International Journal of Research in Medical Sciences
Kekatpure A et al. Int J Res Med Sci. 2016 Jan;4(1):289-293
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20160045

Research Article

Management of comminuted fractures of the shaft of femur by interlocking nailing at a tertiary level hospital in India

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Received: 27 November 2015
Accepted: 18 December 2015

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ABSTRACT

Background: Fracture shaft of femur is one of the most common fractures encountered in orthopaedic practice. Fracture shaft of femur is major cause of morbidity and mortality in patients who sustain high energy trauma. This study looks at the epidemiology of patients presenting with femur fracture at a tertiary level hospital in Navi Mumbai.
Methods: This prospective study was performed at a tertiary level hospital in Navi Mumbai from January 1, 2014 till July 31, 2015. All patients aged 18 years or above, who presented with comminuted femur fracture and were treated with interlocking nailing was included in the study. Various clinical and radiological parameters were collected during the course of treatment.
Results: 50 patients were included in the study; 84% males. 88% aged 50 years or less. Road traffic accident was the most common mode of injury and 54% of patients had fracture in the middle one-third femur. 76% of the patients presented within 24 hours of injury. 52% of the patient's demonstrated clinical union of the fracture in 12 to 14 weeks and majority showed radiological union in 16 to 18 weeks. Partial weight bearing was started in 36% patients in 10 weeks and full weight bearing in 42% patients in 16 weeks. Majority of the patients stayed in hospital for 10 to 14 days and the functional outcome as measured by Klemm and Borner criteria was excellent in 66% patients. Complications were seen only in 6 patients.
Conclusions: In our experience, interlocking nailing had very low complication rate and excellent functional outcome in two thirds patients of comminuted femur fracture.

Keywords: Femur, Fracture, Interlocking nailing, Management, Outcome

INTRODUCTION

Fracture shaft of femur is one of the most common fractures encountered in orthopedic practice. Injury is most common among persons younger than 25 years and those older than 65 years.[1] With the ever-increasing road traffic accidents, pedestrian versus accidents, sports injuries, fall form height, industrial accidents, comminuted shaft fractures of femur are becoming common. In high velocity injuries one must have a high index of suspicion for complications or other associated injuries where the bone is subjected to sudden and violent force resulting in severe and extensive communition, jeopardizing the vascularity of bone and surrounding tissues.[2] Fractures are most often due to a bending load applied to the femur with comminution occurring via higher magnitude forces. Torsional loads, in contrast, form a spiral fracture pattern.

Fracture shaft of femur is major cause of morbidity and mortality in patients who sustain high energy trauma. Morbidity arises from limb shortening, mal union, non-union and the so called fracture disease. The muscle gets atrophied and fibrosed, the hip and knee joints lose their range of motion and chronic dependent edema develops. Mortality is infrequent, but can result from an open

wound, fat emboli, adult respiratory distress syndrome (ARDS) or due to result of multiple organ failure especially in multiple injured patients, deep venous thrombosis (DVT), pneumonia development, long intensive care unit (ICU) stays, infection, hemorrhage nerve palsies and compartment syndrome.[3]

Currently, surgery is indicated for most femur fractures because of the high rate of union, low rate of complications, and the advantage of early fracture stabilization, which decreases the morbidity and mortality rates in patients (especially polytrauma patients) with these fractures.[4] Interlocking nailing of communited fractures with proximal and distal locking screws provides rotational stability and the nail functions as load-sharing, rather than bearing the load.[5] Axial loading across fractures with stable pattern is encouraged thus promoting callus formation. If done by closed method i.e. without disrupting the fracture hematoma, the fracture, appropriate equipment and special expertise are required to carry out the procedure.

The aim of the study was to evaluate the operative procedure in management of communited fractures of the shaft of femur by inter-locking nailing. This study looks at the epidemiology of patients presenting with femur fracture at a tertiary level hospital in Navi Mumbai. It includes detailed study on comminuted fractures of shaft of femur after internal fixation with closed interlocking nailing and an attempt is made to manage these fractures with early ambulation and least disability.

METHODS

Setting

This prospective study was conducted in the urban city of Navi Mumbai, Maharashtra where we included patients who presented to our emergency ward. Institutional ethics review was obtained before commencing this study. With a population of 1,193,477, approximately 55% of which are males, Navi Mumbai is a planned township of Mumbai on the west coast of Maharashtra, India.

Study design

The study duration was from January 1, 2014 till July 31, 2015. We included all patients, aged 18 years or above, who presented to our emergency ward with comminuted fracture of shaft of femur. Initial management in the form of fluid therapy, antibiotics and analgesics were given. After initial stabilization, informed consent was obtained either from the patient or from patient's attendant. The patient was admitted and was followed throughout the course of surgery and post-operative period. Our inclusion criterion was comminuted fracture shaft femur in 18 to 70 years age group patients and those who were treated by interlocking nailing. We excluded patients who had associated abdominal and chest injuries, had epiphysis involvement, patients who were previously operated cases with non-union and mal-union fracture shaft femur, patients with associated pelvic injuries or patients with neurovascular deficit.

Data collection and analysis

We collected demographic information like age and gender of the patient and detailed history was taken. History taking included mode of injury, level of fracture, type of fracture, time of presentation after the fracture and time of surgery after admission. Additional information for all patients was collected from their operative and post-operative notes. Mode of anesthesia administered, clinical union of fracture, radiological union of fracture, protected or partial weight bearing, full weight bearing, duration of hospital stay, any complications experienced and functional outcome of surgery was obtained as well.

Data obtained from hospital was codified and entered into Microsoft excel sheets. Data were then imported in to Statistical Package for Social Sciences (SPSS) version 21and descriptive analysis was performed.

RESULTS

50 patients fulfilled our inclusion and exclusion criteria during the study period, 84% of which were males. 88% of the study population was aged 50 years or less. Road traffic accident was the most common mode of injury, accounting for 86% patients (see Table 1). Majority of patients had fracture in the middle one-third femur. 76% of the patients presented within 24 hours of injury. Only 1 patient in our study population was taken for surgery within 24 hours of injury. 66% of patients were taken in for surgery within 1 to 3 days. General anesthesia was the most common mode of anesthesia administered to patients. 52% of the patients demonstrated clinical union of the fracture in 12 to 14 weeks. Similarly, majority of the patients showed radiological union of the fracture in 16 to 18 weeks. Partial weight bearing was started in 36% patients in 10 weeks and full weight bearing in 42% patients in 16 weeks. Majority of the patients stayed in hospital for 10 to 14 days and the functional outcome as measured by Klemm and Borner criteria was excellent in 66% patients. Infection, limb length discrepancy less than 5 mm and deep vein thrombosis was seen in two patients each.

DISCUSSION

In human body, femur is the longest, strongest, and heaviest tubular bone in the human body and one of the principal load bearing bones in the lower extremity. Fractures of the femoral shaft often result from high energy forces such as motor vehicle collisions.[6] Femoral shaft fractures can also result in major physical impairment due to potential fracture shortening, mal-alignment, or prolonged immobilization of the extremity with casting or traction.[7] Thus the art of femoral fracture

care involves a balancing act between anatomic alignment and early functional rehabilitation of the limb.

Table 1: Baseline characteristics of patients included in the study.

Variable	*n* = 50
Gender	
Male	42 (84%)
Female	8 (16%)
Age	
18 – 30 years	18 (36%)
31 – 40 years	16 (32%)
41 – 50 years	10 (20%)
51 – 60 years	6 (12%)
Mode of injury	
Road traffic accident	43 (86%)
Industrial accident	7 (14%)
Level of fracture	
Upper 1/3rd	12 (24%)
Middle 1/3rd	27 (54%)
Lower 1/3rd	11 (22%)
Type of fracture*	
Type I	13 (26%)
Type II	14 (28%)
Type III	15 (30%)
Type IV	8 (16%)
Time of presentation after injury	
0 – 1 day	38 (76%)
Less than 1 week	8 (16%)
More than 1 week	4 (8%)
Time of surgery after admission	
Less than 24 hours	1 (2%)
1 – 3 days	33 (66%)
4 – 7 days	11 (22%)
More than 7 days	5 (10%)
Mode of anesthesia	
General anesthesia	39 (78%)
Spinal anesthesia	11 (22%)

*Type of fracture as determined by Winquist-Hansen classification.

Essential initial management consists of evaluating the patient for major injuries and treating them as appropriate, placing an intravenous catheter and providing analgesia, and immobilizing the injured extremity. Patients with open fractures receive antibiotics and tetanus prophylaxis. Little clinical evidence exists to support the use of traction in the preoperative management of midshaft femur fractures. Nevertheless, many orthopedic surgeons advocate immobilizing well-aligned fractures, with or without neurovascular injury, in a skin traction device.[8] Those who support the use of traction claim that it reduces patient discomfort, improves fracture alignment, and may resolve problems with arterial flow. A systematic review of studies of traction for proximal femur (i.e. hip) fractures found no clear benefit; comparable studies have yet to be performed in midshaft femur fractures. The use of traction for open femur fractures is controversial. Concern exists that the use of traction in such cases may allow contaminated bone fragments to retract into the wound. In general, stabilization of the fracture site to prevent further hemorrhage, neurovascular damage, or soft tissue injury takes precedence over the theoretical risk of increased contamination. However, decisions about splinting and traction are best made in consultation with the orthopedic or trauma surgeon who will assume care of the patient.

Table 2: Clinical progression of the patients.

Variable	*n* = 50
Clinical union	
10 – 12 weeks	12 (24%)
12 – 14 weeks	26 (52%)
14 – 16 weeks	12 (24%)
Radiological union	
14 – 16 weeks	9 (18%)
16 – 18 weeks	27 (54%)
18 – 20 weeks	14 (28%)
Protected/ partial weight bearing	
8 weeks	15 (30%)
10 weeks	18 (36%)
12 weeks	17 (34%)
Full weight bearing	
16 weeks	21 (42%)
18 weeks	15 (30%)
20 weeks	5 (10%)
22 weeks	9 (18%)
Hospital stay	
6 – 9 days	4 (8%)
10 – 14 days	40 (80%)
15 – 20 days	6 (12%)
Functional outcome*	
Excellent	33 (66%)
Good	9 (18%)
Fair	8 (16%)
Poor	0 (0)

*Functional status of the patients as determined by Klemm and Borner criteria.

Decisions about definitive treatment for femur fractures must take into consideration the patient's age, concomitant injuries, and underlying comorbidities, as well as resource availability and clinician experience. Among the few patients not treated surgically are those who are too unstable to tolerate the procedure and children, in some cases. Standard treatment of a femoral shaft fracture is an antegrade reamed intramedullary nail.[9] Antegrade intramedullary nailing is associated with a 98 to 99 percent union rate and low risk of infection (1 to 2%), even when used in open fractures. Although reamed nailing is accepted as the standard of care, unreamed

intramedullary nailing is also associated with low rates of non-union (approximately 1.9%) and infection.[10] The American College of Surgeons' Committee on Trauma recommends that femoral shaft fractures in polytrauma patients be repaired within 2 to 12 hours of injury, provided the patient is hemodynamically stable.[11] Randomized and observational studies suggest that performing operative fracture repair within the first 24 hours decreases mortality, respiratory complications, multisystem organ failure, and length of hospitalization.[12]

Table 3: Complications among the patients included in the study.

Complication	*n*
Range of movement	0
Infection	2
Limb length discrepancy (<5mm)	2
Delayed union and Nonunion	0
Re-fracture	0
Fat embolism	0
Pulmonary embolism	0
Deep vein thrombosis	2

Kuntscher nailing which is a successful procedure for simple transverse fracture of the shaft of femur is not ideal for communited fracture. Kuntscher nail doesn't offer rotational stability and adequate tight fit is not obtained due to the communition of fragments. Hence implant failure, nonunion, retrograde migration of nail are all known complications. Plate osteosynthesis for communited fractures is a bigger procedure, which needs a wide exposure and complications like infection, fibrosis of muscle and devitalization of the communited fragments are common. Prolonged non-weight bearing is a mandatory requirement when femoral shaft fracture is fixed with a plate.

For trauma patients with severe concomitant injuries, early definitive repair is associated with higher morbidity.[13] Thus, delayed definitive repair of midshaft femur fractures may be the best approach in these patients. According to a large retrospective study, surgical repair delayed beyond twelve hours may reduce mortality by as much as 50 percent in severely injured patients.[14] This strategy is part of the evolving concept of damage control surgery (or damage control resuscitation) in trauma, the details of which are beyond the scope of this review.[15] Essentially, damage control surgery involves stabilizing trauma patients using the least invasive means available in order to minimize additional physiologic stress to a patient already in extremis.

Overall, complication rates for femur fracture are low. The most common complications include infection, abnormal fracture healing, and pain. Less common complications include hemorrhage, neurovascular injury, compartment syndrome, repeat fracture, and hardware failure. Rare but life-threatening complications occur more often in multiple trauma patients and include death, multiorgan failure, and respiratory complications, usually due to acute respiratory distress syndrome and pulmonary or fat embolism.

CONCLUSION

Midshaft femur fractures commonly occur in young adults as a result of high energy trauma and in older patients due to lower energy falls. In this research article, we presented the characteristics of patients who presented with femur fracture, their clinical course throughout their treatment done and the complications. Interlocking nailing had excellent functional outcomes in our patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Kekatpure A, Singh SD, Kale S, Chaudhari P, Dhar S. Management of comminuted fractures of the shaft of femur by interlocking nailing at a tertiary level hospital in India. Int J Res Med Sci 2016;4:289-93.