Mass Casualty Incidents

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Disclosures

• None
• This presentation does not necessarily represent the views of the US Department of Defense or Department of Veterans Affairs
Objectives

• At the conclusion of this presentation, learners will be able to answer the following questions:
  • What is a mass casualty incident?
  • What is the epidemiology of mass casualty incidents in the US?
  • How is a mass casualty incident run, both in the field and hospital?
  • What types of injuries are commonly seen?
  • What can I do at the scene to help?
Mass Casualty (aka MasCal)

• Definition:
  • Any incident in which the number of patients exceeds the capacity of the local healthcare system (EMS & hospitals) to care for them

All MasCals are Local
Types of Incidents

• Can be mundane
  • Pile-up with multiple patients
  • House fire with several patients
  • Drive-by shooting with several patients

• Or Not
  • Explosions
  • Train derailments
  • Mass shootings
  • Chemical incidents
  • Acts of war
MasCal as a Disease?

• The number of mascal incidents is on the rise
• Greatest proliferation is in mass shootings
Epidemiology of Mass Shootings
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Differences in Mass Shootings vs Conventional Shootings

• Weapons typically are assault rifles
  • Large capacity high-velocity rounds
  • Handguns (lower capacity and smaller lower-velocity rounds)

• Larger cavitation and tissue destruction

• Shooters frequently more experienced using their weapons
  • Better accuracy and better “kill shots”

• Mass shooters frequently not concerned with escape
  • Keep killing until they die
Ballistics 101

• Depends on muzzle velocity (rifle vs handgun vs shotgun) and type of projectile (bullet size, hollow point vs jacket, shot)
• Temporary vs permanent cavity in tissue
• Yaw (tumble) of projectile in the body
Ballistics 101
Ballistics 101
Blast Injuries
Blast Injuries

• What are they
• What should I look for
• What don’t I want to miss
Types of Blasts
OK for Real Now

• Thermonuclear
• Thermal
• Chemical
• HE
Thermonuclear Blasts

• Greatest potential destruction
• Least likely type of injury you will see
  • Hardest to obtain
  • Most likely that you will be vaporized as well
• Combine the features of many other types of blast injuries with radiation and intense heat
• Major addition is radiation exposure
• Otherwise similar to HE blasts
Thermobaric

• AKA fuel-air explosives
• Mix of gases or droplets in air
• Causes explosion with intense flame component
Examples of Thermobarics

• Dust/air mixtures in silos
• Slowly-escaping natural gases
• BLEVE (boiling liquid-expanding vapor explosions)
• Munitions
  • Usually designed to be BLEVE-type blasts
HE Explosives

• Have a high reaction rate
  • Aka the conversion is quick
  • Called a detonation
  • Generate a blast wave
Anatomy of an Explosion

• Consider the case of HE blasts
• Detonation creates gas at high temp & pressure
  • Example of C4-over 4 million PSI
• This causes blast wave
  • Rapid omnidirectional pressure front
• This rapid rise in pressure is called overpressure
Anatomy of an Explosion

• Overpressure
  • Primary cause of injury/death
  • Peak overpressure wave of 60-80 psi lethal
  • Caused by transfer of energy to the body
Determinants of Injury

- Peak of overpressure wave
- Duration of overpressure
- Medium of explosion
- Distance from initial blast wave
- Focusing
  - Reflection off other surfaces
  - Worse if it occurs in enclosed space
Determinants of Injury

- Greatest damage occurs at transition points of tissue
  - IE tissue/bone junction
- Pressure-sensitive locations
  - Barotrauma-lungs, eardrums
Determinants of Injury

- Blast winds
  - Large release of gaseous products causes “winds”
  - These can cause a great deal of secondary injury
  - Even low intensity blasts can cause a great deal of winds
Injury Patterns
Specific Injuries

• Primary blast injury
  • Due to pressure wave
  • Seen with HE explosives

• Secondary injury
  • From projectiles
  • Body turned into a projectile
  • Heat
Specific Injuries

• Burns
  • Manage as any other burns
  • Burns rarely in isolation
  • ALWAYS look for additional injuries
Specific Injuries

• Sharpnel
  • Beware penetrating trauma
  • Pinholes can herald big trouble
  • Have an exceptionally low threshold to consider vascular injury
  • Beware complex devices
    • Shrapnel that is radioactive
    • Covered with feces, blood, etc
Specific Injuries

• Amputations
  • Seen commonly with HE blasts
  • A great deal of force released at bone/ST junction
  • Tearing mechanism
    • Usually limits vasospasm
    • Can have massive blood loss
  • Need urgent hemorrhage control
    • TK
    • Guillotine amputation
Specific Injuries

• Barotrauma
  • Can be immediate or delayed
  • Barotrauma in one anatomic region usually means in others
    • Beware isolated “TM perf”
    • Frequently develop associated barotrauma
Barotrauma

• Overpressure causes alveolar rupture
• Leads to pneumothorax, SQE, pneumomediastinum
• Most common pulmonary injury is contusion
• Can also develop systemic air embolism
• CXR usually diagnostic
Barotrauma

• Eardrum
  • May be associated with other barotrauma
  • With lower pressures may see hemotympanum without rupture
  • May not see eardrum injury in certain cases
    • Wearing ear protection
    • Body in water, head out of water during underwater explosion
Barotrauma

• Most common type of blast injury barotrauma is to ears
  • 35% of OKC blast victims had TM involvement
• Severe injury may have permanent hearing loss
Barotrauma

• GI
  • May see pneumoperitoneum
  • May not see pneumoperitoneum; may have perf or hemorrhage instead
  • Colon site of most GI barotrauma
    • Most air filled part of GI tract
  • Look for signs of acute abdomen
  • Presentation frequently subtle
Neurotrauma

- Can be from penetrating injuries
- Can also be from overpressure
  - Can be DAI
  - Also concussion
- Repetitive trauma from blast injuries current research topic
  - Using markers like NFG proteins and s100b
Secondary Injuries

• Can be from debris
• Can be planned
  • Suicide vests with ball bearings
  • EFP’s
  • Cluster munitions
Other Principles

• Scene safety
  • If terrorist incident suspected remember that second device may be around
  • Unsafe structures
    • WTC
  • Radiation if nuclear blast
Management Principles

• ICS (Incident Command System)
  • Mandated by FEMA for hospitals/municipalities/EMS
  • Provides organized structure from scene of incident into hospital
  • Open communication between field and facility
  • Provides for triage, initial stabilization, and transport from scene
  • Hospital-surge capacity, additional resources
The ICS
Field Management

- Most EMS agencies use START (Simple Triage and Rapid Transport)
  - Assigns patients to one of 4 color codes
    - Black-dead
    - Red-immediate
    - Yellow-urgent
    - Green-walking wounded
- Patients without a pulse are usually not resuscitated
- Patients who are critically injured take priority
- Coordinated response with field & hospital IC’s to distribute patients appropriately
Hospital Management

• IC staff (usually senior leaders) staff command center
• Call in appropriate backup staff; open OR’s; extra radiology & lab availability; blood supply; open up outpatient areas as ED overflow
• Plan for inpatient surge capacity
  • Open up unused floor beds
  • Facilitate rapid discharge and bed cleaning
• Support staff on hand for debriefing of providers (EMS & hospital) after the incident is over
Summary

• Mass casualty incidents becoming more common
• Most likely MCI’s are shooting or explosives
• Most shootings likely to be with military type weapons
• Blast injuries have unique injury patterns rarely encountered in civilian life
• Hospitals need surge capacity plan to handle a sudden influx of severe patients
Questions?
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