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Management of Open Fractures of Tibial Diaphysis by External Fixation Followed by Locking compression Plate Osteosynthesis in hemodynamically Unstable Patients: A prospective study

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Abstract
Background: *The purpose of this study was to evaluate the clinical and radiological outcome of open tibial diaphyseal fractures managed temporarily by external fixators in hemodynamically unstable patients followed by definitive internal fixation by Locking compression plate osteosynthesis after the soft tissues and wounds were healed.*
Materials and methods:- *A longitudinal, analytical, quasi-experimental hospital based study was performed at RIMS Hospital,imphal manipur from July 2013 to january 2016 in which 30 aduilt patients presenting with open tibial diaphyseal fractures with hemodynamic instability were treated.Initially the open fractures after the resuscitation of patient and thorough debridement were stabilized by external fixators as damaged control procedure in the first stage and later in the second stage after a period of 28±5days when the wounds were healed was converted to definitive internal fixation by locking compression plate osteosynthesis.The patients with intraarticular extensions,pathological fractures and with comorbodities(Diabetes mellitus,renal failure, chronic smoking) were not included in the study. The data collected was statistically analyzed using spss software.*
Results: *Total of 30 patients completed at least 6 months of followups.The functional outcome was assessed by karlstorm Olerud criteria at 6 months time in which 18 patients(60%) showed excellent results,6 patients(20%) showed good results and 5 patients(16.7%) showed satisfactory results.2 patients developed mal-union in coronal plane.Hardware prominence was also noticed in 2 patients.*
Conclusion:-*External fixation followed by locking plate osteosynthesis is a viable alternative to intramedullary nailing, in open fractures of the tibia with the added advantage of initial lesser operating time and relative safety in case of hemodynamically unstable patients.*
Keywords: *external fixators,intramedullary nail, karl strom olerud criteria, locking compression plate osteosynthesis, Tibial diaphyseal fractures.*

I. Introduction

Fractures of the tibial shaft are the most common long bone fractures.In an average population,there are about 26 tibial diaphyseal fractures per 100000 population.The average age of patient sustaining a tibia shaft fracture is 37 years,with men having an average age of 31 years and women 54 years.[1]Treating the spectrum of bone and soft tissue injuries that accompany open fractures of the tibia requires experience and judgement; an inadequate or inappropriate treatment can lead to severe complications.Hence controversy remains regarding optimum method of treatment of these fractures.[2]The essential part of management of open fracture shaft of long bones, after resuscitation of the patient, consists of thorough debridement and lavage of the wound site,apart from stabilization of fracture by external or internal fixation.[3]After the primary debridement, depending upon the hemodynamic status of the patient, further method of fixation can be decided upon.Damage control surgery should be considered in patients who remain hemodynamically unstable or those with hypothermia,abnormal base deficit or blood clotting.Long bone fractures can be rapidly stabilized with simple temporary external fixation to save life and limb as they cannot undergo long surgery as nailing initially.[4] In case of fracture shaft of tibia, if the patient is stable the fracture can be managed operatively by intramedullary interlocking nailing at the initial setting as the definitive treatment,a form of early total care.[5]Alternatively, temporary damage control stabilization by means of an external fixator can be done, followed by a more definitive procedure like secondary nailing or Locking compression plate fixation at a later stage when the patient becomes fit for a prolonged surgery.[6] External fixation has the advantage of being a very quick procedure which can be performed as damage control orthopaedics, but can lead to pin tract infection, which has the potential to spread along entire medullary canal if an intramedullary implant is used secondarily.[7]

So, locking compression plate osteosynthesis is a viable option in these patients as a definitive treatment in th second stage protocol after temporary stabilization by external fixators in hemodynamically unstable patients.[8]The use of plates and screws has been discouraged by many authors due to potential damage to the periosteal blood supply during soft tissue stripping and increased risk of septic complications.[9]However some studies on severe open tibial shaft fractures yielded satisfactory results,despite the fact that several of them had been fixed internally with plates and screws.The development of new biological techniques and implants have revived the interests towards open reduction and plate fixation.[10]The purpose of this study was to evaluate the clinical and radiological utcomes of tibial diaphyseal fractures with 2 stage protocol. We therefore performed a clinical study to find out the performance of locking compression plates following external fixation in terms of morbidity, time to soft tissue healing, fracture union and complications.

II. Materials and methods

A longitudinal, analytical, quasi-experimental hospital based study was performed at RIMS Hospital,imphal manipur from July 2013 to January 2016 in which 30 adult patients (18-70 years) presenting with type2, type 3A, 3B or 3C open fractures as per the Gustilo and Anderson classification criteria for open wounds of the tibial diaphyseal fractures (transverse/ oblique/ comminuted) not involving articular surface and excluding pathological fractures with associated severe haemodynamic instability (class 3 shock characterized by either of marked tachycardia>120 bpm , systolic blood pressure<100 mm Hg, thready peripheral pulses, empty veins, tachypnoea>30 / min, mental changes or urine output<50ml/ hour in the absence of other causes) without comorbidities (diabetes mellitus/ renal failure/smoking) were taken for emergency surgery after resuscitation in which after thorough debridement of the wound and washing with normal saline, external fixation was done in the first stage protocol using two or more cortical(4.5mm) or cancellous(6.5mm) 8inches schanz pins each proximal or distal to the fracture depending on the fracture site connected by two cylindrical bars. Transverse clamps were used in case of more proximally or distally located fractures. After the soft tissues or the open wounds were healed, the patients were taken up for definitive internal fixation in second stage protocol after 28±5 days from the date of injury in the form of locking compression plates (8-10 holes) with locking screws at least 3 proximal and 3 distal to the fracture after removal of the external fixators. The patients were followed up weekly for 3 months, then fortnightly for 6 months and then monthly till fracture union was complete and patient assumed normal activities. The patients were checked for time for union, functional status and any malunion, soft tissue complications or limb length discrepancy. The data collected was statistically analyzed using spss software.

Fig 1. Intraoperative photograph of type3A open fracture being fixed with uniplanar unilateral external fixators.

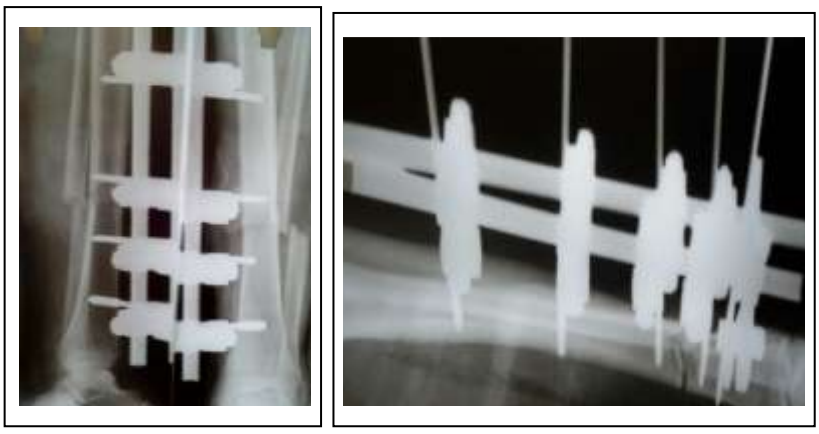

Fig2. Showing post operative xrays with good fracture reduction.

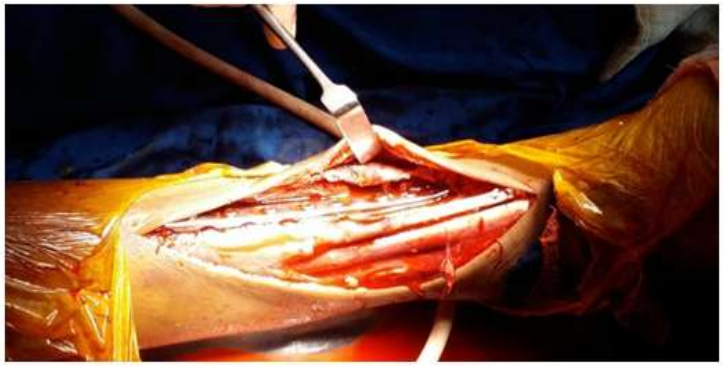

Fig 3. Intraoperative photograph showing locking compression plate fixation after removal of external fixators.

Fig 4. X Ray showing radiological union in both AP and Lateral planes. There is no evidence of persisting active or dormant infection.

Fig.5 Clinical photograph of patient showing normal flexion of knee joint at 6months follow up. There was no associated foot drop.

III. Results

Table 1(Demography)

Age(years)	Male	Female
20-30	4	3
30-40	8	5
40-50	4	2
50-60	3	1
Total	19	11

Table 2(Karlstrom Olerud criteria) For functional assessment

Rating	Results	Number of patients	Percentage
excellent	33	18	60
good	32-30	6	20
fair	29-27	5	16.7
moderate	26-24	1	3.3
poor	23-21	0	0

Table 3(Complications)

1.Wound infection	
a)Superficial	3
b)Deep	1
2.Non-union	0
3.Mal-union	2
4.Implant failure	0
5.Hardware prominence	2

The above TABLES 1,2,3 sumarizes the results.

In our study between July 2013 to january 2016 a total of 36 patients with open tibial shaft fractures attended the emergency fitted in the study criteria but out of which 6 patients did not turn up for follow-ups regularly.The mean time from trauma to surgery was 3.3±2.1 hours.Total of 30 patients comprising 19 males and 11 females attended regularly completing at least 6 months of follow-ups.The mean time of union was 24±2 weeks(range 12-30 weeks).The functional outcome was assessed by karlstorm Olerud criteria at 6 months in which 18 patients(60%) showed excellent results,6 patients(20%) showed good results,5 patients(16.7%) showed satisfactory results and 1 patient(3.3%) showed moderate outcome.3 cases of superficial wound infection and 1 deep infection was reported but managed with antibiotics and local wound care.2 patients developed mal-union in coronal plane(varus angulation of>5).Hardware prominence was also noticed in 2 patients.

Discussions

The decision to perform a definitive fixation or a life and limb salvaging rapid surgery following Road Traffic Accidents depends not on the fracture pattern but on the presence of associated trauma to other organs like head, lung or abdominal organs.

In the presence of such trauma or if the patient's hemodynamics is compromised, a quick in quick out damage control surgery can be performed, which can be changed into a definitive modality once patient is stable. Also if there is extensive soft tissue damage, the risks of failure is relatively high in case of definitive fixation. The paramount principle of treatment is stabilization of the fracture and reconstruction of the soft tissue to create a suitable environment for bone healing.[11]Standard practice followed till now is that of early conversion to internal osteosynthesis mainly intramedullary nailing,but the circumstances do not always allow this approach.[12]Internal fixation using intramedullary nailing for segmental tibial fractures is associated with a high union rate[13]; however, use of intramedullary nails in high energy or open fracture can cause decreased circulation, endosteal necrosis, and elevation of compartment pressures, and is associated with an increased risk of infection[14] .Good initial reduction is important and has a significantly faster healing time, regardless of the type of fixator that is applied.[15]Several reports have described the use of a two-stage protocol for the treatment of open,severe high energy tibial fractures.In those studies,patients had initial treatment with an external fixator followed by a delayed open reduction and internal fixation once the soft tissue envelope have sufficiently healed.[16]In our patients,the quality of reduction was very satisfactory as most of the fractures had good reduction and acceptable alignments until bone union.Exercises of joints,range of motion and rehabilitation progress were also encouraged in our protocol.In the second stage of the protocol the temporary external fixator was replaced by locking compression plate osteosynthesis as definitive internal fixator after wound healing of about 28±5days.To avoid intrinsic problems of delayed union,nonunion,pin loosening and pin track infection Rommens et al.sugested conversion to internal fixation after soft tissues and all pin sites have healed.The proposed 8 to 12 weeks as ideal time for such conversions.[17]The locking plate provided enough stability without immobilization of the knee and the ankle joint,thus allowing for early rehabilitation to be instituted.The average duration of the hospital stay was about 35±3days.In our study the mean time of union was 24±2weeks(range 12-30weeks).In a study by Beltsios michail et al[18] average time for union of fractures was 25weeks where external fixators were used as primary and definitive treatment for tibial diaphyseal fractures.

IV. Conclusion

External fixation followed by locking compression plate osteosynthesis is a viable alternative to intramedullary nailing, in open fractures of the tibia with the added advantage of initial lesser operating time and relative safety in case of hemodynamically unstable patients.A two stage treatment protocol comprising temporary external fixation followed by definitive treatment after soft tissue healing is associated with decreased complications.On the basis of our protocol surgeons can achieve good reduction with stable temporary external fixation,soft tissue reconstruction and ease of subsequent definitive fixation by locking compression plate in due course time. The outcome is satisfactory in terms of soft tissue healing, fracture union alignment of bone fragments and functional status when compared to other similar studies. However, a larger multicentric trial study with greater number of participants and longer duration is recommended.

References

[1]. Egol KA, Koval KJ, Zuckerman JD, Handbook of fractures(Philadelphia: Lippincort William and Wilkins,2010).
[2]. Mir FR, Mehta R, Management protocol for open fractures of tibia, JK Practitioner, 20(3-4), 2015, 18-25.
[3]. Ma CH, Tu YK, Yeh JH, Yang SC and Wu CH, Using external and internal locking plates in a two stage protocol for treatment of segmental tibial fractures, J Trauma, 71(3), 2011, 614-619.
[4]. Ruedi TP, Buckley R, Moran CG, AO Principles of fracture management, Ann R Coll Surg Engl, 91(5), 2009, 448-449.
[5]. Lefaivre KA, Guy P, Chan H, Blachut PA, Long-term follow-up of tibial shaft fractures treated with intramedullary nailing, J Orthop Trauma, 22(8), 525-9.
[6]. Bach AW, Hansen ST Jr, Plates versus external fixation in severe open tibial shaft fractures: a randomized trial, Clin Orthop Relat Res, 241, 1989, 89–94.
[7]. Giannoudis PV, Surgical priorities in damage control orthopaedics, J Bone Joint Surg Br 85(B), 2003, 478–483.
[8]. Poduval M, Diaphyseal tibial fractures treatment and management, Medscape, Apr 2016;1-12, from:http://emedicine.medscape.com /article/1248857-treatment. Accessed on: 01/09/2016
[9]. Kristensen KD, Tibial shaft fractures, the frequency of local complications in tibial shaft fractures treated by internal compression osteosynthesis, Acta Orthop Scand, 50, 1979, 593–598.
[10]. Gopal S, Majumder S, Batchelor AG, et al, Fix and flap, the radical orthopaedic and plastic treatment of severe open fractures of the tibia, J Bone Joint Surg Br, 82(B7), 2000, 959–966.
[11]. all'oca C, Christodoulidis A, Bortolazzi R, Bartolozzi P, Lavini F, Treatment of 103 displaced tibial diaphyseal fractures with a radiolucent unilateral external fixator, *Arch Orthop Trauma Surg*, 130(11), 2010, 1377-1382.
[12]. Cordozo RT, Silva LG, Bragante LA,Rocha MA, Treatment of fractures of the tibial diaphysis using external fixator compared with locked intramedullary nails, Rev Bras Orthop, 48(2), 2013, 137-144
[13]. Wu CC, Shih SH, Segmental tibial shaft fractures treated with interlocking nailing, J Orthop Trauma, 7(5), 1993, 468–472.
[14]. L, Gustilo RB. Infection after intramedullary nailing of severe open tibial fractures initially treated with external fixation, J Bone Joint Surg Am, 71(6), 1989,:835–838.
[15]. Helland P, Boe A, Molster AO, Solheim E, Hordvik M, Open tibial fractures treated with the Ex-fi-re external fixation system, Clin Orthop, 326,1996, 209–220.
[16]. Egol KA, Tejwani NC, Capla EL, Wolinsky PL, Koval KJ, Staged management of high-energy proximal tibia fractures (OTA types 41), the results of a prospective, standardized protocol, J Orthop Trauma, 19(7), 2005, 448–455.
[17]. Canale ST, Beaty JH, Fractures and dislocations in adults, In Canale ST, Beaty JH (ED), Campbell's operative orthopaedics, 12 (Philadelphia:,Elsevier, 2012) 2658.
[18]. Beltsios M, Savvidou O, Kovanis J, Alexandropoulos P, Papagelopoulos P, External fixation as a primary and definitive treatment for tiabial diaphyseal fractures, PMCID, 4(2),2009, 81-87.