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Short-term functional and radiological outcomes of trochanteric and subtrochanteric fractures treated with closed reduction using PFN A2 in Bangladesh

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Abstract
Background: A rising healthcare issue nowadays is trochanteric and subtrochanteric fracture. The anatomical structure makes the site difficult to heal from injury in a short period. Close reduction surgery with PFN A2 is a promising treatment method for surgeons to deal with this problem.
Objectives: The primary objective of this study is to find out the short-term functional and radiological outcome of Trochanteric and Subtrochanteric Fractures Treated with Closed Reduction Using PFN A2 in a tertiary in Bangladeshi settings.
Methodology: A prospective observational study took place at the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) within two years. 50 patients were enrolled and underwent the surgical procedure with pre-determined inclusion and exclusion criteria. Hand-written CRF, MS Excel, and SPSS version 20.0 are used as data collection and data analysis tools for this study.
Results: Patients with 1.5:1 ratios of male and female have been included in this study, 60-75 years patients came with complaints of Trochanteric and Subtrochanteric Fractures mostly (43.33%); the mean age for the patient was 70.79±3.88 years. Trochanteric fractures are most common among patients (87%). Mean Harries Hip Score shows a potential functional outcome with 40% excellent and 46.67% good interpretations. The radiological image also shows an acceptable insight into the good fitting of PFN A2 in the fractured area with limited complications of hip joint stiffness (3.33%), and infections (13.33%).
Conclusion: The short-term functional outcome of close reduction surgery with PFN A2 concludes with promising outcomes in terms of radiological features and patient improvement in a tertiary care center in Bangladesh.

Keywords: Trochanteric fracture, subtrochanteric fracture, proximal femur fracture, close reduction surgery, PFN A2

Introduction
Trochanteric and subtrochanteric fractures have become challenging to the healthcare system worldwide, especially in developing countries like Bangladesh, it add an extra load to surgeons to save patients from death or disabilities with limited resources. These are the most common types of orthopedic injuries that can occur due to osteoporosis, trauma, and certain medications like bisphosphonates [1, 2, 3]. Mostly, the elderly population suffers from trochanteric and subtrochanteric fractures but the prevalence of younger patients is also not negligible in Bangladeshi hospitals. It is accountable for 42% of all hip fractures [4]. The proximal femur plays an important role in weight balancing and promotes swift movement of the site. A fracture between the femoral neck and the trochanteric region is known as a trochanteric fracture. In contrast, a fracture beneath 5 centimeters of the trochanter is a subtrochanteric fracture [5]. Vigorous deforming forces, deep vein thrombosis, and enormous load in the fracture site make it troublesome for physicians to treat [6]. A proximal femoral nail anti-rotation (PFN A2) is a surgical approach to treat Trochanteric and subtrochanteric fractures with rapid bone alignment and fewer complications [7]. PFN A2 stabilizes the fracture by inserting it into the femur and promotes early recovery by applying

directional pressure to the fracture site [7]. Comparing the risks of morbidity and mortality by non-operative methods to treat trochanteric and subtrochanteric fractures, PFN A2 become a choice of treatment nowadays. Minimally invasive and limited duration of surgical intervention is also effective for short blood loss in the fracture area [8]. The favorable outcome and cost-effectiveness are the reasons behind its growth in Bangladesh. This study focuses on the evaluation of short-term functional and radiological outcomes of trochanteric and subtrochanteric fractures treated with PFN A2 among the Bangladeshi population. Evidence-based insights will help the researchers in decision-making and improving patient care in similar settings.

Methodology: The study method was prospective observational, and 50 patients were enrolled in this study in the meantime of 2 years. The site of the study was the National Institute of Traumatology and Orthopaedic Rehabilitation (NITOR) and the timeline was August 2022 to July 2024. With ethical clearance from the Institution Review Board, all patients were included by securing written consent. Some study-specific inclusion and exclusion criteria are followed during patient enrolment:

Inclusion criteria

- Patients aged 18 years or older
- Diagnosed Trochanteric and subtrochanteric fracture by radiological imaging
- Medically fit for surgical procedure

Exclusion criteria

- Open or pathological fractures
- Polytrauma
- Previous surgeries at the fracture site
- Lack of informed consent

Surgical procedures involved closed reduction under fluoroscopic guidance. Standard surgical protocols were followed to insert the PFN A2 after spinal anesthesia. Accurate placement of the nail and screw was ensured to optimize biomechanical stability. Functional and radiological outcomes were measured at 12th and 24th week points. Intraoperative and postoperative complications were closely observed and recorded in patient-specific case report forms. MS Excel and Statistical Package for Social Science (SPSS) version 20.0 was used as the data analysis tool.

Results

This study data showed a male-dominant result with 30 male and 20 female participants. The male-female ratio here was 1.5:1.

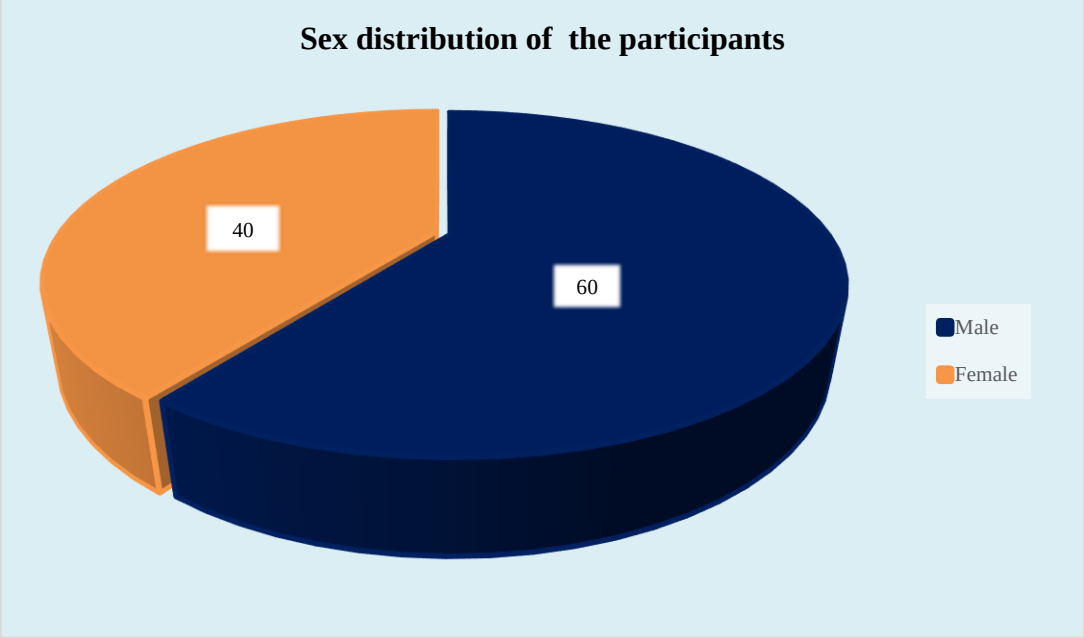

Fig 1: Pie chart showed gender wise patients distribution (N=30)

Trochanteric and Subtrochanteric Fractures were observed in mostly older patients (73-75 years). The mean age recorded for the study was 70.79±3.88 among 60-75 years of all patients.

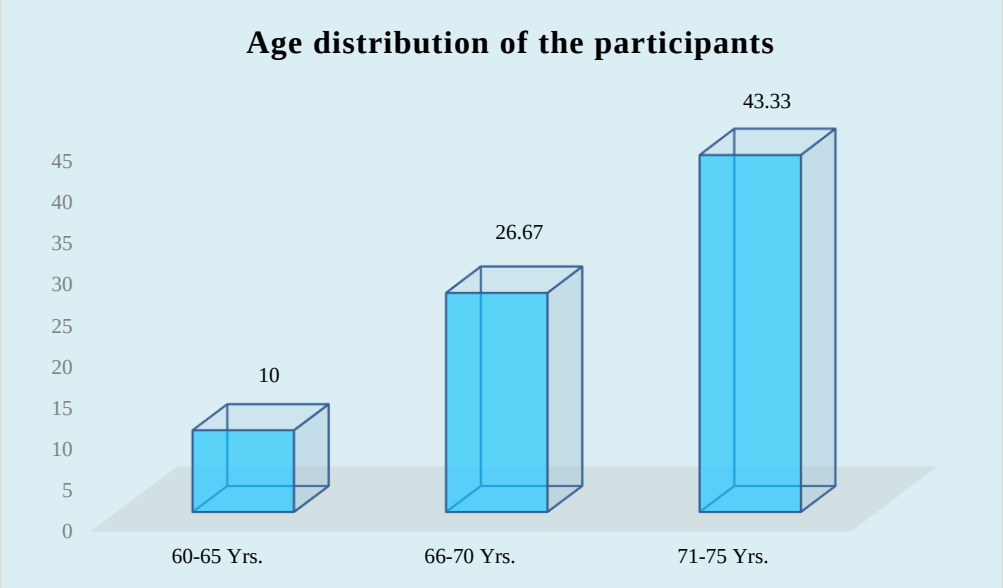

Fig 2: Column chart showed age wise patients distribution (N=30)

In a tertiary care center in Bangladesh, the number of patients presented with Subtrochanteric fracture was 6.5 times higher than that of Trochanteric fracture.

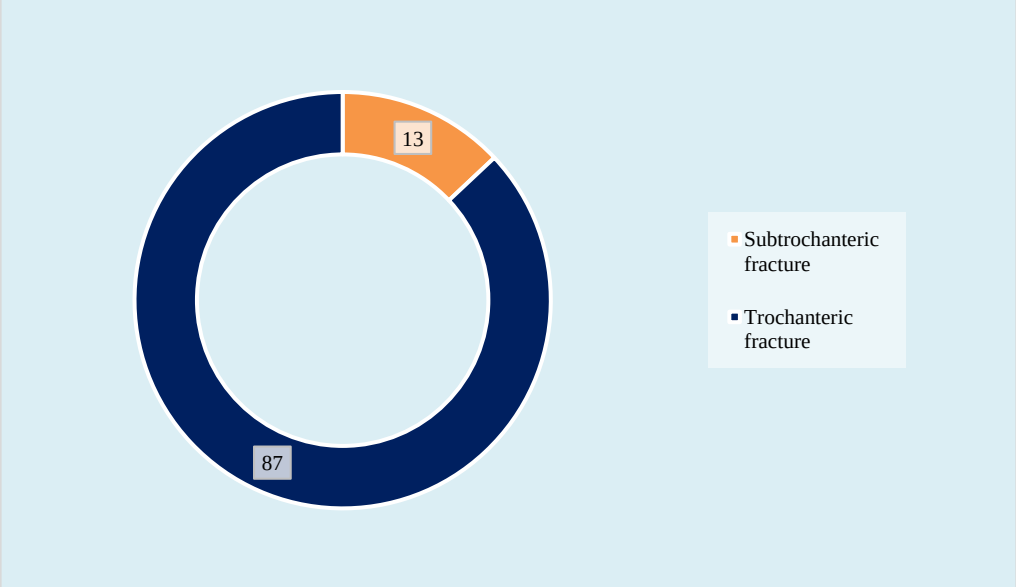

Fig 3: Ring chart showed type of proximal femur fracture (N=30)

Table 1: Mean Harries Hip Score at the end of 6 months (N=30)

Variables	Interpretation	Patient Percentage
Excellent	90-100	40%
Good	80-90	46.67%
Fair	70-80	10%
Poor	<70	3.33%

The postoperative radiograph showed fracture reduction in almost every patient. The maximum consolidation period by follow-up was 5 months.

Fig 4: Pre-operative x-ray subtrochanteric fracture

Fig 5: Post-operative x-ray unstable subtrochanteric Fracture (Left leg)

Table 2: Complication summary by closed reduction with PFN A2 surgery (N=30)

Complications	Percentage of patients
Hip joint stiffness	3.33%
Knee joint stiffness	0%
Nonunion	0%
Implant failure	0%
Infection	13.33%

Figure 6: Pre-operative x-ray subtrochanteric fracture

Figure 7: Post-operative x-ray unstable subtrochanteric Fracture (Right leg)

Discussion

Proximal Femoral Nail Antirotation II (PFN-A2) is a new-era surgical mechanism that units broken trochanteric or subtrochanteric bone with the benefit of close reduction, operating time less than 1 hour (average 47 minutes), limited tissue damage and early recovery [9, 10]. The prevalence of male participants is more prominent than females in this study which is similar to many and dissimilar too. Sachin NS *et al.*, 2019 study showed a male-female ratio of 1.5:1 whereas Mahesan H *et al.*, 2023 showed a 0.57:1 ratio in their study on subtrochanteric fracture managed by PFN A2 [7, 11]. Among 30 patients, the mean age for the patient recorded 70.79±3.88 years, Bakshi AS *et al.*, 2022 reported a mean age of 43.33 years and Kandasamy KG *et al.*, 2020 appeared with a result mean age of 56.4 years in their respective studies [12, 13]. Comparing with previous data, a result can be drawn that demographic results might vary with time and place. We found 87% of patients with trochanteric fractures and 13% with subtrochanteric fractures in our study in 2 years of timeline. Contrasting with another study with 169 cases of trochanteric fractures and 55 cases of subtrochanteric fractures, we can assume that trochanteric fractures are more frequent in proximal femur injuries [14]. Mean Harries Hip

Scoring was done to detect the efficacy of the surgical procedure with Closed Reduction Using PFN A2. 46.67% of participants marked it as good and 40% as excellent. With 3.33% of poor marking, this procedure shows a prominent result in this study. Bakhshi AS *et al.*, 2022 and Rai B *et al.*, 2022 partially disagree with this study with 70% of excellent and 72% of good outcomes in six months respectively [12, 10] whereas, other researchers partially agree with this study by their results [7, 11]. Radiological findings display a good fitting of PFN A2 via the surgical method in 6 month period which is more or less indistinguishable from every researcher [13, 15, 9]. Zero mortality rate is the basic success of this study, and no patients reported complications of delayed union. Although some cases of hip joint stiffness (3.33%), and infections (13.33%) have been recorded; Tiwari M *et al.*, 2016 shared the dissimilar complications of delayed union in their studies [16]. Islam MH *et al.*, 2022 suggested that evidence-based infection control and modification of antibiotic prescriptions in Bangladeshi hospitals can reduce the rate of post-operative infections [17].

Limitations

A single-centered study based on a short time is the primary drawback of this study. The study could be more effective if frequent follow-ups of the participants could be provided with a day-to-day recording of improvement.

Conclusion

The short-term functional and radiological outcomes of closed Reduction with PFN A2 surgery suggest a beneficial outcome for trochanteric and subtrochanteric fractured patients. Short-duration surgery with minimal complications makes the process preferable for patients. Likewise, the Mean Harries Hip Score and radiological images along with previous studies predict that the surgery can take the spot of being the most efficient relief for patients in upcoming times in developing countries like Bangladesh.

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