduction with intramedullary nails. Open reduction with internal fixation can be done utilizing different implants such as transosseus suture fixation, tension band wiring of fracture fragments to semi tubular or cloverleaf plates [10-12].

PHILOS plating is a more up to date age of locking compression plates, screws in the head are locking type and locks plate on to bone forestalling back out of plates which will be particularly helpful in osteoporotic bones. Screws concur and veer alternatively improving purchase in the humeral head. Plate additionally has low profile which prevents impingement syndrome postoperatively.

Proximal humerus interlocking system (PHILOS) provides stable fracture construct by the fixed angle construct of prosthesis [13]. This is a prospective study pointed toward knowing the functional outcomes in proximal humerus fractures treated with PHILOS plating.

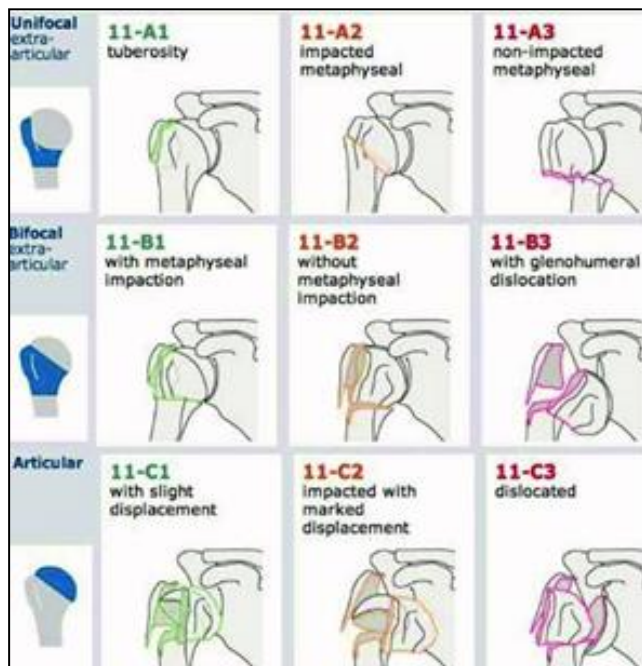


Fig 1: AO classification

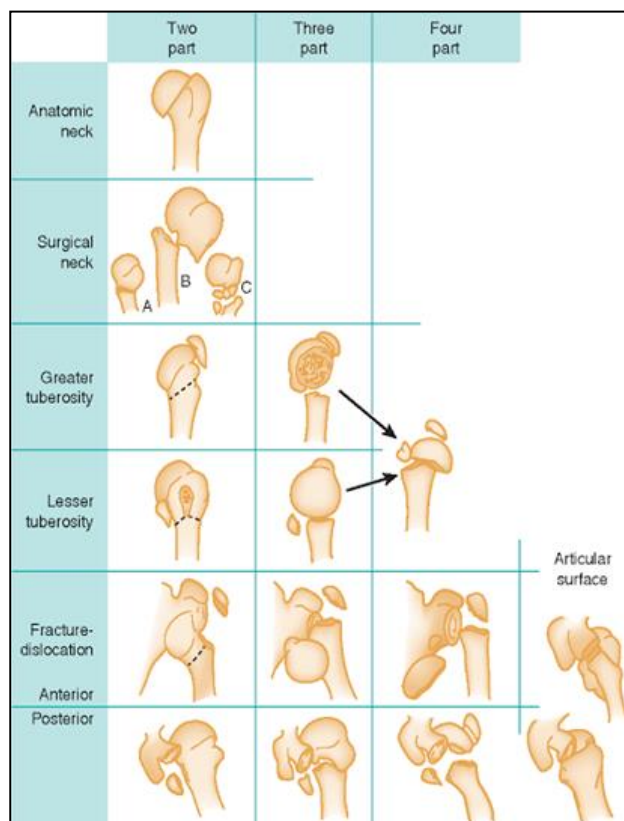


Fig 2: Neers classification

**Materials and Methods**

This is a prospective study done at tertiary center from June 2020 to November 2021 over a period of 1.5yrs for proximal humerus fractures operated by PHILOS system. All patients were operated by the same surgeon with standard surgical procedure. Total number of patients were 30. Inclusion criterion being 1) closed 2 part / 3 part / 4 part proximal humerus fractures 2) fractures less than 3 weeks old 3) age more than 18yrs 4) failed conservative management. Exclusion criterion being 1) open fractures 2) age less than 18yrs 3) pathological fractures.

Plain radiographs (anteroposterior, lateral views) were obtained preoperatively to assess the type of fracture, CT was taken for some patients with complex fractures to assess fracture pattern and plan for surgical procedure. Fractures were classified based on NEER'S classification (fig 3). Patients were assessed for neurovascular deficits. Patients were initially stabilized with u slab and immobilized with arm sling; all their comorbid conditions were accounted for before taking the patient for surgery. 1 dose of antibiotic was given on the day of surgery. Under regional anaesthesia, patients were operated in beach chair position through standard deltopectoral approach. Superficial tissues were separated cephalic vein retracted laterally, deltoid and pectoralis major muscles retracted to expose clavipectoral fascia, dissecting through clavi-pectoral fascia conjoint tendon is retracted to expose humeral shaft. Fracture reduction done in anatomical position or near anatomical position using 1.5mm Kirschner wire or non-absorbable sutures to hold the fracture fragments in position temporarily and PHILOS plate was applied laterally at least 5 to 8mm distal to tip of greater tuberosity and 2 to 4mm lateral to bicipital groove to maintain sufficient gap between long head of biceps tendon and position confirmed by image intensifier. First screw to be fixed is usually a 3.5mm cortical screw close to the fracture site and before tightening it position of the plate is checked. Distal plate should be centered on the humeral shaft, PHILOS plating system has 9 proximal locking screws in 5 zones A, B, C, D, E proximal screws were fixed at least 4 to 6, following which distal cortical screws were fixed. AP and Lateral views were taken using image intensifier to check for fracture reduction and range of movements at shoulder were checked for impingement.

Post operatively patients were started on controlled active mobilization at shoulder on POD 1 with pendulum exercises followed by physical therapy for about 10 weeks. Post operatively antibiotics were continued for 5 days intravenously. Wound dressing were done on POD 2 and 5 and suture/stapler removal done after 2 weeks. Patients were instructed to avoid lifting heavy weights/exercises till signs of union were noted. Serial radiographs were taken to check for position of implant and signs of union. They were followed up and graded at 3 months and 6 months and 1 year using constant murley scoring and VAS scoring. Data collected was analyzed using SPSS system and chi square test was used in comparison of categorical variables. A P value of < 0.05 was considered statistically significant.

**Results**

This was a study conducted at Tertiary hospital conducted between June 2020 to November 2021 including 30 patients over a period of 1.5 yrs with follow up of 1 yr. (Table 1). There were 24 males and 6 females with mean age being 40.53yrs ranging from 25 to 63yrs (fig 3) and mode of injury RTA being most common others being self-fall and work

place injuries.

Right side injuries were 16 being more common than left sided which were 14. Type of fractures were classified base on Neers classification of which 8 were two-part fractures 14 were three part 8 were four-part fractures (fig 4). Mean duration of patients presenting after injury was 3.5 days ranging from 1 to 7 days. Patients were operated the next day after their presenting day. Average operative time was 77.8min ranging from 63 to 92 min with mean blood loss of 257ml. Average duration of patient’s hospital stay was 1 week. Mean Constant murley score at the end of 3mo was 22.5 at 6mo 56 and at the end of 1yr was 73.3, which was statistically significant ( $p < 0.05$ ), (fig 5). All patients attained their preinjury state within 14 weeks. There were no complications like surgical site infections, nonunion, implant failure, screw back outs, malunion, avascular necrosis of head of humerus. All patients were followed up for 6 months. None of the patients were lost to follow up.

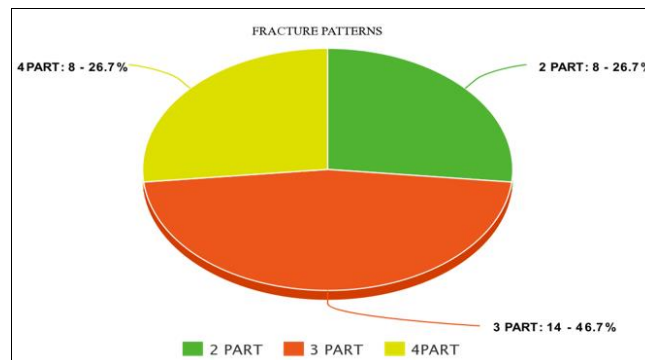


Fig 4: Fracture pattern distribution

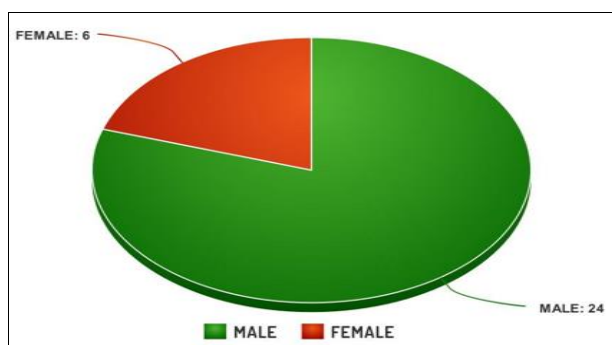


Fig 3: Gender Distribution

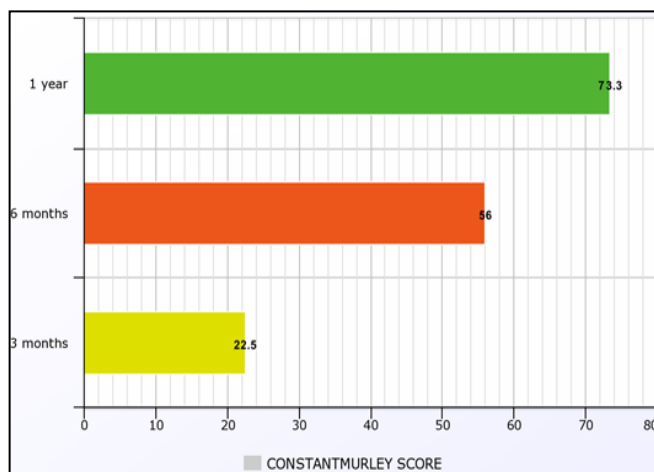


Fig 5: Constant murley scoring

Table 1: Patients Demographic Data

S. No	Sex	Side of Injury	Mode of Injury	Neers Classification	Duration from injury to presentation	Blood Loss (ml)	Surgery Time (Min)	Constant murley scoring		
								Score At 3 Month	Score at 6 month	Score at 1yr
1	M	Right	RTA	2 Part	2 Days	213	64	20	48	63
2	M	Left	RTA	4 Part	1 Day	240	63	15	47	62
3	M	Right	RTA	3 Part	1 day	342	76	13	45	58
4	M	Left	Self-Fall	3 Part	2 days	178	75	21	46	64
5	M	Right	RTA	4 Part	12 hrs	226	87	11	50	62
6	M	Right	RTA	2 Part	1 day	252	66	21	47	63
7	M	Right	RTA	3 Part	3 Days	263	86	22	55	70
8	M	Left	WPI	2 Part	4 Days	332	97	23	51	73
9	M	Left	RTA	4 Part	3 days	242	75	25	56	75
10	F	Left	RTA	3 Part	2 days	196	64	21	59	78
11	M	Right	Self-Fall	3 Part	2 days	187	98	21	48	62
12	M	Left	Self-Fall	4 Part	1 Week	188	76	24	57	76
13	M	Right	RTA	2 Part	1 Day	242	65	26	60	88
14	M	Right	RTA	3part	1 Day	367	86	27	64	86
15	M	Right	RTA	3 Part	1 Day	273	87	26	66	83
16	M	Right	WPI	3 Part	12 Hrs	245	89	20	52	73
17	M	Left	RTA	4 Part	1day	276	69	22	53	83
18	M	Left	RTA	2 Part	2 days	256	68	25	67	89
19	F	Left	WPI	3 Part	12 hrs	246	78	24	61	70
20	F	Right	RTA	2 Part	1 day	250	91	21	51	73
21	M	Right	RTA	4 Part	12 Hrs	267	65	16	49	68
22	M	Right	Self-Fall	3 Part	5 Days	298	88	24	67	81
23	M	Left	RTA	3 Part	2 Days	188	74	29	67	84
24	M	Left	RTA	4 Part	2 Days	302	92	27	63	81
25	M	Right	WPI	2 Part	3 Days	312	68	18	46	68
26	M	Left	RTA	3 Part	4 Days	325	84	30	68	81
27	F	Left	RTA	3 Part	3 days	242	74	14	50	61
28	F	Left	RTA	4 Part	2 Days	234	82	31	65	89
29	F	Right	WPI	2 Part	2 Days	264	69	26	55	71
30	M	Right	RTA	3 Part	1 Week	267	78	32	68	83

RTA: Road traffic accidents, WPI: Work place injury, M-Male, F-Female

## Discussion

Proximal humeral fractures were devastating elements to treat. They show bi modular distribution with high speed injuries in more youthful age and trifling injury in older age groups [13]. Insignificantly displaced/un displaced can be overseen moderately with good outcomes, displaced and comminuted fractures necessitate internal fixation. Many careful choices were proposed for some of which being: Shut or smaller than expected open decrease and percutaneous obsession in this technique crack obsession is finished by joystick pins and obsession is finished by strung pins to present stability. The fundamental benefit of this strategy was delicate tissue preservation, cosmetic, reduced blood loss. Cons of this technique being probability of axillary nerve damage, fixation failure, intraarticular pin migration and necessity for re-surgery.

Closed or open reduction with intramedullary nails-in this method internal fixation with intramedullary nails are used for fracture fixation [14], nails are usually inserted anterograde fashion through a small proximal incision, its statically kept in position by percutaneous locking. This method preserves soft tissue cover and periosteal blood supply whilst giving internal stabilization. Complication associated with nailing are rotator cuff injuries, nonunion, impingement, infection.

Open reduction with internal fixation-can be done using various implants such as trans-osseus suture fixation, tension band wiring of fracture fragments to semi tubular or cloverleaf plates but these implants were non anatomical and should be contoured manually to maintain fracture reduction however complications associated with these procedures are avascular necrosis, nonunion malunion, plate back out, screw cutout, impingement syndromes.

A newer generation of plates PHILOS came into existence which can provide good angular stability, anatomically contoured, providing adequate buttressing and load sharing support to prevent collapse of fragments. PHILOS plating system has a proximal portion a mid-portion and a distal portion. Proximal part comprises of 9 locking holes arranged in 5 zones these screws were used in different combinations to hold the fracture in position. At the center of plate, a combi hole is present distally same were followed. These newer generation plates have few complications with excellent functional outcomes.

Various studies had reported varying results. Thyagarajan, *et al.* [15] in their study on 30 patients showed an overall average Constant score of 57.5. The mean age in this series was 58 years (range 19-92years) and fractures were Neer's 2-part, 3-part, and 4-part fractures.

In one prospective study, mean constant score was 68.31 in 19 patients. Kettler, *et al.* [16] reported a Constant-Murley score between 52 to 72 points after ORIF with the PHILOS plate. Helwig, *et al.* [17] reported screw penetration of the humeral head in 11 of 87 patients' ley KC and Gorczyca JT in their series of 53 patients had a screw cut out rate of 23%. They also stated that screw cut out is one of the most common reasons for revision surgery.

In our review the fundamental test is accomplishing an anatomic decrease of the crack, particularly in the three-part and four-part fractures and in exposure of tendon in the bicipital groove. The anterolateral branch of the anterior humeral circumflex conduit, which is the essential blood supply to the proximal humerus, may be damaged [18-20]. This imperils the blood supply to the humeral head and builds the danger of osteonecrosis. Most entanglements that may emerge are connected with procedure. The PHILOS plate gives

astounding fixation to the humeral head, even in osteoporotic bone. Our study has mean steady score of 73.3 with incredible useful result. Our review hasn't experienced any confusions, for example, screw back out, screw cutout, impingement, avascular necrosis of head.

## Conclusion

Our study concludes that proximal humeral fractures fixed with PHILOS plating with correct plate positioning, adequate reduction provides satisfactory functional outcome. With stable internal construct allows for early mobilization of shoulder. Moreover, they provide satisfactory outcomes even in the osteoporotic bones and comminuted fractures. Our study had very less complications.

## Conflict of Interest

Not available

## Financial Support

Not available

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