Role of the Orthopedic Resident in Emergency Management of Open Tibia Fractures

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Abstract

Open tibia fractures represent one of the most challenging orthopaedic emergencies due to the combination of bony instability, soft tissue compromise, contamination, and frequent association with polytrauma. Early decisions taken in the emergency department critically influence infection rates, limb salvage, union, and long term function. In this setting, the orthopaedic resident functions as the frontline clinician, responsible for initial assessment, classification, emergency stabilization, early antimicrobial therapy, and coordination of definitive multidisciplinary care. This editorial outlines the structured role of the orthopaedic resident in the emergency management of open tibia fractures, emphasizing adherence to Advanced Trauma Life Support (ATLS) principles, meticulous limb evaluation, early recognition of complications, and precise documentation. Beyond traditional Gustilo–Anderson classification, the article highlights the importance of the Ganga Hospital Open Injury Severity Score (GHOISS) as an objective, reproducible tool that aids decision making regarding limb salvage versus amputation. Incorporation of standardized workflows and severity scoring systems empowers residents to deliver timely, ethical, and outcome oriented trauma care while improving communication with senior surgeons and patient families.

Keywords: Open tibia fracture, Orthopaedic resident, Emergency management, ATLS, Ganga Hospital Open Injury Severity Score, Limb salvage

Introduction

The tibia is the most commonly fractured long bone and is particularly prone to open injuries because of its subcutaneous location and limited soft tissue envelope. Open tibia fractures are severe musculoskeletal injuries characterized by a direct communication between the fracture site and the external environment, resulting in a high risk of infection, non union, and limb threatening complications. Prompt and systematic emergency management is therefore paramount.

In most tertiary and teaching hospitals, the orthopaedic resident is the first orthopaedic responder to these injuries. Decisions taken during the initial hours—often termed the "golden period"—have a decisive influence on limb salvage and functional outcome. This editorial reviews the responsibilities of the orthopaedic resident in the emergency department (ED) and advocates a structured approach incorporating modern severity scoring systems, particularly the Ganga Hospital Open Injury Severity Score (GHOISS).

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Initial Assessment and Stabilization: ATLS Based Approach

Management begins with strict adherence to Advanced Trauma Life Support (ATLS) principles, ensuring that life threatening injuries are identified and treated before limb threatening conditions.

Primary Survey

- Airway with cervical spine protection
- Breathing and ventilation
- Circulation with hemorrhage control
- Disability (neurological assessment)
- Exposure with temperature control

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Only after hemodynamic stabilization should focused attention be directed toward the open tibia fracture.

Secondary Survey: Limb Specific Evaluation

History

- Mechanism and energy of injury
- Time since injury
- Environment and contamination (roadside, farm, industrial)
- Pre hospital care
- Comorbidities, medications, and tetanus status

Wound Assessment

- Size, location, and number of wounds
- Degree of contamination
- Soft tissue viability and bone exposure
- Associated crush or degloving injuries

Neurovascular Examination

- Palpation of dorsalis pedis and posterior tibial pulses
- Capillary refill
- Motor and sensory examination of the foot and ankle
- Documentation before and after immobilization

Any evidence of vascular compromise mandates immediate senior and vascular surgery consultation.

Classification of Open Tibia Fractures

Gustilo–Anderson Classification

The Gustilo–Anderson system remains the most widely used classification for open fractures and is essential for guiding early antibiotic therapy and communication.

- Type I: Clean wound <1 cm
- Type II: Wound 1–10 cm with moderate soft tissue injury
- Type III: High energy injury with extensive soft tissue damage
  - o IIIA: Adequate soft tissue coverage
  - o IIIB: Extensive soft tissue loss requiring flap coverage
  - o IIIC: Associated arterial injury requiring repair

Despite its utility, the system suffers from inter observer variability and limited prognostic value in complex limb salvage scenarios.

Ganga Hospital Open Injury Severity Score (GHOISS)

Rationale and Components

The GHOISS was developed to provide an objective and comprehensive assessment of severe open limb injuries, particularly open tibia fractures. It evaluates three key components:

1. Skin and fascia injury
2. Bone and joint injury
3. Muscle, tendon, and neurovascular injury

Additional points are added for contamination, delay in treatment, and systemic factors.

Interpretation

- Score ≤14: Limb salvage likely
- Score 15–17: Borderline salvage
- Score ≥17: High risk of failed salvage; consider primary amputation

Importance for Orthopaedic Residents

For residents, GHOISS provides a structured framework for objective decision making, improves communication with senior surgeons, and facilitates transparent discussions with patients and families regarding prognosis and treatment options.

Emergency Management Principles

Wound Care

- Immediate sterile saline soaked dressing
- Gentle irrigation for gross contamination
- Avoid aggressive debridement in the ED
- Photographic documentation where permitted

Antibiotic Prophylaxis

Antibiotics should be administered within one hour of presentation:

- Type I–II: First generation cephalosporin
- Type III: Cephalosporin plus aminoglycoside
- Farm or heavily contaminated injuries: Add penicillin

Tetanus Prophylaxis

Administer tetanus toxoid with or without immunoglobulin based on immunization status.

Immobilization and Imaging

- Well padded splint immobilization
- AP and lateral radiographs including knee and ankle
- CT scan for complex fracture patterns when indicated

Recognition of Early Complications

Compartment Syndrome

Residents must maintain a high index of suspicion, especially in high energy injuries. Pain out of proportion, pain on passive stretch, and tense compartments require urgent senior review and possible fasciotomy.

Vascular Injury

Absent pulses, expanding hematoma, or ankle–brachial index <0.9 necessitate immediate vascular consultation.

Infection

Early recognition and documentation of infection signs are essential for timely intervention.

Communication and Documentation

Clear communication with patients, families, and the multidisciplinary team is critical. Residents must ensure meticulous documentation of injury details, neurovascular

status, antibiotic timing, classification systems, severity scores, and discussions with senior clinicians.

Conclusion

The orthopaedic resident plays a decisive role in the emergency management of open tibia fractures. A structured approach grounded in ATLS principles, combined with objective severity assessment using GHOISS, enables timely, ethical, and outcome focused care. Incorporation of standardized workflows and scoring systems not only improves clinical outcomes but also strengthens resident training and confidence in managing complex limb threatening injuries.

ATLS-Based Emergency Management Workflow for Open Tibia Fractures

(Role of the Orthopaedic Resident)

ATLS PRIMARY SURVEY (PRIORITY STEP)

Patient with Suspected Open Tibia Fracture Arrives in ED

A – Airway with Cervical Spine Protection
- Secure airway
- Cervical spine immobilization

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B – Breathing & Ventilation
- Oxygen supplementation
- Treat pneumothorax / chest injuries

⬇

C – Circulation & Hemorrhage Control
- IV access (2 large-bore cannulae)
- Control external bleeding
- Assess shock, initiate fluid/blood resuscitation

⬇

D – Disability (Neurological Status)
- GCS assessment
- Rule out head injury

⬇

E – Exposure & Environmental Control
- Complete undressing
- Prevent hypothermia

➡ Life-threatening injuries managed FIRST

Secondary Survey – Limb-Focused Assessment

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Focused History (AMPLE)
- Mechanism (high vs low energy)
- Time of injury
- Contamination (roadside, farm, sewage)
- Comorbidities, drugs, tetanus status

⬇

Local Examination of Open Tibia Wound
- Wound size, location
- Degree of contamination
- Bone exposure
- Soft-tissue loss
- Do NOT probe wound

⬇

Neurovascular Assessment
- Dorsalis pedis & posterior tibial pulses
- Capillary refill
- Motor and sensory examination

⬇

Pain Control
- IV opioids / regional block

Immediate Emergency Interventions

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Sterile Saline-Soaked Dressing Applied

⬇

IV Antibiotics (Within 1 Hour)
- Type I–II: Cefazolin
- Type III: Cefazolin + Aminoglycoside
- Farm/soil contamination: Add Penicillin

⬇

Tetanus Prophylaxis

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Temporary Immobilization
- Above-knee posterior splint

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Radiological Evaluation
- AP & Lateral X-ray (knee to ankle)

Classification & Escalation

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Gustilo–Anderson Classification

⬇

Senior Consultant Alerted

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Shift to GHOISS-Based Decision Making

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Urgent Transfer to OT for Debridement & Stabilization

📌 Orthopaedic resident acts as the coordinator, assessor, and first decision-maker during this entire workflow.

Ganga Hospital Open Injury Severity Score (GHOISS)–Based Decision-Making Flowchart

Post-ATLS & Initial Stabilization

Confirmed Open Tibia Fracture

Apply GHOISS Scoring System

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STEP 1: INDIVIDUAL COMPONENT SCORING

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A. Skin & Fascia Injury Score
- Size of wound
- Degloving / avulsion
- Skin viability

⬇

B. Muscle Injury Score
- Contusion vs crush
- Loss of muscle mass
- Compartment involvement

⬇

C. Bone Injury Score
- Fracture pattern
- Bone loss
- Comminution

⬇

D. Contamination Score
- Clean / road / farm / sewage

⬇

E. Comorbid Factors
- Delay in presentation
- Age, diabetes, smoking

STEP 2: TOTAL GHOISS CALCULATION

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Total GHOISS = Sum of All Component Scores

STEP 3: TREATMENT STRATIFICATION

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GHOISS ≤ 10

🟢 Low-Severity Injury
- Limb salvage favorable
- Early debridement
- Internal fixation possible
- Primary or early soft-tissue closure

⬇

GHOISS 11–16

🔴 Moderate-Severity Injury
- Limb salvage feasible
- Staged debridement
- External fixation preferred
- Planned flap coverage

⬇

GHOISS ≥ 17

🟡 High-Severity Injury
- Poor limb salvage prognosis
- High infection & non-union risk
- Early amputation should be considered
- Multidisciplinary decision (orthopedic, plastic, vascular teams)

STEP 4: COMMUNICATION & DOCUMENTATION

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- Clear discussion with patient & family
- Document GHOISS score
- Medico-legal justification of limb salvage vs amputation

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