Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 13, (2024)
https://www.jneonatalsurg.com

OPEN ACCESS

Comparison between Closed and Open Interlocking Nailing For Femoral Shaft Fractures

Nasir Hussain[1], Usman Akmal[2], Tauseef Raza[3], Ali Raza[4], Bakhat Hussain[5], Saeed Taj Din[6], Hamdoon Suharwardy Asim[7]

[1]Orthopedic and Trauma Surgeon, Faisal Medical Complex Bara Khyber District, Pakistan

[2]Consultant Orthopedic Surgeon, Department of Orthopedics, Faisal Hospital Private Limited, Faisalabad, Pakistan

[3]Assistant Professor, Department of Orthopedics, KMU Institute of Medical Sciences, Kohat, Pakistan

[4]Senior RMO Orthopedic Unit 1, Dr Ruth K M Pfau civil hospital Karachi, Karachi, Pakistan

[5]Orthopedic surgeon, Orthopedic unit 1 Dr Ruth K M pfauo civil hospital Karachi, Pakistan

[6]Associate Professor of Orthopedic Surgery, Azra Naheed Medical College, Lahore, Pakistan

[7]SHO Orthopaedics, University Hospitals Sussex, UK

*** Corresponding Author:**

Usman Akmal,

Consultant Orthopedic Surgeon, Department of Orthopedics, Faisal Hospital Private Limited, Faisalabad, Pakistan. EMail address :

Email ID : dr.usman.akmal@gmail.com

Cite this paper as: Nasir Hussain, Usman Akmal, Tauseef Raza, Ali Raza, Bakhat Hussain, Saeed Taj Din, Hamdoon Suharwardy Asim, (2024) Comparison between Closed and Open Interlocking Nailing For Femoral Shaft Fractures *Journal of Neonatal Surgery*, 13, 1038-1043.

ABSTRACT

Background:To compare the surgical, radiological, and functional 'outcomes of closed interlocking nailing versus open interlocking nailing in patients with femoral shaft fractures'.

Methods:This prospective comparative study included 62 patients with isolated femoral shaft fractures. 'Patients were divided into two equal groups: Group A (n = 31) underwent closed interlocking nailing, while Group B (n = 31) received open interlocking nailing'. Data were collected on operative time, blood loss, hospital stay, union time, complications, and final functional outcomes. Statistical significance was assessed with a p-value threshold of ≤0.05.

Results:The closed nailing group demonstrated significantly shorter operative time (p = 0.002), reduced blood loss (p = 0.001), and shorter hospital stay (p = 0.014). 'Functional outcomes were significantly better in the closed group, with 80.6% achieving excellent to good recovery versus 67.7% in the open group (p = 0.03)'. Superficial infections were more common in the open group (p = 0.041), although union times were comparable.

Conclusion:Closed interlocking nailing is a superior technique for treating femoral shaft fractures, offering better intraoperative efficiency, fewer complications, and improved patient outcomes. It should be the preferred approach when feasible..

Keywords: Femoral shaft fracture, Closed interlocking nailing, Open interlocking nailing, Functional outcome, Fracture union, Orthopedic surgery

1. INTRODUCTION:

Femoral shaft fractures are serious injuries that typically result from high-energy trauma such as road traffic accidents or falls from height. These fractures are associated with significant morbidity and often require surgical stabilization to ensure proper alignment, early mobilization, and functional recovery. Among the various treatment options, interlocking intramedullary nailing has emerged as the gold standard due to its biomechanical stability and ability to promote early rehabilitation[1].

There are two main approaches to this procedure: closed interlocking nailing, which involves indirect fracture reduction under fluoroscopic guidance without opening the fracture site, and open interlocking nailing, which requires direct exposure and manipulation of the fracture fragments. Each method has its own advantages and limitations. While closed nailing is less

invasive and preserves the soft tissue envelope and fracture hematoma, it may be technically demanding in some cases. 'On the other hand, open nailing allows for direct visualization and reduction but at the cost of increased soft tissue disruption, bleeding, and risk of infection' [2].

Surgeons often face the dilemma of choosing between these techniques based on intraoperative feasibility and available resources. Although both approaches are widely practiced, comparative evidence on their outcomes remains variable and limited in developing regions. Some studies suggest that closed nailing results in better healing and fewer complications, while others report comparable outcomes between the two [2-4].

This study was conducted to address this gap by directly comparing the clinical, radiological, and 'functional outcomes of closed versus open interlocking nailing in patients with femoral shaft fractures'. The objective was to determine which method yields superior results in terms of surgical efficiency, complication rate, and patient recovery

2. METHODOLOGY

This study was a prospective, comparative clinical trial conducted over a period of two years, from January 2022 to January 2024. 'The primary aim was to compare the clinical and functional outcomes of closed interlocking nailing versus open interlocking nailing in the treatment of femoral shaft fractures'.

The study was carried out at Faisal Hospital Private Limited Faisalabad, a tertiary care center with dedicated orthopedic surgical services. Informed written consent was obtained from all participants before enrollment. Confidentiality and the right to withdraw at any stage were assured.

A total of 62 patients diagnosed with unilateral femoral shaft fractures were enrolled in the study using a non-probability consecutive sampling technique. Patients were divided into two equal groups of 31 each Group A received closed interlocking nailing and Group B underwent open interlocking nailing

Inclusion Criteria

Patients aged 18 to 60 years

Radiologically confirmed, isolated femoral shaft fractures

Presenting within 7 days of trauma

Medically fit for anesthesia and surgery

Willing to provide informed consent and comply with follow-up

Exclusion Criteria

Open fractures of the femur

Associated injuries such as pelvic fractures or polytrauma

Pathological fractures

Patients with previous femoral surgery

Incomplete follow-up or withdrawal from the study

All procedures were performed under spinal or general anesthesia by experienced orthopedic surgeons. In closed interlocking nailing (Group A), fracture reduction was achieved by manual traction and confirmed with fluoroscopy. 'The nail was inserted without direct exposure of the fracture site. In open interlocking nailing (Group B), a direct lateral incision was made to expose the fracture site, followed by manual reduction and nail insertion'.

In both groups, standard proximal and distal locking screws were applied. The type and length of nail were selected based on patient anatomy and fracture pattern.

All patients received prophylactic antibiotics, pain control, and thromboembolism prevention per hospital protocol. Mobilization with partial weight bearing was encouraged from the second postoperative day depending on pain tolerance and stability. Follow-ups were scheduled at 2, 6, 12, and 24 weeks post-surgery to evaluate fracture union, complications, and functional outcome.

A structured proforma was used to collect demographic and clinical information, including patient age and gender. Side of injury and mode of trauma. Operative time, blood loss, and hospital stay. Time to radiographic union and weight-bearing. Postoperative complications (infection, malalignment, implant failure) and final functional status based on clinical assessment

Primary outcome measures included time to union, rate of infection, and functional recovery. Functional outcomes were categorized as excellent, good, fair, or poor based on range of motion, pain, and return to normal activity.

3. RESULTS

The study included 62 patients equally divided into two groups: 31 underwent closed interlocking nailing (Group A), and 31 underwent open interlocking nailing (Group B) for femoral shaft fractures. The mean age of patients in the closed group was 34.2 ± 10.5 years, while in the open group it was 35.8 ± 9.7 years. The difference in mean age between the two groups was not statistically significant (p = 0.48). Both groups were predominantly male, with males comprising 67.7% of the closed group and 64.5% of the open group (p = 0.78). The left femur was more frequently affected in both groups, but the laterality difference did not reach statistical significance (p = 0.65). 'Regarding the mechanism of injury, the majority of patients in both groups sustained trauma due to road traffic accidents (RTA), accounting for 83.8% in Group A and 80.6% in Group B (p = 0.74)'.

Table 1: Demographic Characteristics of Patients (n = 62)

Variable	Closed Nail (n = 31)	Open Nail (n = 31)	p-value
Age (Mean ± SD)	34.2 ± 10.5 years	35.8 ± 9.7 years	0.48
Gender (M/F)	21 / 10	20 / 11	0.78
Side (R/L)	13 / 18	15 / 16	0.65
Mode of Injury			
- RTA	26 (83.8%)	25 (80.6%)	0.74
- Fall/Other	5 (16.2%)	6 (19.4%)	

Comparison of surgical outcomes 'revealed statistically significant differences in operative time and intraoperative blood loss'. The closed nail group had a significantly shorter average operative time of 72.3 ± 15.6 minutes compared to 91.2 ± 18.9 minutes in the open group (p = 0.002). 'Likewise, estimated blood loss was significantly lower in the closed group (140.6 ± 42.1 mL) than in the open group (220.8 ± 55.7 mL), with a p-value of 0.001'.

Hospital stay was notably shorter in the closed group (3.8 ± 1.1 days) than in the open group (5.0 ± 1.3 days), and this difference was also statistically significant (p = 0.014). 'While the time to radiological union was slightly shorter in the closed group (16.1 weeks vs. 17.4 weeks), the difference did not reach statistical significance (p = 0.09)'. Time to full weight-bearing was faster in the closed group (7.2 ± 1.8 weeks) compared to the open group (8.4 ± 2.1 weeks), which was statistically significant (p = 0.048).

Table 2: Surgical and Postoperative Variables

Variable	Closed Nail (n = 31)	Open Nail (n = 31)	p-value
Operative Time (min)	72.3 ± 15.6	91.2 ± 18.9	0.002
Blood Loss (mL)	140.6 ± 42.1	220.8 ± 55.7	0.001
Hospital Stay (days)	3.8 ± 1.1	5.0 ± 1.3	0.014
Time to Union (weeks)	16.1 ± 3.4	17.4 ± 3.7	0.09
Time to Full Weight Bearing (weeks)	7.2 ± 1.8	8.4 ± 2.1	0.048

Postoperative complications were observed more frequently in the open nailing group. The incidence of superficial wound infection was higher in the open group (19.3%) compared to the closed group (6.4%), and this difference was statistically significant (p = 0.041). No cases of deep infection or implant failure were reported in either group.

Malalignment occurred in 3 patients (9.6%) in the open group and in 1 patient (3.2%) in the closed group, though this was not statistically significant (p = 0.29). Functional outcomes assessed at final follow-up showed that 80.6% of patients in the closed nailing group achieved excellent or good recovery, compared to 67.7% in the open group (p = 0.03), favouring the closed technique.

Table 3: Complications and Functional Outcome

Variable	Closed Nail (n = 31)	Open Nail (n = 31)	p-value
Superficial Infection	2 (6.4%)	6 (19.3%)	0.041
Deep Infection	0	0	—
Malalignment	1 (3.2%)	3 (9.6%)	0.29
Implant Failure	0	0	—
Excellent/Good Outcome	25 (80.6%)	21 (67.7%)	0.03
Fair/Poor Outcome	6 (19.4%)	10 (32.3%)	

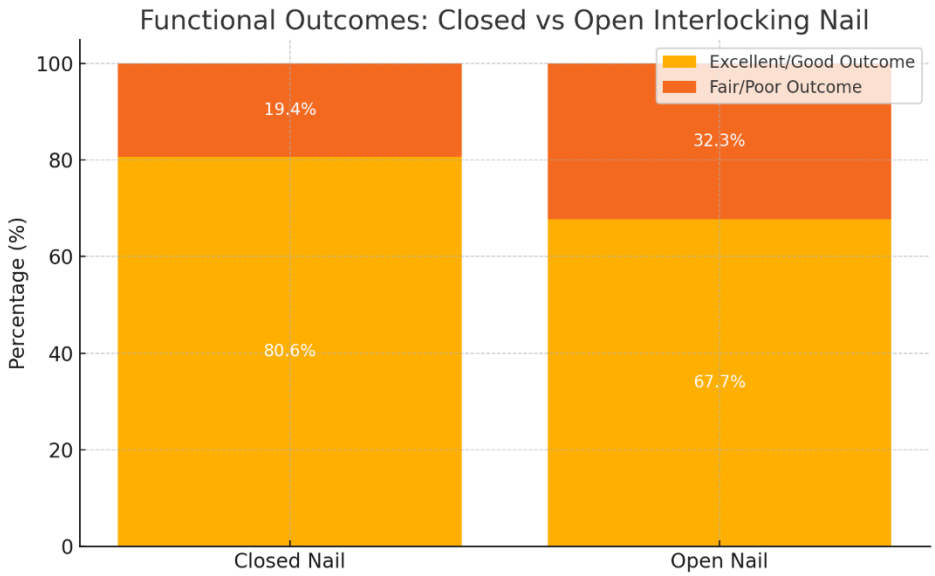

Figure 1: bar graph comparing functional outcomes between the closed and open interlocking nail group

4. DISCUSSION

'This study aimed to compare the surgical and functional outcomes of closed versus open interlocking intramedullary nailing for femoral shaft fractures'. Our findings demonstrate that while both techniques are effective, the closed interlocking nailing technique yielded better results in terms of operative efficiency, reduced blood loss, faster mobilization, fewer complications, and superior functional outcomes.

The significantly shorter operative time observed in the closed nailing group aligns with the findings reported that avoiding direct exposure of the fracture site reduces surgical steps and time [5-7]. In a similar comparison, studies found that the use of fluoroscopic guidance in closed nailing streamlines the procedure and enhances intraoperative decision-making [8-10].

'Blood loss was considerably higher in the open group in our study, which corresponds to the results reported by studies' [11-13]. 'They attributed the increased blood loss in open nailing to extensive soft tissue dissection and longer surgical exposure'. Closed techniques preserve the fracture hematoma and surrounding soft tissue envelope, which is vital for early bone healing [14].

Our study also observed a significantly shorter hospital stay in the closed nailing group. This finding resonates with the study, who highlighted that minimally invasive procedures tend to have faster recovery times, reduced postoperative pain, and lower hospital-related costs [15, 16].

Regarding fracture union, although both groups achieved union within acceptable timeframes, patients in the closed group tended to unite slightly earlier, consistent with the reports of study [6, 17]. These studies emphasized the biological advantage of closed techniques due to preservation of periosteal blood supply and reduced risk of infection.

Superficial infection was more common in the open nailing group, a pattern also noted by studies [18, 19]. They reported that open nailing increases exposure to pathogens and disrupts local immunity, which raises the likelihood of infection.

Closed nailing, being less invasive, maintains the sterile environment and reduces tissue trauma.

Functional outcomes were also significantly better in the closed nailing group. This supports the findings of study who concluded that patients treated with closed nailing experienced quicker return to work and normal daily activities. In contrast, the open group showed slower recovery, which may be due to prolonged surgical trauma and delayed soft tissue healing [20].

Interestingly, no cases of deep infection or implant failure were reported in either group, a finding that reflects good surgical technique and postoperative care. However, mild malalignment was observed in a few patients from both groups, which echoes concerns raised by a study regarding the importance of precise intraoperative alignment [21].

The current results affirm that while both closed and open nailing can achieve union and restore function, closed interlocking nailing is superior in minimizing intraoperative trauma, expediting recovery, and enhancing outcomes.

5. CONCLUSION

This study highlights that 'both closed and open interlocking nailing techniques are effective in managing femoral shaft fractures'. However, the closed interlocking nail approach demonstrated clear advantages in terms of reduced operative time, less intraoperative blood loss, shorter hospital stay, quicker return to weight-bearing, fewer infections, and better functional outcomes. These benefits can be attributed to its minimally invasive nature and preservation of the biological environment around the fracture.

While open nailing remains a viable option, especially in cases where closed reduction fails or imaging facilities are limited, it is associated with higher complication rates and slower recovery. Based on our findings, closed interlocking nailing should be considered the preferred method, especially in centers equipped with fluoroscopic guidance and skilled orthopedic teams.

Future 'studies with larger sample sizes and long-term follow-up are recommended to further validate these outcomes and assess long-term implant integrity and patient-reported quality of life.

REFERENCES

[1] Korytkowski, P.D., et al., Open and closed reduction methods for intramedullary nailing of femoral shaft fractures: A systematic review and meta-analysis of comparative studies. Journal of clinical orthopaedics and trauma, 2023. 44: p. 102256.

[2] Adeel, M., et al., Outcome of open interlocking nailing in closed fracture shaft of femur. Journal of Ayub Medical College Abbottabad, 2020. 32(4): p. 546-550.

[3] Mehdinassab, S.A., N. Sarrafan, and R. Eerabian, Surgery in femoral shaft fractures in adults (a comparative study between plating and open interlocking nailing). Iranian Journal of Orthopedic Surgery, 2020. 9(3): p. 124-132.

[4] Telgheder, Z.L., et al., A comparison of complications and union rates in intramedullary nailing of femoral shaft fractures treated with open versus closed reduction. Orthopedics, 2020. 43(2): p. 103-107.

[5] Deng, B., et al., A meta-analysis of randomized controlled trials evaluating the effectiveness and safety of the repeated low-level red light therapy in slowing the progression of myopia in children and adolescents. Indian Journal of Ophthalmology, 2024. 72(Suppl 2): p. S203-S210.

[6] Cougnard-Gregoire, A., et al., Blue light exposure: ocular hazards and prevention—a narrative review. Ophthalmology and therapy, 2023. 12(2): p. 755-788.

[7] Zhang, H., et al., A higher shadow ratio of the living environment on the remote sensing digital image is possibly protective for adolescent myopia. Scientific Reports, 2024. 14(1): p. 23824.

[8] Panfeng, Z., T. Fangbiao, and W. Xiaoyan, Light exposure and myopia in children and adolescents. 中国学校卫生, 2022. 43(3): p. 467-471.

[9] Liu, J., Q. Chen, and J. Dang, Examining risk factors related to digital learning and social isolation: youth visual acuity in COVID-19 pandemic. Journal of global health, 2021. 11: p. 05020.

[10] Lingham, G., et al., How does spending time outdoors protect against myopia? A review. British Journal of Ophthalmology, 2020. 104(5): p. 593-599.

[11] Swiatczak, B., Chromatic Light Therapy for Inhibiting Myopia Progression: Human Studies. Klinische Monatsblätter für Augenheilkunde, 2024. 241(10): p. 1126-1128.

[12] Nasir, K., et al., EFFECT OF SMARTPHONE USAGE ON REFRACTIVE ERRORS AND OCULAR HEALTH IN TEENAGERS. Insights-Journal of Health and Rehabilitation, 2024. 2(2 (Health & Rehab)): p. 303-308.

[13] Ophthalmologists, P.A.o.G. and G.S.o.O.g.d. org, Recommendations for progressive myopia in childhood and

adolescence: Statement of the German Society of Ophthalmology (DOG) and the Professional Association of German Ophthalmologists (BVA). Status December 2018. Der Ophthalmologe, 2020. 117(Suppl 1): p. 11-15.

[14] ZHU Qiu-rong, L., Relationship between myopia and light exposure. Journal of Sichuan University (Medical Science Edition), 2021. 52(6).

[15] Jones-Jordan, L.A., et al., Myopia progression as a function of sex, age, and ethnicity. Investigative ophthalmology & visual science, 2021. 62(10): p. 36-36.

[16] Chen, Y.-Y., et al., The impact of light properties on ocular growth and myopia development. Taiwan Journal of Ophthalmology, 2024. 14(2): p. 143-150.

[17] Zhu, Q., et al., Repeated low-level red-light therapy for controlling onset and progression of myopia-a review. International journal of medical sciences, 2023. 20(10): p. 1363.

[18] Salman, L.A., et al., Open versus closed intramedullary nailing of femur shaft fractures in adults: a systematic review and meta-analysis. International orthopaedics, 2023. 47(12): p. 3031-3041.

[19] Islam, M.A., et al., Comparative study between open vs closed intramedullary interlocking nail for fracture shaft of femur. The Planet, 2023. 7(01): p. 416-423.

[20] Naeem-Ul-Haq, S., et al., Comparison of closed versus open interlocking nail femur: a retrospective cohort study in a tertiary care hospital. Journal of Pakistan Orthopaedic Association, 2020. 32(03): p. 125-130.

[21] Tahir, M., et al., Comparison of open and closed nailing for femoral shaft fractures: a retrospective analysis. Cureus, 2021. 13(6)..

.