

Management of Massive Bone Gap in a Case of Infected Nonunion of Tibia by Distraction Osteogenesis

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Introduction

Treatment of infected gap non-unions of tibia can be challenging. Subcutaneous bone causes susceptibility to non-responsive infection, nonunion, fibrosis, sinuses, deformities, shortening and various other sets of problems which are associated with it. Different methods of treatment have been recommended for management of infected non-unions. The first is the "conventional" or classic method. The objectives of the conventional method are to convert an infected and draining nonunion into one that has not drained for several months and to promote healing of the nonunion by bone grafting. This method of treatment often requires one or more years to complete and usually results in stiffness of adjacent joints. The objective of the second i.e. active method is to obtain bony union early and shorten the period of convalescence and preserve motion in the adjacent joints. After restoration of bony continuity, all devitalized and infected bone and soft tissues are removed. Then the fragments are aligned and stabilized, usually by an external fixation device [1].

Distraction osteogenesis refers to the production of new bone between vascular bone surfaces created by an osteotomy and separated by gradual distraction. Distraction osteogenesis and bone transport can be successfully accomplished with use of a ring external fixator, monolateral fixator, halfpin frame or with intramedullary nails.. The stiffness and stability of a fixator system are dependent on many variables, including the diameter of the wires, the number of wires used, the tension on each wire, the diameter of the rings, the number of rings used, and the spacing between the rings [2].

Living tissue when subjected to slow steady traction becomes metabolically activated in both the biosynthetic and proliferative pathways. These principles when used with circular external fixator and an appropriately planned and managed surgery allow to achieve repair of extensive defects of bones, nerves, vessels and soft tissues without need for grafting and in one operative stage, limb lengthening, correction of long bone and joint deformities and treatment of infected non unions [3].

Pin tract infection, joint stiffness, muscle contractures, joint subluxation, axial deviation, neurological or vascular insult, premature consolidation, delayed consolidation, refracture, and difficulties with psychological adjustment are the complications associated with this technique. As experience grows, these complications can be reduced to minimum. Good patient compliance is a must as duration of fixator is long and multiple procedures may be undertaken [4].

The conventional methods of treatment of infected gap non-unions of tibia often require prolonged time to complete and are associated with many complications like stiffness of joints, persistent deformity and limb length discrepancy. The distraction osteogenesis method has the potential to correct infection, deformity, bone and soft tissue loss and limb length discrepancy simultaneously.

Material and Methods

We present a case of infected nonunion of tibia with a gap of 13 cm after debridement of necrotic bone. The patient was 30 years male, treated by distraction osteogenesis using Ilizarov ring fixator. Mode

of injury was road traffic accident. He sustained open fracture of both bones of left leg. He had associated injuries in the form of fractures of both bones of contra-lateral (right) leg, fracture of shaft of femur and fracture of neck of femur of ipsilateral (left) lower limb. Duration of nonunion was 1.5 months.

Patient was encouraged for limb elevation and active and passive mobilization of the joints. Infection control was attempted with appropriate antibiotics and wound debridement. Patient was shown the fixator and informed in detail as to what procedures we were going to perform on him. The requirements of other subsequent minor/major procedures were explained to him. The approximate period of treatment was explained to him. This period of treatment was informed to him as one centimeter of bone gap requires minimum 1 month of fixator.

Assessment of the clinical and radiological status of the fracture was done. Patient was taken up for surgery as soon as he was fit for anaesthesia. Fractures were stabilized with ring fixator. Four rings and 4 rods were applied. Pre-operative frame construction was done to save time during surgery. Ring measurements were taken by measuring the greatest circumference of the limb with additional two finger breadth increments for ring skin clearance. Care was taken to provide adequate clearance posteriorly. 1.8 mm wires were used for bone fixation. Corticotomy was done in the distal metaphyseal region.

Patient was encouraged to ambulate from the first post-operative day with crutch walking and partial weight bearing. He was taught pin care and method of distraction. Exercises were advised to him to prevent contracture and stiffness. Distraction was started on 7th day at the rate of 1 mm/day, 0.25 mm 4 times a day. Sutures were removed on the 14th post-operative day. The patient was followed up at monthly intervals. At each clinical follow up, he was assessed clinically and radiologically. Assessment of complications like muscle contractures, joint subluxation, axial deviation, neurological or vascular insult, premature consolidation, delayed consolidation, refracture and pin-site infection was done at each follow up visit. Assessment of quality of regenerate was done by plain radiography at monthly intervals. Physiotherapy was mandatory during the entire treatment period. Patient was encouraged full weight bearing during the entire treatment period. Frame was dynamized before removal. Implant was removed after achieving union at fracture site and consolidation at corticotomy site. Final assessment for bone results and functional results was done using Association for the Study and Application of the Methods of Ilizarov (ASAMI) Scoring System (Figure 1-4).

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Figure 1: Preoperative radiograph.



Figure 2: Intra-operative photograph showing 13 cm gap after debridement.

Results

Union was achieved primarily without any bone grafting. The time in external fixator was 16 months and the external fixator index was 1.2 months/cm. As per ASAMI Scoring System, excellent bony and good functional results were achieved. The only complication observed during the treatment period was superficial pin tract infection in 4 pins which was managed conservatively with oral antibiotics and pin site dressing.

Conclusion

Large bone gaps after debridement are commonly encountered in the treatment of infected nonunions of tibia. Numerous techniques are now available for treatment of such defects. Large defects with complex soft-tissue problems can be managed by distraction osteogenesis. Circular frames are particularly useful for more complex problems.

Restoration of satisfactory limb function is the main aim and if there is extensive soft-tissue damage, amputation may be preferable. Limb salvage in large bone defects should only be attempted in motivated individuals since a good outcome requires extensive patient cooperation and understanding. The treatment is long, difficult and fraught with complications that must be recognized and dealt with if success is to be achieved. The surgeon should set realistic goals both for himself and his patients while offering this method of treatment and one must not forget that an excellent bone result does not guarantee a good functional result, which depends on the condition of nerves, vessels, joints and bones (Figures 4-6).

The conventional methods of treatment of infected gap nonunions of tibia often require prolonged time to complete and are associated with many complications. Distraction osteogenesis using Ilizarov external fixator is an efficient and reliable solution for infected nonunions with massive bone gaps.

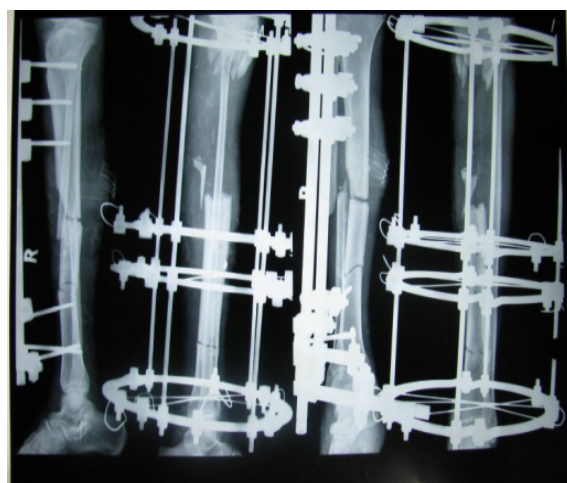


Figure 3: Immediate post-operative radiographs of left leg.

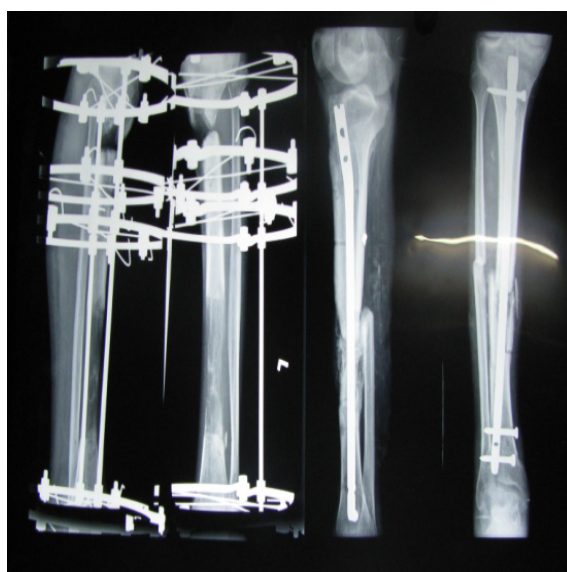


Figure 4: Radiographs at 6 months follow up (showing Ilizarov ring fixator on left side and interlocking nail on right side).

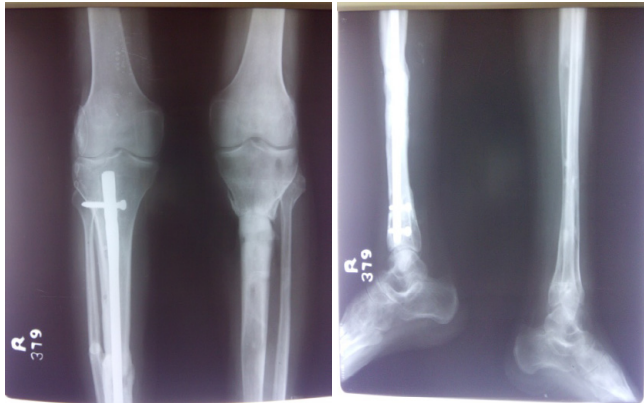


Figure 5: Radiographs at final follow up.



Figure 6: Clinical photographs at final follow up.

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