ORIGINAL RESEARCH PAPER

Orthopaedics

EVALUATION OF ROLE OF LIMB RECONSTRUCTION SYSTEM FIXATOR (LRS) IN MANAGEMENT OF NONUNION TIBIA WITH IMPLANT FAILURE

KEY WORDS: Tibia non union, LRS fixator, ASAMI classification, Bone transport

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ABSTRACT

Introduction; The management of non-unions tibia pose many challenge to the orthopedic surgeons. Challenges include recalcitrant infection, complex deformities, sclerotic bone ends, large bone gaps, shortening, and joint stiffness. Improper management leads to multiple surgeries and disability in patients. The ASAMI classification helps decide treatment. Co-morbid factors such as smoking, diabetes, non steroidal anti-inflammatory drug use, and hypo vitaminosis D influence the choice and duration of treatment External fixation using limb reconstruction system (LRS) is one of the options in the management of these conditions. Compression at nonunion site achieves union. It can be combined with a corticotomy at a distant site for equalization. Soft tissue deficit has to be covered by flaps, either local or microvascular. Bone gaps are best filled with the reliable technique of bone transport. Regenerate bone may be formed proximally, distally, or at both sites. Acute compression can fill bone gaps and may need a fibular resection. When bone ends dock, union may be achieved by vertical or horizontal compression. **Case Series;** We are presenting a series of 03 cases of non-union tibia with implant failure managed with LRS fixator. 02 patients were managed initially with AO external fixator, one with plating. Out of three cases, two cases were non infected non unions and one case was infective non unions. All the three patients were managed secondarily with LRS fixator with less complications and good outcome. **Conclusion;** LRS fixator is one of the best options in the management of both infective and non-infective non unions of the tibia. It helps in both compression and distraction in a single frame with minimal complications. It gives good stability in the bone which helps in early weight bearing and adjacent joint range of motion.

INTRODUCTION

Infected nonunion of tibia and femur are common in clinical practice. Some coexisting problems usually complicate the nonunion including persistent infection, bone and soft tissue loss, limb-length inequalities, deformity, and joint stiffness [1, 2]. Several different surgical treatment options have been proposed, including bone grafting [3], free tissue transfer [4] and Ilizarov methods [5].

Chances of infection and non union are very high in tibia being subcutaneous bone, having less vascularity. Inability to achieve union in a fracture of long bone for a period of 8 to 9 months after the trauma due to persistent infection is supposed to be the infected non Union. [6, 7]Many a times compound fracture tibia are managed by external fixator or internal fixation [8]by nail or plate with open or closed reduction, lands in infection that may be responsible for non-union.

Recently limb reconstruction system has been used to treat the infected non-union after resection of infected and sclerosed bone at the fracture ends creating a bone gap, antibiotic spacer application and doing the bone transport from either end of the tibia. ASAMI classification is commonly used. We present a case series of tibia non unions and their management using LRS fixator.

Table 1: Asami Classification Of Non-unions

A- Aseptic nonunion without bone defect
- A1 Mobile (atrophic/hypo-trophic)
- A2 Stiff without deformity (hypertrophic)
- A3 Stiff with deformity (hypertrophic)

B- Aseptic nonunion with bone defect
- B1 Length of limb preserved with bone defect
- B2 Segment in contact with shortening of limb
- B3 Combined shortening with defect

C- Infected nonunion

Case Series;

Case 1

A 25 year old female presented with complaints of pain, deformity and difficulty in walking with history of RTA with no distal neurovascular deficit. X-rays of the tibia showed middle third shaft tibia fracture with gap in fracture margin (ASAMI type A.A3) with implant in situ (plate). Initially patient was operated somewhere with conventional plate. After 7 month of initial surgery, the patient came with deformity, was admitted and planned for implant removal followed by soft tissue release and proximal tibia coticotomy followed by LRS fixator. Full weight bearing was started from the second post-operative day after the LRS fixation. The compression of the non-union site was started at rate of 1mm per day after one week using compression distraction (CD) devise. The regular follow-up X-rays were taken to assess the compression and union at the non-union site. At 6 months, the non-union got united without any complications and the LRS fixator was removed followed by PTB pop cast application. Cast removed after 9 month. (Figure 1)

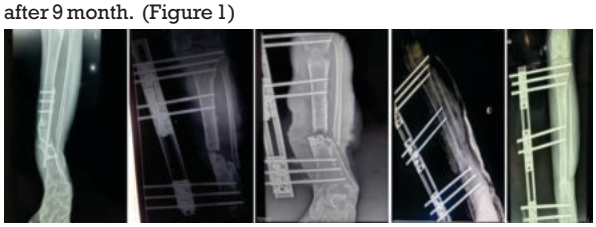

Figure 1; (Pre-op X-ray With Plating, Post-op Day1, Post-op 3 Month, Post-op 6 Month, Post Op 9 Month)

Case 2

A 23 years old male presented with complaints of pain, swelling in the left leg and difficulty in walking. Patient had a RTA. On examination, there was tenderness present with no DNVD. X-ray showed left tibial fibula comminuted shaft fracture (ASAMI type B.B1). Initial fixation was done with C clamp external fixator, debridement of wound was done and VAC was applied. Daily pin tract dressing and knee ROM was started. After one month, skin grafting of the wound was done. After 8 month, Patient was then admitted and operated with implant removal followed by LRS fixation of left tibia with proximal tibial corticotomy. Patient was mobilized with full weight bearing from second post-operative day. The non-union site was united by six months, and the fixator was removed (Figure 2)

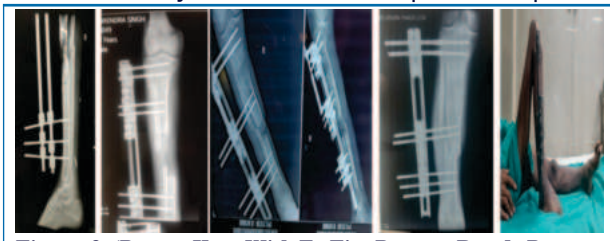

Figure 2; (Pre-op Xray With Ex Fix, Post-op Day 1, Post-op 3 Month, Post-op 6 Month, Knee Rom)

At present one and half years follow-up, the patient is having good knee and ankle range of motion with no pain and difficulty in walking.

Case 3

A 34 year-old male presented with complaints of pain, swelling and wound (1×1 cm) over the right knee and difficulty in walking with history of RTA with no distal neurovascular deficit. Patient was stabilized and Proper wound wash was given and antibiotics were started. X-rays of the tibia showed proximal tibia fracture (ASAMI type A.A1). There was no history of diabetes or hypertension. Initially patient was operated for proximal tibia fracture with antero-lateral plate. After 5 month of initial surgery, the patient came for follow up with pus discharge from wound site. Antibiotics were started according to culture report. Patient was admitted and planned for implant removal with wound debridement and necrotic bone excision followed by LRS fixation. After 2 months of debridement, distal cortico-tomy was done once wound healed. Full weight bearing was started from the 2 weeks after the LRS fixation. The compression of the non-union site was started after one week using compression distraction (CD) devise. The regular follow-up X-rays were taken to assess the compression and union at the non-union site. At 6 months, the non-union got united without any complications and the LRS fixator was removed (Figure 1)

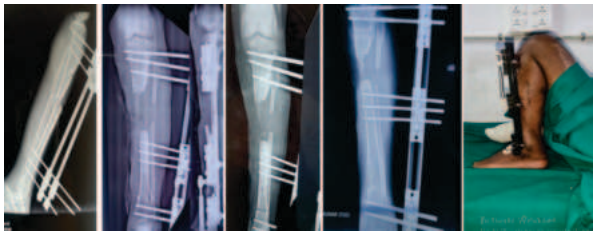

Figure 3; (Pre-op Xray With Ex Fix, Post-op Day 1, Post-op 3 Month, Post-op 6 Month, Knee Rom)

RESULTS

A total of 3 cases were treated by rail external fixators in the Department of Orthopaedics, N.S.C.B. Medical College, Jabalpur.

Post-operative knee movement started within 1 week. Partial weight-bearing was allowed in 6 weeks. Quadriceps and hamstring exercises were started within 2–3 days of operation.

The union ranges from 3 to 12 months but maximum union was achieved in 5–8 months in all cases.

DISCUSSION

The management of non-unions is always the challenge to the orthopedic surgeons. It requires proper expertise in that field. Improper management leads to multiple surgeries and disability in patients

Management of infected non-union is aimed to control the infection and to promote union at the fracture site with a proper alignment of the fracture fragments along with the maintenance of normal length and restoration of movements at the adjacent joints and getting a fully functional and painless limb. The biology of compression distraction osteo-genesis of bone and soft tissue is the basis of treatment using rail fixator for fracture, deformities, non-union, etc. The distraction on tensile force at the corticotomy site, the lining cells covering the bone ends are able to differentiate into osteogenic and chondrogenic cells under an adequate stimulus and environment and are called as osteosynthesis or intramembranous ossification. [8] This type of regeneration of bone can be obtained by an appropriate distraction rate. This rate appears to be critical in the new bone formation and maintenance of adequate blood supply. [9,10] The segment of infected bone was resected till the bleeding ends appear (paprika sign). [11] Distraction osteogenesis was done at the rate of 1 mm / day in 4 steps to fill the gap. [12] It took around 4 weeks to 17 weeks depending upon the length of excised bone. [13]

In the present study, mono planar external fixator was used and appropriate rhythmical distraction was done. About all cases showed good periosteal tube of new bone formation. The site chosen for the osteotomy should ideally, be metaphyseal or immediately sub-metaphyseal, since this is a wider and more vascular region and has been shown to have better osteogenic potential than the diaphysis.

LRS is easy to handle and apply in comparison to ilizarov fixator, though that is also equally good to achieve union in infected nonunion cases but LRS is compatible, light weighted simple design and short learning curve to apply. Wound care is easy and permits early mobilisation and rehabilitation. It provides more stability because of the tapered pins. Advantage of rail fixator include less invasive surgery, early weight-bearing, less infection, less blood loss, prevention of disuse osteoporosis and atrophy, preservation of limb function, and no need for bone grafting.

CONCLUSION

Limb reconstruction system (LRS) fixator is one of the best options in the management of both infective and non-infective non unions of the tibia. It helps in both compression and distraction in a single frame with minimal complications. It gives good stability in the bone which helps in early weight bearing and adjacent joint range of motion. This mono-planer rail fixator not only provides corticotomy, bone transport, fusion of the bone ends and finally consolidation of the regenerate on itself but also facilitates in dealing with limb length discrepancies, along with early mobilization and easy dressing of the wound. It's simple method of bone transport on CD device and being light weight makes patient more compliant for this exhaustive duration.

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