ORIGINAL ARTICLE

# Outcome Evaluation of Intertrochanteric Fracture Fixation Using Dynamic Hip Screw

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**Golam Shaikh Ferdous[1], Nazrul Islam[2], Aynun Nahar Rabeya Diba[3], Aminur Rasul[4], Debashish Dey[5], Mahfujur Rahman[6]**

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Gopalganj Medical College, Gopalganj, Bangladesh

**Correspondence to**
Golam Shaikh Ferdous

**ORCID**
https://orcid.org/0009-0006-9016-793X



***ABSTRACT***
***Background:*** *Intertrochanteric femoral fractures are common in the elderly and often lead to significant morbidity. The Dynamic Hip Screw (DHS) is a widely used fixation method, though its outcomes continue to be evaluated in relation to fracture stability and patient factors.* ***Aim:*** *To assess the clinical, radiological, and functional outcomes of intertrochanteric fracture fixation using DHS and identify factors influencing postoperative recovery.* ***Methods & Materials:*** *This prospective study included 36 patients (mean age 75.2 ± 9.1 years) with AO/OTA 31-A1 to A3 fractures treated with DHS. Follow-up was ≥12 months. Radiological outcomes included time to union, neck–shaft angle, and fracture collapse. Functional outcomes were measured using Harris Hip Score (HHS) and SF-36 PCS. Statistical significance was set at $p < 0.05$.* ***Results:*** *Mean time to union was 13.6 ± 2.1 weeks, and mean neck–shaft angle was 129.8° ± 5.0°. Final HHS averaged 82.4 ± 10.2, and SF-36 PCS averaged 72.5 ± 11.3. Excellent or good outcomes were seen in 55.6% of patients. Younger age (<75 years), stable fracture pattern, early surgery (<3 days), and absence of complications were significantly associated with higher HHS. Complications occurred in 27.8%, including screw cut-out (5.6%), varus malunion (8.3%), and implant-related pain (11.1%).* ***Conclusion:*** *DHS fixation provides dependable union and satisfactory function, particularly in stable fractures and when surgery is performed early. Accurate reduction and careful postoperative care help minimize complications and improve outcomes in elderly patients.*

***Keywords:*** *Intertrochanteric fracture, Dynamic Hip Screw, Harris Hip Score, Osteoporosis, Functional outcome, Elderly fractures*

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1. *DGHS, Deputed to Bangladesh Medical University, Dhaka, Bangladesh*
2. *DGHS, Deputed to Bangladesh Medical University, Dhaka, Bangladesh*
3. *Department of Orthopaedic, Bangladesh Medical University, Dhaka, Bangladesh*
4. *DGHS, Deputed to Bangladesh Medical University, Dhaka, Bangladesh*
5. *DGHS, Deputed to Bangladesh Medical University, Dhaka, Bangladesh*
6. *DGHS, Deputed to Bangladesh Medical University, Dhaka, Bangladesh*

## INTRODUCTION

Intertrochanteric fractures refer to extracapsular fractures of the upper femur occurring in the region between the greater and lesser trochanters [1]. The incidence of intertrochanteric fractures had been increasing due to greater longevity and a rising number of road traffic accidents. Intertrochanteric fractures accounted for approximately half of all hip fractures in the elderly [2,3]. These fractures occur more frequently in females, with the female-to-male ratio reported between 2:1 and 8:1 [1]. At present, there are around 280,000 fractures reported each year, with roughly half being intertrochanteric fractures. Projections indicate that by 2040, the annual number of fractures may rise by 500,000 [1]. The incidence of intertrochanteric fractures is increasing due to a growing elderly population with osteoporosis. It is projected that by 2040, the incidence could double [4]. The incidence of intertrochanteric fractures differs across countries. Research predicted that the total number of hip fractures would reach 2.6 million by 2025 and 4.5 million by 2050. In 1990, Asia accounted for 26% of all hip fractures, a proportion expected to increase to 37% by 2025 and 45% by 2050 [5,6]. Intertrochanteric fractures most commonly result from low-energy trauma, such as a fall from standing height. Contributing risk factors include advanced age, female sex, osteoporosis, previous falls, and gait disturbances [7]. The primary aim in managing hip fractures is to restore the patient's pre-fracture level of function, prevent long-term disability, and minimize medical complications. Stable fixation followed by early mobilization is regarded as the standard approach. Treatment options include both nonoperative and operative methods, with surgical interventions such as internal fixation using dynamic hip screws, sliding screws, or intramedullary devices [8]. The dynamic hip screw (DHS), widely used for extramedullary fixation, is considered a standard implant for managing these fractures [9,10]. Among intramedullary fixation devices, the proximal femoral nail (PFN) and Gamma nail are commonly utilized. However, the Gamma nail has been found to cause a higher rate of postoperative femoral shaft fractures compared to the DHS [11]. Commonly used fixation devices include compression hip screws with side plates, such as the dynamic hip screw (DHS), and intramedullary systems. Although debate exists over the preferred method, intramedullary devices are increasingly favored for their advantages [12,13]. Improved implant design, surgical techniques, and shorter hospital stay help enhance stability and reduce postoperative complications [14]. Intertrochanteric fractures are a common injury among the elderly, often leading to significant morbidity and loss of independence. Although various fixation methods are available, the dynamic hip screw (DHS) remains widely used due to its proven effectiveness, simplicity, and cost-efficiency. However, variations in surgical technique, patient factors, and fracture patterns can influence outcomes. This study aims to evaluate the functional and radiological outcomes of intertrochanteric fracture fixation using the dynamic hip screw, assessing its effectiveness in restoring mobility, promoting fracture union, and minimizing postoperative complications.

## METHODS & MATERIALS

This prospective observational study was conducted at the Department of Orthopaedic Surgery at BSMMU, Shahbagh, Dhaka, Bangladesh over a period of 24 months from September 2022 to September 2024. The study was designed to evaluate clinical, functional, and radiological outcomes following fixation of intertrochanteric femoral fractures using the Dynamic Hip Screw (DHS) system. Ethical approval was obtained from the Institutional Review Board, and all participants provided written informed consent prior to inclusion.

A total of 36 consecutive patients with intertrochanteric fractures of the femur were included based on predefined inclusion and exclusion criteria.

**Inclusion criteria** were:

1. Patients aged ≥ 50 years with closed intertrochanteric fractures (AO/OTA type 31-A1 to A3).
2. Fractures treated primarily with DHS within 5 days of injury.
3. Patient's ambulatory prior to injury.
4. Availability for at least 12 months of follow-up.

**Exclusion criteria** were:

1. Pathological fractures or polytrauma.
2. Subtrochanteric or basicervical fractures extending below the lesser trochanter.
3. Previous ipsilateral hip surgery or deformity.
4. Patients medically unfit for anesthesia or surgery.

### Preoperative Assessment

Upon admission, all patients underwent thorough clinical and radiological evaluation. Demographic data, mechanism of injury, comorbidities, and fracture characteristics were documented. Fractures were classified according to AO/OTA and modified Evans systems based on anteroposterior and lateral radiographs. Preoperative optimization of comorbid conditions was ensured to minimize perioperative risks.

### Surgical Technique

All surgeries were performed under spinal or combined spinal-epidural anesthesia on a fracture table under fluoroscopic guidance by an experienced orthopedic team. Closed reduction was achieved through traction and internal rotation of the affected limb, and reduction was confirmed radiographically. A standard DHS with a 135° barrel plate was inserted via a lateral approach. The lag screw was placed centrally or slightly inferiorly in the femoral head, ensuring a tip–apex distance (TAD) ≤ 25 mm. The plate length (typically 4–6 holes) was chosen according to fracture stability and bone quality. Wound closure was performed in layers over a suction drain, which was removed 24–48 hours postoperatively.

### Postoperative Care

Postoperative management included intravenous antibiotics for 24–48 hours and thromboprophylaxis per institutional protocol. Patients were encouraged to perform active quadriceps and ankle exercises from the first postoperative day. Partial weight-bearing with a walker was initiated based on pain tolerance and gradually progressed to full weight-bearing according to radiological evidence of healing.

### Follow-up and Outcome Assessment

Patients were followed at 6 weeks, 3 months, 6 months, and 12 months. Clinical evaluation was performed alongside standard anteroposterior and lateral radiographs at each visit. Radiological outcomes included time to fracture union, defined as bridging of at least three cortices with absence of pain or tenderness, neck–shaft angle, shortening, and fracture site collapse. Functional outcomes were assessed using the Harris Hip Score (HHS) and SF-36 Physical Component Score (PCS). Postoperative complications, such as superficial and deep infections, screw cut-out, varus malunion, delayed union, nonunion, implant failure, and thigh or implant-related pain, were systematically recorded.

### Statistical Analysis

All data were analyzed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Comparisons between groups (e.g., age, fracture stability, complications) were performed using independent-samples *t*-test or one-way ANOVA for parametric data, and Mann–Whitney U or Kruskal–Wallis test for nonparametric data. Associations between categorical variables were tested using the Chi-square test or Fisher's exact test where appropriate. A p-value < 0.05 was considered statistically significant.

### Ethical Considerations

The study adhered to the principles of the Declaration of Helsinki. All participants provided written informed consent, and the study protocol was approved by the institutional ethics committee.

## RESULT

The mean age of patients was 75.2 ± 9.1 years, with females comprising 72.22%. Right-sided fractures 55.56% and stable patterns 55.56% were common. Most injuries 86.11% resulted from low-energy falls. Hypertension 41.67% and osteoporosis 50% were frequent. Mean injury-to-surgery time was 2.8 ± 1.4 days, and surgery duration 65.3 ± 12.7 minutes shows in (Table 1). Table 2 demonstrates that the mean time to radiological union was 13.6 ± 2.1 weeks. The mean neck–shaft angle was 129.8 ± 5.0°, shortening 5.1 ± 2.3 mm, limb length discrepancy 3.7 ± 1.8 mm, collapse 5.6 ± 2.5 mm, Harris Hip Score 82.4 ± 10.2, and SF-36 PCS 72.5 ± 11.3. Functional outcomes by Harris Hip Score were Excellent ≥90 (22.22%), Good 80–89 (33.33%), Fair 70–79 (25.00%), and Poor <70 (19.44%) examines in (Table 3). Table 4 illustrates that postoperative complications included superficial wound infection 5.56%, deep infection 0.00%, screw cut-out 5.56%, varus malunion 8.33%, delayed union 2.78%, nonunion

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2.78%, implant failure 2.78%, thigh/implant pain 11.11%, with ≥1 complication in 27.78%. Mean Harris Hip Scores were 85.9 ± 8.2 for age <75 and 78.1 ± 9.6 for ≥75 years (p=0.018*), 83.7 ± 9.3 for males and 81.5 ± 10.4 for females (p=0.358), 87.6 ± 7.9 for stable and 75.8 ± 8.6 for unstable fractures (p<0.001*), 86.4 ± 8.5 for surgery <3 days and 77.2 ± 9.7 for ≥3 days (p=0.008*), 86.8 ± 7.4 without complications and 72.9 ± 9.3 with ≥1 complication (p<0.001*), 82.7 ± 9.4 for right and 82.1 ± 10.8 for left side (p=0.859).

**Table – I: Baseline demographic and clinical characteristics of the study population (*n* = 36)**

| Variables | Frequency (n) | Percentage (%) |
|---|---|---|
| Age (years) | | |
| Mean ± SD | 75.2 ± 9.1 | |
| **Gender** | | |
| Male | 10 | 27.78 |
| Female | 26 | 72.22 |
| **Side of fracture** | | |
| Right | 20 | 55.56 |
| Left | 16 | 44.44 |
| **Fracture stability (AO/Evans-like)** | | |
| Stable (A1–A2 / Evans I–II) | 20 | 55.56 |
| Unstable (A3 / Evans III–IV) | 16 | 44.44 |
| **Mechanism of injury** | | |
| Low-energy fall (standing) | 31 | 86.11 |
| Road traffic accident | 5 | 13.89 |
| **Comorbidities** | | |
| Hypertension | 15 | 41.67 |
| Diabetes mellitus | 9 | 25.00 |
| Osteoporosis (documented/clinical) | 18 | 50.00 |
| **Time from injury to surgery (days)** | | |
| Mean ± SD | 2.8 ± 1.4 | |
| **Duration of surgery (minutes)** | | |
| Mean ± SD | 65.3 ± 12.7 | |

**Table – II: Radiological and functional outcomes at final follow-up**

| Outcome parameter | Mean ± SD | Range |
|---|---|---|
| Time to radiological union (weeks) | 13.6 ± 2.1 | 11–18 |
| Neck–shaft angle (°) | 129.8 ± 5.0 | 120–136 |
| Shortening (mm) | 5.1 ± 2.3 | 0–12 |
| Limb length discrepancy (mm) | 3.7 ± 1.8 | 0–9 |
| Collapse at fracture site (mm) | 5.6 ± 2.5 | 2–13 |
| Harris Hip Score (HHS) | 82.4 ± 10.2 | 56–96 |
| SF-36 Physical Component Score (PCS) | 72.5 ± 11.3 | 42–94 |

**Table – III: Functional outcome grading by Harris Hip Score (HHS)**

| Category | HHS range | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Excellent | ≥ 90 | 8 | 22.22 |
| Good | 80–89 | 12 | 33.33 |
| Fair | 70–79 | 9 | 25.00 |
| Poor | < 70 | 7 | 19.44 |

**Table – IV: Postoperative complications**

| Complication | Frequency (n) | Percentage (%) |
|---|---|---|
| Superficial wound infection | 2 | 5.56 |
| Deep infection | 0 | 0.00 |
| Screw cut-out | 2 | 5.56 |
| Varus malunion (clinically relevant) | 3 | 8.33 |
| Delayed union | 1 | 2.78 |
| Nonunion | 1 | 2.78 |
| Implant failure (mechanical) | 1 | 2.78 |
| Thigh pain / implant-related pain | 4 | 11.11 |
| Patients with ≥1 complication | 10 | 27.78 |

**Table – V: Associations between HHS and selected variables**

| Variable | Subgroup | Mean ± SD (HHS) | p-value |
|---|---|---|---|
| Age group (years) | < 75 (n = 20) | 85.9 ± 8.2 | 0.018* |
| | ≥ 75 (n = 16) | 78.1 ± 9.6 | |
| Gender | Male (n = 10) | 83.7 ± 9.3 | 0.358 |
| | Female (n = 26) | 81.5 ± 10.4 | |
| Fracture stability | Stable (A1–A2) (n = 20) | 87.6 ± 7.9 | < 0.001* |
| | Unstable (A3) (n = 16) | 75.8 ± 8.6 | |
| Time to surgery (days) | < 3 (n = 22) | 86.4 ± 8.5 | 0.008* |
| | ≥ 3 (n = 14) | 77.2 ± 9.7 | |
| Presence of complications | None (n = 26) | 86.8 ± 7.4 | < 0.001* |
| | ≥ 1 (n = 10) | 72.9 ± 9.3 | |
| Fracture side | Right (n = 20) | 82.7 ± 9.4 | 0.859 |
| | Left (n = 16) | 82.1 ± 10.8 | |

## DISCUSSION

Intertrochanteric fractures constitute a major clinical challenge in geriatric populations, frequently leading to prolonged hospitalization, loss of independence, and elevated mortality rates [15]. Their management is complicated by the presence of osteoporosis and multiple comorbidities, which demand fixation techniques that provide both biomechanical stability and permit early mobilization [16]. Among the available options, the Dynamic Hip Screw (DHS) continues to be a cornerstone in surgical treatment, offering controlled compression at the fracture site, maintaining anatomical alignment, and facilitating early weight-bearing [17]. Despite the emergence of advanced intramedullary devices, DHS remains widely utilized due to its technical simplicity, cost-effectiveness, and reproducible clinical outcomes, especially in stable and select unstable fracture configurations [18]. In the present study, the mean age of patients was 75.2 ± 9.1 years, with a predominance of female patients (72.2%), reflecting the typical demographic profile for osteoporotic hip fractures. Comparable findings were reported by Prakash et al. (2022), who observed a mean age of 61.09 ± 11.69 years and a female predominance of 60.87% in the DHS cohort [19]. Similarly, Raagul et al. (2025) documented a mean age of 69.04 ± 10.69 years with 52% females, while Jegathesan et al. (2022) reported 80.5 ± 8.8 years and 62.5% female patients [20, 21]. In our study, the majority of fractures (86.1%) resulted from low-energy falls, consistent with the osteoporotic nature of this injury pattern. Previous prospective studies have likewise highlighted low-energy trauma as the predominant cause of intertrochanteric fractures in elderly populations [22,23]. In the present study, radiological outcomes were favorable, demonstrating a mean fracture union time of 13.6 ± 2.1 weeks, an average neck–shaft angle of 129.8 ± 5.0°, and minimal limb shortening (5.1 ± 2.3 mm) or length discrepancy (3.7 ± 1.8 mm). These outcomes indicate satisfactory fracture alignment and healing following Dynamic Hip Screw fixation. Comparable findings were reported by Dar et al. (2023), who observed a mean postoperative neck–shaft angle of 126 ± 4° versus 136 ± 4° on the contralateral side, suggesting a mild varus tendency after fixation [24]. Similarly, Mardani-Kivi et al. (2014) documented favorable radiographic results with minimal shortening and acceptable alignment compared with locking compression plating [25]. The mean collapse at the fracture site in our study was 5.6 ± 2.5 mm, indicating effective impaction without compromising limb geometry. This aligns with Fang et al. (2016), who noted that excessive fracture collapse can impair gait but not survival [26], and Chang et al. (2012), who associated screw sliding over 10 mm with poorer clinical outcomes [27]. The present study demonstrated favorable functional recovery, with a mean Harris Hip Score (HHS) of 82.4 ± 10.2 and an SF-36 Physical Component Score of 72.5 ± 11.3. Over half of the patients achieved excellent or good HHS grades, reflecting satisfactory restoration of mobility and independence. Comparable findings were reported by Park et al. (2018), who observed a mean HHS of 85 following Dynamic Hip Screw fixation, indicating good to excellent outcomes [28]. Similarly, Singh et al. (2019) found no significant differences in clinical or radiological results between DHS and PFNA II for stable intertrochanteric fractures [29]. Furthermore, Shafiei et al. (2022) [30] documented marked postoperative improvement in SF-36 scores, underscoring enhanced quality of life. Postoperative complications in the present study were within the expected range, with superficial wound infections observed in 5.6% of cases, screw cut-out in 5.6%, varus malunion in 8.3%, and implant failure in 2.8%. Thigh or implant-related pain occurred in 11.1% of patients. In total, 27.8% of participants experienced at least one complication, underscoring the importance of meticulous surgical technique and vigilant postoperative follow-up. These findings are comparable with existing literature and reaffirm that, although the Dynamic Hip Screw (DHS) remains a reliable fixation method, careful case selection and intraoperative precision are essential to minimize adverse outcomes [31]. Functional outcomes in the present study were significantly influenced by patient age, fracture stability, and timing of surgery. Individuals below 75 years exhibited superior Harris Hip Scores (HHS) compared with older patients (85.9 ± 8.2 vs. 78.1 ± 9.6; $p = 0.018$), likely reflecting better physiological reserves and fewer systemic comorbidities [32]. Similarly, stable fracture configurations demonstrated significantly better recovery than unstable ones (HHS 87.6 ± 7.9 vs. 75.8 ± 8.6; $p < 0.001$), attributable to reduced technical complexity and improved biomechanical stability [33]. Early surgical intervention within three days of injury also yielded superior outcomes (HHS 86.4 ± 8.5 vs. 77.2 ± 9.7; $p = 0.008$), emphasizing the importance of prompt fixation in optimizing rehabilitation and preventing immobilization-related complications [34]. Conversely, patients with postoperative complications had markedly reduced functional outcomes (HHS 72.9 ± 9.3 vs. 86.8 ± 7.4; $p < 0.001$). Gender and fracture laterality had no significant influence on recovery, indicating a minimal effect on postoperative prognosis following DHS fixation.

**Limitations of the study:** The present study has several limitations. The sample size was relatively small, potentially limiting the generalizability of the findings. Follow-up was limited to 12 months, which may not capture late complications such as implant failure or functional decline. Additionally, this was a single-center observational study without a comparative control group, and bone mineral density was not quantitatively assessed, which could influence fracture stability and functional outcomes.

## CONCLUSION AND RECOMMENDATIONS

The present study demonstrates that Dynamic Hip Screw (DHS) fixation provides reliable radiological union and satisfactory functional recovery in patients with intertrochanteric femoral fractures, particularly in stable fracture patterns and those operated within three days of injury. Age, fracture stability, timing of surgery, and absence of complications were significant predictors of superior functional outcomes. While postoperative complications occurred in a minority, careful surgical technique, optimal implant positioning, and structured postoperative rehabilitation were pivotal in minimizing adverse events. DHS remains a cost-effective and biomechanically sound option for elderly patients, offering favorable outcomes when applied judiciously in appropriately selected cases.

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

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