

## CASE REPORT

## Tibio-fibular synostosis - a viable option in the management of segmental tibial loss: case report

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## INTRODUCTION

Gap non-union of the tibia with infection and extensive scarring creates a challenging clinical situation for treatment.<sup>1</sup> Management of the gap non-union is technically difficult, time-consuming, physically and psychologically demanding for the patient with unpredictable clinical outcome. The problem involves bridging or regenerating areas of bone loss while maintaining limb length and alignment.<sup>2</sup>

## ABSTRACT

Segmental tibia loss resulting in gap non-union presents a major challenge to the orthopaedic surgeon, especially when associated with infection, old or active osteomyelitis, and multiple previous surgeries. This is made rather worse in the presence of extensive skin and soft tissue scarring. Several options of treatment have been proposed with the most recent advance being the Ilizarov technique. However, in the face of extensive skin and soft tissue scarring especially in the anterior and antero-medial portions of the leg, bone transport becomes almost impossible and resort to other methods of treatment become handy.

We report a case of segmental tibial loss in a 26-year-old man who presented to the outpatient clinic with a two-year history of gap non-union of the right tibia (8cm) following a road traffic accident. This was complicated by a chronic ulcer seating on scar tissue with extensive skin and soft tissue scarification and muscle atrophy. He was successfully managed by proximal tibio-fibular synostosis with radiological evidence of distal tibio-fibular synostosis. Limb length and alignment were fully restored.

**Keywords:** Antibiotics, bone graft, gap non-union, Kirschner wire, segmental

being covered by muscles all around, usually escapes segmental loss and also unites easily. Several different techniques have been described for treatment of these defects including the Papineau technique, allograft reconstruction, bone transport using the Ilizarov frame, free vascularized fibular graft, tibio-fibular synostosis and medial transport of the fibula with Tuli's technique, use of the Ilizarov frame, and Huntington's procedure.<sup>3</sup> The non-union may persist despite a series of reconstructive procedures, with external fixation, internal fixation (plate or intramedullary rods), bone grafting, plastic surgery and Ilizarov frame application. The patient may require multiple surgeries and sometimes, the surgeon is left with no option, but secondary amputation or disarticulation.

#### CASE REPORT

A male apprentice, aged 26years, presented to our centre in 2014 with the history of difficulty in walking with the left leg following a rider motorcycle road traffic accident which occurred 2years earlier.

He was hit from the back while on a motorcycle by a vehicle prompting him to lose control of his motorcycle. He, subsequently, ran into an oncoming vehicle and had a head-on collision. He fell on the tarred road along an expressway in Anambra State, South-East Nigeria.

He bled moderately from a wound site on the left lower limb, which had a bone sticking out, and was unable to stand or walk, but did not lose consciousness, have seizures or epistaxis. The patient was transferred immediately to a nearby hospital where the wound was sutured and bandaged. He was in the hospital for 1week before the relatives decided to take him to a traditional bone setter's home. At this place, concoctions were applied on the limb and the limb stabilised on sticks. He was reassured that the wound would heal.

Later, an ulcer developed on the leg, with subsequent discharge of purulent effluent, which continued until presentation. He

noticed he could not walk well and was then brought to Nnamdi Azikiwe University Teaching Hospital, Nnewi, South-East Nigeria for expert management. He was not a known diabetic, hypertensive, epileptic, asthmatic or sickle cell disease patient.

Clinical examination at presentation revealed a young man in no distress, afebrile, not pale and well hydrated, who had an ulcer measuring 3x6cm, in dimension, on the anterior medial surface of the middle 1/3<sup>rd</sup> of the leg. The floor of the ulcer was filled with purulent exudate and was sitting on scar tissue with contractures of the surrounding skin and soft tissues, with severe muscle atrophy. Other systems were essentially normal.

A left leg radiograph showed an 8cm loss on the middle 1/3<sup>rd</sup> of the left tibia with decreased bone density and atrophic tibial fragments (*Figure 1*).

Figure 1. Pre-op radiograph



A diagnosis of chronic leg ulcer and gap non-union of left tibia was made with the following problems: chronic leg ulcer, skin and soft tissue contractures, severe muscle atrophy, loss of middle 1/3<sup>rd</sup> of left tibia (8cm) and bone fragments with decreased density

He was admitted on antibiotics and haematinics and daily wound dressing using hydrogen peroxide and *Edinburgh University Solution of Lime (EUSOL)*. The patient was also instructed on non-weight bearing on the left leg.

After 3 weeks on admission, he had a left tibio-fibular synostosis of the proximal tibia fragment using screws and Kirschner wire, and cancellous bone grafting. The other findings included osteoporotic tibial fragments, hypertrophied left fibula and left tibial bone loss of 8cm with atrophic tapered bone ends. He was commenced on intravenous antibiotics, analgesics and haematinics.

An above-knee protective plaster cast with window for dressing was applied. He was discharged after a subsequent 4 weeks on non-weight bearing crutch ambulation. The Kirschner wires were removed on the 12<sup>th</sup> week after surgery and *Plaster of Paris* cast changed to scotch cast. Six months post-operatively, he commenced partial weight bearing on the limb (*Figure 2*), and by 11 months, he was mobilized on full weight bearing with crutches, to continue on follow-up.

Figure 2. Radiograph taken 6 months post-op



At the last follow-up visit, the ulcer had healed with a scar and constriction over the middle 1/3<sup>rd</sup> of the leg. Radiographic findings were consolidation of the points of synostosis and hypertrophy of the fibula. The

subsequent follow-up visit for screw extraction was scheduled after another 6 months (*Figures 3, 4 and 5*).

Figure 3. Radiograph taken 12 months post-op



Figure 4. The leg, 18 months post-op



Figure 5. Standing on the leg, 18 months post-op



## DISCUSSION

Tibio-fibular synostosis as an option of treatment of segmental tibial loss is very effective, especially in the presence of extensive skin and soft tissue scarring complicating significant gap non-union of the tibia. There are many advantages of this procedure: ipsilateral fibular transfer is an easy, simple, inexpensive biological procedure that does not require microvascular skills. The procedure is restricted to the same limb, unlike those cases in which the opposite fibula is used as a vascularized graft. This helps reduce morbidity. The shorter operating time and the fact that the graft retains its blood supply may help to reduce infection, improving its chances of union and accelerating the process of hypertrophy.<sup>4,7</sup>

Medialization of the ipsilateral fibula (Huntington's procedure) can be performed by a trained orthopaedic surgeon even in hospitals with moderate infrastructure. A large graft of the ipsilateral fibula raised on a pedicle of the peroneal artery, aligned and fixed to the tibia in its posterior long axis, provides a sound mechanical and biological basis for the union.<sup>5</sup> The fibula is surrounded by muscles all around and has abundant vascular supply from the nutrient branch of the peroneal artery with circular anastomosis of the musculo-periosteal vessels, which support union at the synostotic site.<sup>5,6</sup> When the fibula is subjected to more than normal weight-bearing stresses, it undergoes hypertrophy and becomes an integral part of the static supporting architecture of the leg.<sup>8</sup>

In 1944, Huntington popularized a procedure for treatment of tibial defects in children, which he described as a two-stage procedure.<sup>8,9</sup> However, we did a single-stage procedure because of the nature of the fragments, scarring and fibrosis of the tissues and the presence of some measure of synostosis of the distal tibia[L] fragment with the fibula.

The fibula placed centrally in the weight-bearing axis in the medullary cavity of the

tibia seems to be more biomechanically sound than synostosis of the fibula to the tibia in its lateral eccentric position, both in children and adults.<sup>5</sup> However, in patients with extensive scarring and fibrosis, it is too difficult to mobilize the fibula centrally, without excessive periosteal stripping, thus, jeopardizing the blood supply. Furthermore, there is no need to touch or handle the scarred or infected gap area, as surgical incision and procedure is restricted away from the infected non-union site. Even the area of circumferential scarring can be left as such, without performing a substantial plastic procedure like free flap or cross leg flap.

## CONCLUSION

Huntington's procedure is a safe and simple salvage procedure and remains an excellent option for treating difficult infected nonunion of the tibia in selected indications. The Huntington's procedure is still a viable option for salvaging gap non-union of the tibia. The use of fibular grafts in the management of defects of long bones is a relatively straightforward procedure, requiring no microsurgical expertise. This procedure is effective, but, for optimal results the treatment needs to be individualized by the treating surgeon, with due consideration for soft tissue coverage, socioeconomic factors, and available expertise.

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