



ORIGINAL ARTICLE

SHORT TERM RESULT OF INTRAMEDULLARY NAIL IN OPEN FEMORAL FRACTURE IN ADULT

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Abstract

Background: Femoral shaft fractures occur in a bimodal distribution, they are most commonly seen in males age 15-24 and females aged 75 or older. Causes include trauma, lytic lesions and osteoporosis. **Objectives:** The aim of treatment of femoral fractures is normal bone alignment and length, early mobilization with gradually increasing weight bearing and normal knee and hip functional range of motion.

Patients & Methods: Between February 2016 and February 2018, a retrospective study was done on 12 patients (type I and type II and IIIa open femoral shaft fractures) were treated with IMFN (Intramedullary Femoral Nail) as their primary treatment in Libyan Hospitals and Zagazig University Hospital . The age ranged between 16 to 55 years old with mean age 32 years,

Results: These results show that in the grade I and II open femoral shaft fractures, a primary unreamed intramedullary nailing can be safely done, with minimal complications and excellent functional results. For the grade III open fractures of the femur, the modern techniques of management, combined with the skills of experienced orthopedic and plastic surgeons, can consistently restore excellent limb functions in a very high proportion of patients. In some of the most severely injured limbs, salvage is possible and a useful functional limb can be obtained.

Conclusions: This study demonstrates that grade I, II and III An open femoral shaft fractures can be treated with primary debridement and locked reamed or unreamed intramedullary nailing with good short-term results, a better biomechanical stability and early rehabilitations.

Keywords: Nail, Open , Femoral, shaft, fractures

INTRODUCTION

Femoral shaft fractures occur in a bimodal distribution, whereby they are most commonly seen in males age 15-24 and females aged 75 or older. Causes include trauma, lytic lesions (cancerous metastasis, Paget disease and bone cysts) and osteoporosis ^[1].

Open fractures must undergo urgent surgery to clean and repair them, but closed fractures can be maintained until the patient is stable and ready for surgery ^[2].

Intramedullary nail fixation has become the standard of treatment for femoral fractures, with reported union rates for the

femur approaching 97%. Intramedullary nail fixation of these fractures may be less traumatic than conventional techniques, especially in critically ill patients. Intramedullary nailing is the gold standard of the treatment of most diaphyseal fractures of the lower limbs and is gaining hold on humerus and forearm fractures ^[3].

For femoral shaft fractures, reduction and intramedullary nailing is currently recommended. The bone is re-aligned, and then a metal rod is placed into the femoral bone marrow, and secured with nails at either end. This method offers less exposure, a 98%-

99% union rate, lower infection rates (1%-2%) and less muscular scarring [4].

PATIENTS AND METHODS

Between February 2016 and February 2018, a retrospective study was done on 12 patients (type I and type II and IIIa open femoral shaft fractures) were treated with IMFN (INTRAMEDULLARY femoral NAIL) as their primary treatment in Libyan Hospitals and Zagazig University Hospital. The age ranged between 16 to 55 years old with mean age 32 years. The interval between the injury and the surgery was 8-48 hours.

Written informed consent was obtained from all participants and the study was approved by the research ethical committee of Faculty of Medicine, Zagazig University. The work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion criteria:

- Open fractures of femur.
- Age 16-55 years.

- Fractures of mid shaft femur.

Exclusion criteria:

- Type III b and type III.C of open fractures.
- Adult femoral shaft with closed fractures.
- Combined metaphyseal and diaphysial fractures.

Statistical analysis

Independent sample student's t-test was done to assess the parameters like age, follow-up and duration of surgery. The results were expressed as mean with standard deviation and $p < 0.05$ was considered to be statistically significant & < 0.001 for high statistically significant. The analysis was done using the Epi-info software (Version 3.5.4) and Microsoft Excel 2013 (Microsoft Office version 15.0).

RESULTS:

Table (1): Harris score grading distribution among studied group

25% were poor and 75% were good and 4 cases needed support and 8 cases don't need support.

Harris score	Good	9	75.0%
	Poor	3	25.0%
Support	Need support	4	33.3
	Don't need	8	66.7
	Total	12	100.0

Table (2): Complication distribution among studied group

41.7% were complicated

The complication were 4 patient had superficial wound infection discovered (10-14) days post operative, one patient treated with double agent of oral antibiotic and other patient had uncontrolled blood sugar profile and treated with good blood sugar control and double agent of oral antibiotic and , furthermore 3 cases had delayed union and these cases fall under category of gustilo and anderson type II and III which treated with dynamization to achieve full union at 10months. complained of pain at surgical site which were relieved by oral analgesia (nonstiroidal antiinflammatory) for two weeks .

Complication	Infection	1	8.3
	No	7	58.3
	Non union & infection	4	33.3
Overall complication	Not	7	58.3
	Complicated	5	41.7
	Total	12	100.0

Table (3): Association between demographic and clinical data and complication.

Significant association between high grade of Gustilo and complication and late union and also there was association between late time management and complication but not significant.

			Not	Complicate		
			39.0±11.95	37.8±7.69	0.514	0.375
Age/year	Male	N	7	3	3.36	0.067
		%	100.0%	60.0%		
Gender	Female	N	0	2		
		%	0.0%	40.0%		
Co morbidity	DM	N	1	0	1.71	0.42
		%	14.3%	0.0%		
	HTN	N	1	0		
		%	14.3%	0.0%		
Causes	NO	N	5	5		
		%	71.4%	100.0%		
	Fall from height	N	0	1	1.54	0.46
		%	0.0%	20.0%		
Gustilo	Motor crash	N	5	3		
		%	71.4%	60.0%		
	Pedestrian	N	2	1		
		%	28.6%	20.0%		
Time till surgery/day	Type I	N	6	1	6.41	0.04*
		%	85.7%	20.0%		
	Type II	N	1	1		
		%	14.3%	20.0%		
Total	Type IIIA	N	0	3		
		%	0.0%	60.0%		
	<12	N	6	2	2.74	0.098
		%	85.7%	40.0%		
Total	>12	N	1	3		
		%	14.3%	60.0%		
Total		N	7	5		
		%	100.0%	100.0%		

Table (4): Operation time, and hospital stay, and Harris score in complication and not complication

Harris score significant lower in complicated cases

Operation time/min	158.57±13.45	154.0±21.9	0.450	0.662
Harris score	88.14±3.97	70.4±11.3	3.880	0.003*
Hospital stay/day	4.57±0.78	5.2±1.09	-1.163	0.272



Skin wound of femur fracture gustilo classification II



A P and lateral pre-operative radiographs shows mid shaft fracture of femur.



A P and lateral post-operative radiographs with kirschner nail.



8 months A P and lateral post-operative radiographs after exchange nailing and bone grafting



12 months A P and lateral post-operative radiographs.

DISCUSSION

The management of femoral fractures has evolved significantly in recent years. Internal fixation based on anatomical reduction and rigid fixation of diaphyseal bone fragments is no longer the goal. Minimal surgical trauma and preservation of the blood supply of the bone and soft tissue are considered the most important factors in bone healing. The concept of "biological osteosynthesis" appears in the 90s. This term includes several types of osteosynthesis, all aimed at achieving a stable fixation with maximum respect to the "soft tissues". With biological aspects, attention has shifted from absolute anatomic reduction and stability toward the preservation of tissue vascularity while obtaining anatomic alignment and relative stability. Biological internal fixation avoids the need for precise reduction, especially of the intermediate fragments, and has the advantage of indirect reduction. For this purpose; external fixators, plate and screws, and intramedullary nails can be used. In biological fixation, these plates or nails act as a "splint" to maintain fracture alignment without absolute stability. In comminuted fractures, the plate initially is the only load carrier of the construct. However,

indirect reduction and relative stability of the fracture result in secondary callus formation. As the fracture union completes, load is gradually transferred to bone.

In study on 59 patients suffered from comminuted femoral fractures, 24 patients (13 male, 11 female) treated by other method and 26 patients (20 male, 6 female) treated by IMN. In study on 25 patients with 29 diaphyseal fracture femur treated with undreamed locked IMN, 19 cases were males (76%) and 6 cases were females (24%). average age was 31.4 ± 11.1 years ranged from 18 to 65 years, with long term follow up ranged from 26 to 138 months with average 65.1 months, in 21 patients mode of injury was MVC (84%) and 4 patients was fall from height.

They reported average surgery time 66.5 ± 8.2 minutes ranged from 60 to 85 minutes, average intra-operative blood loss 116.8 ± 48 ml and average union time 4.4 - 2.6 months. Regarding complications, they reported 1 case of nonunion, 3 cases with shortening less than 2 cm, 2 cases with mal-alignment, one case varus and one case valgus, both were less than 8 degrees. They used Klemm, Bomer and Thoresen systems to

asses' functional outcome with 23 cases excellent results (79.3%), 5 cases good results (7.2%) and one case fair result (3.5%)^[5].

In study on 32 cases with closed comminuted femoral fractures and treated by biological plating, 14 cases were subtrochanteric fractures, 7 cases were diaphyseal fractures and 11 cases were supracondylar fractures. 24 cases were males and 8 cases were females and average age was 34.3 ranged from 18 to 52 years. They reported timing till surgery from 2 to 7 days, average follow up period 15.2 (from 12 to 19 months), average union time 5.4 months and union rate 90.6 %. Regarding complications, they reported 11 cases with delayed union 4 cases with LLD (12.5%) all were less than 3cm shortening, 3 cases with angular deformity less than 15 degrees in 9 cases, external rotation less than 15 degrees in 2 cases (9.4%) and DVT in only one case. No infections developed in this study^[6].

In study on 31 cases with comminuted femoral fractures and treated with biological plating, 30 cases were males and 1 case was female and average age was 30.8 ranged from 12 to 60 years. He reported time till surgery average 5 days, average surgery time 75 minutes ranged from 45 to 115 minutes, mean blood loss 257 ml and mean follow up period 44 weeks ranged from 32 to 56 weeks. He reported average union time 18 weeks, 4 cases delayed union, 3 case superficial infection, 3 cases shortening less than 3 cm, and 3 cases there was decreased ROM of the knee less than 100 degrees. He used modified Neer's score for assessment of functional outcome and reported 8 cases with excellent results .9 cases with good results and 13 cases with poor result^[7].

In study on 50 patients with fracture of the femur treated by proximal femoral nail, 36 cases were males and 14 cases were females, 38 cases were males and 14 cases were females, MVC was the cause of injury in 38 cases (76%) and fall from height was the cause of injury in 12 cases. He reported average surgery time 90 minutes ranged from 60 to 120 minutes, mean hospital stay 17 days, mean union time 4.6 months. He reported only 2 cases of superficial infection^[8].

In study on 26 patient with Mid shaft fractures and treated with femoral nailing, 20 cases were males and 6 cases were females, average age was 50 years, MVC was the cause of injury in 15 cases, fall from height was the cause in 8 cases and simple fall was the cause in 3 cases. They reported 2 cases with superficial infection, 1 case with delayed union and no implant failure. Regarding functional outcome they used Harris hip score and reported 10 cases with excellent results, 9 cases with good results, 4 cases with fair results and 3 cases with poor results, with average Harris hip score 82 among study group^[9].

In study on 45 patients with femoral fractures and treated with femoral locking plates, average age was 76 years ranged from 43 to 85 years and average follow up period 16 months ranged from 6 to 28 months, mean blood loss 230 ml and mean union time 18.6 weeks. He reported 6 cases with superficial infection, one case of deep infection and 3 cases of implant failure. Regarding functional outcome they used Harris hip score and reported 10 cases excellent results, 15 good results and 5 fair results, with mean Harris hip score 86.5 ± 9.8 ranged from 73 to 95.

In our study, average time to surgery was 1.5 days we believe that fixation must be performed as soon as possible, but if there is an additional life-threatening injury, surgery must be delayed until hemodynamic stability is achieved.

There is no consensus regarding the timing of surgery for femoral fractures, and priority must be given to the life-threatening injuries. According to most authors, early surgery means fixation in the first 24 hours. However, if other system injury accompanies femur fracture, early surgery may cause pulmonary embolism, adult respiratory distress syndrome or multiple organ failure in hemodynamically unstable patients^[10]. Reported of that early fixation of femur fractures in patients with head and chest injury that increases morbidity and mortality rates^[11-13]. However, findings of Carlson and Bosse do not support the other authors^[14]. Regarding **operative time**, the mean operative time in our study was 158.57 ± 13.45 min. The variation in the operative time was related to the fracture

pattern and the body built of the patient. Longer time was needed in obese patients. In fractures with marked displacement and comminution, the need for anatomical or near anatomical reduction takes longer operative time to gain best results. Regarding **intra operative blood loss** in our study, the mean blood loss was 300ml. There was significant difference between Nail and other regarding intra operative blood loss, Which was expected as there is only one incision was done in nailing group compared to the two incisions or big done in biological plating group was more than 300 ml .The use of closed reduction and indirect reduction techniques, leads to decrease blood loss. On the other hand, the use of conventional internal fixation techniques produces considerable blood loss, leading to the probable need for blood transfusion with all its hazards and cost.

In our study the mean hospital stay was (4-7) days. Only one case stays to 10 days due to infection. Regarding follow up period in our study it was 6 months .Regarding union time in our study, the average was 5.76 months and minimum 4 months .There was significant difference between Nail1 and other groups as plate or ex. fix. regarding time of union in our study 2 cases complicated by delayed union, one case managed by percutaneous autologous bone marrow injection, the second case managed by augmentation of the interlocking nail with locking compression plate (LCP) using MIPPO technique without opening the fracture site and without bone grafting.2 cases complicated by non-union, managed by percutaneous autologous bone marrow injection done at 5th months then iliac bone graft.

CONCLUSION:

This study demonstrates that grade I, II and III A open femoral shaft fractures can be treated with primary debridement and locked reamed or unreamed intramedullary nailing with good short-term results, a better biomechanical stability and early rehabilitations.

Conflict of interest: The authors declare that they have no conflict of interest.

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