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STRESS FRACTURE AT DOCKING SITE AFTER BONE TRANSPORT MANAGED WITH INTRAMEDULLARY INTERLOCKING NAIL AND ILIAC AUTOGRAFT - A RARE CASE REPORT

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ABSTRACT **INTRODUCTION :** Distraction osteogenesis was introduced by Ilizarov and further developed by Cataneo et al. The concept of formation of new bone and soft tissues from distraction osteogenesis and freshening the sclerosed bone ends by corticotomy for stronger bony union and consolidation is applied here. **CASE REPORT :** Here we present a rare case of young adult operated by tibial bone transport using monolateral external fixator, who presented to us after refracture near the docking site. We managed this patient with intramedullary reamed nailing and iliac crest autografting, showing good bony union and functional outcome at 3 months postoperatively. **CONCLUSION :** Thus from previous literature and our case findings, we conclude that re-fractures and other complications of bone transport can be effectively managed by intramedullary reamed nailing leading to good bony union and fracture consolidation. The intramedullary nail provides rigid stability to both new bone regenerate due to callotasis and union at docking sit, significantlydecreased rates of future refractures. This significantly decreases patients morbidity and delivering satisfactory functional outcome.

KEYWORDS : Bone transport, stress fracture, callotasis, Limb reconstruction system (LRS), bone grafting, tibia interlocking nail.

INTRODUCTION:

Distraction osteogenesis was introduced by Ilizarov and further developed by Cataneo et al. The concept of formation of new bone and soft tissues from distraction osteogenesis and freshening the sclerosed bone ends by corticotomy for stronger bony union and consolidation is applied here. The new bone formed here though mechanically stronger than formed after bone grafting, carries a risk of refracture after removal of fixator at docking site. A metaphyseal percutaneous osteotomy preserving the endosteum, adequate contact of bone ends at osteotomy site, latency period before distraction begins and rhythmic distraction at 1mm per day was recommended by Ilizarov.[1,2]

Distraction osteogenesis consists of three phases as latency period, distraction and consolidation. The standard rate of distraction osteogenesis is accepted to be 1 mm per day. Decreased rates can predispose to premature consolidation of the regenerate and increased rates can break the callotasis.[2,3]

The use of monolateral external fixator like LRS which is light in weight and simple to use, achieves similar result like circular fixators by callus distraction called callotasis after subperiosteal osteotomy. There is less soft tissue injury due to additional pins and leads to early mobilization with good compliance.[4]

The complications of bone transport include re-fracture at callotasis site, re-fracture at docking site, delayed union or non union of compression site, failure of distraction osteogenesis, deformity of newly formed bone column, axial deviation, soft tissue and joint stiffness and infections. Intramedullary nailing is a great solution to treat these complications. Some literatures have suggested combined external fixator with intramedullary nailing but this carries risk of deep infections of 3-15% with heavy metal hardware and non compliance by patient.[4,5]

CASE REPORT:

A 23 years old male, came with pain in left leg since 1 day after a trivial fall. Patient was previously operated for left tibia bone transport using monolateral LRS external fixator 14 months back for a compound grade 3c tibia shaft fracture and was removed after 8 months as seen in X rays of fig.1. On X rays, left tibia shaft fracture at junction of docking site as in fig.2. We did reamed intramedullary tibia interlock nailing with iliac crest bone grafting. Immediate postoperatively, patient was full weight bearing on walker. At postoperative day 12 weeks, we see good bony healing and fracture consolidation with satisfactory functional outcome.

Figure 1 : X rays immediately after removal of tibial LRS showing good bone regenerate distally and adequate bony union at docking site.

Figure 2 : X rays after trivial fall showing refracture at docking site.

Figure 3 : Postoperative X rays at 8 weeks showing adequate callus formation and bony union.

Figure 4 : Clinical pictures at 8 weeks postoperative showing good functional outcome.

DISCUSSION:

Bone transport is mainly done for long bone defects or limb length discrepancy in management of cases like compound fractures with bone loss, infected non unions and osteomyelitis. This has been managed well with monolateral or circular external fixator. In cases of defects more than 5 cms, allograft bone transfer, vascularised bone grafts or bone transport by external fixator with or without an intramedullary interlocking nail.[4]

Papakostidis et al demonstrated 5% re-fractures and 2.9% amputation rates after use of Ilizarov fixation for managing lower limb defects, out of which most of the amputation were surprisingly on patients request due to poor compliance and tolerability to prolonged external fixation. On other hand, early removal of external fixators hampers strength of bony regenerate predisposing to refractures.[3]

There has been limited reasearch on management of complications of callotasis by intramedullary nailing in literature.[4]

The consolidation phase after bone transport can take upto 2 months per centimeters of lengthening. This prolonged time of treatment can increase infection, cause joint stiffness and psychological stress on patients. This new bone and union at docking site are prone to re-fractures if external fixator is removed prematurely due to lack of internal stabilization. The incidences of re-fractures have been 8-10% in literature.[2,6]

Most of the refractures occurred at the junction of regenerate bone and normal bone.[7]

The use of intramedullary nailing with use of allograft at site of distraction was described by Wassertstein and Correl. Conventionally, plaster casts or plating or increasing the duration of external fixation has been tried but with little success. The use of locking intramedullary nailing in such conditions give superior rotational stability and increased comfort when compared with external fixators and plaster casts in mature skeleton. Lengthening procedures done with external fixators over an intramedullary nail or prolonging the duration of external fixation has shown increased incidence of infection. The use of reamed nails causes increased blood flow and the bone debris can act as bone graft.[8]

Insertion of reamed intramedullary nails during consolidation phase, have also shown to decrease time of external fixation. This also prevents any undesirable deformity or stress fractures and fasten bone healing due to regenerate reaming and superior stability. Intramedullary reaming has also been hypothesized to play a role in activation of growth factors, angiogenic factors, extracellular matrix proteins and bone morphogenic proteins and other inflammatory response.[2]

The reaming of medullary canal stimulates formation of periosteal new bone due to increased periosteal blood flow. Osteoblasts and multipotent stem cells in reamed debris act as good bone graft with superior osteoinductive properties. The new bone formed after reaming showed increased bone mineral content and density as researched by Utvag et al, which increased bone healing.[2,9]

Lambiris et al postulated that distraction osteogenesis can be disturbed by an intramedullary nail. Hence, its better to do nailing after the end of bone lengthening phase.[6]

As Ilizarov stated, loading of distracted segment for several weeks before removal of fixator frame enhances bone healing and consolidation has been supported by Aldegheri, Renzi Brivio and Agostini et al. Bone grafts are useful in cases of re-fractures and non unions of bone transport to hasten bone healing and union.[7,10]

The use of intramedullary lengthening rods or telescoping nails have shown increased risk of infection, increased soft tissue contractures, equinus deformity and are more expensive.[3,5]

Conclusion :

Thus from previous literature and our case findings, we conclude that re-fractures and other complications of bone transport can be effectively managed by intramedullary reamed nailing leading to good bony union and fracture consolidation. The intramedullary nail provides rigid stability to both new bone regenerate due to callotasis and union at docking site, significantly decreased rates of future refractures. This significantly decreases patients morbidity and delivering satisfactory functional outcome.

Intramedullary nail aligns the deformity by giving intramedullary splintage and facilitates secondary union. It also prevents any stress riser at fracture site.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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