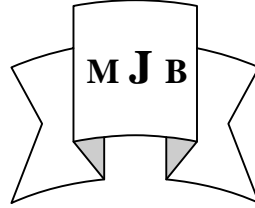


Tibial Shaft Fractures Treated with Closed Intramedullary Nailing, A Short-Term Outcome

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Abstract

Objective: We conducted a study to evaluate the short-term functional outcomes of patients with an isolated tibial shaft fracture treated with locked intramedullary nailing. using a prospective clinical and radiographic assessment, for union time, time of starting full weight bearing, rate of infection, knee and ankle joint movement, knee joint pain, and malalignment.

Patients and Methods: We had included 56 patients with isolated tibia fractures from our patients prospectively followed up in period between Febr.2006 and December 2008 (34 months). 56 patients agreed to present to our timetable of follow up, 4 patient lost after 3 months of follow up .We had a median follow-up of 10 months. with a range from 6 to 18 months. All patients were initially acutely treated with locked intramedullary nailing of their tibia within 48 hours of getting injured . All enrolled patients were evaluated with Functional assessment, and were evaluated radiographically and by physical examination.

Results: Of the total number (56 patients), 15 (26.7%) patients had at least moderate knee pain. 6 patients out of 52 (11 %) got knee joint stiffness . whereas 2 patients (4%) had ankle joint stiffness , both groups treated by a physiotherapy course .in 90% of the patients ,mean time of union was 15 weeks ranged from 12- 24 weeks. After getting union those patients started full weight bearing.Totally 4 patients got superficial wound infection (7 %) . (12 %) got malalignment , all were in proximal and distal1/3.

Conclusions: We see that locked intramedullary nailing is a suitable procedure for unstable fractures of tibial shaft .In contrast to open reduction and internal fixation, intramedullary nailing can be performed initially on the first or second day of admission.

The advantages of IM nailing include better alignment, earlier range of motion of knee and ankle, better mobility of patient, less frequent follow up visits, and earlier return to work.

متابعة قصيرة المدى لحالات كسور عظم القصبة في الساق عولجت بواسطة التثبيت

الداخلي بالصيخ المقفل داخل نخاع العظم.

الخلاصة

دراسة بحثية حية أجريت في قسم العظام في مستشفى الرحبة في أمانة أبو ظبي في الإمارات العربية المتحدة .. تضمنت علاج 56 حالة كسر مغلق في عظم القصبة في الساق تمت معالجتهم بواسطة التثبيت الداخلي بالصيخ المقفل داخل نخاع العظم خلال 48 ساعة من وقت الإصابة. وذلك من شهر شباط 2006 الى كانون الأول 2008 لفترة 34 شهر تمت متابعة المرضى لحين حصول التئام الكسر واستئناف المريض للمشي بدون ألم .فكانت فترة المتابعة من 6-18 شهر . أربعة من المرضى فقننا الاتصال بهم بعد مرور ثلاثة أشهر وتم متابعة 52 مريضاً حسب جدول متابعة معد لذلك سريريا وإشعاعيا .

أظهرت النتائج وجود (26.7 %) من المرضى كانوا يعانون من ألم في الركبة , (11%) حصل لهم تحدد بسيط في حركة مفصل الركبة و (4%) تحدد بسيط في مفصل الكاحل وجميعهم تحسنوا بعد حصولهم على كورس من العلاج الفيزيائي.

90% من المرضى تمكنوا من المشي بدون ألم في الساق بعد حصول التئام في الكسر بمعدل زمني هو 15 أسبوع تراوحت من (12-24) أسبوع. وهناك (7 %) حصل لهم خمج سطحي في جروح العملية عولجت جميعها بالمضادات الحيوية.(12%) من المرضى حصل لهم التئام معيب في محل الكسر .
 من متابعة نتائج علاج مرضانا ومقارنة بنتائج الدراسات السابقة نرى بأن طريقة معالجة كسور عظم القصبة في الساق بواسطة التثبيت الداخلي بالصيخ المقل داخل نخاع العظم. تعتبر الطريقة المثالية لغرض الحصول على التئام الكسر وتمكين المريض من استعادة قدرته على المشي بأقرب وقت متعارف عليه علميا . مع سرعة رجوعه للعمل وممارسة حياته اليومية بدون مساعدة. وبأقل نسب من المضاعفات المتوقعة بعد هذه الأنواع من الكسور.

Introduction

Intramedullary nailing has become the treatment of choice for displaced diaphyseal fractures of the tibia in adults.[1–9].

A commonly cited complication of this injury treated by this method is anterior knee pain.[3,5,6,10–22]. This has been associated with the approach for nail insertion, and the influence of entry point has also been extensively investigated [9,14,15,17,20] . There have been multiple reports to support the superiority of intramedullary nailing to other methods of treatment with respect to return to weight bearing and work.[7,23]. Over the past years, intramedullary (IM) nailing has become an established technique for the surgical management of tibial shaft fractures. Apart from unreamed IM devices, reamed interlocked systems are becoming increasingly popular. Gradual reaming of the tibial medullary cavity allows larger-diameter devices to be inserted [25]. This should enhance the stability of the fixation, and reduce micro movements at the fracture site. Also, contemporary IM implants offer a variety of interlocking and/ or compression options, which will affect the geometry and the stability of the overall system [26]. Choosing the correct implant length, diameter, and interlocking mode is particularly important in the management of unstable fractures of the tibial shaft.

Further, it has been shown that even a very small amount of residual angulation in the united fracture alters

load through the knee and ankle joints.[24] The evidence in the literature on the effects of tibial angular malunion in lower extremity outcomes is conflicting; however, this alteration in force could cause a predisposition to osteoarthritis .

In this study we would like to estimate the effectiveness of using the closed locked I.M. nailing system as a primary procedure in treatment of isolated fracture of tibial shaft, as well as the complication of this surgical procedure.

Patients and Methods

In our study , we selected all patients who were treated for an isolated tibial shaft fracture with an intramedullary nailing , at orthopedics department in Rahba hospital/Abu Dhabi. between Febr.2006 and December 2008 (34 months). The anatomic locations of fracture were included are the middle three fifths and only those with closed fractures and treated with an intramedullary nail, and all patients with other injuries were excluded including proximal and distal fifth, Immature skeletons (less than 15years) and compound fractures.

All patients had been discharged from follow-up once their fractures had united. and started painless unprotected full weight bearing .

Of the 56 patients enrolled in the study, there were 13 women (23%) and 43 men (77%). The overall average age at time of injury was 34.4 years.

A total of 56 patients agreed to present our timetable of follow up, 4 patient

lost after 3 months. Each of the 52 patients underwent a physical examination which included both knees and ankles, were they are evaluated at 2 weeks, 6 weeks, 3 months, 6 months, 9 months following surgery according to our schedule, 10 patients presented after 12 months and 6 patients presented after 18 months after surgery as per their will. Average follow-up was 10 months (range 6– 18 months)

During each postoperative assessment, patients were directly asked if they had knee pain, and knee range of motion was evaluated. Additionally, patients were asked to kneel down during the clinic visit to assess for pain or difficulty kneeling.

Finally, 52 of 56 patients agreed to have full-length radiographs of their affected lower leg, including the knee and ankle. These were used to establish nail presence, presence of locking screws, prominence of nail at the knee, and heterotopic ossification and alignment.

Healing is defined as the time when the patient is walking without pain on the operated leg with full weight bearing and on radiological examination bridging bone healing of at least three of the four cortices seen in the a.p. and lateral views is visible. Delayed union was defined as bone healing which occurred without additional surgery with a healing time, which exceeded double of the normal healing time of three months. Non-union was defined as deficient bone healing, which must be treated with additional surgical measures such as cancellous bone grafting or revision osteosynthesis. Mal-union was defined as bone healing with an axial deviation in any direction exceeding 5° in any plane. Malunion was analyzed at the time of union, on the a.p. and lateral x-rays, the axis deviation between the proximal and distal fragment was

measured at the level of the previous fracture

Patients were placed supine on a radiolucent operating table.

A thigh pneumatic tourniquet was used, and the extremity was draped free. using a C-arm X-Ray Image intensifier, the knee positioned in 90 degree flexion, and did not use skeletal or calcaneal traction to aid in reduction. A (3 cm) longitudinal incision was made from the inferior pole of the patella just medial to the lateral edge of the patellar tendon, and extended distally. The retinacular layer was identified and incised just at the lateral edge of the tendon. The infrapatellar fat pad was identified and its insertion into the proximal tibia was sharply incised transversely from lateral to medial, allowing its retraction superiorly for exposure of the proximal tibial ridge.

Postoperative management included restricted weight bearing for 6 weeks, followed by progression to weight bearing as tolerated. Supervised physical therapy was initiated for thigh muscle strengthening and knee range of motion exercise.

Dynamization done in 9 patients by removing the distal static screw after starting full weight bearing.

We routinely use low molecular heparin in a prophylactic dose preoperatively and continue postoperatively until patient start active movements in bed.

Results

In our study we had treated a 56 patients presented with closed isolated fracture of tibial shaft, with locked intramedullary nailing using closed technique in all of them, 52 patients agreed to present our timetable of follow up until they get their fractures united and started pain free full weight bearing, while 4 patients we lost any contact with them after three months. ,

there were 13 women (23%) and 43 men (77%). The overall average age at time of injury was 34.4 years, the average age of the female patients was 38 years and of male patients was 32.3 years. (32) patients (57%) due to RTA, (20) (36%) due to work related injuries, (4) (7%) sport injuries.

The range of follow-up was 6-18 months, with a median of 10 months. Of these injuries, 40 were comminuted (71%),

7 were spiral (13%). 3 transverse (5.3%), 6 are short oblique (10.7%).

Anatomically, of the 56 fractures, 38 (68%) were middle 1/3 and 10 (18%) were distal 1/3. 8 patients (14%) with proximal tibial fractures.

The proximal and distal fractures were away from the proximal and distal fifth of the bone and approximately more than 5 cm from the articular surface.

There were 4 patients who required urgent fasciotomies (7%) all treated by delayed primary closure with out need for skin graft.

15 patient out of 56 (27%) having associated fracture fibula in the proximal or middle third that did not need for fixation.

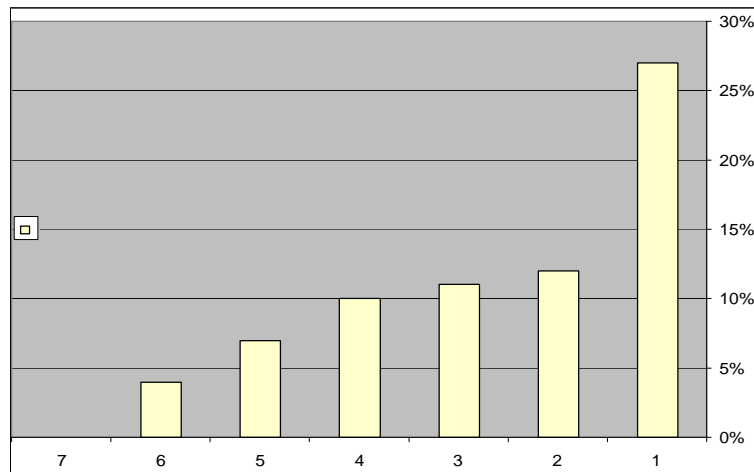
Estimated blood loss during and after surgery was 400-600 cc during the first 24 hours, where we routinely used

a vacuumed drain. In 12 patients a blood transfusion was necessary.

Of the total number (56 patients), 41 patients (73.2%) denied knee pain with any activity whereas 15 (26.7%) patients had at least moderate knee pain postoperatively. Knee range of motion was equivalent to the unaffected side in 46 patients (82%) but 6 patients out of 52 (11%) got knee joint flexion restricted to about 85 degrees and needed a course of physiotherapy. whereas 2 patients (4%) had a about 10-15 degrees restricted range of motion of the ankle who need also a physiotherapy course. Union time was 15 weeks in 12 patients out of 52 (23%), from 16-20 weeks in 25 patients. (48%). From 21-24 weeks in 10 patients (19%), total cases got union within 24 weeks are 47 patients (90%). Delayed union (26-29) weeks in 5 patients (10%). Mean time of union was 13.2 weeks ranged from 15-24 weeks. Totally 4 patients got superficial wound infection (7%).

3 patients got superficial wound infection in the distal screw entry sites and 1 patient got superficial wound infection in the proximal nail entry sites and all responded well to antibiotics.

Figure (1)



- 1. Knee pain.
- 2. Mal alignment
- 3- knee stiffness.
- 4- delayed union.
- 5- infection.
- 6-ankle stiffness.

Complications of I.M .nailing

During our radiographic review of (52 patients) revealed no case of tibial nonunions. There was one fibular nonunion, which was asymptomatic. In 10 patients (19%) Dynamization done by removing the static distal screw after 12 weeks(3 transverse fractures and 7 short oblique) . In 6 patients out of 52 (12 %) , there were malalignment(with 10-15 degrees of angulation anterolaterally) , 4cases (8%) were in proximal 1/3 and 2 cases(2%) in the distal 1/3 (4 comminuted and 2 are short oblique). In 33 patients (63.5%) the result was excellent , were the fractures united within 24 weeks, with no knee joint pain or stiffness , and no infection. In 4 patients (8%)the result of treatment was(Good), as the united within 24 weeks, but there was a superficial infection, and considered (fair) in 9 patients (17%) as they

developed one or more of the following knee joint pain or mild knee and/or ankle joints stiffness as well as a delayed union. In 6 patients (11.5%) considered poor due to significant malalignment.

Discussion

Intramedullary nailing is the treatment of choice for displaced diaphyseal fractures of the tibia in adults(1–9). Patients with this injury are generally young. The average age of patients treated with this method at our hospital between February 2006 and December2008 was 34.4 years. While in the study of (Yoram et.al 2009) [27] was 45 years, that difference because most of our patients are young expatriates traveling to UAE for work. For a patients of that age, information related to at least the short-term

outcome is important as well as a long term follow up if possible . This study aimed to report the short-term outcomes of patients treated with intramedullary tibial nail using as time table schedule of clinical and radiological examination.

In our study total cases got union within 24 weeks are 47 patients (90%). , in the study of (Alho A et al)[28] and (Court-Brown et al) [4,11]even a union rate exceeding 95% can be expected .

Mean time of union in our patients was 13.2 weeks ranged from 15- 24 weeks, which is less than reported in other studies like(Court-Brown et al) [11] who reported 16.9 weeks. Karladni [5] reported 16.4 weeks, Toivanen [10] reported 12 weeks ,and 19 weeks by Bone [3]. we does not have a case of non union , as Court-Brown et al got a rate of 0 % of non union [4,11].(Shuler et al 2007) [29] mentioned a non union rate of 3 %.

intramedullary nailing can be performed initially on the day of admission. The intramedullary approach produces superior results, as described by Robinson [30] and Nork [31], who reported a 100% union rate. El Ibrahimy [32] confirmed that good results with no major complications were obtained with reamed nailing. Fan [33] reconfirmed that there were no signs of nonunion or malunion. . Toivanen [10] reported a rate of 0% of nonunion , 1.8% in the study of Bone [3] ,Karladni [5] reported 3.8% of nonunion.

In our study we have 5 patients (10%) of delayed union , but finally all of them get united at within 29 weeks. In three important studies , delayed union was reported 20% by Karladni [5], 0% by Toivanen [10] .

We have 6 patients (12%) resulted with significant malalignment 4 cases (8%) were in proximal 1/3 and 2 cases (4%) in the distal 1/3 , (Hansen et al

2007) [34]reported in his study a total of 19.4 % of malalignment (13.6% for proximal fractures ,4.3% for shaft fractures, and 1.5% for distal fractures) We have a 4 patients (7%) got a superficial infection, while it was approximately 1 % in the study of Shuler (2007)[29], and 43.8% of patients were considered to have developed infection as had been mentioned by .(Puloski 2004) [35] , and 1.9% by Court-Brown CM (2004)[36]

In our study out of 52 patients, (11%) got knee joint flexion restricted to about 85 degrees and needed a course of physiotherapy . whereas 2 patients (4%) had a about 10- 15 degrees restricted range of motion of the ankle who need also a physiotherapy course . Keating JF [38] shown a loss of knee range of motion in the early postoperative period and a 10% loss of ankle range of motion.

Habernek H [37] shown a rare difference in knee range of motion and in contrast he did find a loss of ankle range of motion in (42.4%) ranging from 5 to more than 20 degrees.

In our patients 90% started full weight bearing at a mean time of 13.2 weeks. Martinus Braten(2005) [39]shown that unprotected weight-bearing was achieved at 12 weeks .

In our patients estimated blood loss during and after surgery was 400–600 cc during the first 24 hours. James E(2008)[40]shown an estimated blood loss of 100-300cc intra operatively.

However, in our 6-18 months of follow-up, we found a comparable result to previous short term follow-up studies.

out of our 56 patients , 15 (26.7%) patients had at least moderate knee pain postoperatively, Habernek reported a knee pain incidence of 31% [12], whereas Court-Brown

reported an incidence of 56.2% [11]. Court-Brown also reported that knee pain was worse in younger patients and frequently required nail removal.

One advantage of early fixation is the ability for early range of motion of both the knee and ankle. (Schmidt et al., 2003)[41]. Overall, intramedullary nailing is an effective treatment for fractures of the tibial shaft.

Conclusion

After tibial nailing of isolated tibial fractures, majority of patients' function is comparable to population norms, where they can start full weight bearing without assistance , other advantages of intramedullary fracture fixation, that it is a familiar technique for fixing tibial shaft fractures; it allows osteosynthesis under biological

aspects; there is no need to open the fracture site; soft tissue dissection is not necessary; and the blood supply is spared.

It enables symmetric, dynamic and load-sharing fracture stabilization without the need to restrict joint motion. with very few complications.

We see that locked intramedullary nailing is a suitable procedure for unstable fractures of tibial shaft .

In contrast to open reduction and internal fixation, intramedullary nailing can be performed initially on the first or second day of admission.

The advantages of IM nailing include better alignment, earlier range of motion of knee and ankle, better mobility of patient, less frequent follow up visits, and earlier return to work.

<i>Mechanism of injury</i>	<i>Number of patients</i>	<i>Percentage</i>
RTA	32	57%
Work related injury	20	36%
Sport injuries	4	7%

Table(2) Causes of fractures

<i>Results of treatment</i>	<i>Number of patients</i>	<i>Percentage</i>
Excellent	33	63.5%
Good	4	8%
Fair	9	17%
Poor	6	11.5 %

Table (3) results of our study

<i>Pattern of fracture</i>	<i>Number of patients</i>	<i>Percentage</i>
Comminuted	40	71%
Spiral	7	13%
Short oblique	6	10.7%
Transverse	3	5.3%

Table (4) fracture configuration

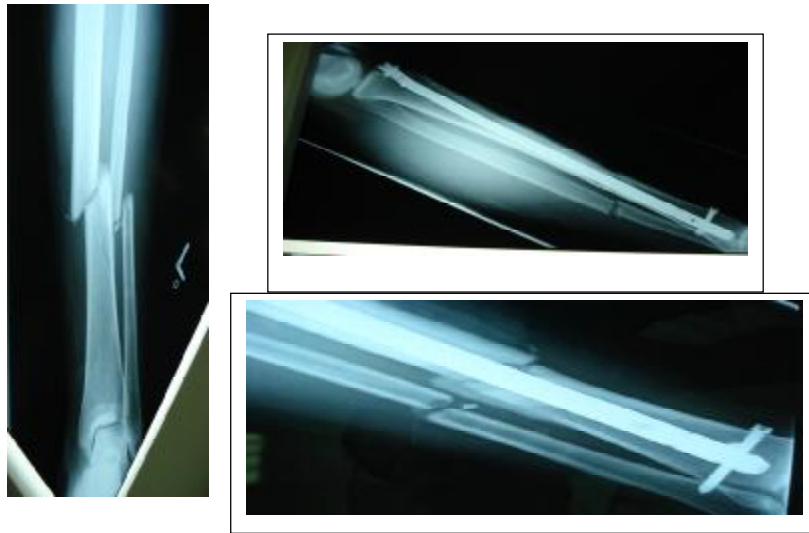


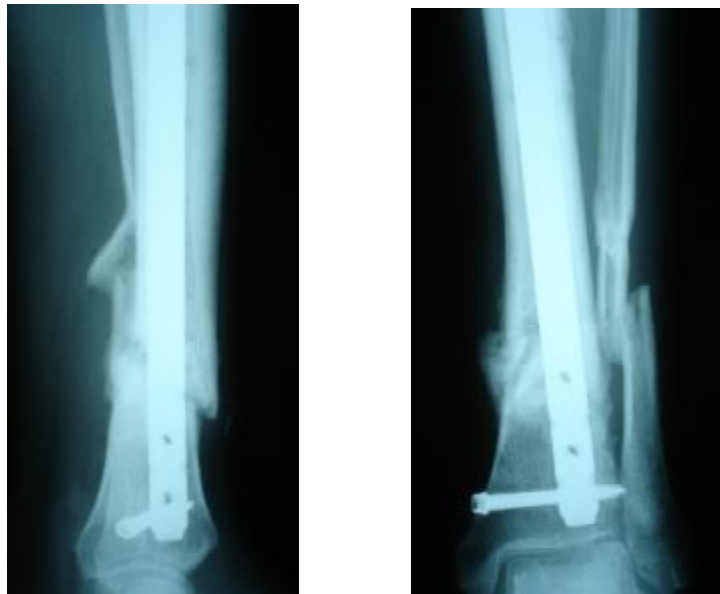
Figure (1) Midshaft tibial fracture of left leg using only distal static screw



Figure (2) Comminuted midshaft fracture with better fly.



Figure (3) One case with superficial infection at the proximal wound and the distal screws entry wounds



Figure(4) Healing in distal 1/3 fracture after Dynamization by removal of static screw



Figure(5) One case of spiral fracture in distal 1/3 of left leg using of 2 planes distal screws sets

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