Hussain J. Al-Khatteib*, Wejdi A. Al Fatlawy* and Ihsan A. Twaij**

الخلاصة

عظم القصبة هو العظم الرئيس في الساق، غالباً ما يسمى القصبة. كسور القصبة ممكن ان تنشأ من انواع عديدة من الاصابات.

دراستنا هي لتقييم المرضى المصابين بانواع مختلفة من كسور وتد القصبة، 53 مريضاً ادخلوا لمستشفى الحكيم، الصدر و الفرات. 39 ذكر و 14 انثى وكانت اعمارهم تتراوح بين 12-55 سنة تمت تقييمهم لانواع مختلفة من كسور وتد عظم القصبة لما يتعلق بشكل الكسر، نوع الكسر فيما اذا كان مفتوح او مغلق، سبب الكسر، شدة الاصابة، طريقة العلاج، عقابيل العلاج، ووقت الالتام وعودة المريض الى العمل.

لقد وجدنا بانه الكسور المغلقة هي اكثر من الكسور المفتوحة وان اِلتآم الكسور المغلقة التي عولجت بالعملية هي اسرع من تلك التي تمت معالجتها بالجبيره.لكن العقابيل اقل في مجموعة الجبيره.لذا نحن ننصح باستخدام الجبيره لعلاج الكسور المستقرة، المغلقة وان العملية الجراحية تستخدم لعلاج الكسور غير المستقرة او الكسور المفتوحة مع اصابة نسيجية شديدة.

Abstract

The tibia is the major bone of the lower leg, commonly referred to as the shin bone. Tibia fractures can occur from many types of injuries.

Our study is to evaluate patients with different types of fracture shaft tibia. 53 patients were admitted to Al Hakim, Al Sadder & Al Forat hospitals, 39 males &14 females their ages range from 12-55 years were evaluated for different types of fracture shaft tibia in regard to shape of fracture, type of fracture whether open or close, cause of fracture, severity of injury, method of treatment, the complication of treatment, & the time of union & patient return to job.

We found that closed fractures were more than open fractures & that healing of closed fractures in those treated operatively was earlier than those treated by cast but complication rate was less in casted group.

So we recommend using cast in treatment of stable, closed fracture shaft tibia& that operative treatment is to be used for unstable, or for open fractures with sever soft tissue injury.

*Iraqi board ortho. Department of surgery Collage of Medicine Kufa University
** Iraqi diploma of orthopedic & fractures Al Basra University.

Aim of study

This study is to evaluate patients wit fractures of shaft of tibia in regard to shape of fractures, type of fractures whether open or closed, cause of fractures, severity of injury whether high or low energy trauma, method of treatment, the complications of fracture & its treatment & time of union & patient return to job.

Introduction

The tibia is the 2nd longest bone of the skeleton, located at the medial side of the leg. It articulate with the fibula laterally, the talus distally, & the femur proximally, forming part of the knee joint [1] . Lower leg fractures including fracture of tibia & fibula; of these tow bones the tibia is the only weight bearing bone. Fractures of the tibia generally are associated with fibula fractures. because the force is transmitted along the interosseous membrane to the fibula; the skin & subcutaneous tissue are very thin over the anterior & medial tibia & as a result of this a significant number of fractures to the lower leg are open, even in closed fracture the thin soft tissue can be compromised. In the united state the fractures of the tibia are the most common long bone fracture [2]. The tibia is the major bone of the lower leg commonly referred to as the shinbone. Tibia fractures can occur from many types of injuries. Tibia fractures come in different shapes & sizes & each fracture must be treated with individual factor taken into account. Tibial shaft fractures are the most common type of tibia fractures, & occur between the knee & the ankle joints. Most tibial shaft fractures can be treated in a long leg cast.

However,some fractures have too much displacement or angulations & may require surgery to realign & secure the bone[2,3,4]. If the fracture is caused by direct blow the bone may fracture in several places (comminuted or segmental) & a break in the skin (open) is more likely. The spiral fracture is most commonly in toddler (1-3 years) & is usually caused by twisting force from a fall or from abuse. Fractures can also result from low energy trauma LET. such as stress fracture or from repetitive impact as in jogging. Fractures from LET are often stable & minimally displaced. A high energy trauma HET (direct blow, gun shot wound, motor vehicle accident) is more likely to cause injury to surrounding soft tissue (muscle, ligament, blood vessel & nerve) [4] .

Patients and Methods

From June 2006 to September 2009; 53 patients were admitted to al Hakim, al Sadir, & to al Forat hospitals with different types of fracture tibia, were evaluated; 39 were males & 14 were females, their ages range from 12-55 years, average 33.5 years. Those patients with closed well aligned fracture were treated by above knee pop cast immobilization for 1.5-2 months then by below knee walking cast for another 1.5-2 months, until union become sound as seen by x-ray. Those patients with comminuted or severely displaced closed fracture that fail to reduce closely treated by open reduction & fixation either by plate & screws or by external fixation, through anterior curved incision over the anterior subcutaneous boarder of the tibia & periosteal stripping of the lateral surface of tibia & reduction achieved & fixed with either plate & 6-8 screws or with external fixator & only skin closed with interrupted sutures & no drain left in place. Patient put on triple antibiotics & sutures removed after 2 weeks. Those patients with open fracture were treated by repeated wound excision some also need skin graft & the fracture fixed with external fixation device, & patient put on triple antibiotics until wound become healed. For all patients' intra & post operative complications, time of union, & return to function was assessed; the choice between external fixation & plate & screws was surgeon & type of fracture dependent.

Results

53 patients were admitted to hospital with different types of fracture tibia, 39 patients were males 74% &14 were females 26% their ages range between 12-55 years average 33.5 years.

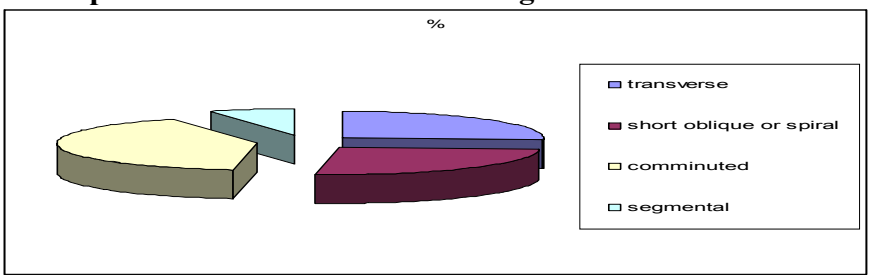
Table (1) Age & sex distribution

	11-20 y	21-30 y	31-40 y	41-50 y	51-60 y	total
male	6	21	8	2	2	39
female	0	2	2	6	4	14
Total	6	23	10	8	6	53

36 fracture were closed 68% & 17fracture were open 32%, of these open fractures 2 were Gustilo I 12%, 6 fractures were Gustilo II 35% & 9 fractures were Gustilo III 53%.

IN 28 patients the fracture was caused by low energy trauma (LET) 53%, & in 25 patients 47% caused by high energy trauma (HET).

In 28 patients 53% the right tibia was fractured & in 25 patients 47% the left tibia was fractured. In 14 patients 26% the fracture was transverse, & in another 14 patients 26% the fracture was short oblique or spiral, in 22 patients 41% the fracture was comminuted & in 3 patients 7% the fracture was segmental.



Chart(1) Show percent of shape of fractures.

IN 36 patients 68% RTA was the cause of the fracture, in 9 patients 16% bullet & high velocity missile was the cause of the fracture, in 4 patients 8% fall from height was the cause of the fracture & home accident was the cause of fracture in another 4 patients 8%.

Pop cast was the method of treatment in 18 patients with closed well aligned fracture initially above knee for 6-8 wk. then changed to bellow knee walking cast until union become sound as seen by x-ray which usually take another 6-8 wk.

External fixation was the method of treatment in 20 patients; 14 patients with open fracture, & 6 patients with closed severely comminuted or segmental fracture

Plate & screws was the method of treatment in 12 patients all with closed transverse or short oblique fracture.

2 patients with comminuted open fracture were treated by calcaneal skeletal traction changed after 6 wks. of wound excision & skin graft to functional cast for another 20-36 wks.

For one patient treated with locked intramedullary nail IMN referred to us from Ibin Sina hospital for sever GustiloIII B open segmental fracture caused by high velocity missile need repeated wound excision which take 10 wks. followed by bone graft + skin graft until union occurs after another 10 wks.

For the 18 patients treated by pop cast union occur between 16-20 wks. except for one patient with non union need bone graft & external fixation after 9 months & another one patient remain with non union.

For the 20 patients treated with external fixation (EF) union occurs for those with closed fracture in 14-16 wks. & for those with open fracture union occurs in 20-24 wks. except for one patient for whom the EF changed after 17 wks. to pop cast until union occurs after 8 wks. & another one patient in whom the EF changed after 22 wks. of non union to internal fixation (IF) + bone graft which unite after another 4 months.

For the 12 patients treated by plate & screws (P&S) union occurs between 14-16 wks. except for 2 patients one with malunion with 15^0 anterior angulation united in 20 wks. & another one patient with implant failure after 4 wks. of initial operation need to be replaced by another plate & screws then union occurs in 24 wks.

For the 2 patients treated by calcaneal traction for open comminuted fracture changed after wound healing after 1.5 month to functional cast for another 20-36wks.

For the one patient with locked IMN need bone graft + skin graft after 10 wks. & union occurs after another 10 wks.

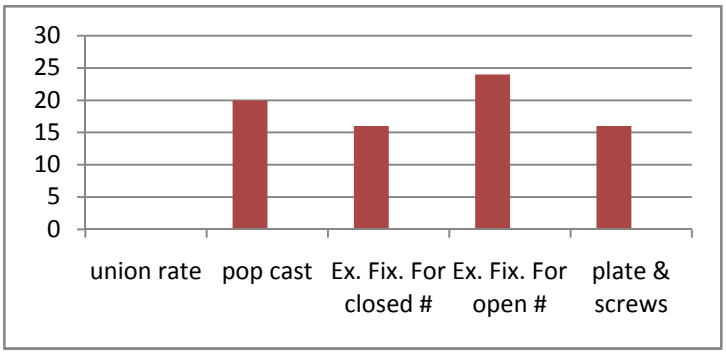


Chart (2) Show union rate in weeks.

For those treated with pop cast non union occurs in 2 patients 11%. For those treated by EF delay union occurs in 4 patients 20%, & non union occurs in one patient 5% who need to be replaced by IF + bone graft & another one patient 5% with ankle stiffness. For those treated with P&S; malunion occurs in 2 patients 16.6%, & implant failure in one patient 8.3%. for the patient treated by IMN there is delay union need bone graft after 10 wks. & for the patients treated by calcaneal traction there is delay union need to replace the traction by functional cast until union occurs after 10 months.

Discussion

In our study we found that fracture tibia occurs more in males 74% than in females 26%, also we found that fracture tibia occurs more in young age group between 11-40 years 74%, & there is bi modal sex distribution of fracture tibia that in young age group it occurs more in males 35 patients 66%, than in females 4 patients 7.5%, while in older age group between 41-60 years the fracture tibia occurs more in females 10 patients 19% than in males 4 patients 7.5%, in one study they found that the highest incidence of tibial fracture in adult is among male aged between 15- 19 years [4] .

It is also found that the average age of patients with tibial shaft fracture is approximately 37 years, & teen ager male are reported to have the highest incidence [5] .

Although tibial bone is subcutaneous but in our study closed fracture 68% occurs more than open fracture 32%, & that severe open fracture GII & GIII 88% occurs more than the less severe open fracture GI 12%, & that the mechanism of trauma is nearly equal between HET 47% & LET 53%. This is not what is found by one study that tibial bone more commonly sustains open fracture [6] .It is also found that open fracture more common in the tibia than in any other major long bone[7].another study shows that high energy fracture resulted from accidents such as automobile collision & crush injuries & that this group included more than half the total fractures, & 90% of open fracture [8]. one study of 197 tibial fracture; 79 % were closed & 21% were open of which 71% were GII & III & 21% were GI [7] .

The right & left tibia are about equally fractured with 53% of the fracture affect the Rt. side & 47% affect the Lt. side also most of the fractures affect the tibia seem to be comminuted 41%, with 26% of fractures transverse & other 26% of fractures are short oblique & spiral, & only 7% are segmental.

In our society RTA seem to be the most common cause of fracture tibia 68%, while in the 2nd rank come bullet injury & high & low velocity missile 16%, lastly come fall from a height & home accidents with 8% for each. It is found that motor cycle accident is the most common cause of fracture [6] . it is also shown that tibial shaft fracture can be caused by fall, car accident sport injuries & other activities [3] . one study shows that the tibia is most commonly fractured in motor vehicle accident [4] . tibial shaft fractures are often the result of high speed trauma but can also be insidious in onset such as stress fracture in active individual [5] .

Union rate occurs about the same time for those with closed fracture treated by plate & screws & those by EF. between 14-16 wks. while it took a little longer for those with closed fracture treated by pop cast 16-20 wks. while union rate for open fracture took longer time 20-25 wks. with 7 patients develop delay union after more than 25 wks. whether treated by EF., by traction or by IMN. & one patient developed non union that EF. needed to be replaced by IF. & bone graft. In one study found that high energy fracture took longer to heal than low energy fracture regardless of whether the fracture is open or closed [6]. another study shows that HET fracture heal in average of 6 months while LET fracture heal in an average of 4 months [8].Bone et al found that patient with closed fracture return to work at an average 6.5 months [9,10]. Sarminto reviewed 482 fracture of tibia treated with a short cast functional brace the average healing time 14-15 wks [11,12]. Lubber found that GI open fracture require 4.7 months to heal after fixation with Hoffman EF. & 8% require secondary bone graft. [7] Rommens et al found that the average time in the fixator to be 6 months & that 15% of fracture require changing the EF. to IF. + bone graft [13,14]. in one study found that for stable fracture tibia the average time for union is 4-5 months with a range of 2-24 months [15] .

The complications seem to occur more in those patients treated by EF. 30% as; 20% delay union, 5% nonunion & 5% ankle stiffness. 2nd complication occurs in those treated with P&S. 25% of patients as; 16.6% malunion & 8.4% implant failure, & thirdly complications occurs in those treated with pop cast in 11% of patients develop nonunion & we did not take in consideration the complications of those patients treated with skeletal traction or by IMN. because of the small number of the patients. It is found that conservative treatment carries a higher risk of delayed union & malunion [6]. it is also found that delayed union, nonunion & infection are relatively common complications of tibial shaft fracture [7].

Bone et al have 10% nonunion & 10% of malunion in patients treated with cast [10]. Puno reported 4.3% malunion rate after casting [16].

In one study ankle stiffness occurs in 20-30% of patients who had closed treatment [17] another study reported 27% of ankle & subtalar stiffness & 10-55% develop angular deformity more than 5 degrees in patients treated conservatively [18]. Rudi reported 6% complication rate of closed fracture & 30% complication rate of open fracture treated by compression plate & screws & it is also

found that implant failure occurs in 0.6% of closed fracture & in 10.3% of open fracture [19] .
Another study shows that nonunion occurs in 2-5%, malunion occurs in 3-8% & shortening more than 1 cm. occurs in as many as 10% [15] .

Conclusions

Casting is safe with low complication rate but should be reserved for stable closed fractures.

- Open fractures better treated by EF. while locked IMN still not available or still not practiced with.
- Closed fractures could be treated by EF. with good functional out come.
- Severe open fractures have high complication rate & take longer time to heal.

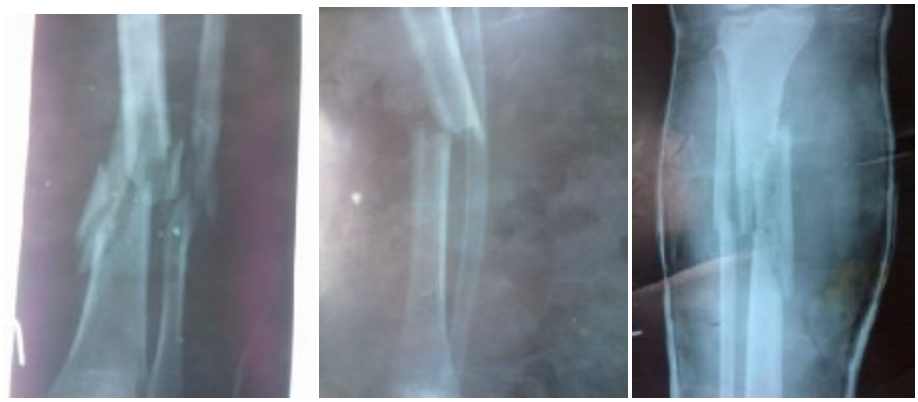
Recommendations

We recommend to use cast in stable closed fracture because of low complication rate while severe open fractures should be treated by EF. & repeated debridement until locked IMN become available & have staff well trained with it. Bone graft need to be used primarily in case of severe comminution when feasible & in absence of deep infection.

References

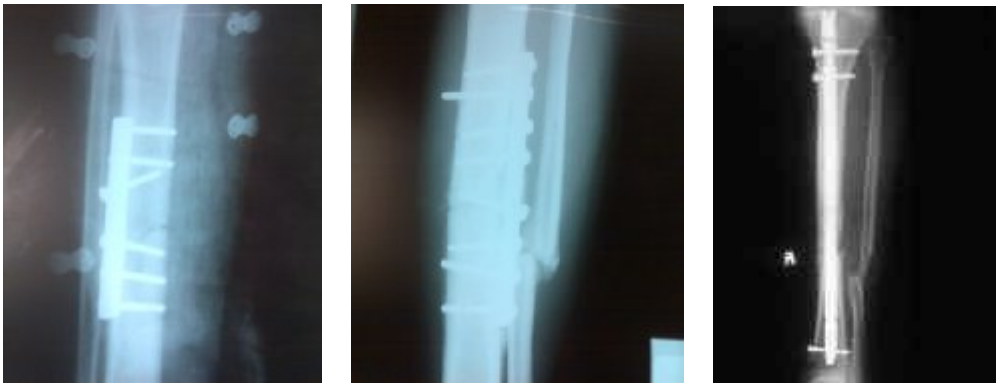
1. Health Encyclopedia-Diseases & Conditions: Tibial Fracture, Health Central Network, Health Encyclopedia & Reference, April 1, 2009. (int.)
2. Jeffery G. Norvell, Mark Steel, Thomas M. Cooper: Fracture, Tibia & Fibula, eMedicine Specialties > Emergency Medicine > Trauma & Orthopedics, Oct 1, 2009. (int.)
3. Jonathan Cluett: Tibia Fracture, About. Com Health's Disease & Condition, September 26, 2005. (int.)
4. Medical Disability Guidelines: Fracture, Tibia or Fibula, Red Group, 1991-2009. (int.)
5. Brian K. Konowalchuk, Nicholas J. Wills, Brian Tollefson, Marc Swiontkowski: Tibial Shaft Fractures, eMedicine Orthopedic Surgery, May 15,2009.
6. Louis Solomon, David J. Warwick, Selvadural Nayagam: Fracture of The Tibia & Fibula, Aple's system of orthopedic &

fractures, Arnold 33 Euston Road, London NW13 BH, 724-730, 2002.
7. S. Terry Canale: Tibial Shaft Fracture, Campbell's Operative Orthopedic, Tenth Edition, Mosby: Philadelphia, Pennsylvania 19106: 2754-2782, 2003.
8. Hoaglund FT, States JD: Factors influencing the rate of healing in tibial shaft fractures, Surg Gynecol Obstet 124:71, 1967.
9. Bone LB, Johnson KD: Treatment of tibial fractures by reaming & IMN, J. Bone Joint Surgery 68A: 877, 1986.
10. Bone LB, Kassman S, Stegemann P, France J: Prospective study of union rate of open tibial fractures treated with locked, un reamed IMN, J Orthop Trauma 8:45, 1994.
11. Sarmiento A: A functional below-the-knee cast for tibial fractures, J Bone Joint Surg 49A:855, 1967.
12. Sarmiento A: A functional below-the-knee brace for tibial fractures: a report on its use in one hundred thirty-five cases, J Bone Joint Surg 52A:295, 1970.
13. Rommens P, Gielen J, Broos P, Gruwez J: Intrinsic problems with the external fixation device of Hoffmann-Vidal-Adrey: a critical evaluation of 117 patients with complex tibial shaft fractures, J Trauma 29:630, 1989.
14. Rommens P, Schmit-Neuerberg KP: Ten years of experience with the operative management of tibial shaft fractures, J Trauma 27:917, 1987.
15. Cliford R. Wheelass, III, MD: Cast treatment of tibial fractures, Wheelass' Text book of Orthopedics, Duke Orthopedics, 2008.
16. Puno RM, Teynor JT, Nagano J, Gustilo RB: Critical analysis of results of treatment of 201 tibial shaft fractures, Clin Orthop 212:113, 1986.
17. Waddell JP, Reardon GP: complications of tibial shaft fractures, Clin Orthop 178:173, 1983.
18. Digby JM, Holloway GMN, Webb JK: A study of function after tibial cast bracing, Injury 14:432, 1983.
19. Ruedi T, Webb JK, Allgower, M.: Experience with the dynamic compression plate (DCP) in 418 recent fractures of the tibial shaft, Injury 7:252, 1976.



Different types of fracture shaft of tibia

Different modalities of treatment



Different modalities of treatment

Different stages of union with IF. & EF.

Example of malunion

Example of implant failure