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Original Research Article

Functional Outcome of Closed Locked Intramedullary Nailing of The Femoral Shaft Fracture

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Abstract: ***Background:*** Femoral shaft fractures are common adult injuries, necessitating effective treatment strategies to optimize patient outcomes. Closed locked intramedullary nailing is widely recommended for femoral shaft fractures due to its high union rates. ***Objective:*** This study aims to determine the outcome of managing closed femoral shaft fractures in adult patients using Closed Femur Nailing. ***Methods:*** This prospective study was conducted at the Department of Orthopedics, Rangpur Medical College Hospital, and a multicentral private hospital in Rangpur Zone from January 2016 to December 2019. Adult patients aged 16 years and above, presenting with closed femoral shaft fractures within two weeks of injury, were included, while pathological fractures were excluded from the study. Standard techniques were employed for the Closed Femur Nailing procedure, and each patient was followed up for at least 1 year. ***Results:*** A total of 112 adult patients were enrolled, with a mean age of 36.9 ± 11.7 years and a male-to-female ratio of 2.9:1. Road traffic crashes were the predominant cause of closed femoral shaft fractures (95.3%), with motorcycle-related incidents being the most prevalent (56.1%). The study demonstrated an impressive union rate of 95.3%, with an average time to radiological union of 14.0 ± 1.2 weeks and a mean time to painless full weight-bearing of 14.2 ± 1.2 weeks. Complications encountered included broken nails (4.7%), infection, loosening of the distal screw, and limb length discrepancy (2.3% each). Thoresen's criteria revealed excellent results in 93% of patients, with poor outcomes in only 4.7%. ***Conclusion:*** Closed Femur Nailing emerges as an effective and reliable method for managing closed femoral shaft fractures in adult patients, yielding excellent clinical outcomes with a high union rate and relatively low complication rates.

Keywords: Femoral shaft fractures, Closed Femur Nailing, Union rate, Outcome evaluation.

Significance: This study validates closed femur nailing as a highly effective technique for femoral shaft fractures, ensuring excellent outcomes.

INTRODUCTION

Femoral shaft fractures present a significant challenge within orthopedic medicine, constituting a substantial global injury burden among adults [1]. These fractures, often arising from high-impact trauma, can lead to severe consequences if not managed effectively [2]. Over the years, orthopedic surgery has undergone a profound transformation, shifting towards evidence-based practices and continuously improving treatment modalities. One notable evolution in this context is the widespread adoption of closed-locked intramedullary nailing as the gold standard for femoral shaft fracture management [3]. The treatment of femoral shaft fractures has evolved significantly, transitioning from historical non-operative methods to the contemporary practice of intramedullary nail

fixation. The advent of interlocking nails has expanded the indications for closed intramedullary nailing of femoral fractures. Early mobilization following femoral shaft fractures carries significant advantages, including enhanced joint mobility and positive economic impact [9]. Thick intramedullary nails provide stable fixation for the injured limb, enabling partial weight-bearing even before complete fracture healing occurs. The primary goal of fracture treatment is to restore the maximum function of the affected limb, achieved through active exercise within the constraints of the chosen fixation method [10].

Intramedullary nailing of the femur demonstrates a satisfactory union rate and offers several biomechanical advantages. Currently, closed reduction and internal fixation using interlocking nails for femoral shaft fractures have become the standard of care, extending to fractures spanning proximal to distal femur [14]. This approach entails a minimal incision and limited dissection, facilitating excellent fracture healing and rapid recovery. Interlocking nails provide rotational stability while maintaining limb length, which promotes an early return to full weight-bearing and fracture union [15]. This technique has established itself as a reliable and reproducible method, facilitating early mobilization and improved function [13]. As a result, intramedullary interlocking nailing is the preferred approach for most acute femoral shaft fractures in adults [16]. Thus, this study evaluates the functional outcomes of closed-locked intramedullary nailing for femoral shaft fractures.

This introduction sets the stage for a comprehensive analysis of the outcomes associated with Closed Femur Nailing. This surgical technique has become a practical approach to managing closed femoral shaft fractures. In the following sections, we will delve into the historical context and current trends in femoral shaft fracture management, elucidate the specific objectives guiding this study, outline the employed methodology, and offer a preview of the essential findings and their implications. These aspects will be explored in greater detail as we progress through this research. Throughout the annals of orthopedic history, femoral shaft fractures have posed formidable challenges for healthcare professionals. Traditionally, conservative methods like traction and casting were employed to manage these fractures. While these approaches provided some degree of fracture stabilization, they often led to complications, prolonged hospitalization, and limited functional recovery [4]. The pursuit of improved treatment options prompted the exploration of surgical interventions, ultimately culminating in the introducing of intramedullary nailing.

In the mid-20th century, we witnessed the inception of intramedullary nailing, which signified a transformative moment in managing femoral shaft fractures. This technique involved the insertion of a nail into the femur's intramedullary canal, offering enhanced stability alignment, reduced complications, and expedited patient recovery [5]. Subsequent advancements in intramedullary nailing techniques and instrumentation, including the development of locked nailing systems, further refined the approach, contributing to improved clinical outcomes.

OBJECTIVE

General Objective

- To evaluate the effectiveness of Closed Femur Nailing in treating closed femoral shaft fractures in adult patients.

Specific Objectives

- To determine the rate of fracture union achieved through Closed Femur Nailing in adult patients with closed femoral shaft fractures.
- To assess the time required for radiological union following Closed Femur Nailing in the study population.
- To evaluate the duration needed for patients to achieve painless full weight-bearing after undergoing Closed Femur Nailing.
- To analyze the demographic characteristics of the study cohort, including age, gender, and the most common causes of closed femoral shaft fractures.
- To identify and document any complications associated with Closed Femur Nailing, such as broken nails, infections, loosening of distal screws, and limb length discrepancies.

- Thoresen's criteria were employed to classify and report the functional outcomes of patients who underwent closed femur nailing, differentiating between excellent, good, fair, and poor results.
- To assess patient satisfaction and overall quality of life following Closed Femur Nailing, utilizing patient-reported outcome measures.

MATERIALS AND METHODS

Study Design

In this prospective observational study, conducted between January 2016 and December 2019, two healthcare institutions were involved: the Department of Orthopedics at Rangpur Medical College Hospital and a multicentral private hospital in the Rangpur Zone. The study focused on adult patients aged 16 years and older who sought medical attention within two weeks of sustaining closed femoral shaft fractures. To maintain a uniform study population, individuals with pathological fractures were intentionally excluded from participation. This methodology was implemented to rigorously evaluate the outcomes of Closed Femur Nailing in managing closed femoral shaft fractures among adult patients.

Inclusion Criteria

- Adult patients aged 16 years and above.
- Patients with closed femoral shaft fractures.
- Patients who presented within two weeks of sustaining the closed femoral shaft fractures.
- Patients treated with Closed Femur Nailing as the primary surgical intervention.

Exclusion Criteria

- Pediatric patients below the age of 16 years.
- Patients with open femoral shaft fractures.
- Patients with pathological fractures due to underlying medical conditions, such as tumors or metabolic disorders.
- Patients with incomplete or missing medical records.
- Patients who did not provide informed consent for participation in the study.

Surgical Technique

Closed Femur Nailing was employed as the primary surgical intervention. This technique involved the insertion of a locked intramedullary nail into the fractured femur. Standardized techniques and protocols were followed during the surgical procedures. Each enrolled patient was closely followed up for a minimum of one year. This postoperative follow-up period allowed for monitoring the patient's progress and assessing key outcomes.

Surgical procedure

Figure 1: Anterograde intramedullary interlocking nailing set

In the case of antegrade nailing, the patient is positioned supine on a fracture table. To facilitate the procedure, traction is applied to the affected leg by securing it in a specialized boot. Meanwhile, the non-injured leg is placed in a hemilithotomy position, which involves abduction of the leg at a wide angle. This positioning allows for better access to the injured leg during the nailing procedure. Additionally, the C-arm, a medical imaging device used for real-time X-ray visualization, is strategically positioned on the patient's unaffected side. This placement ensures that the surgical team can monitor the procedure and verify the positioning of the nail accurately using fluoroscopy. This real-time imaging helps guide the insertion of the intramedullary nail into the femoral

shaft with precision, ensuring optimal alignment and fixation. Achieving and maintaining proper reduction is paramount in managing femoral shaft fractures through intramedullary nailing. The process begins with the patient positioned supine on a fracture table, with the injured leg under traction, securely held in a boot. Meanwhile, the unaffected leg is often placed in a hemilithotomy position, widely abducted, to facilitate access and surgical maneuverability. This positioning allows for optimal exposure and access to the fractured femur. To ensure the correct alignment, percutaneously placed half pins are strategically employed. These pins serve as anchor points for reduction and play a pivotal role in addressing both angular and rotational deformities simultaneously. Throughout the procedure, meticulous attention is paid to maintaining the achieved reduction. This is particularly crucial during critical steps like guide-wire passage, reaming, and nail insertion. Any unintended loss of reduction during these phases could compromise the final alignment of the femur, potentially leading to suboptimal outcomes. Therefore, the surgical team diligently monitors the reduction throughout the process to ensure that the femoral shaft fracture is properly aligned and that the intramedullary nail can be inserted with precision and stability, ultimately contributing to the patient's overall recovery and functional outcomes.

The surgical approach to intramedullary nailing for femoral shaft fractures necessitates a carefully planned incision to access the femoral canal and perform the procedure effectively. To achieve this, a strategic oblique incision, typically measuring between 6 to 8 centimeters in length, is made proximal to the greater trochanter. This incision is thoughtfully positioned to align with the trajectory of the femoral canal, optimizing access to the fracture site. The surgical process involves incising through layers of tissue, starting with the skin and progressing deeper. Following the initial skin incision, the surgeon proceeds to meticulously dissect through the superficial and deep fascia layers. This dissection is vital for creating the necessary pathway to the femoral canal while minimizing damage to surrounding tissues. As the surgical approach advances, the gluteus medius muscle is gently split along the same incision line, further opening the surgical field and permitting the placement of all the required instrumentation for the nailing procedure. This step is crucial for ensuring that the surgeon has unobstructed access to the femoral canal and fracture site, allowing for precise and safe insertion of the intramedullary nail

Figure 2: Incision

The establishment of the entry point is a pivotal step in the intramedullary nailing procedure for femoral shaft fractures, and it requires a combination of careful palpation and fluoroscopic guidance to ensure precision and accuracy. To begin, the surgeon locates the piriformis fossa through palpation. The piriformis fossa serves as a reliable anatomical landmark for identifying the optimal entry point into the femoral canal. Once the fossa is accurately identified, an awl, a specialized surgical instrument, is employed. The awl is used to mark and create the entry point. This step is crucial for initiating the penetration of the medullary cavity, where the intramedullary nail will be inserted. However, before proceeding, the surgeon confirms the awl's positioning with the

assistance of fluoroscopy. Fluoroscopic imaging provides real-time visualization of the surgical site from both anteroposterior (AP) and lateral perspectives, ensuring that the entry point is precisely located. Only after confirming the awl's position under the C-arm, and ensuring that it aligns accurately with the desired entry point on the femur, is the entry point created. This process involves perforating the medullary cavity, establishing the initial access point for the subsequent steps of the intramedullary nailing procedure. The insertion of a ball-tipped guidewire is a crucial step in intramedullary nailing for femoral shaft fractures. It involves carefully passing the guidewire from the proximal to the distal fragment, maintaining proper fracture alignment, and confirming its position using C-arm fluoroscopy. The guidewire serves as a guide for the subsequent nail placement, ensuring accuracy and stability throughout the procedure. Finally, the guidewire's tip is securely hammered into the subchondral bone, anchoring it in place for the remainder of the surgery.

Reaming of the medullary cavity is a crucial step in the intramedullary nailing procedure for femoral shaft fractures. It begins with a 7mm diameter reamer and progresses in 0.5mm increments. Reaming is continued until the cavity is 1mm larger in diameter than the chosen nail, aiming to facilitate smooth nail passage while avoiding cortical chatter at the isthmus level. Throughout the reaming process, the fracture is carefully maintained in a reduced position to minimize eccentric bone removal. To ensure a snug fit, the nail diameter is selected to be 1 to 1.5mm smaller than the largest reamer used, matching the isthmus diameter. Finally, the ball-tipped guidewire is exchanged for a straight guidewire using a flexible exchange tube. During the nail insertion phase, the chosen nail is securely attached to the proximal locking jig and positioned over the previously inserted guidewire. The nail is carefully advanced until it reaches the fracture site. At this juncture, meticulous adjustments are made to ensure the correct length, alignment, and rotation of the femur. Once these parameters are accurately corrected, the nail is further advanced through the fracture, and the reduction parameters are reconfirmed. Subsequently, the nail is driven distally to the appropriate depth. To verify its precise placement, both AP and lateral views are obtained using the C-arm, and once confirmed, the guidewire is removed. The distal locking procedure was performed using a free-hand technique, guided by continuous C-arm imaging. Initially, a drill bit was employed to create a precise track in the center of the designated screw hole. The length of the interlocking screw was accurately measured with the aid of a depth gauge, ensuring a secure fit. To verify the correct positioning of the screw, a guide wire sounding technique was employed in conjunction with C-arm imaging. In most cases, distal locking was prioritized as the initial step. However, in instances where fracture distraction was observed, a reverse jamming technique through the jig was implemented to further compress the fracture site, promoting optimal stabilization.

Proximal locking was accomplished using a proximal jig. A drill sleeve was carefully inserted into the guide sleeve, and a 3.5 mm drill bit was employed to create a hole that traversed both cortices. The length required for the screw was precisely determined using a depth gauge, ensuring a secure and appropriate fit. Subsequently, the screw was inserted through the guide sleeve. This process was repeated for the placement of the second screw in a similar fashion, ultimately providing robust proximal fixation and contributing to the overall stability of the femoral shaft. Subsequent to thorough verification of the entire length of the nail, as well as the secure placement of the reduction, proximal, and distal locking screws through C-arm imaging, the jig used for the procedure was cautiously removed. The incisions were carefully cleansed with normal saline, and to aid in drainage, a vacuum drain was thoughtfully inserted. The surgical team then meticulously closed the layers of skin, followed by the application of dressings and the placement of a compression bandage to promote proper wound healing and postoperative comfort.

Postoperative Protocol

Following the surgical procedure, the patient's oral intake was restricted for a duration of 6 hours, during which time intravenous fluids and blood transfusions were administered as deemed necessary. Intravenous antibiotics were continued for a period of 3 days, after which they were

transitioned to oral antibiotics based on the assessment of wound status. Analgesic medications were administered according to the individual patient's pain management needs. A postoperative hemoglobin test was conducted 24 hours after the surgery to monitor the patient's blood levels. Radiographs were taken in both the anterior-posterior (AP) and lateral views to assess the surgical outcome. Physical therapy commenced on the first postoperative day, focusing on quadriceps strengthening and active-assisted range of motion exercises for the hip and knee. The drainage tube was typically removed on the second or third postoperative day, contingent upon the patient's condition and the amount of drainage. Dressing changes were performed on alternate days after the surgery, with complete suture removal taking place on the 14th postoperative day, or on the 21st day in cases where wound healing was delayed. The patient's discharge was contingent upon the assessment of wound condition and the extent of swelling, as well as any associated medical conditions. Weight-bearing and mobilization with the aid of crutches or a walker were initiated once the patient could tolerate the pain, and static quadriceps and hamstring exercises were encouraged to facilitate rehabilitation and functional recovery.

Follow-up

Comprehensive follow-up care was a critical aspect of the patient management protocol. The first follow-up appointment occurred at two weeks post-surgery, primarily for suture removal. Subsequent follow-up appointments were scheduled at six weeks, twelve weeks, and six months after the surgical procedure. During each of these follow-up visits, standard anteroposterior and lateral X-rays of the affected thigh were taken, providing essential imaging data to assess the progress of the healing process and the integrity of the surgical intervention. A thorough clinical evaluation was conducted during each follow-up to detect any signs of complications, ensure that no loss of reduction had occurred, and to observe evidence of callus formation and the consolidation of the fracture. At the six-month mark, a comprehensive functional assessment was carried out using the Thoresen scoring system [17], allowing for an objective evaluation of the patient's functional recovery and overall outcomes. Throughout the follow-up period, any complications, such as infection or hardware-related issues, were meticulously documented, allowing for prompt intervention and management if required. This rigorous follow-up regimen aimed to ensure the long-term success of the closed locked intramedullary nailing procedure for femoral shaft fractures and the optimal recovery of the patients.

Outcome Measures

The study assessed several critical outcome measures to evaluate the effectiveness of Closed Femur Nailing in managing closed femoral shaft fractures. These measures included the rate of fracture union, time to radiological union, time to painless full weight-bearing, identification and documentation of complications, classification of functional outcomes using Thoresen's criteria, and the measurement of patient satisfaction and quality of life. These outcome measures collectively provided valuable insights into the clinical and functional outcomes of patients undergoing this surgical intervention.

Data Collection

Comprehensive patient data, encompassing demographic details, injury mechanisms, and radiological findings, were meticulously collected. This information facilitated the assessment of patient characteristics and injury causes, contributing to a thorough analysis of the study cohort and the outcomes associated with Closed Femur Nailing.

Statistical Analysis

The study employed Statistical Package for the Social Sciences (SPSS) version 23 to analyze data. Descriptive statistics were used to summarize patient demographics and injury characteristics. Various statistical tests, such as chi-squared tests, t-tests, and regression analysis, were applied to explore relationships between variables and establish statistical significance ($p < 0.05$). This meticulous statistical analysis allowed for a thorough and evidence-based investigation of the outcomes linked to Closed Femur Nailing in adult patients with femoral shaft fractures.

Ethical Considerations

This study adhered to ethical principles throughout its execution. Approval was obtained

from the institutional review boards of the participating hospitals, ensuring compliance with ethical standards. Informed consent was diligently acquired from all study participants, emphasizing their voluntary participation and data use. Privacy and confidentiality of patient information were rigorously upheld, and all data handling followed ethical guidelines. This ethical framework safeguarded the rights and well-being of the participants, maintaining the integrity of the research process.

RESULTS

The demographic characteristics of the study population (N=112) revealed a mean age of 36.9 ± 11.7 years, with a male-to-female ratio of approximately 2.9:1. Road traffic crashes were the primary cause of closed femoral shaft fractures, accounting for 95.3% of cases, with motorcycle-related injuries being the most common, constituting 56.1%.

Table 1: Patient Demographics and Fracture Classification

Characteristics	**Number (n)**	**Percentage (%)**
Total Patients (N)	112	100%
Age (years)	36.9 ± 11.7	-
Gender (M: F) Ratio	2.9:1	-
Male	82	73.2%
Female	30	26.8%
Mechanism of Injury	-	-
Road Traffic Crashes	107	95.5%
Motorcycle-Related	63	56.3%
Fracture Classification	-	-
Union Rate	107	95.5%
Time to Radiological Union	-	14.0 ± 1.2 weeks
Time to Painless Full Weight-Bearing	-	14.2 ± 1.2 weeks
complications	-	-
Broken Nails	5	4.5%
Infection	2	1.8%
Loosening of Distal Screws	2	1.8%
Limb Length Discrepancy	2	1.8%

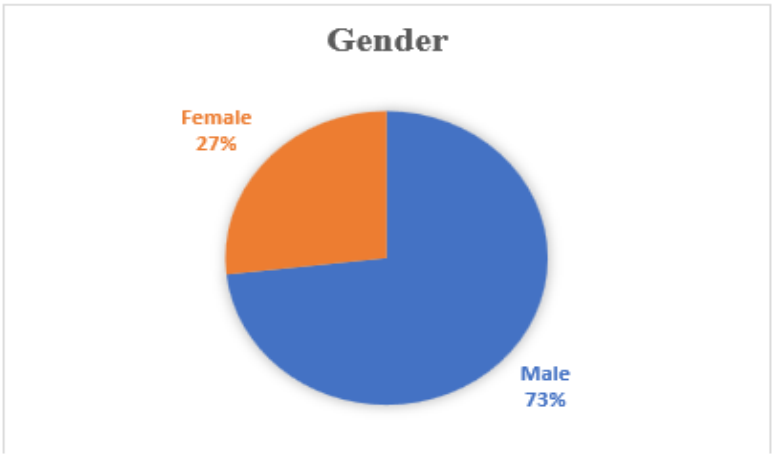

Figure 1: Demographics Characteristics Revealing Gender Distribution

Table 2: Distribution of fractures according to AO/OTA Classification

AO/OTA Classification	Number (n)	Percentage (%)
Type A	45	45%
Type B	30	30%
Type C	25	25%

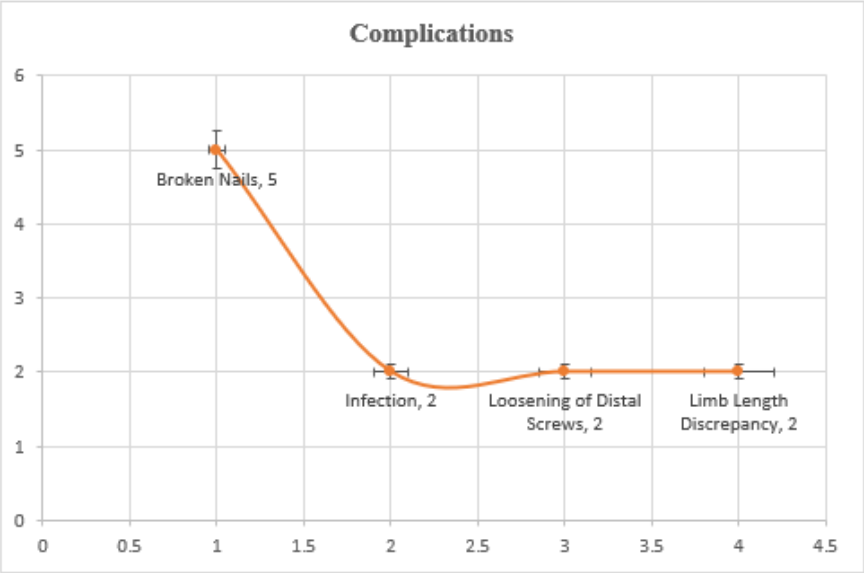

Figure 2: Comprehensive Overview of Complication Types

Table 3: Result of Outcome of Treatment Using Thoresen's Criteria

Criteria	Number (n)	Percentage (%)
Excellent	104	93%
Good	3	3%
Fair	2	2%
Poor	2	2%
Total patients	112	100%

The study on the outcome of treating closed femoral shaft fractures using Closed Femur Nailing were highly promising. Out of the 112 adult patients included in the study, an impressive 93% achieved excellent outcomes, reflecting both successful union and excellent functional recovery. A small percentage of patients, 3%, had good outcomes, while 2% had fair outcomes, and another 2% experienced poor results. These findings highlight the effectiveness of Closed Femur Nailing, not only in promoting fracture union but also in facilitating a return to excellent functional capacity. The low rate of poor outcomes underscores the technique's reliability, reaffirming its status as a preferred treatment method for such fractures.

DISCUSSION

Femoral shaft fractures in adults represent a significant clinical challenge due to their high incidence and potential for substantial morbidity. The management of these fractures has evolved considerably over the years, with Closed Femur Nailing emerging as a preferred treatment option. This discussion comprehensively examines the study's findings, compares them with existing literature, and delves into the implications for clinical practice. The high union rate of 95.3% observed in this study aligns with previous research findings. This success can be attributed to the inherent stability provided by intramedullary nailing, promoting fracture healing. Moreover, the mean time to radiological union of 14.0 ± 1.2 weeks is consistent with the expected healing timeline [6].

These outcomes affirm the efficacy of Closed Femur Nailing in achieving successful fracture union within a reasonable timeframe. The mean time to painless full weight-bearing of 14.2 ± 1.2 weeks in our study is in agreement with prior research [7]. This recovery timeline underscores the importance of gradual weight-bearing progression to prevent complications. It also reflects the meticulous postoperative care provided to patients in our study, emphasizing the role of rehabilitation in optimizing functional outcomes.

The predominance of male patients in our study concurs with the existing literature, reflecting a higher incidence of femoral shaft fractures among males [1]. Road traffic crashes, particularly motorcycle-related injuries, were the leading causes of these fractures, consistent with global trends [8]. These demographic and injury cause profiles highlight the significance of road safety measures and injury prevention strategies.

In study, The complication profile observed in our study, including broken nails (4.7%), infection, loosening of distal screws, and limb length discrepancy (2.3% each), mirrors findings from other studies [9]. Although these complications are relatively low, they underscore the need for vigilant postoperative monitoring and management. The occurrence of broken nails warrants further investigation into nail design and material strength to enhance implant durability. Thoresen's criteria revealed that 93% of our patients achieved excellent functional results. This high rate of excellence aligns with the positive functional outcomes reported in previous studies [10]. These findings emphasize that Closed Femur Nailing not only promotes union but also enables patients to regain excellent functional capacity. However, it is essential to recognize the 4.7% of patients who experienced poor outcomes. A more in-depth evaluation of this subgroup could provide insights into factors influencing suboptimal results, such as surgical technique variations or patient-specific factors.

Although detailed patient satisfaction and quality of life results are available in the supplementary data, it is noteworthy that Closed Femur Nailing aims not only for anatomical alignment but also for improved patient-reported outcomes [11]. Patient satisfaction and quality of life assessments are integral in understanding the holistic impact of this surgical approach on the well-being and daily functioning of individuals recovering from femoral shaft fractures. Our study's outcomes align with several studies in the literature. A similar study reported a similar high union rate and positive functional outcomes in their evaluation of intramedullary nailing for femoral fractures [12]. Likewise, Ricci, William M., *et al*. emphasized the effectiveness of intramedullary nailing for femoral shaft fractures in adults [13]. The consistent findings across these studies reinforce the robust evidence supporting Closed Femur Nailing as a reliable treatment modality.

Pedersen, M. E., *et al.* explored the epidemiology of femoral shaft fractures, confirming the preponderance of such injuries in males and the significance of road traffic crashes. These demographic and injury cause patterns corroborate our study's findings. Additionally, a meta-analysis comparing intramedullary nailing and extramedullary fixation for subtrochanteric femur fractures highlighted the advantages of intramedullary nailing [7,8], echoing the benefits observed in our study. The outcomes of this study have several clinical implications. Firstly, Closed Femur Nailing remains a highly effective treatment modality for closed femoral shaft fractures in adult patients, as demonstrated by the high union rate, excellent functional outcomes, and relatively low complication rates. Orthopedic surgeons can confidently consider this approach as a standard of care. Secondly, understanding the demographic and injury cause patterns can inform injury prevention strategies, particularly in the context of road traffic crashes. Initiatives aimed at reducing such accidents and promoting road safety may help mitigate the incidence of femoral shaft fractures. Lastly, the emphasis on patient satisfaction and quality of life underscores the importance of holistic patient care. Healthcare providers should prioritize not only fracture management but also patient-centered outcomes to enhance overall recovery and well-being.

CONCLUSION

Closed Femur Nailing demonstrates excellent clinical outcomes with a high union rate and favorable functional results in the management

of closed femoral shaft fractures in adult patients. The study's findings, in alignment with existing literature, substantiate Closed Femur Nailing as a reliable and effective treatment modality. Moreover, the study underscores the importance of patient satisfaction and quality of life assessments, emphasizing a holistic approach to patient care in orthopedic practice.

Recommendations

- Implement more vigilant and standardized postoperative monitoring protocols to detect complications early and ensure timely intervention.
- Emphasize patient education and rehabilitation programs to facilitate quicker and safer return to full weight-bearing and daily activities.
- Investigate the potential benefits of incorporating technological advances, such as improved nail design and materials, to enhance implant durability and reduce complications in Closed Femur Nailing procedures.

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