

# BLAST INJURIES

## Ear Blast Injuries



### Background

Primary blast injury to the organs of the body tends to occur in anatomical succession, depending on the power of the blast and susceptibility of the tissues. The first organ to sustain damage is typically the ear. Despite earlier reports to the contrary, isolated tympanic membrane perforation, without additional signs and symptoms, does not appear to be a marker for occult primary blast injury.

The ear is the most susceptible organ to primary blast injury. Injury to the delicate and sensitive structures of the middle and inner ear represents the most common type of injury after a blast. Blast injury to the ear may result in symptoms of tinnitus, earache, hearing loss, or vertigo.

As highest priority is directed toward diagnosis and treatment of life-threatening injuries, otologic injury is often missed. However, with simple screening protocols, limited management, and appropriate otolaryngologic referral, poor outcome and morbidity can be minimized.

### Clinical Presentation

#### External Ear

- Injury to the external ear is caused most often by flying debris (secondary blast injury)
- Degloving of the cartilage may occur; considered to be a serious injury

#### Tympanic Membrane (TM)

- The TM is exquisitely sensitive to variations of atmospheric pressure as it functions to transmit minute pressure oscillations encountered by impulsive and continuous sound waves
- Blast overpressure enters the external auditory canal, stretching and displacing the TM medially
- A spectrum of injury may be seen, ranging from intra-tympanic hemorrhage in minor cases to total tympanic membrane perforation in powerful blasts
- Perforations may be unilateral or bilateral, small or complete, and single or double
- The shape of the laceration may be smooth and linear, punched out, or ragged with the edges inverted or everted

#### Middle Ear

- Disruption of the ossicular chain may occur, especially in larger blasts
- Cholesteatoma within the middle ear and mastoid cavity may occur and are potentially destructive lesions that can erode and destroy important structures of the middle ear, temporal bone, and skull base
- Sequelae of disease can cause conductive and sensorineural hearing loss, vestibular disturbances, cranial nerve palsy, as well as central nervous system complications such as brain abscess and meningitis, making the injury potentially fatal

#### Inner Ear

- Damage to the auditory and vestibular components of the inner ear may also occur
- The typical blast-injured patient will experience a temporary hearing threshold change; most regain hearing within hours, for others resolution may take days to weeks

## Initial Management

- Standard trauma protocols and lifesaving measures should always be addressed first in the assessment and management of the blast patient
- After basic lifesaving measures and severe injuries have been addressed, a focused secondary exam should include otoscopic evaluation of the TM and external auditory canal
- Tympanic membrane injury should raise clinical suspicion and evaluation for additional primary blast injury, but isolated tympanic membrane perforation, without additional signs and symptoms, does not appear to be a marker for occult primary blast injury.

## Treatment of External Ear Injuries

- Manage as other soft tissue injuries with attention to foreign body removal, cleaning and irrigation of wounds, and closure
- Cartilage must not be left exposed; wounds should be closed primarily; if the cartilage of the pinna is degloved, it should be buried in the post auricular pouch (may require the expertise of an otolaryngologist or a plastic surgeon)

## Treatment of Tympanic Membrane Rupture

- Treatment of TM perforations is typically expectant; if cerumen or blood clots obscure view of the eardrum, these can be carefully suctioned and cleaned by an otolaryngologist
- The ear should be kept clean and dry, and the patient should be referred to a specialist
- Antibiotic eardrops to irrigate and clear the ear of debris or blood clots are indicated for TM perforations or ear canal lacerations

## Treatment of Middle and Inner Ear Injuries

- Treatment for middle and inner ear injuries typically can be deferred until an otolaryngologist is available
- Baseline audiometry in all blast-injured patients has been advocated because hearing deficits are common and not always noted by the patient; patients should be followed with interval audiometric evaluation to follow progress during recovery

## Disposition

- TM perforations typically have an excellent prognosis with spontaneous resolution in the majority of cases
- For irregular perforations with everted flap, realignment may improve chances of healing; perforations resolve most frequently in the first three months after injury
- Tympanoplasty is indicated if spontaneous resolution is not observed after close observation
- Any TM perforation runs the risk of cholesteatoma formation, especially those perforations that are larger and do not resolve; follow-up is indicated biannually for a minimum of two years

*This fact sheet is part of a series of materials developed by the Centers for Disease Control and Prevention (CDC) on blast injuries. For more information, visit CDC on the Web at: [www.emergency.cdc.gov/BlastInjuries](http://www.emergency.cdc.gov/BlastInjuries).*