

# High Union Rate with Low Implant Failure after Proximal Femoral Nailing for Subtrochanteric Femur Fractures: Experience from a Tertiary Hospital Series

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## Abstract

**Background:** Subtrochanteric femur fractures represent a challenging injury due to high biomechanical stress and inherent instability. Proximal femoral nailing (PFN) is widely accepted as the gold standard treatment because of its biomechanical advantages and minimally invasive approach. This study aimed to evaluate the union rate, implant failure, complications, and functional outcomes following PFN in a tertiary hospital setting.

**Methods:** This prospective cohort study was conducted at a tertiary care hospital in Bangladesh from August 2022 to July 2023. Twenty adult patients with closed post-traumatic subtrochanteric fractures treated with PFN were included. Patients were followed for at least 24 weeks. Data collected included demographic characteristics, mechanism of injury, fracture type (Seinsheimer classification), time to surgery, radiological union, complications, and functional outcome assessed using the Modified Harris Hip Score.

**Results:** Most patients were aged 31-40 years (40%) and male (65%). Road traffic accidents were the commonest cause of injury (80%). Seinsheimer type II fractures were more frequent (45%). Surgery was done within 8-14 days in 70% of cases. Radiological union was achieved within 13 weeks in 65% and 13-18 weeks in 25%, with an overall union rate of 95%. Seventy per cent of patients had no complications, while restricted knee movement (10%), restricted hip movement (10%), and superficial infection (10%) were noted. Deep infection and implant failure were not observed. The functional results were excellent in 65%, good in 20%, fair in 10%, and poor in 5%.

**Conclusion:** PFN demonstrated a high union rate with minimal complications and excellent functional outcomes in most patients, supporting its effectiveness in managing subtrochanteric femur fractures.

**Keywords:** Subtrochanteric Fracture, Proximal Femoral Nail, Functional Outcome, Harris Hip Score

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## I. INTRODUCTION

The subtrochanteric region of the femur is defined as the area of the femur 5 cm distal to the lesser trochanter. The region is primarily made up of thick cortical bone. The region is subjected to large axial and bending stresses. The strong pull of the surrounding musculature, particularly the iliopsoas, gluteals, and adductors, causes large deforming forces after a fracture. The region is considered inherently unstable and difficult to heal due to the constraints of anatomy, blood supply, and mechanical stress distribution [1,2]. Therefore, subtrochanteric fractures are a worldwide health issue because these fractures are associated with a high morbidity rate and resource use. Globally, subtrochanteric fractures contribute to 10% to 34% of all proximal femoral fractures, with a majority due to high-energy trauma from motor vehicle accidents in young people and falls in elderly people from low-energy trauma [3,4]. In Asia, urbanization and motorization are leading causes of increasing subtrochanteric fractures, especially in young males from traffic accidents [5,6]. Reports from South Asia, including Bangladesh, reveal a similar trend in subtrochanteric fractures, with a majority of young males with high-energy subtrochanteric fractures presenting a big challenge for orthopaedic surgeons [7,8]. Proximal femoral nails are load-sharing implants that offer relative stability and preserve soft tissue attachments, enabling early weight-bearing compared to traditional plating methods [9,10]. This analysis has shown that union rates for such fractures are between 85-96%, while complication rates are highly variable depending on the fracture pattern, timing of intervention, and quality of reduction [11-13]. Implant-related failures such as screw cut-out, collapse, and non-union are also important concerns and have been reported to occur in up to 5-10% of cases [10,12]. Many of the studies conducted on subtrochanteric fractures have limitations in fracture patterns, fixation methods,

definitions of union, and varying follow-up periods [12,13]. Literature on this issue from low- and middle-income countries, such as Bangladesh, is scarce in terms of studies conducted on the failure rates of implants and the rates of union in such cases. Most of the literature is retrospective in nature and has limitations in comparing the outcomes with international data [6,7]. This analysis presents a consecutive series of patients with subtrochanteric femur fractures managed with proximal femoral nailing, with the primary objective of evaluating union rates, time to radiological healing, and incidence of implant-related complications in a real-world, developing-country context. Functional outcomes were also assessed to provide a comprehensive evaluation of both clinical and radiological recovery. Therefore, the study aims to determine the high union rate and low implant failure following proximal femoral nailing in a tertiary hospital setting.

## II. METHODS

This prospective cohort study was conducted at the Department of Orthopedics in Mymensingh Medical College Hospital, Mymensingh, Bangladesh, for a period of one year from August 2022 to July 2023. During the study period, a total of 20 patients were considered eligible for this study if they were adults (age 18 years and above) of either sex with closed fractures undergoing proximal femoral nailing. Patients with open contaminated fractures, polytrauma, pathological fractures (except osteoporotic), or those who cannot follow up were excluded. The baseline information was collected using a structured case record form, which included demographic variables (age, sex, occupation), mechanism of injury, type of fracture (Seinsheimer classification), and preoperative clinical information. Operative and perioperative variables were also recorded. The patients were followed up for a period of at least 24 weeks. The assessment parameters included the rate and time to fracture union, implant failure, complications, fracture alignment, limb length discrepancy, weight-bearing status, pain, range of motion, and functional recovery as measured by the Modified Harris Hip Score [14]. Data were analyzed using SPSS (version 25.0). Continuous variables were summarized as mean±SD and categorical variables as frequency and percentage. Ethical approval was obtained from the Institutional Review Board of the hospital.

## III. RESULTS

Table 1 shows that the group cohort consisted mainly of those aged 31-40 years (40%) and were male (65%). The majority of injuries were due to road traffic accidents (80%), followed by falls on the ground (15%) and falls from height (5%). This would indicate that middle-aged males are the most vulnerable to injury from traffic-related incidents.

**Table 1: Baseline cohort profile and injury mechanism (n = 20)**

Variable	Category	n	%
Age group (years)	18-30	1	5.0
	31-40	8	40.0
	41-50	5	25.0
	51-60	4	20.0
	61-70	2	10.0
Sex	Male	13	65.0
	Female	7	35.0
Mechanism of injury	Road traffic accident	16	80.0
	Fall on the ground	3	15.0
	Fall from height	1	5.0

Table 2 demonstrates that the fracture patterns were predominantly Seinsheimer type II (45%), type III (30%), and type IV (20%). Type V fractures were few (5%). This suggests that two-part fractures (type II) are more common in this series, and more complex fracture patterns are less common.

**Table 2: Fracture pattern by Seinsheimer classification (n = 20)**

Seinsheimer type	n	%
II	9	45.0
III	6	30.0
IV	4	20.0
V	1	5.0

Table 3 presents that the majority of patients (70%) underwent surgery 8-14 days post-injury, while 20% of patients underwent surgery within 0-7 days, and 10% underwent surgery 15-21 days post-injury. This suggests a trend towards delayed surgery beyond the first week.

**Table 3:** Time interval from injury to operation (days) (n = 20)

Time interval (days)	n	%
0-7	4	20.0
8-14	14	70.0
15-21	2	10.0

Table 4 shows that the radiological union was achieved in less than 13 weeks in 65% of patients, 13-18 weeks in 25%, and 19-24 weeks or beyond 24 weeks in 5% each. This indicates that most fractures in the cohort healed within three months postoperatively.

**Table 4:** Radiological union time (n = 20)

Union time (weeks)	n	%
<13	13	65.0
13-18	5	25.0
19-24	1	5.0
>24	1	5.0

Table 5 shows that radiological union was satisfactory in 95% of patients, with only 5% experiencing delayed union, indicating a high rate of successful fracture healing in this cohort.

**Table 5:** Radiological union time (n = 20)

Status	n	%
United (satisfactory)	19	95.0
Delayed union	1	5.0

Table 6 presents that postoperatively, 70% of patients had no complications. Minor issues included restricted knee (10%) and hip (10%) range of motion, and superficial wound infection (10%). There were no cases of deep infection or implant failure, indicating overall favourable surgical outcomes.

**Table 6:** Postoperative complications, including implant failure (n = 20)

Complication	n	%
No complications	14	70.0
Restricted knee ROM	2	10.0
Restricted hip ROM	2	10.0
Superficial wound infection	2	10.0
Deep infection	0	0
Implant failure	0	0

Table 7 reveals that the functional outcomes were favourable: 65% of patients had excellent, 20% good, 10% fair, and 5% poor Modified Harris Hip Scores. This indicates that the majority regained high hip function postoperatively.

**Table 7:** Functional outcome at final follow-up (Modified Harris Hip Score, n = 20)

HHS category	n	%
Excellent (90-100)	13	65.0
Good (80-89)	4	20.0
Fair (70-79)	2	10.0
Poor (<70)	1	5.0

#### IV. DISCUSSION

In this analysis involving 20 patients with subtrochanteric and intertrochanteric fractures, the age distribution pattern revealed that the majority of patients (40%) belonged to the 31-40 years age group which is aligned with earlier studies [15]. The age distribution pattern of this analysis reveals that the study population is relatively younger compared to the majority of hip fracture studies, which involve predominantly elderly osteoporotic females [16]. The mechanism of injury also supports this finding, as road traffic accidents were responsible for the majority of fractures (80%), with falls to the ground accounting for 15% and falls from height accounting for 5%, which is consistent with previous studies [15,17]. Analysis of fracture patterns showed that Seinsheimer type II fractures were the most common (45%), followed by type III (30%), type IV (20%), and type V (5%), suggesting that two-part fractures were more common than complex comminuted fractures. However, this has been seen in other clinical studies where stable fracture patterns are more common than highly comminuted fractures [18,19]. Regarding the surgical timing, most patients (70%) underwent surgery between 8-14 days post-injury, followed by 20% who underwent surgery within 0-7 days, and 10% between 15-21 days, indicating a trend towards delayed fixation beyond the first week, which might be due to optimization considerations; although early surgery is preferred, delay in surgery has been a common practice in many healthcare settings and has been previously discussed in the literature [20,21]. The radiological union was attained in less than 13 weeks in 65% of patients, between 13-18 weeks in 25%, between 19-24 weeks in 5%, and after 24 weeks in 5%, showing that most patients had union of their fractures within three months, which is in accordance with the previously reported union times ranging from 12 to 17 weeks post-intramedullary fixation [15,17,22]. The total rate of satisfactory union at 95%, with only one case (5%) of delayed union, further supports the efficacy of the fixation technique used and reflects the rates of union of approximately 90-95% seen in similar studies [15,18,23]. The rate of postoperative complications was relatively low, with only 70% of patients having no complications. Restricted knee movement was noted in 10% of patients, restricted hip movement in 10%, and superficial wound infection in 10%. Notably, there were no patients who developed deep infection or implant failure, further validating the existing literature that modern fixation techniques have low rates of complications when proper surgical techniques and postoperative care are employed [15,17,24]. Analysis of functional outcome by Modified Harris Hip Score revealed that 65% of patients had excellent results (90-100%), 20% had good results (80-89%), 10% had fair results (70-79%), and only 5% had poor results (<70%). The results suggest that the majority of patients have regained a high level of hip function. The results are comparable to other studies that have shown excellent to good results in 70-85% of patients after proximal femoral nailing [16,18,19,23]. This study draws attention to the fact that in a young and predominantly male trauma group, road traffic accidents are the most common cause of injury and have simpler fracture patterns. The surgery is often delayed beyond one week; however, the radiological union is usually attained within three months with a high success rate and few complications. In conclusion, the functional results are mostly excellent and comparable to the existing literature on the treatment of subtrochanteric and intertrochanteric femoral fractures [15-24].

**Limitations of the study:** The limitations of the current study include a small sample size, a single-centre study, a short follow-up period, and a lack of a control group. The current study did not evaluate the patients' comorbidities, adherence to rehabilitation, and patient-reported outcomes.

#### V. CONCLUSION

Proximal femoral nailing achieved a high rate of fracture union with minimal complications and excellent functional outcomes, emphasizing its effectiveness and reliability in the treatment of subtrochanteric fractures of the femur. This indicates the biomechanical stability and clinical effectiveness of PFN in the achievement of radiological and functional recovery from subtrochanteric fractures of the femur.

#### VI. RECOMMENDATION

Surgical intervention at an early stage with proximal femoral nailing is advised in the case of subtrochanteric femur fracture to ensure a high union rate without complications. More emphasis might be placed on fracture reduction during surgery.

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