www.jmscr.igmpublication.org
Impact Factor (SJIF): 6.379
Index Copernicus Value: 71.58
ISSN (e)-2347-176x ISSN (p) 2455-0450
crossrefDOI: https://dx.doi.org/10.18535/jmscr/v6i7.195

IGM Publication
Journal Of Medical Science And Clinical Research
An Official Publication Of IGM Publication

Clinical Outcome of Tibial Fractures treated by using Locking Plates as Fixator

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Abstract
Tibial fractures with compromised soft tissue envelop May lead to significant complications and optimal management of these injuries is still controversial. The use of a locking plate as an external fixator appears to be an attractive option because it not only minimizes injury to soft tissue, but also overcome some of the disadvantages of standard external fixators. The purpose of this study is to evaluate the results of external fixation using the locking plates in tibial fractures. In this study prospectively evaluated 17 patients (13 males and 4 females] with an age of 40.7 years who presented with fresh tibial fractures. According to Gustilio classification, grade IIIB injury in cases, grade IIIA in 2 cases, grade II injuries in 6 cases and 7 cases had closed injuries with skin blebs. Locking plates were used to fix these fractures which were placed on the anteromedial aspect of tibia as an external fixator. The mean follow up period was 10 months. In all patients the plate was left in place till 6 weeks after full healing was obtained clinically and radigraphically. All fractures healed in a mean period of 19 weeks. There was one case on non union which subsequently healed with skin grafting. There was no case of infection or any failure of hard ware. The skin sees to tolerate the screws well and even seems to tolerate the screws well and even seems to adhere to the screw. At the latest follow up at a 12month period, all the patients were fully recovered weight bearing with a well healed tibia and good range of motion of knee and ankle. It is believed that the supra-cutaneous locking plate technique is an effective procedure for treatment of tibial fractures in patients who need a long period of external fixation, ankle sparing stable fixation with good reduction is achieved immediately. Soft tissue reconstruction where ever is necessary, lead to union of all fractures with good action.

Keywords: *Tibia, Fracture, Locking plates, Fixator, Clinical outcome.*

Introduction

Tibial fractures with soft tissue injury pose treatment dilemmas for orthopaedic surgeons. These injuries are associated with significant morbidity due to the increased risks of infection, nonunion, mal-union, joint stiffness and possible amputation[1-2]. The use of two stage reconstruction for the treatment of these fractures has been successful in decreasing the complication rates[3-4]. The two stages involve stabilization of the injured tibia with a bridging external fixator to allow the soft tissues to improve and recover and definitive fixation for reconstruction of the articular surface and meta-diaphysial fracture. However, the two staged reconstruction incurs additional cost compared with traditional open methods. Therefore, external fixation used alone or with limited internal fixation as the definitive treatment for lower extremity fractures with compromised soft tissue envelope

was advocated by some orthopedic surgeons[5-6]. Standard external fixators are relatively inexpensive and easy to apply. However, frames are often bulky and cumbersome. Patients typically encounter problems with clothing and in day to day activities. They may also cause disturbance in gait while trying to clear from the opposite limb during the swing phase.

Recently, locking plate as an external fixation without joint spanning has been used as part of staged reconstruction in the management of open tibial fractures[7-10]. The locking plate used as a definitive external fixator is attractive because it not only minimizes trauma to the soft tissues, but also overcomes the short comings of standard external fixators. We report in this study, the outcome of anatomically contoured locking plates as an external fixator device in the fractures of tibia.

Materials & Methods

The study was approved by our institutional review board and informed consent was given by the patients. Inclusion and exclusion criteria are formed. Between April 2014 and September 2014, 17 patients with tibial fractures having soft tissue injury underwent external fixation with locking plates at Kamineni Academy of medical sciences and Research institute. There were 13 men and 4 women with mean age of 40.47 years (range 24 to 67 years). Three patients sustained a fracture as a result of fall, 14 patients sustained a fracture in road traffic accidents. There were 10 open fractures. Injury grading was done after wound debridement. Grades include 2 Gustilo type IIIB, 2 Gustilo type IIIA and 6 Gustilo type II fractures. 7 patients were having closed injuries with skin blebs. Two patients were diabetic and are under proper control at the time of surgery. The mean time between injury and operation was 1 day in closed fractures. For open fractures, external plating was performed after debridement during the emergency operation.

Patients will be evaluated

- Clinical examination of injury
- X ray AP and lateral views
- Grade of open injury
- Grade of communition
- Fracture pattern
- Other comorbid conditions

Inclusion criteria

- Patients with narrow medullary canal
- Open tibial fractures
- Closed fractures with soft tissue injury
- Patients who cannot be treated with intramedullary nailing/plating. Well reduced fractures.

Exclusion criteria

- All fractures that can be treated with interlocking nailing or ORIF and plating.
- Fractures that need dynamisation, bone transfer procedures.
- Ill reduced fractures
- Pathological fractures
- Patients with poly trauma where other organ systems are involved.

Intervention

Anatomically contoured locking plate applied on the antero-medial aspect of the leg with locking screws.

Surgical technique and protocol

With the patient under spinal anesthesia, the involved limb is prepared and draped in the usual standard sterile fashion. Pre-operative antibiotic treatment is given. No tourniquet is used to allow intravenous antibiotic to reach the operative site and compound area. Althorough debridement and wound wash is given for open wounds. Fracture alignment is achieved prior to wound closure. Fracture is reduced and fixed percutaneously or through open wound or with minimal skin incisions with cancellous screws wherever necessary. Compound wound is generally closed in one layer before the placement of the locking plate, as the plate might limit easy access to wound.

A locking plate for the tibia of the appropriate length and contour is chosen. The plate is initially fixed to the proximal and distal fragments with K-wires after certaining fracture reduction under fluoroscopy guidance. Locking plate is placed as close to the bone as possible to increase the mechanical stability of fixation, allowing some

space for swelling and regular wound care. Plate is placed through the antero-medial cortex along the subcutaneous border of the tibia to avoid soft tissue tethering by the screws. It is separated from the skin surface by a spacer of uniform thickness, like keeping large needle holder. Bi-cortical locking screws are used for fixation of locking plate as an external fixator. For the tibia, at least four screws proximally, three to four screws distally and minimum of two screws in segmental fracture fragment are applied.

Rehabilitation

Should begin immediately depending on the fracture and soft tissue stability. Adjacent joints should be mobilized as soon as possible. Motion of musculo-cutaneous units over fracture surfaces in the open fractures would irritate the soft tissues and may decrease resistance to infection.Physical therapy includes active and active assisted exercises for joint mobilization as soon as soft tissue healing permits. Neurological deficits resulting in loss of active motion should be evaluated and the appropriate joints should be splinted in functional positions to avoid contractures. Weight bearing should be limited depending on stability of fixation, the type of fixation and its inherent fatigue life and the systemic condition of the patient. Progression of weight bearing should be monitored radiographically according to evidence of stability and bone regeneration.

Radiographical assessment

In the extra-articular fractures, displacement was classified as excellent (<2mm), good (<5mm), fair (<10mm) and poor (≥10mm). We defined union as more than 50% visible bridging callus across the fracture on conventional Antero posterior and lateral radiographs[11]. Clinical and radiographical follow up examinations were performed at 6 weeks, 12, 18 and 24 weeks and then every 3 months.

Results and Discussion

This study includes 17patients with mean age of 40.47 years in a period from April 2014 to September 2014 and all the patients had a follow up of 24 weeks. In other studies are average age ranges from 36-45 years[12,13]. Male and female were 13 and 4 respectively, with 9 left and 8 right sided injuries. Domestic fall is the cause of injury in 3 patients and RTA is cause in majority i.e 14 cases. 9 patients having shaft or diaphyseal which includes 4 segmental[14] fractures and 8 patients having the proximal tibial fractures with intra articular extensions. Injury grading was done after wound debridement. Primary closure was achieved for all open injuries except Grade IIIB injuries before plate fixation. Closed fractures with skin blebs were seen in 7 patients, Grade II injuries in 6, grade IIIA in 2 and 2 cases with grade III B injuries. Grade III B injuries need soleal flap closure with skin grafting. Associated ipsilateral lower limb injuries were found in 3patients. One patient is having contralateral lower limb injury.

Straight locking plates were used for external fixation in 3 patients, 14 proximal tibial locking plates were used of which 12 were of contralateral side for better anatomical contour on the anteromedial side. Two ipsilateral proximal tibial plates were used for distal end fractures. Distal femoral locking plates are also indicated.

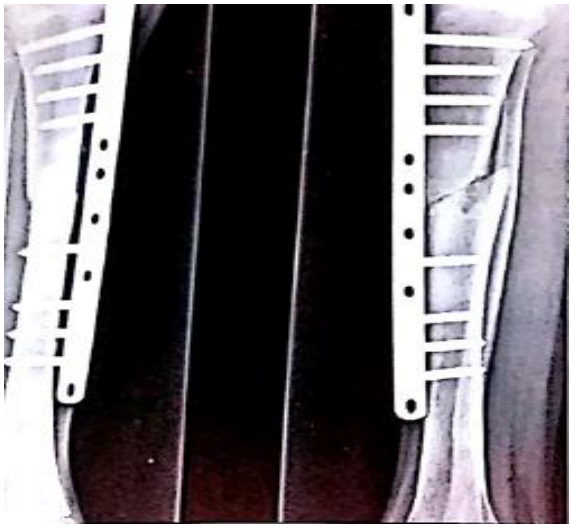

Fig.1 Post operative radiograph with plates in situ.

A non union rate of 5.8% is observed in this study and non union of 5-13% had been noted by other authors[15]. In all patients the plate was left in place till full body healing was left in place till full bony healing was obtained clinically and radiologically. The plate was insitu for an average of 20 weeks

except in one case of nonunion, where the plate was kept insitu for more than 36 weeks. The non-union progressed to union after bone grafting. We did not see any screw tract infections or failure of the hardware. The skin seems to tolerate the screws well and even seems to adhere to the screw. At the latest follow up an average of 10 months, all patients were fully weight bearing with well healed tibia and good range of motion of knee and ankle. All patients were free of infection with healed wounds.

Tibial fracture with or without articular extension is one of the difficult fractures to manage. Locking plate is an friction-free, independent self stable construction which provides both angular and axial stability and minimizes risk of secondary loss of reduction through a threaded interface between the screws heads and plate body.

Few studies suggest use of locking plates as external fixation devices using LCP as an external fixation device not only stabilizes the fracture but also preserves the vascularity of tibia and promotes union .non union due to infection in compound fractures of tibia is commonly encountered scenario which can be avoided by external stabilization devices.

Toe touch walking and partial weight bearing were allowed as tolerated by the patient from the first postoperative day[13]. Active knee and ankle ROM exercises were included in rehabilitation. Walking was delayed for 3 months in patient with contra-lateral lower limb injury.

Fig.2 Clinical picture with plates in situ

Fig.3 Clinical image of healed leg

Mean hospital stay was 4.12 days ranging from 3-11 days[48]. Plates were kept insitu till radiological signs were appeared, full weight bearing was allowed. Plates were kept insitu for 6 weeks after radiological signs of union of 4 cortices. "Controlled destiffering" or dynamization by removing screws closest to the fracture site is possible, allowing some measure of control to the load sharing process[16].

No screw tract infections were observed except in one patient who had serous discharge and is relieved with oral antibiotics. Other studies similar superficial effusions which relieved with oral antibiotics[14] and with screw removal. No deep infections were reported. No implant failure was noted among the subjects[17]. One screw was found to be loose during visits was removed. The reason for loosening is assumed to be improper locking of screw head. In patients having closed grade II fractures, radiological union occurred by 12 weeks[18].

All fractures are united except one grade III B injury in which the distal shaft extension of the fracture appears to be non union[19] by the end of 24 wks . Bone grafting was done at the non union site and at the follow up till the end of study shows good callus formation. Reason for non union site is attributed to the severity of injury. Implant removal

was done as a simple OPD procedure. Patients were advised to walk with support for 2 weeks after implant removal in order to avoid secondary fractures at the screw hole sites. Skin condition was good in all patients at the follow up.

The consistent good outcome using this "supracutaneous technique", support our opinion of using locking compression plate as external fixator in tibial fractures which are very well tolerated by patients and address the challenging problems.

Conclusion

Tibia fractures or without intra articular extension, with or without significant soft tissue injury is one of difficult fractures to manage with all currently available treatment options. Tibial fractures treated by using locking plates as fixators utilized as permanent fixation method, Ease of application and implant removal, reduced Hospital stay, union time and complications rate and Less radiographic silhouette and low profile. Implant compliance is good there is less chance of striking contralateral lower limb during walking and the low profile plate can be concealed under stockings and it is aesthetically acceptable.

It is believed that the supracutaneous locking plate technique is an effective procedure for treatment of tibial fractures in patients who need a long period of external fixation. Ankle sparing stable fixation with good reduction is achieved immediately. Soft tissue reconstruction where ever necessary, led to union of all fractures with good function.

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