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AN IMPALED POTENTIAL UNEXPLODED DEVICE IN THE CIVILIAN TRAUMA SETTING: A CASE REPORT AND REVIEW OF THE LITERATURE

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Abstract—Background: The management of patients with impaled unexploded devices is rare in the civilian setting. However, as the lines of the traditional battlefield are blurred by modern warfare and terrorist activity, emergency providers should be familiar with facility protocols, plans, and contact information of their local resources for unexploded devices. **Case Report:** A 44-year-old male sustained a close-proximity blast injury to his lower extremities while manipulating a mortar-type firework. He presented to the regional trauma center with an open, comminuted distal femur fracture and radiographic evidence of a potential explosive device in his thigh. His management was coordinated with the local Explosive Ordinance Disposal and the fire department. **Why Should an Emergency Physician Be Aware of This?:** Explosive devices pose a grave threat when encountered. Familiarization with protocols to manage these patients can mitigate disaster. Emergency providers should expect and be prepared to coordinate care for these patients. © 2017 Elsevier Inc. All rights reserved.

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INTRODUCTION

Recent terrorist activity has blurred the lines of the battlefield. Mass casualties from unfortunate events in Manchester, England; Paris, France; and Boston, Massachusetts

have taught us that physicians in urban settings should be familiar with the general principles regarding the triage, diagnosis, and management of explosive device injuries. With distance from the explosion epicenter being directly related to lethality, such mass-casualty scenarios produce large variation in morbidity and mortality. All of these patients, including expectant casualties, remain the emergency provider's responsibility (1).

Additionally, emergency physicians need to know how to manage a patient with an impaled unexploded device. Improper management can have catastrophic consequences for the patient, the hospital, and the medical team. The presence of such a device will undeniably cause a heightened state of anxiety, and preparation for such an occurrence can minimize errors (1). We present a case of a patient with an impaled potentially unexploded device in a lower extremity and a review of precautions to take in similar scenarios.

CASE REPORT

A 44-year-old Caucasian male presented to the emergency department of a United States (US) Level I trauma center as a transfer via ground ambulance after he sustained a close-proximity blast injury to his lower extremity while manipulating a mortar-type firework. The patient was reloading the device, after a presumed dud or misfire, when an explosion caused injury to his right leg. He

believed the mortar firework he was loading had propelled into in his leg during the explosion. He was evaluated by Emergency Medical Services (EMS) in the field, where his limb was noted to be grossly unstable with a large anterior soft-tissue wound. A pressure dressing and tourniquet were applied and he was transported to a local, Level IV trauma center. At this facility, the tourniquet was deflated and he was treated with cefazolin, tetanus toxoid, a pressure dressing, and a leg splint. His tourniquet was reapplied to minimize blood loss during his transfer due to continued brisk bleeding from the wound.

The patient arrived in the emergency department of our Level I trauma center, 244 minutes from the time of initial injury. The patient was examined in accordance with Advanced Trauma Life Support protocols. The primary survey was unremarkable. He was noted to have a blood pressure of 119/69 mm Hg, heart rate of 82 beats/min, respiratory rate of 16 breaths/min, oxygen saturation of 99% on room air, and an oral temperature of 97.9°F. On secondary survey, the patient had significant pain localized to his right thigh. The tourniquet and pressure dressing were removed and examination revealed a large grossly contaminated, hemostatic wound on the right anterior thigh (Figure 1). Total tourniquet time was 168 min with a 77-min tourniquet-free interval while at the outside facility. He had palpable dorsalis pedis and posterior tibial pulses with normal motor and sensory examinations. The remainder of his physical examination was unrevealing.

The patient denied comorbid medical conditions. However, his history was significant for a high-velocity gunshot wound sustained 12 years earlier to his right and left thigh with associated vascular injury. These injuries required reconstruction of the superficial femoral artery, four-compartment fasciotomies, and multiple subsequent soft-tissue procedures as a part of his limb salvage. He had no allergies and denied any current medications or supplements.

While in the trauma bay, plain radiographs of the chest and injured extremity were obtained and basic laboratory tests were sent for analysis. Views of his right thigh revealed a comminuted distal femur fracture with multiple impaled radiopaque foreign bodies (Figure 2). Because of the potential explosive nature of the device and concern for the safety of the patient and medical team, the Explosive Ordnance Disposal (EOD) was contacted. The patient was placed in a separate room away from other patients and strict precautions were enacted to minimize the risks associated with a potential explosive device. Specifically, the patient was informed to remain still. The care team avoided transporting, vibrating, or moving the patient and contact was reduced to essential individuals until full identification of the foreign body was made.

In the initial discussion with the EOD, it was determined that an impaled firework did not meet criteria for self-



Figure 1. Photograph of injured extremity.

detonation. They suggested coordination of care with the fire department for safe removal and disposal. The fire department advised thorough irrigation with water and avoidance of electrocautery would be sufficient to avoid explosion during removal. For disposal, they also advised bagging the wet firework to avoid delayed detonation.

The impaled foreign material was removed without complication by orthopaedic surgery. The patient underwent several rounds of debridement and irrigation during admission. After initial external fixation, negative pressure wound therapy, and local antibiotic delivery, the fracture was treated with a retrograde intramedullary implant, and a split-thickness skin graft was used for soft-tissue coverage. He was discharged from the hospital to home after 13 days.

DISCUSSION

Most literature on unexploded devices is derived from unexploded ordnances (UXOs) in the military setting, where such devices are most commonly seen (2,3). UXOs are defined as military munitions that have been primed, fused, or armed and have been fired, dropped, launched, or projected to create hazard for military operations and remain unexploded either by malfunction, design, or any other cause (4). Other unexploded devices can be improvised explosive devices (IEDs), which range from

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