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Sarcopenia As A Predictor Of Postoperative Functional Outcome In Elderly Patients With Hip Fracture: A Prospective Observational Study.

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Abstract

Background: Hip fractures are a major cause of morbidity, disability and mortality among older adults. Sarcopenia, characterized by progressive loss of skeletal muscle strength, mass and physical performance, is common in elderly patients and may adversely affect recovery following hip-fracture surgery. Early identification of sarcopenia may therefore help predict postoperative functional outcome and guide rehabilitation. Objectives: To determine the prevalence of sarcopenia among elderly patients undergoing surgery for hip fracture and assess its association with postoperative complications, duration of hospitalization and functional recovery. ***Materials and Methods***: A prospective observational study was conducted among 150 patients aged ≥65 years undergoing surgical treatment for fragility hip fractures at a tertiary-care hospital. Sarcopenia was assessed using clinical parameters based on muscle strength and muscle mass assessment. Handgrip strength was used for evaluation of muscle strength, supplemented by anthropometric assessment where appropriate. Demographic characteristics, fracture type, medical comorbidities, haemoglobin, serum albumin and postoperative complications were recorded. Functional outcome was evaluated using the Modified Harris Hip Score (mHHS) at three and six months. ***Results***: Of 150 patients, 78 (52.0%) fulfilled the study criteria for sarcopenia. Sarcopenic patients were significantly older than non-sarcopenic patients (75.8 ± 7.2 vs. 70.9 ± 6.4 years; p<0.001). They had lower mean serum albumin levels and a higher prevalence of multiple medical comorbidities. Postoperative complications occurred in 32.1% of sarcopenic patients compared with 16.7% of non-sarcopenic patients (p=0.029). Mean six-month mHHS was significantly lower among sarcopenic patients (65.8 ± 13.1) compared with non-sarcopenic patients (76.4 ± 11.7; p<0.001). On multivariable analysis, sarcopenia, age ≥75 years and hypoalbuminaemia were independently associated with poor functional outcome. ***Conclusion***: Sarcopenia was common among elderly patients undergoing surgery for hip fracture and was associated with increased postoperative morbidity and poorer functional recovery. Simple preoperative screening for sarcopenia, combined with medical optimization, nutritional assessment and structured rehabilitation, may help identify high-risk patients and improve multidisciplinary hip-fracture care.

Keywords: Sarcopenia; Hip fracture; Elderly; Functional outcome; Orthopaedics; Handgrip strength; Rehabilitation.

INTRODUCTION

Hip fractures represent one of the most serious musculoskeletal injuries affecting older adults. Increasing age, osteoporosis, falls, frailty, malnutrition and multiple chronic diseases contribute to their occurrence. Despite advances in surgical fixation, arthroplasty, perioperative medicine and rehabilitation, many elderly patients fail to regain their pre-fracture level of mobility and independence.

The prognosis following hip fracture is influenced not only by fracture characteristics and surgical treatment but also by the patient's physiological reserve. Age, pre-fracture mobility, nutritional status, cognitive impairment and comorbid illnesses have all been associated with postoperative recovery.

Sarcopenia has emerged as an important component of geriatric frailty. It is characterized by progressive and generalized loss of skeletal muscle strength and muscle quantity or quality. Reduced muscle strength predisposes elderly individuals to falls, fractures, impaired mobility and loss of independence.

The relationship between sarcopenia and hip fractures is particularly important because the two conditions may reinforce each other. Sarcopenia increases susceptibility to falls and fractures, while hip fracture causes immobilization, inflammation and reduced nutritional intake, potentially accelerating muscle loss.
A 2021 systematic review reported an overall sarcopenia prevalence of approximately 44% among older adults with hip fracture and found that most studies demonstrated poorer postoperative functional recovery in sarcopenic patients. More recent studies have reinforced the importance of muscle strength, nutritional status and rehabilitation in determining functional recovery.

Early identification of sarcopenia during admission may therefore provide useful prognostic information and facilitate targeted nutritional and rehabilitation interventions.

The present study was undertaken to assess the prevalence of sarcopenia among elderly patients with hip fracture and determine its association with postoperative complications and functional recovery.

AIM AND OBJECTIVES

Aim

To evaluate the impact of sarcopenia on postoperative clinical and functional outcomes among elderly patients undergoing surgery for hip fracture.

Objectives

1. To determine the prevalence of sarcopenia among elderly patients with hip fracture.
2. To compare demographic and clinical characteristics between sarcopenic and non-sarcopenic patients.
3. To evaluate the relationship between sarcopenia and postoperative complications.
4. To compare functional recovery at three and six months.
5. To identify independent predictors of poor functional outcome following hip-fracture surgery.

MATERIALS AND METHODS

Study Design

Prospective observational study.

Study Setting

Departments of Orthopaedics and General Medicine, Shri Balaji Institute of Medical Sciences, Raipur, Chhattisgarh, India.

Study Population

Patients aged 65 years or above admitted with fragility fracture of the proximal femur and undergoing surgical management were evaluated.

Sample Size

A total of **150 patients** fulfilling the study eligibility criteria were included.

Inclusion Criteria

- Age ≥65 years.
- Low-energy hip fracture.
- Femoral neck or intertrochanteric fracture.
- Patients undergoing operative treatment.
- Ability to undergo assessment for sarcopenia.
- Written informed consent.

Exclusion Criteria

- High-energy trauma.
- Pathological fracture secondary to malignancy.
- Polytrauma.
- Previous ipsilateral hip surgery.
- Pre-existing severe neuromuscular disorder.
- Terminal illness.
- Patients lost to follow-up.

ASSESSMENT OF SARCOPENIA

Sarcopenia was evaluated through assessment of muscle strength and muscle quantity using available clinical measurements.

Handgrip strength was measured using a hand dynamometer whenever feasible. Measurements were obtained from the unaffected upper extremity, and the best value from repeated attempts was recorded.

Anthropometric assessment, including calf circumference, was additionally performed as a practical screening parameter.

Patients were subsequently classified into:

Group A – Sarcopenia

Group B – No sarcopenia

CLINICAL AND LABORATORY ASSESSMENT

Baseline assessment included:

- Age and sex
- Body mass index
- Pre-fracture mobility
- Fracture type
- Hypertension
- Diabetes mellitus
- Coronary artery disease
- Chronic kidney disease
- Number of medical comorbidities
- Haemoglobin
- Serum albumin
- Serum creatinine
- Serum calcium
- Duration of hospitalization

The General Medicine team evaluated and optimized medical comorbidities during the perioperative period.

SURGICAL MANAGEMENT

Patients underwent appropriate surgical treatment depending upon fracture pattern, age, bone quality and functional requirements.

Procedures included:

- Proximal femoral nail/intertrochanteric fracture fixation
- Hemiarthroplasty
- Total hip arthroplasty
- Other appropriate internal fixation procedures

Postoperative mobilization and rehabilitation were initiated according to clinical condition and fracture stability.

OUTCOME ASSESSMENT

Postoperative complications assessed included:

- Surgical-site infection
- Pneumonia
- Urinary tract infection
- Delirium
- Deep-vein thrombosis
- Cardiovascular complications
- Requirement for prolonged hospitalization

Functional recovery was assessed using the **Modified Harris Hip Score (mHHS)** at three and six months.

The functional outcome was classified as:

- Excellent: ≥90
- Good: 80–89
- Fair: 70–79
- Poor: <70

STATISTICAL ANALYSIS

Continuous variables were expressed as mean ± standard deviation and categorical variables as frequency and percentage. Independent Student's t-test or appropriate non-parametric tests were used for continuous variables. Chi-square or Fisher's exact test was used for categorical variables.

Multivariable logistic regression analysis was performed to identify independent predictors of poor functional outcome. A **p-value <0.05** was considered statistically significant.

RESULTS

A total of 150 patients were evaluated. The mean age was **73.4 ± 7.3 years**. Eighty-six patients (57.3%) were women and 64 (42.7%) were men.

Sarcopenia was identified in **78 patients (52.0%)**.

Table 1. Baseline characteristics

Parameter	Sarcopenia (n=78)	No sarcopenia (n=72)	p-value
Mean age, years	75.8 ± 7.2	70.9 ± 6.4	<0.001
Female	48 (61.5%)	38 (52.8%)	0.28
Hypertension	46 (59.0%)	35 (48.6%)	0.20
Diabetes mellitus	31 (39.7%)	22 (30.6%)	0.24
≥2 comorbidities	38 (48.7%)	22 (30.6%)	0.024
Mean haemoglobin, g/dL	10.6 ± 1.7	11.2 ± 1.6	0.028
Serum albumin, g/dL	3.1 ± 0.5	3.6 ± 0.4	<0.001

Sarcopenic patients were significantly older and had lower serum albumin and haemoglobin levels.

FRACTURE CHARACTERISTICS

Intertrochanteric fracture was the most frequent fracture type in both groups.

Table 2. Distribution of fracture types

Fracture type	Sarcopenia (n=78)	No sarcopenia (n=72)	p-value
Intertrochanteric	49 (62.8%)	39 (54.2%)	0.28
Femoral neck	29 (37.2%)	33 (45.8%)	

No statistically significant relationship was identified between sarcopenia and anatomical fracture type.

POSTOPERATIVE OUTCOMES

Postoperative complications were more frequent among patients with sarcopenia.

Table 3. Postoperative clinical outcomes

Outcome	Sarcopenia	No sarcopenia	p-value
Any postoperative complication	25 (32.1%)	12 (16.7%)	**0.029**
Mean hospital stay, days	9.4 ± 3.2	7.8 ± 2.7	**0.001**
Delayed mobilization	24 (30.8%)	10 (13.9%)	**0.014**
30-day readmission	8 (10.3%)	4 (5.6%)	0.29

Patients with sarcopenia demonstrated a longer mean hospital stay and greater frequency of delayed postoperative mobilization.

FUNCTIONAL OUTCOME

Functional outcome improved between three and six months in both groups. However, recovery remained significantly poorer among patients with sarcopenia.

Table 4. Functional outcomes according to sarcopenia status

Functional parameter	Sarcopenia	No sarcopenia	p-value
mHHS at 3 months	57.9 ± 13.8	69.8 ± 12.4	**<0.001**
mHHS at 6 months	65.8 ± 13.1	76.4 ± 11.7	**<0.001**
Poor outcome at 6 months	35 (44.9%)	14 (19.4%)	**0.001**

At six months, poor functional outcome was observed in 44.9% of sarcopenic patients compared with 19.4% of patients without sarcopenia.

PREDICTORS OF POOR FUNCTIONAL RECOVERY

Multivariable logistic regression analysis was performed after adjustment for age, sex, comorbidities, fracture type, haemoglobin and serum albumin.

Table 5. Independent predictors of poor functional outcome

Variable	Adjusted OR	95% CI	p-value
Sarcopenia	2.71	1.29–5.69	**0.008**
Age ≥75 years	2.18	1.05–4.52	**0.036**
Serum albumin <3.5 g/dL	2.34	1.11–4.93	**0.025**
≥2 medical comorbidities	1.74	0.83–3.66	0.143

Sarcopenia emerged as an independent predictor of poor functional recovery following hip-fracture surgery.

DISCUSSION

The present study demonstrated that sarcopenia was common among elderly patients undergoing surgical management of hip fractures, affecting approximately half of the study population. More importantly, sarcopenia was associated with increased postoperative complications, delayed mobilization, longer hospitalization and significantly poorer functional recovery.

These observations are consistent with contemporary evidence indicating a close relationship between sarcopenia, falls and fragility fractures. Loss of skeletal muscle strength may impair balance and gait stability, increasing the probability of falls. Simultaneously, reduced physical activity following fracture may further accelerate muscle loss, producing a cycle of progressive functional decline.

Chiang et al. systematically evaluated postoperative outcomes among older adults with hip fracture and reported an overall sarcopenia prevalence of approximately 44%. Most included studies indicated poorer postoperative functional recovery among patients with sarcopenia.

The present study found a somewhat higher prevalence of 52%. Differences in population characteristics, age distribution, nutritional status and diagnostic criteria may explain variation between studies.

Sarcopenia was also associated with significantly lower Modified Harris Hip Scores at both three and six months. This finding is biologically plausible because successful rehabilitation following hip-fracture surgery requires adequate muscle strength, balance and endurance.

Evidence from orthopaedic populations similarly suggests that sarcopenia adversely affects postoperative recovery, particularly following emergency procedures. However, considerable heterogeneity remains in the methods used to diagnose sarcopenia.

Nutritional status appears to be closely related to this process. Serum albumin was significantly lower among sarcopenic patients in our study, and hypoalbuminaemia independently predicted poor functional recovery. Elderly hip-fracture patients frequently experience inadequate protein and energy intake, and acute hospitalization may further aggravate nutritional deficits.

The findings emphasize the need to integrate medical assessment into orthopaedic fracture management. Elderly patients commonly have multiple chronic diseases, including hypertension, diabetes, cardiovascular disease, anaemia and renal dysfunction. These conditions may affect surgical fitness, postoperative complications and rehabilitation.

Multidisciplinary orthogeriatric management has received increasing attention. Such models combine early fracture surgery with physician-led optimization of medical problems, prevention and management of delirium, nutritional evaluation, early mobilization and coordinated discharge planning.

The clinical importance of sarcopenia extends beyond hospitalization. Sarcopenic older adults are at increased risk of falls, fractures, disability and mortality. Therefore, identifying sarcopenia at the time of a fragility fracture may provide an opportunity for intervention.

Exercise, particularly progressive resistance training, together with adequate nutritional and protein intake, represents an important component of sarcopenia management. Nevertheless, evidence regarding the optimal nutritional or rehabilitation intervention specifically for sarcopenic hip-fracture patients remains limited, and treatment should be individualized.

CLINICAL IMPLICATIONS

Routine assessment of elderly hip-fracture patients should extend beyond fracture classification and surgical fitness.
A practical multidisciplinary evaluation may include:

- Screening for sarcopenia and frailty

- Assessment of handgrip strength
- Nutritional assessment
- Serum albumin and haemoglobin evaluation
- Optimization of medical comorbidities
- Early postoperative mobilization
- Progressive muscle-strengthening rehabilitation
- Osteoporosis evaluation
- Falls-risk assessment
- Secondary fracture-prevention measures

Simple screening tools may be particularly useful in busy clinical settings where sophisticated muscle-mass measurements are unavailable.

STRENGTHS OF THE STUDY

The study evaluates an increasingly important interaction between medical frailty and orthopaedic outcomes. Prospective assessment and serial functional evaluation at three and six months allow evaluation of recovery rather than limiting analysis to immediate postoperative complications.

The study also emphasizes a multidisciplinary approach involving Orthopaedics and General Medicine.

LIMITATIONS

The study has several limitations. It was conducted at a single tertiary-care institution with a relatively modest sample size. Gold-standard measurement of muscle mass using DXA or advanced imaging was not available for every participant. Baseline pre-fracture functional status, nutritional intake and socioeconomic factors may influence postoperative recovery and could not be completely controlled.

The follow-up period was limited to six months. Longer follow-up is required to evaluate one-year mortality, recurrent falls, subsequent fractures and long-term independence.

CONCLUSION

Sarcopenia is highly prevalent among elderly patients presenting with hip fractures and represents an important predictor of postoperative functional recovery. Patients with sarcopenia experienced more postoperative complications, longer hospitalization, delayed mobilization and significantly poorer functional outcomes.

Early identification of sarcopenia may allow clinicians to recognize high-risk patients before or soon after surgery. Integration of **orthopaedic management with medical optimization, nutritional assessment and structured rehabilitation** should therefore be considered an important component of comprehensive geriatric hip-fracture care.

Further prospective studies using standardized diagnostic criteria for sarcopenia and longer follow-up are warranted to determine whether targeted interventions can improve functional recovery and reduce subsequent fractures.

DECLARATIONS

Ethical Approval:

The study conducted after obtaining approval from the Institutional Ethics Committee.

Funding:

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Conflict of Interest:

none

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Data Availability:

Study data may be made available by the corresponding author upon reasonable request, subject to institutional and ethical requirements.

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