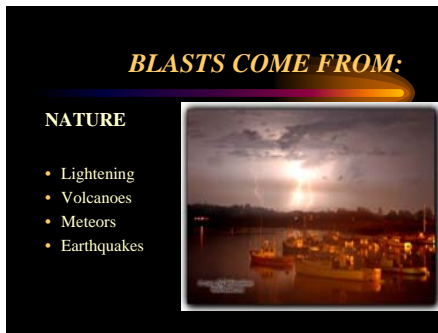


Slide 1



Slide 2



Slide 3

BLASTS COME FROM:

MAN-MADE
ACCIDENTS

- Industry
- Utilities
- Transportation



Slide 4

BLASTS COME FROM:

MAN-MADE
INTENTIONAL

- International
- Domestic



Slide 5

Key Elements of Terrorism:

- Pre-meditated
- “Cause” (Political, Religious, Ideological)
- Aimed at Civilians
- Carried out by Sub-National Groups
- Groups can be International or Domestic

Slide 6

BLAST FACT:

- 1968-1999 – 7000 International Terrorists bombings
- 2001-2003 – 500 International bombings
- 2005 – 399 International bombings
- BOMBS ARE METHOD OF CHOICE BY TERRORISTS – Trend is Upward
- 9/11, Iraq (OIF), Madrid04, London05, Tel Aviv06, Mumbai06

Slide 7

WHY BOMBS??

- Big Statement
- Big Media Attention, Drama
- Large Groups of People in a Single Event
- Inflict Multi-system Injuries

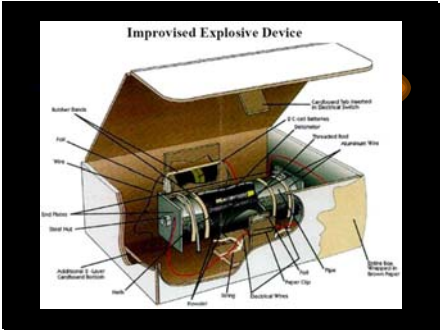


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INTENTIONAL BLASTS

- Bombs
- Improvised Explosive Devices
 - Package type
 - Vehicle bombs
 - Suicide bombs
- Mines
- Warheads

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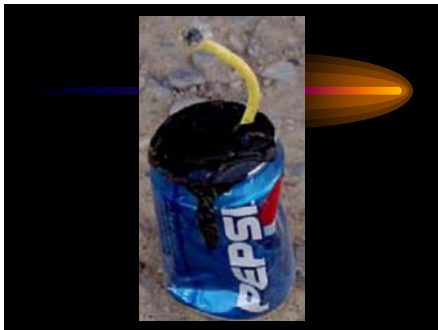
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Slide 14



Slide 15









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Use and Characteristics of IEDs

- Thrown from overpasses
- Emplaced in potholes (covered with dirt)
- Thrown in front of buses (many victims)
- Carried and left on mass transit
- Used in tunnels
- Worn into crowded market areas
- Think like a terrorist

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Vehicle Gone Bad!!!					
BATF Explosive Standards					
ATF	Vehicle Description	Maximum Explosives Capacity	Lethal Air Blast Range	Minimum Evacuation Distance	Falling Glass Hazard
	Compact Sedan	500 pounds 227 Kilos (In Trunk)	130 Feet 50 Meters	1,500 Feet 457 Meters	1,250 Feet 381 Meters
	Full Size Sedan	1,000 Pounds 455 Kilos (In Trunk)	125 Feet 38 Meters	1,750 Feet 534 Meters	1,750 Feet 534 Meters
	Passenger Van or Cargo Van	4,000 Pounds 1,815 Kilos	200 Feet 61 Meters	2,750 Feet 838 Meters	2,750 Feet 838 Meters
	Small Box Van (14 Ft. Box)	10,000 Pounds 4,545 Kilos	320 Feet 91 Meters	3,750 Feet 1,143 Meters	3,750 Feet 1,143 Meters
	Box Van or Water/Well Truck	30,000 Pounds 13,636 Kilos	450 Feet 137 Meters	6,500 Feet 1,982 Meters	6,500 Feet 1,982 Meters
	Semi-Trailer	60,000 Pounds 27,273 Kilos	600 Feet 183 Meters	7,000 Feet 2,134 Meters	7,000 Feet 2,134 Meters

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EXPLOSIVES

HIGH ORDER	LOW ORDER
<ul style="list-style-type: none">• Detonate quickly• Generate high heat & noise• Fill space with high pressure gases in 1/100th second• Produce "blast wave" (positive wave)• Brisance (shattering effect)• Vacuum (negative wave)	<ul style="list-style-type: none">• Subsonic w/o over pressurization• Slower release of energy• Burns by deflagration

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Background: Blast Agents

High-order explosive: HE	Low-order explosive: LE
<ul style="list-style-type: none">• Nitroglycerin (NTG)• Dynamite• Plastic• Ammonium nitrate/fuel oil (ANFO)• Trinitrotoluene (TNT)• Triacetone triperoxide (TAPT)	<ul style="list-style-type: none">• Petroleum products ("Molotov cocktail")• Gunpowder ("black" powder)• Can become HE, if contained (e.g., pipe bomb)

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BLAST PHYSICS

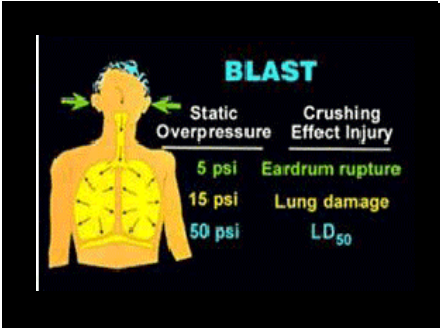
- Rapid chemical conversion of a solid or liquid into highly pressurized gases
- Gases expand rapidly and compress the surrounding air
- Pressure wave and blast wind are generated and spread in all directions
- Is affected by the medium through which it travels, i.e., air vs. water

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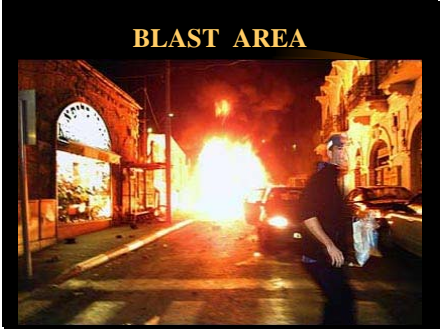
***Blast Wave Blast Wind
Negative Pressure Wave***



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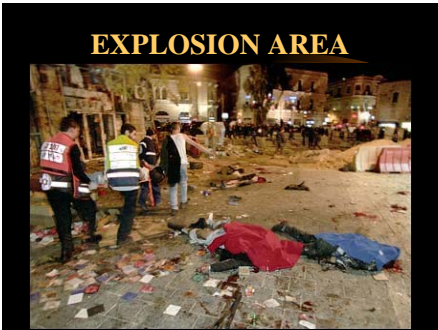
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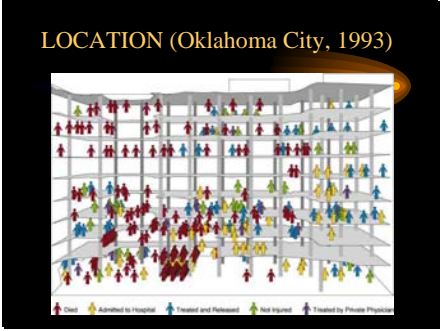
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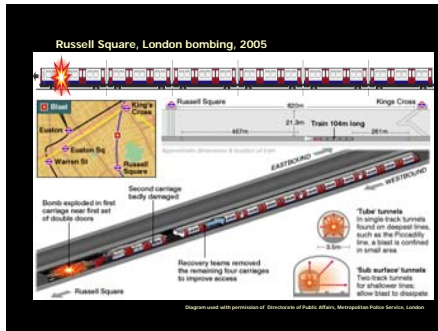
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BLAST INJURIES

- Primary – direct damage
- Secondary – flying debris
- Tertiary – thrown against a stationary object
- Quaternary – burns, crush injury, inhalation injury, neuropsychiatric conditions

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Triage

- Unique patterns, multiple and occult injuries
- Death often result of combined blast, ballistic, and thermal effect injuries (multidimensional injury)
- Walking wounded
- Hidden/internal injuries
- Many non-critical patients who require time intensive workups

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Triage

- Nature of injuries may lead to overtriage
- Up to 75% of victims self-refer to hospital; arrive by private transportation
- Field triage
 - Dynamic process

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Triage

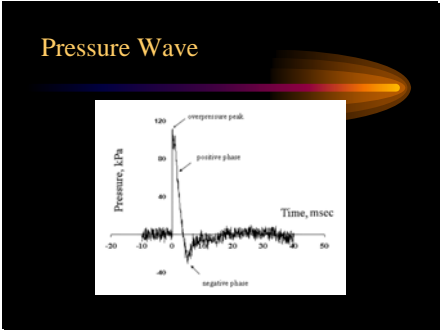
- Factors that determine when needs exceed resources
 - Large number of patients make rapid triage impossible
 - Large number of patients cause delay in transport to hospitals
 - Large number of patients exceed responder treatment capabilities
 - Surge at local hospitals

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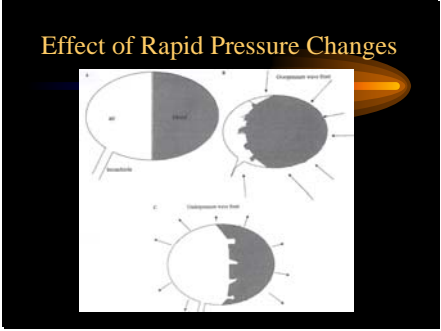
BLAST LUNG INJURY (BLI)

Injury pattern	Signs and symptoms
<ul style="list-style-type: none">• Major cause injury/death• Triage challenge• May have no other injuries• Blast impact – tearing, contusion, profuse small hemorrhages, edema, pneumothorax	<ul style="list-style-type: none">• Short of breath• Hypoxic• Cyanotic• Hemoptysis• Wheezes• Dx with CXR

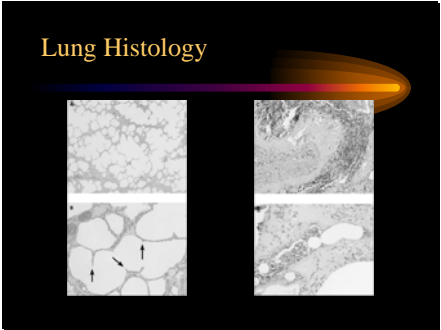
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BLAST LUNG INJURY

MANAGEMENT

- Judicious use of fluids
- High flow O2
- Chest tube
- Ventilator
- Infection prevention



The image shows a chest X-ray with bilateral lung opacities, characteristic of blast lung injury. The opacities are most prominent in the lower lung zones and are associated with a widened mediastinum.

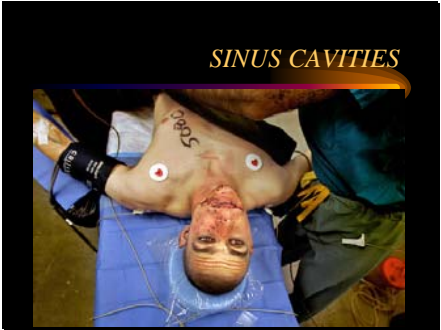
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PRIMARY BLAST INJURY

Gastrointestinal	Neurologic
<ul style="list-style-type: none">• Hollow organs<ul style="list-style-type: none">– Tearing, petechia, perforations• Solid organs<ul style="list-style-type: none">– Lacerations, hemorrhage, contusions (due to deceleration)	<ul style="list-style-type: none">• Usually dead on scene• Subarachnoid and subdural hemorrhage• GCS used as indicator• TBI – residual effects

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SECONDARY BLAST INJURIES

- Results from flying debris
- Any body part affected
- Penetrating ballistic (fragmentation) or blunt injury
- Eye penetration
- Orthopedic

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*Mortal Head Injury from
Secondary Blast Injury*



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SHRAPNEL INJURIES



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Tertiary Blast Injury

- Individuals thrown by the blast wind
- Multitude of injury types
- Fracture and traumatic amputation
- Closed and open brain injury
- Impalement


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Head Injury by Tertiary Forces

- Head strikes solid object after traveling through air
- Bi-frontal / bi-temporal concussions
- SubArachnoid hemorrhages

An axial CT scan of the head showing bilateral frontal and temporal contusions. The image is a grayscale cross-section of the brain, with the skull visible as a bright white ring. There are dark, irregular areas in the frontal and temporal regions, indicating areas of injury or hemorrhage.

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Quaternary Blast Injury

- All explosion-related injuries, illnesses or diseases not due to primary, secondary or tertiary mechanisms
- Also known as miscellaneous category
- Includes exacerbation or complications of existing conditions
- Burns, crush injuries, closed and open brain injury, angina, asthma, COPD, psychological effects


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Eye Injury

- Flash burns due to secondary explosions/fires
- Chemical burns
- Abrasions
- Foreign bodies



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Head Injuries

- Falling debris
- Closed head injury - blunt
- Open head injury
- Lacerations
- De-gloving of scalp



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Crush Injuries



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Treatment Considerations

- Triage / CAUTION
- High Flow Oxygen
- Intubation
 - Pneumo – Chest Tube
 - Air Embolus – Left Lateral Position
- Bleeding Control
 - Tourniquets
 - Hemostatic Dressings
- Fluids as required (cautious)
- Rapid definitive treatment

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Emergency Management Options



- **BLAST INJURIES ARE NOT CONFINED TO THE BATTLEFIELD!!**
- Expect local EMS to be overwhelmed quickly
- Expect up-side-down triage
- Double 1st hour's casualties to predict total "first wave"
- If structural collapse, expect increase severity and delayed arrival of casualties