Management Of Open Type IIIA And Type IIIB Fractures Tibia With LRS External Fixator

VC, MKL, MCN

Citation

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Abstract

Back ground: The specific method of skeletal fixation and soft tissue management in open fracture of tibia, one of the common fracture continues to be a topic of debate in orthopedic traumatology. The current study was done with an objective to assess the role of LRS external fixator in the management of open type IIIA and type IIIB fractures of the tibia. Materials and method: Out of the total 157 cases of open fractures of tibia encountered during the study period, 45 cases belonged to type IIIA and IIIB were treated by primary wound debridement and fracture stabilization with LRS external fixator. The surgery was aimed at achieving anatomical reduction, stable fixation and early soft tissue coverage to allow early mobilization. Average duration of the use of external fixator was 24 weeks. Using the principle of compression distraction osteogenesis, fracture union was enhanced by doing compression and distraction at the rate of 1 mm for every 10 days alternatively. Regular follow up done and the cases were assessed as per modified Andersons and Hutchins criteria. Additional procedures like bone grafting fibular osteotomy were performed for few patients. Results: Overall 90% of the fractures united well. While good to excellent results were seen in 28 cases amounting to 72%, moderate and poor results were observed in 18% and 10% of the cases respectively.Conclusion: The method of management using the LRS external fixator was found to be simple and effective for fracture stabilization in terms of easy access to soft tissue care, enable fracture union, early return to function and can be considered as an alternative choice fixation for type IIIB and type IIIB fracture both bone of leg with bone loss which lessens the economical burden and those patient not willing to undergo multiple procedures.

INTRODUCTION

The shaft of the tibia is one of the most common sites of an open fracture.^[1] Usually a sequential protocol of treating compound fractures are initial debridement, external fixation, closure of the wound, intramedullary interlocking nail with reaming.^[2]The disadvantage of this technique is the need for several operative procedures and longer period of hospitalization. The infection rate of fractures which were first treated by external fixation and then with IMIL nailing was significantly much higher than those fractures treated with IM nailing alone.^[3] A high incidence of infection is noted secondary to the delayed intramedullary nailing and the need for several procedures. ^{[4] [5]}so we resorted to external fixator to continue as definitive management. The results achieved with external fixation alone were studied for fractures of the tibia by adhering to the important principles of External fixation with well supervised follow up.^[6] Our aim was to return the patient to full function as soon as possible and not make the patient to undergo several operative procedures and burden the poor patients

economically in which external fixation can be used as primary and definitive line of management for open fractures tibia which is very cost effective.^[7] Especially type IIIA type IIIB and type IIIC injuries result in extensive soft tissue and bone damage with high rates of infection, non union, malunion complication and poor treatment outcome. [8][9][10] Sequential management of these injuries thorough debridement, bony stabilization soft tissue coverage to enable mobility and early return to function.^{[11][12][13]}External fixators being one of the method of fixation for type IIIA, IIIB and IIIC compound fractures, severely contaminated fractures, delayed treatment of open tibial fractures, open periarticular fractures and in polytraumatized patients.^[1] External fixator is an indispensable tool has unique capability of stabilizing the bone and soft tissue at a distance from the operative or injury focus providing an unobstructed access to the wound with minimal vascular compromise to the bone and soft tissue. Limb Reconstructive System (LRS) is a unilateral frame with half pins being simple, effective, offers rigid stabilization of fracture fragments and an access

to soft tissue care reducing the economic burden and obtains maximum benefit.^[8] The problems of bone transport and docking are all related with the technique.^{[14][15]} This study investigated the role of external fixation based on the principles of ilizarov techniques in the management of severe open tibia fracture.

OBJECTIVES

To analyze the efficacy of LRS external fixation in achieving anatomical reduction, stable fixation, early return to function, results with respect to bony union, soft tissue coverage and with special consideration of knee and ankle movements, limb shortening and disadvantages.

MATERIALS AND METHOD

In Sri Adichunchangiri hospital and Research centre, Mandya, 157 cases of open fractures of both bones of leg were treated out of which 45 cases of type IIIA and type IIIB were selected for the study between June 2007 and July 2010. There were 40 male and 5 female patients, most of them were between 20-40 years, commonest mechanism of injury being road traffic accidents. Thorough examination was done to rule out associated injuries and all patients were administered prophylactic cephalosporins along with aminoglycosides tetanus toxoid, tetanus immunoglobulins to combat infection.^[16]Once the patient is haemodynamically stabilized, clinical evaluation, primary wound debridement with copious amount of normal saline done and Open Fractures were classified according to Gustilo Anderson's classification as Type I, II, III and type III is further classified into three groups as III A, IIIB and IIIC to be more precise to determine the rate of infection and prognoses. ^[17] Compound middle one-third fracture both bones of leg and on the right side were more common, 18 comminuted, 6 segmental fractures, butterfly fragment in 4 cases, oblique fracture in 2 cases and transverse fracture in 15 cases. Application of LRS external fixator was carried out such that it should be away from the site of wound. (fig1) If a soft tissue coverage procedure is required, then railing application should be applied such as to leave enough area for the soft tissue procedure intended. The fixator was placed in neutralization mode in case of comminuted and butterfly fragment fractures, compression mode in case of 23 transverse, oblique and segmental fracture as to narrow fracture gap and improve stability, relaxing skin incisions done around the pin tracts to avoid skin necrosis, bone was covered with overlying muscles and skin approximated with stay sutures, rest of the wound left open to heal by secondary intention. The foot and ankle were manipulated to ensure

absence of musculotendinous tethering by half pins. Radiograph was taken in the post operative period.(fig 2) Out the 45 cases in our series, one patient had contralateral closed fracture both bones of leg for which closed reduction and internal fixation with intramedullary nailing was done Based on the fracture pattern, compression distraction technique was started at 1 mm for every week alternatively in the immediate postoperative period. Later adequate soft tissue coverage was done with skin grafts for 12 and local flaps for six patients after 3-4 weeks and took up well ^[10] In our series 2 patients needed cancellous bone grafting. Of the 45 patients who had undergone primary and secondary suturing, all of them healed well.. Patients were trained regarding the compression distraction cycles at a rate of 1 mm per week or 10 days on alternate basis and were followed up at 4 weeks interval. Clinical and radiological assessment done with due importance to the pin tract infection and presence of callus. Once there is a radiological signs of fracture healing, patients were allowed to bear weight on toes with aid of walking frame or crutches and joints were mobilized. Two of the type IIIB pattern showed signs of sclerosis of which 1 to 2 fragments were excised and bone grafting done to bridge the fracture gap later immobilized with above knee slab for 6 weeks .once the signs of callus formation seen, the fixator is removed and above knee cast applied for 3 weeks, later converted to patellar tendon bearing(PTB) cast. One type IIIB cases developed deep infection with pin loosening for which fixator was removed and suitable antibiotics administered after culture sensitivity, revision surgery done with LRS external fixation once the infection is under control. One of the type IIIB patient proximal corticotomy and lengthening by compression and distraction osteogenesis was performed after 2 months and achieved 1 cm of lengthening of limb. One type IIIB patient required pin replacement for loosening due to pin tract infection. One type IIIA patient fibular osteotomy was done as intact fibula was not allowing compression at the fracture site. Two landed up with infective non-union and one required debridement, sequestrectomy and refixation with LRS external fixator. In these cases satisfactory fracture union occurred after 9-12 months. All the 45 cases of type IIIA and IIIB were treated with LRS external fixator for average period of 5-6 months depending on the rate of union, after which the fixator is removed and limb immobilized with PTB cast for another 3-4 weeks.

Figure 1

Figure 1: Fracture stabilized with LRS external fixator after debridement.



Figure 2

Figure 2: Immediate postoperative X-ray showing segmental fracture of tibia stabilized with LRS-fixator



RESULTS In the present study, 45 cases of type IIIA and type IIIB

open fracture tibia were treated. The patients were between 18-60 years of age out of which maximum number of patients were in the age group of 20-40 years, 88 % of the patients were male which may suggest higher level of activities and mobility.^[18] RTA was the cause of injury in 97% of the cases except one patient fell from a height. 68%of the fractures were middle one third. 18 patients underwent split skin grafting and flap repair, all soft tissue transfers were successful in our series and in 2 cases bone grafting was done. One patient needed proximal corticotomy and lengthening and equal limb length was achieved. One patient required pin replacement. Common complication in our study was pin tract infection, were treated with suitable parenteral antibiotics after culture and sensitivity. Good ranges of movements were obtained in the follow up period (fig 3&4). 90% of the fractures united well (fig 5). Excellent to good results were obtained in 72 % moderate in 18 % and poor in 10 %.

Figure 3

Figure 3: knee extension.



Figure 4

Figure 4: Knee flextion



Figure 5 Figure 5: Well united fracture tibia.



DISCUSSION

Edwards In 1988 reported large series of open Grade III tibial fractures, suggested successful staged reconstruction is a reasonable expectation for most of these severe injuries with a union rate of 93% with a median time of nine months and the healing time depends on the amount of tissue injury and bone loss and satisfactory clinical function of 89%.^[19] The management of open tibia fractures with the Dynamic Axial Fixator allows immediate functional stabilization of fractures , weight bearing and axial fracture site movement promote an early callus response can be utilized till the fracture unites.^{[20] [21]} The results and complication rates were comparable with those of other more complex external fixators and good results depend on the adequacy of initial

reduction and the duration of external fixation .main complication being the pin tract infection pin placement must be given due consideration to ensure successful outcome.,^{[22] [23]} Dynamic Axial Fixator is a safe, reliable device provides adequate initial stability, gives an excellent easy accessibility for the management of soft tissue injuries, and early reconstruction of the soft tissue with a flap to cover the exposed bone significantly reduces the risk of infection ,non union and amputation. [24] [25][26] Open fractures are surgical emergencies, that perhaps should be thought as incomplete amputation and one of the basic goals of treating open fractures is to prevent deep infection. Due to the open fracture of the tibia there is a personal and economic loss of staggering proportions, present study included all the patients between 18-60 years of age out of which maximum number of patients were in the age group of 20-40 years. Excellent to good result were obtained in 72%, moderate 18% and poor in 10%. External fixation has been the skeletal stabilization of choice with the lowest reported deep sepsis rates with relatively high rate of fracture union, pin tract infection, malunion, and nonunion have complicated its use but Most complications can be successfully managed without frame removal.^[27] [^{28]} The method of application of the monolateral fixator is simple with better patient compliance and exposure to fluoroscopy is very less. ^[29]Definitive contributing factors for the better results are the experience of the surgeon and patients commitment. Healing and range of motion does not vary much either operated with nail and the external fixation.

CONCLUSIONS

Initial External fixators has been effective and can be one of the choice of fixation in open fractures of tibia especially in comminuted and severe Gustilo-Anderson type III injury, provides adequate stability as there were predictably moderate to good bone and functional results in our series by using LRS type of external fixator. Infection is effectively controlled by proper wound debridement and fracture fixation with LRS type of fixator. Moreover in 90 % of cases the fracture has united and one patient needed revision surgery because of deep infection. LRS external fixator gives an excellent accessibility for the management of soft tissue procedures like skin grafting, myocutaneous flaps and reduces the risk of infection, non union and amputation mean time lessening the economical burden on the patient. Resection of devitalized bone, simultaneous compression of the fracture gap or site and secondary limb lengthening by proximal corticotomy and compression and distraction techniques can be accompanied with the LRS external

fixator with low rates of infection and non-union. In the distal third tibia, due to its subcutaneous location and sparse blood supply and poor muscle coverage, fracture healing is difficult and in such cases external fixator is quite useful. Complications are minimal, with good range of movements at knee and ankle. LRS external fixation technique is often successful in salvaging limbs which otherwise would have been at high risk for amputation.

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Author Information

Vijay C

Assistant Professor, Department of Orthopaedics, Adichunchanagiri Institute of Medical Sciences

Mahendra Kumar K L

Assistant Professor, Department of Orthopaedics, Adichunchanagiri Institute of Medical Sciences

Manjappa C N

Associate Professor, Department of Orthopaedics, Adichunchanagiri Institute of Medical Sciences