Management of Nonunion of Tibia by Ilizarov Technique

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Abstract

This prospective study was carried out during the period of January 2007 to December 2011 in Mymensingh Medical College Hospital and other private clinics of Mymensingh town to assess the results of Ilizarov technice for nonunion of the tibia. Here total operated patient were 30, of them 24 were male and 6 were female. 10 cases are hypertrophic, 8 cases are atrophic and 12 cases are infected nonunion. In this series age of the patients was 10 – 60 years. Motor vehicle accident was the commonest cause of fracture found in 66.67% cases. Second most common cause of injury was fall from height. Among 30 patients proximal corticotomy was done in 24 patient and distal corticomy in 2 patient. Union time was 4-12 months. Among 30 patients 27 were united at initial procedure. From nonunited 3 cases again refreshening of the ends along with bone grafting was done and ultimately 2 were united and 1 remains nonunited. In this series limb length discrepancy reduced to maximum 1.5 cm with contralateral limbs. Average total hospital stay was 15 days. Pin site infection and pain were the commonest complications in our study. Close adherences to Ilizarov principles make it now possible to successfully treat a most of orthopaedic conditions that previously were fraught with high morbidity rates and poor results.

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Introduction

Infected non-union and gap non-union are great challenge for the orthopaedic surgeons. Though many procedures like radical debridement, flaps, bone grafting are used. none of these are satisfactory and the morbidity is high during treatment.[1-3] Internal fixation with dynamic compression plate (DCP) or interlocking nail (ILN) is impossible due to the gap at the non-union site, defective quality of bone or the presence of infection. In these conditions external fixator is the treatment of choice, especially the ring fixator of Ilizarov[4-7]. With this apparatus inter- calary bone transport is possible along with soft tissue transport, resulting to eliminate the gap and soft tissue cover without any significant leg length discrepancy. With this techniques resection of infected tissue and sequestrated bone and defect produced by it can be reconstructed by intercalary bone transport, compression and distraction technique. Ilizarov technique for complex nounions has a high rate of success in achieving union and eradicating infection, bone loss and malalignment. It produces excellent results where the existing methods are failed to achieve union. The results of treatment were healing of the nonunion, functional recovery of the limb, correction of leg length discrepancy with recovery of mechanical axis.

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Methods

Total 30 patients, 24 males & 6 females, aged 10-60 years (mean age 32 years), with 12 cases of infected non-union of tibia were treated between January 2007 to December 2011 in Mymensingh Medical College Hospital and other private clinics of Mymensingh town. The average duration of non-union was one and half years. The commonest cause being open fracture of tibia and the commonest site the ower 1/3rd. In children chronic osteomyelitis is another common cause. Wound swab for culture and sensitivity was sent in all the infected cases. After preparation the debridement and sequestrectomy was done and the Ilizarov ring fixator, transport assembly, was applied, leaving behind a gap ranging from 2cms to 8cms (mean 4.5cms. The patient remained on non weight bearing for about three weeks till soft tissue healing. Appropriate antibiotics were given. Transport took place at the rate of 1mm/day, till docking was achieved, with partial weight bearing. Knee and ankle exercise was continued from day one. If a navigation wire was used that should be removed after full achievement of docking. Patients remained on frame till the regenerate got consolidated and union occured at the docking site. After frame removal, above knee slab was applied for two weeks without weight bearing and then patellar weight bearing cast for four weeks in some cases. Patients were followed-up for at least six months and advised gait training.

Operative Procedure

After complete pre-operative investigations & pre-anesthetic assessment by anaesthesiologist the patients were placed on operating table. Usually spinal anaesthesia had been given to all adult patients and general anaesthesia in children . After draping all patients were underwent complete resection of the infected/dead bone, debridement of the soft tissue, and lavage. At the nonunion site longitudinal anterior skin incision was given in 21 patients and a curvilinear-shaped incision in the remaining 9 patients. Part of the fibula at the nonunion site was resected to facilitate the process of acute compression. A preassembled Ilizarov ring fixator was applied around the leg. A 4 or 5-rings apparatus was usually used: 2 or 3 rings in proximal segment and 2 rings in distal segment. Pairs of 1.8-mm wires were placed in the proximal tibia with adequate tensioning at the proximal 1st ring, a second ring was placed below the level of proximal corticotomy with a pair of tensioned wires; a third pair of wires connected to an intermediate ring was placed 5 cm proximal to the distal end of the proximal fragment. A navigation wire was introduced into the medullary cavity from distal to proximal segment in some cases.. Acute compression of the defect site was achieved by approximating the distal segment with the proximal segment. The distal segment of the limb was stabilised by placing fourth and fifth rings with a pair of adequately tensioned transosseous wires. In some cases distally U shaped half ring were applied, when full ring application did not pqssible. Acute compression was maintained after verifying the approximation between the segments and checking the alignment of the bone under an image intensifier. We had need 1.8mm plain wires at diaphysis and olive tip at metaphysis. Then getting reduction in all planes, rings proximal and distal to fracture site fastened with threaded rods. Sometimes, we used drops wires and attached them with the help of posts to rings. Corticotomy was done in between 1st and 2nd rings.

All the rings were larger by 2-fingers breath to the diameter of leg over anterior aspect and 3-fingers breath to posterior aspect of leg. While inserting the wires, they were first gently pushed upto the bone through skin and then drilled with power drill. As soon as they come out through other cortex, they were hammered gently to get out to other side. Muscles were at their maximum length while inserting the pins and all the wires were passed through safe zones. The wire sites were dressed with povidone Iodine solution soaked gauzes.

Preoperative X-ray 48 years old man

Post operative X-ray after 2 weeks

Post operative X-ray after 6 weeks

Post operative X-ray after 9 months

Postoperative Photograph after 9 months

Postoperative Management

Parentral antibiotics was given upto 3rd – 4th day and then orally. Check x-rays were done on next day and adjustments were done on 2nd or 3rd day if required. To attain gradual simultaneous limb lengthening and to restore loss of length at the defect, acute compression of the site was followed by distration at proximal site of metaphyseal corticotcotomy On 10th postoperative day the corticotomy site was distracted at a rate of 1 mm per day. The rate of distraction was modified according to the quality of the regenerate formation. All patients underwent active physiotherapy of the knee and ankle. If maximum compression at the fracture site occurred then stop the compression and only distraction at corticotomy site if needed. Transmetatarsal half-ring wire stabilisation was performed to prevent equinus deformity associated with gradual distraction if required. Removal of stiches done on 12th POD. The patient remained on non weight bearing for about three weeks till soft tissue healing. Patients were allowed with partial weight bearing

walking if they were tolerated and docking site compression was completed. Gradually they were allowed to full weight bearing walking. Patients were trained for daily wash of fixator, pins, pin care and mobility of joints and quadriceps excercises.
The Ilizarov ring fixator was removed after complete consolidation of the regenerate and fracture union. The time taken to accomplish radiographic and clinical union was recorded and all difficulties (such as hardware complications, pin tract infections, wound infections, and malalignment) were noted. Patients were followed up every 2 weeks until consolidation. The frames were removed once full healing was achieved, and the limbs immobilised in a patellar tendon-bearing cast for one month in some cases.

Results

Union was achieved at the docking site in 27 cases at the time of frame removal i.e. 4-12 months. Among the nonunited 3 patients 3 needed refreshening of bone at the docking site along bone graft and ultmate union has been acheived in 2 cases. All the patients were satisfied except one 60 years old who had severe osteoarthritis of knee. Pin tract infection occurred in 12 the patients; appropriate antibiotic was given. The infection subsided in all the cases.

Discussion

Infected non-union and gap non-union is difficult to treat and is a challenging problem for the orthopaedic surgeon. It usually leads to residual deformity, persistent infection, contracture and worst a useless limb[8]. Many methods have been applied to treat in this situation e.g. radical debridement, local flaps, muscle flaps, bone grafting, tibiofibular synostosis, cancellous allograft, fibrin mixed with antibiotics, antibiotic beads, micro vascular flaps and vascularized bone transplants. All have improved results but none has been able to fully solve this clinical situation[1]. Following conventional treatment with bone grafting, plate and screw osteosynthesis, external fixation or prolong cast immobilization amputation frequency was 10%[3]. By using of Ilizarov technique this frequency seems lower, but not all the amputation can be avoided[3-5]. The Ilizarov ring fixator gives an option of compression, distraction and bone transport, and is effective in the treatment of infected non-union of tibia where other types of treatment have failed[7]. The Ilizarov apparatus is axially elastic and as the weight bearing forces are directly applied to the bone ends, maintaining the weight bearing function of the extremity actually becomes one of the prerequisites for the success of the method. The cyclic axial telescoping mobility, not rigidity, at the non-union or fracture site is an important requirement for the formation of a repairative callus. Ilizarov experimentally showed that when gradual distraction tension stress is applied to the corti- cotomy site, the vascularity of the entire limb is increased, which in turn enhances the ability of the bone ends to unite[7]. In a study performed by Tranquilli et al in Italy on 20 patients with non-union of tibia, the result was union in all the cases; mean time of union being 4.5 months[9]. In another study Marsh et al showed union in 40 out of 46 non-union cases treated with Ilizarov method, with a high level of patient satisfaction[10]. In our study union occured in 29 cases out of 30 and result was excellent. Menon and associates also concluded in their study that there is a role of Ilizarov ring fixator with nail retention in resistant long bone diaphyseal non-union and that this method could achieve high union rates where other methods failed[11]. Several modifications have undergone to increase the efficacy of treatment with Ilizarov method and patient.s acceptability, e.g. Rozbruch et al. used a computer prog-rammable Ilizarov Spatial frame in two cases of hyper- trophic non-union of tibia

with deformity for which distraction was utilized, yielding noticeable results[12]. The duration of frame application is a disadvantage but when all other treatment modalities have failed, this technique is probably the only alternative and the only hope for many suffering patients, though the patients. compliance is important for a successful outcome.

Conclusion

The conclusion derived from this study is that Ilizarov technique is the demanding treatment of infected non-union of tibia and nonunion of tibia with leg length discrepancy.

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