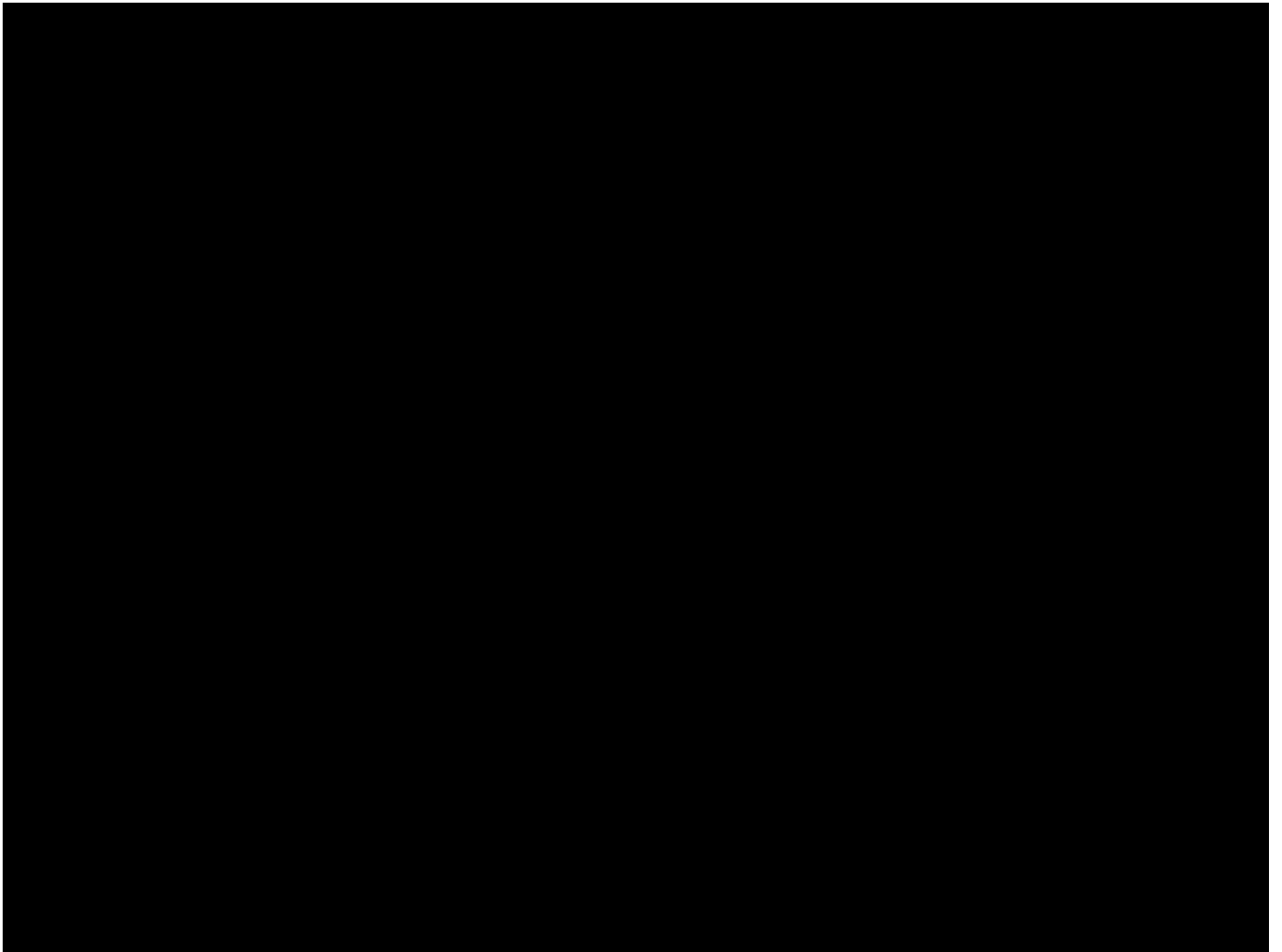
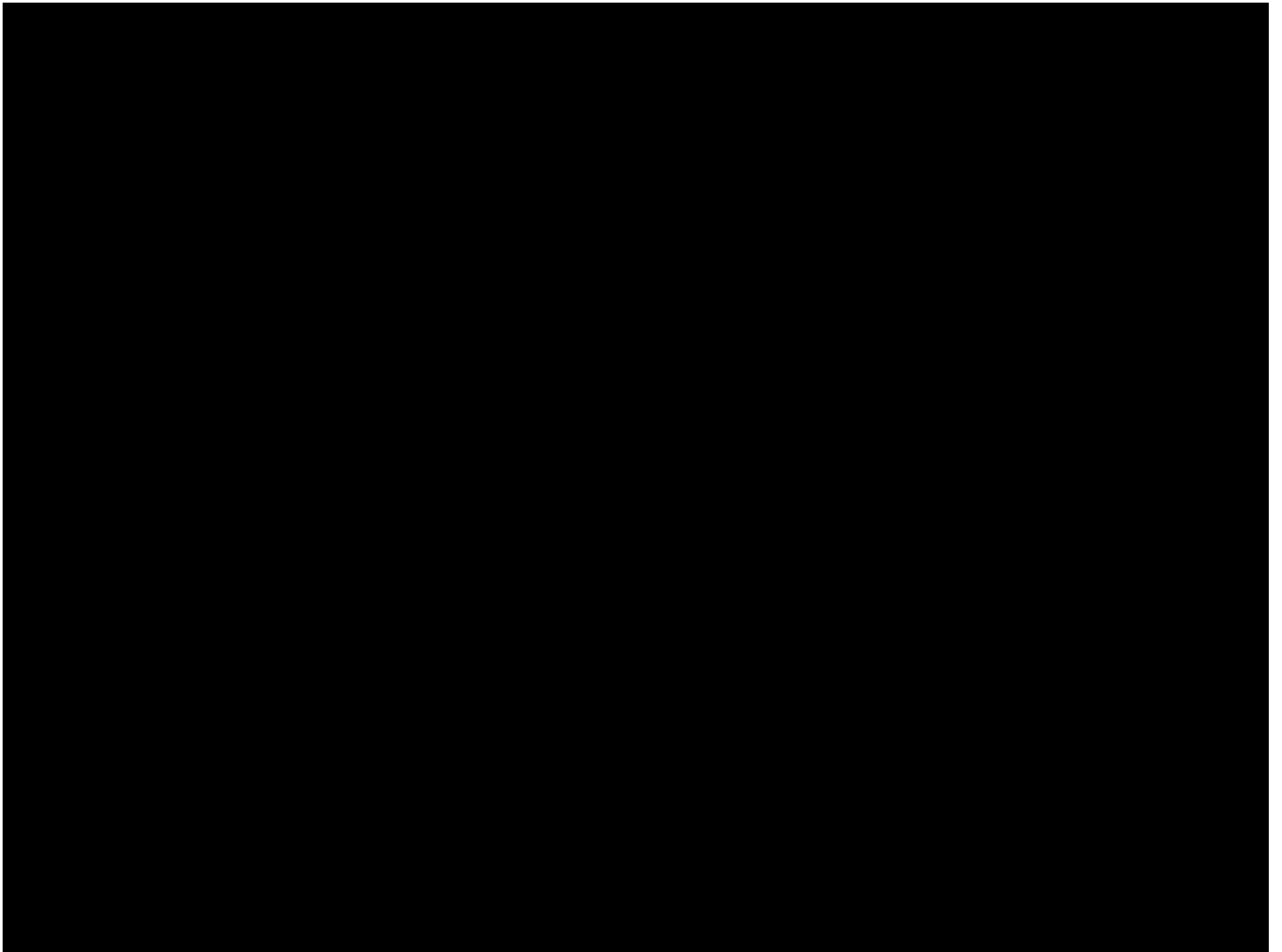


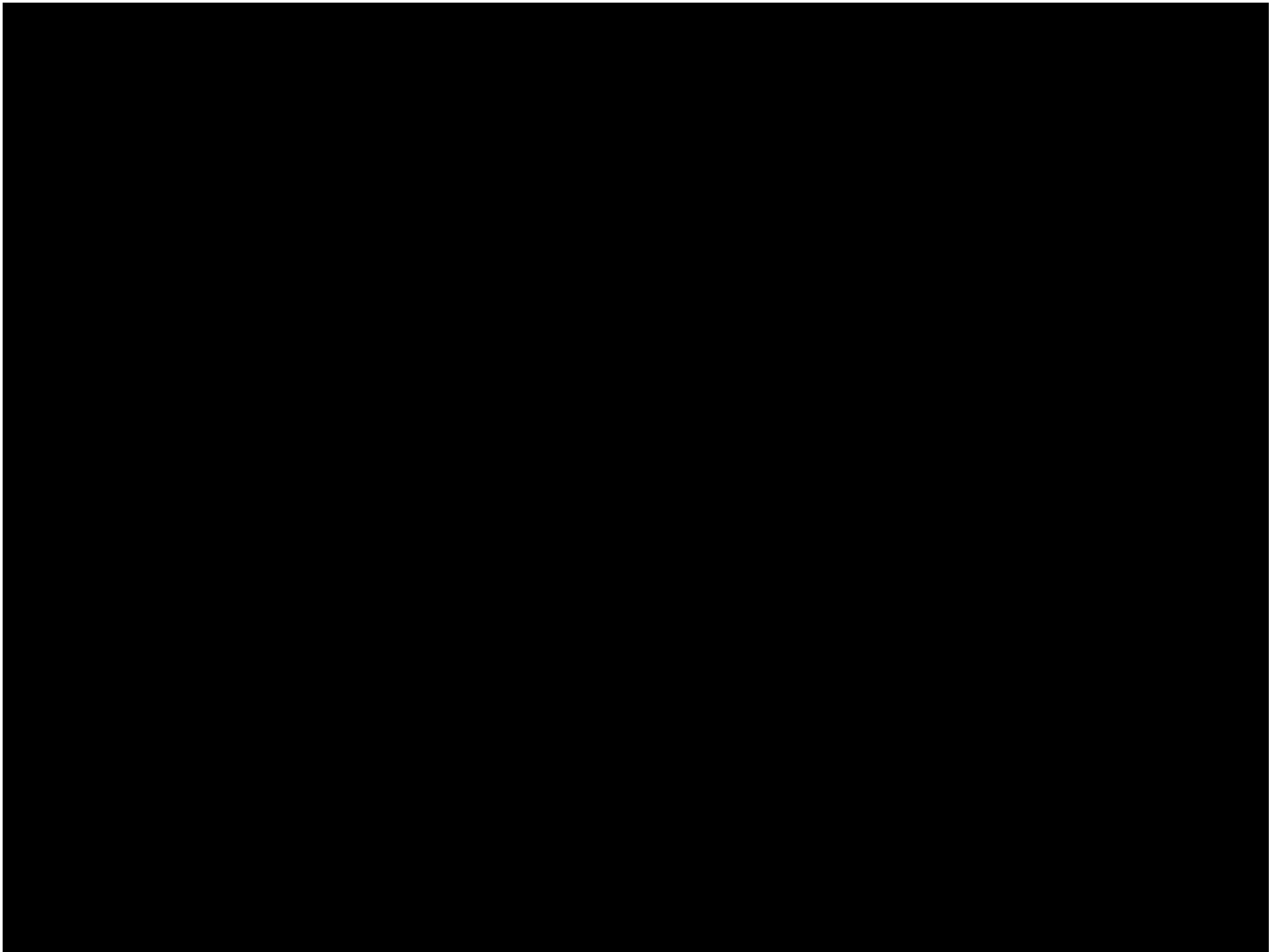
A photograph of emergency responders at a scene, overlaid with a blue semi-transparent filter. The responders are wearing dark uniforms and are focused on providing medical care to a patient lying on a stretcher. One responder is kneeling and attending to the patient's head, while others stand nearby, some holding red medical bags. The background shows a red fire truck and other emergency vehicles. The overall scene is busy and professional.

# Pre-hospital Management of Blast Injuries

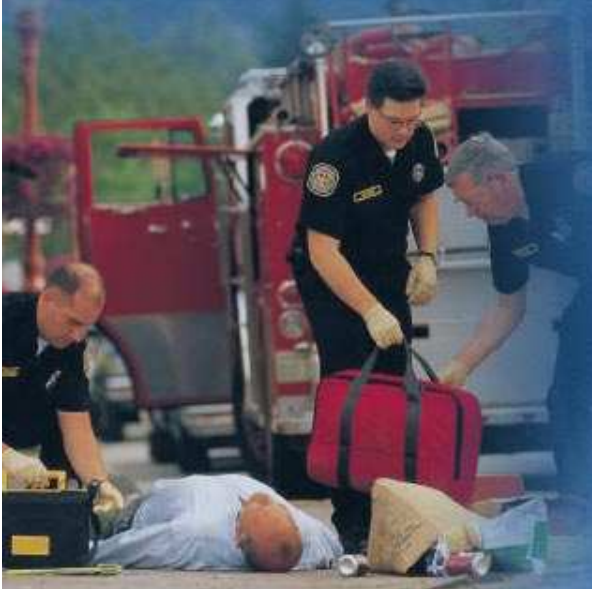
Guy Peifer

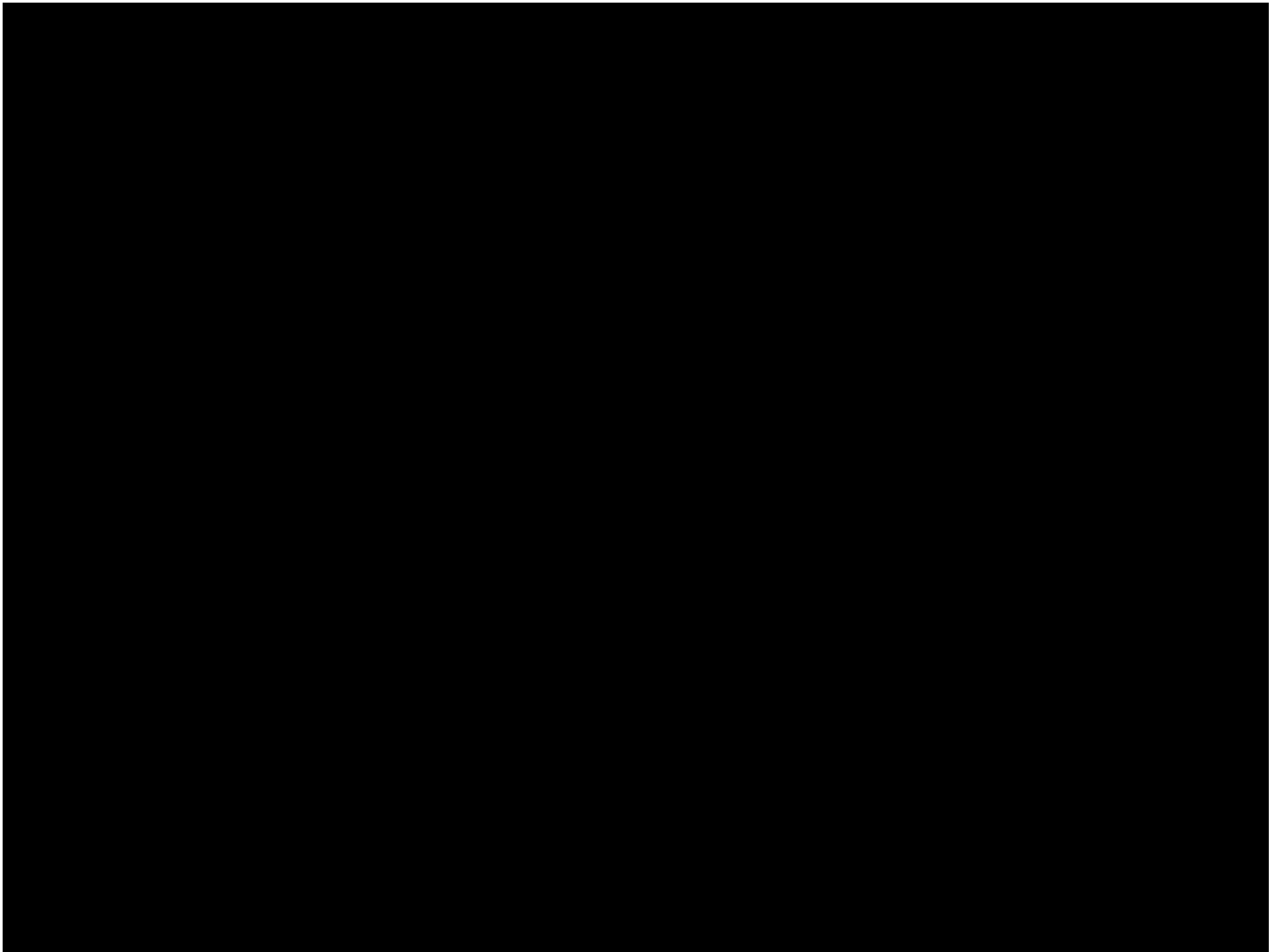






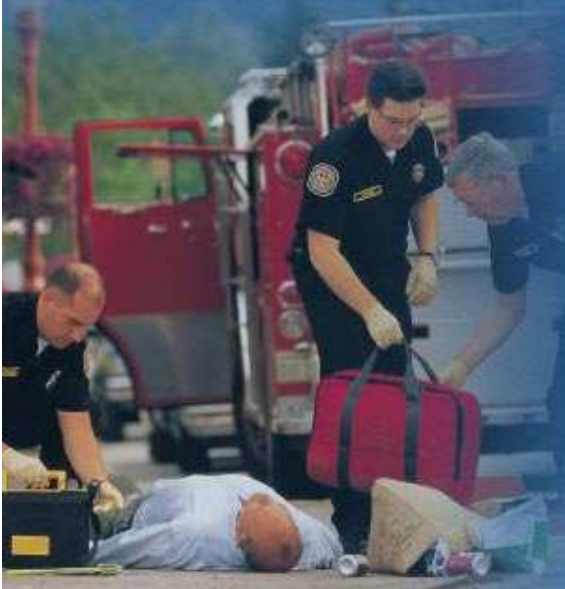
Extrication and life support are the primary management priorities.



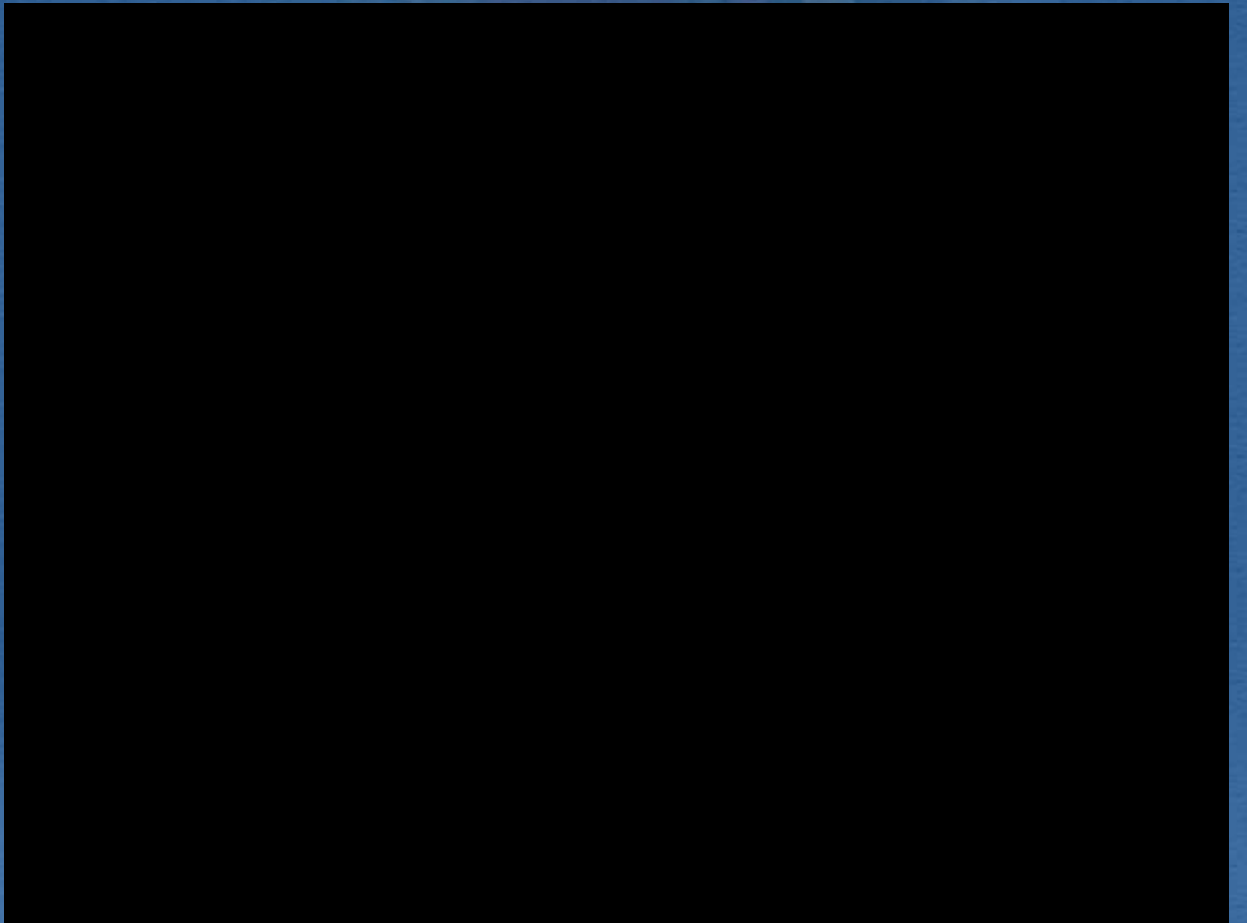




- When faced with a major explosion, the EMT and Paramedic's job will be difficult.
- The predominant injuries found after an explosion will be penetrating and blunt trauma.
- Because the initial signs and symptoms of significant blast injury can be subtle, the early presentation of victims can be deceiving.
- Blast lung injury is the most common fatal injury among initial survivors of the blast.



An explosion that occurs in a confined space (vehicles, mines, buildings, and subways) is associated with greater morbidity. If the structure collapses, this markedly increases mortality.







**Unique  
to Blast**

## PRIMARY

- Blast lung
- Eardrum rupture and middle ear
- Abdominal hemorrhage and perforation
- Eye rupture
- Non-impact, blast-induced mTBI?

## SECONDARY

- Penetrating ballistic (fragmentation) or blunt injuries
- Eye penetration

## TERTIARY

- Fracture and traumatic amputation
- Closed and open brain injury
- Blunt injuries
- Crush injuries

## QUATERNARY

- Burns
- Injury or incapacitation from inhaled toxic fire gases

## QUINARY

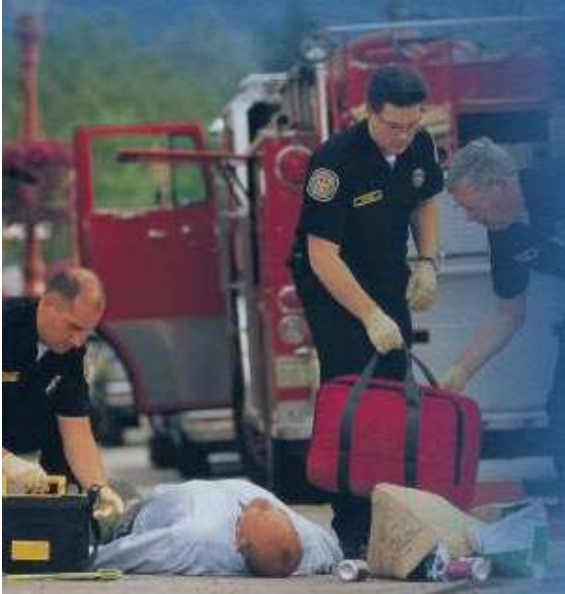
- Illnesses, injuries, or diseases caused by chemical, biological, or radiological substances (e.g., "dirty bombs")

## \*PSYCHOLOGICAL TRAUMA (including PTSD)

- \* Added based on latest research suggesting a high risk of developing PTSD following a concussion

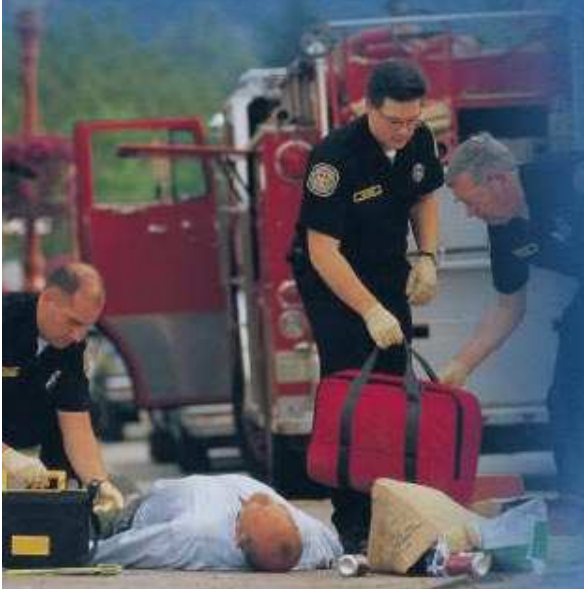
# Special Considerations

- Overzealous fluid administration may worsen primary pulmonary injury and bleeding.
- Mechanical ventilation and positive pressure ventilation may increase the risk of alveolar rupture and air embolism.
- Transport patient in a left lateral trendelenburg position to prevent air embolism.



## Scene Safety

If patient is unconscious or there is a fatality and you are evaluating the patient for signs of life: Before moving note if there are wires coming from the patient, or it appears the patient is lying on a package/pack, or bulky item, do not move the patient, quickly back away and immediately notify a law enforcement officer.

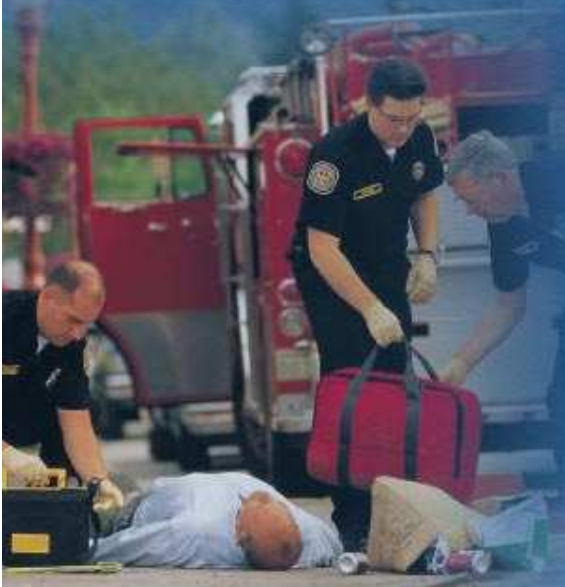






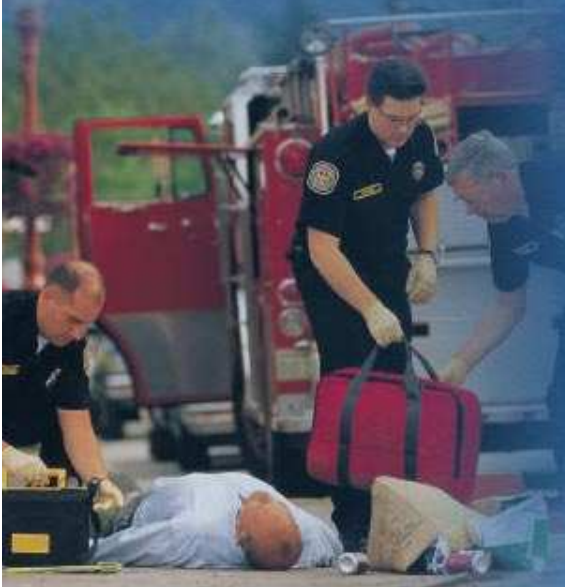
# Scene Safety: Common Hazards

- Secondary devices
- Shrapnel
- Building collapse
- Air-borne contaminants
- Contaminated patients
- Contaminated scene/environment
- Perpetrators
- Terrorist patients



# Scene Safety: Common Hazards

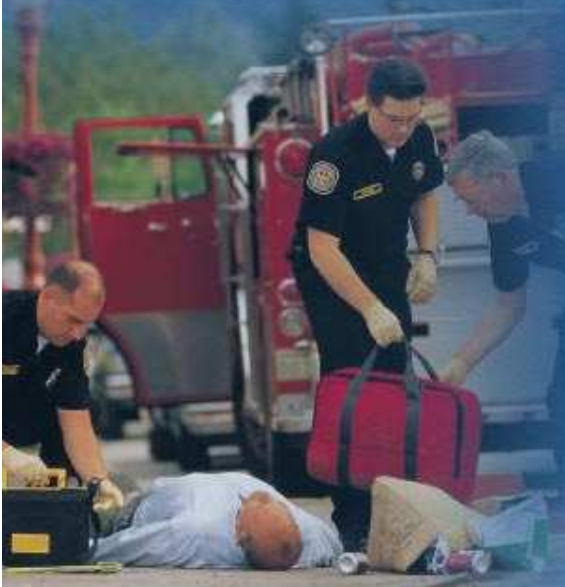
- Victims with no soft tissue injuries
- Vehicles coming or leaving scene (out of place)
- People acting oddly
- Packages or containers at scene (out of place)
- Vehicles not damaged or out of place
- Structural damage
- Weather
- Possible places for secondary devices





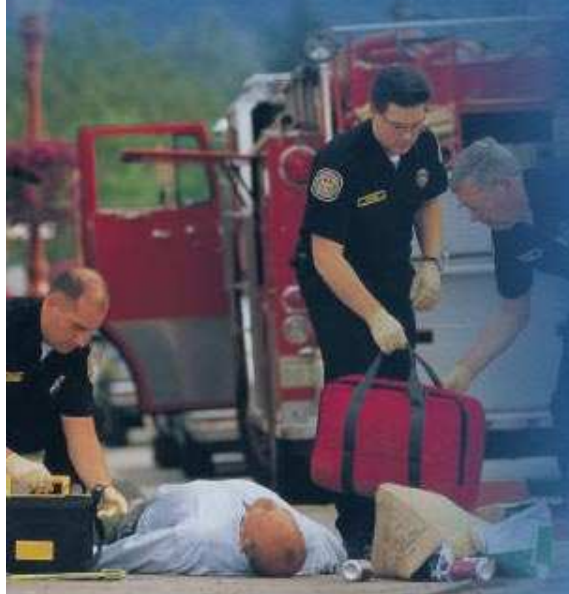
# Scene Safety: Appropriate PPE for blasts

- Coveralls
- Heavy coat
- Heavy gloves
- Steel-toed boots
- Hard hat
- Eye protection
- Dust particle mask
- Breathing apparatus for toxic fumes



# Scene Safety: Common Principles

- Contain the incident
  - Deny entry to all but responders
  - Set up zones
    - Hot
    - Warm
    - Cold
- Contain the people
  - Do not let anyone leave scene until checked
  - Decontaminate if necessary





# Scene Safety: Common Principles

- Cause no further injury or destruction
- Protect yourself
- Activate command and hazard response (ICS)
- Limit access
- Contain the incident



Photo used with permission of Kathryn Brinsfield, MD, FACEP

VARI0U-1.JPG

Incident  
Command

Operations

Planning

Logistics

Finance/Admin

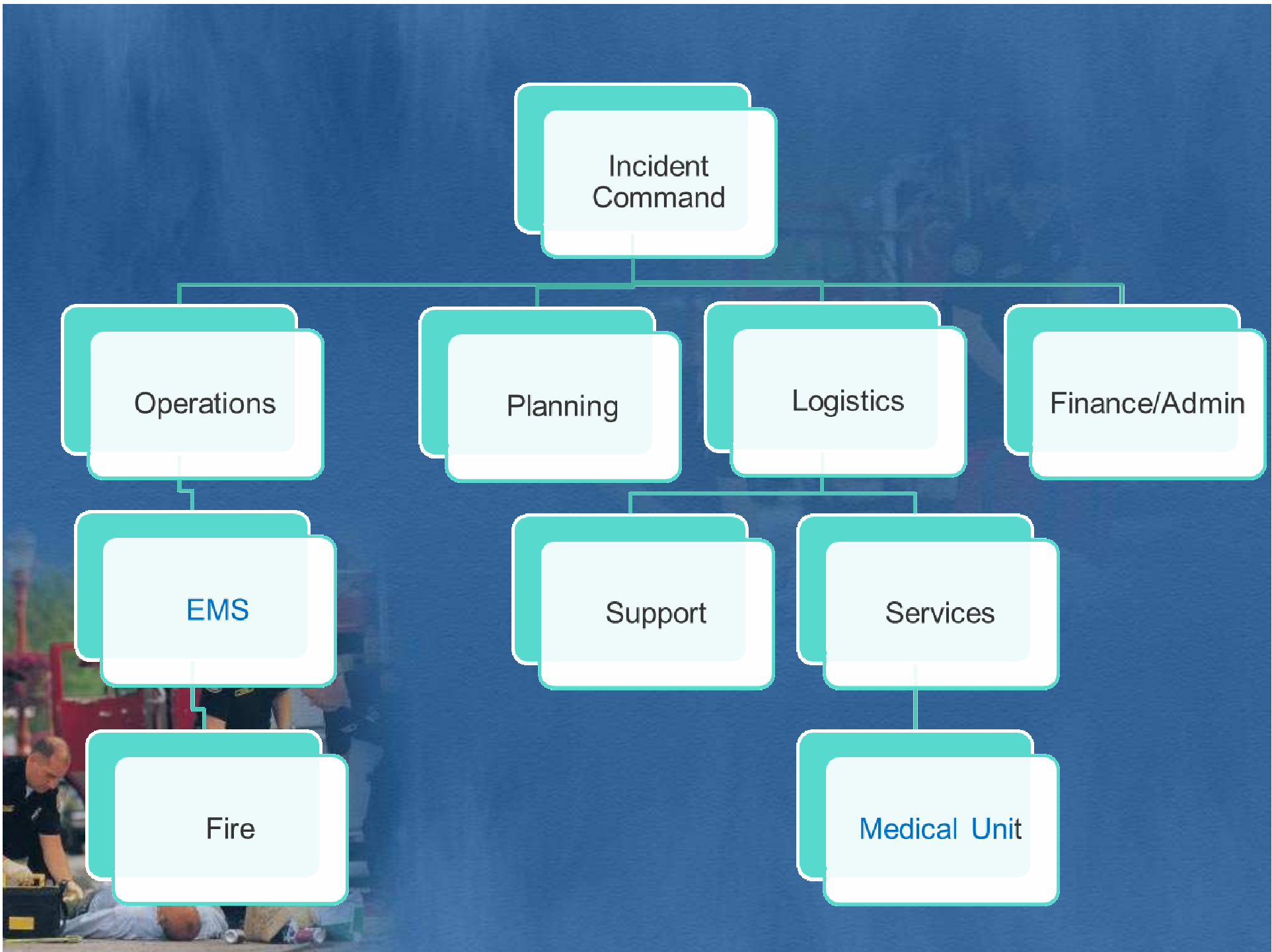
EMS

Support

Services

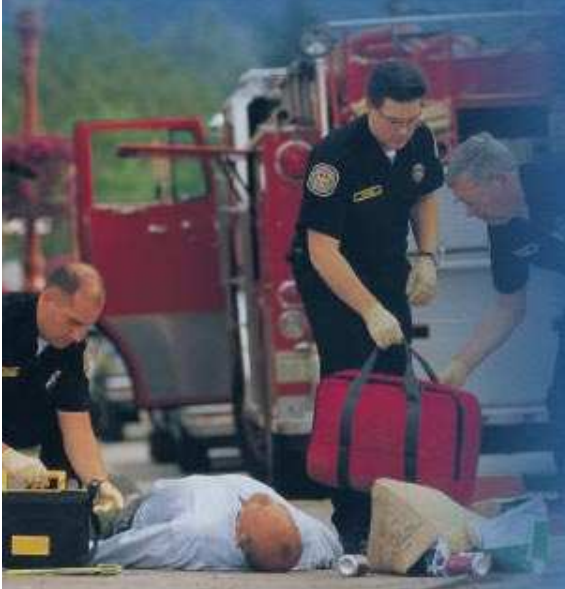
Fire

Medical Unit



# Scene Safety: Common Principles

- Worker safety
- Protection of uninvolved public and volunteers
- Protection of injured
- Treatment of injured
- Surveillance of patients and workers for long-term effects







# Triage

**EVACU-AID™ TRIAGE TAG**

**CONTAMINATION:**  NO  YES  
Circle tape slices

Respirations  Yes  No  
 Perfusion  +2 SEC  -2 SEC

Mental Status  Can do  Can't do  
 Max + ORIENTED  DISORIENTED  UNCONSCIOUS

Time: \_\_\_\_\_ Pulse: \_\_\_\_\_ B.P: \_\_\_\_\_ Respiration: \_\_\_\_\_

Time: \_\_\_\_\_ Drug Solution: \_\_\_\_\_ Dosage: \_\_\_\_\_

Major Injuries: \_\_\_\_\_  
 Destination: \_\_\_\_\_

**DECEASED** **DECEASED**

**IMMEDIATE** **IMMEDIATE**

**DELAYED** **DELAYED**

**MINOR** **MINOR**

Notes: \_\_\_\_\_

Notes: \_\_\_\_\_

Allergies: \_\_\_\_\_  
 Prescriptive Medication: \_\_\_\_\_

**Personal Information**

Name: \_\_\_\_\_  
 Address: \_\_\_\_\_  
 City: \_\_\_\_\_ St: \_\_\_\_\_ Zip: \_\_\_\_\_ Phone: \_\_\_\_\_  
 Male: \_\_\_\_\_ Female: \_\_\_\_\_ Age: \_\_\_\_\_ Weight: \_\_\_\_\_





# 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



# 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





# 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



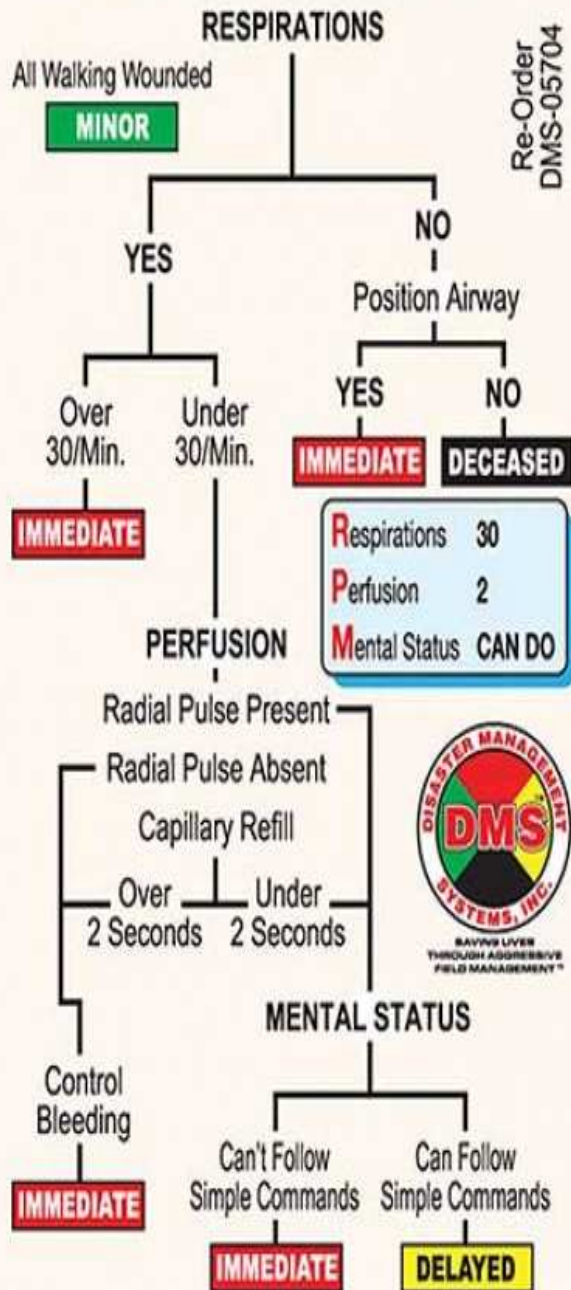
# START Triage

- Simple Triage and Rapid Treatment
- Respirations
- Perfusion
- Mental State

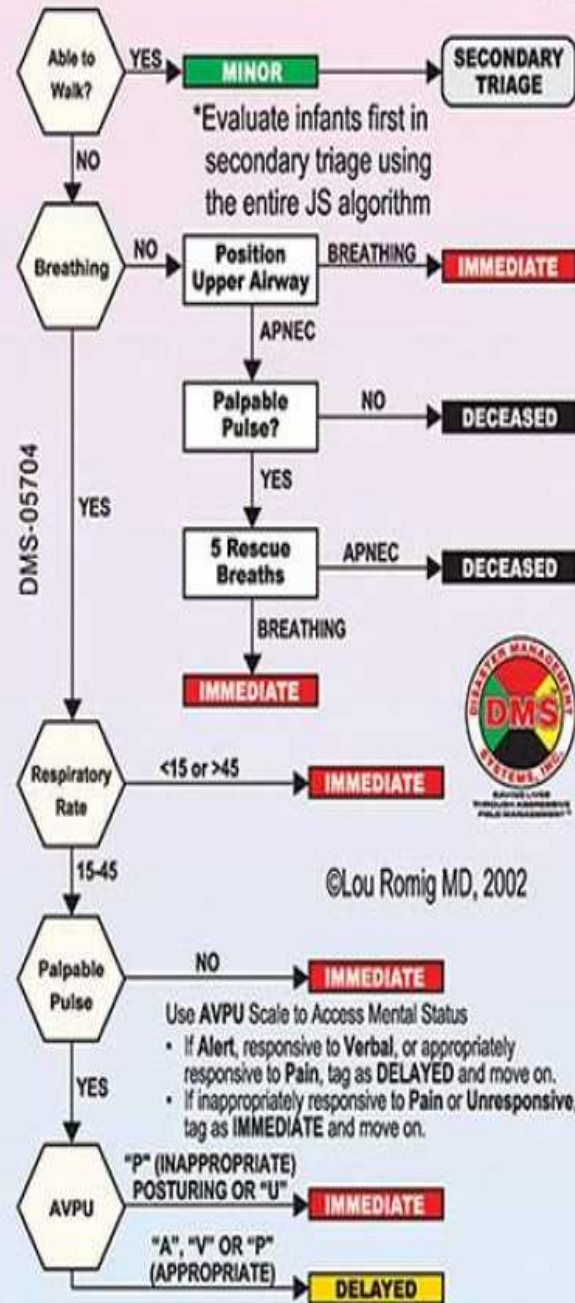




# START TRIAGE



# JumpSTART Pediatric MCI Triage





# History

- **What type of explosive and how much?**
- **Where was victim located with respect to the blast?**
- **What did the victim do after the blast?**
- **Were fire/fumes present to cause inhalational injury?**
- **What was orientation of head and torso to the blast?**





# Open Chest Wounds

- Occlusive dressing
  - Ascherman
  - SAM





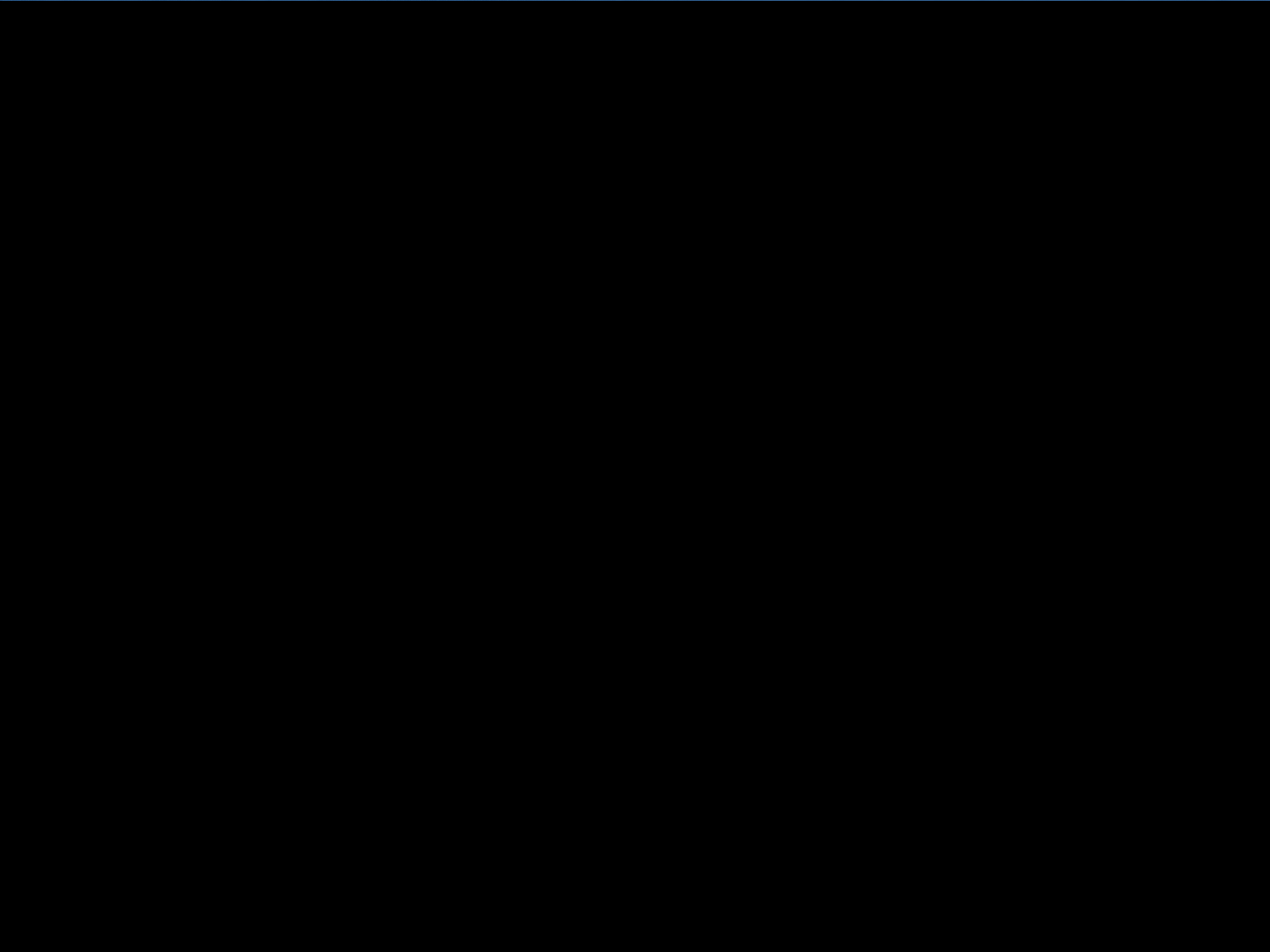
# Bleeding and Shock

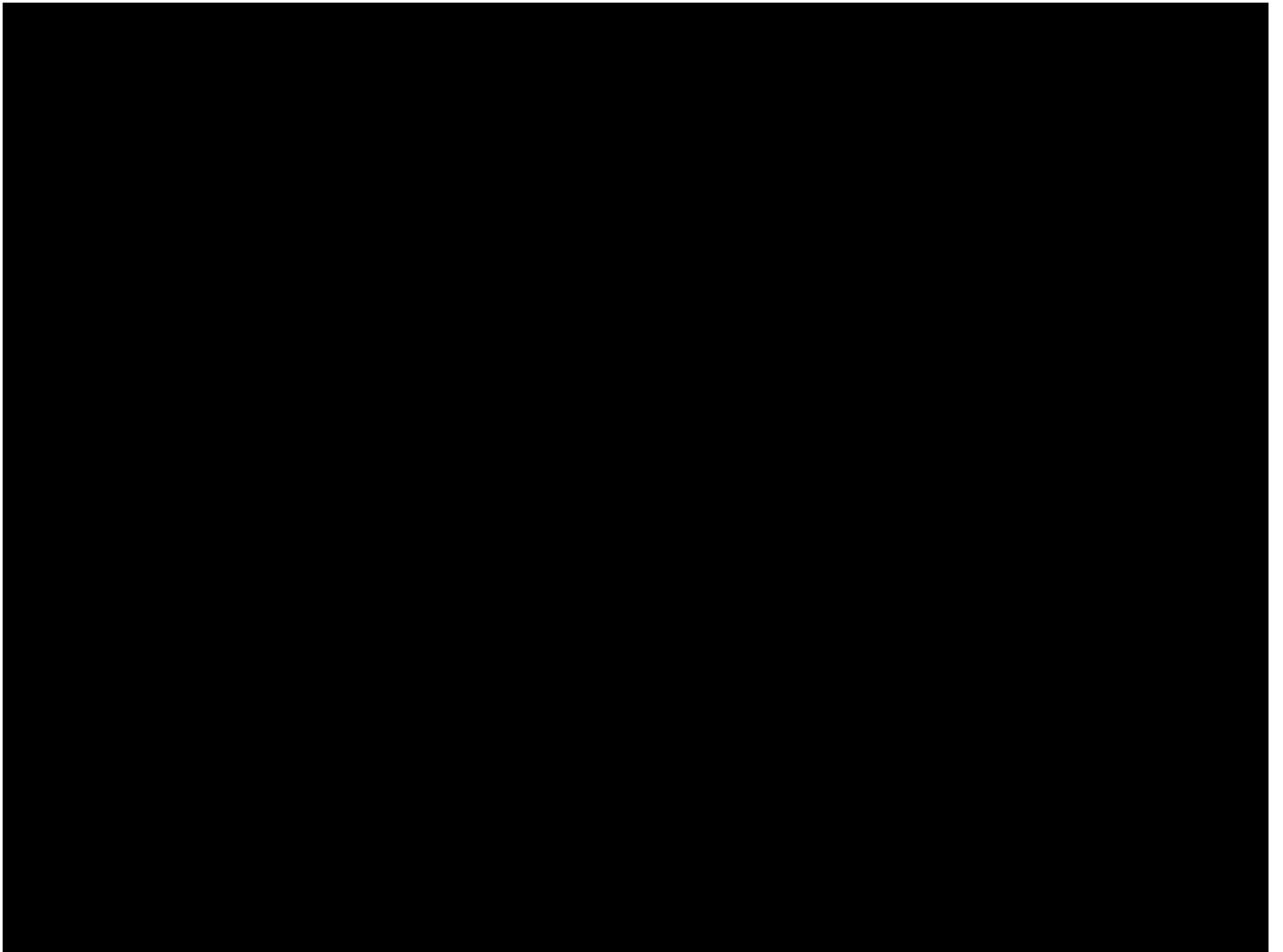




“tourniquets have made a comeback with a vengeance, due to their overwhelming success at saving lives in Iraq and Afghanistan, and most recently during the Boston marathon bombing.”









# Burns

Phosphorous

Thermal

Acid

Radiation



Parkland Formula  
(4 ml x weight in Kg x % of BSA)





# Impaled Objects

- Do not remove impaled objects
- If object prevents transport (too large, etc.), shorten (saw, cutters, etc.)





# Long Bone Fractures

Often present with significant soft tissue damage.

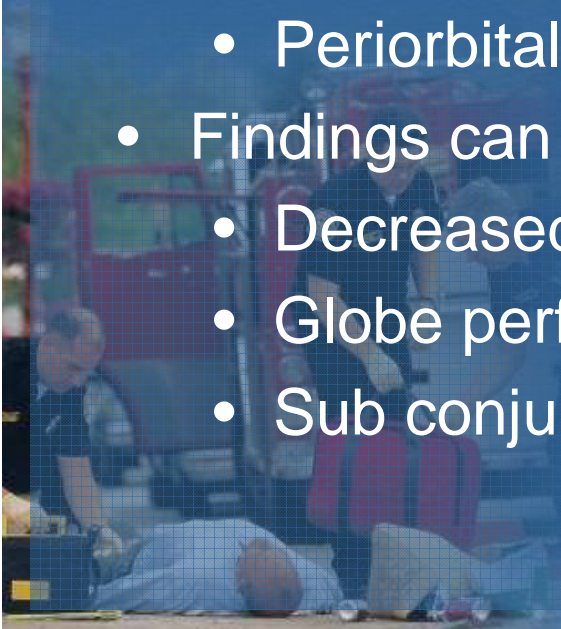
Distracting. Don't get Tunnel Vision





# Eye Injuries

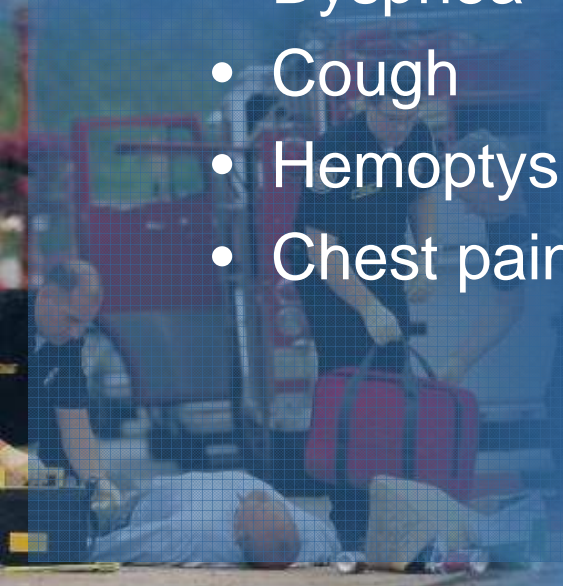
- 10% will have an eye injury.
- Symptoms include:
  - Eye pain or irritation
  - Foreign body sensation
  - Altered vision
  - Periorbital swelling or contusions
- Findings can include:
  - Decreased visual acuity
  - Globe perforation
  - Sub conjunctival hemorrhage





# Blast Lung

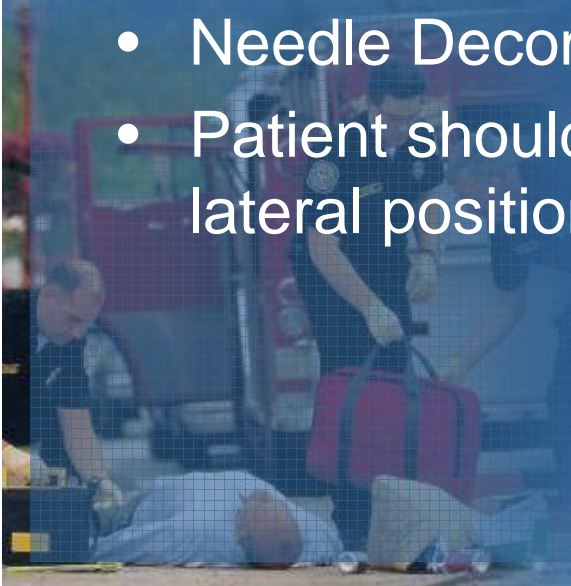
- Most common fatal primary blast injury.
- Signs usually present at the time of the initial evaluation but can present up to 48 hours after.
- Triad of apnea, bradycardia, and hypotension.
- Suspect for patients with:
  - Dyspnea
  - Cough
  - Hemoptysis (spitting or coughing up blood)
  - Chest pain





# Blast Lung Management

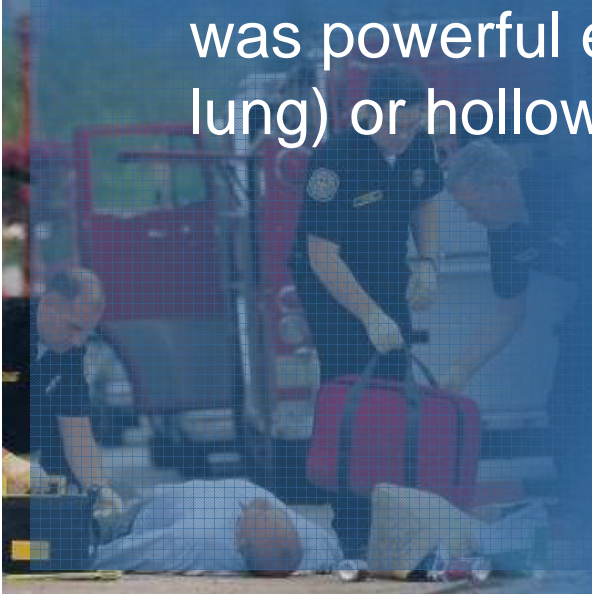
- IV fluid use ensuring tissue perfusion without volume overload.
- Supplemental high flow oxygen sufficient to prevent hypoxemia.
- Patients with massive hemoptysis or significant air leaks may benefit from selective bronchus intubation.
- Needle Decompression.
- Patient should be placed in prone, semi-left lateral, or left lateral positions.





# Ear Injury

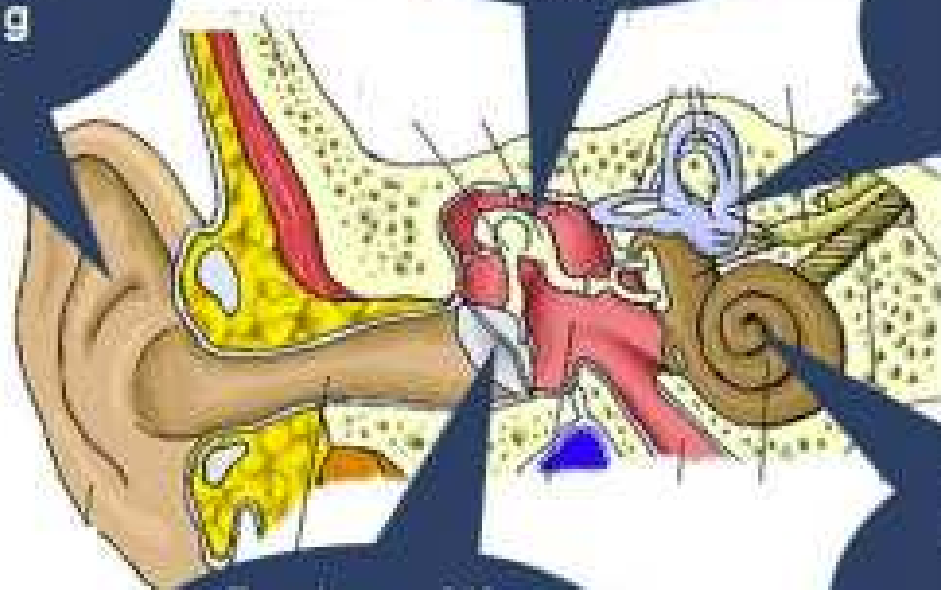
- Signs of ear injury are usually present at the time of the initial evaluation and should be suspected for anyone presenting with hearing loss, tinnitus, and vertigo, or bleeding from the external ear canal.
- If there is blood coming from the ears suspect the blast was powerful enough to cause pulmonary injury (blast lung) or hollow organ injury.



Pinna damage:  
burns/damage  
from flying  
debris

Ossicular  
disruption  
from pressure  
wave

Blast wave  
damages to  
semicircular  
canals causing  
vestibular  
problems



Rupture of the  
tympanic  
membrane from  
pressure wave

Blast wave and  
noise damages  
hair cells and  
basilar  
membrane in  
cochlea



# Abdominal Injuries

Gas-containing sections of the GI tract are most vulnerable to primary blast effect.

- Immediate or delayed bowel perforation.
- Internal hemorrhage
- Solid organ lacerations
- Testicular rupture





# Abdominal Injuries



- Abdominal pain
- Nausea
- Vomiting
- Vomiting blood
- Rectal pain
- Testicular pain
- Unexplained Hypovolemia
- Distention/rigidity

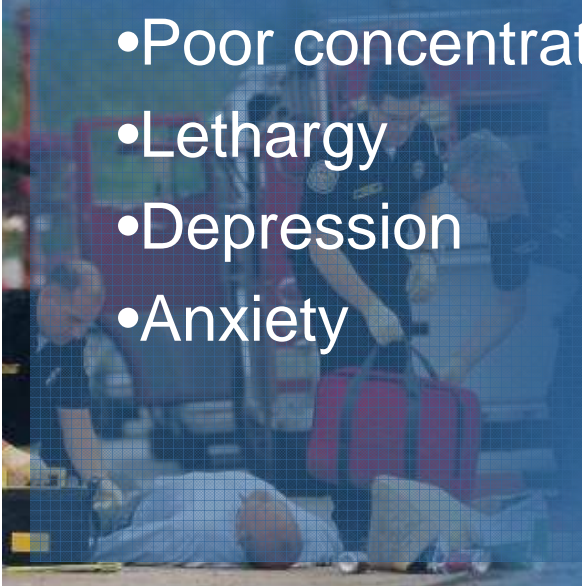




# Brain Injury

Primary blast waves can cause concussions or mild traumatic brain injury without a direct blow to the head. Consider the proximity of the victim to the blast. Patient may present with:

- Headache
- Fatigue
- Poor concentration
- Lethargy
- Depression
- Anxiety





# Special Considerations: Pregnancy

- Injuries to the placenta are possible.
- Second or third trimester of pregnancy should be transported for continuous fetal monitoring.
- The placental attachment is at risk for primary blast injury.





# Special Considerations: Children

- History of event or patient's complaints may be difficult to obtain.
- Pulmonary contusion is one of the most common injuries from blunt thoracic trauma. The injury may not be clinically apparent initially and should be suspected when abrasions, contusions, or rib fractures are present.
- Specialized equipment & facilities





# Special Considerations: Elderly

- May be at a higher risk of mortality.
- Orthopedic injuries may be more prevalent.
- Blunt chest trauma should be of special consideration.
- Decontamination methods may need modification due to limited mobility.
- Technical decontamination of medical equipment such as wheelchairs, walkers and other walking aides may be needed.





# Special Considerations: Disabled

- Consideration should be given to patients with underlying medical conditions.
- Untreated or inadequately treated fractures may lead to severe and long lasting disabilities.





# Special Considerations: Language Barriers

- Diverse population speaking multiple languages may be an unforeseen obstacle
- Interaction with the deaf, hard of hearing, late-deafened and the deaf-blind
- History of the event may be difficult to obtain as well as the individual history for the patient.
- Translation
  - On scene resources
  - Pool of medical interpreters including sign language
  - Telephone translation services



Lets Not Forgot to Take Care of Ourselves

