



ORIGINAL RESEARCH PAPER

Orthopaedics

STUDY OF MANAGEMENT OF PROXIMAL HUMERUS FRACTURE BY PHILOS PLATE AND ITS OUTCOME

KEY WORDS: PHILOS plate, open reduction, internal fixation, functional outcome, Constant Murley score, Proximal humerus fracture

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ABSTRACT

Background: Fractures of the proximal humerus are frequently encountered injuries, arising from low-energy trauma in the elderly and high-energy trauma among the younger population. These fractures can result in considerable morbidity and functional limitations. Different methods of fixation have been employed, and among them, the PHILOS plate has gained prominence as the preferred implant for addressing displaced and comminuted proximal humerus fractures. Despite this, a degree of debate persists regarding the optimal approach to treatment. **Methodology:** This prospective observational study was carried out with the goal of assessing the functional outcomes of PHILOS plates for the management of proximal humerus fractures. The research involved a cohort of 30 adult patients who underwent open reduction and internal fixation through the implementation of the PHILOS plate at a tertiary care medical center. Follow-up evaluations were conducted over a minimum duration of 1 year, and the assessment of patient outcomes was executed using the Constant Murley score. **Results:** The patient cohort exhibited an average age spanning from 20 to 80 years, with a male-to-female ratio of 4:1. Most fractures were 3-part fractures (60%), followed by 2-part and 4-part fractures (20% each). Road traffic accidents were the most common mode of trauma (66.66%), and the right side was predominantly affected. Postoperative complications included shoulder stiffness (23.33%) and postoperative wound infection (10%), while varus collapse/malunion occurred in 6.66% of cases. Overall, the PHILOS plate yielded good functional outcomes, with 73.33% of patients achieving good results and 6.66% having excellent outcomes. **Conclusion:** The study demonstrates that internal fixation and open reduction with the help of a PHILOS plate offer stable fixation, early mobilization, and good functional outcomes for displaced and comminuted proximal humerus fractures. The proper clinical evaluation, accurate anatomical restoration, and aggressive rehabilitation regime are essential for successful outcomes. The PHILOS plate serves as a reliable implant for treating such fractures and ensuring better functional results.

INTRODUCTION

Fractures of the proximal humerus are widespread occurrences stemming from both low-energy and high-energy traumatic events. In contemporary contexts, the prevalence of these fractures has been on the rise among both the elderly demographic due to osteoporosis and among younger individuals due to high-impact incidents such as road traffic accidents and industrial trauma. These fractures constitute approximately 5% of all appendicular fractures and encompass 45% of all humerus fractures.¹ Their occurrence is particularly notable within the older and younger populations, driven by age-associated osteoporosis and high-energy trauma, respectively.²

Historically, most proximal humerus fractures were treated nonoperatively, and conservative management resulted in good functional outcomes in 80-85% of cases. However, comminute fractures and fractures with significant displacement (15-20%) showed poor functional outcomes when treated nonoperatively, leading to the adoption of anatomical rigid fixation for better results.³ The management of displaced and comminuted fractures in the proximal humerus has sparked considerable debate, as multiple methods of fixation are at hand. These encompass the utilization of the PHILOS plate, trans osseous suturing, percutaneous pinning, tension band wiring, rush nailing, J nailing, and arthroplasty. Among these options, trans osseous suturing and tension band wiring have not been found helpful for comminute fractures, while percutaneous pinning requires careful postoperative care and patient compliance with the implant. J nailing and rush nailing have also been associated with instability.⁴

The implant known as the PHILOS plate, which stands for

Proximal Humerus Interlocking Plate, has risen as the preferred option for addressing fractures in the proximal humerus that are both displaced and comminuted. This particular implant offers robust anatomical fixation and heightened angular stability. These attributes facilitate early mobilization and, over time, contribute to favorable functional outcomes. The use of PHILOS plates has shown promising results, making it a preferred option for surgeons dealing with these fractures.^{5,6}

This study was designed with the objective of appraising the functional consequences associated with employing the PHILOS plate for managing proximal humerus fractures that are both displaced and comminuted. The research aimed to gauge the efficacy of this implant in delivering secure anatomical fixation and heightened angular stability, thereby enabling the eventual attainment of favorable functional outcomes. Through a comparative analysis of outcomes, the study sought to offer significant insights into the ongoing debate surrounding the most effective strategies for addressing these intricate fractures in patients treated with the PHILOS plate.

METHODOLOGY

This observational prospective study aimed to assess the functional outcomes among patients afflicted with proximal humerus fractures who underwent the PHILOS plate procedure for open reduction and internal fixation. The study was carried out within the confines of a Tertiary Care Hospital, spanning from December 2019 to December 2021. A total of 30 adult patients with displaced two-part, three-part, or four-part fractures of the proximal humerus, including those with osteopenic bone, were included in the study. Patients willing and medically fit for surgery were considered eligible.

Data collection involved obtaining detailed medical histories through verbal communication with patients or their attendants. General, systemic, and local clinical examinations were conducted, along with clinical and radiological diagnoses. Lab investigations were performed for further evaluation and surgical fitness. Surgical findings, post-operative wound healing, complications, time for union, and shoulder joint range of motion were assessed post-operatively.

Inclusion criteria encompassed patients with specified types of proximal humerus fractures, willing and fit for surgery. Patients with compound fractures, fractures with acute infections, pathological fractures, patients unwilling or medically unfit for surgery, and those aged below 20 years or above 150 years were excluded.

To gauge functional outcomes, the assessment relied on the Constant Murley score, which encompassed aspects such as pain, daily activities, range of motion, and strength. This score was structured on a scale from 0 to 100, with elevated scores signifying superior functionality. The interpretation of scores categorized outcomes as excellent (86-100), good (71-85), fair (56-70), or poor (<56).

Two case illustrations were presented to demonstrate the application of the Constant Murley score. Case 1 achieved a total score of 89, falling into the "excellent" category, while Case 2 obtained a total score of 82, indicating a "good" outcome.

The study employed an observational prospective approach to evaluate the functional consequences of employing the PHILOS plate procedure for the treatment of proximal humerus fractures. Specific inclusion and exclusion criteria were established, and the evaluation of postoperative outcomes was conducted using the Constant Murley score.

OBSERVATION AND RESULT

We studied 30 adult patients with proximal humerus fractures. After initial evaluation in the casualty or outpatient department, history-taking, clinical exams, and radiological analysis were done. Admitted patients received primary treatment with an arm sling or shoulder immobilizer. Upon achieving surgical fitness, open reduction and internal fixation were performed using a PHILOS plate via the deltopectoral approach. Fracture alignment was restored, and assessed by intraoperative fluoroscopy. Post-op, day-one radiographs were taken, and patients began mobility with an arm pouch. Codman pendulum exercises followed after suture removal.

Table -1: Gender and age distribution of cases.

Gender	No. of cases	Percentage
Male	24	80.00%
Female	6	20.00%
Age (Years)		
20-30	2	6.66%
30-40	4	13.33%
40-50	5	16.66%
50-60	5	16.66%
60-70	8	26.66%
70-80	6	20%
Total	30	100%

Within our study group, 80% (n=24) of individuals were male, while 20% (n=6) were female, resulting in a male-to-female ratio of 4:1. The incidence of proximal humerus fractures was notably higher among males than females. Within the subset of operated cases, the distribution across age groups was as follows: 6.66% (n=2) in the 20-30 years bracket, 13.33% (n=4) in the 30-40 years range, 16.66% (n=5) in the 40-50 years range, another 16.66% (n=5) in the 50-60 years category,

26.66% (n=8) in the 60-70 years range, and 20% (n=2) in the 70-80 years range. The age distribution within the patient cohort spanned from 23 to 76 years, with a mean age of 52.3 years.

Table-2: Distribution Of Affected Side And Mode Of Trauma.

Side Affected	No. of cases	Percentage
Left	11	36.67%
Right	19	63.33%
Mode of Trauma		
RTA	20	66.66
History of Fall	6	20
Assault	4	13.33

The predominant side affected by proximal humerus fractures was the right side, aligning with the dominant side in most individuals. Among the procedures performed, 19 were conducted on the dominant extremity, while 11 were carried out on the non-dominant extremity. The assessment of dominance was crucial, given its impact on the patient's day-to-day activities. Notably, the prevailing modes of trauma were road traffic accidents and falls on the side, which often occurred on the dominant side. Road traffic accidents, constituting high-energy trauma, emerged as the most frequent mode, accounting for 66.66% (n=20) of cases. Falls were the subsequent common cause, reported by 20% (n=6) of patients, followed by 13.33% (n=4) reporting a history of assault.

Table 3: Classification of types of fracture and associated injury.

Type of fracture	No. of cases	Percentage
2 part	6	20%
3 part	18	60%
4 part	6	20%
Total	30	100%
Associated injury	No. of cases	Percentage
Rib fracture	2	6.67%
Contralateral shoulder dislocation	2	6.67%
Colles's fracture	2	6.67%
None	24	80.00%
Total	30	100.00%

This study reveals that the prevailing fracture type observed was the 3-part fracture, identified in 60% (n=18) of the 30 patients studied. Subsequently, both 2-part and 4-part fractures were equally common, each accounting for 20% (n=6) of the cases. Remarkably, none of the fractures were accompanied by dislocation. Given the predominance of high-energy trauma as a causative factor, several injuries coincided with the fractures. Among these, rib fractures, contralateral shoulder dislocations, and clavicle fractures were the most frequently observed.

Table-4: Post-operative Complications

Complications	No of patients
Shoulder stiffness	07
Post-operative Infection	02
Implant loosening of screws asso with infection	01
Varus collapse/ malunion	02
None	18

During the follow-up period, the majority of patients exhibited a favorable post-operative course, with 60% (n=18) experiencing no complications. Shoulder stiffness, constraining the range of motion on the affected side, emerged as the most frequent complication, affecting 23.33% (n=7) of the cohort. Among the observed complications, post-operative wound infection was noted in 10% (n=3) of patients. Notably, two of these infections were superficial and responded well to intravenous antibiotics, while the third necessitated debridement surgery, ultimately resulting in

implant screw loosening. Varus collapse or malunion was reported by 6.66% (n=2) of patients. Remarkably, no instances of fracture nonunion or osteonecrosis of the humeral head were recorded.

Table-5:Functional Outcomes Of Patients.

CMS grade	No of cases	Percentage
Excellent	02	06.66%
Good	22	73.33%
Fair	04	13.33%
Poor	02	06.66%

The assessment of final outcomes was conducted using the Constant Murley Score. Within our study, the recorded varied from a minimum of 40 to a maximum of 87, yielding an average score of 70.8.. Outcomes were categorized as follows: excellent results were achieved in 6.66% (n=2) of patients, 73.33% (n=22) attained good results, fair outcomes were observed in 13.33% (n=4) of patients, and poor results were identified in 6.66% (n=2) of cases.

DISCUSSION

In the realm of proximal humerus fractures, this discussion delves into their prevalence and treatment outcomes, aiming to provide insights into the effectiveness of surgical intervention, specifically using the PHILOS plate procedure. Proximal humerus fractures constitute a substantial portion of upper limb fractures, accounting for 45% of all humerus fractures and 4-5% of overall fractures.⁷ Among individuals in the geriatric age group (65 years and above), these fractures stand as the third most frequent fracture occurrence, trailing only hip and distal radius fractures.⁷ These fractures showcase a bimodal distribution pattern, characterized by high-energy trauma among the younger population and incidents linked to osteoporosis in the elderly.⁷ Consequently, surgical intervention is crucial for preserving tuberosity alignment and articular congruence, particularly in the young and active elderly population. The main objective in the treatment of proximal humerus fractures is to attain a shoulder that is both free from pain and fully functional.

Factors influencing treatment outcomes include patient age, bone quality, fixation technique, and rehabilitation protocols. While non-operative management with shoulder immobilization suffices for undisplaced or minimally displaced fractures, comminuted and significantly displaced fractures tend to yield poor outcomes. Consequently, anatomical rigid fixation is sought for improved functional outcomes. The debate surrounding the optimal approach for treating displaced and comminuted proximal humerus fractures continues due to the variety of fixation modalities available.

Diverse fixation techniques have been investigated, encompassing PHILOS plates, percutaneous pinning, and arthroplasty. PHILOS plates provide robust anatomical fixation and foster early mobilization and yield positive functional results. Our study's results are aligned with those of other institutes, as evidenced by comparisons with previous research.

Age incidence analysis in our series revealed an average age of 54.4 years, consistent with similar studies by **Emanuel Geiger et al.**⁸ and **Vivekbansal et al.**⁷ Sex incidence findings differed from expectations, with a male-to-female ratio of 4:1 in our series due to road traffic accidents and high-energy trauma. Contrary to the usual prevalence of proximal humeral fractures among females in the elderly age category.

Complications observed included secondary displacement, varus collapse, and implant-related stiffness or impingement. Infections occurred in two cases, necessitating various interventions. Overall, our study assessed functional outcomes using the Constant Murley Score. Excellent results

were achieved in 6.66% of patients, good results in 73.33%, fair results in 13.33%, and poor results in 6.66%. These results align with those of previous studies. The results of the study by **Emanuel Geiger et al.**⁸ showed that out of their patient cohort, 10.7% achieved excellent functional outcomes, 46.4% had good outcomes, 3.6% experienced fair outcomes, and 39.3% had poor outcomes. Similarly, the study conducted by **Vivek Bansal et al.**⁷ reported that 16% of patients had excellent outcomes, 44% achieved good outcomes, 16% experienced fair outcomes, and 24% had poor outcomes. This highlights the effectiveness of the PHILOS plate procedure in achieving favorable functional outcomes for proximal humerus fractures. Further analysis and comparison across multiple studies are necessary to draw definitive conclusions about the efficacy of the PHILOS plate procedure in treating proximal humerus fractures.

CONCLUSION

The management of fractures occurring in the proximal humerus domain continues to be a subject of debate in modern orthopedics, offering an array of treatment modalities spanning conservative and operative approaches. For the successful handling of these intricate fractures, a pragmatic approach coupled with sound surgical management is paramount. This entails meticulous clinical evaluation, procurement of high-quality radiological assessments, and thoughtful consideration of patient age and activity levels.

The bimodal distribution of fracture occurrences, characterized by osteoporotic falls in the elderly and instances of high-energy trauma among the youthful population, underscores the criticality of attaining precise anatomical restoration and secure fixation. Within the array of available implant options, the PHILOS plate has ascended as the preferred selection, presenting steadfast internal fixation, early mobilization facilitation, and support for physiotherapeutic efforts.

The meticulous restoration of the articular surface and tuberosities to their accurate anatomical states significantly impacts the attainment of superior functional results. Employing adept surgical techniques can effectively curtail complications, and a proactive rehabilitation regimen, inclusive of dynamic physiotherapy, serves as a linchpin for achieving optimal outcomes among patients subjected to open reduction and internal fixation involving the PHILOS plate.

In summary, the research reinforces the utilization of the PHILOS plate as a dependable and efficient choice for addressing displaced and comminuted fractures in the proximal humerus, resulting in enhanced functional outcomes.

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