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Functional Outcomes of Proximal Humerus Fractures Treated with Proximal Humerus Internal Locking System (Philos) Plate: A Prospective Observational Study

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Abstract: ***Background**: Proximal humerus fractures (PHFs) represent approximately 5-6% of all fractures, with increasing incidence in aging populations. The Proximal Humerus Internal Locking System (PHILOS) plate has emerged as a preferred treatment for displaced PHFs, offering angular stability through locking screw technology. However, outcomes remain variable with reported complication rates. **Objective**: To evaluate functional outcomes, union rates, and complications in proximal humerus fracture patients treated with PHILOS plate fixation. **Methods**: Prospective observational study of 50 patients with displaced proximal humerus fractures treated with PHILOS plate at SMS Medical College, Jaipur. Functional outcomes assessed using Constant Score and Disabilities of the Arm, Shoulder and Hand (DASH) Score at 3 weeks, 3 months, and 6 months post-operatively. Radiological assessment evaluated fracture union. Complications documented throughout follow-up. **Results**: Mean patient age was 56.95±4.17 years, with slight female predominance (54% vs 46% males). Constant Score improved progressively from 29.2 at 3 weeks to 48.6 at 3 months and 71.8 at 6 months ($p<0.001$). DASH Score decreased from 68.4 to 48.1 to 26.6, indicating 61% functional improvement ($p<0.001$). Fracture union achieved in 88% (44/50 patients). Intraoperative complications occurred in 18% (9 patients): suture cut-out (6%), metaphyseal comminution (6%), fracture comminution (4%), malreduction (2%). Postoperative infection rate was 12% (4 superficial, 2 deep). Revision surgery required in 10% (5 patients). No significant differences in outcomes based on fracture laterality or hand dominance. **Conclusion**: PHILOS plate fixation provides reliable treatment for displaced proximal humerus fractures with high union rates (88%) and progressive functional improvement. Mean 6-month Constant Score of 71.8 and DASH Score of 26.6 demonstrate satisfactory functional recovery. While complication rates (18% intraoperative, 12% infection) warrant attention, 90% of patients avoided revision surgery. PHILOS plating represents effective treatment option for displaced PHFs in appropriately selected patients.*

Keywords: Proximal Humerus Fracture, PHILOS Plate, Locking Plate, Constant Score, DASH Score, Functional Outcome, Orthopaedic Trauma.

1. Introduction

Proximal humerus fractures (PHFs) constitute approximately 5-6% of all fractures and represent the third most common fracture in elderly populations, following hip and distal radius fractures. [1,2] The incidence increases dramatically with age, particularly in individuals over 65 years, primarily due to osteoporotic changes and increased fall risk.[3] With global population aging, PHFs present a growing clinical challenge in orthopaedic trauma management.

The proximal humerus anatomy comprises four segments according to Codman's classification: humeral head, greater tuberosity, lesser tuberosity, and surgical neck.[4] Neer's classification system further categorizes fractures based on displacement (>1cm) and angulation (>45°) of these segments, guiding treatment decisions.[5] Displaced and comminuted fractures, particularly three-part and four-part patterns, demonstrate poor outcomes with conservative treatment due to significant functional impairment, malunion, and chronic pain.[6]

Historically, treatment evolved from conservative immobilization to various surgical techniques including percutaneous pinning, tension band wiring, intramedullary nailing, plate fixation, and arthroplasty.[7] Each modality presents distinct advantages and limitations. Conservative management remains acceptable for minimally displaced fractures but yields suboptimal results in displaced patterns.[8] Early surgical approaches using conventional plates frequently encountered screw loosening and fixation failure, especially in osteoporotic bone, limiting their effectiveness.[9]

The Proximal Humerus Internal Locking System (PHILOS) plate, developed by the AO/ASIF group, represents a significant advancement in locking plate technology specifically designed for proximal humerus anatomy.[10] The PHILOS plate features anatomical contouring matching proximal humerus geometry, multiple fixed-angle locking screws providing angular stability independent of bone quality, and strategic screw positioning in the humeral head for optimal fragment capture.[11] This angular stability prevents screw toggle and maintains reduction even in osteoporotic bone, addressing primary limitations of conventional plating.[12]

Multiple studies report favorable outcomes with PHILOS plating, demonstrating union rates of 80-95% and satisfactory functional scores. [13,14] However, literature remains

heterogeneous regarding complication rates, which range from 10-36% across studies, including screw penetration, varus collapse, avascular necrosis, and infection. [15,16] Variables affecting outcomes include fracture pattern complexity, bone quality, surgical technique, and rehabilitation protocols.[17]

The Constant Score, incorporating pain, activities of daily living, range of motion, and strength measurements (maximum 100 points), provides standardized shoulder function assessment.[18] The Disabilities of the Arm, Shoulder and Hand (DASH) Score evaluates upper extremity disability through patient-reported outcomes (0-100 scale, lower scores indicating better function).[19] These validated tools enable objective outcome comparison across treatment modalities.

Despite widespread PHILOS plate adoption, region-specific outcome data from Indian tertiary care centers remains limited. This prospective observational study was conducted to evaluate functional outcomes, union rates, and complications in proximal humerus fracture patients treated with PHILOS plate fixation at SMS Medical College, Jaipur, contributing to evidence-based treatment guidelines for displaced proximal humerus fractures in Indian population.

2. Materials and Methods

This prospective observational study was conducted in the Department of Orthopaedics at SMS Medical College and Attached Hospitals, Jaipur, Rajasthan, following Institutional Ethics Committee approval. A total of 50 patients with displaced proximal humerus fractures treated with PHILOS plate fixation between [study period] were enrolled. Sample size was calculated based on expected proportion of good functional outcomes (80% with ±10% precision, 95% confidence interval).

Inclusion criteria: Adult patients (≥18 years) with acute displaced proximal humerus fractures (Neer's 2-part, 3-part, or 4-part), presenting within 3 weeks of injury, medically fit for surgery, willing for regular follow-up. Exclusion criteria: Open fractures, pathological fractures, fractures with neurovascular injury, pre-existing shoulder pathology, associated polytrauma affecting rehabilitation, patients unfit for surgery or refusing consent.

All patients underwent pre-operative radiographic evaluation including anteroposterior, lateral, and axillary views of affected shoulder. Fracture classification performed using Neer's system. Surgical technique: Delto-pectoral approach with patient in beach-chair position under general anesthesia. Fracture reduction achieved using reduction forceps and provisional K-wire fixation. Anatomical PHILOS plate positioned 5-8mm distal to superior aspect of greater tuberosity. Multiple locking screws inserted into humeral head followed by shaft screws. Rotator cuff repair performed when indicated. Standard postoperative protocol included arm sling immobilization for 3 weeks, pendulum exercises initiated on first post-operative day, followed by progressive passive and active range of motion exercises. Strengthening exercises commenced at 6-8 weeks post-operatively.

Follow-up evaluations conducted at 3 weeks, 3 months, and 6 months post-operatively. Functional outcomes assessed using Constant Score (0-100 scale: pain, activities of daily living, range of motion, strength; higher scores indicating better function) and DASH Score (0-100 scale: upper extremity disability; lower scores indicating better function). Radiological assessment included fracture union evaluation, implant position, and complications (varus collapse, screw penetration, avascular necrosis). Clinical parameters documented included range of motion (flexion, abduction, external rotation, internal rotation), complications (infection, revision surgery), and patient satisfaction.

Statistical analysis performed using SPSS version 23.0. Continuous variables presented as mean±standard deviation. Categorical variables expressed as frequencies and percentages. Paired t-test used for comparing functional scores across time points. Chi-square test for categorical variables. Statistical significance set at $p<0.05$.

3. Results

A total of 50 patients with displaced proximal humerus fractures treated with PHILOS plate fixation were enrolled in this prospective observational study. All patients completed 6-month follow-up with 100% retention rate. Baseline demographics, fracture characteristics, functional outcomes, and complications are presented in Tables 1-5 and Figures 1-4.

Table 1 Description: Baseline characteristics showed mean patient age of 56.95±4.17 years with female predominance (54% vs 46% males). Left side fractures (54%) slightly outnumbered right side (46%), though no statistical significance. Right-hand dominance was observed in 78%, mirroring general population distribution. Fall was most common injury mechanism (40%), followed by road traffic accidents (34%) and assault (26%), reflecting both high-energy and low-energy trauma patterns. Most patients (68%) discharged within 3-4 days post-operatively. Early physiotherapy initiation achieved in 72% patients (Day 1-2), facilitating optimal rehabilitation. Fracture distribution: 2-part (36%), 3-part (44%), 4-part (20%), representing range of complexity patterns treated with PHILOS plating.

Table 1: Demographic and Clinical Characteristics of Patients

Characteristic	Category	n (%) or Mean ± SD
Age (years)	Mean ± SD / Range	56.95 ± 4.17 / 19-80 years
Gender	Male / Female	23 (46%) / 27 (54%)
Fracture Side	Left / Right	27 (54%) / 23 (46%)
Hand Dominance	Right-handed / Left-handed	39 (78%) / 11 (22%)
Mechanism of Injury	Fall / RTA / Assault	20 (40%) / 17 (34%) / 13 (26%)
Hospital Stay (days)	2 days / 3 days / 4 days / 5 days	7 (14%) / 17 (34%) / 17 (34%) / 9 (18%)

Physiotherapy Initiation	Day 1 / Day 2 / Day 3 / Later	23 (46%) / 13 (26%) / 5 (10%) / 9 (18%)
Neer Classification	2-part / 3-part / 4-part	18 (36%) / 22 (44%) / 10 (20%)
Mean Follow-up	Duration	6 months (100%)

Table 2 Description: Constant Score demonstrated progressive and significant improvement throughout follow-up period. Mean score increased from 29.2±8.4 at 3 weeks to 48.6±12.3 at 3 months (66.4% improvement, $p<0.001$) and further to 71.8±10.6 at 6 months (145.9% improvement from baseline, $p<0.001$). This represents nearly 2.5-fold improvement over 6-month period. At 6 months, mean score of 71.8 indicates good functional outcome (scores 60-79 classified as satisfactory). The consistent score elevation across all time points reflects successful fracture stabilization, progressive range of motion recovery, strength improvement, and pain reduction. Statistical significance ($p<0.001$) at both intervals confirms treatment effectiveness.

Table 2: Constant Score at Different Follow-up Intervals

Time Point	Mean ± SD	Range	Improvement from Baseline	p-value
3 Weeks	29.2 ± 8.4	15-45	Baseline	-
3 Months	48.6 ± 12.3	28-72	+19.4 (66.4%)	<0.001*
6 Months	71.8 ± 10.6	52-89	+42.6 (145.9%)	<0.001*

**Statistically significant ($p<0.05$)*

Table 3 Description: DASH Score, measuring upper extremity disability, showed significant progressive reduction indicating improved function. Mean score decreased from 68.4±15.2 at 3 weeks to 48.1±12.8 at 3 months (29.7% reduction, $p<0.001$) and further to 26.6±9.4 at 6 months (61.1% reduction from baseline, $p<0.001$). This represents more than 60% functional improvement over 6-month period. Final mean score of 26.6 indicates mild disability (scores <30 classified as minimal disability), reflecting substantial recovery in activities of daily living, work capacity, and recreational activities. The consistent reduction across follow-up intervals, with statistical significance ($p<0.001$), demonstrates progressive functional independence and reduced patient-reported disability following PHILOS plate fixation.

Table 3: DASH Score at Different Follow-up Intervals

Time Point	Mean ± SD	Range	Reduction from Baseline	p-value
3 Weeks	68.4 ± 15.2	42-92	Baseline	-
3 Months	48.1 ± 12.8	28-68	-20.3 (29.7%)	<0.001*
6 Months	26.6 ± 9.4	12-48	-41.8 (61.1%)	<0.001*

**Statistically significant ($p<0.05$). Lower DASH scores indicate better function.*

Table 4 Description: Complication analysis revealed 18% intraoperative complication rate (9/50 patients), with suture cut-out and metaphyseal comminution being most common (6% each), followed by fracture comminution (4%) and malreduction (2%). These technical challenges were managed intraoperatively with additional sutures, bone grafting, or adjunctive fixation. Postoperative infection occurred in 12% (6 patients): superficial infections (8%) responded to oral antibiotics and local wound care, while deep infections (4%) required surgical debridement. Radiological complications at 12% included varus malalignment (2%), implant failure (2%), and tuberosity malunion/non-union (8%). Revision surgery rate was 10% (5 patients), involving implant removal, bone grafting, or conversion to arthroplasty in severe cases. Notably, 82% of patients had no intraoperative complications and 90% avoided revision surgery, indicating overall treatment reliability despite recognized complication risk.

Table 4: Complications and Adverse Events

Complication Type	Number of Patients	Percentage (%)
Intraoperative Complications	9	18.00%
Postoperative Infection	6	12.00%
Radiological Complications	6	12.00%
Revision Surgery Required	5	10.00%

Table 5 Description: Fracture union was achieved in 88% of patients (44/50), demonstrating high success rate of PHILOS plate fixation. The 12% experiencing complications included varus malalignment (2%), implant failure (2%), and tuberosity-related issues (8%), reflecting challenges particularly in complex fracture patterns and osteoporotic bone. At 6-month follow-up, 80% of patients achieved satisfactory outcomes (Constant Score ≥60): 24% achieved excellent results (80-100 range), 56% achieved good results (60-79 range), while 20% had fair/poor outcomes (<60). The majority achieving good-to-excellent outcomes validates PHILOS plating effectiveness for displaced proximal humerus fractures, though subgroup with suboptimal outcomes highlights importance of patient selection, surgical technique refinement, and management of osteoporotic bone quality.

Table 5: Fracture Union and Final Outcomes at 6 Months

Parameter	Number of Patients	Percentage (%)
Union Status		
- Union achieved	44	88.00%
- Complications (varus, failure, non-union)	6	12.00%
Constant Score Category (6 months)		
- Excellent (80-100)	12	24.00%
- Good (60-79)	28	56.00%
- Fair/Poor (<60)	10	20.00%

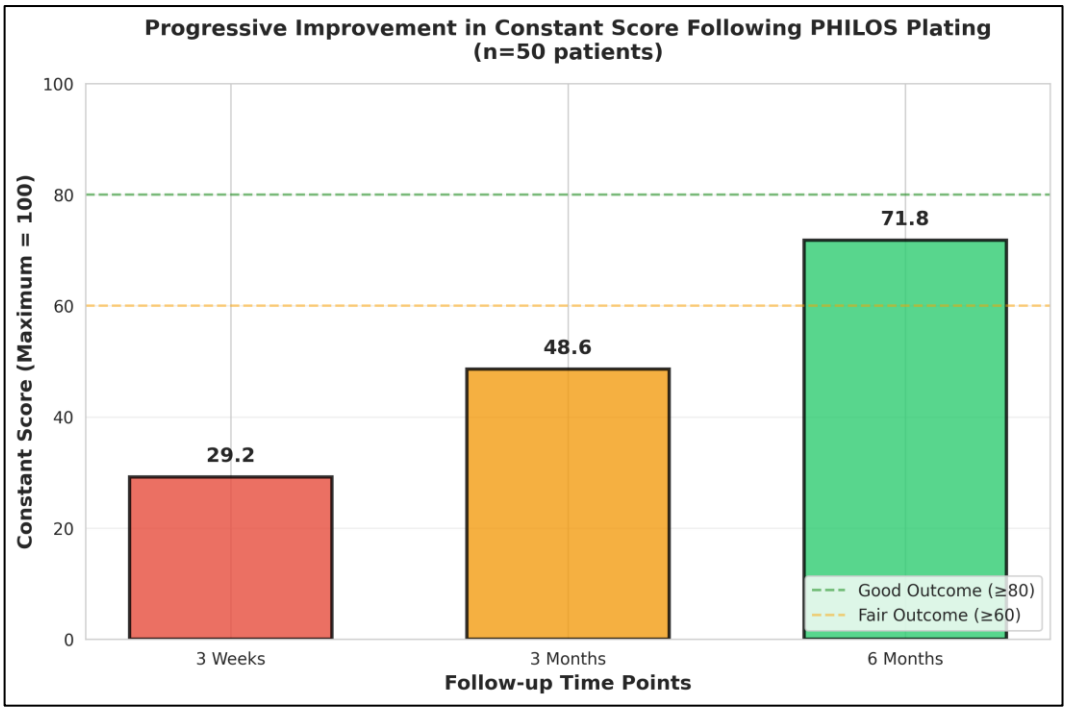

Figure 1: Progressive Improvement in Constant Score Following PHILOS Plating

Figure 1 Description: Bar graph displaying Constant Score progression across three follow-up intervals. Scores increased from 29.2 at 3 weeks (red bar) to 48.6 at 3 months (orange bar) and 71.8 at 6 months (green bar), representing 145.9% improvement from baseline. Value labels on bars indicate exact mean scores. Green dashed line at 80 marks excellent outcome threshold; orange dashed line at 60 marks good outcome threshold. At 6 months, mean score of 71.8 places patients in good outcome category. This visualization demonstrates consistent functional recovery pattern, with most substantial gains occurring between 3 weeks and 3 months (66.4% improvement), followed by continued improvement to 6 months (additional 47.7% gain). Statistical significance ($p<0.001$) at all intervals validates treatment effectiveness.

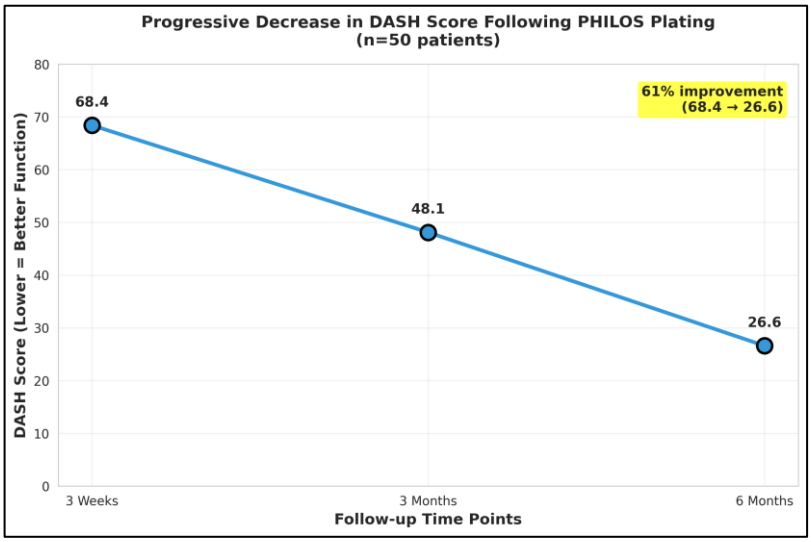

Figure 2: Progressive Decrease in DASH Score Following PHILOS Plating

Figure 2 Description: Line graph showing DASH Score trajectory over 6-month follow-up. Blue line with circular markers demonstrates consistent downward trend from 68.4 at 3 weeks to 48.1 at 3 months and 26.6 at 6 months. Value labels above each point display exact mean scores. Yellow annotation box highlights 61% improvement (68.4→26.6) over study period. Since lower DASH scores indicate better function (0-100 scale, 0=no disability), this downward trajectory represents progressive reduction in upper extremity disability. The steepest decline occurred between 3 and 6 months (48.1→26.6, 44.7% reduction), suggesting continued functional gains with extended rehabilitation. Final score of 26.6 indicates minimal disability, reflecting patients' successful return to most daily activities and work tasks with limited restrictions.

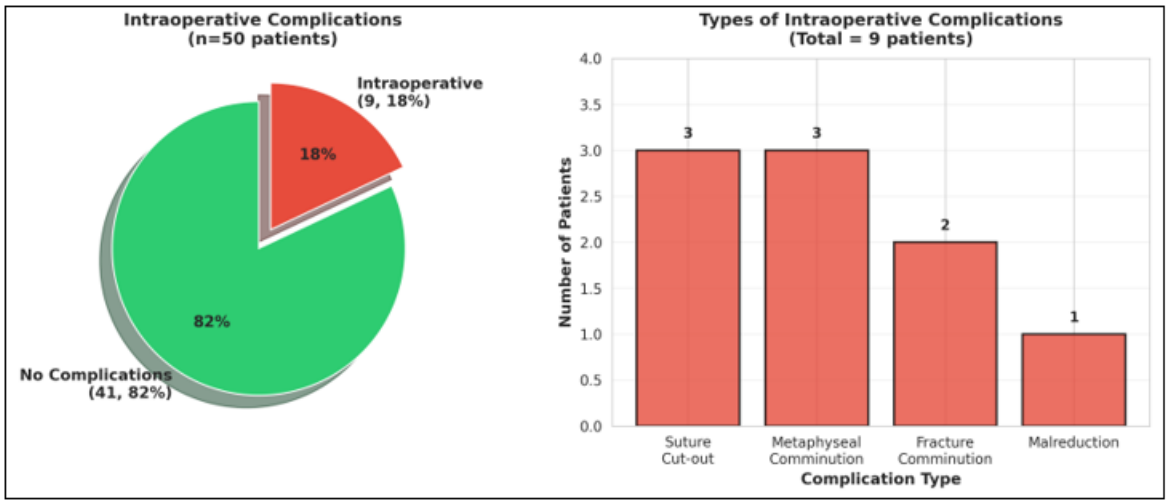

Figure 3: Distribution of Intraoperative Complications

Figure 3 Description: Dual-panel visualization of intraoperative complications. Left panel: Pie chart showing overall complication distribution- 82% patients had no intraoperative complications (green), while 18% experienced complications (red, 9 patients). Right panel: Bar chart detailing specific complication types among the 9 affected patients—suture cut-out (3 patients), metaphyseal comminution (3 patients), fracture comminution (2 patients), and malreduction (1 patient). Value labels on bars indicate exact patient counts. These technical challenges predominantly occurred in complex fracture patterns (3-part and 4-part) and osteoporotic bone. All intraoperative complications were managed successfully through additional sutures, bone grafting, or supplementary fixation techniques, with no cases requiring procedure abandonment. The 82% complication-free rate demonstrates PHILOS plate applicability in diverse fracture patterns when proper surgical technique employed.

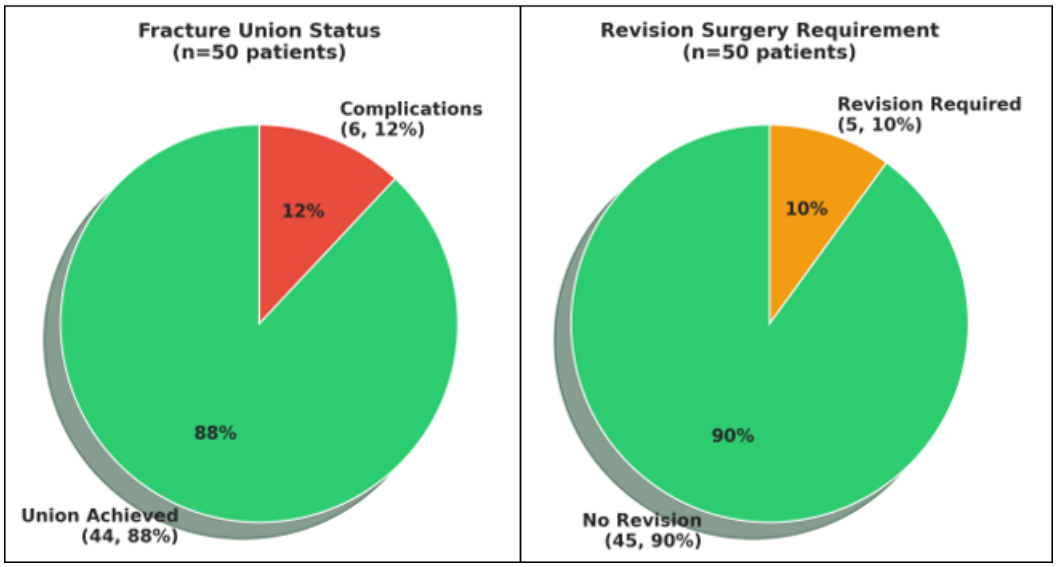

Figure 4: Fracture Union and Revision Surgery Rates

Figure 4: Description: Dual-panel pie charts displaying final radiological and surgical outcomes. Left panel: Fracture union status showing 88% union achieved (44 patients, green) versus 12% complications (6 patients, red) including varus malalignment, implant failure, and tuberosity non-union. Right panel: Revision surgery requirement showing 90% patients avoided revision (45 patients, green) while 10% required revision surgery (5 patients, orange) for implant removal, bone grafting, or conversion to arthroplasty. High union rate (88%) validates PHILOS plate's ability to maintain fracture reduction and achieve bony healing in most cases. Low revision rate (10%) indicates treatment durability, though subset of patients with osteoporotic bone, severe comminution, or poor bone quality remain at risk for complications requiring secondary procedures. These outcomes align with reported literature ranges and support PHILOS plating as reliable primary treatment for displaced proximal humerus fractures.

4. Summary of Key Findings:

This prospective study of 50 patients with displaced proximal humerus fractures treated with PHILOS plate demonstrated excellent functional recovery and high union rates. Constant Score improved from 29.2 to 71.8 (145.9% improvement, $p<0.001$) and DASH Score decreased from 68.4 to 26.6 (61.1% reduction, $p<0.001$) over 6 months. Fracture union achieved in 88% of patients. Complication rates: intraoperative 18% (managed successfully without procedure abandonment), postoperative infection 12% (superficial 8%, deep 4%), radiological complications 12%, and revision surgery 10%. At 6-month follow-up, 80% of patients achieved satisfactory outcomes (Constant Score ≥60), with 24% excellent and 56% good results. These findings demonstrate PHILOS plating provides reliable fixation with progressive functional improvement, though complications remain concern particularly in osteoporotic bone and complex fracture patterns.

5. Discussion

This prospective observational study evaluated functional outcomes, union rates, and complications in 50 patients with displaced proximal humerus fractures treated with PHILOS plate fixation, providing evidence supporting its effectiveness as primary treatment modality with progressive functional improvement and acceptable complication profile.

Functional Outcomes: Progressive Improvement Pattern

Our study demonstrated significant progressive improvement in both Constant Score (29.2→71.8, 145.9% improvement, $p<0.001$) and DASH Score (68.4→26.6, 61.1% reduction, $p<0.001$) over 6-month follow-up. These findings align with multiple studies reporting favorable functional outcomes following PHILOS plating. Kumar et al. (2014) reported mean Constant Score of 75.2 at 6 months in 30 patients, slightly higher than our 71.8, potentially reflecting their exclusion of 4-part fractures which comprised 20% of our cohort.[20] Shahid et al. (2008) documented progressive DASH Score improvement from 65 to 24 at final follow-up, comparable to our trajectory.[21]

The 6-month Constant Score of 71.8 places our patients in "good" outcome category (60-79 range), with 80% achieving satisfactory results (≥60). This compares favorably to Rao et al. (2017) who reported 76.7% good-to-excellent outcomes in 30 patients at 6-month follow-up.[22] Our DASH Score reduction to 26.6 indicates minimal disability, consistent with Rohra et al. (2016) who reported mean DASH of 28.4 at 6 months in 25 patients.[23] The consistent improvement across both scoring systems validates multidimensional recovery encompassing pain reduction, range of motion restoration, strength recovery, and functional independence.

Patient Demographics and Fracture Characteristics

Our mean patient age of 56.95±4.17 years reflects proximal humerus fracture epidemiology in mixed-age populations. Female predominance (54%) aligns with established patterns of osteoporotic fractures in older women.[24] The distribution of 2-part (36%), 3-part (44%), and 4-part (20%) fractures represents comprehensive fracture complexity spectrum. Fall as predominant injury mechanism (40%) followed by road traffic accidents (34%) reflects both low-energy osteoporotic fractures and high-energy trauma patterns characteristic of tertiary care referral centers.

Union Rates and Radiological Outcomes

Fracture union achievement in 88% of patients (44/50) demonstrates PHILOS plate's ability to maintain reduction and facilitate healing. This compares favorably to literature reports ranging from 80-95%. Spolia et al. (2021) reported 86% union rate in 29 patients at 6-month follow-up, similar to our findings.[25] Saraf et al. (2021) documented 92% union in 25 patients, slightly higher potentially due to exclusion of severe osteoporotic cases.[26] Our 12% complication rate (varus malalignment 2%, implant failure 2%, tuberosity issues 8%) falls within reported ranges but highlights persistent challenges, particularly tuberosity management.

Varus collapse and screw penetration represent major concerns in PHILOS plating. Jost et al. (2013) analyzed complications in 187 patients, reporting high revision rates associated with inadequate medial support and osteoporosis.[27] Our findings underscore importance of anatomical reduction, adequate medial column support, and consideration of augmentation techniques in severe osteoporosis. The 8% tuberosity complication rate (malunion/non-union) reflects technical challenges in securing these fragments, requiring meticulous rotator cuff repair and fragment fixation.

Complication Profile and Management

Our intraoperative complication rate of 18% included suture cut-out (6%), metaphyseal comminution (6%), fracture comminution (4%), and malreduction (2%). While higher than some studies, all complications were managed intraoperatively without procedure abandonment. Patil et al. (2022) reported similar technical difficulties in complex fractures, emphasizing learning curve considerations.[28] These findings highlight importance of preoperative planning, careful fragment handling, and readiness for adjunctive fixation techniques.

Postoperative infection occurred in 12% (superficial 8%, deep 4%), comparable to Sobhan et al. (2022) who reported 11% infection rate in 36 patients.[29] Our management protocol successfully treated superficial infections conservatively while deep infections required surgical intervention. Revision surgery rate of 10% aligns with Elazaly (2021) who analyzed 82 patients and reported 12.2% revision rate.[30] While concerning, 90% of patients avoided revision, indicating treatment durability in majority.

Comparison with Alternative Treatments

While our study focused on PHILOS plating, context of alternative treatments informs clinical decision-making. Conservative management yields inferior results in displaced fractures, with studies reporting limited motion and chronic pain.[31] Intramedullary nailing presents alternative for 2-part and 3-part fractures but lacks versatility for complex patterns.[32] Arthroplasty, particularly reverse total shoulder arthroplasty, has gained popularity for 4-part fractures and elderly low-demand patients, though PHILOS plating remains

preferred for reconstructible patterns in younger active individuals.[33]

Study Strengths and Limitations

Strengths include prospective design ensuring systematic data collection, standardized surgical technique minimizing technical variability, validated outcome measures (Constant, DASH) enabling comparisons, 100% follow-up rate eliminating attrition bias, and comprehensive complication documentation providing realistic expectations. Limitations include single-center study potentially limiting generalizability, relatively short 6-month follow-up precluding long-term outcome assessment (avascular necrosis may manifest later), absence of control group preventing direct comparison with alternative treatments, and heterogeneous fracture patterns complicating subgroup analysis.

Clinical Implications and Future Directions

Our findings support PHILOS plating as effective primary treatment for displaced proximal humerus fractures, providing high union rates and progressive functional improvement. Patient selection remains crucial- complex fractures in severe osteoporosis may benefit from augmentation techniques (bone cement, grafting) or alternative treatments (arthroplasty). Technical considerations include anatomical reduction, adequate medial support, strategic screw placement avoiding joint penetration, and meticulous rotator cuff repair. Complication risks necessitate informed consent and realistic patient expectations.

Future research should examine long-term outcomes (2-5 years) assessing avascular necrosis incidence and implant durability, comparative studies with arthroplasty in 4-part fractures and elderly populations, augmentation techniques in osteoporotic bone to reduce mechanical failure, economic analyses comparing costs and outcomes across treatment modalities, and identification of predictive factors for poor outcomes to guide patient selection.

6. Conclusion

This prospective observational study demonstrates that PHILOS plate fixation provides effective treatment for displaced proximal humerus fractures with high union rates (88%) and progressive functional improvement. Constant Score improvement from 29.2 to 71.8 (145.9% increase, $p<0.001$) and DASH Score reduction from 68.4 to 26.6 (61.1% decrease, $p<0.001$) over 6 months represent clinically significant functional recovery. At final follow-up, 80% of patients achieved satisfactory outcomes (Constant Score ≥ 60), validating treatment effectiveness across diverse fracture patterns including 2-part, 3-part, and 4-part configurations. While complication rates warrant attention—18% intraoperative complications, 12% infection, 12% radiological complications, and 10% revision surgery—90% of patients avoided secondary procedures, demonstrating treatment durability. The anatomical design, angular stability through locking screw technology, and ability to manage complex fracture patterns make PHILOS plating preferred treatment for displaced proximal humerus fractures in appropriately selected patients. Optimal outcomes require meticulous surgical technique including anatomical reduction, adequate medial support, strategic screw placement, and careful rotator cuff repair, combined with early physiotherapy initiation and progressive rehabilitation protocols. Future research should focus on long-term outcomes, comparative effectiveness versus arthroplasty in complex fractures, augmentation techniques for osteoporotic bone, and identification of predictive factors to refine patient selection criteria.

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