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CASE REPORT

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Staged Intramedullary Nailing Following Infection Control and Rotational Flap Coverage in Gustilo–Anderson IIIB Open Tibial Fractures: A Case Series from Tanzania

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ABSTRACT

Background: Management of infected Gustilo–Anderson type IIIB open tibial fractures remains challenging, particularly in resource-limited settings. Successful treatment requires infection eradication, soft-tissue coverage, and stable skeletal fixation.

Methods: Three female patients aged 23–28 years sustained Gustilo–Anderson IIIB open tibial fractures following a high-energy road traffic collision. Initial management consisted of resuscitation according to Advanced Trauma Life Support principles, intravenous antibiotics, surgical debridement, and external fixation. All patients subsequently developed infection with exposed bone. Prolonged wound care using honey dressings and systemic antibiotics was followed by rotational flap coverage and staged reamed intramedullary nailing.

Results: External fixation was maintained for 12–14 weeks before conversion to intramedullary fixation. Radiographic union was observed approximately six months after injury. All patients achieved infection control, fracture union, and independent ambulation. No recurrent infection, draining sinus, clinically significant malalignment, or limb shortening greater than 2 cm was observed. Functional knee range of motion improved to 0°–120° following rehabilitation.

Conclusion: A staged treatment protocol involving aggressive debridement, infection control, rotational flap coverage, and delayed intramedullary nailing can achieve satisfactory outcomes in infected Gustilo–Anderson IIIB tibial fractures, even in low-resource environments.

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Introduction

Open tibial fractures are among the most severe injuries encountered in orthopedic trauma because of the limited soft-tissue coverage surrounding the tibia and the high susceptibility to contamination and infection. High-energy road traffic injuries often produce extensive soft-tissue damage, periosteal stripping, and bone exposure, increasing the risk of delayed union, nonunion, and chronic osteomyelitis [1-3].

Gustilo–Anderson type IIIB fractures are particularly difficult to manage because they require both skeletal stabilization and soft-tissue reconstruction. Despite improvements in trauma care, infection rates remain substantial and frequently lead to prolonged hospitalization, repeated surgical procedures, and socioeconomic hardship [4].

Successful treatment requires adherence to several fundamental principles including early antibiotic administration, meticulous debridement, skeletal stabilization, and timely soft-tissue coverage. Mechanical stability is particularly important because persistent motion at the fracture site contributes to bacterial persistence and impaired healing [5-10].

The purpose of this study was to evaluate the outcomes of a staged treatment protocol involving infection control, rotational flap coverage, and delayed intramedullary nailing in patients with infected Gustilo–Anderson IIIB tibial fractures.

Methods

Study Design

This retrospective case series was conducted at Mbeya Zonal Referral Hospital, Tanzania.

Patients

Three female patients aged 23, 26, and 28 years sustained Gustilo–Anderson type IIIB open tibial fractures following a high-energy road traffic collision. Two patients sustained bilateral fractures, while one sustained a unilateral fracture.

Initial Management

All patients were managed according to Advanced Trauma Life Support (ATLS) guidelines. Initial treatment included:

- Hemodynamic resuscitation
- Blood transfusion when indicated
- Tetanus prophylaxis

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- Intravenous antibiotics
- Surgical debridement
- Temporary stabilization using unilateral external fixation

Definitive Reconstruction

Following development of infection and exposed bone, prolonged wound management was undertaken using systemic antibiotics and honey dressings. Once wounds were suitable for reconstruction, rotational flap coverage was performed. Definitive stabilization was achieved using reamed SIGN intramedullary nails.

Outcome Measures

Primary outcomes included:

- Fracture union
- Infection eradication
- Independent ambulation

Secondary outcomes included:

- Knee range of motion
- Ankle range of motion
- Limb alignment
- Limb length discrepancy

Results

The duration of follow-up ranged from 10 to 12 months.

External fixation remained in place for 12–14 weeks before conversion to intramedullary fixation. Rotational flap coverage successfully achieved soft-tissue closure in all patients.

Radiographic evidence of union was observed approximately six months following injury. No patient developed recurrent infection or persistent draining sinus after definitive fixation.

All patients regained independent ambulation and returned to routine daily activities.

Knee stiffness observed during the period of external fixation improved substantially following physiotherapy. At final follow-up, all patients achieved functional knee motion ranging from 0° to 120°. Residual ankle stiffness remained present, with average dorsiflexion limited to approximately 5°.

No clinically significant malrotation or shortening greater than 2 cm was identified.

Discussion

Infected Gustilo–Anderson IIIB tibial fractures remain among the most challenging conditions in orthopedic trauma surgery because of extensive soft-tissue damage, contamination, compromised vascularity, and instability [11].

Debridement remains the cornerstone of treatment. Cierny and Mader demonstrated that successful eradication of musculoskeletal infection depends primarily upon adequate surgical debridement (8). Similarly, Tetsworth and Cierny emphasized that removal of all nonviable tissue is essential for successful treatment of chronic orthopedic infections [12,13].

Mechanical stability is another critical factor. Hak et al. reported that instability contributes to delayed union and nonunion while also compromising infection control. Although external fixation provides temporary stabilization, definitive intramedullary fixation improves load sharing and facilitates fracture healing [14,15].

Soft-tissue reconstruction is equally important. Gopal et al. introduced the "fix-and-flap" concept and demonstrated improved outcomes when fracture stabilization is combined with vascularized soft-tissue coverage. In the present series, rotational flaps successfully covered exposed bone and contributed to successful limb salvage [16].

The use of honey dressings represented an important adjunct in this resource-limited setting. Honey has recognized antibacterial and wound-healing properties and may assist in wound bed preparation before definitive reconstruction.

The absence of culture and sensitivity testing and local antibiotic delivery systems constituted significant limitations. Nevertheless, satisfactory outcomes were achieved through adherence to fundamental orthopedic principles of debridement, soft-tissue coverage, infection control, and stable fixation [17-19].

Conclusion

A staged treatment strategy consisting of aggressive debridement, prolonged infection control, rotational flap coverage, and delayed reamed intramedullary nailing resulted in successful fracture union and eradication of infection in all patients.

This approach may provide an effective limb-salvage strategy for infected Gustilo–Anderson IIIB tibial fractures in resource-constrained environments.

Declarations

Ethical Approval

Ethical approval was waived because this study reports a retrospective review of patients managed according to standard clinical protocols.

Informed Consent

Written informed consent was obtained from all patients for publication of anonymized clinical information and images.

Conflict of Interest

The author declares no conflict of interest.

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Author Contributions

SL conceived the study, collected data, managed the patients, analyzed outcomes, and prepared the manuscript.

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