

ORIGINAL ARTICLE

Comparison of Functional Outcome and Union of Proximal Humerus Fractures Fixed with Philos Plate Versus T PlateZAHID IQBAL¹, MUHAMMAD IMRAN HAIDER², MUHAMMAD IMRAN ANJUM³, MUHAMMAD ISHFAQ MAZARI⁴, RANA MUHAMMAD JAVAID AFZAL⁵, RANA SHAHID WASEEM RONAQ⁶¹Consultant Orthopedic Surgeon, Bahawal Victoria Hospital²Assistant Professor Orthopedics, Nishtar University Multan³Consultant Orthopedic Surgeon, Bahawal Victoria Hospital, Bahawalpur⁴Senior Registrar Orthopedic Unit, Sheikh Zayed Hospital, Rahimyarkhan⁵Consultant Orthopedic Surgeon, Nishtar University Multan⁶Consultant Orthopedic Surgeon, Nishtar Medical UniversityCorresponding author: Muhammad Imran Haider, Email: drihqaisrani@gmail.com, Cell: 03336100785**ABSTRACT****Aim:** The purpose of this study was to evaluate the differences between PHILOS and T plates in terms of functional recovery and fracture union after proximal humerus fractures.**Study Design:** Prospective study**Place and Duration:** Bahawal Victoria Hospital, Bahawalpur/Nishtar Hospital, Nishtar Medical University, Multan. Jun 2020-January 2022**Methods:** There were a total of 48 patients, both sexes, ranging in age from 20 to 75. All the included patients had humerus fractures and admitted to hospital for operation. Age, sex, BMI, fracture aetiology, and fracture side were recorded together with other pertinent demographic information after obtaining written consent from the patients. Patients were equally divided in two groups. Group I received Proximal Humerus Internal Locking System (PHILOS) in 24 cases and group II 24 cases received T plating. Patients were followed for 12-months. Post-operative functional and union outcomes among both groups were assessed. We used SPSS 26.0 to analyze all data.**Results:** There were 36 (75%) male patients and 12 (25%) females among all cases. In group I mean age was 47.9±8.42 years with mean BMI 23.6±4.23 kg/m² while in group II mean age was 50.3±7.29 years and had mean BMI 24.5±3.42 kg/m². RTA was the most common etiology found in group I 13 cases and 12 cases in group II. Right was the most common affected side among all cases 15 in group I and 14 in group II. Mean operative time of T plates 131.3±12.16 minutes were higher as compared to PHILOS 121.2±17.40 minutes. Blood loss was also higher in T plates as compared to PHILOS with p value <0.003. As per functional results, group I showed higher frequency of excellent and good results (16.7%, 54.2%) as compared to group II (8.3%, 41.7%). Mean union time was lower in group I 11.6±5.33 weeks as compared to group II 15.8±2.52 weeks. Post-operative complications by using T plates were found higher 6 (25%) as compared to group PHILOS group 3 (12.5%).**Conclusion:** We concluded in this study that PHILOS plating for the fixation of proximal humerus fractures were effective and useful in terms of less blood loss, less operative time, less union time and higher number of excellent and good results as compared to T plating. Except this complications were also found lower in PHILOS plating group.**Keywords:** Proximal Humerus Fracture, PHILOS Plate, T Plate, Complications, Functional outcomes**INTRODUCTION**

Due to a growing number of senior osteoporotic patients[2], proximal humeral fractures (PHF) have risen to the position of third most common injury among the aged[3]. PHF account for 4%-5% of the total body bone fractures[1]. Patients with slightly displaced PHF may be handled without surgery in about 80% of cases, according to reports[3], but over 20% of patients with displaced and comminuted fractures need surgery. These fractures are challenging to treat because it is impossible to anticipate whether or not a firm fixation can be achieved that will preserve intra-operative reduction. Orthopaedic surgeons throughout the world continue to find PHF a difficult condition to treat surgically.

Proximal humeral internal locking systems (PHILOS) are becoming increasingly popular for treating unstable PHFs due to their improved biomechanical properties, which include the provision of divergent and convergent fixed angle screws that improve fixation and pullout strength in osteoporotic bone[5]. Various surgical techniques have been described for the treatment of PHFs. Furthermore, it has been shown to be both clinically and biomechanically helpful in geriatric individuals with PHF. Nonetheless, even with PHILOS, reliable fixation is challenging in osteoporotic patients[7]. Avascular necrosis (AVN), screw cutting, implant failure, plate impingement, head collapse, and infection are only some of the problems that have been described by certain writers. Utilization of an associated intramedullary allograft has been related with positive results. To date, however, no research has compared the clinical and radiological results of PHILOS in older patients with and without an accompanying fibular allograft. Most prior investigations are case series. [8]

The standard classification of proximal humerus fractures is based on the anatomical components of the proximal humerus and

is known as the Neer system. Avascular necrosis is commonly found in patients with a head split fracture. In order to purchase the head in a variety of locations, the proximal humerus plate osteosynthesis uses screw holes of varying angular degrees. Enhancing the purchase, particularly in osteoporotic bone, serves as an internal fixator and improves angular stability. Locking plates for the proximal humerus are fixed in place by a single beam construction that prevents any wiggle room between the screw, plate, and bone. In comparison to the load sharing concept, this one is four times stronger. Because of its anatomical similarity to the proximal humerus, the proximal humerus internal locking system (PHILOS®, Synthes, Switzerland) is the implant of choice for the treatment of misplaced or complicated PHF. With its locking construction of convergent and divergent screws, it offers angular stability and increases pull-out strength in osteoporotic bone. However, there is a dearth of prospective trials that assess the efficacy of this method and detail any treatment-related problems [11,12].

Age, health, bone quality, accurate assessment of current fixation procedures, and patient expectations all play a role in how quickly and painlessly a patient may resume normal shoulder function following PHF. Other surgical risks include humeral head necrosis, intra-operative humerus shaft fracture, malpositioning of greater/lesser tuberosity, implant loosening or failure, failure of osteosynthesis, and malunion of the fracture [13]. For these reasons, pinpointing the best approach to PHF care remains a formidable obstacle. [14,15]

In this study, we compared PHILOS plates to T plates in treating proximal humerus fractures and assessing the patients' functional recovery and fracture union.

MATERIAL AND METHODS

This prospective study was conducted at Bahawal Victoria Hospital, Bawalpur/Nishtar Hospital, Nishtar Medical University, Multan and comprised of 48 patients had proximal humerus fracture. Age, sex, BMI, fracture aetiology, and fracture side were recorded together with other pertinent demographic information after obtaining written consent from the patients. Skeletally immature patients, patient not willing for surgery or follow-up, pathological fractures, bedridden patients and patients with 2-part proximal fracture or un-displaced fracture were not included.

The functional outcome of the operation was evaluated with pre- and post-testing. Finally, statistical analysis was used to compare the surgical results of using a PHILOS plate for osteosynthesis to those achieved using a T plate. During the operations, 48 people were randomly assigned to get either the PHILOS plating or the T plating. Preoperative testing, surgical procedures, and follow-up treatment were all the same for all groups. During surgery, patients were placed in the supine position with a sandbag placed under the interscapular region to raise it 30-45 degrees. Antibiotics were administered intravenously for three days following surgery, followed by three days of oral medication. It was decided to remove the drain from the second pod and the sutures from the twelfth pod. The cephalic vein was discovered, identified, and reflected laterally using the deltopectoral approach, which entailed making an incision across the coracoid process and continuing it via the deltopectoral groove.

Surgery known as PHILOS plate osteosynthesis involves reducing the tuberosities and humeral head and tagging the rotator cuff tendons with eithbond sutures to attach the final plating in place; k-wires are used for temporary fixation. A PHILOS plate was fixed laterally to the bicipital groove with the help of locking and cancellous screws. The surgery was followed up by an immediate X-ray to check on the patient's recovery.

The technique was carried out in accordance with the 6 intraoperative steps for T plating, which were as follows: Reducing and fixing the skull pieces is Step 1. In every case, the authentic AP fluoroscopic, sometimes known as the "beetle car" look, was utilized; Second, align the plate and humeral head as directed by the implant surgical instructions; Third, secure the plate to the humeral head. The fourth step is to align the plate with the shaft. Step 5: Secure the shaft to the plate using extra locking head screws, the head, and the calcar; Step 6: Fasten the cuff sutures to the plate. We used SPSS 26.0 to analyze all data. Frequencies and percentages were used for categorical variables. Outcomes among both groups were compared in 12-months.

RESULTS

There were 36 (75%) male patients and 12 (25%) females among all cases. In group I mean age was 47.9±8.42 years with mean BMI 23.6±4.23 kg/m² while in group II mean age was 50.3±7.29 years and had mean BMI 24.5±3.42 kg/m². RTA was the most common etiology found in group I 13 cases and 12 cases in group II. Right was the most common affected side among all cases 15 in group I and 14 in group II. (table 1)

Table-1: Participants' Socio-demographics

Variables	Group I (24)	Group II (24)
Gender		
Male	17 (35.4%)	19 (39.6%)
Female	7 (16.6%)	5 (10.4%)
Mean age (years)	47.9±8.42	50.3±7.29
Mean BMI (kg/m ²)	23.6±4.23	24.5±3.42
Etiology		
RTA	13 (27.1%)	12 (25%)
Fallen	6 (12.5%)	5 (10.4%)
Assault	3 (6.3%)	5 (10.4%)
Other	2 (4.2%)	2 (4.2%)
Affected side		
Right	15 (31.3%)	14 (29.2%)
Left	9 (18.7%)	11 (20.8%)

As per Neer's classification, we found that majority of the cases had greater tuberosity 10 cases in group I and 11 cases in group II, followed by articular surface in 7 cases in group I and 5 cases in group II, lesser tuberosity found in 5 cases of group I and 4 cases of group II while shaft in 3 and 4 cases. (figure 1)

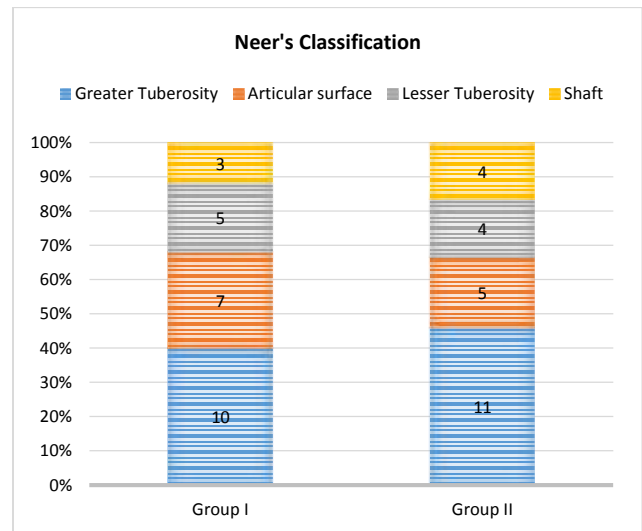


Figure-1: Determines the proximal humerus fracture by Neer's Classification

Mean operative time of T plates 131.3±12.16 minutes were higher as compared to PHILOS 121.2±17.40 minutes. Blood loss was also higher in T plates as compared to PHILOS with p value <0.003. (table 2)

Table-2: Surgery time and loss of blood among all cases

Variables	PHILOS	T plates
Intraoperative outcomes		
Surgery time (minutes)	121.2±17.40	121.2±17.40
Blood Loss (ml)	180.5±109.8	203.5±165.7

As per functional results, group I showed higher frequency of excellent and good results (16.7%, 54.2%) as compared to group II (8.3%, 41.7%). Mean union time was lower in group I 11.6±5.33 weeks as compared to group II 15.8±2.52 weeks. (table 3)

Table-3: Determination of functional outcomes

Variables	Group I	Group II
Functional outcomes		
Excellent	4 (16.7%)	2 (8.3%)
Good	13 (54.2%)	10 (41.7%)
Fair	5 (20.8%)	8 (33.3%)
Poor	2 (8.3%)	4 (16.7%)
Mean union time (weeks)	11.6±5.33	15.8±2.52

Post-operative complications by using T plates were found higher 6 (25%) as compared to group PHILOS group 3 (12.5%). (table 4)

Table-4: Analysis of postoperative complications

Variables	Group I	Group II
Complications		
Malunion	0	2
Stiffness	1	1
Infection	1	2
Reoperation	1	1

DISCUSSION

The humerus bone can sometimes heal on its own after being shattered. The proximal humerus can be surgically repaired using one of several different techniques. Percutaneous pinning,

intramedullary fixation, hemiarthroplasties, and interfragmentary suturing are all examples of such operations. [16-18]

In current study 48 cases of proximal humerus fracture were included. There were 36 (75%) male patients and 12 (25%) females among all cases. Patients were equally categorized in two groups. In group I mean age was 47.9±8.42 years with mean BMI 23.6±4.23 kg/m² while in group II mean age was 50.3±7.29 years and had mean BMI 24.5±3.42 kg/m². RTA was the most common etiology found in group I 13 cases and 12 cases in group II. Results were comparable to the previous study.[19] RTA was the most common etiology found in group I 13 cases and 12 cases in group II. Right was the most common affected side among all cases 15 in group I and 14 in group II. Mean operative time of T plates 131.3±12.16 minutes were higher as compared to PHILOS 121.2±17.40 minutes. Blood loss was also higher in T plates as compared to PHILOS with p value <0.003. Previous study showed comparable results.[20]

Plate-and-screw fixation is commonly used to treat proximal humeral fractures, however it has been related to complications such as screw pullout in osteoporotic bone, subacromial friction, and avascular necrosis of a humeral head from extensive periosteal stripping. [21] There is a significant rate of fixation failure after T-buttruss plates are used for proximal humeral fractures, according to research by Kristiansen and Christensen. Wijgman et al. found that 87% of patients who received T-buttruss plate fixation of three- and four-part fractures experienced satisfactory intermediate and long-term outcomes. Patients in their research had a mean age of 48 years. [22] Our study showed same results, PHILOS group showed higher frequency of excellent and good results (16.7%, 54.2%) as compared to T plate group (8.3%, 41.7%). Mean union time was lower in group I 11.6±5.33 weeks as compared to group II 15.8±2.52 weeks.

Osteonecrosis was another frequent complication of PHILOS plate osteosynthesis. The humeral head has a 50% probability of developing avascular necrosis after an osteosynthesis procedure. Despite this, during the early follow-up, individuals who developed osteonecrosis had a functional prognosis equivalent to those who had T plating.[23] Bone cement was used by certain researchers in an attempt to increase the stability of PHILOS in PHF, and while the results were positive and the complication rate went down (see references [24,25], there is a risk of cement-related heat injury. Alternatively, varus collapse might be treated with autologous bone grafting. However, there are risks associated with autologous bone grafting taken from the patient themselves, such as vascular or neurologic damage, severe infection at the donor area, and deep hematoma formation[26].

CONCLUSION

We concluded in this study that PHILOS plating for the fixation of proximal humerus fractures were effective and useful in terms of less blood loss, less operative time, less union time and higher number of excellent and good results as compared to T plating. Except this complications were also found lower in PHILOS plating group.

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