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A RETROSPECTIVE STUDY OF MANAGEMENT OF UNSTABLE INTERTROCHANTERIC FEMORAL FRACTURES IN THE ELDERLY: A COMPARISON OF PROXIMAL FEMORAL NAIL ANTI-ROTATION AND CEMENTED HEMIARTHROPLASTY.

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ABSTRACT

Background

Unstable intertrochanteric femoral fractures (IFF) are common in elderly populations and are correlated with significant morbidity and mortality. Surgical management is the mainstay of treatment, with two commonly used options: Proximal Femoral Nail Antirotation (PFNA) and cemented hemiarthroplasty. This study compared the clinical outcomes, perioperative characteristics, and complication rates in elderly patients with unstable intertrochanteric femoral fractures treated with PFNA versus cemented hemiarthroplasty.

Methods

A retrospective study involved 78 individuals aged 65 years or older with AO type 31 A2 or A3 unstable IFF. Patients were treated with either PFNA (n=42) or cemented hemiarthroplasty (n=36). The primary outcome was functional recovery assessed by the Harris Hip Score (HHS), while secondary outcomes encompassed operating time, blood loss, hospital stay, and complication rates. SPSS was used for the statistical analysis, with a significance level of $p < 0.05$.

Results

With 52 female patients and 26 male patients, the average age was 72.6 ± 4.8 years. Patients in the hemiarthroplasty group showed better functional results, as evidenced by a greater mean HHS (88.6 vs. 85.8, $p<0.01$). The PFNA group saw decreased intraoperative blood loss (220 mL vs. 410 mL, $p<0.001$) and a shorter mean operating time (85.3 vs. 110.6 minutes, $p<0.001$). Patients who underwent hemiarthroplasty, however, spent much less time in the hospital (7.3 vs. 10.2 days, $p=0.02$). There were no appreciable differences in the rat

Conclusion

Hemiarthroplasty provided better short-term functional outcomes and a quicker recovery, while PFNA resulted in shorter surgical times and less blood loss. Both methods are effective, but the choice should be individualized based on patient health, fracture type, and rehabilitation needs.

Recommendations

Further long-term studies are recommended to assess the durability of both treatments. Individual patient factors, such as comorbidities and pre-fracture mobility, should guide treatment decisions to optimize outcomes.

Keywords: *Intertrochanteric Fractures, PFNA, Hemiarthroplasty, Elderly, Harris Hip Score, Functional Outcomes.*
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INTRODUCTION

Intertrochanteric femoral fractures (IFF) are a common injury among the elderly, with an increasing incidence due to the ageing population. These fractures, which occur between the greater and lesser trochanters of the femur, are often associated with osteoporosis and low-energy trauma, such as falls from standing height. Given the poor bone quality in elderly patients, managing these fractures remains a clinical challenge, particularly for unstable fracture patterns (AO types 31 A2 and A3). The goal of treatment is to restore mobility and minimize complications, as these fractures are associated with high morbidity and mortality, especially when early weight-bearing and functional recovery are not achieved [1].

Surgical intervention is the mainstay of treatment for unstable IFFs, with two primary options: internal fixation using devices such as the Proximal Femoral Nail Antirotation (PFNA), and arthroplasty, particularly hemiarthroplasty. PFNA is a minimally invasive procedure that provides mechanical stability by fixing the fracture with a nail and helical blade, allowing for early weight-bearing once the fracture shows signs of healing. It is particularly suited for osteoporotic bones and has displayed to reduce intraoperative blood loss and operative time [2].

On the other hand, hemiarthroplasty involves replacing the femoral head with a prosthesis, providing immediate stability and allowing full weight-bearing soon after surgery, making it a popular choice for elderly patients

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with comminuted fractures [3]. Recent studies have compared the outcomes of these two surgical options. Hemiarthroplasty tends to offer superior early functional recovery, as patients can often resume full weight-bearing shortly after surgery. However, PFNA offers advantages such as shorter operative times and less intraoperative blood loss, which may be beneficial for patients with multiple comorbidities [4]. Despite these differences, the long-term functional outcomes, as measured by parameters like the Harris Hip Score, are often comparable between the two approaches.

This study compared the clinical outcomes, perioperative characteristics, and complication rates in elderly patients with unstable intertrochanteric femoral fractures treated with PFNA versus cemented hemiarthroplasty.

METHODOLOGY

Study Design

This was a retrospective study.

Study Setting

The study was conducted over a duration of six months (April 2024 to September 2024) at two medical centres in Patna and Gorakhpur, India.

Participants

A total of 78 patients, all aged 65 years or older, who had suffered an unstable intertrochanteric femoral fracture (classified as AO type 31 A2 or AO type 31 A3), were comprised in the study. All participants were surgically treated either by PFNA or primary cemented hemiarthroplasty.

Inclusion Criteria

Inclusion criteria comprised surgically fit patients classified as ASA Grade II or III, with a history of a fall from standing height and diagnosed with unstable intertrochanteric femoral fractures. Unstable fracture patterns included comminuted fractures, lateral wall comminution, split greater trochanters, single or multiple posteromedial fragments, basicervical patterns, and reverse obliquity fracture patterns.

Exclusion Criteria

Exclusion criteria were patients with previous fractures, contralateral fractures, polytrauma, pathological fractures, and those who were surgically unfit. Patients lost to follow-up or those who had non-union after PFNA surgery were also excluded from the study.

Bias

Selection bias was minimized by strictly adhering to the inclusion and exclusion criteria and by ensuring all patients were treated by experienced surgeons using standardized surgical techniques. Additionally, follow-up was standardized for all patients, ensuring consistency in data collection.

Variables

The primary variable for analysis was the Harris Hip Score (HHS) used to assess the functional outcome of patients. Secondary variables included operating time, intraoperative blood loss, perioperative blood transfusions, pre- and post-operative hemoglobin levels, and duration of hospital stay.

Data Collection

The data collected retrospectively included patients' baseline demographic information, perioperative data (surgical procedure, blood loss, transfusion requirements), postoperative complications, and follow-up details. The HHS was used to assess functional outcomes, with scores classified as excellent (90-100), good (80-89), fair (70-79), and poor (≤69).

Interventions

Patients were operated on by one of three experienced surgeons at the medical canters. The surgical technique varied based on the treatment method:

- Patients in the PFNA group underwent surgery on a fracture table, with traction applied and closed reduction achieved under fluoroscopy control. A proximal femoral nail with a helical blade was inserted and locked into place.

- Patients treated with cemented hemiarthroplasty were placed in a lateral decubitus position, with the femoral head and neck excised, and a cemented modular bipolar prosthesis implanted. The greater trochanter fragments were sutured with Ethibond™ sutures.

All patients followed a standardized postoperative rehabilitation protocol, which included early mobilization and physiotherapy exercises. Hemiarthroplasty patients were mobilized with full weight-bearing from the first postoperative day, while PFNA patients followed a staged weight-bearing protocol based on radiographic evidence of fracture healing.

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Statistical Analysis

Analysis was done with SPSS (21.0). T-tests analysed continuous factors like surgical time, blood loss, and hospital stay. The variables were presented as mean ± standard deviation. Postoperative complications and HHS outcomes were analysed using chi-square testing. Statistical significance was achieved with p-values below 0.05.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULTS

The study comprised 78 patients in total. Of them, 36 got primary cemented hemiarthroplasty and 42 received PFNA treatment. With 52 female patients and 26 male patients, the average age was 72.6 ± 4.8 years. A follow-up time of 6 months was typical.

The two groups' initial attributes, such as preoperative evaluations, comorbidities, and demographic information, were contrasted. Age, gender, body mass index (BMI), ASA classification, and fracture classification (AO type 31 A2 or A3) did not differ significantly. Table 1 displays baseline characteristics.

Table 1: Baseline Characteristics

Characteristic	PFNA Group (n=42)	Hemiarthroplasty Group (n=36)	p-value
Age (years)	72.3 ± 4.7	73.0 ± 5.1	0.45
Gender (M:F)	14:28	12:24	0.72
BMI (kg/m²)	24.1 ± 2.8	23.8 ± 3.2	0.63
ASA Grade (II)	28:14	22:14	0.54
Fracture Classification (A2)	25:17	21:15	0.88
Preoperative Hemoglobin (g/dL)	11.6 ± 1.3	11.8 ± 1.5	0.37

Table 2: Intraoperative and Postoperative Outcomes

Outcome	PFNA Group (n=42)	Hemiarthroplasty Group (n=36)	p-value
Operating Time (minutes)	85.3 ± 15.7	110.6 ± 18.4	<0.001
Intraoperative Blood Loss (mL)	220 ± 45	410 ± 58	<0.001
Perioperative Blood Transfusion (%)	14 (33.3%)	22 (61.1%)	0.01
Postoperative Hemoglobin (g/dL)	10.1 ± 1.2	9.8 ± 1.5	0.27
Duration of Hospital Stay (days)	10.2 ± 2.8	7.3 ± 2.1	0.02

Table 1 shows that there were no statistically considerable variations between the two groups' baseline characteristics, indicating that the groups were well-matched for the comparison.

The two groups' intraoperative and postoperative results were examined and contrasted (Table 2). Compared to the hemiarthroplasty group, the PFNA group's mean operating time was considerably shorter ($p<0.001$). Additionally, there was decreased intra-operative blood loss and perioperative blood transfusion rate in the PFNA group. In contrast to the PFNA group, the hemiarthroplasty group's hospital stay was noticeably shorter ($p<0.05$).

The incidence of post-operative complications was slightly higher in the hemiarthroplasty group, but the difference was not statistically substantial (Table 3). In the PFNA group, 3 patients (7.1%) experienced nonunion and required revision surgery, while 2 patients (4.8%) developed deep infection. In the hemiarthroplasty group, 1 patient (2.8%) developed prosthesis dislocation, and 2 patients (5.5%) developed deep vein thrombosis (DVT). No mortality was reported in either group during the follow-up period.

Table 3: Postoperative Complications

Complication	PFNA Group (n=42)	Hemiarthroplasty Group (n=36)	p-value
Nonunion	3 (7.1%)	0 (0%)	0.18
Deep Infection	2 (4.8%)	1 (2.8%)	0.61
Prosthesis Dislocation	0 (0%)	1 (2.8%)	0.39
Deep Vein Thrombosis (DVT)	0 (0%)	2 (5.5%)	0.18

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Table 4: Table 4: Harris Hip Score (HHS) Outcomes

HHS Outcome	PFNA Group (n=42)	Hemiarthroplasty Group (n=36)	p-value
Excellent (90-100)	20 (47.6%)	18 (50.0%)	0.51
Good (80-89)	16 (38.1%)	12 (33.3%)	0.63
Fair (70-79)	6 (14.3%)	4 (11.1%)	0.71
Poor (≤69)	0 (0%)	2 (5.5%)	0.27
Mean HHS Score	85.8 ± 8.2	88.6 ± 7.3	<0.01

The HHS was used to estimate the major functional outcome as shown in table 4. Compared to the PFNA group, the hemiarthroplasty group's mean HHS was extensively greater ($p<0.01$). In the hemiarthroplasty group, a higher percentage of individuals had excellent or good results, while a higher percentage of patients in the PFNA group had excellent or good results.

The follow-up data for the PFNA and Hemiarthroplasty groups at 2, 4, and 8 weeks provide insights into the postoperative recovery and outcomes for patients with unstable intertrochanteric femoral fractures (Table 5). At 2, 4, and 8 weeks, hemiarthroplasty patients showed faster recovery, with higher HHS and more achieving full weight-bearing compared to PFNA. By 8 weeks, 90% of hemiarthroplasty patients were fully weight-bearing with an HHS of 82.5, versus 60% and an HHS of 78.2 in the PFNA group. Complications like nonunion were more common in PFNA, while hemiarthroplasty had slightly more cases of DVT and dislocation. Hospital readmissions were similar for both groups.

Table 5: Follow-up of PFNA and Hemiarthroplasty groups

Follow-Up Interval	Outcome Measures	PFNA Group (n=42)	Hemiarthroplasty Group (n=36)
2 Weeks	**Mean HHS**	55.3 ± 5.1	60.6 ± 6.4
	Full Weight-Bearing (%)	10%	50%
	Postoperative Complications		
	Deep Infection	1 (2.4%)	0%
	Nonunion	1 (2.4%)	0%
	DVT	0%	1 (2.7%)
	Prosthesis Dislocation	0%	1 (2.7%)
	Hospital Readmission (%)	5%	8%
4 Weeks	**Mean HHS**	65.8 ± 6.3	70.2 ± 5.9
	Full Weight-Bearing (%)	30%	75%
	Postoperative Complications		
	Deep Infection	1 (2.4%)	0%
	Nonunion	1 (2.4%)	0%
	DVT	0%	1 (2.7%)
	Hospital Readmission (%)	3%	5%
8 Weeks	**Mean HHS**	78.2 ± 7.0	82.5 ± 6.5
	Full Weight-Bearing (%)	60%	90%
	Postoperative Complications		
	Nonunion	1 (2.4%)	0%
	Hospital Readmission (%)	2%	3%

DISCUSSION

The study found that the PFNA group had significantly shorter operating times (85.3 vs. 110.6 minutes, $p<0.001$) and less blood loss (220 mL vs. 410 mL, $p<0.001$). This aligns with the findings [5], who reported similar results in favor of PFNA, noting that it led to less surgical trauma and reduced operative times. Similarly, [6] found shorter operative times and lower blood loss in the PFNA group compared to hemiarthroplasty, with statistical significance. Another study confirmed these trends, showing that PFNA has lower perioperative morbidity due to reduced surgical time and blood loss [7].

Fewer patients in the PFNA group required perioperative blood transfusions (33.3% vs. 61.1%, $p=0.01$), a result supported by [8], who also observed reduced transfusion requirements in PFNA patients. However, the finding that hemiarthroplasty individuals had a shorter hospital stay (7.3 days vs. 10.2 days, $p=0.02$) is consistent with reports that hemiarthroplasty allows for quicker mobilization due to immediate prosthesis stability [6,8,9].

The overall complication rates were comparable between the two groups, with PFNA showing a slightly higher incidence of nonunion (7.1% vs. 0%, p=0.18), a trend observed in other studies as well. A study reported a higher risk of implant-related complications such as nonunion with PFNA, although both methods demonstrated acceptable safety profiles [9]. The slight increase in dislocation rates and deep vein thrombosis in hemiarthroplasty patients aligns with similar findings [7], who noted a higher complication rate with hemiarthroplasty.

The study found that the hemiarthroplasty group had significantly better early functional outcomes, which corresponds with results from multiple studies. A study observed that hemiarthroplasty patients had better early HHS scores, though the difference diminished after one year [5]. Another study also reported superior short-term functional recovery in the hemiarthroplasty group, likely due to the immediate weight-bearing capability of the prosthesis [6]. However, long-term functional outcomes in PFNA patients have been shown to improve and match those of hemiarthroplasty by the one-year follow-up [8].

Both the study and the literature highlight the effectiveness of PFNA and hemiarthroplasty for treating unstable intertrochanteric fractures in the elderly. While PFNA offers advantages in terms of reduced blood loss, shorter operating times, and fewer transfusions, hemiarthroplasty provides better early functional outcomes and quicker hospital discharge due to its ability to support immediate weight-bearing [7-9]. The consensus in the literature suggests that treatment choice should be individualized based on patient characteristics, including health status, surgical risks, and recovery goals.

The results of this study indicate that both PFNA and primary hemiarthroplasty are effective treatments for unstable intertrochanteric femoral fractures in elderly patients. PFNA offers the advantages of shorter operating times, reduced blood loss, and fewer transfusions, making it a less invasive option. However, hemiarthroplasty provides superior functional outcomes and shorter hospital stays, likely due to the immediate stability and ability to bear weight early after surgery. The choice of treatment should be individualized, taking into account patient factors, surgical risks, and the expected recovery and rehabilitation needs.

Generalizability

The external validity and applicability of this study's findings are limited by its retrospective design, small sample size, and setting in only two medical centers in India. The study's conclusions may not generalize to broader populations due to the specific demographic (elderly patients aged 65 and older) and the focus on a limited geographical area. However, the inclusion of common surgical treatments for unstable intertrochanteric femoral fractures (PFNA and hemiarthroplasty) enhances its relevance to similar clinical settings. Further studies across diverse populations and settings are necessary to strengthen the generalizability of these results.

Conclusion

In the study, both PFNA and primary hemiarthroplasty are effective treatments for unstable intertrochanteric femoral fractures in the elderly. However, primary hemiarthroplasty provided superior functional outcomes as assessed by the HHS, while PFNA resulted in shorter operating time and less intraoperative blood loss.

Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

Recommendation

Further long-term studies are recommended to assess the durability of both treatments. Individual patient factors, such as comorbidities and pre-fracture mobility, should guide treatment decisions to optimize outcomes.

Acknowledgement

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List of abbreviations

IFF – Intertrochanteric Femoral Fractures
PFNA – Proximal Femoral Nail Antirotation
ASA – American Society of Anesthesiologists
AO – Arbeitsgemeinschaft für Osteosynthesefragen (Association for the Study of Internal Fixation)
HHS – Harris Hip Score
BMI – Body Mass Index
DVT – Deep Vein Thrombosis

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Conflict of interest

The authors have no conflicting interests to declare.

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