TREATMENT OF INFECTED NON-UNION OF LONG BONES WITH MONOLATERAL EXTERNAL FIXATION (LRS)Hanume Gowda S. N¹, Archana G²**HOW TO CITE THIS ARTICLE:**

Hanume Gowda S. N, Archana G. "Treatment of Infected Non-Union of Long Bones with Monolateral External Fixation (LRS)". Journal of Evolution of Medical and Dental Sciences 2014; Vol. 3, Issue 14, April 07; Page: 3582-3588, DOI: 10.14260/jemds/2014/2324

ABSTRACT: Infected non-union has been defined as a state of failure of union and persistent infection at the fracture site for 6-8months¹ and union is not likely to occur without active intervention. Infected non-union has been a challenge in orthopaedic surgical care. Open debridement of the infected non-union site appropriate antibiotics and stabilization of fracture are the basic principles of treatment in an infected non-union. Internal fixation of such fracture is fraught with recurrence and or persistence of infection as the implant so placed will act as a foreign body. The best way to stabilize such a fracture is with an external fixation. External fixation so used should not only stabilize the fracture but should also take the cyclical loading of day to day activities and also weight bearing. **MATERIALS AND METHODS:** In this study 18 cases of infected non-union of long bones were treated from 2009 to 2012. Their age ranged from 22 to 51. There were 13 male and 5 female patients. Basic principles followed in the treatment. 1. Elimination of infection by physical debridement removal of implants if any and antibiotic treatment based on culture sensitivity reports. 2. Stabilization of fracture to give the fracture area rest and allow it to heal. 3. Restoration of function of the limb and also the adjacent joints. **RESULTS:** 17 of the 18 patients had good results. Patient had to be treated with amputation as the infection was severe. **CONCLUSION:** Based on our study, experience and also after reviewing the published reports we conclude that "Best treatment for infection is Prevention". Treatment infected non-union is a long drawn battle. It needs an aggressive approach and a lot of patience from the patient. Basic treatment protocol for infected non-union is thorough debridement, removal of all infected material including the internal fixation devices. Long duration antibiotics treatment as per the culture and sensitivity pattern. Fracture stabilized with external fixation. Monolateral external fixators like LRS are equally effective and a good modality of treatment in infected non-union of long bone fractures. Treatment of Infected non-union of long bones using monolateral external fixation (LRS)-A prospective Study

KEYWORDS: LRS, Monolateral external Fixation, Infected Non-union.

INTRODUCTION: Infected non-union has been defined as a state of failure of union and persistent infection at the fracture site for 6-8months¹ and union is not likely to occur without active intervention. Infected non-union has been a challenge in orthopaedic surgical care. It is two problems rolled into one. Surgeon and the patient needs to exercise at most patience as the treatment will be long drawn and may need multiple operative procedures.

At times and control of infection and fracture union may not be possible in spite of very good care. The suffering for patient is so severe in some cases that ablation /amputation may be one of the treatment options to save the life of the patient.²⁻⁴ Limb salvage and reconstruction is always the primary goal and is preferred to amputation.

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Infected non-union is associated with multiple problems like osteomyelitis, bone and soft tissue distortion and loss, sinuses, osteopenia, joint stiffness and multidrug-resistant and at times multibacterial infection.¹

Open debridement of the infected non-union site appropriate antibiotics and stabilization of fracture are the basic principles of treatment in an infected non-union.

Internal fixation of such fracture is fraught with recurrence and or persistence of infection as the implant so placed will act as a foreign body. Colonization of bacteria on the implant cannot be eliminated as the antibiotics will not reach non vascular areas.

The best way to stabilize such a fracture is with an external fixation. External fixation so used should not only stabilize the fracture but should also take the cyclical loading of day to day activities and also weight bearing. Ilizarov ring fixator, LRS and Orthofix are the implants that can serve the above purpose.

We have used the easier and more patient friendly uniplanar LRS system to treat the infected non-union in our study.

MATERIALS AND METHODS: 18 cases of infected non-union of long bones were treated from 2009 to 2012. Their age ranged from 22 to 51. There were 13 male and 5 female patients. Of the 18 fracture 6 were open fractures to start with and all of them were tibial fractures. Of the 6 femur fractures which were treated with inter locking nail 4 had open reduction and 2 closed nailing. There were 8 tibial fractures 7 femoral fractures and 3 humerus fractures with established infected non-union.

All patients were assessed and diagnosed as established infected non-union with draining sinuses. All patients had post traumatic fractures and had surgeries in the form of internal fixation. All of them except one patient had metal implants when they were received for treatment. All tibial fractures were treated with interlocking nail 5 femur fractures were treated with interlocking nails. 2 femur fractures and all 3 humerus fractures were treated with Plating.

Basic principles followed in the treatment of infected non-union are:

1. Elimination of infection by physical debridement removal of implants if any and antibiotic treatment based on culture sensitivity reports.
2. Stabilisation of fracture to give the fracture area rest and allow it to heal.
3. Restoration of function of the limb and also the adjacent joints.

Treatment protocol followed:

1. All patients underwent X-rays of the affected limbs.
2. Blood Investigations were done to detect any systemic illness. Appropriate treated started preoperatively.
3. Under anaesthesia all internal metal implants were removed.
4. Deep tissue biopsy, Grams stain and culture to identify the infecting organism and its sensitivity pattern was sent.
5. Through debridement was done excising all the infected and unhealthy soft tissue and bone till fresh bleeding was seen. Washed with antiseptic solution.
6. All of them were fixed and stabilised with LRS- Uniplanar external fixators

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7. All wounds were closed tight and drained with suction drain for a minimum period of 48hrs and a maximum period of 72 hrs. depending on the amount of drainage.
8. Post operatively antibiotics were given parenteral for 2 weeks and oral for a further 4 weeks.
9. They were treated as inpatients for 4-8 days.
10. All were encouraged to use the limb post operatively to full range of movements and full function. Lower limb fractures were made to walk weight bearing as early as pain was tolerable.
11. Follow-up was done till complete union of the fracture along with elimination of infection. End result was to have a fully functional limb with no infection.

Images 1-4 Infected non-union of femur treated with LRS:

Image 1

Image 2

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Image 3

Image 4

Image 5 & 6 infected shaft of Humerus fracture treated with LRS:

Image 5

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Image 6

RESULTS: 17 of the 18 patients had good results. 1 patient had to be treated with amputation as the infection was severe and diabetic control was not possible due to persistent infection and patient developed septicemia. Below knee amputation was done.

Of the 17 patients who healed 14(82%) had good and 3(18%) had fair results.

The average shortening was about 1cms. Average time taken to control the infection was 4 weeks ranging from 2 weeks to 10 weeks. Average time taken for the fracture to heal was 7 months ranging from 4 to 13 months. Femur took the shortest average time at 7 months to heal and tibia took 11 months on an average humerus took 8 months to heal on average.

The faster healing of femur was probably because of better vascularity due to good soft tissue coverage and tibia being subcutaneous bone at most of its length took longer time to heal as vascularity is low.

There were 6 pin tract infections in 4 patients 5 settled with local treatment and antibiotics 1 pin had to be replaced.

DISCUSSION: Non-union of fracture is a difficult situation to manage, when associated with infection it becomes one of the most difficult clinical situation in orthopedics. With multiple procedures described and followed world over it becomes difficult to follow a path in treating infected non-union. Prevention of infection in any fracture surgery is very important.

Once infected the treatment has to be aggressive. All infected tissue and implants has to be removed. Thorough debridement of the infected area is of at most importance. This reduces the load of infection.⁵⁻¹⁰ Removal of internal fixation devices is mandatory as micro-organisms colonize on these implants. Antibiotics do not reach the implant surface leading to persistent infection.

Antibiotics should be used according to the organism grown and its sensitivity pattern. We recommend 6 weeks of antibiotics⁸ of which 3-4 weeks intravenous and remaining period oral antibiotics occasionally a longer duration may be required. This extended antibiotic is recommended in recalcitrant infections. Repeated debridement may be required in few infected non-unions.

Stabilization of fracture is very important for control of infection. Stabilization can be either internal fixation or through external devices. Infection of infection control is better with external stabilization than internal fixation. Persistent infection is noted with internal fixation because of colonization of organisms on such implant.^{1, 9} So we recommend external fixation over internal

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fixation^{1, 9, 11, 12} External fixators span the infected area giving stability to the fracture but without any contact with the already infected area. Only drawback is discomfort for the patient as there is an implant on the limb. With a well counseled patient it is not a major problem.

Full weight bearing walking is encouraged to help in healing the fracture. Early return to full function will also improve the morale of the patient. Patient is encouraged to walk full weight bearing and also advised to move all the joints to full range of motion.

Commonest complication is a pin tract infection.¹³ Regular follow up will ensure identification of infection at the earliest. Constant care of the external device and the pin tract is mandatory and needs participation from the patient.

Educating the patient and making them responsible for the complication will help for a good participation from the patient. Pin tract care twice daily with antiseptic lotion is advised and goes a long way preventing the infection. Good personal hygiene of the patient should be insisted upon.

The goal of treatment in infected non-unions is a patient with full functional limb with no deformities, healed fracture having no residual infection⁷

CONCLUSION: Based on our study, experience and also after reviewing the published reports we conclude that “Best treatment for infection is Prevention”. All care must be taken to prevent infections in orthopaedic surgeries. Selection of cases and deft handling of soft tissues go a long way in preventing infection.

Treatment of infected non-union is a long drawn battle. It needs an aggressive approach and a lot of patience from the patient.

Basic treatment protocol for infected non-union is thorough debridement, removal of all infected material including the internal fixation devices. Long duration antibiotics treatment as per the culture and sensitivity pattern. Fracture stabilized with external fixation.

Monolateral external fixators like LRS are equally effective and a good modality of treatment in infected non-union of long bone fractures.

LRS adds the advantage of easy to apply and maintain along with full weight bearing during the treatment period. This helps physiologically to heal the fracture and allows the patient to be active.

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Date of Submission: 10/03/2014.
Date of Peer Review: 11/03/2014.
Date of Acceptance: 017/03/2014.
Date of Publishing: 01/04/2014.