ANALYSIS OF SUPRACUTANEOUS LOCKING COMPRESSION PLATE IN COMPOUND DISTAL METAPHYSEAL FRACTURES OF TIBIA- A PROSPECTIVE STUDY

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ABSTRACT

BACKGROUND

Complexity of open tibial fractures is on the rise with increased high-velocity road accidents. Temporary bony stabilization by external fixation avoids the instability at the fracture site and promotes healing of soft tissues. There is paucity of literature ascertaining the role of Locking Compression Plate (LCP) as external fixator device in compound tibial fractures. Hence a study was undertaken to assess the role of LCP as an external fixation tool in providing stability to the fractured bone.

MATERIALS & METHODS

A prospective study was done on 21 consenting patients with open distal metaphyseal fractures of the tibia. Demographic, clinical and radiological assessment was done. Lower Extremity Functional Scale (LEFS) was used as an outcome measure.

RESULTS

There was a 90% union rate in patients treated with LCP. There was an identifiable improvement in LEFS after treatment.

CONCLUSION

LCP as an external fixation device is an effective and safe method with good union rate.

KEY WORDS

Supracutaneous LCP, Locking Compression Plate, Open Tibial Fractures, External Fixation, LEFS, Supercutaneous LCP, Smoking, Non-Union of Bone.

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BACKGROUND

With an increase in high-velocity speeding motor vehicle accidents in the last decade, the complexity of tibial fractures has also seen a rise. Challenge lies in managing these tibial fractures because of their subcutaneous nature, poor vascularity and lack of circumferential muscular sleeve. Traditional open reduction and internal fixation with plates carry high rates of complications like infection, delayed union and non-union as a consequence of periosteal stripping.^{1,2}

Management of an open fracture includes an early and aggressive debridement, intravenous antibiotics and temporary/definitive stabilization of fracture.³ Intramedullary inter-locking nailing as a definitive stabilization is indicated in Gustilo Anderson types I, II fractures.⁴ There is significant controversy with nailing as an option in Gustilo Anderson type III A and III B; especially when there is significant bone depth contamination. Also, voluminous distal meta-diaphyseal region and absence of metaphyseal cortical contact allows easy displacement at the fracture site.

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Temporary bony stabilization by external fixation avoids the instability at the fracture site and promotes healing of soft tissues.^{5,6} However external fixators for distal meta-diaphyseal tibial fractures are bulky, inconvenient and it hampers gait.

Anatomically contoured Locking Compression Plate (LCP) as a "Supercutaneous Plate" addresses few of the drawbacks of external fixators.⁷ LCP have superior holding power with fixed angular stability provided by screws locking onto the plate. There is paucity of literature ascertaining the role of LCP as external fixator device in compound Gustilo Anderson type III A and III B tibial fractures. Hence a study was undertaken to assess the role of LCP as an external fixation tool in providing stability to the fractured bone.

MATERIALS AND METHODS

This study was a prospective observational study done at PES Institute of medical sciences and research, Kuppam from March 2015 to Sept. 2018. The study subjects included all patients more than 18 years presenting with open distal meta-diaphyseal fractures of tibia (Inclusion criteria). Patients with open distal meta-diaphyseal fractures of tibia associated with vascular injuries were excluded from the study (Exclusion criteria).

A detailed history and physical examination were done as per the trauma protocol. After initial resuscitation routine blood and radiological investigations were done. Wound lavage was given in emergency room and injured limbs were temporarily splinted. Preoperative prophylactic antibiotic-

Inj. Ceftriaxone 1 g and Tetanus toxoid injections were given. Patients were taken up for surgery on an emergency basis after deemed fit by anaesthetist and physician. Surgery was performed under spinal anaesthesia and tourniquet control. Surgical wound debridement was done. Fractured ends of bone were aligned and stabilized with appropriate pre-contoured LCP with bicortical screws as an external fixation device. Tension-free wound closure was done. Bulky sterile dressing and plaster splint was applied. Sutured wounds were regularly observed and dressed. Postoperative rehabilitation and gait training were begun from 2nd-day post-surgery. After suture removal patients were discharged and followed up on an outpatient basis at regular intervals of 4 weeks and were assessed for soft tissue healing and bony union clinically and radiologically (Figure 1-4). Functional Outcome was assessed by the clinical and radiological union, and the Lower Extremity Functional Scale (LEFS).

The Lower Extremity Functional Scale (LEFS) is a patient-reported outcome questionnaire containing 20 questions about a person's ability to perform everyday tasks.⁸ The LEFS is reliable and valid tool to assess group and individual changes.⁹

RESULTS

The present study included 21 patients satisfying inclusion criteria. All the 21 patients presented with distal metaphyseal fractures and underwent supracutaneous LCP fixation after thorough debridement. One patient was lost for follow-up after one-month post-surgery. All the remaining patients were followed-up till bony union. Results were analysed for 20 patients.

The average age at presentation was 54.5 yrs. (Range 25-66 yrs.). There was a predominance of the male gender in the study group (M: F=3:1). Side distribution of the injured limbs was equal (Right: Left=1:1). The presentation of fractures with Gustilo Anderson Type II, IIIA and IIIB were 1, 8 and 11 respectively (Chart 1). The average follow-up was 7 months (Range 6-9 months).

Out of 20 patients, one patient has screw site infection, which settled with local dressings and oral antibiotics. There were no screw back out, deep infection, and loss of reduction (Table 1). In two of the patients non-union was diagnosed and they underwent additional procedures to promote bony union (Figure 5-8).

The average LEFS among patients with union and non-union was 73.27 and 29.5 respectively (Chart 2.). Among patients with non-union the scores improved to 70 after surgical intervention to promote bony union.

Chart 1. Incidence of Non-Union in Different Gustilo Anderson Open Fracture Types

Superficial /Screw Site Infection	1
Deep Infection	0
Loss of Reduction	0
Non-Union	2*
Joint Stiffness	2*

Table 1. Analysis of Complication in Our Study

*-Same two patients who had non-union and also had joint stiffness

Chart 2. Representation of Mean Lower Extremity Functional Scale (LEFS) Measured at Different Time Frames

Figure 1 Preoperative Clinical & X-Ray Pics

Figure 2. Immediate Postoperative Clinical & X-Ray Pics

Figure 3. Four Months Postoperative Pics

Figure 4. Implant Removal After Union at Five Months

Case 1. From Presentation Till Union (Fig. 1-4)

Figure 5. Case 2 Preoperative Pics

Figure 6. Case 2- Immediate Post Op Pics

Figure 7. Case 2- Non-Union Evidenced at 4 Months Postop

Figure 8. After Implant Removal, Interlock Nailing & Bone Grafting

Case 2. Nonunion Evidenced at 4m, Underwent Intramedullary Nailing (Fig. 5-8)

DISCUSSION

The prime objectives of treatment of open fractures of distal tibia are the prevention of infection, promotion of soft tissue healing, stabilization of fracture and restoration of function of affected extremity.^{9,10,11,12} A good surgical debridement is of paramount importance in eliminating the chances of infection. Primary internal fixation is preferred wherever possible in preventing malunion and early mobilization and return to activities.^{13,14} External fixators have a role in severe comminuted open fracture wherein they stabilize the bone at a distance from injured area thereby promoting healing of soft tissues and preventing additional damage to vascularity.^{5,6,15,16} The drawbacks of traditional external fixators are pin tract infection, loosening, loss of reduction, delayed and non-union.

LCP as an external fixator device has been described in the literature. Kloen P et al. in 2012 coined the term "Supercutaneous plating" and used LCP as an external fixator in diverse acute and chronic infectious non-union of distal tibia.⁷ They reported good union and infection control with the use of LCP.

In our study, there was a 90% union rate in distal tibial fractures treated with LCP as an external fixation device. All the patients in the united group had good to excellent results as per LEFS at the end of 6 months. Our study had predominantly Gustilo Anderson type III cases. The two patients who had non-union underwent secondary surgeries like interlocking nailing and bone grafting. Eventually, these fractures united in these patients and LEFS scores improved from 25 to 70 in patient-2 and 34 to 70 in patient-9. Retrospectively these patients were interviewed again and both of them regularly continued to smoke beedies throughout their rehabilitation period even in spite of repeated warnings. In a meta-analysis done in 2016 investigators found that smokers have an increased incidence of delayed union and twice the risk of non-union as compared to non-smokers.¹⁷

LCP¹⁸ has advantages over traditional fixators. They are less bulky and cumbersome and can be easily hidden in patients clothing. They offer multidirectional screw placement with superior pull out rates. The pitch of locking screw is less compared to Schanz pins of external fixators and provides sturdy purchase in metaphyseal cancellous bones and in osteoporotic patients. The locking screws engage on to the locking plate and chances of secondary loss of reduction as in traditional external fixators are negligible. Implant removal can be done under local anaesthesia

Limitations

This was a single centre study with a smaller sample size, hence projection of the results for a general population may not be accurate. A multicentre study with larger sample and longer-term follow-up is needed for confirming the results obtained in the present study.

CONCLUSION

In our study, we have found that an LCP as an external fixation device is an effective, safe and promising method with good union rates. In a certain subset of patients where internal fixation is a contraindication (absolute / relative), external fixation with LCP plays an important role.

Supracutaneous LCP alone can also be used as a definitive fixation method.

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