Prevention of Infection in Open Fractures

Charalampos G. Zalavras, MD, PhD, FACS

KEYWORDS

• Open fracture • Infection • Antibiotics • Debridement • Soft tissue coverage
• Fracture fixation

KEY POINTS

- Open fractures are challenging injuries and are associated with increased risk for complications, such as infection.
- The goals of open fracture management are prevention of infection, fracture union, and restoration of function.
- Management principles include careful patient and injury assessment, early administration of antibiotics, thorough surgical debridement, wound management with soft tissue coverage, and stable fracture fixation.

INTRODUCTION

Open fractures are often the result of high-energy trauma and may be associated with life-threatening injuries.[1] Open fractures are characterized by definition by soft tissue injury that results in communication of the fracture site with the outside environment and contamination of the fracture site with microorganisms or even introduction of foreign bodies into the wound.[2] Moreover, depending on the severity of injury, there is damage to the surrounding soft tissue envelope and to bone vascularity, which compromises the healing potential, as well as the response of the host defense mechanisms to contaminating microorganisms. As a result, open fractures are associated with increased risk for complications, such as infection and nonunion, and present a challenging problem to the treating physician.

The goals of open fracture management are prevention of infection, fracture union, and restoration of function. These goals are best achieved by careful patient and injury evaluation, early administration of systemic antibiotics supplemented by local delivery of antibiotics in severe injuries, thorough surgical debridement, wound management

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LAC+USC Medical Center, Keck School of Medicine, University of Southern California, 1200 North State Street, GNH 3900, Los Angeles, CA 90033, USA
E-mail address: zalavras@usc.edu

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with soft tissue coverage if needed, and stable fracture fixation. Key principles in prevention of infection following open fractures are summarized in **Box 1**.

EVALUATION AND CLASSIFICATION

Evaluation of Patient and Extremity

Open fractures are often caused by high-energy trauma, such as motor vehicle, motorcycle, and auto versus pedestrian injuries, and may be associated with potentially life-threatening injuries to the head, chest, and abdomen.[1,3] The injury severity score of patients with open diaphyseal fractures of the femur is 18.1 on average.[1] Thorough evaluation of every patient with an open fracture is necessary to diagnose and treat associated injuries, and appropriate resuscitation measures should be initiated on presentation of the patient.

The neurovascular status of the injured extremity should be carefully assessed and documented. The size, location, and degree of gross contamination of the open fracture wound should be evaluated. The wound should be irrigated, gross contamination should be removed, and a sterile dressing should be applied. The treating surgeon should not forget that the complication of compartment syndrome may still develop, despite the presence of the open fracture wound, especially in injuries with a severe crushing component.[4] The fractured extremity should be grossly realigned and immobilized with a splint. Intravenous antibiotic therapy should be started and tetanus prophylaxis should be given depending on the patient's immunization status. Fracture characteristics, such as location, articular involvement, and comminution, should be assessed by imaging studies to plan fixation of the fracture.

Classification of Open Fractures

Open fractures vary in severity depending on the mechanism and energy of injury. Therefore, classification systems of open fractures have been developed to describe the injury, guide treatment, determine prognosis, and compare various treatment methods for research purposes. The classification system of Gustilo and Anderson, subsequently modified by Gustilo, Mendoza, and Williams, has been extensively used (**Box 2**).[5,6] Newer classification systems have also been proposed.[7]

Box 1
Key principles in prevention of infection after open fractures

- Detailed evaluation of patient for associated and potentially life-threatening injuries.
- Systemic antibiotic therapy on patient presentation.
- Intraoperative assessment of severity of injury and classification of open fracture.
- Thorough surgical debridement with removal of all devitalized tissue and foreign bodies.
- Local antibiotic delivery with the bead-pouch technique in severe injuries.
- Primary wound closure is an option for less-severe injuries if only healthy, viable tissue is present in the wound after a meticulous debridement.
- Delayed closure with second-look debridement for more severe injuries.
- Local or free muscle flaps for extensive soft tissue damage.
- Fracture stabilization with appropriate technique based on fracture, soft tissue, and patient characteristics.