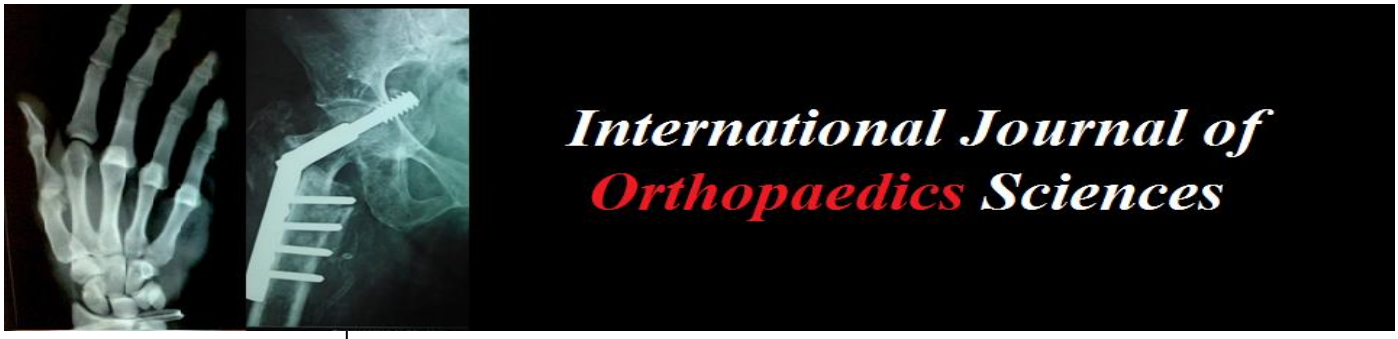

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A comparative study of surgical management of surgical neck of humerus fracture in adults by proximal humeral nailing and PHILOS

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Abstract
Fractures of surgical neck of the humerus represent 25% of the proximal part of humerus. Neer described three types of fracture of the surgical neck: angled, translated/separated and comminuted. Proximal humeral nail and PHILOS plate fixation for the surgical neck of humeral fractures offers good anatomic fracture reduction and stable primary fixation to ensure rapid fracture healing and immediate post-operative functional therapy without prolonged immobilization.
Objective: To assess and compare the functional outcome and the fracture union of surgical neck of humerus fractures using proximal humeral nail and PHILOS plate.
Material and Method: Prospective Comparative study was conducted at Bapuji and Chigateri General hospital attached to JJM Medical college, Davangere for a period of two years from July2018 to July 2020.60 adult patients with surgical neck of humerus fractures who were willing for surgery were admitted during the period of study and followed up for 12 months.
Result: In our study most patients were Female (60%) out of 60 patient. The mean age being 58 years in Group1 and 47.66 years in Group 2. Most of the case were road traffic accident comprising of 65% in Group 1 and self fall 63% in Group 2. In this study,70% of the patients presented with 2-part fracture, 30% with 3-part fracture in Group 1 and 50% of each fracture pattern in Group 2. In this study, according to Neer's score of patients had excellent 9(30%), satisfactory outcome 17(56.66%), and unsatisfactory outcome 4(13.33%) in Group 1 patients and, excellent result in 6(20%) cases, 20 cases (66.66%) had satisfactory outcome and unsatisfactory outcome 4(13.33%) in Group 2.
Conclusion: Surgical neck of humerus treated with PHN offers minimally invasive, cosmetically acceptable scar, stable and axial fixation with minimal soft tissue damage, early mobilization, where as in PHILOS provide rigid and stable fixation in most of communited fractures.

Keywords: surgical neck of humerus fractures, proximal humeral nailing, PHILOS, Neer's shoulder score

Introduction
Fractures of the proximal humerus represent 5% of all fractures. They are more prevalent in the elderly population and among females [1]. Surgical neck fractures are the most common type of proximal humerus fractures. Surgical indications are based on the displacement presented by the fragments, according to the criteria described by Neer [2], and on the variations in expectations from the final result, which depend on the patient's age and activity levels before the injury [3, 4, 5]. Most fractures do not present with displacement [6]. Among adolescents and young adults, high-energy mechanisms are more common. Among elderly people, osteoporosis and low-energy mechanisms are more common, such as falling to the ground with an indirect injury to one of the upper limbs.
Fractures of surgical neck of the humerus represent 25% of the proximal part of humerus. Provided that the soft tissues and blood supply are not greatly compromised, there is a low risk of osteonecrosis. Neer described three types of fracture of the surgical neck: angled, translated/separated and comminuted [2]. The majority of surgical neck of the proximal humerus fractures is non-displaced or minimally displaced and do not require operative intervention. Displaced fractures can disrupt the function of the upper extremity, however, and

often necessitate operative care. Although there has been data supporting the role of non-operative treatment in many individuals with surgical neck of humerus fracture, operative intervention is indicated in the properly selected patient. Many advocates for the anatomic fixation of all young patients and active elderly patients with fractures amenable to stable, anatomic fixation [7].

Fixation strategies for the surgical neck of humerus fractures have gone through an evolution over the last few decades. Modern antegrade IMNs have improved designs and therefore avoid some of the historical concerns of rotator cuff morbidity, proximal screw migration, and iatrogenic fracture [8]. Proximal humeral nailing offer the greater advantages over locking proximal humerus plates, as their implantation requires shorter surgical time and results in less fracture site pain reported in the treatment of surgical neck of humerus fractures. PHILOS plate offers a good functional outcome with context to early joint mobilization and rigid fixation of the fracture [9]. Considering these advantages and the scarcity of data on the efficacy and functional outcome following comparative study between Proximal humerus nailing with internal fixation with PHILOS plate for displaced proximal humerus fractures was done

Material and Methods

It is a Prospective Comparative study was conducted at Bapuji and Chigateri General hospital attached to JJM Medical college, Davangere for a period of two years from July 2018 to July 2020.60 adult patients with surgical neck of humerus fractures who were willing for surgery were admitted during the period of study. They were clinically and radiologically evaluated. Laboratory investigation was carried out before surgery. Inclusion criteria were patients greater than 18 years of age, patients with Neer's classification- Two part with surgical neck of humerus fracture and three part fractures, patients who are willing to follow up in our department. Exclusion criteria were patient age less than 18 years of age, patients having an associated nerve injury, pathological fractures and Compound fractures. Patients who are medically unfit for surgery, patients who refused our protocol.

Surgical Technique

1. Proximal Humerus Nailing: Intramedullary nails may provide stable fixation for surgical neck of humerus fractures and require minimal soft tissue dissection for insertion. They are especially suited for two-part and three- part surgical neck fractures, as four-part fractures are not generally amenable to reduction and fixation with an intramedullary device. The technique involves closed or percutaneous reduction of the fracture, anterolateral approach to the humeral head, and antegrade insertion of the intramedullary nail. The nail insertion site is located at the bone-cartilage junction of humeral head.

The nails are non-cannulated intramedullary proximal humeral nails that feature a tapered profile with a spiral array of proximal screws designed to target the best quality bone. Multi-planar fixation acts as a scaffold, aiding in fracture reduction and realignment. The nails are designed to have a 4° lateral bend to fit patient anatomy and also Pre-assembled jig inserts create proximal locking and distal locking screw fixation.

2. PHILOS: The proximal humerus internal locking operating system plate is pre contured to the proximal humerus. Patient was placed in a supine position with a sand bag under the scapula of operating arm to push up the operation side for allowing arm to fall backward. Deltopectoral approach was used and the plates are anatomically pre contured to the lateral aspect of proximal humerus. No bending is required, the plates are low profile for low risk of subacromial impingement. The PHILOS plate has 9 proximal locking screw head in different orientation to ensure good distribution of forces across the screw and 10 suture holes. The plate has 3 types of holes 2mm suture holes where suture passed through rotator cuff and knotted to the plate. These help to maintain and neutralize muscle tension. Locked head screw in proximal part in different orientation gives angular stability and increases buttressing providing better pull out strength.

Results

This prospective study was conducted at Bapuji and Chigateri General hospital attached to JJM Medical college, Davangere for a period of two years from July2018 to July 2020. A total of 60 patients sustained with surgical neck of humerus fractures were studied. One group of patient underwent PHN and the other group PHILOS.

Most of the patients were Female (60%) out of 60 patient. There age ranges from 32 to76yrs, mean being 58yrs in Group1 and the age of the 18-60 years, mean age of the patients was 47.66 years in Group 2. Most of the case were road traffic accident comprising of 65% in Group 1 and self fall at ground comprising of 63% in Group 2. In this study, 70% of the patients presented with 2-part fracture, 30% with 3-part fracture in Group 1 and 50% of each fracture pattern in Group 2.

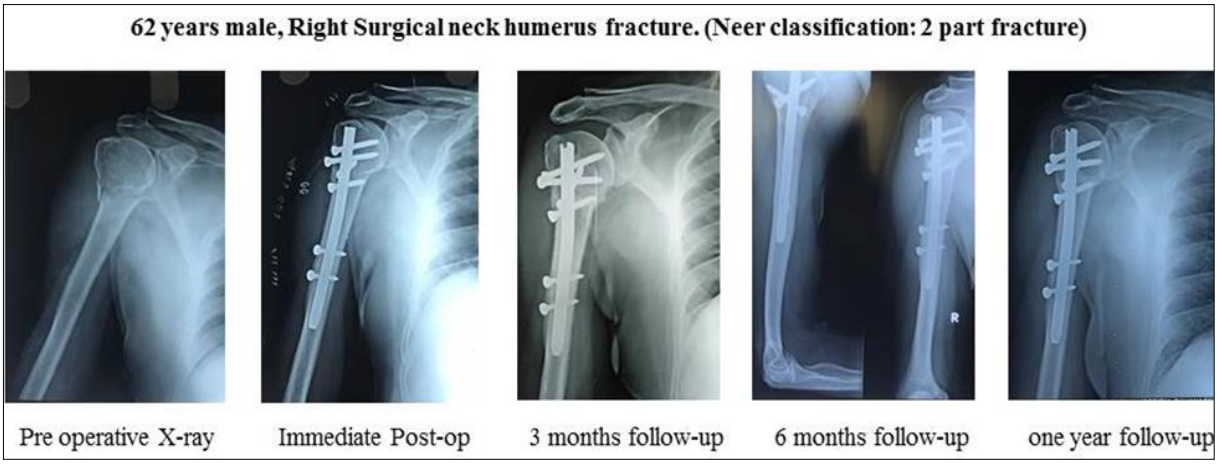
In this study first follow up was at six weeks, pain at fracture site was observed in 27 patients (90%), and also radiological union was noted in 3(10%) patients Group 1 and in 29 patients (96.66%), and also radiological union was noted in 4(13.33%) patients in Group 2.

At second follow up at 12 weeks, clinical union was noted in 27(90%) of patients and radiological union noted in 29(96.66%) patients in group 1, pain at fracture site was noted in 3(10%) of patients and complications noted were impingement in 2(6.66%) patients, malunion in 1(3.33%) and screw back out in 1(3.3%) patients. In group 2 clinical union was noted in 27 (90%) patients and radiologically union in 28(93.33%), pain at fracture site was noted in 4(13.33%) of patients and complications noted were impingement in 1(3.33%) patients, malunion in 2(6.66%) and superficial infection in 1(3.33%).

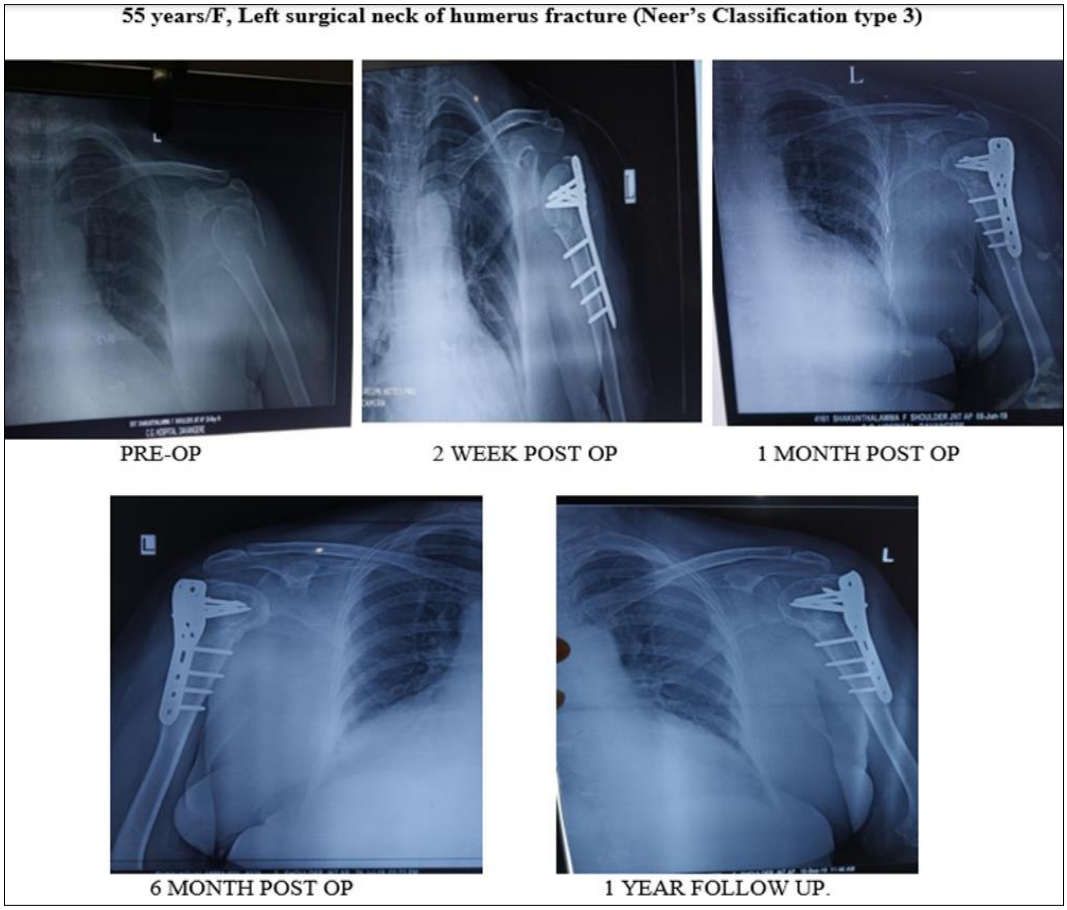
Third follow up at six month, all patients 30(100%) had clinical and radiological union. Pain at fracture site was noted in 3(10%) of the patients, while complications noted were of impingement 5(16.66%), malunion 2(6.66%) and screw backout in 1(5%) of patients in group 1. In group 2, all patients 30(100%) had clinical and radiological union. Pain at fracture site was noted in 4(13.33%) of the patients, while complications noted were of impingement 1(3.33%), malunion 4(13.33%) patients.

In this study, according to Neer's score of patients had excellent 9(30%), satisfactory outcome 17(56.66%), and unsatisfactory outcome 4(13.33%) in group 1 patients and, excellent result in 6(20%) cases, 20 cases (66.66%) had satisfactory outcome and unsatisfactory outcome 4(13.33%) in group 2.

Case of proximal humerus nailing



Case of Philos



Discussion

The treatment of surgical neck of humerus fractures continues to evolve. While many of these injuries can be managed non-operatively, a certain percentage requires operative treatment. Closed reduction and internal fixation can offer excellent outcomes when performed in the appropriate patient and utilizing proper techniques, as it can occur in different configurations.

The appropriate treatment of surgical neck of humerus fractures is predicated on the ability of the treating surgeon to identify the injury in a timely and accurate fashion and have a complete and thorough understanding of the fracture pattern. There are many factors to consider on an individual basis when deciding whether closed reduction and internal fixation should be undertaken, including patient age, functional status, physic social factors, fracture pattern, displacement, associated injuries, remaining vascular supply to the articular fragment, and bone quality and finally the ability to tolerate postoperative rehabilitation.

Treatment options currently range from non-operative treatment with physical therapy to fracture fixation using percutaneous, closed or open technique to arthroplasty reconstructions. Majority of the surgical neck of humerus fracture which are un-displaced can be treated conservatively. Even with development of newly designed locking plates and nails, treatment of displaced fracture or fracture dislocation is difficult. Many studies have shown that the displaced fracture of the surgical neck of humerus have a poor functional prognosis when left untreated because of severe displacement of fragments [10].

Closed reduction and internal fixation (CRIF) with an intramedullary nail (PHN) or Open reduction with internal fixation with PHILOS plate provides near anatomical reduction and stable fixation.

In proximal humerus fractures, proximal humerus nail offers excellent outcome with context to early joint mobilization and stable fixation of the fracture with limited soft tissue damage where as PHILOS plate osteosynthesis provides better rigid fixation and stability in osteoporotic and communited fractures and the possibility of bone grafting [11].

The present study was undertaken to compare the efficacy and the functional outcome following closed reduction and internal fixation with PHN (proximal humeral nail) vs PHILOS for displaced surgical neck of humerus fractures. The present two year prospective study was conducted at Jagadguru Jayadeva Murugarajendra medical college, Davangere from July 2018 to July 2020. A total of 60 patients sustained with surgical neck of humerus fracture were enrolled and evaluated. Patients underwent closed reduction and internal fixation using PHN in group 1 and PHILOS in group 2.

In our study the age ranges from 32 to76yrs, mean being 58yrs in Group1 and the age of the 18-60 years, mean age of the patients was 47.66 years in Group 2. Most of the patient in both groups were female 60% in each group. The most common cause for female incidence is osteoporosis.

In this study most of the case were road traffic accident comprising of 65% in Group 1 and self fall at ground comprising of 63% in Group 2.

In this study, 70% of the patients presented with 2-part fracture, 30% with 3-part fracture in Group 1 and 50% of each fracture pattern in Group2 and were fixed accordingly.

In this study first follow up was at six weeks, pain at fracture site was observed in 27 patients (90%), and also radiological union was noted in 3(10%) patients Group 1 and in 29 patients (96.66%), and also radiological union was noted in 4(13.33%) patients in Group 2.

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In this study, according to Neer's score of patients had excellent 9(30%), satisfactory outcome 17(56.66%), and unsatisfactory outcome 4(13.33%) in group 1 patients and, Excellent result in 6(20%) cases, 20 cases (66.66%) had satisfactory outcome and unsatisfactory outcome 4(13.33%) in group 2.

Konrad *et al*. [11] have conducted a prospective study was to compare the clinical and radiological outcomes of plate versus nail fixation of 3-part fractures in 211 patients with proximal humeral fractures. Outcome measurements included pain, Constant and Murley and Neer's scores, and the occurrence of complications at 3, 6- and 12-months post-surgery. Throughout the 1year follow-up period there was no significant difference between the nail group compared with the plate group.

Xiandong *et al*. [12] have conducted a retrospective study to analyse the outcomes of proximal humeral fractures in 38 patients treated with locking plate (24 cases) and intramedullary nail (9 cases) from March 2012 to May 2013. And all the patients were followed up for 9 to 23 months (mean 16.1 months). There were significant differences in the length of incision, operation time and complication rate between two groups (t=8.857, 5.323, 2.460, $p<0.05$). The incidence of complications in the locking plate group was low, and in the interlocking intramedullary nail group patients had small incision and short operation time. There was no significant difference in neck dry angle and fracture healing time between the two groups (t=0.548, 0.459, $p>0.05$). The pre-existing range, Constant-Murley shoulder function score, and excellent rate of patients with the locking plate group were higher than those of interlocking intramedullary nail group, but the difference was not statistically significant (t=1.470, 0.905, 0.133, $p>0.05$).

Conclusion

We conclude that surgical neck of humerus treated with PHN offers minimally invasive, cosmetically acceptable scar, stable and axial fixation with minimal soft tissue damage, early mobilization, where as in PHILOS provide rigid and stable fixation in most of communited fractures.

The choice of implant for proximal humeral fractures depends on the surgeon's expertise to manage the fracture as every fracture has its own orientation and need for reduction and to provide an early mobilization and good clinical & functional outcome to the patient.

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