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Comparative study of surgical management of fracture shaft of femur with intramedullary interlocking nail Z: Open VS closed type

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Abstract

Introduction: Intramedullary interlocking is currently considered the treatment of choice for most femoral shaft fractures, with successfully high rates of fracture union and low incidence of infection, malunion, non union or implant failure.

Methodology: Patients who are admitted with fracture shaft of femur to the department of Orthopaedics formed the study subjects. The time taken for bone union, range of movements, early mobilization, and the complications encountered during the procedure and later will be compared btw open vs closed method of intramedullary nailing for fracture shaft of femur.

Results: Superficial infection was encountered in 1 (4%) cases in group A and 2(8%)cases in group B. Shortening of 1-2 cms was encountered in 0 (0%) cases in group A and 1(4%)case in group B. External rotation deformity $> 5^\circ$ was encountered in 3 (12%) cases in group A and 1(4%)case in group B. Deep infection was encountered in 1 (4%) cases in group A and no cases in group B. No post operative cases of neuro vascular defect was encountered in the study groups

Conclusion: The time to mobilization in the post-operative period and there after were similar in both the study groups.

Keywords: Fracture Shaft Femur, Interlocking Intramedullary Nail

Introduction

Fracture of the shaft of the femur is the most common fractures encountered in orthopedic practice. Since the femur is the largest bone of the body and one of the principal load-bearing bones in the lower extremity, fractures can cause prolonged morbidity and extensive disability unless treatment is appropriate. Fractures of the femoral shaft often are the result of high-energy trauma and may be associated with multiple system injuries^[1].

The concept of a long metallic intramedullary device that gripped the endosteal surface of the bone so called elastic nailing was the brainchild of Gerhardt Kuntscher working in collaboration with professor Fischer and the engineer Ernst Pohl at Kiel University in Germany in 1930's. Kuntscher originally used a V shaped nail but changed to a nail with a clover leaf cross section for greater strength and designed to more faithfully follow a guide pin. Kuntscher published his first book on Intra medullary nailing at the end of second world war in the late 1944^[2].

In 1940 Kuntscher first described his cloverleaf nail and its use in fracture femur. He initially described closed nailing first with fluoroscopic control^[3].

There were high complication like failure to reduce fracture, jamming of nail, splitting of distal fragments, radiation exposure^[2].

Hence open reduction of the fracture was developed (Watson Jones *et al*, 1950)^[4].

During the late 40's and early 50's open reduction and internal fixation of femoral shaft fractures with Kuntscher nail became widely popular in the west and a new era in managing femur fracture evolved^[3].

In the late 50's and the early 60's Image intensifiers (C-arm), with decreased radiation hazards were developed. The potential complications of open nailing were being recognized and the old knowledge of closed nailing of Kuntscher was being reviewed. Kuntscher himself never gave up his idea of closed nailing an went ahead to develop his new nail called the Detensor nail in 1968 to give rotational stability to the fracture by creating a proximal and distal hole in his nail for transfixing pins. With this concept evolved the closed interlocking nailing system^[5]

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Reduction during closed nailing was initially performed by traction applied through thigh straps above and below fracture site attached through ropes to hooks in the walls of the operating room. Linsmayer introduced an apparatus in which lateral traction was applied through windlasses in a frame [7]. Wittmoser followed with his gear controlled rings in his reduction apparatus [7]. Kuntscher later used a crutch with a strap attached near the large end that would control both fragments and used the crutch as the lever arm [2].

Regardless of the method of treatment chosen, the following principles are agreed upon:

- 1) restoration of alignment, rotation, and length,
- 2) preservation of blood supply to aid union and prevent infection, and
- 3) Rehabilitation of the extremity and thereby the patient.

The present study was to compare the functional outcome of closed vs open intramedullary interlocking nailing of fracture shaft of femur.

Methodology

Patients admitted with fracture shaft of femur were involved in the study. In group A Closed intramedullary interlocking nailing of the fracture was done. In group B open method of intramedullary nailing was done. The sample size was 25 each group

Inclusion Criteria

Fractures of shaft of femur

- Age Group >16yrs
- 5 Cms Distal To Lesser Trochanter & 5 Cms From Distal Articular Cartilage
- Closed Fractures
- Open Type I, Ii, Iii A- Gustilo Anderson
- Comminuted Fractures
- Old Fractures

Exclusion criteria

- Children And Adolescents < 16 Yrs
- Type Iii B And C- Gustilo Anderson
- Old Age- Not Fit For Surgery
- Fractures Shaft With Supracondylar Extension
- Pathological Fractures

Operative procedure

Group – A (closed nailing)

Closed nailing was done with patient supine position on a fracture table. Initially fracture site was visualized under image intensifier. The piriformis fossa was exposed through gluteal approach and curved bone awl positioned over the piriformis fossa, in line with the medullary cavity and position confirmed on both AP and lateral views. Ball tipped guide wire passed through the entry point, fracture site and distal segment after reduction of fracture. Position of guide wire was confirmed on AP and lateral imaging. Reaming was done over the guide wire to appropriate size with 1 mm increments. Exchange tube passed and ball tipped guide wire removed and plain guide wire was passed across the fracture side. The nail length was confirmed. Proximal jig mounted interlocking nail of appropriate size and length passed over the guide wire. Guide wire was removed and

proximal locking was done. Rotational alignment was confirmed and distal locking was done with free hand technique. For stable fractures dynamic locking was done. Wound was closed in layers after heamostasis under aseptic precautions.

Group – B (Open nailing)

Open nailing was done on routine operating table with patient on lateral decubitus position. Femur was exposed through postero-lateral approach. Fracture site identified and fracture hematoma evacuated. 6mm manual reamer passed across the proximal fragment and than guide wire was passed and extracted through the gluteal region. Reaming of the proximal fragment was done over the guide wire with 1 mm increments. Followed by the reaming of the distal fragment. Nail length and size confirmed. Nail with proximal jig mounted and pass through the proximal fragment in antegrade fashion after reduction of fracture site. The nail was passed across the distal fragment. Proximal locking was done followed by distal locking by free hand technique after analyzing rotational alignment. Wound closed in layers after maintaining hemostasis under aseptic precautions.

Criteria for evaluation

Evaluation of functional outcome was done according to criteria laid by Thoresn. B.O *et al*

Results

Table 1: Age Distribution

Age In Years	Group A		Group B	
	No. of Patients	%	No. of Patients	%
<20	3	12	4	16
21-30	13	52	10	40
31-40	8	32	7	28
41-50	1	4	1	4
51-60	0	0	3	12
TOTAL	25	100	25	100

The average age in Group A was 29 (18-50 years)

The average age in Group B was 33 (18-57 years)

Table 2: Sex distribution

Sex	Group a		Group b	
	No. of Patients	%	No. of Patients	%
Female	0	0	1	4
Male	25	100	24	96
Total	25	100	25	100

In Group A all the patients were male.

In Group B 24 male patients and 1 female patient.

Table 3: Fracture site

Fracture site	Group a		Group b	
	No. of Patients	%	No. of Patients	%
Proximal thirds	7	28	6	24
Middle thirds	12	48	12	48
Distal thirds	6	24	7	28
Total	25	100	25	100

In group A 7 (28%) cases were proximal third, 12 (48%) cases were middle third and 6(24%) cases were distal third.

In group B 6 (24%) cases were proximal third, 12 (48%) cases were middle third and 7(28%) cases were distal third.

Table 4: Duration to Radiological Union

Duration to Radiological Union				
Duration in Weeks	Group a		Group b	
	No. of Patients	%	No. of Patients	%
14 -16	9	36	4	16
17 -20	9	36	13	52
21-23	3	12	4	16
24 -27	3	12	3	12
> 27	1	4	1	4
total	25	100	25	100

The duration to union in group A was: majority of the fracture united between 14-16 (36%) weeks and 17-20 (36%) weeks. In group B: majority of the fractures united between 17-20 (52%) weeks.

Table 5: Functional Grading

Duration In Weeks	Group a		Group b	
	No. of Patients	%	No. of Patients	%
Excellent	18	72	19	76
Good	6	24	6	24
Fair	0	0	0	0
Poor	1	4	0	0

Majority of the patients in the study group had excellent result (grading); 72% in group A and 76% in group B.

Table 6: Post Operative Complications

Complications	Group a		Group b	
	No. of Patients	%	No. of Patients	%
Superficial infection	1	4	2	8
Shortening of 1-2 cm	0	0	1	4
Deformity >5% extrotation	3	12	1	4
Deep infection	1	4	0	0
Nvd	0	0	0	0
Total	5	20	4	16

Superficial infection was encountered in 1 (4%) cases in group A and 2(8%) cases in group B. Shortening of 1-2 cms was encountered in 0 (0%) cases in group A and 1(4%)case in group B. External rotation deformity > 5° was encountered in 3 (12%) cases in group A and 1(4%)case in group B. Deep infection was encountered in 1 (4%) cases in group A and no cases in group B. No postoperative cases of neuro vascular defect was encountered in the study groups.

Table 7: Late Complications

Complications	Group a		Group b	
	No. of patients	%	No. of patients	%
Deep infection	1	4	0	0
Implant removal	1	4	0	0
Non union	0	0	0	0
Malalignment	3	12	1	4
Shortening	0	0	1	4
Implant brekage	0	0	0	0
Screw brekage	1	4	1	4
Total	6	20	3	12

Deep infection was encountered in 1 (4%) cases in group A and no cases in group B. Implant removal was done in 1 (4%) cases in group A and no cases in group B. No cases of Non union was encountered in the study groups. Malalignment (External rotation deformity > 5°) was

encountered in 3 (12%) cases in group A and 1(4%) case in group B. A case of shortening was encountered in Group B. There were no case of implant breakage in the study groups. A case of distal screw breakage was encountered in both the groups.

Discussion

Intramedullary nailing is the treatment of choice for all femoral shaft fractures. Closed intramedullary interlocking nailing has predominated over open nailing after advent of image intensifier. In India there are few centers have facility of image intensifier, particularly at the basic level of health infrastructure. So open method of nailing is accepted modality of treatment at the basic level of health infrastructure. Present study was aimed to evaluate functional outcome of close nailing v/s open nailing of femoral shaft fractures. From the historical prospective its known that closed nailing was conceived followed by open method of nailing. There have been few studies which have compared the functional outcome of closed v/s open nailing. In our present study we have 25 cases of fracture shaft of femur treated by closed intramedullary interlocking nail in Group A, 25 cases of open intramedullary interlocking nailing in group B. The patients were allotted randomly into each group and also based on surgical indication and surgeon compliance. Group A superficial infection 1 (4%) case, 3 (12%) cases of external rotation dermoity > 5° and 1 (4%) case deep infection in which fracture united and implant removal done at 14 months and medullary cavity debrided by reaming and patient was put on de rotation boot for 4 weeks followed by guarded mobilization, patient did well. In group B superficial infection was seen in 2 (8%) cases which subsided with antibiotics according to culture and sensitivity, 1 (4%) case of shortening of 1.5 cms presented at final follow up, it was type IIIA open fracture with bone loss, open nailing with iliac crest grafting was done, fracture healed by 25 weeks with no signs of infection. External rotation dermoity > 5° 1 (4%) case. Post operative complication in our study groups were almost similar and statistically insignificant. Meena R C *et al* [8] reported delayed/Non union in 12 (19.35%) cases in open and 3 (7%) in closed group; Infection (deep; superficial) 2+10 in open and 2+4 cases in closed; shortening of 4 cases in open and 14 in closed ; broken nail 2 case in open group. Gharehdaghi M *et al*. [9] reported 6 cases of external rotation deformity in closed and none in open method, nonunion in 6 cases, deep infection 2 cases one in each group, 3 cases implant failure. Meena RC *et al* [8] reported union rate at 12 months period of 93% in closed and 87.9% in open group. Gharehdaghi M *et al* [9] reported 93.2% union in open and 95.4% in closed group in 6 months. The rates of union reported in other series of interlocking nailing are Thoresen BO *et al* [45]-16wks; Brumback

et al.- 19wks; *Wiss et al.* 26wks. The union in our study group A and B were 14-32 wks and 16-30 wks respectively. All patients in our study groups achieved union.

Conclusion

- The post-operative complications were almost similar in both the study groups and statistically insignificant.
- The range of movements achieved at knee and hip were similar in both the study groups.
- The time to fracture union in both the study groups were almost similar

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