



SCENE ASSESSMENT

- High-explosive detonation
 - Fire
 - Spilled materials
 - Power lines
 - Debris
- Chemicals
 - Offending agent
 - Secondary contamination (pts. Clothing, belongings, etc.)

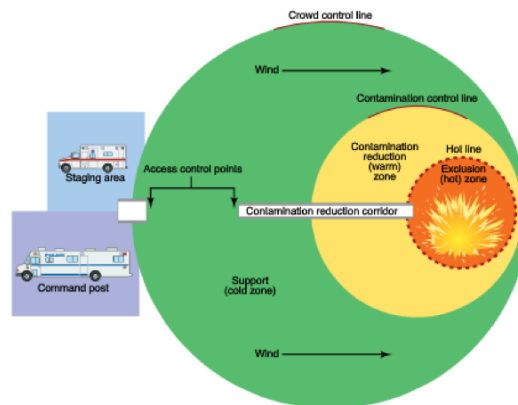


WHO'S IN CHARGE

- Who's in charge of Superior EMS
- Who's in charge of the Scene
- What do you do if someone is barking orders at you outside the chain of command?



SCENE SAFETY



PPE

- Level A
 - SCBA
 - Encapsulated Chemical Resistant Barrier
- Level B
 - SCBA
 - Non encapsulated chemical-resistant barrier
- Level C
 - Air purifying respirator
 - Skin protection per B
- Level D
 - Standard Uniform



CONTROL ZONE

- **Hot Zone**
 - Immediate threat to health and life
 - PPE determined based on potential routes of exposure
- **Warm Zone**
 - Concentration of offending agent is limited
 - Still at risk of exposure
 - PPE per above
- **Cold Zone**
 - Area outside where no risk of exposure
 - Standard PPE



TRIAGE

- Field triage based on standard procedures
- Follow START, MASS and SALT

Simple
Triage
And
Rapid
Treatment

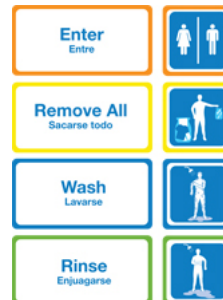
Move
Assess
Sort
Send

Sort by
Ability to
move
Assess need
for
Lifesaving
interventions
, Triage and
transport



DECONTAMINATION

- Two step process
- Performed in a systematic manner
- Privacy, etc.
- Lots of considerations
- Outside our scope!



CATEGORIES OF EXPLOSIVES



- High Explosives
 - Instant
 - Can produce shockwaves resulting in primary blast injuries
 - Examples – TNT, nitro, dynamite, ammonium nitrate, etc.
- Low Explosives
 - Change slowly from a solid to a gas
 - Less impact
 - Usually cause the container to rupture and ignite volatile compounds
 - Examples – Gunpowder



EVACUATION & THREAT ASSESSMENT

ICM10 THREAT STAND-OFF CHART

Threat Description Impvised Explosive Device (ED)	Explosives Capacity (TNT Equivalent)	Building Evacuation Distance*	Outdoor Evacuation Distance*
Pipe bomb	5 LBS	70 FT	120 FT
Buck burner	20 LBS	110 FT	170 FT
Release device	90 LBS	195 FT	165 FT
Car	500 LBS	320 FT	150 FT
SUV	1,000 LBS	420 FT	240 FT
Small Delivery Truck	4,000 LBS	495 FT	380 FT
Medium Delivery Truck	10,000 LBS	660 FT	510 FT
Semi-trailer	40,000 LBS	1,170 FT	930 FT



BLAST CATEGORIES

Effect	Impact	MOI	Typical Injuries
Primary	Direct Blast Effects	<ul style="list-style-type: none"> • Contact of blast shockwave • Stress and shear waves • Impact with gas filled organs 	<ul style="list-style-type: none"> • Tympanic membrane rupture • Blast lung • Eye injury • Concussion
Secondary	Projectiles Propelled	<ul style="list-style-type: none"> • Ballistic wounds produced by: <ul style="list-style-type: none"> • Primary fragments • Secondary fragments 	<ul style="list-style-type: none"> • Penetrating Injury • Traumatic amputation • Lacerations • Concussion
Tertiary	Propulsion of Body onto something	<ul style="list-style-type: none"> • Whole body translocation • Crush injuries caused by structural damage/collapse 	<ul style="list-style-type: none"> • Blunt Injury • Crush Syndrome • Compartment Syndrome • Concussion
Quaternary	Heat and or Combustion Fumes	<ul style="list-style-type: none"> • Burns and toxidromes from fuel/metals • Septic syndromes from environmental contamination 	<ul style="list-style-type: none"> • Burns • Inhalation Injury • Asphyxiation
Quinary	Additives such as radiation or chemicals (dirty bombs)	<ul style="list-style-type: none"> • Contamination of tissue from: Bacteria, radiation, or chemical agents 	<ul style="list-style-type: none"> • Depends on the agent

PATTERNS OF INJURY FOR TERRORIST BOMBINGS

- Most wounds are noncritical soft-tissue or skeletal injuries
- Head injuries predominate the deaths (50-70%)
- Most head injury survivors (98.5%) have non-critical injuries
- Head injuries are disproportionate to exposed total body surface areas
- Most casualties with blast lung injuries die instantly
- Survivors have low incidence of abdominal and chest wounds, burns, traumatic amputation, and blast lung injury, although specific mortalities are high (10-40%)

BLAST LUNG INJURY

- A clinical triad of apnea, bradycardia and hypotension caused by pulmonary injuries from the blast.
- Victims with > 10% of BSA covered with burns, skull fractures, and penetrating torso or head injuries more likely to suffer from a BLI.
- Hemo/Pneumo may occur
- Can be sub-acute (24-48 hours later)
- Very important to rule out and manage rapidly.



COMMON EXPLOSION INJURIES

System	Injury or Condition
Auditory	TM rupture, ossicular disruption, cochlear damage, foreign body
Eye, Orbit, Face	Perforated globe, foreign body, air embolism, fractures
Respiratory	Blast lung, hemothorax, pneumothorax, pulmonary contusion and hemorrhage, A-V fistulas (source of air embolism), airway epithelial damage, aspiration pneumonia, sepsis
Digestive	Bowel perforation, hemorrhage, ruptured liver or spleen, sepsis, mesenteric ischemia from air embolism
Circulatory	Cardiac contusion, myocardial infarction from air embolism, shock, vasovagal hypotension, peripheral vascular injury, air embolism-induced injury
CNS injury	Concussion, closed and open brain injury, stroke, spinal cord injury, air embolism-induced injury
Renal Injury	Renal contusion, laceration, acute renal failure due to rhabdomyolysis, hypotension, and hypovolemia
Extremity injury	Traumatic amputation, fractures, crush injuries, compartment syndrome, burns, cuts, lacerations, acute arterial occlusion, air embolism-induced injury



BASIC ASSESSMENT CONSIDERATIONS

- Rapid Trauma Assessment
- Respiratory Assessment
 - Frothy secretions
 - Respiratory distress
 - SPO₂



CHEMICAL AGENTS

- Present often as a aerosol or vapor in biological warfare
- Classifications
 - Cyanides
 - Nerve agents
 - Lung toxicants
 - Vesicants (blistering agents)
 - Incapacitating agents
 - Vomiting agents



CONTAMINATION RISKS

- **Primary Contamination**
 - Exposure at the point of release
 - i.e. in the HOT zone
 - Gases, vapors, liquids, solids and aerosols most common
- **Secondary Contamination**
 - Exposure carried away from the point of release
 - Often happens in the Warm Zone
 - Can happen in remote areas
 - Solids and liquids most common agents
 - Vapors can be trapped in clothing causing release also



PPE

- Really depends on the threat level
- Level A typically needed in the hot zone



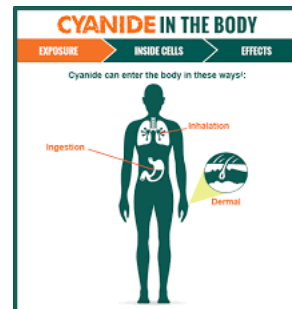
EVALUATION

- Once decontaminated assess for
 - Respiratory
 - Mucous membranes
 - CNS
 - GI
 - Skin
- Assess for toxidrome
 - Irritant gas toxidrome – mucous membrane burning & inflammation, coughing, SOB
 - Asphyxiant toxidrome – cellular oxygen deprivation. CO, cyanide, etc. – SOB, chest pain, dysrhythmia, syncope, coma, death
 - Cholinergic toxidrome – rhinorrhea, resp secretions, SOB, N&V, pinpoint pupils, altered LOC, seizures, coma – pesticides, nerve agents, etc.



CYANIDE

- Possible with fire where certain plastics are burning
- Can be terrorist related
- Volatile liquid, so usually a vapor or gas
- Results in cell death – shuts down the power house of the cell
- Most effected: CNS, and the heart
- Sx: headaches, dizziness, drowsiness, N&V, mucosal irritation
- Severe Sx: decreased LOC, dysrhythmias, hypotension, seizure and death
- Mgt: supportive therapy, high concentration O₂, fluid resuscitators, vasopressors, and Cyanide antidote kit



NERVE AGENTS

- Developed initially as insecticides
- Liquid at room temp
- Sarin most common and volatile
- Inhalation or absorption
- Small dose is enough to kill
- A number of MOI – primary consideration CNS
- Remember DUMBELS – diarrhea, urination, miosis, bradycardia, brochorrhea, bronchospasm, emesis, lacrimation, salivation, sweating.
- Treatment: oxygen, ventilation, atrophine, hospital!



WHAT NERVE AGENT EXPOSURE DOES TO THE BODY

MODERATE EXPOSURE

Head: Confusion, drowsiness, and headache.

Eyes: Watery eyes, eye pain, blurry vision, small/pinpoint pupils.

Mouth and nose: Cough, drooling, runny nose.

Cardiovascular: abnormal blood pressure and heart rate, weakness.

Lungs: rapid breathing, chest tightness.

Digestion: nausea, vomiting, abdominal pain, increased urination, diarrhea.

Skin: Excessive sweating, muscle twitching at the site of contact.

LETHAL EXPOSURE

Convulsions: Nerve agents trigger muscles into overdrive as they reach the nerves connected to them.

Loss of consciousness: Muscles that control breathing can be affected, causing the brain to be starved of oxygen.

Breathing failure: If a person breathes in roughly a rice grain worth of VX – the most toxic nerve agent on Earth – it can be enough to kill.

Paralysis: By interfering with enzymes that help muscles relax, the body can freeze up.

Death: Lethal exposure to nerve agents, left untreated, typically kills in 20-30 minutes.

SOURCES: Centers for Disease Control

BUSINESS INSIDER



LUNG TOXICANTS

- Chlorine, ammonia, sulfur, nitrogen dioxide, etc.
- Gasses and vapors and aerosolized liquids/solids
- MOI – compromises the pulmonary system from the airway to the lungs.
- Tx: decom, oxygen, ventilation, treat specific cause if possible



VESICANTS

- Mustard
- Inexpensive and cheap!
- Usually done by a bomb blast
- Absorbs through the skin and mucous membranes and works within 3-5 minutes
- Treatment: decontamination, supportive treatment, and no antidote (SHIT!)



BIOLOGICAL AGENTS

- Bacterial
 - Anthrax
 - Brucellosis
 - Glanders
 - Plague
 - Q fever
 - Tularemia
- Viral
 - Smallpox
 - Encephalitis
 - Viral hemorrhagic fevers
- Toxins
 - Botulinum
 - Ricin
 - Strep enterotoxin B
 - T-2 mycotoxins



ANTHRAX

- Common one we here in the news!
- Watch your envelopes! White powder is out to get you!
- Respiratory, GI, and skin borne
- Usually distributed in a "spore" format
- Results in hemorrhagic mediastinitis (bleeding lymph nodes in the chest cavity) resulting in death
- Managed by antibiotics
- Vaccine available for military



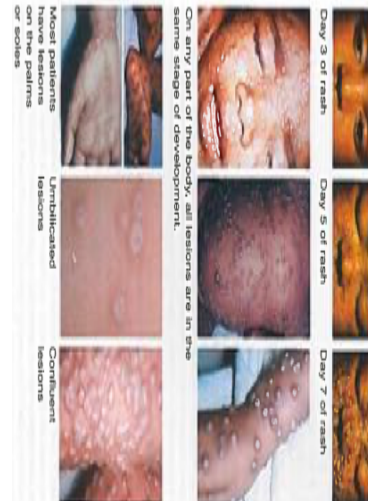
PLAGUE

- Not just certain people... it's a real condition
- Causes sepsis and death
- Most notable incident: Black death of 1346
- Distribution likely to be aerosol
- Treatment: supportive therapy, decontamination, management of the symptoms, isolation



SMALLPOX

- Mucous membrane transmission
- Incubation period
- Produces macropapular rash that turns into vesicles and pustules
- Highly Contagious
- Spreads rapidly
- Mgt: supportive care, isolation,



BOTULINUM TOXIN

- Most poisonous substance known to man
- Binds irreversibly, so in other words you die!
- CNS disruption
- Starts with double vision, and works to cranial nerve defects, then causes paralysis and then you DIE.
- Small Doses – may recover as nerves re-innervate, etc. but likely you DIE.
- Classic Traid
 - Descending symmetric flaccid paralysis with Cranial Never Deficit
 - Lack of Fever
 - Clear Sensorium
- Management: antitoxin @ hospital ,supportive care, maintain airway



RADIATION

- Assess for Safety
- Stabilize Patients
- Look for tissue damage
- Remove clothing and wash them
- Ensure you are using PPE
- Potassium Iodide may be useful
- Avoid Exposure – Use the Geiger to know what your being exposed to!



Figure 20-23 Acute Radiation Syndrome

Effects of Whole-Body Irradiation or Internal Absorption, by Dose Range in rad
(1 rad = 1 centigray; 100 rad = 1 gray)

Feature	0-100 (0-1 Gy)	100-200 (1-2 Gy)	200-600 (2-6 Gy)	600-800 (6-8 Gy)	800-3000 (8-30 Gy)	> 3000 (>30 Gy)
PRODROMAL PHASE OF SYNDROME						
Nausea, vomiting	None	5-50%	50-100%	75-100%	90-100%	100%
Time of onset	---	3-6 hr	2-4 hr	1-2 hr	< 1 hr	N/A
Duration	---	< 24 hr	< 24 hr	< 48 hr	48 hr	N/A
Lymphocyte count	Unaffected	Minimally decreased	< 1000 at 24 hr	< 500 at 24 hr	Decreases within hours	Decreases within hours
CNS function	No impairment	No impairment	Routine task performance Cognitive impairment for 6-20 hr	Simple, routine task performance Cognitive impairment for > 24 hr	Rapid incapacitation; May have a lucid interval of several hours	
LATENT PHASE OF SYNDROME						
No symptoms	> 2 wk	7-15 d	0-7 d	0-2 d	None	None
MANIFEST ILLNESS						
Signs/symptoms	None	Moderate leukopenia	Severe leukopenia, purpura, hemorrhage, pneumonia, hair loss after 300 rad		Diarrhea, fever, electrolyte disturbance	Convulsions, ataxia, tremor, lethargy
Time of onset	---	> 2 wk	2 d to 4 wk	2 d to 4 wk	1-3 d	1-3 d
Critical period	---	None	4-6 wk; greatest potential for effective medical intervention		2-14 d	1-46 hr
Organ system	None	---	Hematopoietic; respiratory (mucosal) systems		GI tract Mucosal systems	CNS
Hospitalization duration	0%	< 5% 45-60 d	90% 60-90 d	100% 100+ d	100% Weeks to months	100% Days to weeks
Mortality	None	Minimal	Low with aggressive therapy	High	Very high; significant neurologic symptoms indicate lethal dose	

CNS, central nervous system; d, day(s); hr, hour(s); N/A, not available; wk, week(s)

Source: Modified from Armed Forces Radiobiology Research Institute. Medical management of radiological casualties. Bethesda, MD: 2003.



ACTIVITY TIME!

