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ORIGINAL ARTICLE

Influence of Perioperative and Patient-Related Factors on Clinical Outcomes in Intertrochanteric Femoral Fractures Managed with Dynamic Hip Screw

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ABSTRACT

Background: *Intertrochanteric femoral fractures are common in the elderly and contribute to significant morbidity. Dynamic Hip Screw (DHS) fixation remains a widely used and cost-effective treatment, though outcomes depend on both patient factors and perioperative parameters.* ***Aim:*** *To assess how perioperative factors and patient characteristics influence clinical and functional outcomes after DHS fixation.* ***Methods & Materials:*** *This quasi-experimental observational study included 26 patients (aged 31–80 years) treated with DHS between September 2022 and September 2024. Demographics, comorbidities, injury mechanism, bone density (Singh Index), perioperative variables, and postoperative complications were analyzed. Pain was assessed using the Visual Analogue Scale (VAS), and functional recovery was evaluated by the Harris Hip Score (HHS) at nine months.* ***Results:*** *Mean age was 67.7 ± 10.3 years, with females comprising 61.5%. Falls from standing height caused most injuries (84.6%). The mean injury-to-surgery interval was 4.96 ± 1.76 days, operative time 66.8 ± 8.1 minutes, and blood loss 200 ± 50 mL. Mean union time was 16.6 ± 2.4 weeks. VAS improved significantly from 7.9 ± 0.95 to 1.0 ± 0.92. Independent ambulation was regained by 53.9% of patients. Complications were low (7.7% superficial infection; 7.7% screw cut-out). HHS was significantly associated with bone density ($p = 0.04$) and tip–apex distance ($p = 0.003$).* ***Conclusion:*** *DHS fixation provides predictable union, favorable functional outcomes, and low complication rates. Better bone quality and optimal screw positioning (TAD ≤25 mm) were key predictors of improved recovery.*

Keywords: *Intertrochanteric Femoral Fractures, Harris Hip Score (HHS), Dynamic Hip Screw (DHS)*

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INTRODUCTION

Dynamic Hip Screw (DHS) is a widely used orthopedic implant designed to stabilize extracapsular hip fractures, particularly intertrochanteric fractures, by allowing controlled sliding of the femoral head to promote bone healing through dynamic compression [1]. It remains the most common fixation method for stable intertrochanteric fractures, accounting for approximately 50–60% of global surgical treatments, especially in regions where intramedullary nails are less accessible or cost-prohibitive [2].The DHS implant consists of three main components: a lag screw inserted into the femoral head and neck to stabilize fracture fragments, a side plate along the lateral aspect of the femur providing structural support, and cortical screws securing the plate to the femoral shaft [3]. Its main advantage is the ability to achieve controlled dynamic compression at the fracture site, facilitating bone healing and resulting in high union rates [4]. Most fractures treated with DHS achieve union within six months, allowing early mobilization, shorter hospital stays, and faster return to daily activities [1]. Early mobilization after hip fracture surgery has been shown to improve functional recovery and reduce complications such as pneumonia, deep vein thrombosis, urinary tract infections, and pressure ulcers, which are particularly relevant in elderly patients or those with comorbidities [5]. Compared to alternative fixation methods, DHS is generally cost-effective, preserves the femoral head, and is suitable for younger patients, potentially delaying the need for future arthroplasty [6]. It also has a relatively lower risk of implant failure and non-union, enhancing its reliability as a treatment option [1]. However, the procedure requires relatively larger incisions and more soft-tissue dissection compared to intramedullary nails, which may increase operative trauma and surgical time, raising the risk of perioperative complications [7]. Implant-related issues may

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include cut-out or cut-through of the lag screw, plate detachment, implant breakage, and pseudarthrosis, all of which can compromise fracture stability [4] . Patients may also experience infection, hematoma formation, malunion or non-union, and, in some cases, avascular necrosis of the femoral head [8]. DHS may have higher complication rates than alternative fixation methods, particularly in unstable intertrochanteric fractures, emphasizing the importance of careful patient selection, fracture assessment, and precise surgical technique [9]. DHS remains a reliable and widely adopted method for managing stable intertrochanteric fractures, particularly in settings with limited resources. Its ability to provide stable fixation, promote controlled bone healing, and facilitate early mobilization makes it an essential tool in orthopedic practice, offering favorable functional outcomes and improving quality of life for patients recovering from hip fractures [10]. The aim of this study is to evaluate how perioperative and patient-related factors affect the clinical outcomes of intertrochanteric femoral fractures treated with Dynamic Hip Screw fixation.

METHODS & MATERIALS

This quasi-experimental observational study was conducted over a two-year period, from September 2022 to September 2024, in the Department of Orthopaedic Surgery at Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbagh, Dhaka. Purposive sampling was used to recruit patients with intertrochanteric femoral fractures who presented during the study period and underwent Dynamic Hip Screw (DHS) fixation. Total 26 patients were enrolled based on defined inclusion and exclusion criteria.

Inclusion Criteria:

- Patients aged 31–80 years.
- Unilateral or bilateral intertrochanteric femoral fracture.
- Ambulatory patients prior to injury.
- Surgery performed within 3 weeks of injury.
- Patients who available follow-up.

Exclusion Criteria:

- Pathological fractures other than osteoporosis.
- Open fractures or associated ipsilateral femoral neck fractures.
- Prior hip surgeries.
- Polytrauma cases or patients with severe neuromuscular disorders.
- Patients unable to comply with at least 9 months of follow-up.

Ethical Considerations

The study adhered to the Declaration of Helsinki (1964, revised 2013) for research involving human subjects. Written informed consent was obtained from all participants. Patient confidentiality was strictly maintained, and participants were allowed to withdraw at any point without prejudice. The study protocol was approved by the Department of Orthopaedic Surgery and subsequently cleared by the Institutional Review Board (IRB) of BSMMU.

Surgical Technique

All patients underwent Dynamic Hip Screw (DHS) fixation under either spinal or general anesthesia using a standard lateral approach to the proximal femur. Closed or open reduction was performed, and fracture alignment was confirmed with intraoperative fluoroscopy. The appropriate length DHS lag screw and side plate were selected, and fixation was carried out following standard operative protocols.

distance ≤25 mm was strongly associated with better outcomes (88.9 ± 4.53 vs. 79.6 ± 5.41, p=0.003) (Table VI).

Data Collection

All patients who fulfilled the inclusion criteria underwent a detailed clinical and radiological assessment at admission. A structured data collection form was used to record patient demographics, comorbidities, injury mechanism, bone density (assessed by Singh Index), perioperative variables, and clinical outcomes. Preoperative information included age, gender, BMI, comorbid conditions, and the side of injury. Mechanism of injury was documented as fall from standing height, fall from height, or road traffic accident. Bone density was classified based on radiological assessment using the Singh Index. Perioperative data included injury-to-surgery interval (days), operative time (minutes), intraoperative blood loss (ml), length of hospital stay (days), and Tip–Apex Distance (TAD) measured postoperatively on radiographs to evaluate implant placement accuracy. Fracture healing was evaluated by the time to radiological union, defined as bridging callus across three cortices and painless full weight-bearing. Pain was assessed using the Visual Analogue Scale (VAS) preoperatively and at 9 months postoperatively. Functional outcomes were measured at the 9-month follow-up using the Harris Hip Score (HHS). Postoperative complications were also recorded. All patients were followed up at 1, 3, 6, and 9 months postoperatively with clinical examination and radiographic evaluation.

Statistical Analysis

Data were analyzed using SPSS software version 25.0 (IBM®, Armonk, USA). Quantitative variables were expressed as mean ± standard deviation (SD) and compared using Student's t-test (parametric data) or Mann–Whitney U test (non-parametric data). Qualitative variables were expressed as frequency and percentage and analyzed using the Chi-square test or Fisher's exact test where appropriate. A p-value <0.05 was considered statistically significant.

RESULTS

The study included patients with a mean age of 67.73 ± 10.26 years, most of whom were over 60 years old (76.92%) and female (61.5%). Half of the patients had a normal BMI (50%), while 30.77% were pre-obese and 19.23% obese (Table I). Among all, hypertension (65.4%) and diabetes mellitus (46.2%) were the most common comorbidities. Most injuries resulted from falls at standing height (84.6%), with the left limb more frequently affected (57.7%). Bone density assessment showed equal distribution between osteoporotic (≤III, 50%) and non-osteoporotic (>III, 50%) patients (Table II). The mean injury-to-surgery interval was 4.96 ± 1.76 days, with an average surgery duration of 66.81 ± 8.11 minutes and estimated blood loss of 200 ± 50 ml. The mean hospital stay was 5.42 ± 1.63 days. Most patients (80.8%) had a tip apex distance ≤25 mm (mean 22.12 ± 4.47 mm) (Table III). Fracture union occurred in 16.62 ± 2.38 weeks, with VAS pain scores improving from 7.88 ± 0.95 preoperatively to 1.04 ± 0.92 at nine months (Table IV). Over half of the patients (53.85%) regained their previous walking ability without support, while 23.08% used a cane occasionally, and 7.69% remained non-ambulatory. 76.92% achieved a full range of hip motion. Postoperative complications were minimal, with superficial wound infection and screw cutout each occurring in 7.7% of patients, while no cases of nonunion or malunion were reported (Table V). Harris Hip Score (HHS) was not significantly influenced by age or gender, but patients with better bone density (>Singh Index III) had higher scores (88.9 ± 5.1, p=0.04). A tip apex

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Table – I: Demographic profile of the study population (*n* = 26)

Variables	Frequency (n)	Percentage (%)
Age (years)		
≤60	6	23.08
>60	20	76.92
Mean ± SD	67.73 ± 10.26	
Gender		
Female	16	61.5
Male	10	38.5
BMI (kg/m2)		
Normal (18-24.99)	13	50.00
Pre-obese (25-29.99)	8	30.77
Obese (>30)	5	19.23

Table – II: Clinical characteristics and injury profile of participants (*n* = 26)

Variables	Frequency (n)	Percentage (%)
Comorbidities		
Hypertension	17	65.4
Diabetes Mellitus	12	46.2
Coronary Artery Disease	5	19.2
Respiratory Disease	5	19.2
Kidney Disease	3	11.5
Mechanism of Injury		
Fall on standing Height	22	84.6
Road Traffic Accident	2	7.7
Fall from height	2	7.7
Involved limb		
Left	15	57.7
Right	11	42.3
Bone Density (Singh Index)		
≤III (Osteoporotic)	13	50
>III	13	50

Table – III: Perioperative parameters of patients (*n* = 26)

Variable	Mean ± SD
Injury to Surgery Interval (days)	4.96 ± 1.76
Duration of Surgery (minutes)	66.81 ± 8.11
Estimated Blood Loss (ml)	200 ± 50
Length of Hospital Stay (days)	5.42 ± 1.63
Tip Apex Distance (mm)	
≤25	21 (80.8)
>25	5 (19.2)
Mean ± SD	22.12 ± 4.47

Table – IV: Fracture healing and pain outcomes

Parameter	Mean ± SD
Fracture Union Time (weeks)	16.62 ± 2.38
VAS (Pre-op)	7.88 ± 0.95
VAS (9 months)	1.04 ± 0.92

Table – V: Functional outcomes and postoperative complications among study population (*n* = 26)

Variables	Frequency (n)	Percentage (%)
Walking ability (Support)		
Regained previous walking ability/No support needed	14	53.85
One cane or walking stick for long work and most of the time	6	23.08
Walk with crutches/walking stick	4	15.38
Two crutches/Non-ambulatory	2	7.69
Mobility of hip		
Full range of motion	20	76.92
Limited range of motion	4	15.38
Movements not possible due to pain	2	7.69
Complications		
Superficial wound infection	2	7.7
Screw cutout	2	7.7
Nonunion	0	0
Malunion	0	0
None	22	84.6

Table – VI: Factors affecting Harris Hip Score (HHS)

Factor	HHS (Mean ± SD)	P-value
Age (years)		
<60 yrs	88.5 ± 5.2	0.19
≥60 yrs	86.7 ± 6.1	
Gender		
Female	85.63 ± 6.03	0.087
Male	89.50 ± 5.15	
Bone Density (Singh Index)		
≤III (Osteoporotic)	85.2 ± 6.0	0.04
>III	88.9 ± 5.1	
Tip Apex Distance		
≤25 mm	88.9 ± 4.53	0.003
>25 mm	79.6 ± 5.41	

DISCUSSION

Intertrochanteric femoral fractures are a common injury, particularly in the elderly, and are associated with high morbidity, mortality, and functional decline. Dynamic Hip Screw (DHS) fixation remains a widely used surgical method due to its simplicity, cost-effectiveness, and favorable biomechanical stability. However, patient characteristics and perioperative factors significantly influence surgical outcomes and recovery. This study aimed to analyze these factors to optimize treatment strategies and improve patient prognosis. In the present study, the mean age of participants was 67.73 ± 10.26 years, which is broadly consistent with the findings of similar earlier studies [11,12]. Intertrochanteric fractures are frequent in the elderly due to osteoporosis-related bone fragility, high stress on the femoral trochanteric region during falls, and age-related comorbidities that impair mobility, strength, and coordination, thereby increasing fall risk. In this study, females constituted the majority, representing 61.5% of the cases. In comparable study Gallagher et al. reported a female-to-male ratio of 1.7:1 [13]. Intertrochanteric fractures are more common in females due to the higher prevalence of postmenopausal osteoporosis [14]. Body mass index patterns showed 50% normal weight, 30.8% pre-obese, and 19.2% obese in our study, which is consistent with the study of Bhosale et al [15]. In our study, 76.9% had comorbidities, with hypertension (65.4%) and diabetes (46.2%) being most frequent, followed by coronary artery and respiratory diseases (19.2%) and kidney disease (11.5%). Similarly, Asad et al reported that 77.1% of patients had at least one major comorbidity, most commonly hypertension (65.7%) and diabetes (54.3%) [16]. Falls from standing height were the leading cause of injury with 84.6% of cases in this study. Shams et al and Shiraz et al observed similar findings [17,18]. In contrast, Bhosale et al reported road traffic accidents (68.7%) was the most common mode of injury [15]. We observed left side involvement in 57.7% cases. Our finding is similar to the study of Kumar et al and Prakash et al [19,20]. In this study, bone

density evaluation by the Singh Index revealed that 50% of patients had osteoporotic bone (≤III) and 50% had non-osteoporotic bone (>III). The average time from injury to surgery was about five days in this present study. Different studies indicate that the average interval between injury and surgery was about 3 days [17,19]. The delay in surgery occurred due to time taken for medical optimization of the patients as most of the patients had comorbid conditions. According to this study, the mean duration of surgery was 66.81 ± 8.11 minutes, which is consistent with other similar studies [21,22]. Estimated blood loss (EBL) averaged 200 ± 50 mL in our study, reflecting moderate intraoperative bleeding. The average length of hospital stay was 5.42 ± 1.63 days, which is comparable to the studies done by Gurung et al [23]. In this study the mean Tip Apex Distance was 22.12 ± 4.47. TAD ≤25mm is safe and >25mm may result in the penetration of implant, nonunion, cut-through and other complications [24]. The mean fracture union time was 16.62 ± 2.38 weeks, comparable with other relevant study [25]. The average preoperative VAS score was 7.88 ± 0.95, which improved markedly to 1.04 ± 0.92 at 9 months postoperatively. Studies done by Gill et al showed a mean VAS score of 2.5 at the final follow-up [26]. In this DHS-treated patients, just over half (53.9%) regained their pre-injury walking ability without support and three-quarters (76.9%) achieved a full hip range of motion, with an overall complication-free rate of 84.6%. These functional results are broadly in line with other published study [27]. Age and gender showed trends in the expected direction (slightly lower HHS with older age and in females) but did not reach statistical significance in our sample (p = 0.19 and p = 0.087 respectively). Our finding that TAD ≤ 25 mm is associated with significantly higher HHS and fewer mechanical complications aligns with established literature. A more recent prospective study found that all instances of screw cut-out occurred when TAD exceeded 35 mm, while no failures occurred with TAD < 25 mm [28]. The association between low Singh index (≤III) and a lower mean HHS (85.2 vs 88.9; p = 0.04) is biologically and clinically plausible. The Singh index correlates with femoral neck BMD and has been used as a surrogate for osteoporosis in many series; lower bone density impairs implant anchorage, may slow rehabilitation, and has been linked to poorer functional outcomes after proximal femur fracture fixation [29,30].

Limitations of the study:

Every hospital-based study has some limitations and the present study undertaken is no exception to this fact.

- Purposive sampling could have introduced selection bias.
- No direct comparison was made with alternative fixation techniques such as proximal femoral nailing.

CONCLUSION

Dynamic Hip Screw fixation for intertrochanteric femoral fractures offers satisfactory functional outcomes, low complication rates, and consistent fracture union when performed with precise implant positioning. Bone quality and optimal tip–apex distance significantly influence results, underscoring the importance of preoperative planning and surgical technique. Future large-scale, multicenter studies with longer follow-up are recommended to validate these findings and compare DHS with newer fixation methods.

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Ethical approval: *The study was approved by the Institutional Ethics Committee.*

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