

Civilian Hospital Response to Mass Casualty Events The Israeli Experience

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Mass Casualty Events in Israel

October 2000-January 2003

- 91 Events
- 71 Explosions (78%)
- 53 Open Space Explosions
 - 1976 injured, 156 dead
 - 37 injured/event, 3 dead/event
- 18 Closed Space Explosions
 - 911 injured, 177 dead
 - 50 injured/event, 10 dead/event

Mass Casualty Drill, Haifa July 2003



Mass Casualty Drill, Haifa July 2003







Scene of the Explosion, January 29, 2004



Scene of the Explosion

- Magen David Adom
- Police
- Fire
- Army

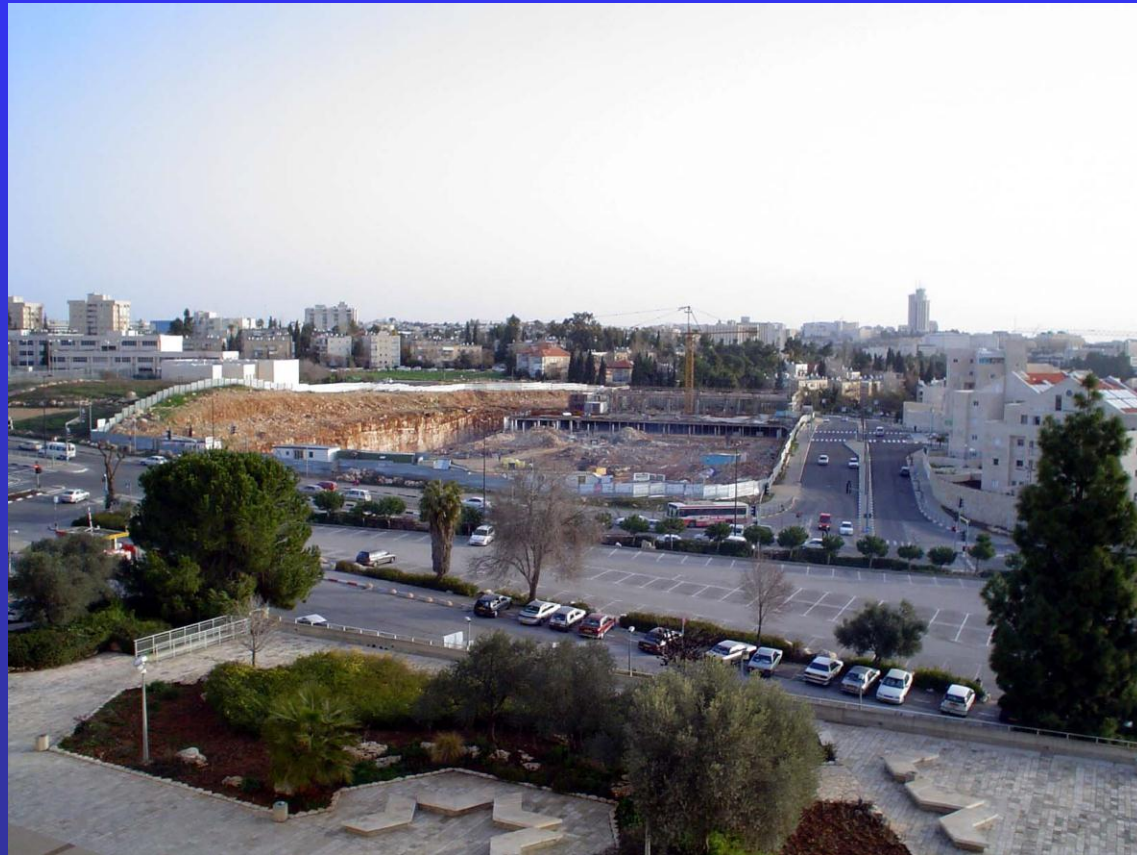
Procedure at the Scene

- Secure the area – limit access to the victims
- Identify additional terrorist operatives – prevent a “second hit”
- Search for unexploded ordinance
- Extract and concentrate victims
- Airway, Breathing
- Immediate Evacuation of Victims with Life threatening injuries to hospital
- Distribute victims to various hospitals to avoid overloading any one hospital

Securing the Hospital- Traffic controlled and intersections approaching the hospital



All ambulances inspected at entrance to hospital



Sha'arei Zedek Hospital

- 08:48: Emergency Room notified of terrorist attack
 - ER cleared of patients
 - Patients transported to corridors
 - “Aran Storage” opened and emergency gurneys removed
 - Front area of ER cleared for Triage
 - Security Commander arrives



- 08:54: All emergency gurneys out of storage and triage area clear
- Triage physician in initial triage area
- 08:55: Hospital ready for casualties (7 minutes after report of explosion)
- Information received from field that 34 casualties will arrive



9 minutes after the explosion the Asst Hospital Director arrives to inform the Triage Officer (Hospital Commander) the number of free operating rooms available. Armed guards arrive to control entrance to the ER



- 09:00 12 minutes after the explosion, a representative of MADA arrives providing communication between field commander and hospital commander.
- Transport begins at approximately the same time.



- 13 minutes after the explosion, a large number of worried citizens begin to arrive searching for relatives.



- A large number of professional and non-professional volunteers arrive to help (and hinder!!)



- At 09:06, the first ambulance arrives, 18 minutes and 30 seconds after the explosion
- Last ambulance arrives at 09:23
- 15 patients arrive within 17 minutes





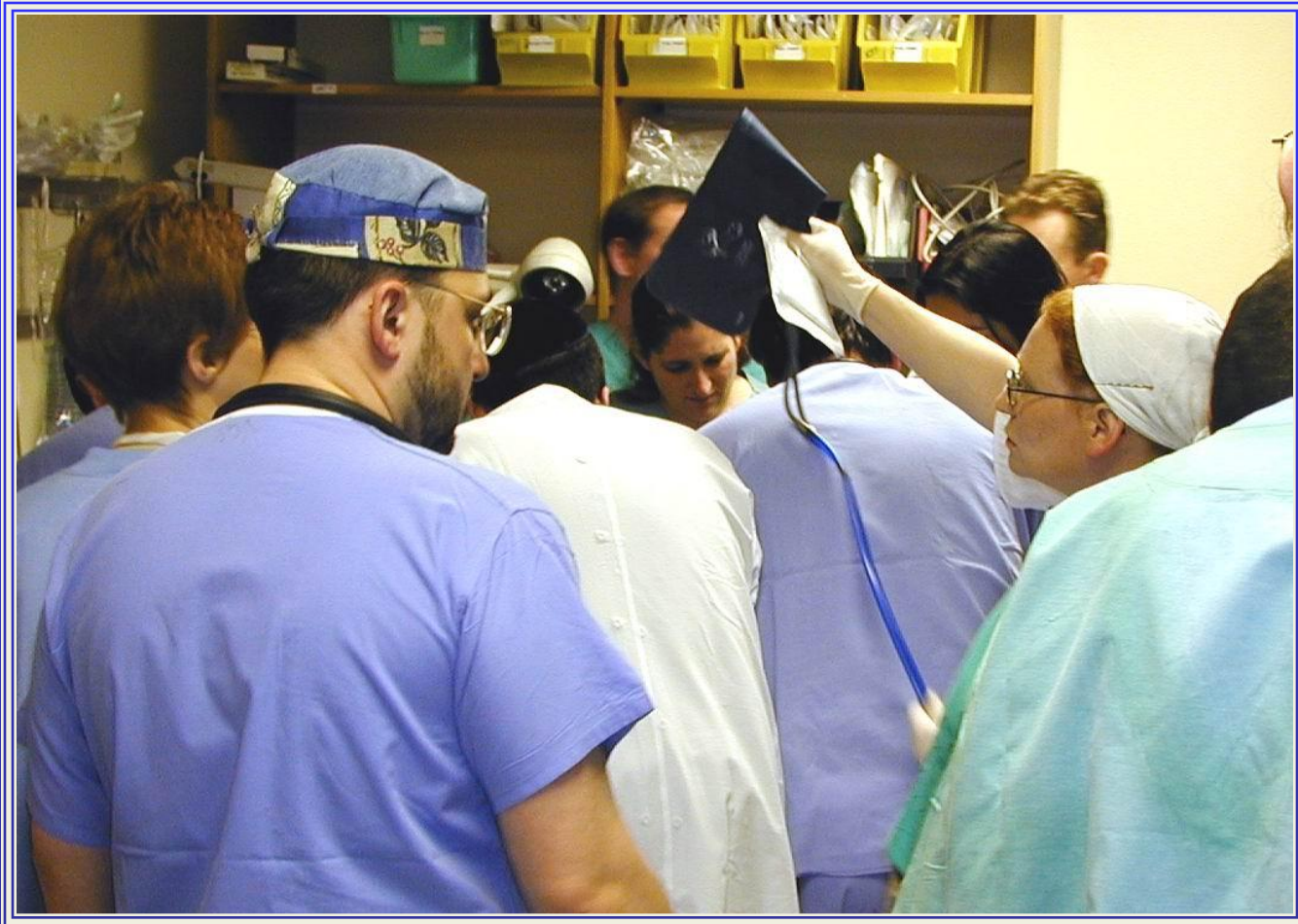
Secondary Triage by Senior Surgeon immediately within ER



Goal of Secondary Triage

- “The Sickest to the Most Experienced”
- Separate the Critically Injured patients (relatively few) from the large number of patients with non-life threatening injuries

Congested Trauma Room



Recovery Room – Tertiary Triage/ICU Station



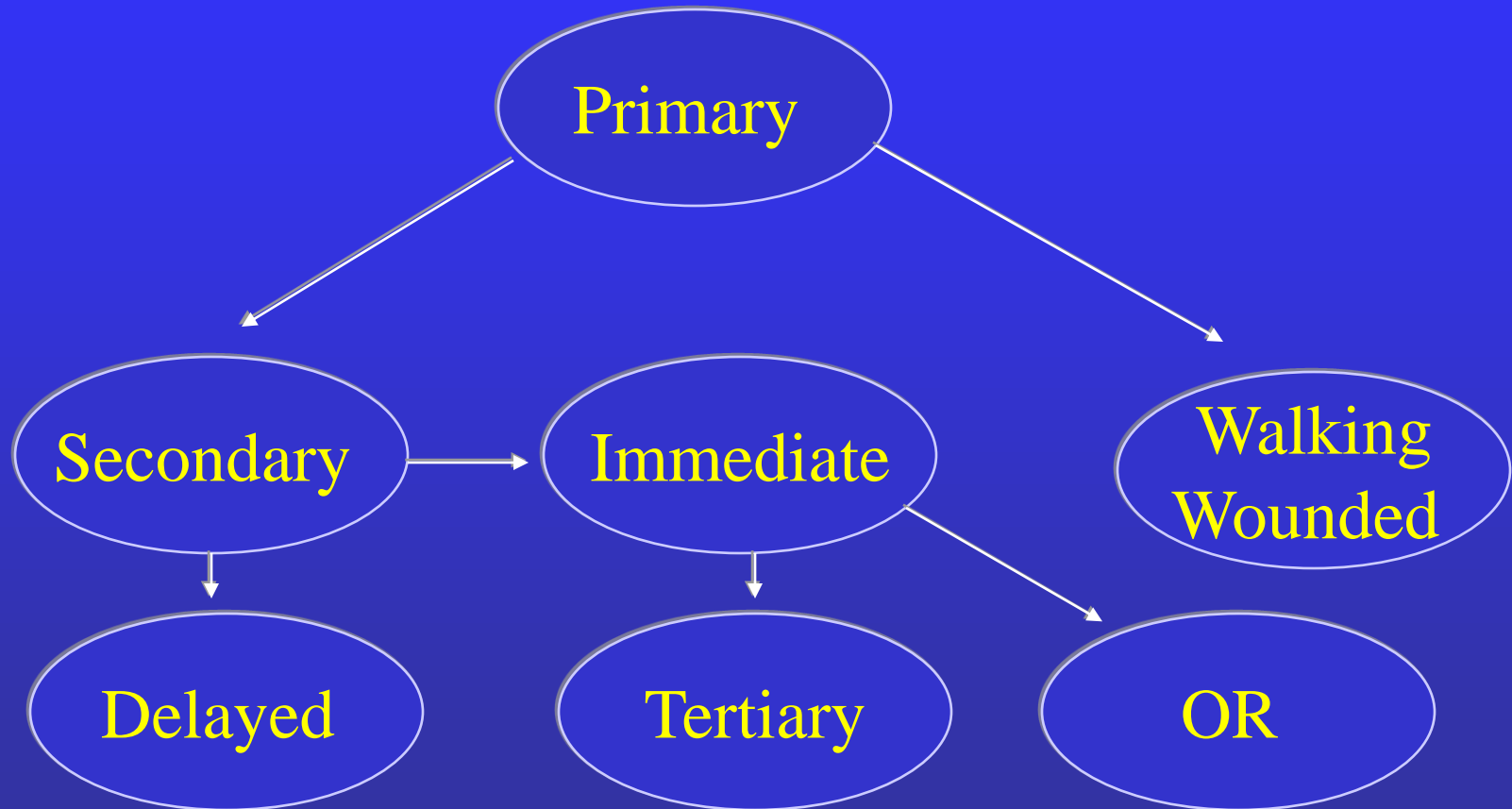
Delayed Care

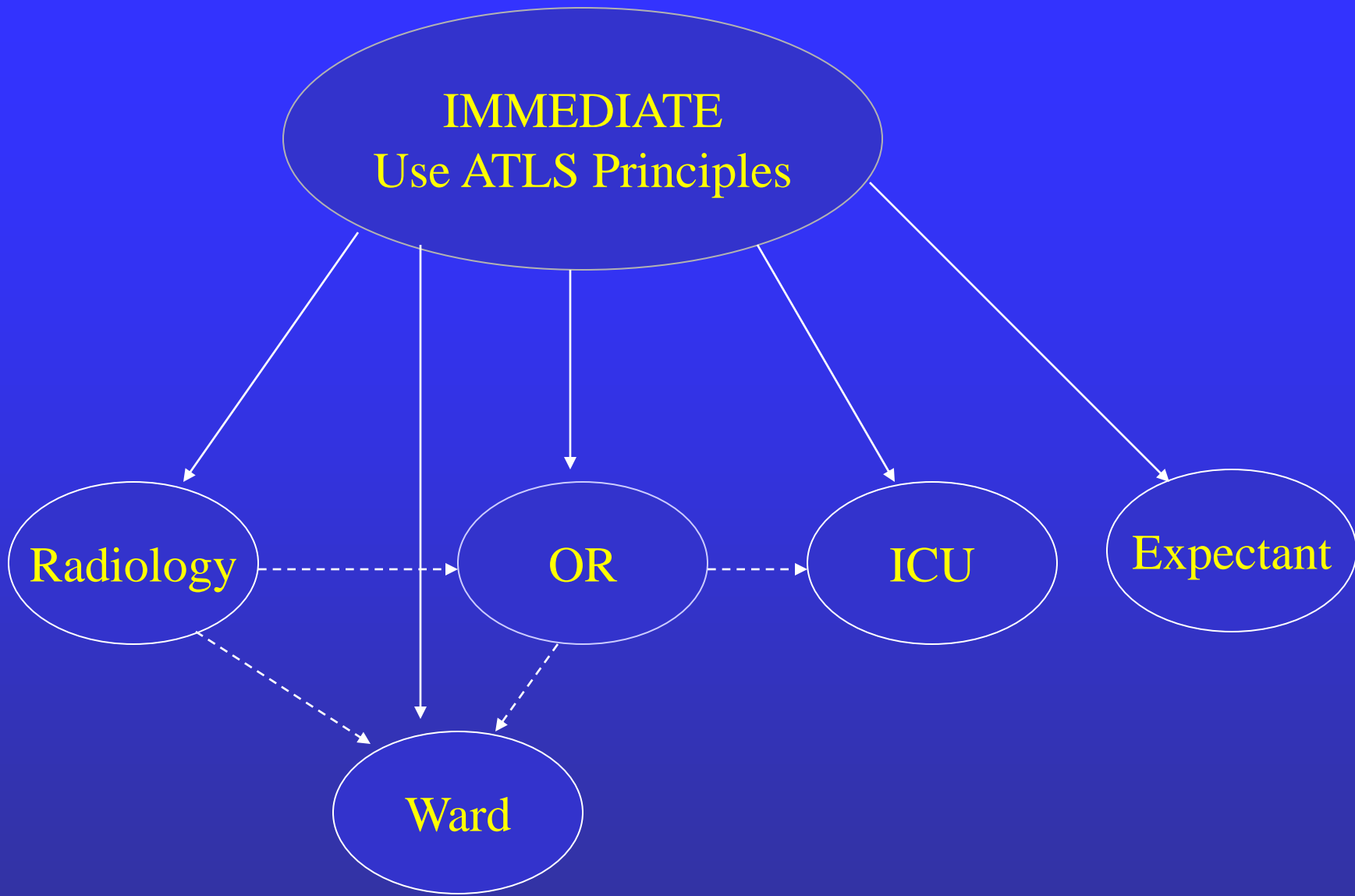
- Each patient is assigned a physician (preferably a junior surgeon) and a nurse
- A senior surgeon is in charge of the Delayed Treatment area.

Walking Wounded

- One senior surgeon is in charge of this area
- The patients are managed primarily by nurses and junior doctors

Initial Triage Stations





Intra-hospital Triage

Time (min)	50	70	90	110	150	180	210	240	270	330
RR	1	2	1	3	1	4	4	4	2	2
ER	13	6	6	2	3	2	3	3	2	2
CT	4	8	10	10	8	2	3	3	5	3
D/C	0	3	3	4	6	7	7	9	9	11
Hosp Xfer	0	0	1	1	1	1	1	1	1	1
Ward	0	0	0	1	2	4	4	2	3	3
OR	0	0	0	0	1	2	1	1	1	1
Total	18	19	21	21	22	22	23	23	23	23

Terrorist Bombing Victims at SZMC Jan 1995-Jan 2004

- 847 victims of bombings
- 14 (1.6%) died during initial resuscitation
- 32 (3.8%) required ICU admission
- 160 (19%) admitted to ward
- 46 Severely Injured Patients

Spectrum of Explosive Related Injuries

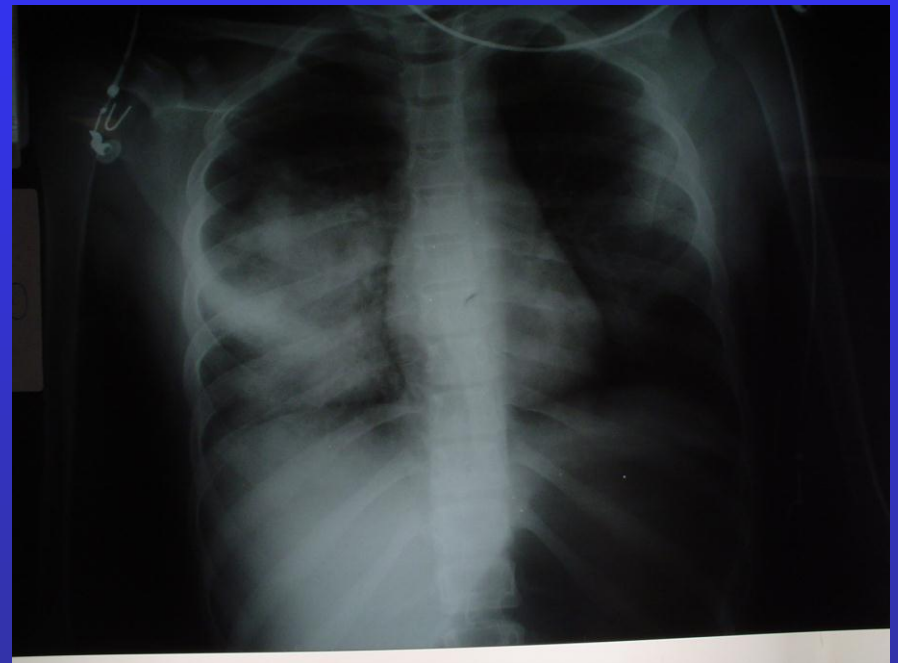
- Auditory: Ruptured TM, Ossicular disruption, cochlear damage, foreign body
- Eye, Orbit, Face: Ruptured globe, foreign body, fracture, air embolus
- Respiratory: Blast Lung, Pneumothorax, air embolism, Pulmonary Contusion, Aspiration
- GI: Bowel Perforation, Hemorrhage, Solid Viscus Injury (blunt trauma), mesenteric ischemia (air embolus)

Spectrum of Explosive Related Injuries

- Circulatory: Myocardial Contusion, Myocardial infarction (air embolism), hemorrhagic shock
- CNS: Concussion, closed and open brain injury, stroke & spinal cord injury (air embolus), spinal cord injury (blunt trauma)
- Renal Injury: Contusion, laceration, acute renal failure (rhabdomyolysis, ATN due to shock)
- Extremity Injury: amputation, crush, fracture, compartment syndrome, etc. Most common reason for surgery

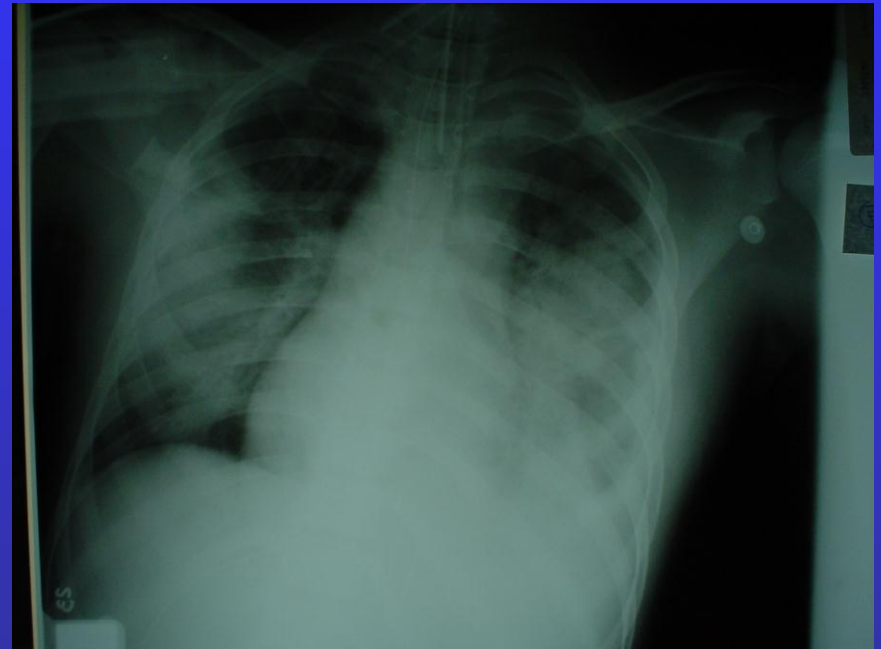
Case 1 Primary Blast Injury

- 12 yo girl involved in bus bombing Feb 23, 2004
- Admitted with SOB but hemodynamically stable
- CT scan ordered 40 minutes after arrival
- Intubated in CT Scan
- Fresh blood suctioned from ET tube



Case 1

- Infiltrates worsen
- CXR deteriorates
- Hemodynamic instability requires large infusion of crystalloid
- Gas exchange deteriorates, requires FiO₂ 100% and HFPPV



Case 1

- Patient improves with HFPPV and diuresis
- Develops diplopia for unclear reasons which improves over 2 month period
- Returns to school

Case 2 Primary and Tertiary Blast Injury

- 73 yo former Pediatric Head Nurse
- Bus explosion Jan 29, 2003
- Admitted with SOB, chest pain
- Injuries:
 - Flail chest
 - Pulmonary contusion
 - Fracture right humerus
 - Traumatic bilateral finger amputations
 - Partial thickness facial burns



Case 2

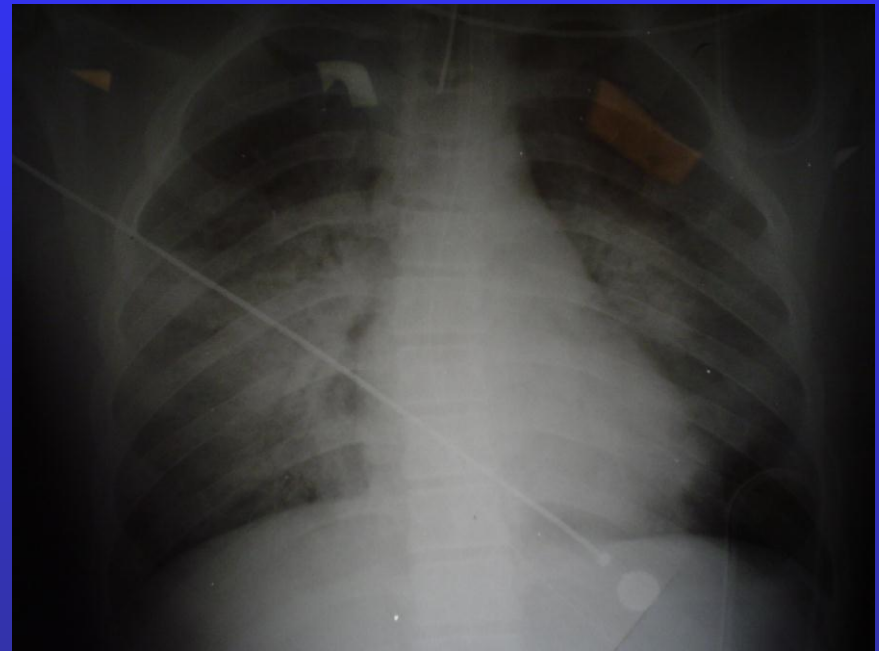
- 10 days of mechanical ventilation
- 1 month of in hospital rehabilitation
- Prolonged recovery at home

Significant Risk of Left Sided Air Embolism

- Caused by alveolar-pulmonary venous fistula due to disruption of alveoli due to primary blast injury
- Possible Patent Foramen Ovale
- Risk increased with positive pressure ventilation
- Clinical manifestations
 - Blindness
 - “Hemiparesis
 - Paraplegia
 - Acute obstruction of other vascular beds

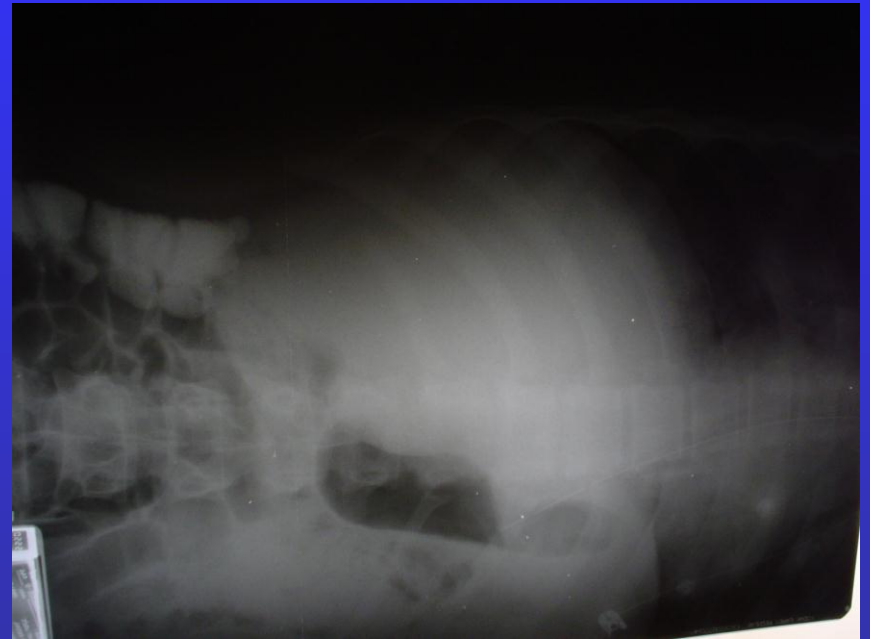
Case 3 Primary Blast Injury with Air Embolism and ? Intestinal injury

- 14 yo boy admitted in shock, unconscious with pH 7.0 and pCO2 70
- Intubated in ER and moved immediately to RR (secondary triage)
- Resp Status improves
- CT Chest and Abd ok except for pulm blast injury
- CT head ? Air embolus



HD3

- BP becomes labile
- Vomits a small nail
- Abdominal rigidity develops
- KUB in the middle of the night suggests free air
- Dx of delayed intestinal perf due to blast injury or shrapnel injury
- Exp lap: **NORMAL**



Case 3

- Condition at discharge:
- Left hemiparesis
- Extremely labile
- 2 months later Hemiparesis almost Completely resolved, playing soccer

Intestinal Blast Injury

- Jerusalem Bus Bombing reported in 1989
- 3 dead at the scene and 55 survivors
- 29 patients hospitalized
- 2 patients with perforated intestine with late presentation (delayed dx vs delayed perforation)

Katz E, Ofek B, Adler J et al. Primary blast injury after a bomb explosion in a Civilian bus. *Ann Surg* 1989;209:484-8

Intestinal Blast Injury

