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Interests of Ilizarov technique in limb salvage for 3 weeks old open tibia fibula fracture in low-income country: A case reports

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Abstract
We aimed to report outcome of a limb salvage of 3 weeks open infected tibia fibula fracture treated by Ilizarov external fixator (IEF). A male 42-year-old male, had sustained a motorcycle accident leading to a midshaft open type IIIB comminuted tibia fibula fracture. In face of poor prognosis, after 10 days, due to inadequate wound care, the orthopedic team made a decision to amputate the leg. In the context of lack of means, the patient has been transferred to a community hospital at Kpalime, town located at 120km from Togo's capital in other to be managed by a team of trip missionary. After three procedures and intensives wound care associated to appropriate antibiotic, the consolidation was achieved at 6 months. A year follow up showed healing without infection. Patient walked with a limp and no cane. A combination of a stronger immune system, proper external fixation with adequate compression and thorough wound care treatments allowed this patient to keep his leg and perform daily activities.

Keywords: Ilizarov technique, open IIIB tibia fracture, delayed management, Africa

1. Introduction
Open tibial fractures are very common in our clinical setting, especially Gustilo Anderson IIIB/C open fractures, which are mostly high-energy injuries [1]. They are often associated with wound infection, soft tissue necrosis, bone nonunion, and osteomyelitis, and in extreme cases, even amputation is required [1-3]. Thus, considering the complications and wide array of treatment requirements and options, the management of these fractures poses a great challenge for orthopedic surgeons, microscopic surgeons, and plastic surgeons [3, 4]. The challenge is particulary high, in the low-income country where health insurance is not mandatory and most of patient have to pay directly for their treatment [1, 3]. In this context, we aimed to report a limb salvage using Ilizarov external fixator (IEF) in a 3 weeks old open tibia fibula comminuted fracture.

2. Case presentation
This is a case presentation of a 42-year-old male motorcycle driver, had sustained a motorcycle accident leading to a midshaft open type IIIB comminuted tibia fibula fracture (42-C3). The patient presented to the surgical emergency room in the teaching hospital of Sylvanus Olympio of Lome, about 12 hours after the trauma (Fig. 1).
Due to the characteristic of the fracture as well as its clinical appearance, initial treatment was performed almost after 24h post trauma. It included: initial wound dressing, iv amoxicillin acid clavulanic (1gx3 per day) relayed by PO and a "card board" posterior splint. Due to the lack of materials, the dressing was just changed every day while the patient waited a support from his family. The poor prognosis of the fracture, the orthopedic department made a decision to amputate the left lower extremity after about 10 days. At that time a surgical team from Miami was planned for a trip missionary in a community hospital of Kpalime (smaller city located at 120km in north west of Togo's capital).

Fig 1:
1A: Clinical aspect of open IIIB tibia fracture with loss skin and intra medullary exposition
1B and 1C: X-ray view of tibia and fibula showing displaced complex tibia shaft fracture 42-C3

This team once arrival, discussed with the orthopaedic surgeon and a brief description of the patient was given to them. The goal was to try to salvage the leg. There are palpable pulses distal to the traula and the leg still appeared to have decent blood flow, no vascular changes were noted to the extremity and despite mild purulence at the open site, the tissues still appeared viable. There was some granulation tissue and very little necrosis. The patient was taken to surgery that same afternoon. The procedure consisted on abundant irrigation and washing, debridement of necrosis soft tissues and bone, smooth reaming of distal tibia segment, distal traction and realignment applied and fixation bone by IEF (Fig. 2). The knee and ankle were free of motion. Intra operative blood site sample was took for cyto-bacteriologic test. In post-operative, the negative pressure wound therapy (Fig. 3) was applied to the open site.

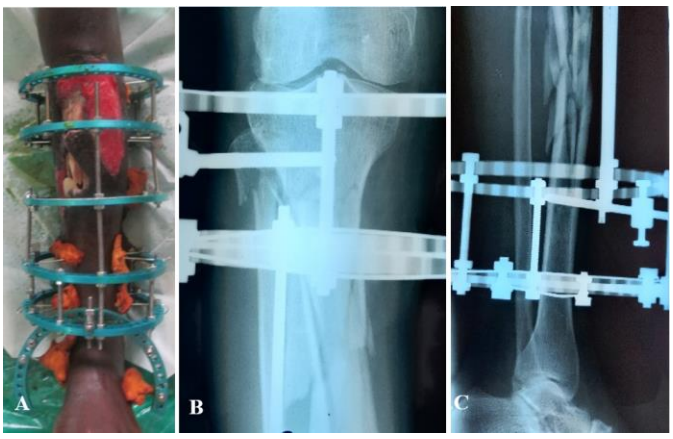

Fig 2:
2-A: Clinical aspect in post-operative, Multi segment ring external fixator used to maintain distal traction and alignment
2-B, C: X-ray view showing tibia alignment in post-operative

A bacteria, Staphylococcus aureus was isolated from the sample and specific antibiotics iv relayed per os was administrated. Various types of dressings were applied like negative pressure wound therapy was applied (Fig. 3A) over the course of the next couple of weeks but mostly wet to dry betadine. A secondary procedure was performed, when there was no more purulent flow, to cover the bone exposed by hemi-soleus flap (Fig. 3B). This was followed 10 days after by skin graft (Fig. 3C, D).

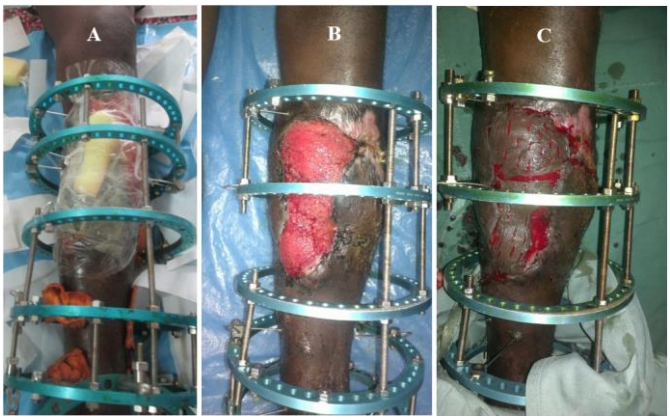

Fig 3:
A: Negative pressure wound therapy applied in post-operative.
B: Clinical aspect 3 months postoperative with frame intact and good healthy granulation tissue coverage after hemi-soleus flap
C: Clinical aspect after of split thickness skin graft from the thigh

A motion of above and below joint maintained by physiotherapy during all process. Soft tissues healing was occurred at 3 months. There were any pin-tract infections. Partial weight bearing was allowed at 3 months under use of cane. Bone healing was obtained after 6 months with sepsis persistence. The IEF was removed at the 6 months mark and the patient was placed in a cast for one month. After a year follow up the was no sepsis. The patient walked with a limp and no canes (fig 4 A, B). The swelling is uncontrolled but compression stockings was added. The X-ray after year showed bone callus without alignment (fig. 4C).

Fig 4:
A, B: Clinical aspect in walking.
C, D: AP and lateral X-ray view showing consolidation after one-year follow-up

3. Discussion

In our setting the IEF wasn't available until the mission trip arrived to Togo. This was a benefit type of collaboration between developing country and low-income country. It had been a really transfer of skills and donation of equipment which give us opportunity and chance to improve management of complicated patients.
Infection rates in open fractures have been reported to be as high as 50 % with amputation rates as high as 30 % [4]. In our case-report, this fracture with intramedullary canal exposure and purulence could be describe as osteomyelitis as it can be.

In a low-income country the complications are also often related to insufficient logistics: implant and all surgical material are paid by patient or family support, late presentation at hospital [1, 3] As open IIIB tibia fracture, the emergency debridement was done in golden period (24hrs) for our patient. Literatures data indicate that after the 24-hour period and up to 4 days, the risk of infection remains relatively constant independent of the time to debridement [1, 4]. However, immobilization by a "card board" posterior splint was inadequate and not rigid. It permitted micro movement which promote inflammation and so infection. Otherwise insufficient wound care which was just changed without irrigation had contributed also to infection despite the oral antibiotic maintained. This oral antibiotic combined with good immune system of patient had probably be helpful to avoid systemic infection.

Treatment options may be limited, especially when open type IIB fractures of tibia are complicated with osteomyelitis or infected non-union [5]. The paramount principle of treatment in this case will be a creation of a suitable environment for healing. This should be obtained by aggressive debridement of nonviable tissues, and stabilization with an IEF, and delayed closure is a sound of treatment method for such injuries [1]. The IEF have been used to achieve fracture union as well as wound closure by wound negative therapy, soleus flap and skin graft. The stabilization by Ilizarov method had been the best option in this case comparatively to monoplane external fixation as it confirmed in the literature [6, 7]. In context of open tibia fracture infected the Ilizarov external fixation provide many advantages. These include : keeping the tibia alignment and fewer indications for rotational, gave access to wound for further free flap wound coverage, less need for amputation, enabled above and below joints motions [1, 7]. In addition, the surgery is performed using percutaneous technique with limited exposure to minimize soft tissue trauma. Post operatively the frame allows adjustability as well early weight bearing through axially dynamized stable fixation [6, 8].

The wound negative therapy had contributed to make the site free of purulence before applying flap. However, the ideal timing and method of wound management prior to flap coverage is debatable [9]. The coverage by soleus flap was performed in optimal condition which lead to wound healing for our patient. Pin tract infections form the bulk of complications associated with IEF, [6, 10]. Our patient didn't have any pin tract probably due to repeated and intensive wound care during all the hospital staying and follow up.

The Ilizarov surgery in open type IIIB fracture have a higher union rate less chance of infection and obscure amputation of limb [6, 8]. Our patient had consolidation in 7 months with persistence infection which was healed after a year. Despite the limp this outcome could be considered as good according the high risk of amputation. The to achieve bone union was in agreement with loss bone and soft tissue as it confirmed by Wani and *et al.* [6]. Indeed, this may be related to the severity of trauma in the former and secondary after resection of necrotic infected bone and soft tissue which lead to significant loss of structure and also loss of blood supply to the bone.

4. Conclusion

The Ilizarov external fixator is a versatile instrument in the armentarium of an orthopedic surgeon. It holds great promise in the management of open fracture tibia in the developing countries where complications of these fractures lead to huge disabilities. A combination of a stronger immune system, proper external fixation with adequate compression and thorough wound care treatments allowed this patient to keep his leg and perform daily activities. Very few end up being as lucky as this patient, but education is key in orthopedic and plastic surgery. Donations with transfer of competences are necessary and missions from developing country are one of solutions for improving local setting.

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