

**COMBAT RADIOLOGY: DIAGNOSTIC IMAGING OF BLAST AND BALLISTIC INJURIES**

By Les Folio  
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*COMBAT RADIOLOGY IN ESSENCE* COMPRISES 3 BOOKS IN A SINGLE volume. The first is a firsthand account of the front-line experiences of a military physician, author, and educator on the bloody battlefields of Iraq. The second is a detailed report of the current state of military medicine practiced in wartime conditions. The third is a comprehensive, well-illustrated textbook detailing the diagnosis and management of blast and ballistic injuries, whether inflicted by the enemy in times of war by terrorists in times of peace.

The author begins by describing in graphic terms what it is like for combat physicians deployed into harm's way. Physicians deployed to Iraq carry weapons, wear body armor, and are constantly under attack; moreover, they often must perform in desert conditions of heat, sand, and dust. Patient care must continue in the face of daily power outages, explosions, and the need to duck into bunkers to avoid incoming artillery and insurgent fire. In spite of these challenges, the combat hospital in which the author practiced achieved a 98% survival rate, the highest ever recorded.

Today, combat zones have 5 echelons of care. The first is self-aid or buddy care (taking care of oneself or another) on the battlefield. The second is a small tent-hospital with basic surgical and imaging capabilities. The third is a base facility that houses more sophisticated radiologic equipment including computed tomography and ultrasound as well as subspecialists including trauma surgeons. The fourth are the major military hospitals in Germany and Hawaii, and the fifth are the academic military hospitals in the United States.

Individual chapters focus on specific types of trauma, such as blast or high-velocity missile trauma, which account for most injuries sustained by military personnel in Iraq. There are 4 types of blast injuries: primary, resulting from a wave of blast overpressure, which frequently causes hollow organs to burst; secondary, resulting from flying debris and projectiles; tertiary, in which the soldier's body becomes a flying object and collides with other objects; and quaternary, in which injury comes from burns or inhalation of gases and smoke. Many casualties are a combination of all 4 types.

A chapter on ballistic injuries points out that a bullet spins on its axis when exiting a weapon but begins to wobble as the distance from the weapon increases. Once the bullet enters the body, it tumbles and often reverses orientation so that the heavy end of the bullet takes the lead. This re-

versed orientation, augmented by pressure waves created by the projectile as it passes through tissues, creates a temporary cavity. In this manner, solid organs such as the liver or spleen are damaged to a much greater extent than tissues that stretch easily, such as muscle. Sophisticated computed tomography scanners now use reformatted paraaxial imaging to demonstrate various lacerations and projectile-caused cavities in wounded persons so that immediate and more effective surgical treatment can be administered, minimizing damage.

With the aid of diagrams and illustrations, many in color, the author shows how ultrasound and computed tomography with multiplanar reconstruction and 3-dimensional volume-rendered images are used to determine the wound path of a projectile and display the anatomical damage to surrounding organs and major vessels to accurately guide trauma surgeons to the involved regions and organs. At times, bullet or other projectile fragments can ricochet off bony structures, changing paths and penetrating vascular and other structures outside the range of entry. Radiologic imaging can pinpoint the precise trajectories of fragments as well as their anatomical locations.

The purpose of triage is to identify critically wounded individuals for whom immediate treatment will save life or limb and to then separate them from those whose injuries are so severe that trying to save them would unnecessarily drain resources from those who could live. The challenge of contemporary military medicine is to save more lives than ever by raising the mortality threshold toward more severe injuries. Many persons who in past conflicts were set aside with the expectation that they would soon die are now being saved.

The author likewise shows how the same techniques that have been developed to treat wartime combat injuries can be used to treat civilians injured in motor vehicle accidents, naturally occurring disasters such as earthquakes, or altercations in which shotguns or other means of inflicting personal injury are used.

*Combat Radiology* is a valuable resource for any physician involved in military or emergency medicine, in which trauma is common. Although the focus of the book is medical, it nonetheless will appeal to any reader with an interest in how medicine is practiced on today's battlefields.

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