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OUTCOME AFTER FIXATION OF TWO-PART FRACTURE OF PROXIMAL HUMERUS WITH PHILOS AND PROXIMAL HUMERUS NAIL: A PROSPECTIVE COMPARATIVE STUDY

Orthopaedics

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ABSTRACT

Background: The study compares PHILOS plate and proximal humerus nail treatment for two-part proximal humerus fractures, aiming to evaluate range of motion, pain, complication rates, and union time. **Methods:** This prospective comparative study comprised 40 surgical neck fracture of the humerus patients, equally split into two groups: PHILOS (n=20) and PHN (n=20). Injury-to-surgery delay, hospital stay, operation time, blood loss, neck shaft angle, postoperative complications, and functional outcomes were assessed using the Constant Score at 6 months. **Results:** Total 40 patients included in the study. The PHILOS group had a substantially longer injury-to-surgery delay (11.16 ± 3.50 days) than the PHN group (7.8± 3.89 days). Both groups had comparable hospital stays (5.85 ± 1.55 days for PHILOS, 4.55 ± 1.60 days for PHN). The PHILOS group had a lengthier operation time (110.84 ± 13.50 minutes) compared to the PHN group (70.40± 9.88 minutes). The PHILOS group had considerably larger blood loss (190.60± 38.03 ml) than the PHN group (119.80± 31.70 ml). The neck shaft angle was greater in the PHN group (135.11 ± 3.71 degrees) compared to the PHILOS group (135.65± 3.55 degrees). At 6 months, the mean Constant Score was similar for both groups: 84.26± 5.69 for PHILOS and 85.65± 6.78 for PHN. Both groups experienced 20.0% postoperative issues, with similar patient satisfaction percentages (satisfactory, good, outstanding) in both groups. **Conclusion:** PHILOS and PHN both effectively treat proximal humerus fractures, with PHN offering faster surgery, less blood loss, and better neck shaft angle preservation, despite identical Constant Score results after 6 months.

KEYWORDS

Proximal humerus fracture, PHILOS plate, Proximal humerus nail, Constant Score

INTRODUCTION:

Fractures of the proximal humerus constitute approximately 4–5% of all fractures and are the third most common fractures in the elderly after hip and distal radius fractures [1]. The incidence of two-part fractures, primarily involving the surgical neck, is expected to rise due to the growing geriatric population and osteoporosis prevalence. [2]

Two-part proximal humerus fractures management is debated, but surgical intervention is often necessary for anatomical alignment, shoulder function restoration, and prevention of complications. Popular surgical options include open reduction and internal fixation. [3-5].

PHILOS is a locking plate system specifically designed for the proximal humerus and offers angular stability through multiple locking screws. It allows for accurate reduction under direct vision, especially in osteoporotic bone, making it a favorable option for comminuted and complex fracture patterns [6]. However, it requires extensive soft tissue dissection, which may compromise the vascular supply to the humeral head and increase the risk of complications such as infection, hardware prominence, and avascular necrosis [7].

Proximal Humerus Nailing (PHN) is a minimally invasive technique for intramedullary fixation, resulting in less blood loss, shorter operative time, and faster recovery, but may cause impingement. [8].

The optimal surgical method for two-part proximal humerus fractures remains controversial due to varying clinical outcomes and factors like patient age, bone quality, surgical expertise, and postoperative rehabilitation protocols, often assessed using validated scoring systems. [9]

This study compares PHILOS and Proximal Humerus Nail for treating two-part proximal humerus fractures, aiming to inform evidence-based decision-making in elderly and osteoporotic patients.

METHODS

This study was conducted in Department of Orthopaedics, autonomous state medical college, Hardoi after giving written informed consent was taken. Total 40 patients with surgical humeral neck fractures. All patients aged 18 to 60 years with a Neer - Two Part classification with surgical humeral neck fractures over a period of one year. The study excluded patients with concomitant nerve injuries, pathologic fractures, compound fractures, chronic diseases, and those not medically suitable for surgery.

A skilled surgeon team assessed for each patient a proximal humerus fracture, followed by clinical and radiological investigations. A questionnaire was used to collect personal data, including diagnosis, therapy, and complications. A written and informed consent was taken from all potentially eligible patient. Baseline characteristic including age, sex, BMI and comorbidities was collected and analysed. Patients were equally divided into two groups on the basis of treatment modality by lottery method:

Group A: Proximal Humerus nailing
Group B: PHILOS

Radiological examinations were conducted to determine the appropriate course of action for a fracture. The patient underwent surgery, which involved a shoulder immobilizer, intravenous antibiotics, drain removal, and sutures removal. Postoperative therapy for the elbow, wrist, and hand began, with shoulder isometric exercises starting at 3 weeks and isotonic exercises starting between 8 to 12 weeks. The patient was observed for 6 months to 1 year.

The patients underwent clinical and radiological evaluations at various intervals to assess fracture healing. These evaluations included pain, mobility, and radiological markers. Functional capacities were assessed to determine mobility, soreness, anomalies, and lingering problems. Therapeutic side effects were observed. X-rays were performed after two weeks to evaluate fracture positioning and radiological union. After a 3-month period, patients were assessed using the Constant score. Patients were monitored for a year.

The study utilized Constant Murley's Shoulder Score for poor (0-69), bad (70-79), acceptable (80-89), and extraordinary (90-100) functional testing, with radiographs at follow-ups to assess fracture healing and identify problems, and failure was characterized by screw retraction, plate breaking, bone healing failure, or humeral head bone tissue death.

Statistical Analysis:

The study utilized SPSS version 22.0 for statistical analysis, comparing categorical and discrete variables using chi-square and independent t-tests, with a p-value of 0.05 being considered statistically significant.

RESULTS:

Table 1 shows the association of baseline characteristics of the patients between PHILOS group and PHN group. The mean age was 45.58±13.58 years for PHILOS and 43.59±13.15 years for PHN. The average age was similar in both groups. The study found that the proportion of patients with a history of traumatic brain injuries (PHN)

was similar between PHILOS and PHN, with a similar gender distribution. Both groups experienced similar types of injuries, with road traffic accidents being the most common. Alcoholism, anemia, diabetes, and hypertension were common in both groups. Both groups had similar chronic diseases, with PHILOS having a higher proportion of previous interventions and a lower surgical history.

Table 1: Association Of Baseline Characteristics Of The Patients Between PHILOS Group And PHN Group

		PHILOS group (n=20)		PHN group (n=20)		p-Value
		No.	%	No.	%	
Age (years)	Mean±SD	45.58±13.58		43.59±13.15		0.75
Gender	Male	14	70.0	12	60.0	0.67
	Female	6	30.0	8	40.0	
Side	Left	8	40.0	6	30.0	0.62
	Right	12	60.0	14	70.0	
Associated Injury	Calcaneum fracture	2	10.0	0	0.00	0.40
	Fracture Clavicle	1	5.0	0	0.00	
	fracture intertrochanteric femur	1	5.0	0	0.00	
	Head Injury	1	5.0	0	0.00	
	Open fracture 3,4,5th metacarpal	1	5.0	0	0.00	
	Proximal Tibia Fracture	1	5.0	0	0.00	
	Abdominal Injury	0	0.0	1	5.0	
	Chest Injury	0	0.00	1	5.0	
	Fifth Metacarpal Fracture	0	0.00	1	5.0	
	Fracture ulna	0	0.00	1	5.0	
	L1 vertebrae fracturre	0	0.00	1	5.0	
	Rib Fracture	0	0.00	1	5.0	
Mode of Injury	Road Traffic Accident	10	50.0	8	40.0	0.495
	Slip on Ground	4	20.0	2	10.0	
	Assault	3	15.0	5	25.0	
	Fall from height	1	5.0	3	15.0	
	Fall from Stairs	1	5.0	1	5.0	
	Hit by animal	1	5.0	1	5.0	
Chronic Illness	Alcoholism	4	20.0	5	25.0	
	Anemia	3	15.0	1	5.0	
	Diabetes	3	15.0	1	5.0	
	Hypertension	3	15.0	2	10.0	
History of previous surgeries	Yes	3	15.0	2	10.0	
	No	17	85.0	18	90.0	

Table 2 compares the mean injury-to-surgery delay, hospital stay, and blood loss between PHILOS and PHN groups. PHILOS had a longer delay, longer operation length, and higher mean blood loss during surgery compared to PHN. Both groups had similar hospital stays and mean blood loss.

Table 2: Association Of Mean Injury Surgery, Interval (days), Duration Of Surgery (min), Hospital Stay (days) And Blood Loss (ml) Between PHILOS Group And PHN Group

	PHILOS group (n=20)		PHN group (n=20)		p-Value
	Mean	±SD	Mean	±SD	
Injury Surgery Interval (days)	11.16	3.50	7.80	3.89	0.002
Duration of Surgery (min)	110.84	13.50	70.40	9.88	<0.001
Hospital stay(days)	5.85	1.55	4.55	1.60	0.480
Blood Loss (ml)	190.60	38.03	119.80	31.70	<0.001

Table 3 shows the association of mean Neck shaft angle (Degree) and Constant Score at 6 months between PHILOS group and PHN group. The neck shaft angle was 135.65 ± 3.55 degrees in PHILOS and 137.15 ± 3.99 degrees in PHN. Moreover, the neck shaft angle significantly more in PHN group as compared to PHILOS group. The mean Constant Score was not significantly different between groups: 84.26 ± 5.69 in PHILOS and 85.65±6.78 in PHN at 6 months. On the basis of Constant Score at 6 months, both groups were comparable.

Table 3: Association Of Mean Neck Shaft Angle (Degree) And Constant Score At 6 Months Between PHILOS Group And PHN Group

	PHILOS group (n=20)		PHN group (n=20)		T	p-Value
	Mean	±SD	Mean	±SD		
Neck shaft angle (Degree)	135.65	3.55	137.15	3.99	-3.40	0.039
Constant Score at 6 months	84.26	5.69	85.65	6.78	-1.55	0.310

Table 4 compares post-op problems in PHILOS and PHN groups. The PHILOS and PHN groups had 20.0% post-op problems. Both groups had similar post-op difficulties. Satisfactory, Good, and Excellent rates were 30.0%, 60.0%, and 10.0% in PHILOS and 20.0%, 55.0%, and 25.0% in PHN. Results showed both groups were similar.

Table 4: Association Of Frequency Of Post-op Complications Between PHILOS Group And PHN Group

		PHILOS group (n=20)		PHN group (n=20)		p-Value
		n	%	N	%	
Post-op complications	Yes	4	20.0	4	20.0	1.35
	No	16	80.0	16	80.0	
Outcome	Satisfactory	6	30.0	4	20.0	0.650
	Good	12	60.0	11	55.0	
	Excellent	2	10.0	5	25.0	

DISCUSSION:

The average age in our study was 45.58 years (±13.58) for the PHILOS group and 43.59 years (±13.15) for the PHN group. The average age did not differ significantly between the groups. Singh et al. study on proximal humerus fractures revealed no significant age difference between treatment groups.[10]

The frequencies of males and females in our study were 14(70.0%) and 6(30.0%) in PHILOS and 12(60.0%) and 8(40.0%) in PHN. In terms of gender, both groups were similar. Sharma et al. (2019) found no significant gender differences, indicating that gender does not influence effectiveness.[11]

The study found no significant differences in the prevalence of previous surgery between the groups. Singh et al. (2020) found similar records of previous surgery, which showed that previous surgery did not change treatment outcomes.[10]

In our study, the time between injury and surgery for bipartite fractures was significantly longer in PHILOS (11.16 ± 3.50 days) than in PHN (7.8± 3.89 days). Kumar et al. (2018) found that PHILOS delayed surgery by 10.8 days and PHN by 6.7 days, similar to our findings. [12] The study suggests that the less invasive nature of PHN could expedite surgical preparation and enhance patient outcomes.

Our study showed a mean hospital stay of 5.85 ± 1.55 days for PHILOS and 4.55 ± 1.60 days for PHN. Both groups had similar hospital stays. Studies show PHILOS patients stay in hospital for 5.5 days, PHN patients for 4.8 days, and PHN-treated patients stay shorter but not significantly longer.[11]

The study found that PHILOS surgery has a significantly longer mean operation time than PHN surgery, with an average duration of 105 minutes, compared to PHN's 70 minutes. This may reduce anesthesia time, complications, and surgical efficiency.[13]

The study revealed that the PHILOS group experienced significantly higher mean blood loss compared to the PHN group, primarily due to the more invasive nature of open reduction and internal fixation. Open surgery requires hemostasis and surgical planning, increasing blood loss. Less invasive methods minimize morbidity and blood loss, reducing complications and accelerating recovery, with proximal humeral fractures demonstrating significant reduction.[14,15]

The study compared neck-shaft angles of PHILOS and PHN patients, finding PHILOS patients had a higher Constant-Murley score of 85.8, and higher fracture reduction loss rates. The study supports Handoll et al.'s finding that a 132-degree neck shaft angle optimizes healing and

function. PHILOS and PHN fixation procedures improve functional outcomes in proximal humeral fractures, with PHILOS improving shoulder function but having a lower Constant Score.[16]

PHILOS and PHN are effective fixation methods for proximal humeral fractures, improving functional outcomes. Both methods have similar postoperative problems, infection, hardware failure, and nonunion rates. PHILOS plates with PHN fixation work well in two-part fractures, and different fixation methods can affect results.[16]

The study found that both PHILOS and PNH fixation techniques in proximal bipartite humerus fractures resulted in similar patient satisfaction and functional recovery, with PHN patients showing better results.[1] PHILOS and PHN patients showed similar outcomes in two-part proximal humerus fractures, with PHN patients showing superior outcomes.[17]

The study explores the effectiveness of PHILOS plating and proximal humerus nailing in managing two-part proximal humerus fractures, particularly in rural areas with limited access to specialized orthopedic care. Its prospective design ensures robust data collection and real-world applicability. However, limitations include small sample size, limited postoperative rehabilitation facilities, and variability in surgical expertise. Further multicentric studies with larger cohorts are recommended for broader applicability.

CONCLUSION:

The study found that PHILOS plating and proximal humerus nailing are effective surgical options for treating two-part proximal humerus fractures. PHILOS offers better angular stability and osteoporotic bone, while proximal humerus nailing offers minimally invasive fixation and reduced soft tissue disruption. Both procedures have comparable functional outcomes, but implant selection should be individualized based on fracture pattern, surgeon expertise, and patient factors.

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