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Patient-Reported Upper Limb Disability After Non-Operative Treatment of Displaced Two-Part Proximal Humerus Fractures in Adults Above 40 Years: A One-Year Prospective Evaluation Using the DASH Score.

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Abstract

Background: Displaced two-part surgical neck fractures of the proximal humerus are increasingly treated surgically despite randomised evidence showing equivalent patient-reported outcomes with non-operative care. Patient-reported outcome measures such as the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire capture the disability that matters most to patients. This study evaluated the injury profile and one-year patient-reported disability following conservative treatment of these fractures. ***Methods:*** In this prospective, descriptive, hospital-based study conducted at a tertiary teaching hospital in Bengaluru between 2022 and 2024, 24 consecutive patients above 40 years of age with displaced two-part surgical neck fractures (Neer classification) were treated with two weeks of sling immobilisation, early pendulum exercises and graduated physiotherapy. The DASH score was recorded at 3, 6 and 12 months, with the Constant–Murley Score (CMS) as a corroborative measure. ***Results:*** A low-energy fall from a surface was the commonest mechanism of injury (58.33%), the right side was involved in 66.67% of cases, and 91.67% of patients had no associated injuries. The mean DASH score declined progressively from 38.83 ± 3.28 at 3 months to 34.08 ± 2.75 at 6 months and 31.74 ± 2.54 at 12 months. All patients assessed at 6 months reported only mild disability, which was maintained in 95.83% at one year. Twenty-three of 24 patients (95.8%) completed follow-up and no complications occurred. ***Conclusion:*** Conservative treatment of displaced two-part surgical neck fractures of the proximal humerus in adults above 40 years leads to consistently declining upper limb disability, with almost all patients reporting only mild residual disability at one year.

Keywords: Proximal humerus fracture; DASH score; Patient-reported outcome; Non-operative treatment.

INTRODUCTION

Proximal humerus fractures (PHFs) constitute approximately 4–6% of all fractures in adults and are strongly associated with osteoporosis, occurring predominantly in women over 60 years of age.1-3 They rank as the third most frequent fragility fracture after those of the hip and distal radius,4,5 and their incidence is projected to rise steeply as populations age. The typical injury is a low-energy fall onto the outstretched hand in an older adult with compromised bone quality, although higher-energy mechanisms such as road traffic accidents contribute an important minority of cases, particularly in relatively younger patients.2,6

Although up to 85% of PHFs are undisplaced or minimally displaced and are managed without surgery,7 treatment of the displaced two-part fracture of the surgical neck remains contentious. Registry data from several countries document a marked increase in operative treatment over the past two decades, attributable to the availability of locking plates, intramedullary nails and reverse shoulder arthroplasty rather than to any demonstrated improvement in outcomes.7-9 Indeed, the landmark PROFHER randomised trial, in which most participants had displaced two- or three-part fractures involving the surgical neck, found no significant difference in patient-reported outcomes between surgical and non-surgical treatment over two years, findings that persisted at five-year follow-up.10 Comparative studies and meta-analyses have reached similar conclusions, while highlighting the additional burden of implant-related complications and reoperation after surgery.11-13

In this context, how outcome is measured assumes central importance. Traditional clinician-derived instruments may not reflect the difficulties patients actually experience in daily life. The Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire is a validated, region-specific patient-reported outcome measure that quantifies symptoms and physical

function of the entire upper limb on a 0–100 scale, with lower scores denoting less disability; it is well suited to tracking recovery after shoulder trauma from the patient's own perspective.14 The Constant–Murley Score (CMS), combining subjective and objective domains, provides a complementary clinician-based assessment.15

For the older adult, the ideal outcome after a PHF is a pain-free shoulder with a range of motion adequate for individual functional demands, achieved with the least possible risk.7,16 Conservative management — brief sling immobilisation followed by early, structured rehabilitation — offers precisely this profile, provided that residual disability is acceptable. However, prospective data describing the trajectory of patient-reported disability after non-operative treatment of displaced two-part surgical neck fractures remain relatively sparse, particularly from the Indian subcontinent. The present study was therefore designed to describe the demographic and injury profile of adults above 40 years of age with displaced two-part surgical neck PHFs treated conservatively at a tertiary teaching hospital, and to prospectively evaluate their patient-reported upper limb disability over one year using the DASH score, corroborated by the CMS.

MATERIALS AND METHODS

This prospective, descriptive study was conducted in the Department of Orthopaedics of a tertiary teaching hospital (Vydehi Institute of Medical Sciences and Research Centre, Bengaluru) over 18 months between 2022 and 2024. The study protocol received institutional ethical committee approval, and written informed consent was obtained from all participants. A minimum of 24 patients was enrolled by convenience sampling, and data were captured in a structured, pre-designed proforma.

Patients above 40 years of age presenting with an acute, displaced two-part fracture of the proximal humerus involving the surgical neck according to the Neer classification17 were eligible. Exclusion criteria were two-part fractures of the greater or lesser tuberosity, age below 40 years, and unwillingness to participate. Each patient underwent a detailed clinical history, including the mechanism of injury, and a comprehensive examination of the skeletal system and soft tissues, with documentation of the side of injury, neurovascular status and any associated skeletal injuries. Anteroposterior and, where possible, axillary radiographs of the shoulder were obtained and fractures classified accordingly.

All fractures were managed non-operatively according to a uniform protocol. The limb was supported in a collar-and-cuff sling or shoulder immobiliser for two weeks with adequate analgesia. Pendulum exercises were begun promptly, active mobilisation of the elbow, wrist and fingers was encouraged from the outset, and patients were advised to use the injured limb for light daily activities.

From the end of the second week, graduated active range-of-motion exercises of the shoulder were instituted under physiotherapist supervision, and attendance at physiotherapy sessions was verified at each review.

Follow-up assessments were performed at 3, 6 and 12 months after injury. The primary outcome was the DASH score,14 a 30-item self-administered questionnaire scored from 0 (no disability) to 100 (most severe disability); scores were additionally categorised as mild, moderate or severe disability for descriptive analysis. The CMS15 was recorded at the same intervals as a corroborative clinician-assessed measure. Complications, including secondary displacement, non-union, avascular necrosis and stiffness, were specifically sought at each visit.

Data were compiled in a master chart in Microsoft Excel and analysed with SPSS version 27.0 (SPSS Inc., Chicago, IL, USA) and GraphPad Prism version 5. Continuous variables were expressed as mean ± standard deviation and categorical variables as frequencies and percentages. Paired and unpaired t-tests were used for comparison of means, and the Z-test of proportions and chi-square test for categorical comparisons. Statistical significance was set at $p \leq 0.05$.

RESULTS

Twenty-four patients (10 males, 14 females; mean age 54.56 years) were enrolled, and 23 (95.8%) completed the entire follow-up schedule; one patient was lost to follow-up between the 6- and 12-month visits.

The injury characteristics of the cohort are presented in Table 1. A simple fall from a surface was the predominant mechanism of injury, accounting for 58.33% of cases, while road traffic accidents were responsible for the remaining 41.67%.

The right side was involved twice as often as the left (66.67% versus 33.33%). Associated skeletal injuries were uncommon: a single lateral malleolar fracture and a single metatarsal fracture were recorded, and 91.67% of patients had an isolated proximal humerus fracture.

Table 1. Injury characteristics of the study population (n = 24)

Variable	Category	Frequency (n)	Percentage (%)
Mechanism of injury	Fall from surface	14	58.33
	Road traffic accident	10	41.67
Side involved	Right	16	66.67
	Left	8	33.33
Associated injury	None	22	91.67
	Lateral malleolus fracture	1	4.17
	Metatarsal fracture	1	4.17

The categorical distribution of DASH scores over the follow-up period is shown in Table 2. At 3 months, two-thirds of patients (66.67%) reported only mild disability while one-third (33.33%) reported moderate disability ($p < 0.01$). By 6 months, every patient had improved into the mild disability category (100%), and at 12 months, 23 of 24 patients (95.83%) continued to report mild disability, the sole exception being the patient lost to follow-up. No patient reported severe disability at any time point.

Table 2. Distribution of DASH disability categories at 3, 6 and 12 months

DASH category	3 months, n (%)	6 months, n (%)	12 months, n (%)
Mild disability	16 (66.67)	24 (100)	23 (95.83)
Moderate disability	8 (33.33)	0 (0.00)	0 (0.00)
Lost to follow-up	0 (0.00)	0 (0.00)	1 (4.17)
Total	24 (100)	24 (100)	24 (100)

The serial mean DASH scores are summarised in Table 3. Mean disability declined steadily from 38.83 ± 3.28 at 3 months to 34.08 ± 2.75 at 6 months and 31.74 ± 2.54 at 12 months. The reduction was greatest between 3 and 6 months, with a smaller further gain between 6 and 12 months, indicating that most patient-perceived recovery occurred in the first half-year after injury. This trajectory was corroborated by the clinician-assessed CMS, which rose in parallel from 51.83 ± 5.85 at 3 months to 59.29 ± 5.17 at 6 months and 65.26 ± 4.88 at 12 months. No fracture-related complications occurred during the study, and 83.33% of patients expressed satisfaction with their outcome at final review.

Table 3. Mean DASH scores at serial follow-up intervals

Follow-up interval	Mean DASH score	Standard deviation
3 months	38.83	3.28
6 months	34.08	2.75
12 months	31.74	2.54

DISCUSSION

This prospective series demonstrates that, from the patient's own perspective, conservative treatment of displaced two-part surgical neck fractures of the proximal humerus in adults above 40 years produces a consistently improving functional trajectory: mean DASH scores fell by more than seven points over the year, every patient assessed at 6 months reported only mild disability, and this was maintained at one year without a single complication.

The demographic and injury profile of our cohort accords with the established epidemiology of PHFs. The female preponderance and the dominance of low-energy falls reflect the fragility fracture character of this injury described in large epidemiological surveys,1,2,4 while the substantial minority of road-traffic-related fractures is consistent with the bimodal mechanism distribution reported in mixed-age populations.6 The rarity of associated injuries in our series supports the view that the displaced two-part surgical neck fracture in this age group is usually an isolated fragility injury amenable to protocol-based outpatient rehabilitation.

Our patient-reported findings align closely with the comparative literature. Hauschild et al., in a prospective multicentre study of two-part surgical neck fractures, found no meaningful difference between conservative and operative treatment at 12 months, surgery conferring at most earlier comfort and motion in the first three months.11 Urda et al. reported that three different operative strategies for displaced surgical neck fractures achieved health-related quality of life and functional results no better than conservative benchmarks.12 The PROFHER trial, the largest randomised comparison in this fracture population, showed equivalent patient-reported outcomes for surgical and non-surgical care at two and five years.10 Within non-operative care itself, Bonifacio et al. observed that both DASH and Constant scores improved continuously after conservative treatment of displaced two-part humeral neck fractures, with the largest gains concentrated in the first six

months — precisely the pattern seen in our data — emphasising that early rehabilitation exploits the principal window of recovery.13

The design of our rehabilitation protocol is supported by trial evidence. Lefevre-Colau et al. demonstrated in a randomised controlled trial that early mobilisation of non-operatively treated proximal humeral fractures is safe and accelerates functional recovery compared with conventional prolonged immobilisation,18 and current concept reviews recommend limiting immobilisation to two to three weeks with prompt physiotherapy thereafter.7,16 Spross et al. achieved 97% satisfactory outcomes applying conservative treatment within an evidence-based algorithm, with only 3% of patients requiring unplanned surgery,19 while Foruria et al. showed that fracture pattern and initial displacement, rather than the decision to operate, are the principal determinants of outcome.20

This study has limitations. The sample was small, drawn from a single centre by convenience sampling, and lacked a surgical comparator, so the findings describe rather than compare treatment effects. DASH categorisation may also mask individual variation at the extremes. Nonetheless, the prospective design, uniform protocol, validated patient-reported instrument and 95.8% follow-up completion lend credibility to the observed trajectory of recovery.

CONCLUSION

In adults above 40 years of age, displaced two-part surgical neck fractures of the proximal humerus — most often the result of a low-energy fall — can be treated conservatively with a short period of immobilisation and early, supervised rehabilitation, producing a steadily declining DASH score over one year. Almost all patients report only mild residual upper limb disability at final follow-up, with no complications, supporting non-operative management as a safe, patient-acceptable first-line strategy for this injury.

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