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Complication rates and healing trends in intertrochanteric fractures managed with dynamic hip screw

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Abstract
Background: Intertrochanteric fractures are among the most common hip fractures in elderly populations, often resulting in significant morbidity and functional limitations. The Dynamic Hip Screw (DHS) is widely used for fixation; however, complications such as screw cut-out, delayed union, and impaired functional recovery remain concerns, particularly in unstable fractures.
Aim of the study: To evaluate complication rates, radiological healing patterns, functional outcomes, and predictors of surgical failure in patients with intertrochanteric fractures treated with DHS.
Methods: A quasi-experimental study was conducted at a tertiary care center from September 2022 to September 2024. Twenty-six patients with Kyle Type 1 (n=14) and Type 2 (n=12) intertrochanteric fractures underwent DHS fixation. Demographic, clinical, and operative data were collected, including tip-apex distance (TAD), quality of reduction, and lag screw position. Postoperative outcomes assessed were complications, radiological union, delayed union (>20 weeks), non-union (at 6 months), and functional recovery measured by Harris Hip Score (HHS). Statistical analyses included t-tests, chi-square/Fisher's exact tests, and relative risk calculations, with $p<0.05$ considered significant.
Result: The mean age was 67.7±10.3 years; 61.5% were female. Superficial wound infection occurred in 7-8% of patients; screw cut-out occurred only in Type 2 fractures (16.7%). Type 1 fractures demonstrated significantly faster union (12.4±2.3 vs. 16.2±3.1 weeks; p=0.002) and higher HHS (85.6±7.2 vs. 74.8±9.5; p=0.004). TAD >25 mm, poor reduction, and non-central lag screw placement were significant predictors of complications.
Conclusion: DHS provides reliable fixation with satisfactory healing and functional outcomes in stable intertrochanteric fractures. Optimal reduction and implant positioning are essential to minimize complications, especially in unstable fractures.

Keywords: Intertrochanteric fractures, dynamic hip screw (DHS), complication rates, radiological healing, functional outcomes

Introduction
Intertrochanteric fractures, occurring between the greater and lesser trochanters of the femur, are among the most common types of hip fractures, particularly affecting the elderly population [1]. Globally, hip fractures affect approximately 14.43 million people annually, with intertrochanteric fractures comprising a substantial proportion of these cases. The prevalence is notably higher among older adults, with incidence increasing with age [2]. These fractures typically result from low-energy trauma such as falls, although high-energy trauma may cause similar injuries in younger individuals [1]. Fractures are classified as stable or unstable based on the fracture pattern, with unstable fractures characterized by comminution, reverse obliquity, or posteromedial cortex disruption. The incidence of unstable intertrochanteric fractures is rising globally due to an aging population and the increasing prevalence of osteoporosis, which compromises bone quality and fracture healing potential [3]. The Dynamic Hip Screw (DHS) is a widely used orthopedic implant for the surgical management of intertrochanteric fractures [4]. It consists of three main components: a lag screw inserted into

the femoral head and neck to stabilize fracture fragments, a barrel plate, and side plate screws that secure the construct to the femoral shaft [5]. The DHS design allows controlled sliding at the fracture site, promoting dynamic compression, which facilitates bone healing and early mobilization [6]. The procedure involves careful preoperative planning, accurate placement of the lag screw into the femoral head, and secure attachment of the barrel plate to the femoral shaft [7]. This technique enables gradual impaction of the fracture fragments during weight-bearing, supporting natural bone healing and functional recovery [6]. The advantages of DHS include technical simplicity, cost-effectiveness, and consistent success in achieving fracture union in stable intertrochanteric fractures [7]. Most patients achieve bone healing within six months, allowing early mobilization, reduced hospital stays, and faster return to routine activities [4]. Early mobilization is particularly important in elderly patients, as it reduces the risk of complications such as pneumonia, deep vein thrombosis, urinary tract infections, and pressure ulcers, which can otherwise significantly increase morbidity and mortality [8]. DHS also preserves the femoral head, making it advantageous in younger patients or those in whom future arthroplasty may be anticipated [9]. However, DHS has limitations in unstable fracture patterns or in patients with severely osteoporotic bone. Potential complications include lag screw cut-out or cut-through, plate detachment, implant breakage, nonunion, and malunion [8]. The procedure requires larger incisions and more soft-tissue dissection compared to intramedullary devices, which may increase operative trauma, surgical time, and postoperative pain [10]. Careful patient selection, precise surgical technique, and thorough assessment of bone quality are therefore critical to optimize outcomes, reduce complications, and improve long-term functional recovery [11]. DHS remains a reliable and widely adopted method for managing intertrochanteric fractures. Its ability to provide stable fixation, promote controlled bone healing, facilitate early mobilization, and restore functional independence makes it an essential tool in orthopedic practice, offering favorable outcomes and improving quality of life for patients recovering from hip fractures [12]. The aim of this study is to evaluate the complication rates and healing patterns in patients with intertrochanteric femoral fractures treated using the Dynamic Hip Screw (DHS).

Methodology and Materials

This quasi-experimental study was conducted in the Department of Orthopaedic Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Shahbagh, Dhaka, from September 2022 to September 2024. Purposive sampling was used to enroll patients presenting with intertrochanteric femoral fractures. A total of 26 patients were included and classified into two groups based on fracture type: Kyle Type 1 (n = 14) and Kyle Type 2 (n = 12).

Inclusion and Exclusion Criteria

Inclusion Criteria

1. Patients aged 31-80 years.
2. Both genders.
3. Unilateral or bilateral Kyle Type 1 or 2 intertrochanteric femoral fractures.
4. Ambulatory prior to injury.
5. Surgery performed within 3 weeks of injury.

Exclusion Criteria

1. Pathological fractures other than osteoporosis.
2. Open fractures or prior ipsilateral hip surgery.
3. Associated femoral neck fractures or polytrauma.
4. Patients unable to comply with follow-up or provide informed consent.

Surgical Intervention

All patients underwent Dynamic Hip Screw (DHS) fixation performed by experienced orthopedic surgeons under spinal or general anesthesia. Patients were positioned supine on a fracture table. Closed reduction was achieved under fluoroscopic guidance. Intraoperative assessment included grading the quality of reduction (good, acceptable, poor), recording lag screw position, and measuring tip-apex distance (TAD). Postoperative care included standardized analgesia, early mobilization, and physiotherapy. Partial weight-bearing was initiated at 2-3 weeks postoperatively, progressing to full weight-bearing at 8-12 weeks depending on tolerance. Operative parameters, including duration of surgery, intraoperative blood loss, transfusion requirements, and hospital stay, were recorded.

Data Collection: A structured questionnaire was developed to collect demographic and clinical variables, including age, sex, BMI, comorbidities, involved limb, Singh's index, and mechanism of injury (low- vs. high-energy trauma). Operative parameters, including duration of surgery, intraoperative blood loss, transfusion requirement, and hospital stay, were recorded. Preoperative assessment included laboratory tests, chest X-ray, ECG, echocardiography, and multidisciplinary consultations to confirm surgical and anesthetic fitness. Patients were followed postoperatively at 1, 3, 6, and 9 months. Clinical evaluation and radiographs (AP pelvis, AP and lateral hip views) were used to assess fracture healing. Functional outcomes were evaluated using the Harris Hip Score (HHS).

Outcome Measures: The primary outcomes were postoperative complications, including superficial wound infection, screw cutout, reoperation, and 90-day mortality, as well as radiological healing outcomes such as time to union, delayed union (union beyond 20 weeks), and non-union (no union at 6 months). Secondary outcomes included functional recovery measured by VAS and HHS at final follow-up and analysis of implant- and reduction-related predictors of DHS failure, including TAD, lag screw position, quality of reduction, and postoperative neck-shaft angle. Radiological union was confirmed when bridging trabeculae were observed across the fracture site on anteroposterior and lateral radiographs.

Statistical Analysis: Quantitative variables were expressed as mean ±standard deviation (SD) and compared between groups using independent-samples t-test (for normally distributed data) or Mann-Whitney U test (for non-normal data). Categorical variables were expressed as frequencies and percentages and compared using chi-square or Fisher's exact test, as appropriate. Relative risk (RR) with 95% confidence intervals (CI) was calculated for categorical outcomes. A p-value <0.05 was considered statistically significant. All analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA).

Considerations: The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants after detailed explanation of the

study objectives, procedures, risks, and benefits. Confidentiality, privacy, and anonymity were strictly maintained. Patients had the right to withdraw at any time. Institutional approval was obtained from the Academic Committee of the Department of Orthopaedics, BSMMU, and subsequently from the Institutional Review Board (IRB).

Result

Table 1: Baseline demographic and clinical characteristics of the study population

Variable	Frequency (n)	Percentage (%)
Age (years)		
31-40	1	3.85
41-50	1	3.85
51-60	4	15.38
61-70	8	30.77
71-80	12	46.15
Mean±SD	67.73±10.26	
Gender		
Female	16	61.54
Male	10	38.46
BMI (kg/m²)		
Mean±SD	24.9±3.8	
Comorbidity		
Hypertension	17	65.38
Diabetes Mellitus	12	46.15
Coronary Artery Disease	5	19.23
Respiratory Disease	5	19.23
Kidney Disease	3	11.54
Involved limb		
Left	15	57.69
Right	11	42.31
Singh's Index		
I	0	0.00
II	4	15.38
III	9	34.62
IV	7	26.92
V	4	15.38
VI	2	7.69
Kyle's Type		
Type 1	14	53.85
Type 2	12	46.15

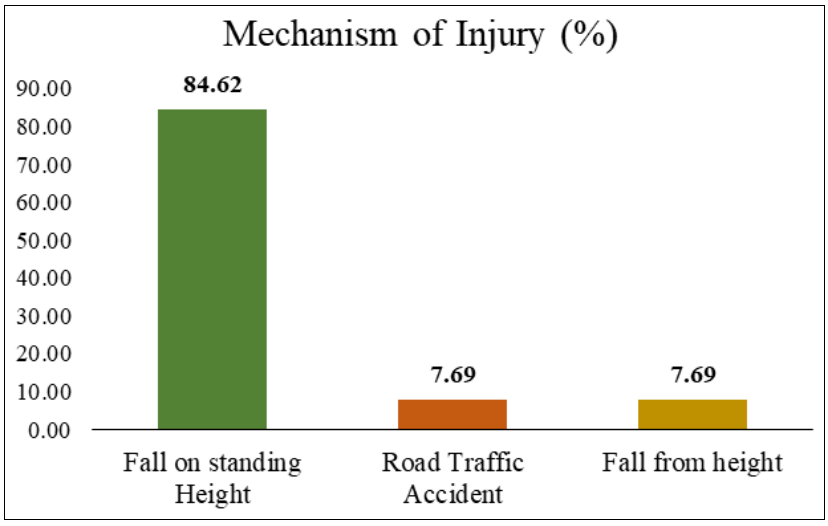

Fig 1: Distribution of patients according to mechanism of injury in intertrochanteric fractures managed with DHS

Table 2: Operative and perioperative parameters of the study population.

Variable	Mean±SD / n (%)
Duration of surgery (minutes)	66.8±8.1
Intraoperative blood loss (mL)	178.4±62.1
Blood transfusion required	7 (26.92)
Hospital stay (days)	5.4±1.6
Time to partial weight bearing (weeks)	2.4±0.7
Time to full weight bearing (weeks)	9.6±2.1
Length of follow-up (months)	14.3±4.2

Table 3: Postoperative complication rates in intertrochanteric fractures managed with DHS

Complication	Type 1 (n = 14)	Type 2 (n = 12)	Effect (RR, 95% CI)	p (Fisher)
Superficial wound infection	1 (7.14)	1 (8.33)	0.86 (0.06-12.7)	1
Screw cutout	0 (0.00)	2 (16.67)	0.17 (0.01-3.29)	0.203
Any complication	1 (7.14)	3 (25.00)	0.29 (0.04-2.09)	0.306
Reoperation required	0 (0.00)	2 (16.67)	0.17 (0.01-3.29)	0.203
90-day mortality	1 (7.14)	1 (8.33)	0.86 (0.06-12.7)	1

Table 4: Radiological healing outcomes in the study population

Outcome	Type 1 (n = 14)	Type 2 (n = 12)	Effect	p
Time to union (weeks), mean ±SD	12.4±2.3	16.2±3.1	Δ = −3.8 (95% CI −6.1 to −1.5)	0.002
Delayed union (>20 weeks)	0(0.00)	2 (16.67)	RR 0.17 (0.01-3.29)	0.203
Non-union	0(0.00)	2 (16.67)	RR 0.17 (0.01-3.29)	0.203

Table 5: Functional outcomes at final follow-up in the study population

Parameter	Type 1 (n=14)	Type 2 (n=12)	Effect	p
Harris Hip Score (Mean ±SD)	85.6±7.2	74.8±9.5	Δ = +10.8 (95% CI +3.8 to +17.8)	0.004
Good-Excellent Outcome (%)	12 (85.71)	7 (58.33)	RR 1.47 (0.87-2.48)	0.19
Poor Outcome (%)	1 (7.14)	3 (25.00)	RR 0.47 (0.06-3.71)	0.306

Table 6: Implant- and reduction-related predictors of DHS failure or complications in the study population

Parameter	Success (n = 21)	Complication / Failure (n = 5)	Effect Size / RR (95% CI)	p
Tip-Apex Distance (mm), mean ±SD	22.3±3.6	29.8±4.2	Δ = −7.5 (−10.9 to −4.1)	0.001
TAD >25 mm	3 (14.29)	4 (80.00)	RR = 0.18 (0.05-0.61)	0.004
Lag screw position (center-center)	17 (80.95)	1 (20.00)	RR = 4.05 (0.73-22.4)	0.028
Quality of reduction				
Good	14(66.67)	0(0.00)	$\chi^2 = 9.12$	0.01
Acceptable	6(28.57)	2(40.00)		
Poor	1(4.76)	3(60.00)		
Postoperative neck-shaft angle (°), mean ±SD	132.1±4.2	125.3±5.1	Δ = +6.8 (2.9-10.7)	0.002

Discussion: Intertrochanteric fractures remain a common challenge in orthopedic practice, and evaluating complication rates and healing trends following dynamic hip screw fixation provides crucial insight into patient outcomes [13]. In our study of elderly patients (mean age 67.7±10.26 years) with intertrochanteric fractures fixed by Dynamic Hip Screw (DHS), we observed demographic and clinical characteristics broadly comparable to prior literature, while also highlighting distinct operational and functional outcomes [14]. Our study population had a female predominance (61.54%), reflecting the well-established higher incidence of hip fractures in postmenopausal women, likely related to osteoporosis. This aligns with previous report by Alpantaki *et al.*, indicating female-to-male ratio ranging from 2.9:1 up in intertrochanteric fracture study [15]. In terms of injury mechanism, our finding that the overwhelming majority (84.62%) resulted from falls from standing height parallels other studies reporting trivial falls as the most common cause in elderly populations [16]. We recorded a mean surgical duration of 66.8±8.1 minutes, intraoperative blood loss of 178.4±62.1 mL, and a mean hospital stay of 5.4±1.6 days, followed by partial and full weight-bearing at 2.4±0.7 and 9.6±2.1 weeks, respectively. These timelines suggest a relatively expedited early postoperative recovery. While studies vary in reporting timing to weight-bearing, many DHS protocols endorse early mobilization within similar windows though direct comparisons remain sparse in the literature available [17-19]. In terms of complications, our overall complication rates remained low (7.14% in Type 1 vs. 25.00% in Type 2), with screw cut-out occurring only in Type 2 (16.67%). Mortality rates within 90 days ranged between 7-8% across groups, though not statistically different. Radiologically, Type 1 fractures united earlier (12.4±2.3 weeks) versus Type 2 (16.2±3.1 weeks), a significant difference (p = 0.002). Notably, delayed union or non-union was present only in Type 2 (16.67%), though this did not reach statistical significance. These findings resonate with broader clinical observations associating certain fracture patterns and fixation quality with delayed healing or mechanical failure. However, detailed comparative values from other DHS-focused studies are limited [20]. Functionally, the mean Harris Hip Score (HHS) at final follow-up was significantly higher in Type 1 (85.6±7.2) compared to Type 2 (74.8±9.5) (p = 0.004). The proportion achieving a good to excellent outcome was notably higher in Type 1 (85.71% vs. 58.33%), although this difference did not reach statistical significance (p = 0.19). Prior studies have reported varied HHS outcomes with DHS [21]. Meanwhile, a retrospective study of 64 DHS-treated patients recorded excellent outcomes in 57.8%, good in 20.3%, fair in 14.1%, and poor in 7.8% a distribution similar to our study, reinforcing external consistency [22]. Our analysis reaffirmed the critical importance of TAD as a predictor of DHS failure. Patients with complications had a significantly higher mean TAD (29.8±4.2 mm vs. 22.3±3.6 mm, p = 0.001), and those with TAD > 25 mm faced substantially higher risk (RR = 0.18, p = 0.004). Likewise, optimal lag screw placement (center-center) and good fracture reduction quality were strongly associated with successful outcomes (p = 0.028 and p = 0.01, respectively). Furthermore, a higher postoperative neck-shaft angle (132.1±4.2° vs. 125.3±5.1°, p = 0.002) predicted favorable results. These findings echo the work by Geller *et al.*, who found that no cut-outs occurred when TAD was < 25 mm; all failures occurred in patients with TAD > 35 mm [23]. The importance of proper screw position especially in the inferior-central zone of the femoral head and TAD are consistently highlighted as critical technical considerations [24].

Limitations of the study

The present study has several limitations. Firstly, the sample size was relatively small, limiting statistical power and generalizability. Secondly, it was a single-center study, which may not fully represent outcomes in different clinical settings. Thirdly, the follow-up period, although sufficient to assess early union and functional recovery, was relatively short for evaluating long-term complications such as implant fatigue, osteoarthritis, or secondary fractures. Finally, variability in patient bone quality and comorbidities may have influenced outcomes.

Conclusion

The present study demonstrates that Dynamic Hip Screw (DHS) fixation provides reliable and effective management for intertrochanteric femoral fractures, particularly in stable (Kyle Type 1) patterns, achieving favorable radiological healing and functional outcomes. Complication rates were low, with screw cut-out and delayed union occurring primarily in unstable (Type 2) fractures. Tip-apex distance >25 mm, poor reduction quality, and non-central lag screw placement significantly increased the risk of DHS failure. Meticulous surgical technique, accurate implant positioning, and early mobilization are critical to optimize outcomes. DHS remains a cost-effective and dependable option for intertrochanteric fracture management in clinical practice.

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