

Management of High-Velocity Injuries of the Head and Neck

Jacob S. Majors, MD^{a,*}, Joseph Brennan, MD^a,
G. Richard Holt, MD, MSE, MPH, MABE, D Bioethics^{a,b}

KEYWORDS

• High-velocity injury • Mass casualty incident • Head and neck surgery

KEY POINTS

- The most recent conflicts in Iraq and Afghanistan have significantly improved understanding of battlefield trauma and how to appropriately address these injuries.
- Blast injuries causing primary, secondary, tertiary, and quaternary injuries require a thorough evaluation of each of those systems to which they can cause injury. These types of injuries can be among the most devastating soft and hard tissue trauma to the human body.
- Triage is the first step in determination of patient stability and identification of the need for airway or surgical intervention. Understanding triage principals allows the surgeon to provide the most benefit to the most patients in the event of a mass casualty situation.
- The primary goals during the initial surgery for high-velocity injuries are to reapproximate wound edges and to achieve soft tissue coverage of plates and exposed bone. Revision surgery can be considered after initial wounds heal and the surrounding temporary cavity injury resolves.
- As the incidence of high-velocity injuries increases in the civilian sector, so must the understanding of these injuries by community and academic head and neck, facial plastic, and reconstructive surgeons.

INTRODUCTION

High-velocity projectiles from improvised explosive devices (IEDs) and assault rifles on the battlefield result in unique head and neck injuries and injury patterns far different than those caused by civilian low-velocity projectiles. Although few surgeons will have the experience of treating injuries

sustained in the combat theater, the rise of global and domestic terrorism and injuries caused by high-velocity weapons highlight the importance and application of these wartime principals to the civilian sector.

From 2006 to 2015, more than 77,000 incidents related to terrorism were reported globally. The United States alone experienced more than 170

The authors have nothing to disclose.

The views expressed herein are those of the authors and do not reflect the official policy or position of Brooke Army Medical Center, the US Army Medical Department, the US Army Office of the Surgeon General, the Department of the Army, Department of Defense, or the US Government.

^a Department of Otolaryngology–Head and Neck Surgery, San Antonio Uniformed Services Health Education Consortium, Brooke Army Medical Center, 3551 Roger Brooke Drive, JBSA, Fort Sam Houston, TX 78234-6200, USA; ^b Department of Otolaryngology–Head and Neck Surgery, University of Texas Health Science Center at San Antonio, 325 East Sonterra Boulevard, Suite 210, San Antonio, TX 78258, USA

* Corresponding author. Department of Otolaryngology–Head and Neck Surgery, MCHC-SDT-Otolaryngology, 3551 Roger Brooke Drive, Fort Sam Houston, TX 78234-4504.

E-mail address: jacobscottmajors@hotmail.com

incidents, leading to hundreds of injuries and fatalities.¹ The mass shooting in Orlando on June 12, 2016, led to 49 fatalities with 53 injured.² Six months before the Orlando shooting, 14 people were killed and 21 wounded in a terrorist attack in San Bernardino, California.³ However, gunshot wounds are not the only types of injuries sustained at the hands of terrorists in the United States. On April 15, 2013, 2 IEDs were detonated near the finish line of the 117th Boston Marathon, killing 3 people and injuring 264 others. At least 10% of the injuries sustained from the bombing resulted in high-velocity injuries to the head and neck.⁴

Most trauma centers have experience with managing head and neck injuries sustained by low-velocity weapons. However, the management of high-velocity injuries caused by IEDs or other weapons is rarely performed outside the battlefield. Preparing to manage these high-velocity injuries resulting from a mass casualty incident (MCI) is becoming more integral to health care teams as global terrorism becomes a greater concern and an increasing risk. The most recent conflicts in Iraq and Afghanistan have significantly improved understanding of battlefield trauma and how to appropriately address these injuries.

INJURY PATTERNS OF RECENT CONFLICTS

Historically, head and neck surgeons, including facial plastic and reconstructive surgeons, have been essential members of multispecialty head and neck surgical teams involved in treating injuries sustained during combat. The modern specialty of plastic surgery developed largely due to advancements in the treatment of injuries sustained during World War I.⁵ Although the lethality of weapons has increased with a significantly higher percentage of lethal explosive injuries (IEDs) in modern warfare, soldiers have a significantly higher rate of survival compared with previous conflicts.⁶ This increase in survival can be explained by multiple factors, including rapid mobilization of the wounded to higher echelons of care, improved access to immediate and urgent medical care, and improvements in body armor.⁷ Injuries to the chest, abdomen, and pelvis that previously proved to be fatal have dramatically decreased with technical advancements in body armor. Although body armor has a negligible effect on the incidence of head and neck injuries, a higher percentage of wounded are presenting with survivable head and neck trauma due to this decreased incidence chest, abdomen, or pelvic trauma.⁸ Consequently, the percentage of head and neck injuries treated in modern combat has significantly increased, making the role of the

head and neck or facial plastic surgeon paramount in treating these high-velocity injuries.⁸

During the Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF), conflicts, more than 43,000 US military personnel were injured, 25% to 40% of which sustained injuries involving the head, face, and/or neck.^{9–11} The most commonly performed head and neck procedures were repair of facial lacerations, tracheotomy, neck exploration for penetrating neck trauma (PNT), arch bars or intermaxillary fixation, and open reduction or internal fixation of facial fractures.^{8,12,13}

Essential to the understanding of the treatment of high-velocity head, neck, and facial injuries is a basic knowledge of the physiology and kinetics of modern battlefield trauma. Although the type of head, neck, and facial procedures performed during OIF and OEF are not uncommonly performed in civilian trauma centers, the physiology and presentation of these high-velocity injuries differs significantly from the typical low-velocity injuries. Understanding these differences is essential to appropriate preoperative and postoperative planning and care. As the incidence of high-velocity injuries increases in the civilian sector, so must the understanding of these injuries by community and academic head and neck, facial plastic, and reconstructive surgeons.

PHYSIOLOGY AND KINETICS OF HIGH-VELOCITY INJURIES

The mechanism of injury of different weapons or projectiles and the amount of energy transferred to tissues is directly related to the size and velocity of the projectile.¹⁴ Measuring the kinetic energy of a projectile, allows one to more accurately predict the type and degree of tissue injury. Kinetic energy is calculated by the following equation:

$$KE = \frac{1}{2}m (V1 - V2)^2$$

in which KE is kinetic injury, m is missile mass, V1 is entry or impact velocity, and V2 is exiting velocity of the projectile.^{14,15} The most lethal projectiles are those that enter the target tissue with a high entering velocity, then dissipate all their energy into the tissue without exiting the target (V2 = 0).^{14,15}

Advancements in modern warfare have led to the development of high-velocity weapons that are able to transfer maximal energy to vital structures. A high-velocity weapon is able to fire a projectile at a velocity of greater than 610 m/s.^{14,15} Handguns generally have a muzzle velocity between 210 and 600 m/s, defining them as

Download English Version:

<https://daneshyari.com/en/article/5714365>

Download Persian Version:

<https://daneshyari.com/article/5714365>

[Daneshyari.com](https://daneshyari.com)