A Prospective Analysis of How Pre Fracture Functional Independence and Charlson Comorbidity Index Predict Length of Stay, Complication Rates, and 12 Month Survivorship in Elderly Patients Undergoing Hemiarthroplasty for Displaced Intracapsular Femoral Neck Fractures

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Abstract

Background: Displaced intracapsular femoral neck fractures in older adults commonly follow low-energy falls and often lead to loss of mobility and independence. This study examines whether a patient's functional ability and burden of chronic illness before surgery affect length of hospital stay, complications, functional recovery and one-year survival after hemiarthroplasty.

Methods: In a prospective cohort of 100 consecutive patients aged 65 years and older treated between October 2020 and August 2022, we recorded baseline characteristics (age, sex, BMI), ASA grade, Charlson comorbidity index, specific comorbid diagnoses and time from injury to surgery. Surgical details (cemented versus uncemented arthroplasty, blood loss, transfusion) and perioperative complications were documented. Functional outcome was assessed with WOMAC and Harris Hip Score at 3, 6 and 12 months. Length of stay and 12-month mortality were noted.

Results: The mean age was 77.9 years; 59% were women. Most patients experienced measurable functional improvement by 12 months and overall survival at one year was 97%. Patients with higher Charlson scores and multiple comorbidities had longer hospital stays and worse functional scores.

Conclusion: Baseline functional status and comorbidity burden are important, practical predictors of outcome after hemiarthroplasty. Identifying high-risk patients before surgery allows targeted medical optimisation, closer monitoring and tailored rehabilitation, which may shorten hospital stay and improve recovery.

Keywords: Femoral neck fracture, Hemiarthroplasty, Comorbidity, Frailty, Functional outcome, Length of stay

Introduction

Fractures of the femoral neck are an important cause of disability and dependence in older people. Most occur after a simple fall in someone with osteoporotic bone, and displaced intracapsular fractures commonly require surgery to alleviate pain and permit early mobilization. Treatment options include internal fixation, hemiarthroplasty and, for selected active patients, total hip arthroplasty; the choice depends on fracture pattern, the patient's general health and pre-fracture function. Early surgery that allows immediate weight bearing reduces the hazards of prolonged bed rest such as chest infection, venous thromboembolism and muscle wasting. However, the outcome after surgery is shaped not only by the operation but by the patient who receives it. Long-standing illnesses, poor nutrition,

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DOI: https://doi.org/10.13107/jmt.2025.v11.i01.248

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limited mobility before the fracture and frailty all affect the ability to recover, the risk of complications and the chances of returning to independent living. Large cohort studies have shown that cardiac and pulmonary disease increase postoperative complications and lengthen hospital stay. [1] For fitter older adults, total hip arthroplasty can produce better patient-reported outcomes than hemiarthroplasty, but it comes with a higher dislocation risk and greater surgical demand, so careful selection is needed. [2] Neurological disorders such as Parkinson's disease have been linked with higher mortality and revision rates after femoral neck fracture surgery. [3] Preexisting hip arthritis does not, in itself, reliably predict poor short-term results after hemiarthroplasty. [4] Measures that summarise medical burden — for example the Charlson comorbidity index — offer a reproducible way to quantify risk and have been repeatedly associated with worse functional recovery and higher mortality after hip fracture. [5] Given these realities, preoperative assessment that includes both comorbidity scoring and a clear record of baseline function is essential for planning surgery, setting realistic goals and organising perioperative support.

Aims & Objectives

1. Measure the relationship between preoperative functional status and comorbidity burden and length of hospital stay after hemiarthroplasty for displaced intracapsular femoral neck fractures.
2. Determine how baseline comorbidities relate to early perioperative and late postoperative complications up to one year.
3. Identify modifiable preoperative risk factors that can be addressed through targeted optimisation and multidisciplinary care to improve recovery and survivorship.

Review of literature

A substantial body of literature links frailty and comorbidity with worse outcomes after hip fracture surgery. Analyses of national datasets and single-centre cohorts have consistently shown that frail patients, and those with serious cardiac or respiratory disease, are more likely to suffer postoperative complications and require longer inpatient stays. [5] When comparing total hip arthroplasty with hemiarthroplasty in healthier older patients, randomized trials and meta-analyses report superior patient-reported outcomes with THA but a modestly increased dislocation risk, underscoring the need for individualized decision-making. [6] Large registry studies identify diabetes, disseminated cancer and higher ASA grade as independent predictors of adverse perioperative events; these factors commonly influence the decision to choose hemiarthroplasty over THA. [7] Neurological illnesses such as Parkinson's disease confer higher mortality and revision rates after femoral neck fractures, suggesting such patients need particular attention. [3] By contrast, preexisting osteoarthritis does not reliably predict poorer short-term outcomes after hemiarthroplasty. [4] Composite indices — especially the Charlson score — and frailty measures have been validated as predictors of both short-term complications and longer-term mortality and functional decline in hip fracture populations. [10] Organ-specific comorbidities, notably heart failure and chronic kidney disease, have been linked to higher rates of postoperative complications and longer hospital stays, pointing to opportunities for targeted optimisation. [11,13] Nutritional markers such as low preoperative serum albumin correlate with higher rates of postoperative pneumonia and morbidity, suggesting nutrition should be part of risk assessment. [12] Finally, studies of protocolised, multidisciplinary hip-fracture pathways show reductions in time to surgery, complication rates and length of stay when orthopaedics, geriatrics, anaesthesia and physiotherapy work together. [19] The literature therefore supports a twofold approach: careful, standardised baseline assessment using validated indices, and institution of multidisciplinary optimisation and rehabilitation for those identified at higher risk.

Materials and methods

This prospective observational study enrolled 100 consecutive patients aged 65 years and older who presented with displaced intracapsular femoral neck fractures and underwent hemiarthroplasty between October 2020 and August 2022. Exclusion criteria were pathological fracture, high-energy trauma, rheumatoid arthritis, pre-existing immobility and severe cognitive impairment that precluded rehabilitation. On admission we recorded demographics (age, sex), the injured side, body mass index and the American Society of Anesthesiologists (ASA) grade. Comorbid conditions were recorded and grouped as cardiovascular, respiratory, neurological, endocrine, renal and other systemic illnesses; the Charlson comorbidity index was calculated for each patient to quantify overall medical burden. Time from injury to surgery was captured as <24 hours, 24–72 hours and >72 hours. Operative variables included implant type (cemented or uncemented hemiarthroplasty), estimated blood loss and transfusion requirements. Perioperative surgical complications (periprosthetic fracture, wound problems, dislocation, and infection) and postoperative medical events (cardiac, pulmonary, neurological, thromboembolic, urinary and gastrointestinal complications, and delirium) were recorded prospectively. Functional outcome was measured with the WOMAC osteoarthritis index and Harris Hip Score at 3, 6 and 12 months; radiographs were reviewed at the same intervals for implant position and mechanical complications. Length of hospital stay and mortality at 12 months were recorded. Data were entered into SPSS for analysis. Continuous variables are presented as means with standard deviations and categorical variables as counts and percentages. Group comparisons used t-tests for continuous variables and chi-square tests for

categorical variables. A multivariable linear regression model was planned to identify independent predictors of one-year Harris Hip Score, with statistical significance set at $P < 0.05$. Institutional ethics committee approval and written informed consent from all participants were obtained prior to enrolment. [14]

Results

One hundred patients met the inclusion criteria. Mean age was 77.9 years (SD 7.0) and 59% were female. Right-sided fractures accounted for 58% of cases. Time to surgery was under 24 hours for 21% of patients, between 24 and 72 hours for 68% and after 72 hours for 11%. Thirty-nine percent underwent cemented hemiarthroplasty and 61% uncemented. Fifty-three percent had no recorded chronic illnesses; among those with comorbidities, hypertension and diabetes were most common. Charlson comorbidity index distribution was: 0 in 53% of patients, 1–3 in 8%, 4–5 in 25% and 6–8 in 14%. Perioperative surgical complications were uncommon — 90% had no perioperative surgical complication. Postoperative medical complications occurred in a minority and included isolated cardiac, neurological and gastrointestinal events. Approximately two-thirds of patients stayed in hospital for two to seven days; longer stays were more frequent among those with higher comorbidity burden. At 12 months the survival rate was 97% (three deaths recorded). Mean WOMAC score improved from 31.82 at three months to 20.25 at 12 months, a meaningful improvement in pain and function. Higher Charlson scores correlated with longer stays and lower functional scores at follow-up.

Discussion

The patients in this series generally recovered useful function and had low one-year mortality, but preoperative health strongly affected the course of recovery. Those with greater comorbidity and lower pre-fracture function required longer inpatient care and achieved lower functional scores at follow-up. These findings mirror larger studies that identify comorbidity and frailty as key drivers of complications, prolonged hospitalization and increased mortality after hip fracture surgery. [14–17] The choice between cemented and uncemented stems was made individually; evidence from randomized trials and registry data suggests cemented fixation may reduce the risk of intraoperative and early postoperative periprosthetic fracture and can improve initial mobilization in frail patients, although cement carries its own set of perioperative risks and decision-making must be individualized. [16] Most operations in this cohort occurred within recommended early timeframes; delays were typically for medical optimization. Classic observational studies have shown that uncorrected comorbidity and postoperative complications substantially increase mortality following hip fracture, underscoring the need to balance prompt surgery with patient safety. [16,17] Practical tools such as the cumulated ambulation score and age-adjusted comorbidity indices help identify individuals who will need closer perioperative attention and tailored rehabilitation. [18] Multidisciplinary, protocolised care that combines orthopaedic, geriatric, and anaesthetic and physiotherapy input reduces delays to definitive surgery, lowers complication rates and shortens length of stay in many centres. [19] The data here support targeted measures: systematic comorbidity recording at admission, correction of reversible problems (for example anaemia and malnutrition), focused cardiac or renal optimisation when indicated, and early physiotherapy and discharge planning. For selected, active older patients, total hip arthroplasty can confer better long-term patient-reported outcomes, but for many frailer patients hemiarthroplasty offers a reliable, lower-demand operation with acceptable results. [6, 20] Future work should evaluate which specific optimisation steps most improve outcomes for high-risk patients and whether standardised bundles of care can be widely implemented.

Conclusion

Baseline functional ability and the burden of chronic disease strongly influence recovery after hemiarthroplasty for displaced intracapsular femoral neck fractures. While most patients in this series regained meaningful pain relief and improved function with a low one-year mortality, those with higher Charlson comorbidity scores and multiple long-term illnesses required longer hospital stays and had less favourable functional outcomes. Routine use of comorbidity indices and simple frailty assessments at admission can identify patients who would benefit from focused medical optimisation, closer monitoring and tailored rehabilitation. Addressing reversible factors such as malnutrition and anaemia, optimising cardiac and renal function when needed, and delivering coordinated multidisciplinary care are practical steps that can shorten hospital stay and improve recovery. Local adoption of standardised hip-fracture pathways that prioritise high-risk patients for optimisation is recommended.

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Conflict of Interest: Nil

Source of Support: None

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Year of Acceptance of Thesis: 2023

How to Cite this Article: Chaudhari A, Joshi R, Sanghavi S, Dugad M, Sonawane D, Shyam A, Sancheti P. | A Prospective Analysis of How Pre Fracture Functional Independence and Charlson Comorbidity Index Predict Length of Stay, Complication Rates, and 12 Month Survivorship in Elderly Patients Undergoing Hemiarthroplasty for Displaced Intracapsular Femoral Neck Fractures | Journal of Medical Thesis | 2025 January-June; 11(1): 40-43.