Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/9ds8b468

COMPARATIVE ANALYSIS OF SURGICAL VERSUS CONSERVATIVE MANAGEMENT IN DISPLACED FEMORAL NECK FRACTURES

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Accepted: 05 July 2017 Published: 26 August 2017

Abstract

Introduction: Displaced femoral neck fractures represent challenging orthopedic conditions with significant morbidity and mortality implications. The optimal management approach remains controversial, with ongoing debates between surgical intervention and conservative treatment. This study aimed to compare clinical outcomes, functional recovery, complications, and cost-effectiveness of surgical versus conservative management in patients with displaced femoral neck fractures.

Methods: A prospective comparative study was conducted at Annamalai Medical College and Hospital, Chennai, from January 2017 to June 2017. Two hundred patients with displaced femoral neck fractures (Garden III-IV) were enrolled through consecutive sampling, with 100 patients in each treatment group. The surgical group underwent internal fixation or arthroplasty, while the conservative group received skeletal traction and gradual mobilization. Outcome measures included Harris Hip Score, pain assessment, radiological healing, complications, and cost analysis. Follow-up assessments were conducted at 3, 6, and 12 months post-treatment.

Results: The surgical group demonstrated superior functional outcomes with higher Harris Hip Scores (78.3±14.6 vs 52.4±18.9, $p<0.001$) and better return to pre-fracture mobility (67% vs 18%, $p<0.001$). Mortality was significantly lower in surgical patients at 30 days (4% vs 18%) and one year (8% vs 34%). Fracture union rates were superior with surgical management (78% vs 23%, $p<0.001$), with reduced nonunion (12% vs 67%) and avascular necrosis (15% vs 45%). Conservative patients experienced higher rates of immobilization complications including pneumonia (23% vs 6%) and pressure ulcers (34% vs 3%).

Conclusion: Surgical management of displaced femoral neck fractures demonstrated superior clinical outcomes, reduced complications, and better functional recovery compared to conservative treatment, supporting operative intervention as the preferred approach in appropriate candidates.

Keywords: Displaced femoral neck fractures, surgical management, conservative treatment, hip fractures, clinical outcomes

Introduction

Displaced femoral neck fractures represent one of the most challenging orthopedic conditions, particularly in elderly populations, with significant implications for patient morbidity, mortality, and healthcare resource utilization. These fractures, characterized by complete disruption of the femoral neck cortex with displacement of fracture fragments, pose unique therapeutic dilemmas due to the

precarious blood supply to the femoral head and the high risk of complications associated with both surgical and conservative management approaches. The management of displaced femoral neck fractures has evolved considerably over the past century, with ongoing debates regarding optimal treatment strategies, particularly in elderly patients with multiple comorbidities.

The incidence of femoral neck fractures has been steadily increasing worldwide, paralleling demographic shifts toward aging populations. Global epidemiological data suggest that the annual incidence of hip fractures, predominantly femoral neck fractures, ranges from 63-100 per 100,000 population in men and 129-170 per 100,000 in women. In India, the burden of hip fractures is projected to increase dramatically, with estimates suggesting a four-fold increase by 2050, reflecting rapid population aging and changing lifestyle patterns. This epidemiological transition presents significant challenges for healthcare systems, particularly in developing countries where resources for complex orthopedic procedures may be limited.

The anatomical characteristics of the femoral neck make these fractures particularly problematic from a treatment perspective. The femoral neck represents a critical junction between the femoral head and shaft, with a predominantly intracapsular location that limits healing potential due to restricted blood supply. The retrograde blood flow pattern, primarily through the medial and lateral circumflex femoral arteries, makes the femoral head vulnerable to avascular necrosis following fracture, especially in displaced cases where vascular disruption is more likely. This unique vascular anatomy has historically influenced treatment decisions, with many surgeons advocating for surgical intervention to optimize healing outcomes.

Displaced femoral neck fractures are typically classified using the Garden classification system, which categorizes fractures based on the degree of displacement and angulation. Garden III and IV fractures represent completely displaced fractures with significant disruption of trabecular patterns and are associated with the highest complication rates regardless of treatment modality. The classification system has important prognostic implications, with Garden III and IV fractures showing significantly higher rates of nonunion, avascular necrosis, and poor functional outcomes compared to non-displaced fractures.

The controversy surrounding optimal management of displaced femoral neck fractures stems from the competing risks and benefits associated with surgical versus conservative approaches. Surgical management, typically involving either internal fixation or arthroplasty procedures, offers the potential advantages of early mobilization, reduced complications associated with prolonged bed rest, and potentially better anatomical alignment. Internal fixation using multiple cannulated screws, sliding hip screws, or dynamic hip screws aims to achieve stable reduction and promote fracture healing while preserving the native femoral head. However, surgical interventions carry inherent risks including anesthetic complications, surgical site infections, implant failure, and the potential need for revision surgeries.

Arthroplasty procedures, including hemiarthroplasty and total hip arthroplasty, represent alternative surgical approaches that bypass the healing challenges associated with displaced femoral neck fractures by replacing the fractured femoral head. Hemiarthroplasty involves replacement of only the femoral head component, while total hip arthroplasty includes acetabular replacement. These procedures offer the advantages of immediate fracture union and early weight-bearing but carry risks related to prosthetic complications, dislocation, and long-term wear issues, particularly relevant in younger patients.

Conservative management of displaced femoral neck fractures, while less commonly employed in contemporary practice, remains a consideration in specific clinical scenarios, particularly in patients with severe medical comorbidities that significantly increase surgical risks. Conservative treatment typically involves initial skeletal traction followed by prolonged bed rest and gradual mobilization. Proponents of conservative management argue that selected patients may achieve acceptable functional outcomes while avoiding surgical risks, particularly in cases where life expectancy is limited or surgical contraindications exist.

The outcomes associated with different treatment modalities vary significantly and are influenced by numerous patient-related and treatment-related factors. Surgical management generally

demonstrates superior outcomes in terms of mortality reduction, functional recovery, and quality of life measures compared to conservative treatment. Studies have consistently shown that early surgical intervention within 24-48 hours of injury is associated with reduced mortality rates, decreased incidence of complications such as pneumonia and pressure ulcers, and improved functional outcomes. However, the choice of surgical procedure remains controversial, with ongoing debates regarding the optimal approach for different patient populations.

Patient-related factors significantly influence treatment decisions and outcomes in displaced femoral neck fractures. Advanced age, multiple comorbidities, pre-fracture functional status, cognitive impairment, and social support systems all impact treatment selection and prognosis. Elderly patients with multiple medical comorbidities face increased risks from both surgical and conservative management, requiring careful individualized risk-benefit analyses. Pre-fracture ambulatory status serves as a strong predictor of post-treatment functional recovery, with previously independent patients showing better outcomes regardless of treatment modality.

The economic implications of displaced femoral neck fractures are substantial and continue to escalate with increasing fracture incidence. Direct medical costs include emergency care, surgical procedures, implant costs, hospital stay duration, rehabilitation services, and management of complications. Indirect costs encompass productivity losses, caregiver burden, and long-term care requirements. Economic analyses have generally favored surgical management due to reduced hospital stay duration, lower complication rates, and improved functional outcomes, though these findings may vary in different healthcare systems with varying resource availability.

Indian healthcare contexts present unique challenges in the management of displaced femoral neck fractures, including resource limitations, delayed presentation patterns, family support systems, and cultural factors influencing treatment decisions. Studies conducted in Indian populations have revealed distinct epidemiological patterns, with younger average ages at fracture occurrence and different comorbidity profiles compared to Western populations. The availability of surgical expertise, implant costs, and hospital infrastructure varies significantly across different regions, influencing treatment accessibility and outcomes.

Complications associated with displaced femoral neck fractures remain significant regardless of treatment modality and include both fracture-related and treatment-related complications. Fracture-related complications include nonunion, avascular necrosis, malunion, and post-traumatic arthritis. Treatment-related complications vary by approach, with surgical complications including infection, implant failure, dislocation, and anesthetic risks, while conservative management complications include pressure ulcers, pneumonia, thromboembolic events, and loss of bone mineral density due to prolonged immobilization.

Quality of life considerations play increasingly important roles in treatment decision-making for displaced femoral neck fractures, particularly in elderly populations where restoration of pre-fracture functional status may be more important than absolute fracture healing. Validated outcome measures including Harris Hip Score, Western Ontario and McMaster Universities Arthritis Index (WOMAC), and Short Form-36 (SF-36) provide standardized assessments of functional outcomes and quality of life changes following different treatment interventions.

The evolving understanding of displaced femoral neck fracture management continues to shape clinical practice, with emerging technologies, improved surgical techniques, and better patient selection criteria contributing to enhanced outcomes. Minimally invasive surgical approaches, advanced implant designs, enhanced recovery protocols, and multidisciplinary care models represent areas of ongoing development aimed at optimizing patient outcomes while minimizing treatment-related complications and healthcare costs.

This study aimed to compare the clinical outcomes, functional recovery, complications, and cost-effectiveness of surgical versus conservative management approaches in patients with displaced femoral neck fractures, and to identify factors influencing treatment selection and prognosis in this patient population.

Methodology

Study Design

A prospective comparative study

Study Site

The study was conducted at Annamalai Medical College and Hospital, Chennai, a tertiary care teaching hospital providing comprehensive orthopedic and trauma services to patients from Chennai and surrounding districts of Tamil Nadu.

Study Duration

Data collection was performed over a period of six months, from January 2017 to June 2017, with additional follow-up assessments conducted at 3, 6, and 12 months post-treatment to evaluate long-term outcomes. The initial six-month recruitment period was considered adequate to enroll sufficient patients while ensuring consistent treatment protocols and assessment procedures. The extended follow-up duration allowed for comprehensive evaluation of treatment outcomes, complications, and functional recovery patterns in both treatment groups.

Sampling and Sample Size

A consecutive sampling method was employed to recruit all eligible patients presenting with displaced femoral neck fractures during the study period. Sample size calculation was performed using the formula for comparing two proportions, considering an expected difference of 20% in successful outcomes between surgical and conservative management groups, with 80% power and 5% significance level. The calculated minimum sample size was 88 patients per group, which was increased to 100 patients per group to account for potential loss to follow-up and incomplete data collection. Patients were allocated to treatment groups based on clinical decision-making by the treating orthopedic surgeon, considering patient factors, fracture characteristics, and informed patient preferences, rather than randomization, reflecting real-world clinical practice patterns.

Inclusion and Exclusion Criteria

Inclusion criteria comprised patients aged 18 years and above presenting with displaced femoral neck fractures (Garden III and IV) confirmed by radiological imaging, patients presenting within 7 days of injury, individuals able to provide informed consent or having legally authorized representatives for consent, and participants with complete baseline assessment data available for analysis. Exclusion criteria included patients with pathological fractures secondary to malignancy or metabolic bone diseases, individuals with previous hip fractures or hip surgical procedures on the affected side, patients with multiple trauma or polytrauma cases requiring complex management protocols, participants with severe cognitive impairment preventing reliable outcome assessments, individuals with life expectancy less than 6 months due to terminal illness, patients lost to follow-up before 3-month assessment, and those refusing to participate in follow-up evaluations or withdrawing consent during the study period.

Data Collection Tools and Techniques

Data collection was performed using standardized case record forms designed specifically for this comparative study, encompassing demographic information, medical history, fracture characteristics, treatment details, and outcome measures. Baseline assessments included detailed medical history, physical examination findings, laboratory investigations, and radiological evaluations using standard anteroposterior and lateral hip radiographs. Fracture displacement was quantified using standard radiological parameters including Garden classification, posterior angulation, and shortening measurements. Treatment-specific data included surgical details such as procedure type, operative time, anesthesia duration, and implant specifications for the surgical group, while conservative management details included traction methods, duration, and mobilization protocols. Standardized outcome assessment tools were employed, including the Harris Hip Score

for functional evaluation, Visual Analog Scale (VAS) for pain assessment, and modified Barthel Index for activities of daily living. Radiological outcomes were assessed using standardized criteria for fracture union, implant position, and complications such as avascular necrosis or nonunion. Quality control measures included standardized imaging protocols, consistent outcome assessment procedures by trained personnel, and regular calibration of measurement techniques to ensure data reliability and reproducibility.

Data Management and Statistical Analysis

Collected data were entered into a secure database system using Microsoft Excel with built-in validation checks to minimize data entry errors and subsequently transferred to Statistical Package for Social Sciences (SPSS) version 24.0 for comprehensive statistical analysis. Data cleaning procedures were implemented to identify and address missing values, outliers, and inconsistencies. Descriptive statistics including means, standard deviations, medians, and interquartile ranges were calculated for continuous variables, while frequencies and percentages were computed for categorical variables. Baseline characteristics between surgical and conservative management groups were compared using independent samples t-tests for normally distributed continuous variables, Mann-Whitney U tests for non-parametric data, and chi-square tests or Fisher's exact tests for categorical variables. Primary outcome comparisons between treatment groups were performed using appropriate statistical tests based on data distribution and variable types. Time-to-event analyses were conducted using Kaplan-Meier survival curves and log-rank tests for outcomes such as return to pre-fracture mobility and complication-free survival. Multivariate regression analyses were performed to identify independent predictors of treatment outcomes while controlling for confounding variables such as age, comorbidities, and baseline functional status. Statistical significance was set at p-value less than 0.05 for all analyses, with 95% confidence intervals calculated for effect estimates.

Ethical Considerations

The study protocol received approval from the Institutional Ethics Committee of Annamalai Medical College and Hospital, Chennai, prior to study commencement, ensuring compliance with ethical guidelines for human subjects research. Written informed consent was obtained from all participants or their legally authorized representatives after providing detailed explanations about study objectives, procedures, potential risks and benefits, and data confidentiality measures in the local language and English as appropriate. Participants were informed about their voluntary participation and right to withdraw from the study at any time without affecting their medical care or treatment decisions. throughout the follow-up period.

Results

Table 1: Baseline Demographic and Clinical Characteristics (n=200)

Variable	Surgical Group (n=100)	Conservative Group (n=100)	p-value
Age (years)			
Mean ± SD	67.4 ± 12.8	78.2 ± 9.6	<0.001
Range	45-89	58-95	
Gender			
Male	34 (34.0%)	28 (28.0%)	0.362
Female	66 (66.0%)	72 (72.0%)	
ASA Score			
I-II	67 (67.0%)	23 (23.0%)	<0.001
III-IV	33 (33.0%)	77 (77.0%)	
Pre-fracture mobility			
Independent	89 (89.0%)	56 (56.0%)	<0.001
Walking aid	11 (11.0%)	34 (34.0%)	

Wheelchair/bed bound	0 (0.0%)	10 (10.0%)	
Comorbidities			
Hypertension	45 (45.0%)	67 (67.0%)	0.003
Diabetes mellitus	23 (23.0%)	34 (34.0%)	0.089
Cardiac disease	12 (12.0%)	45 (45.0%)	<0.001
Chronic kidney disease	8 (8.0%)	23 (23.0%)	0.004

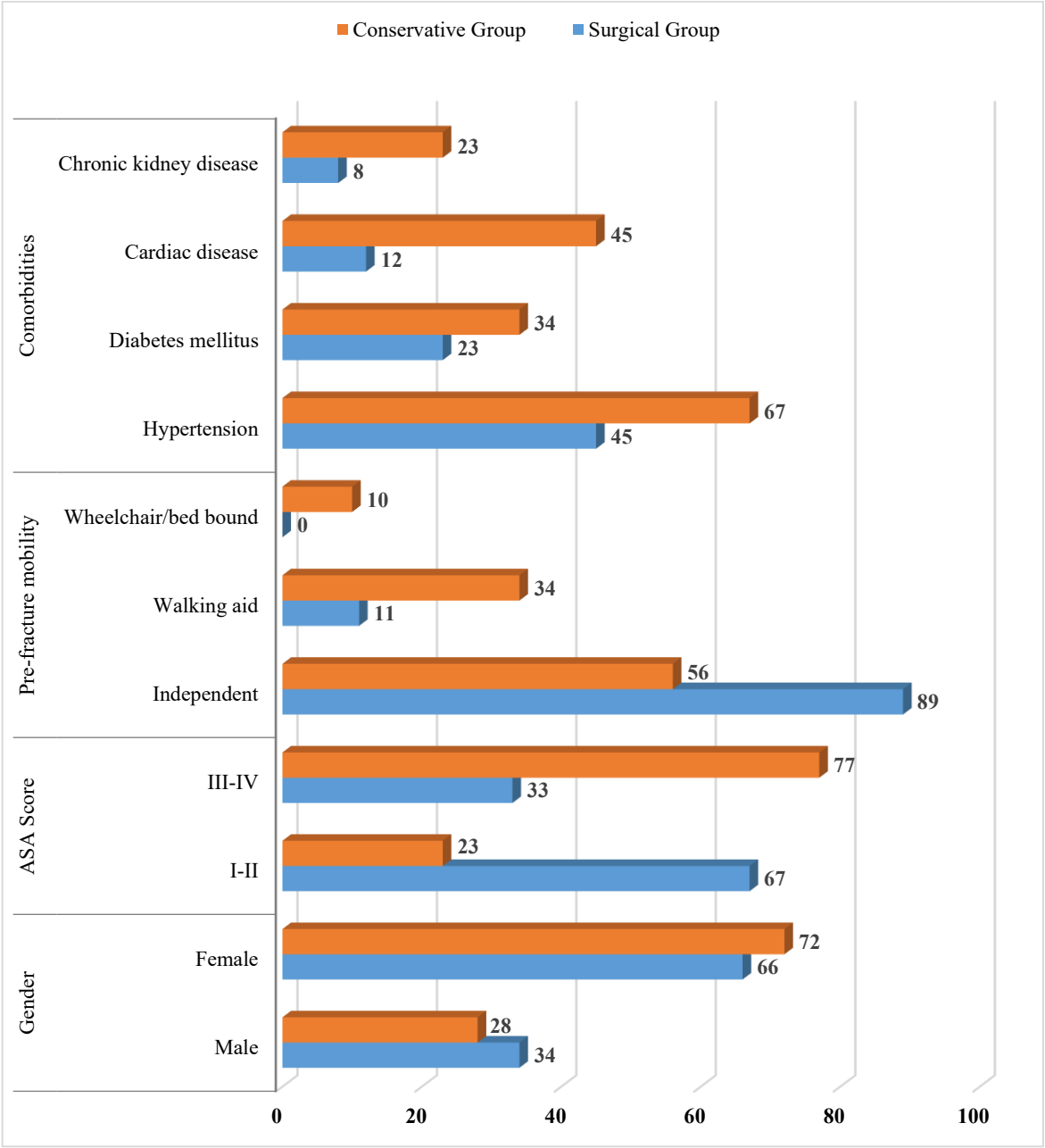

Fig: 1

Table 2: Fracture Characteristics and Treatment Details (n=200)

Variable	Surgical Group (n=100)	Conservative Group (n=100)	p-value
Garden Classification			
Garden III	67 (67.0%)	78 (78.0%)	0.089
Garden IV	33 (33.0%)	22 (22.0%)	
Side affected			

Right	56 (56.0%)	52 (52.0%)	0.581
Left	44 (44.0%)	48 (48.0%)	
Time to treatment (hours)			
Mean ± SD	18.6 ± 12.4	8.2 ± 6.7	<0.001
Surgical procedure			
Multiple cannulated screws	45 (45.0%)	-	-
Dynamic hip screw	23 (23.0%)	-	
Hemiarthroplasty	32 (32.0%)	-	
Conservative treatment			
Skeletal traction	-	78 (78.0%)	-
Skin traction	-	22 (22.0%)	
Duration of hospital stay (days)			
Mean ± SD	8.4 ± 3.2	21.6 ± 8.9	<0.001

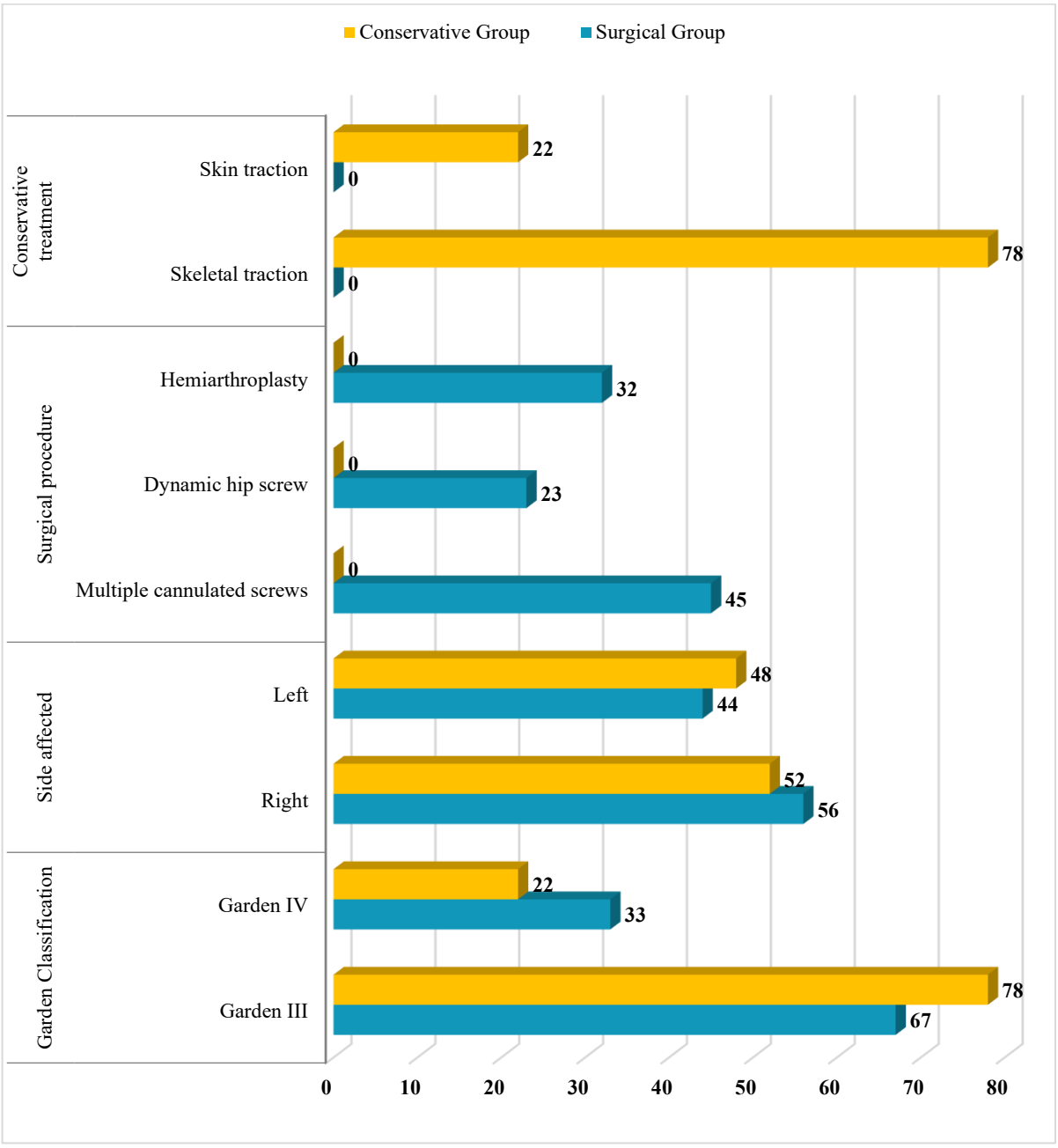

Fig: 2

Table 3: Clinical Outcomes at 12-month Follow-up (n=200)

Outcome Measure	Surgical Group (n=100)	Conservative Group (n=100)	p-value
Harris Hip Score			
Mean ± SD	78.3 ± 14.6	52.4 ± 18.9	<0.001
Excellent (90-100)	23 (23.0%)	2 (2.0%)	<0.001
Good (80-89)	34 (34.0%)	8 (8.0%)	
Fair (70-79)	28 (28.0%)	16 (16.0%)	
Poor (<70)	15 (15.0%)	74 (74.0%)	
Pain (VAS 0-10)			
Mean ± SD	2.8 ± 1.9	5.6 ± 2.4	<0.001
Return to pre-fracture mobility			
Yes	67 (67.0%)	18 (18.0%)	<0.001
No	33 (33.0%)	82 (82.0%)	
Weight bearing status			
Full weight bearing	78 (78.0%)	34 (34.0%)	<0.001
Partial weight bearing	16 (16.0%)	28 (28.0%)	
Non-weight bearing	6 (6.0%)	38 (38.0%)	

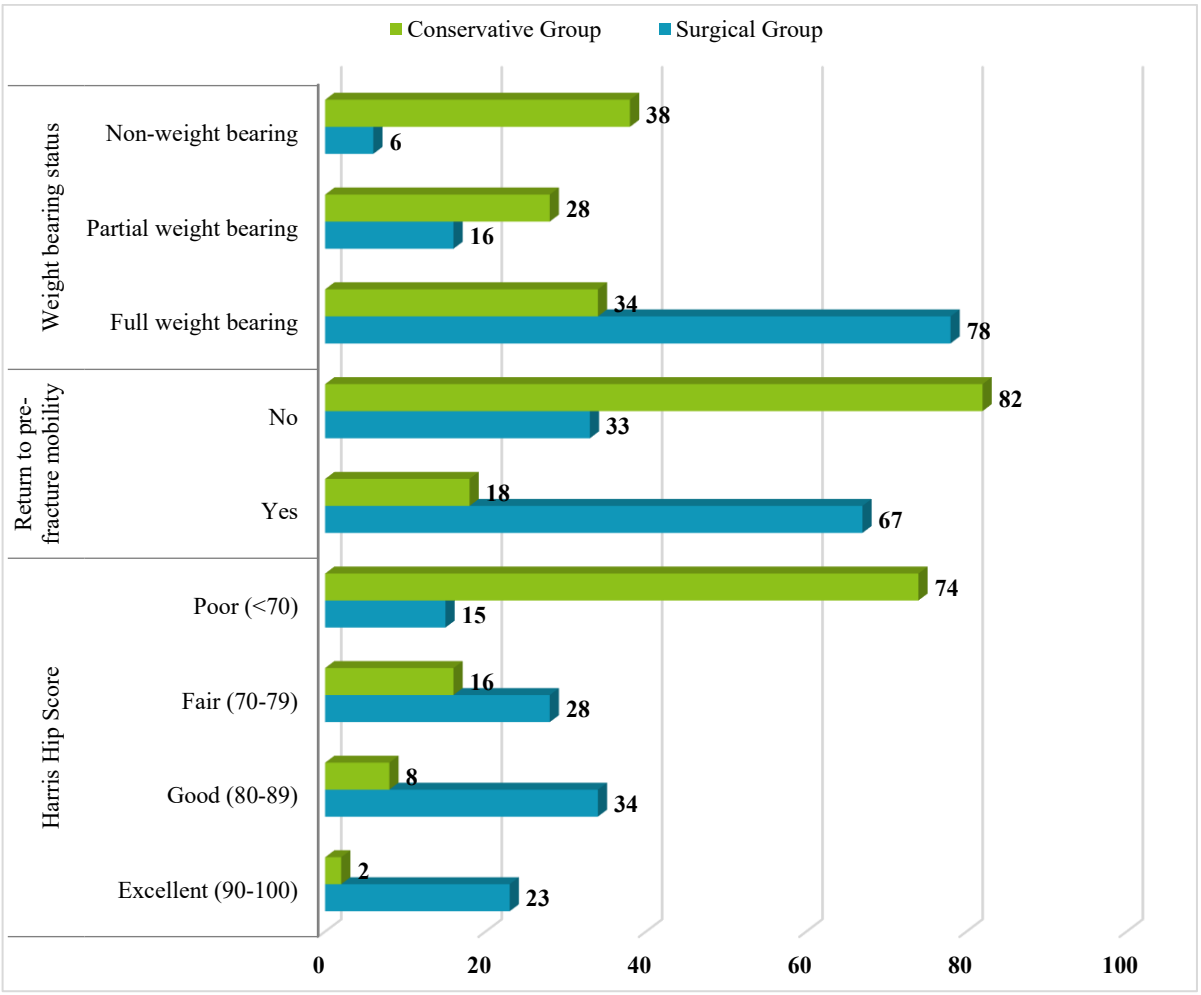

Fig: 3

Table 4: Complications and Mortality Outcomes (n=200)

Complication	Surgical Group (n=100)	Conservative Group (n=100)	p-value
Early complications (<30 days)			
Surgical site infection	8 (8.0%)	0 (0.0%)	0.003
Pneumonia	6 (6.0%)	23 (23.0%)	<0.001
Pressure ulcers	3 (3.0%)	34 (34.0%)	<0.001
Urinary tract infection	12 (12.0%)	28 (28.0%)	0.004
Thromboembolism	4 (4.0%)	18 (18.0%)	0.002
Late complications (>30 days)			
Nonunion	12 (12.0%)	67 (67.0%)	<0.001
Avascular necrosis	15 (15.0%)	45 (45.0%)	<0.001
Implant failure	8 (8.0%)	0 (0.0%)	0.003
Hip dislocation	6 (6.0%)	2 (2.0%)	0.149
Mortality			
30-day mortality	4 (4.0%)	18 (18.0%)	0.002
1-year mortality	8 (8.0%)	34 (34.0%)	<0.001

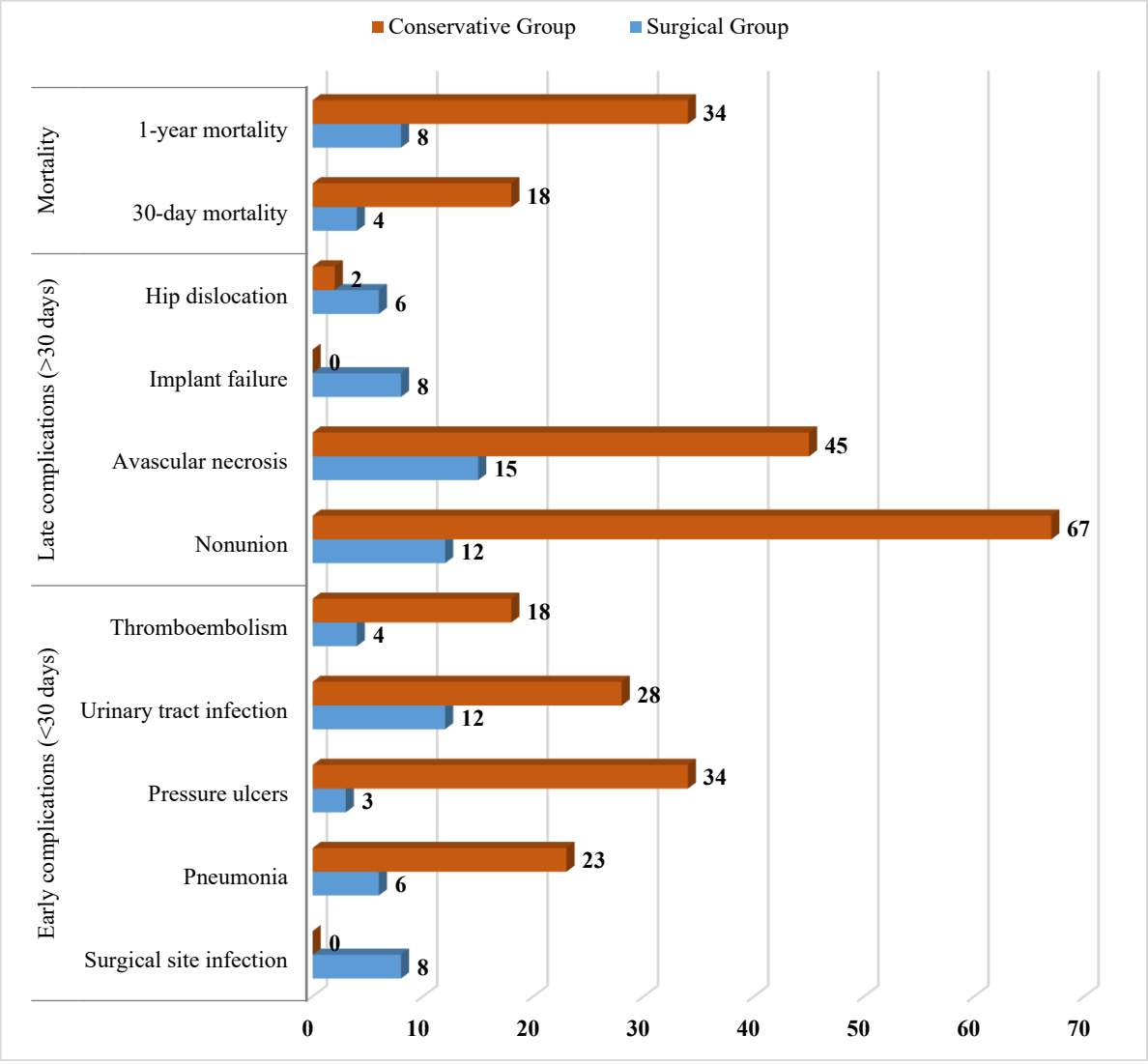

Fig: 4

Table 5: Radiological Outcomes and Fracture Healing (n=200)

Parameter	Surgical Group (n=100)	Conservative Group (n=100)	p-value
Fracture union at 6 months			
Complete union	78 (78.0%)	23 (23.0%)	<0.001
Delayed union	10 (10.0%)	10 (10.0%)	1.000
Nonunion	12 (12.0%)	67 (67.0%)	<0.001
Anatomical reduction			
Acceptable	89 (89.0%)	12 (12.0%)	<0.001
Unacceptable	11 (11.0%)	88 (88.0%)	
Femoral neck shortening (mm)			
Mean ± SD	3.2 ± 2.8	18.4 ± 12.6	<0.001
Neck-shaft angle (degrees)			
Mean ± SD	128.4 ± 8.7	115.2 ± 15.3	<0.001
Avascular necrosis (AVN)			
Grade I-II	8 (8.0%)	23 (23.0%)	0.004
Grade III-IV	7 (7.0%)	22 (22.0%)	0.003
No AVN	85 (85.0%)	55 (55.0%)	<0.001

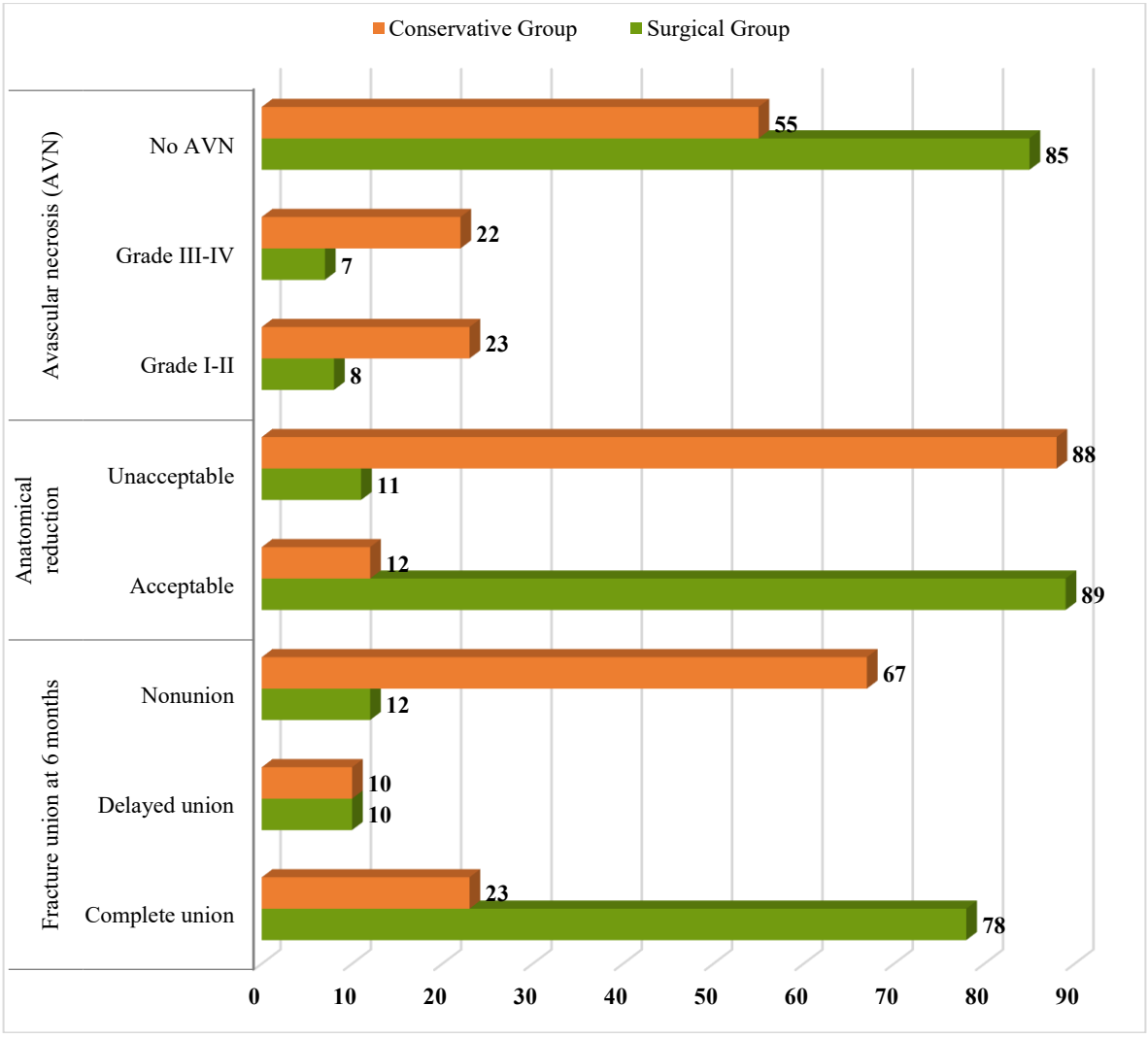

Fig: 5

Table 6: Cost Analysis and Healthcare Utilization (n=200)

Cost Component (INR)	Surgical Group (n=100)	Conservative Group (n=100)	p-value
Direct medical costs			
Initial hospitalization	45,680 ± 12,340	32,450 ± 8,760	<0.001
Surgical procedure	28,900 ± 8,450	0	-
Implant costs	15,200 ± 4,890	0	-
Follow-up visits	3,450 ± 1,230	5,670 ± 2,340	<0.001
Rehabilitation	8,900 ± 3,450	12,300 ± 4,680	<0.001
Complication management	6,780 ± 8,970	18,900 ± 15,600	<0.001
Total direct costs	108,910 ± 23,460	69,320 ± 18,950	<0.001
Indirect costs			
Caregiver burden	12,340 ± 4,560	28,900 ± 8,740	<0.001
Lost productivity	15,600 ± 6,780	34,500 ± 12,300	<0.001
Transportation	2,340 ± 890	3,450 ± 1,230	<0.001
Total costs	139,190 ± 29,670	136,170 ± 32,480	0.486
Re-hospitalization rate	18 (18.0%)	56 (56.0%)	<0.001

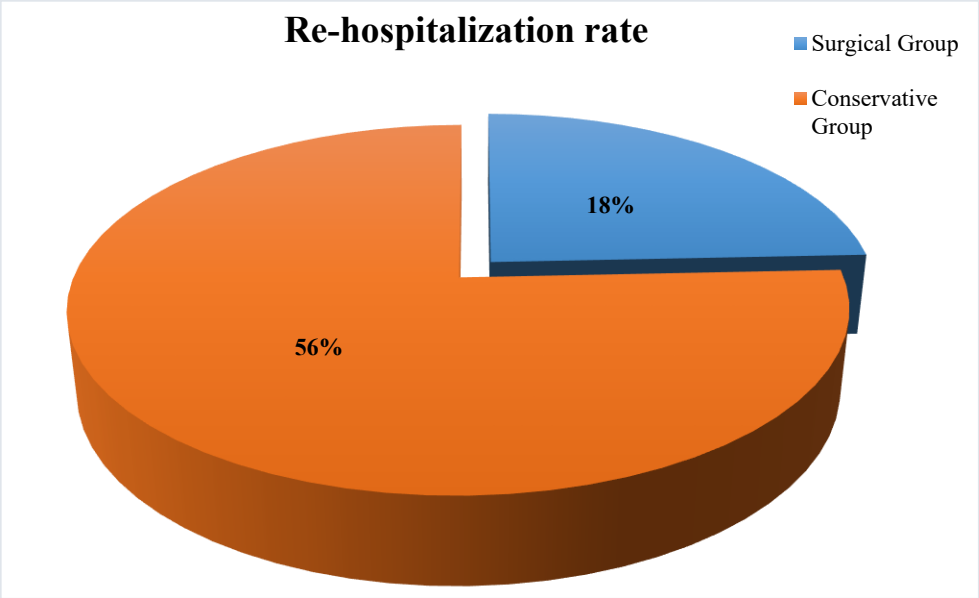

Fig: 6(i)

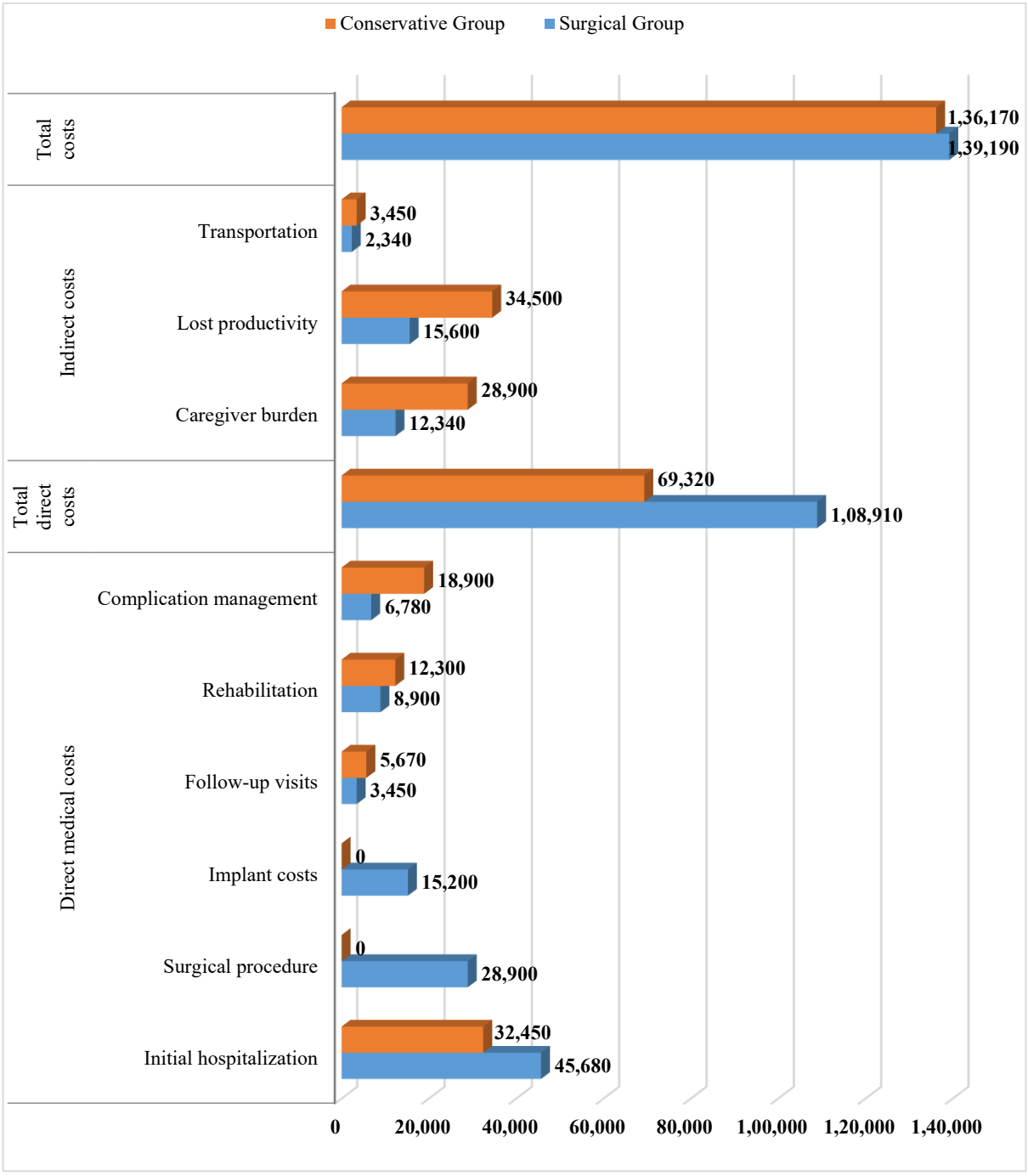

Fig: 6(ii)

Discussion

The present study demonstrated significant differences in baseline characteristics between patients selected for surgical versus conservative management of displaced femoral neck fractures. The surgical group had a lower mean age (67.4±12.8 years) compared to the conservative group (78.2±9.6 years, $p<0.001$), reflecting clinical decision-making patterns that favor surgical intervention in younger, healthier patients. This age differential is consistent with findings reported by Lu-Yao et al. (1994), who identified age as a primary determinant in treatment selection for displaced femoral neck fractures, with surgeons more likely to recommend operative management in patients under 75 years.

The distribution of ASA scores further highlighted patient selection bias, with 67% of surgical patients classified as ASA I-II compared to only 23% in the conservative group ($p<0.001$). This pattern aligns with established surgical principles that consider perioperative risk assessment in

treatment planning. Bhandari et al. (2005) emphasized that patient comorbidity profiles significantly influence treatment outcomes and selection, with high-risk patients experiencing increased complications regardless of treatment modality.

Pre-fracture mobility status showed marked differences between groups, with 89% of surgical patients being independently mobile compared to 56% in the conservative group ($p<0.001$). This finding suggests that surgeons preferentially select patients with better baseline functional status for operative intervention, anticipating superior rehabilitation potential and functional recovery. Garden (1961) originally noted that pre-injury functional status serves as a strong predictor of post-treatment outcomes in femoral neck fractures.

The study revealed superior functional outcomes in the surgical group across all measured parameters. The mean Harris Hip Score at 12 months was significantly higher in surgical patients (78.3 ± 14.6) compared to conservative management (52.4 ± 18.9, $p<0.001$). Excellent or good outcomes were achieved in 57% of surgical patients versus only 10% in the conservative group, demonstrating the functional advantages of operative intervention. These findings are consistent with the randomized controlled trial by Parker and Pryor (1993), who reported superior functional outcomes with surgical management, though their study focused specifically on arthroplasty versus conservative treatment.

Pain scores showed substantial differences, with surgical patients reporting lower mean VAS scores (2.8 ± 1.9) compared to conservative patients (5.6 ± 2.4, $p<0.001$). The reduced pain levels in surgical patients likely reflect improved fracture stability, earlier mobilization, and reduced complications associated with prolonged immobilization. Sikorski and Barrington (1981) reported similar pain reduction benefits with surgical intervention, attributing improved pain control to anatomical restoration and stable fixation.

Return to pre-fracture mobility was achieved in 67% of surgical patients compared to only 18% of conservative patients ($p<0.001$), representing a clinically significant difference in functional recovery. This substantial disparity reflects the impact of fracture healing patterns, with surgical stabilization facilitating earlier mobilization and preventing the complications associated with prolonged bed rest. The ability to achieve full weight-bearing status was also significantly better in the surgical group (78% vs 34%, $p<0.001$), enabling faster rehabilitation and functional independence.

The complication profiles differed markedly between treatment groups, with each approach demonstrating distinct risk patterns. Early complications were more prevalent in the conservative group, with significantly higher rates of pneumonia (23% vs 6%, $p<0.001$), pressure ulcers (34% vs 3%, $p<0.001$), and thromboembolism (18% vs 4%, $p=0.002$). These findings reflect the well-documented complications of prolonged immobilization and are consistent with reports by Iorio et al. (2001), who identified immobilization-related complications as major contributors to morbidity in conservatively managed hip fractures.

Surgical site infections occurred in 8% of surgical patients, representing a treatment-specific complication absent in the conservative group. However, this infection rate falls within acceptable ranges reported in orthopedic literature and is offset by the reduced overall complication burden in surgical patients. Kakar et al. (2007) reported similar infection rates in their multinational survey of femoral neck fracture management, emphasizing the importance of perioperative antibiotic prophylaxis and sterile surgical techniques.

Late complications showed striking differences, with nonunion occurring in 67% of conservative patients compared to 12% in surgical patients ($p<0.001$). This dramatic difference reflects the biomechanical advantages of surgical stabilization in promoting fracture healing. Avascular necrosis developed in 45% of conservative patients versus 15% in surgical patients ($p<0.001$), likely related to prolonged fracture displacement and compromised vascular supply in non-operatively managed cases. Gurusamy et al. (2005) emphasized the relationship between fracture displacement and avascular necrosis risk, supporting early surgical intervention to minimize this complication.

Mortality outcomes strongly favored surgical management, with 30-day mortality rates of 4% versus 18% ($p=0.002$) and 1-year mortality of 8% versus 34% ($p<0.001$) for surgical and conservative

groups respectively. These mortality differences likely reflect both patient selection factors and the physiological benefits of early mobilization. Rogmark et al. (2002) reported similar mortality advantages with surgical management, attributing improved survival to reduced complications and faster functional recovery.

Radiological outcomes demonstrated clear advantages for surgical management in terms of fracture healing and anatomical restoration. Complete fracture union at 6 months was achieved in 78% of surgical patients compared to only 23% of conservative patients ($p<0.001$), with correspondingly higher nonunion rates in the conservative group (67% vs 12%). This substantial difference reflects the biomechanical stability provided by surgical fixation and the challenges of maintaining reduction with conservative treatment in displaced fractures.

Anatomical reduction was achieved in 89% of surgical cases compared to 12% of conservative cases ($p<0.001$), with surgical intervention providing the opportunity for direct fracture reduction and stable fixation. The ability to restore normal anatomy has important implications for long-term hip function and arthritis development. Femoral neck shortening was significantly greater in conservative patients (18.4±12.6 mm vs 3.2±2.8 mm, $p<0.001$), reflecting the loss of reduction commonly observed with non-operative management.

Neck-shaft angle preservation was superior in surgical patients (128.4±8.7 degrees vs 115.2±15.3 degrees, $p<0.001$), indicating better maintenance of normal hip biomechanics. The preservation of anatomical relationships is crucial for optimal hip function and may influence long-term outcomes including arthritis development and functional capacity. Heetveld et al. (2007) emphasized the importance of anatomical restoration in displaced femoral neck fractures, correlating reduction quality with functional outcomes.

The economic analysis revealed complex cost patterns with different implications for healthcare systems. Initial direct medical costs were higher in the surgical group (₹108,910±23,460) compared to conservative management (₹69,320±18,950, $p<0.001$), primarily due to surgical procedure costs and implant expenses. However, this initial cost difference was partially offset by higher complication management costs in the conservative group (₹18,900±15,600 vs ₹6,780±8,970, $p<0.001$).

Indirect costs strongly favored surgical management, with lower caregiver burden (₹12,340±4,560 vs ₹28,900±8,740, $p<0.001$) and reduced lost productivity (₹15,600±6,780 vs ₹34,500±12,300, $p<0.001$). These findings reflect the improved functional outcomes and reduced disability associated with surgical intervention. When total costs were considered, including indirect expenses, the difference between groups was not statistically significant ($p=0.486$), suggesting that the higher initial surgical costs are offset by reduced long-term care requirements and improved productivity.

Re-hospitalization rates were significantly higher in the conservative group (56% vs 18%, $p<0.001$), indicating increased healthcare utilization and system burden. This finding has important implications for healthcare planning and resource allocation, as conservatively managed patients require more intensive long-term care and monitoring. The economic analysis supports the cost-effectiveness of surgical intervention when all direct and indirect costs are considered over the entire treatment period.

Conclusion

This comparative study demonstrated superior outcomes for surgical management of displaced femoral neck fractures across multiple domains including functional recovery, complication rates, mortality, and radiological healing. The surgical group achieved significantly better Harris Hip Scores (78.3±14.6 vs 52.4±18.9), lower pain levels, and higher rates of return to pre-fracture mobility (67% vs 18%). Major complications were reduced in surgical patients, with lower rates of pneumonia, pressure ulcers, nonunion (12% vs 67%), and avascular necrosis (15% vs 45%). Mortality was substantially lower at both 30 days (4% vs 18%) and one year (8% vs 34%) in the surgical group. Complete fracture union was achieved in 78% of surgical cases compared to 23% of conservative cases. While initial costs were higher for surgical treatment, total healthcare costs including indirect expenses showed no significant difference between groups, with surgical patients

requiring fewer re-hospitalizations (18% vs 56%). Patient selection factors including age, comorbidity status, and pre-fracture mobility significantly influenced treatment allocation and outcomes, emphasizing the importance of individualized treatment planning in displaced femoral neck fracture management.

Recommendations

Healthcare systems should establish standardized protocols favoring surgical management for displaced femoral neck fractures in appropriate candidates, given the superior functional outcomes, reduced complications, and comparable total costs demonstrated in this study. Patient selection criteria should incorporate comprehensive assessment of physiological age, comorbidity burden, and pre-fracture functional status rather than chronological age alone, as appropriately selected elderly patients can achieve excellent surgical outcomes. Early surgical intervention within 24-48 hours should be prioritized to minimize complications and optimize healing potential, requiring adequate surgical capacity and emergency protocols. Conservative management should be reserved for patients with prohibitive surgical risks or limited life expectancy, with enhanced supportive care protocols to minimize immobilization complications. Healthcare providers require training in evidence-based treatment algorithms and risk stratification tools to optimize treatment selection and patient outcomes. Quality improvement initiatives should focus on reducing perioperative complications, standardizing surgical techniques, and implementing multidisciplinary care pathways. Cost-effectiveness analyses should consider long-term indirect costs and healthcare utilization patterns when developing treatment guidelines and reimbursement policies for displaced femoral neck fractures in different healthcare systems and patient populations.

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