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Managing bone loss with rail road external fixator & bone transport: A case report

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Abstract
Gap non-union of long bones is a challenging problem in modern world, due to the limitation of conventional reconstructive techniques more so if associated with infection and soft tissue defect. Bone transport is on of the technique that restores normal autologous bone to the defect site, but this can be a long process. Using two osteotomy sites allows for more rapid recovery of length and this is well tolerated. Bone transport can often be used to close soft tissue defects thereby reducing the need for free tissue transfer.
We report a case of 55-year-old man, laborer by occupation, had H/O Road Traffic Accident and had Gustilo Anderson Type IIIb fracture of Right Tibial Diaphysis 5 years back.

Keywords: Nonunion, tibia fracture, Paley classification, rail road fixator, bone transport

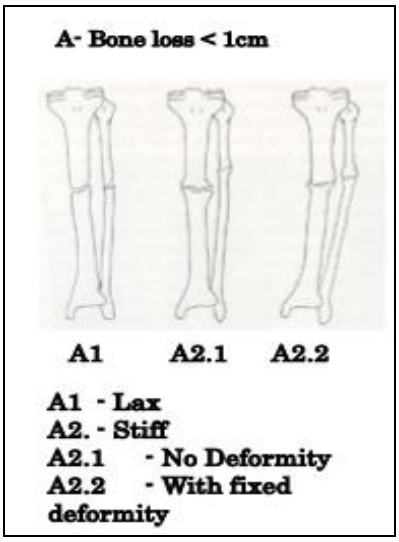
1. Introduction
Non-union with bone loss of long bones is a challenging problem, requiring serious attention with the rising incidences [1] of high-velocity trauma. The conventional treatment options include autograft with non-vascularized fibula strut graft [2] and cancellous bone grafting, vascularized bone graft [3] and bone transportation [4, 5]. All these techniques are highly demanding, on the part of surgeons as they require high learning curve [4, 5] and hospital infrastructure requiring specialized instrumentations [3], which emphasize their limitations. Very few options remain with the presence of associated significant skin loss or infection where complication and failure rate further increases and solution often lies in amputation. Problem further intensifies in the developing countries where facilities and expertise are not readily available and the surgeon has to rely on simple techniques of treatment. a monolateral external fixator has advantages with being located to one side of the limb, is usually easier to apply and remove and has greater patient acceptance [6, 7].

2. Material & Methods
Our study include case study of 55-year-old male, labourer, had history of road traffic accident 5 years back where he sustained Gustilo Anderson IIIb fracture of his Right Tibia Diaphysis and segmental fibular fractures with tibia bone loss of around 5cm in proximal 1/3rd region.
He was treated with Ilizarov external fixator at some tertiary centre along with debridement. Thereafter Multiple debridements was done at same centre to control the infection. Later on after around 6 months' area of skin loss was managed by flap coverage in some other hospital and removal of Ilizarov frame. Thereafter, patient went to some other hospital and there he was put Above knee cast, after that patient was able to walk, but with some amount of shortening.
He presented at OPD of Dept. of Orthopaedics, Mahatma Gandhi Medical College, Jaipur on Dec 2017. PTB was removed and on examination, painless abnormal mobility both at sagittal and coronal plane at fracture site +, skin condition was good, no discharging sinus, Flap uptake was also adequate, Scar mark + along edges of flap, no distal neurovascular deficit, shortening + of 7cm. After thorough cleaning of the whole extremity and due to financial condition of patient, after 1-month patient was planned for Rail Road Fixator along with bone transport. Informed written consent was obtained from the patient and their guardians.

3. Result

Fig 1: X-ray at the time of presentation (Dec 2017)

This was classified according to Paley classification as Type B3.



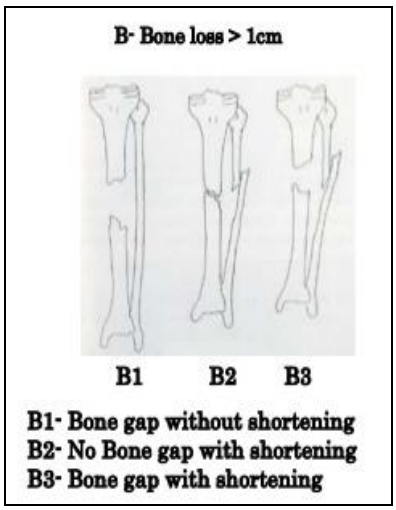


Fig 2: Paley Classification of non-union of Long Bones

Fig 3: X-ray 1 month after presentation (Jan 2018)

Fig 4: Immediate Post-Operative X-ray (Jan 2018)

Sutures were removed 12th day postoperatively. Stitch line was healthy. Patient was allowed partial weight beating with the help of walker at that time and and full weight bearing was done after complete union. Limb shortening was well managed by Shoe raise. Distraction of 1mm/day was started at this phase of in two divided stages of 0.5mm every 12 hr. Patient was discharged 3 week postoperatively and he was counselled about the technique of distraction. Monthly follow-up was done.

Fig 5: X-ray after Bone Transport (3 months post-operative)

Fig 6: Final X-ray (9 months post-operative)

Fixator and TENS nail was removed at 9-months post operatively and bone grafting was done by using Ipsilateral Iliac crest bone graft in the same sitting. Closure was done and above knee slab was applied. Suture were removed at 12th postoperative day and PTB cast was applied.
Shortening at 9 months postoperatively was 2.5 cm which was managed by shoe raise alone.

4. Discussion

Treatment for infected non-union improved with the use of the Ilizarov technique and the principle of distraction histogenesis is well documented in literature. The use of external fixation in managing infected non-union is established [8, 9].
The principle of tension-stress describes the response of tissue when put under gradual stretch, in certain conditions, that leads to generation of new tissue (bone, muscle, tendon, nerve, fascia, vessels, skin and its appendages) [10].
The Ilizarov technique produces an increase in the blood supply of the affected bone through biological stimulation at the corticotomy site. In osteomyelitis, debridement and sequestrectomy produces a bone gap. The use of external fixation in managing infected non-union is established [9, 10].
The rail fixation system (S. H. Pitkar Ortho tools, Pune, India) is a uniplanar, dynamised external fixator system based on the principle of distraction histogenesis. The mechanical stability is provided by the tapered pins and variable placement of sliding clamps. In being uniplanar, it cannot be used easily to correct three-dimensional deformities as with a circular fixator but, conversely, allows easy access for secondary plastic surgical procedures. It is more patient-friendly; compression and distraction across a fracture or osteotomy site is simpler than with a circular external fixator [11].
The Rail Fixation System is designed primarily for bone transport for reconstructing bone loss following open fracture and sequestrectomy following osteomyelitis. This system provides correction in these situations through the techniques of bone transport, compression-distraction and bifocal lengthening. Most of series mentioned in literature about distraction histogenesis are on tibia [12-15].
Despite many obstacles, rail fixator provided a reliable method to treat bone gap and achieve union. But filling of bone gap and union does not guarantee good functional result. The functional result is affected by condition of the nerve, muscles, vessels, joints, and bone.

5. Conclusion

In case with bone loss due to open fracture and infected non-union in Tibia fracture, rail fixator is a good option to achieve union and to restore limb length and function of the limb. Rail Road fixator was well-tolerated by the patient, thereby proving it to be a good alternative to Ilizarov. However, education of patient for compliance is must before deciding to go ahead with this procedure, as it may take several months to achieve the desired results.

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