Evaluation T of Closed Reamed Antegrade Intramedullary Locking Nailin Treatment of Femoral Shaft Fractures

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Abstract:

Background: Fractures of the shaft of femur are a major cause of morbidity and mortality in patients with lower extremity injuries. Most fractures are sustained in young adults during high velocity injuries. The technique of intramedullary locked nail(IMLN) of bone wasdeveloped to overcome the rotational and longitudinal malalignments of long bone fractures.

Aim of study: To evaluate the results of femoral shaft fractures treated by closed reamed antegrade interlocking nail.

Patients and Method: prospective study conducted at Department of Orthopedic surgery in Al-Kadhemiyah Teaching Hospital from October 2008 to October 2010 to evaluate 20 patients with acute femoral shaft fractures, all treated with reamed antegrade IMLN inserted with closed techniques. All patients treated for established non-unions and infections or with pathological fractures were excluded from the study.

Results:out of 20 patients 16(80%) were male and 4(20%)were female. The age range was from 18 to 52 years (average age of 35 years).15 patients with closed fractures (75 %) and 5 patients with open fractures (25%). The union rate was 90% with 10% of fractures going into delayed union treated with dynamizationDuration of union range from 12 to 24 weeks. At the final clinical follow-up, 2cases (10%) had minor thigh pain, 1case (5%) had limb length discrepancy of less than 2cm and 1case(5%) had decreased range of motion at the knee joint, We had 2 cases(10%) of infection. There were 1(5%) case of pudendal nerve neuropraxia .

Conclusion:closed Intramedullary Interlocking nailing is a safe and effective treatment modality for acute fractures of the femoral shaft. Patient rehabilitation is early, hospitalization is short, and fracture healing response is good.

Keywords: Closed antegrade reamed interlocking nail, femoral shaft fracture.

تقييم نتائج عملية تثبيت كسر جدع الفخد باستخدام مسمار العظم بطريقة توسيع الثقب المغلقة الامامية

الخلاصة

المقدمة: تعتبر كسور جدع عظم الفخد واحدة من الكسور الشائع في اصابات الحوداث وأحد أهم اسباب الوفاة أو الاعاقة وتكون اكثر شيوعا في البالغين أكثر من غيرهم وتعتبر طريقة مسمار العظم باستخدام توسيع الثقب المغلقة واحدة من الطرق المفضلة في التثبيت الداخلي لكسر جدع الفخد

الطريقة والنتائج: تم أخذ مجموعة من المصابين بكسر جدع الفخد ومعالجتهم باستخدام مسمار العظم في قسم الكسور في مستشفى الكاظميه التعليمي ومتابعة حالتهم بعد العملية لعدة أشهر وتقييم النتائج حيث تبين أن نسبه ألتحام العظم كانت٩٠% خلال فترة ١٢ الى ٢٤ اسبوع وأن ١٠% من المرضى عانوا من الالام البسيطة في الفخد وكدلك ٥% كان هناك قصر في طول الساق أقل من ٢ سم وتحدد في حركة الركبة, كدلك كان هناك حالتين ١٠%من خمج الجرح وحالة واحدة من خدر العانة المؤقت .

الاستنتاج: أن طريقة تثبيت جدع الفخد باستخدام مسمار العظم بطريقة توسيع الثقب المغلقة واحدة من أكثر الطرق أمانا وفعالية ودلك لسرعة تأهيل المريض بعد العملية وسرعة التحام العظم وقصر فترة بقائه في المستشفى .

الكلمات المهمة: كسر عظم الفخد ,مسمار عظم الفخد المغلقة الامامية.

Introduction

Fractures of the shaft of the femur are among the most common fractures encountered in orthopedic practice. Because 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. Several techniques are now available for their treatment, and the orthopedic surgeon must be aware of the advantages, disadvantages, and limitations of each to select the proper treatment for each patient. The type and location of the fracture, the degree of comminution, the age of the patient, the patient's social and economic demands, and other factors may influence the method of treatment [1, 2].

Interlocking intramedullary nailing currently is considered to be the treatment of choice for most femoral shaft fractures.

IMLN is either antegrade or retrograde, reamed and non-reamed method.

The standard of care today for nearly all fractures of the diaphysis of the femur is antegrade, interlocked, reamed nailing using closed technique. [2]

Femoral nailing has advanced continuously over the past 60 years. The transition from open nailing techniques to closed techniques using a remote entry site at the proximal femur paralleled the availability of image intensification. Intramedullary reaming allowed placement of larger implants, allowing improved rotational control and resistance to bending. The introduction and increased popularity of interlocking nails allowed for improved rotational control, better maintenance of femoral length, early weight bearing, the use of smaller implants, and improved control of comminuted and segmental fractures. [3, 1]

The evaluation and management of patients with femoral shaft fractures continue to evolve on the basis of the improved understanding of the local anatomy, impact of treatment, and biomechanics of fixation technique. [3]

While today's experience with intramedullary fixation for tibia and femur fractures has been quite good, there will most certainly be continued research to improve the technique. [4]

A variety of intramedullary devices are available. The most commonly used today are interlocking intramedullary nails,through which transverse or oblique transfixing screws can be inserted to control the major proximal and distal fragments.[1, 4, 5]

The development of image intensifiers and of improved fracture tables has led to a significant gain in popularity of closed nailing. [6]

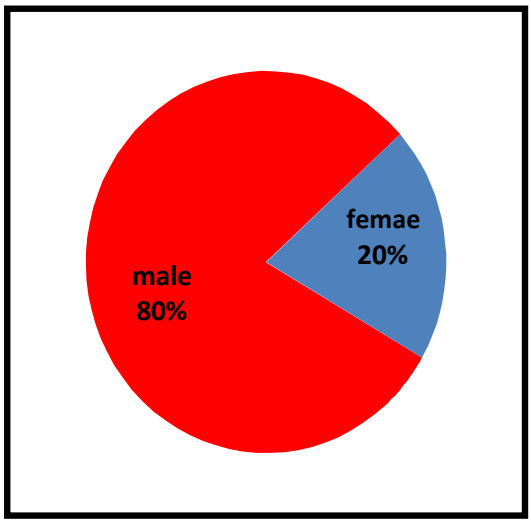
Various treatment modalities have been used to treat femoral fractures, with IMLN being the gold standard. Intramedullary locking nails are weight sharing implants which allow immediate weight bearing after static locking even in unstable fractures. They have the advantage of providing greater fatigue strength, better stability in all planes especially if locking screws are used and providing reamed bone at the fracture site.[7, 8, 9]

Patients and Methods:

Study conducted at Department of Orthopedic surgery in Al-Kadhemiyah Teaching Hospital from October 2008 to October 2010 to evaluate 20 patients with acute femoral shaft fractures treated with closed reamed antegrade IMLN.

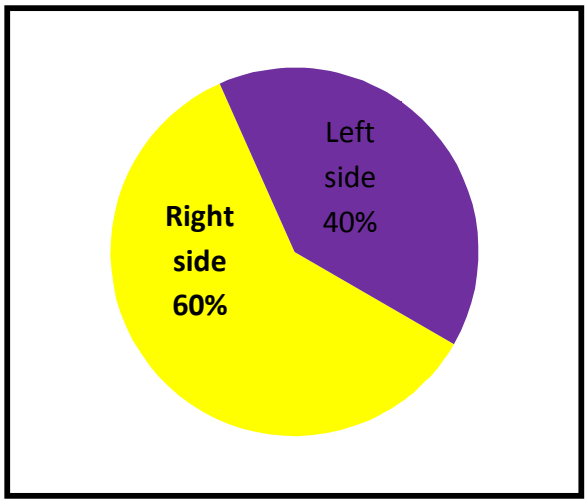
All patients treated for established non-unions and infections or with pathological fractures, and patients with compound fractures Guestillo type II and above, multiple injured and those who failed the follow up were excluded from the study.

The age ranges were from 16 to 52 years, the average age was 35 years and most of them were younger patients. There were 16 males (80%) and 4 females (20%). 12 patients (60%) had right femoral shaft fractures, while 8 patients (40%) had the left side involved.



Ratio of Maleto female

Ratioofrighttoleft sidefractures



The mechanism of injury was road traffic accident in 11 patients; fall in 4and gunshot in 5 patients. There is 15(75%) patients had closed fracture while 5 (25%) patients had open fracture Gustillo typeI. According to Winquist and Henson classification of fractures, we had 15% type I, 55% type II, 20% type III and 10% type IV fractures. **(Table .1)**

All patients were admitted through casualty department, diagnosis was confirmed by radiography of the femur in antero-posterior and lateral views including the hip and knee joints, skin traction applied temporary, wound dressing and antibiotics given intravenously for compound fractures.

Closed reamed antegrad IMLN operation of femur was performed under fluoroscopic control within 5 to10 days of injury the patients given spinal or general anesthesia and were put on orthopedic table for surgery; all operations were carried out under antibiotic prophylaxis.

Average time of surgery was approximately 120 minutes including set-up time on operation table closed manipulation. The most commonly used nail size and diameter was 380 x11mm.

The range of hospital stay post operatively was 5to7days.

Some patient with risk factors for deep veins thrombosis given subcutaneous low molecular heparin 4000I.U. preoperatively and continuous for 5days post operatively.

Post-operative advice was to avoid weight bearing on the extremity and used two crutches until the appearance of radiological bridging callus. However active and passive program for the mobilization of the knee and hip joints was encouraged from the first day.

Follow up was done for twelve to eighteen months in outpatient clinic, with first visit after two weeks post operation, then monthly visits till union achieved then followed every three months.

The patient's phone numbers was taken to be in contact with them and to remind them about the visit date.

Treatment outcome was analyzed regarding fracture union(both clinically and radiologically)in less than 24weeks, delayed union if more than 24weeks and nonunion if more than 32weeks , knee joint movements, limb length discrepancy, pain trendilinberg gait, infections, pudendal nerve injury , and deep venous thrombosis which diagnosed depend on clinical and Doppler ultrasound.

Table1:patients'characteristics

Case NO.	Age(year)	Sex M/F	Side of#	Closedor open#	Winquist type
1	18	M	RT.	CLOSED	II
2	25	M	LF.	OPEN	III
3	30	F	RT.	CLOSED	II
4	25	M	RT.	CLOSED	I
5	52	F	LF.	OPEN	III
6	25	M	RT.	CLOSED	II
7	30	M	LF.	CLOSED	III
8	25	M	RT.	CLOSED	II
9	20	M	RT.	OPEN	II
10	18	M	LF.	CLOSED	II
11	19	M	LF.	CLOSED	II
12	35	M	RT.	CLOSED	II
13	20	F	LF.	OPEN	II
14	40	M	RT.	CLOSED	III
15	20	M	LF.	CLOSED	II
16	40	M	RT.	OPEN	I
17	35	M	RT.	CLOSED	IV
18	26	M	RT.	CLOSED	II
19	19	F	RT.	CLOSED	I
20	30	M	LF.	CLOSED	IV

(M,male;F, female; RT, right; LF, left; #,fracture)

Results:

The clinical outcome showed that eighteen (90%) patients had a good early union, in 16 weeks (range from 12 to 24 weeks), Union was declared when the patient was able to bear weight without pain or walking aid and formation of good callus. two (10%) patients had delayed union were later dynamized to achieve union. Thereare no nonunion results in our study.

Intraoperativly there is no significant complications happened; sometimes there are errors in positioning of the patient, incorrect portals of entry and difficulty in fractures reduction. Initially we find some difficulty in putting the distal screws by free hand technique. Also in one case we face problem of missing proper nail size and diameter.

No major injury to neurovascular structures happened, no anesthetic complications.

Clinical follow up at the time of final evaluation showed that all the fractures healed in good alignment with two patients (10 %) had thigh pain on prolonged activity which was spontaneously resolved in two weeks; one (5%) had a limb length discrepancy less than 2cm; and one (5%) had a decrease in the range of motion at the knee joints.

There are two cases(10%) of infection, one superficial at the site of skin incision who were managed with appropriate oral antibiotics and dressing; and one deep infection and sinus discharge as the fracture was due to blast injury with multiples shells, treated with wound debridement and antibiotics **(Table. 2)**.

There is pudendal nerve neuropraxia in one patient (5%); a broken nail at the site of entrance of distal screw after falling on the ground at eight months post operation in one case (5%) he need nail removal. There is no case of deep vein thrombosis or pulmonary embolism in our study. All patient gain full range of motion at the knee by the end of first year and can fully squat and stand up easily.

Table 2:post-operative complicationsof IMLN

Complications	Number of cases	Percentage%
Non union	**0**	**0%**
Delay union	**2**	**10%**
Limblengthdiscrepancy <2cm	**1**	**5%**
Decreased range of motion ofhipand knee	**1**	**5%**
Superficial&deep infection	**2**	**10%**
Thigh pain	**2**	**10%**
Pudendalnerveneuropraxia	**1**	**5%**
Broken nail	**1**	**5%**
Deepveinthrombosis&pulmonaryembolism	**0**	**0%**

Discussion

A femoral shaft fractures can sometimes be life threatening and frequently occur in multiply- injured patients. [7, 19]

Treatment goals include allowing early mobilization of the patient, restoration and maintenance of normal length and alignment, the ability to consistently achieve union, and to maintain a normal, functional range of motion in the hip and knee.

At present, the ideal treatment for skeletally mature patients with a femoral shaft fracture from the level of the lesser trochanter to within 6 to8 cm of the distal subchondral bone is closed IMLN. Recent orthopedic literature also supports closed intramedullary nailing as the treatment of choice for femoral shaft fractures in adolescents.[12]

Closed nailing allows the original hematoma to remain intact, closed reaming of the intramedullary canal deposits bone graft material at the fracture site. [13, 14]

In mid-diaphysealWinquist-Hansen type I and II, one screw proximally and one distally is adequate. In type III and IV,using the maximum number i.e. three cross screws available in the nail design is advisable. [16]

Early weight-bearing after reamed static interlocked nailing of femoral fractures is a safe and effective method, and the risk of implant failure does not preclude the procedure. [16, 17,18, 19]

In a recent and the largest study of closed, reamed femoral nailing, Wolinsky et al. [20] reported a union rate of 93.6% after initial nailing, in our study the union rate was 90%. Most large series of femoral shaft fractures treated with closed IM nailing report a nonunion rate of less than 1%, in our study we support these result.[16, 17, 19] In our study, 10% had delayed union, mostly resulting from open injuries as a result of road traffic accidents and gunshot injuries.Infection rate in open fractures treated by immediate Intramedullary locking nailing is variable in different studies ranging from 1.5 to 6% depending on the grade of the open fracture [8,21, 22],in our study it was 10%, None of them developed osteomyelitis.Shortening of 1 cm is quite acceptable in most femoral shaft fractures, but shortening of more than 2 cm is typically symptomatic. Noumi et al [23]reported two cases (8%) of shortening due to dynamic locking, in our study one patient (5%) had <2cm limb length discrepancy. Aiho et al [24] in their series reported a shortening rate of 7.3%,and recommended performing static IMLN in every case.Although the precise risk is still unknown, the increased use of fluoroscopy has raised concerns about the dosage of applied radiation and its potential harmful effects, both to surgeons and patients.

Conclusion

1. Closed reamed intramedullary nailing will continue to be the gold standard treatment for acute femoral shaft fractures.
2. Our review of the initial 20 cases performed at our institution has shown it to be a successful experience.
3. The technique is simple to learn and once mastered it is associated with very few complications.
4. Patient rehabilitation is early, hospitalization is short and fracture union is good with IMLN avoids shortening and rotational deformities.
5. If proper equipmentisavailable, preoperative assessment and peroperative care is taken, IMLN is safe method for treating femoral shaft fractures.

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