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INTRAMEDULLARY INTERLOCKING NAILING FOR FEMORAL SHAFT FRACTURES: FUNCTIONAL AND RADIOLOGICAL OUTCOMES IN 30 ADULT PATIENTS

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ABSTRACT

Background: Fractures of the femoral shaft are common, high-energy injuries associated with substantial morbidity. Intramedullary interlocking nailing is currently regarded as the treatment of choice, providing rotational and axial stability while permitting early mobilisation. This study evaluated the functional and radiological outcome of interlocking nailing in adult femoral shaft fractures. **Methods:** This prospective study included 30 adult patients (≥20 years) with closed Gustilo–Anderson type I and II fractures of the femoral shaft, treated with antegrade intramedullary interlocking nailing at a tertiary care centre between October 2012 and March 2014. Patients were followed clinically and radiologically at 6, 12 and 24 weeks and thereafter three-monthly. Functional outcome was graded using the Thoresen scoring system.**Results:** The cohort comprised 20 men and 10 women with a mean age of 31.63 years (range 21–60). Road traffic accidents accounted for 93.33% of injuries, and Winquist–Hansen type III was the commonest fracture pattern (46.66%). Mean time to radiological union was 20.27 weeks (range 16–32). Complications included malalignment in 3 patients (10%), limb-length discrepancy in 2 (6.66%), superficial infection in 1 (3.33%), and delayed union in 2 (6.66%); no nonunion or implant failure occurred. Excellent-to-good functional results by Thoresen criteria were achieved in 90% of patients. Conclusion: Intramedullary interlocking nailing provides reliable union, low complication rates, and good-to-excellent functional recovery in adult femoral shaft fractures, and remains the treatment of choice for the majority of these injuries.

KEYWORDS : Femoral Shaft Fracture; Intramedullary Interlocking Nailing; Fracture Union; Functional Outcome; Thoresen Score

INTRODUCTION

The femur is the longest and one of the principal load-bearing bones of the lower limb, and shaft fractures are among the commonest major injuries in orthopaedic trauma practice. These fractures usually follow high-energy trauma such as road traffic accidents, and are frequently accompanied by significant soft-tissue injury and, at times, multisystem trauma. Inadequately treated, femoral shaft fractures cause prolonged immobilisation, joint stiffness and considerable morbidity, particularly in a young, economically active population.

Management has evolved from traction and plaster immobilisation to locked intramedullary nailing, now standard of care for most femoral shaft fractures. Interlocking nails control rotation and length even in comminuted fractures, act as load-sharing implants, and permit early mobilisation, hastening return to function. This study evaluates union rate, complications and functional outcome of intramedullary interlocking nailing in a series of adult femoral shaft fractures.

Aims and Objectives

To evaluate the radiological union rate, complications and functional outcome of intramedullary interlocking nailing in adult patients with closed fractures of the femoral shaft.

Materials and Methods

This prospective hospital-based study was conducted in the Department of Orthopaedics of a tertiary care teaching hospital between October 2012 and March 2014. Thirty adult patients (≥20 years) with closed Gustilo–Anderson type I and II femoral shaft fractures were enrolled after ethical clearance and informed consent. Patients with paediatric fractures, type III open injuries, pathological fractures, pre-existing deformity, or established delayed union, malunion or nonunion were excluded. Routine preoperative work-up included haematological, biochemical and radiographic assessment for surgical fitness.

After clinico-radiological assessment, limbs were splinted in skin traction pending surgery, performed after a mean interval of 2 days under spinal anaesthesia with patient supine on a fracture table. Closed antegrade interlocking nailing was performed through a piriformis-fossa entry point under image-intensifier guidance, with sequential reaming and free-hand distal and jig-guided proximal locking; open reduction was used when closed reduction failed. Postoperatively, quadriceps and ankle exercises began on day 2, active knee mobilisation on day 4, and walker-assisted ambulation from day 7–10, progressing to full weight-bearing after confirmed union. Patients were reviewed at 6, 12 and 24 weeks and three-monthly thereafter. Radiological union was defined as bridging callus with trabeculation across fracture line. Functional outcome was graded as excellent, good, fair or poor using Thoresen scoring system.

RESULTS

Of the 30 patients, 20 (66.66%) were male and 10 (33.33%) female, aged 21–60 years (mean 31.63 years); 21–30-year

group was largest (50%) (Table 1, Figure 1). Road traffic accidents were predominant mode of injury (93.33%), and the right femur was more often involved (70%) (Table 1). Winquist–Hansen type III was commonest (46.66%), followed by type II (23.33%), type I (20%) and type IV (10%) (Table 2). Mean hospital stay was 12.3 days.

Radiological union occurred in all patients at a mean of 20.27 weeks (range 16–32); 21 patients (70%) achieved full weight-bearing by 16 weeks (Table 3). Full knee range of motion was recorded in 21 patients (70%), while 6 (20%) and 3 (10%) had residual restriction to 0–120° and 0–90° respectively.

Associated injuries occurred in 5 patients, most needing a secondary procedure (Table 4). Malalignment occurred in 3 patients (valgus in 2, varus in 1); 2 patients (6.66%) had limb-length discrepancy of 1–2 cm. One patient (3.33%) developed superficial infection that resolved with antibiotics; 2 patients (6.66%) had delayed union, uniting by 32 weeks. No nonunion, deep infection or implant failure occurred (Table 4). By Thoresen criteria, 21 patients (70%) had excellent, 6 (20%) good and 3 (10%) fair outcomes, an overall excellent-to-good result in 90% of cases (Table 5, Figure 2).

Table 1: Demographic and Injury Profile (n=30)

Parameter	Category	No. of Patients (n=30)	Percentage (%)
Age group (years)	21–30	15	50.00
	31–40	11	36.66
	41–50	3	10.00
	51–60	1	3.33
Sex	Male	20	66.66
	Female	10	33.33
Mode of injury	Road traffic accident	28	93.33
	Fall	2	6.66
Side	Right	21	70.00
	Left	9	30.00

Table 2: Fracture Pattern – Winquist–Hansen Classification (n=30)

Winquist–Hansen Grade	No. of Patients (n=30)	Percentage (%)
I	6	20.00
II	7	23.33
III	14	46.66
IV	3	10.00

Table 3: Radiological Union and Overall Functional Recovery Parameters

Parameter	Finding
Mean time to radiological union	20.27 weeks (range 16–32)
Full weight-bearing by 16 weeks	21 patients (70%)
Full weight-bearing at 17–20 weeks	9 patients (30%)
Mean hospital stay	12.3 days
Full knee range of motion	21 patients (70%)
Knee flexion 0–120°	6 patients (20%)
Knee flexion 0–90°	3 patients (10%)

Table 4: Complications and Associated Injuries

Complication	No. of Patients	Percentage (%)
Malunion (valgus/varus)	3	10.00
Limb-length discrepancy (1–2 cm)	2	6.66
Delayed union	2	6.66
Superficial infection	1	3.33
Deep infection	0	0.00
Nonunion	0	0.00
Implant failure	0	0.00
Associated injury needing 2° procedure	4	13.33

Table 5: Functional Outcome by Thoresen Score (n=30)

Thoresen Grade	No. of Patients (n=30)	Percentage (%)
Excellent	21	70.00
Good	6	20.00
Fair	3	10.00
Poor	0	0.00

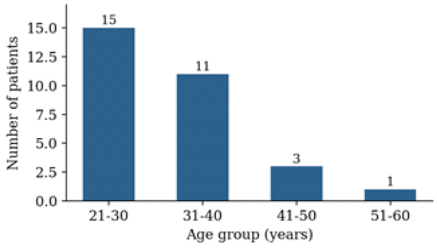

Figure 1: Age distribution of study patients (n=30)

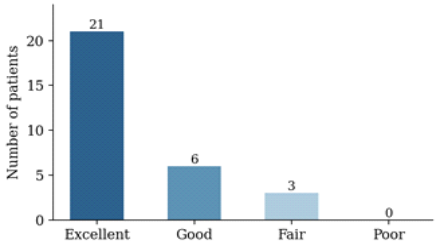

Figure 2: Functional outcome by Thoresen score (n=30)

DISCUSSION

These results are broadly consistent with wider literature on interlocking nailing of femoral shaft fractures. The mean age of 31.63 years and male preponderance (66.66%) mirror pattern reported by Wiss et al. (1986) and Alho et al. (1991), reflecting predominance of high-energy road traffic trauma in young, active men. Road traffic accidents accounted for 93.33% of injuries here, comparable to 77% reported by Winquist and Hansen (1980), underscoring the need to actively exclude associated skeletal and visceral trauma. Winquist–Hansen type III was commonest pattern (46.66%), consistent with comminution from high-velocity trauma, and comparable to 36% and 52% reported by Lhowe and Hansen (1988) and Brumback et al. (1992) respectively.

Mean union time (20.27 weeks) was intermediate between shorter times reported by Thoresen et al. (1985) (16 weeks) and Kempf et al. (1986) (18 weeks), and longer time of 26 weeks reported by Wiss et al. (1986), likely reflecting differences in comminution, reaming and weight-bearing protocols (Table 6).

The complication profile compares favourably with published data: no nonunion occurred, consistent with Alho et al. (1991) and Christie et al. (1988); the single superficial infection (3.33%) is comparable to rates reported by Wiss et al. (1986) and Christie et al. (1988); and the absence of implant failure or deep infection reflects biomechanical advantage of a load-sharing intramedullary construct over plate osteosynthesis.

An excellent-to-good outcome in 90% of patients closely matches 90–97% rates reported by Wiss et al. (1986) and Klemm and Börner (1986) (Table 6), supporting intramedullary interlocking nailing as a reproducibly effective, reliable technique across diverse geographic and institutional practice settings.

Table 6: Comparison of Present Study with Published Series

Study	Mean age (yrs)	Male:Female	RTA (%)	Union (weeks)	Excellent–Good (%)
Present study	31.63	20:10	93.33	20.27	90
Thoresen et al. (1985)	28	–	–	16	–
Wiss et al. (1986)	29	–	–	26	92
Winquist & Hansen (1980)	–	–	77	14	–
Klemm & Börner (1986)	–	–	–	–	97

CONCLUSION

Intramedullary interlocking nailing achieves a high union rate with low complication rates and restores good functional status in most adult patients with femoral shaft fractures. Its load-sharing biomechanics and rotational-axial control permit early mobilisation and favourable return to function. Based on this series and comparison with published literature, intramedullary interlocking nailing can be recommended as treatment of choice for closed Gustilo–Anderson type I and II femoral shaft fractures in adults.

REFERENCES

1. Alho, A., Strømsøe, K., & Ekeland, A. (1991). Locked intramedullary nailing of femoral shaft fractures. Journal of Trauma, 31(1), 49–59.
2. Brumback, R. J., Ellison, T. S., Poka, A., Bathon, G. H., & Burgess, A. R. (1992). Intramedullary nailing of femoral shaft fractures. Part III: Long-term effects of static interlocking fixation. Journal of Bone Joint Surgery (American), 74(1), 106–112.
3. Christie, J., Court-Brown, C., Kinninmonth, A. W., & Howie, C. R. (1988). Intramedullary locking nails in the management of femoral shaft fractures. Journal of Bone Joint Surgery (British), 70(2), 206–210.
4. Gustilo, R. B., & Anderson, J. T. (1976). Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones. Journal of Bone Joint Surgery (American), 58(4), 453–458.
5. Johnson, K. D., Johnston, D. W., & Parker, B. (1984). Comminuted femoral-shaft fractures: Treatment by roller traction, cerclage wires, and an intramedullary nail, or an interlocking intramedullary nail. Journal of Bone Joint Surgery (American), 66(8), 1222–1235.
6. Kempf, I., Grosse, A., & Lafforgue, D. (1986). Locking in interlocking nail. Clinical Orthopaedics and Related Research, 212, 211–219.
7. Lhowe, D. W., & Hansen, S. T. (1988). Immediate nailing of open fractures of the femoral shaft. Journal of Bone Joint Surgery (American), 70(6), 812–820.
8. Thoresen, B. O., Alho, A., Ekeland, A., Strømsøe, K., Follerås, G., & Haukebø, A. (1985). Interlocking intramedullary nailing in femoral shaft fractures. Journal of Bone Joint Surgery (American), 67(9), 1313–1320.
9. White, G. M., Healy, W. L., & Brumback, R. J. (1986). Treatment of fractures of the femoral shaft with the Brooker–Wills distal locking intramedullary nail. Journal of Bone Joint Surgery (American), 68(6), 28–34.
10. Winquist, R. A., & Hansen, S. T. (1980). Comminuted fractures of the femoral shaft treated by intramedullary nailing. Orthopedic Clinics of North America, 11(3), 633–648.
11. Wiss, D. A., Fleming, C. H., Matta, J. M., & Clark, D. (1986). Comminuted and rotationally unstable fractures of the femur treated with an interlocking nail. Clinical Orthopaedics and Related Research, 212, 35–47.