Disaster Preparedness for Surgeons

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Today's Topics

- Overview of disaster planning
  - Why do you need to know this?
- Typical hospital response
  - Organization and response in ED
  - Role of surgeons
    - Traumatic MCIs
    - Other events
- IEDs and blast injuries

Disaster Planning

- Formal process
  - Nationally standardized format
  - National Incident Management System (NIMS)
  - Surgeon on disaster committee required in Trauma Centers

The “All Hazards Model”

- Tornado
- Earthquake
- Hurricanes
- “Man Caused Disasters”
  - Bombings
  - Plane crashes
  - CBRNE

Emergency Management Program

- Multiple components
  - Hazard Vulnerability Analysis (HVA)
  - Emergency Operations Plan
    - Event specific annexes
      - Chemical, Biological, Burn, Evacuation
  - Training
  - Exercise Program
    - Exercise plan, improvement process

Hazard Vulnerability Analysis

EVENT	PROBABILITY				RISK						PREPAREDNESS			TOTAL
					HUMAN (IN OUR BUILDING)			HOSPITAL DISRUPTION						
	HIGH	MED	LOW	NONE	DEATH	HEALTH/SAFETY	NONE	HIGH	MOD	LOW	POOR	FAIR	GOOD	
SCORE	**3**	**2**	**1**	**0**	**6**	**3**	**0**	**3**	**2**	**1**	**3**	**2**	**1**	
MASS CASUALTY INCIDENT (TRAUMA)		X					X	X				X		**7**
MASS CASUALTY INCIDENT (MEDICAL)		X					X	X				X		**7**
MASS CASUALTY INCIDENT (HAZMAT)		X				X		X				X		**10**
HAZMAT INCIDENT (INTERNAL)		X				X		X					X	**9**
HAZMAT INCIDENT (EXTERNAL)			X			X		X					X	**8**
WMD (CHEMICAL)			X			X		X				X		**9**
WMD (BIOLOGICAL)			X			X		X				X		**9**
WMD (NUCLEAR)			X			X		X				X		**9**
INFANT ABDUCTION		X					X		X				X	**5**
CIVIL DISTURBANCE			X				X		X			X		**5**
HOSTAGE SITUATION			X			X		X			X			**10**
ACTIVE SHOOTER			X		X			X			X			**13**
BOMB THREAT			X			X			X				X	**7**
ILLEGAL CHEMICAL LAB		X				X				X		X		**8**

Action Point determined to be 9 or above

Incident Command System (ICS)

- Originated 1970s
- Tested in multiple disasters

- Similar organization across all responders
  - NIMS: National Incident Management System
  - Joint Commission

IEDs

- Highest FBI ranked threat in USA
- Easily made devices
- Primary bombing
  - Maximize casualties and PR impact
  - Closed spaces
- Secondary devices common
  - Targeted at first responders
- Hospitals targeted overseas

IEDs

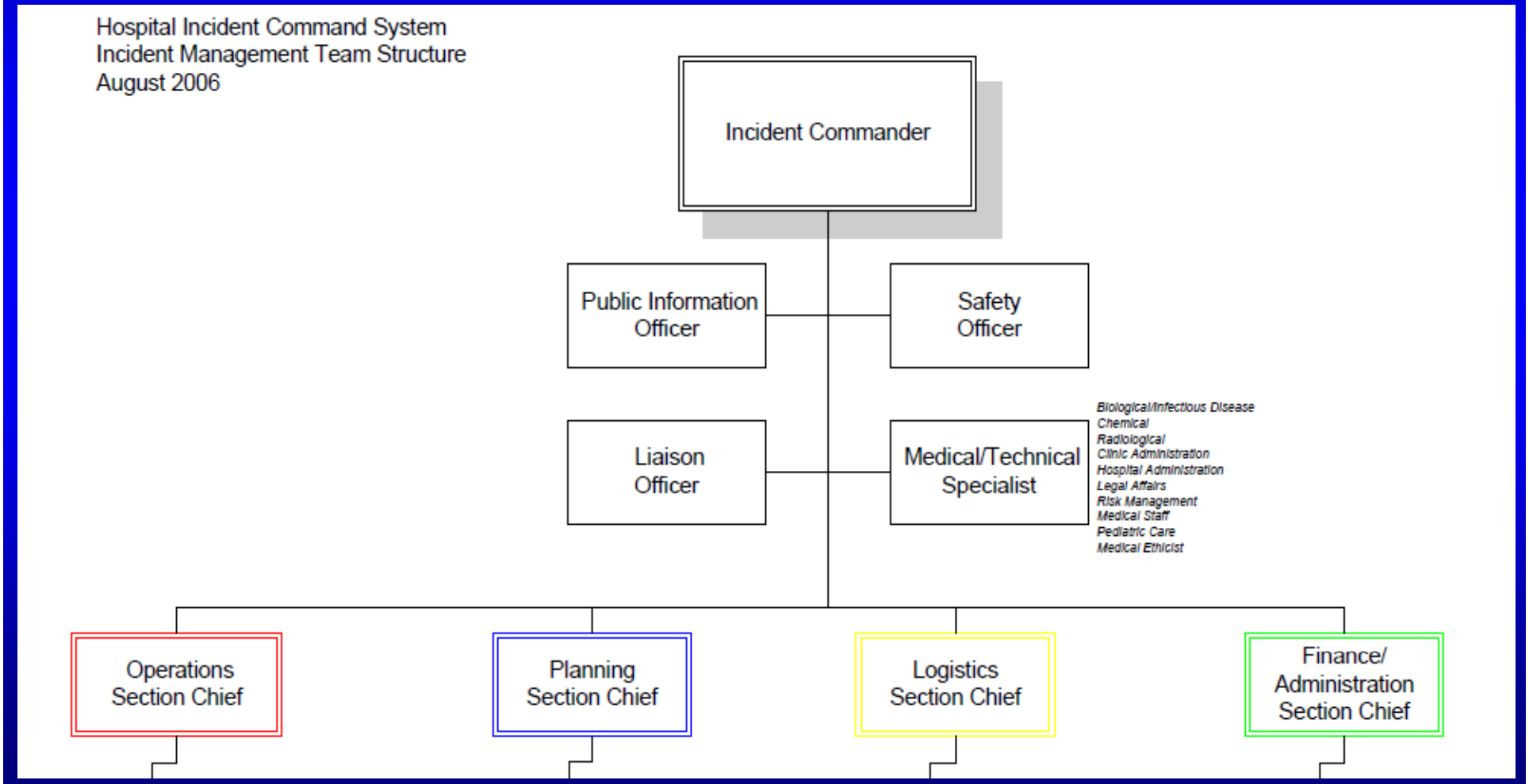
- Present large surges of patients
  - About 10% critical
- Even larger psychological casualties
  - Acute stress reactions
  - PTSD
- U.S. surge capacity low for these events
- Limited experience with blast injuries

US 1983-2002

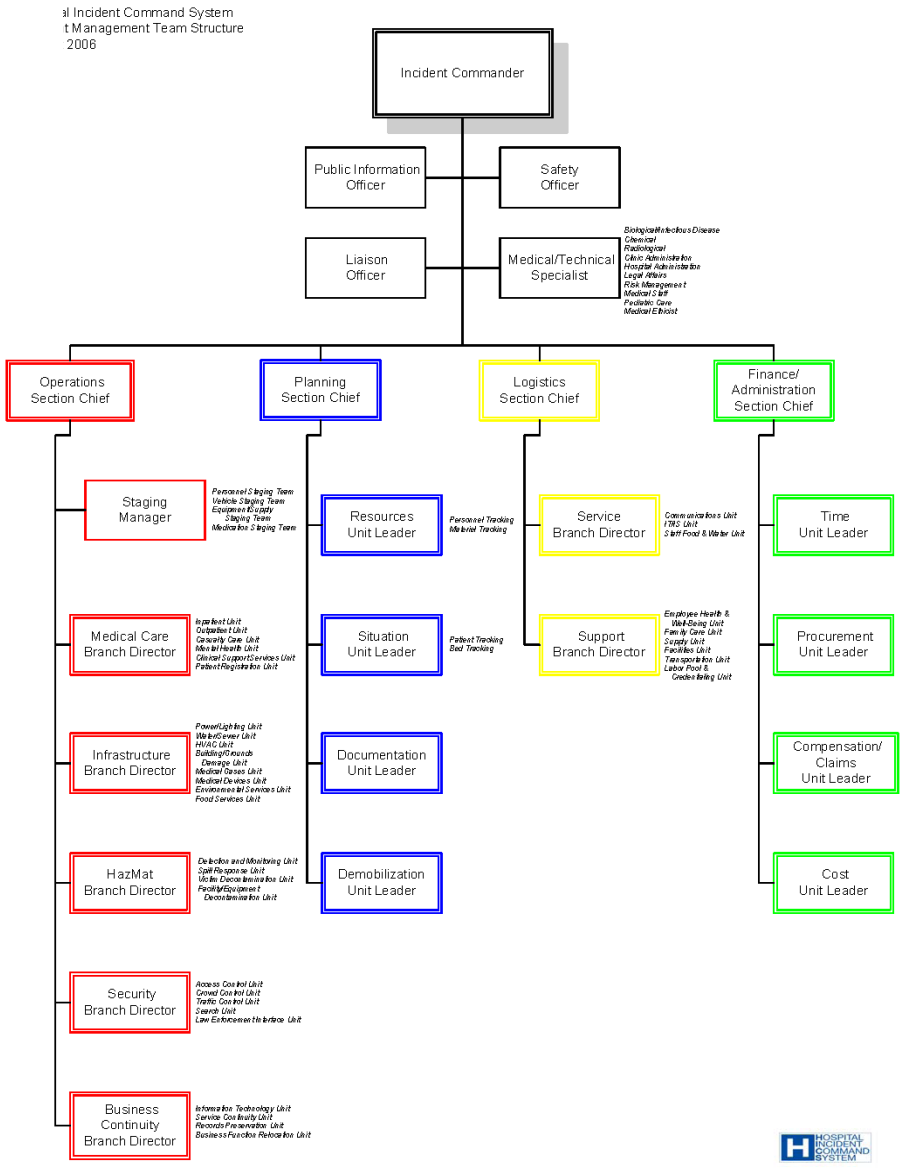
- Bombing Incidents: 36,110
- Injuries: 5,931
- Deaths: 699
- Examples
  - Oklahoma City bombing
  - Olympic Park bombing
  - Abortion clinic bombings

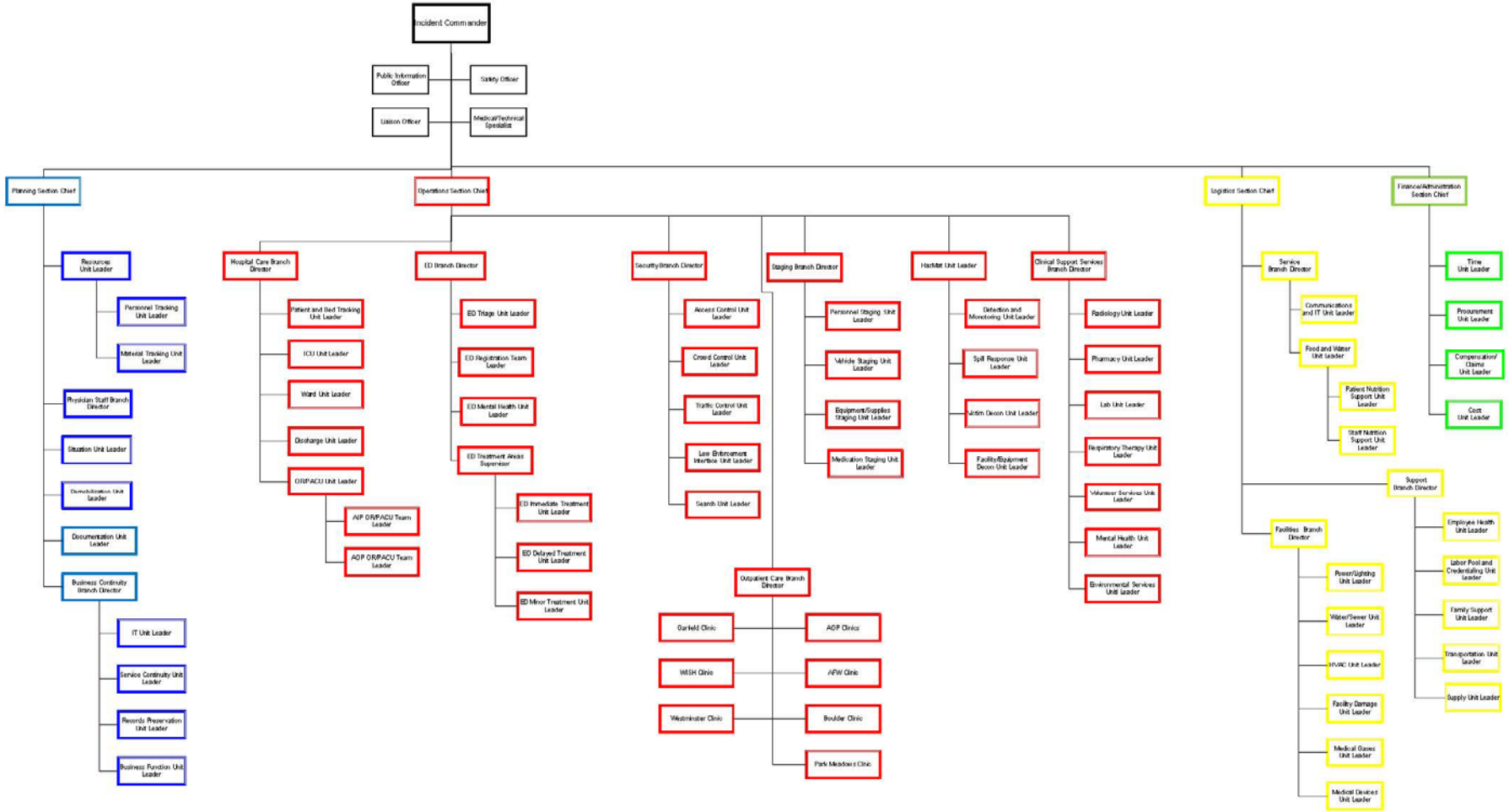
Kapur GB, Hutson HR, Davis LA, Rice PL: The US 20 Years Experience with Bombing Incidents: Implications for terrorism preparedness and medical response.
J Trauma. 2005;59:1436-1444.

ICS Structure



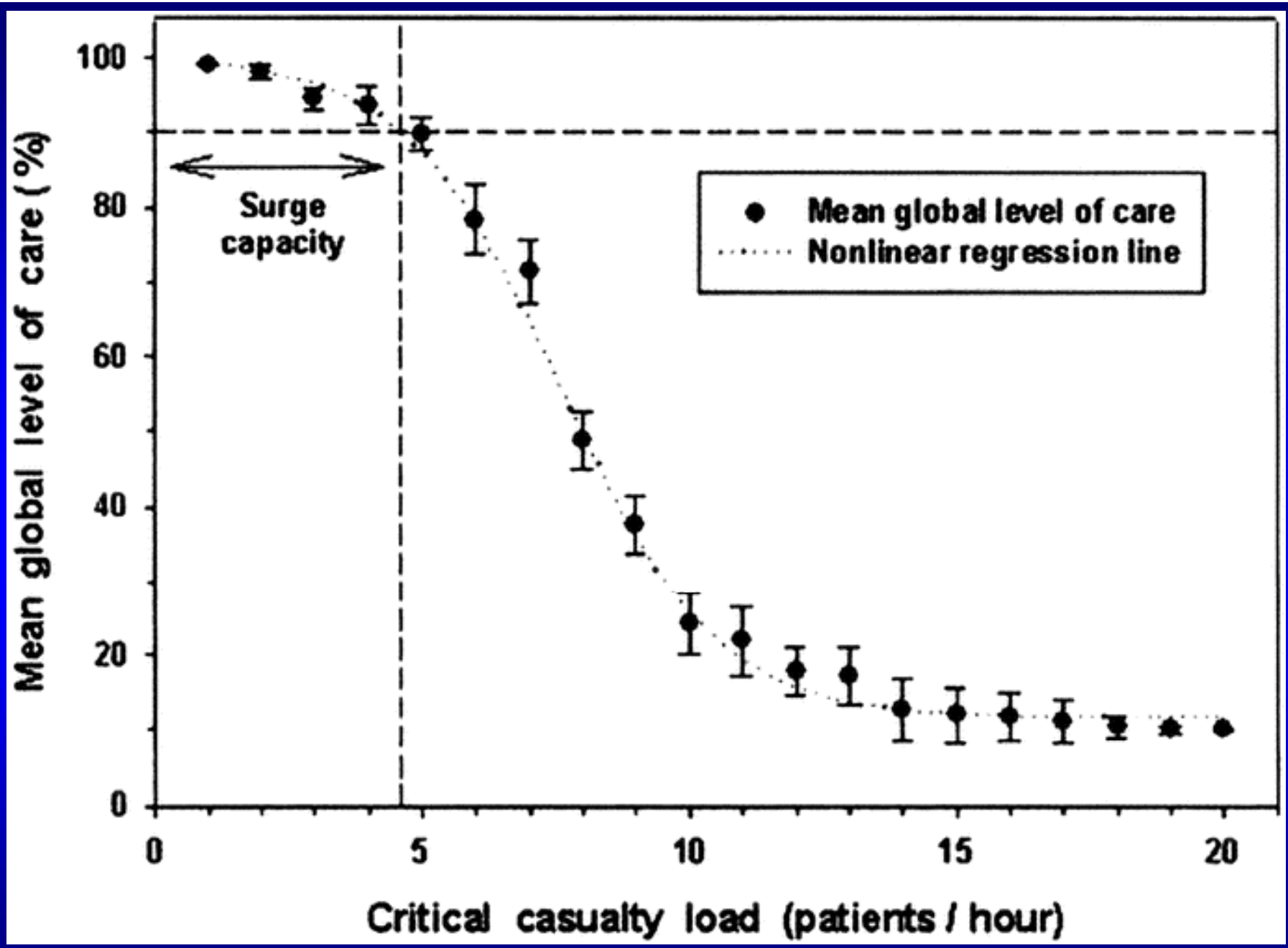
Hospital Incident Command System




Incident Commander
Public Information Officer
Safety Officer
Liaison Officer
Medical/Technical Specialist
Planning Section Chief
Resources Unit Leader
Personnel Tracking Unit Leader
Material Tracking Unit Leader
Physician Staff Branch Director
Situation Unit Leader
Demobilization Unit Leader
Documentation Unit Leader
Business Continuity Branch Director
IT Unit Leader
Service Continuity Unit Leader
Records Preservation Unit Leader
Business Function Unit Leader
Operations Section Chief
Hospital Care Branch Director
Patient and Bed Tracking Unit Leader
ICU Unit Leader
Ward Unit Leader
Discharge Unit Leader
OR/PACU Unit Leader
A/P OR/PACU Team Leader
A/P OR/PACU Team Leader
ED Branch Director
ED Triage Unit Leader
ED Registration Team Leader
ED Mental Health Unit Leader
ED Treatment Areas Supervisor
ED Immediate Treatment Unit Leader
ED Delayed Treatment Unit Leader
ED Minor Treatment Unit Leader
Security Branch Director
Access Control Unit Leader
Crowd Control Unit Leader
Traffic Control Unit Leader
Law Enforcement Interface Unit Leader
Search Unit Leader
Staging Branch Director
Personnel Staging Unit Leader
Vehicle Staging Unit Leader
Equipment/Supplies Staging Unit Leader
Medication Staging Unit Leader
HazMat Unit Leader
Detection and Monitoring Unit Leader
Spill Response Unit Leader
Victim Decon Unit Leader
Facility/Equipment Decon Unit Leader
Clinical Support Services Branch Director
Radiology Unit Leader
Pharmacy Unit Leader
Lab Unit Leader
Respiratory Therapy Unit Leader
Volunteer Services Unit Leader
Mental Health Unit Leader
Environmental Services Unit Leader
Outpatient Care Branch Director
Garfield Clinic
WISH Clinic
Westminster Clinic
A/P Clinics
AFW Clinic
Boulder Clinic
Park Meadows Clinic
Logistics Section Chief
Service Branch Director
Communications and IT Unit Leader
Food and Water Unit Leader
Patient Nutrition Support Unit Leader
Staff Nutrition Support Unit Leader
Support Branch Director
Facilities Branch Director
Power/Lighting Unit Leader
Water/Sewer Unit Leader
HVAC Unit Leader
Facility Damage Unit Leader
Medical Gases Unit Leader
Medical Devices Unit Leader
Employee Health Unit Leader
Labor Pool and Credentialing Unit Leader
Family Support Unit Leader
Transportation Unit Leader
Supply Unit Leader
Finance/Administration Section Chief
Time Unit Leader
Procurement Unit Leader
Compensation/ Claims Unit Leader
Cost Unit Leader

Hospital Trauma Capacity

- 1 critical patient/100 beds – normal operations
- 2-3 critical patient/100 beds – maximal response



How does casualty load affect trauma care in urban bombing incidents? A quantitative analysis.
Hirshberg A, Scott BG, Granchi T, Wall MJ Jr, Mattox KL, Stein M .J Trauma. 2005 Apr;58(4):686-93

MCI Hospital Response

- EOP Activation
  - System wide notifications
  - UCH uses AlertFind
    - Notifies staff, physicians are separate
  - Overhead page of “Plan D”

MCI Hospital Response

- Security
  - Lockdown vs controlled access
    - No badge No entry
  - Security staff numbers limited
  - UCD/UCH campus area access plan

ED Initial Response

- ED Organizes
  - Red (Immediate, Critical)
  - Yellow (Intermediate, Delayed)
  - Green (Minor, Ambulatory)
  - Triage area set up
  - Disaster Registration commences
  - Form treatment teams for Red
    - Physician, nurse, ancillary

Surgery in Trauma MCI

- Report to Red Area
- Chief or Attending confer with ED Branch Director (ED senior physician)
- Senior surgeon assigns OR priority
- Form treatment teams for Red patients
- Patients to PACU for surgery holding
  - Coordinate with anesthesia

MCI Hospital Response

- ED empties of all noncritical patients
  - Use hall beds
  - D/C stable patients
- All patient flow is unidirectional
  - ED, critical studies, ICU or OR
- Operate in minimalist mode
  - Defer tests not immediately mandatory

Hospital Response

- Hospital Command Center Opens
  - Coordinate Response
  - Push out resources
    - Labor Pool
    - Supplies
  - Family Center
  - Behavioral Health Area
  - Morgue

MCI Hospital Phases: Chaos

- Duration: minutes to hours
- Poor communications
- Minimal and unreliable information
- Implement disaster plan, reorganize resources
- Staff checks family

Casualty Receiving

- Duration: few hours
- Hospital resources limited to on hand only
- Damage control mode, limited treatment of life and limb threatening injuries to maximize surge

Consolidation

- Duration: about 24 hours
- All casualties received
- Restock supplies
- Tally patients and prioritize surgeries
- Rotate staff

Phases continued

- Definitive Care: weeks
  - Further surgeries as needed
- Rehabilitation: months

MCI Triage

- Experienced Clinician in Ambulance Bay
- Red, Yellow, Green, Blue, Black
  - Modified START triage
  - Add behavioral component
- Tagged with tags/tape/folders/writing
- Stream to treatment areas
- Re-triage
- Mix in non-event patients

Special Triage Situations

- Pandemic
  - CDPHE Pandemic Triage Plan
  - Altered standards and places of care
- Radiation
  - Treat life threatening injuries before decon
  - Decon others first
- Nerve agents
  - Decon and wear PPE
  - Apnea with pulse becomes Immediate
  - Give antidote

MRN10003
VN002033
02033

University of Colorado Hospital Disaster Record

DISASTER
THREE

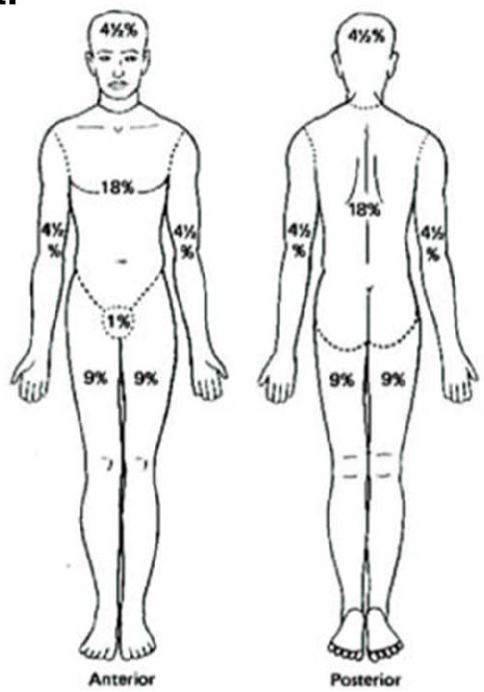
TRIAGE CATEGORY
Red Yellow Green
Blue Black

Real Last Name_____
Real First Name_____
M F DOB ___/___/___
Allergy NKDA _____
Meds None _____

Field Tag#_____

Rad Survey Y N
Time By:

Decon Y N



A–abrasion
E–ecchymosis
B–burn
L–laceration
P–amputation
V–avulsion
D–deformity
S–swelling

BSA%

Time	BP	HR	RR	Pox	T
_____	___/___	___	___	_____	___
_____	___/___	___	___	_____	___
_____	___/___	___	___	_____	___
_____	___/___	___	___	_____	___
_____	___/___	___	___	_____	___

Time	Med/IVF	Amount	Time	Med/IVF	Amount

HPI

SHx Smoke Y N ETOH Y N DU Y N

ROS Gen
Eyes nl
Ears nl
Mouth nl
Resp nl
CV nl
Abd nl
GU nl
Neuro nl
Heme nl
MS nl
Psych nl

PE Gen NAD
Skin nl
Eyes nl
ENT nl
Neck nl
Lungs nl
Heart nl
Abd nl
Ext nl
Neuro nl
Psych nl

DRILL

NOTES

Impression _____

Signatures: Nurse Resident Attending

HCC Response

- Send staff and beds to ED
  - ICU and PACU personnel ideal
  - Cross train
- Floor teams discharge all appropriate patients
  - Use discharge holding area
- Further guidance by HCC
  - Based on event magnitude

Family Center

- Hospital Family Information Center
  - Social worker staffing
  - Computer linked
  - Phones for families
- CDPHE HC Standard
  - Patient tracking
    - State wide
    - Need wide access

Behavioral Health Center

- Near but separate from hospital ED
- Staffed with social workers and psychological support staff
- Refer patients for medical screening if needed
- Screen for individuals needing intervention
- Quite setting, provide food and rest

Mental Health Issues

- Physically injured **:** acute stress reactions
  - 1**:**5
- Somatization issues
  - Chest Pain, dyspnea
  - May have injured patients in mix
  - Continuously retriage

IEDs Continued

- Large IEDs
  - Common in Iraq and Afghanistan (VBIED)
- Suicide Bombers
  - Smaller devices
  - Closed spaces
  - Added shrapnel
  - Biologic issues
- Multiple devices
  - Secondary bomber common

IED Injuries

- Casualties: a few to 100-200
  - Multiple bombs > 1000 (Madrid)
- Approximately 60% of patients require surgery
- Average 1.5 operations/patient
- 5:1 ratio of Acute Stress Reactions to physically injured.

Demographic Detail	Prevalence Among Admitted Patients* n	%
Sex		
Male	187	57.5
Female	138	42.5
Age		
0–14	14	4.3
15–29	161	49.7
30–44	81	25.0
45–59	42	13.0
60–74	22	6.8
75+	4	1.2
Religion		
Jewish	275	84.6
ISS		
1–8	151	47.5
9–14	56	17.6
16–24	44	13.8
25–75	67	21.1

In-hospital resource utilization during multiple casualty incidents

Einav S, Aharonson-Daniel L, Weissman C, Freund HR, Peleg K; Israel Trauma Group. Ann Surg. 2006 Apr;243(4):533-40

Admission Characteristics	n	%
Sent to CT scan from the ED	129	39.7
Underwent operation	196	60.3
Direct transfer to the OR	116	35.7
1st admitting department*		
ICU	109	33.5
Orthopedics	61	18.8
General surgery	59	18.1
Other surgical	36	11.1
Nonsurgical	32	9.8
Pediatric surgery	6	1.9
Neurosurgery	5	1.5
Chest surgery	3	0.9
Mortality		
Died prior to transfer to department	14	4.3
Overall inpatient mortality	26	8

In-hospital resource utilization during multiple casualty incidents

Einav S, Aharonson-Daniel L, Weissman C, Freund HR, Peleg K; Israel Trauma Group. Ann Surg. 2006 Apr;243(4):533-40

TABLE 1. Proportion of Hospitalized Patients Undergoing Procedures, by Injury Mechanism and Severity

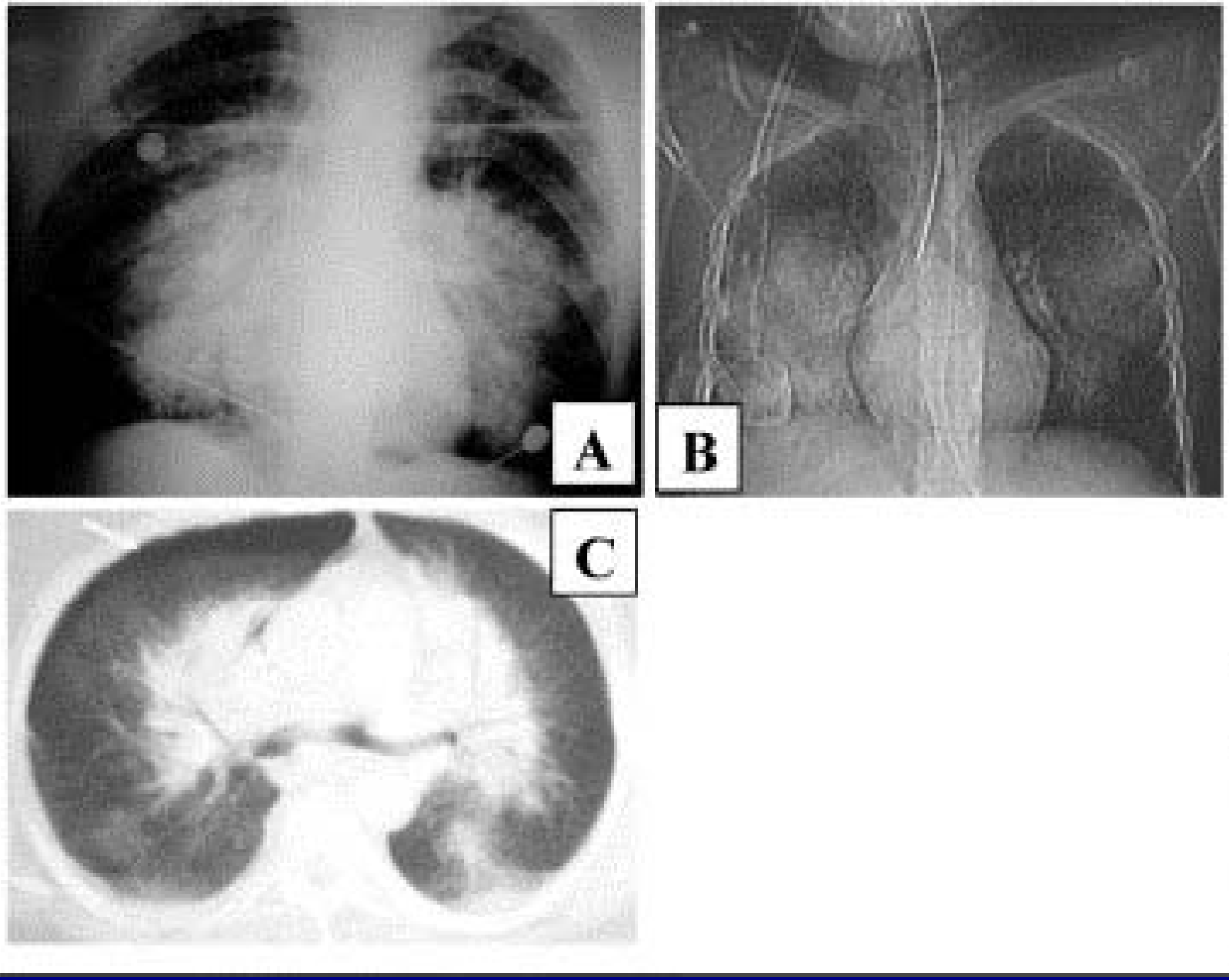
Number of Patients for Whom Noted	All Casualties (n = 94,653)			Severe Injuries (ISS 16+) (n = 9670)		
	Explosion (n = 1155)	Other (n = 93,498)	*P*	Explosion (n = 329)	Other (n = 9267)	*P*
In the ED						
Intubation	12.2	1.9	<0.0001	32.4	13.5	<0.0001
Chest decompression	5.9	1.3	<0.0001	17.9	8.1	<0.0001
ED thoracotomy	1.2	0.2	<0.0001	3.6	1.1	<0.0001
Arteriograms	2.9	0.4	<0.0001	5.8	2.3	<0.0001
CT	36.6	24.9	<0.0001	59.7	73.5	0.001
Ultrasound scan	26.8	11.2	<0.0001	47.0	38.2	<0.0001
x-ray	53.2	48.5	0.002	60.0	64.4	0.1
In the OR						
Thoracotomy	6.2	1.4	<0.0001	20.3	10.3	<0.0001
Laparotomy	12.9	2.2	<0.0001	33.9	10.6	<0.0001
Vascular	4.5	0.8	<0.0001	12.1	3.2	<0.0001
Craniotomy	6.7	1.9	<0.0001	20.6	17.2	0.1
Fracture management	21.8	29.8	<0.0001	33.6	17.4	<0.0001

ISS indicates Injury Severity Score; ED, emergency department; OR, operating room; CT, computed tomography.

Suicide bombers form a new injury profile
Aharonson-Daniel L, Klein Y, Peleg K; ITG.
Ann Surg. 2006 Dec;244(6):1018-23

Primary Blast Injuries

- Blast wave (rapid overpressurization)
  - Affects gas filled structures
  - Lungs: “blast lung”, diffuse aveolar hemorrhage and air leaks
  - Middle ear: TM rupture, ossicle or cochlear disruption
  - GI tract: hemorrhage and perforation
  - Brain: TBI and concussion



Avidan V, Hersch M, Armon Y etal: Blast lung injury: clinical manifestations, treatment, and outcome AmJSurg 190:6 2005

Blast Lung

- Alveolar hemorrhage and airway disruption
- High risk of air embolism and pneumothorax

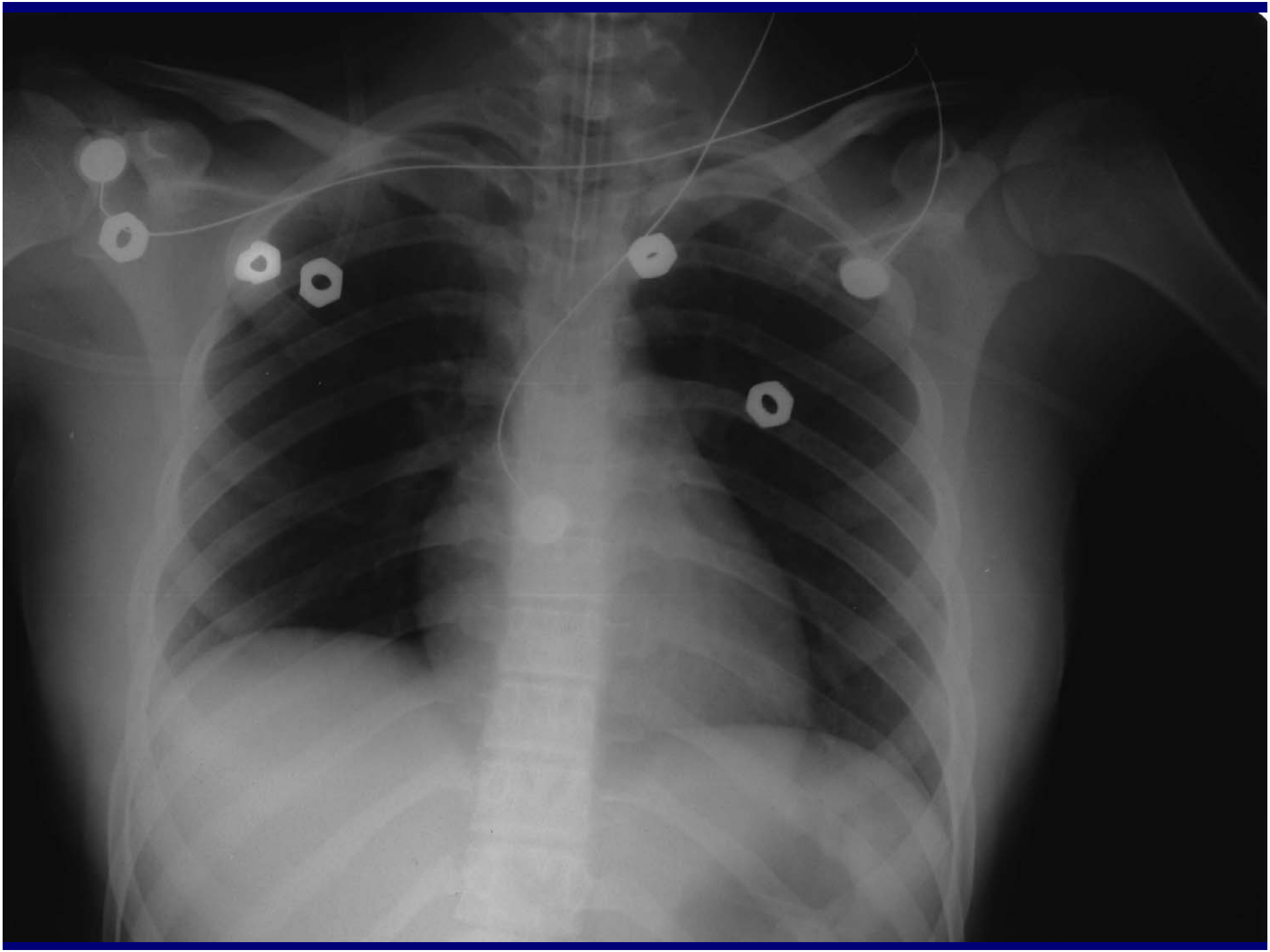
- Low ventilation pressure/volumes/PEEP

Secondary Blast Injuries

- Flying objects and shrapnel
  - Penetrating ballistic injury
  - Blunt injury
  - Biologic issues
    - Body parts
    - Hepatitis
    - HIV
    - Toxins
- Multiple patients with penetrating injuries
- Up triage patients with multiple punctures

Initial Treatment

- Typical trauma stabilization and evaluation
  - Fluid resuscitation
  - Screening ultrasound
    - Aids with immediate OR
  - Peritonitis or unstable to OR
- Liberal use of radiology and CT
- Hepatitis B vaccination



Multiple Penetrating Injuries

- Up triage multiple puncture wounds
- Damage control laparotomy
- Extensive use of interventional radiology
- Ophthalmology and ENT needed
- Multiple orthopedic cases
- Vascular surgery

Tertiary Blast Injury

- Caused by blast wind: individual thrown into objects
  - Any injury type
  - Fractures
  - Amputations
  - TBI

Quaternary Blast Injuries

- All other injuries
- Burns
- Crush injuries
- Exacerbation of pre-existing diseases
  - E.g. asthma

Mental Health Issues

- Open Family Center
  - Support
  - Reunification
- Behavioral health areas
- Staff support
  - Debrief
  - Formal Counseling

IED Summary

- Real risk for mass casualty events
- Will present multiple patients rapidly
- Markedly strain hospital resources
- Unique injury patterns and treatment