The Science of Mass Casualty Triage

Jeffrey Coughenour MD FACS
Trauma Medical Director
Associate Professor of Surgery and
Emergency Medicine
University of Missouri School of Medicine

Disclosure

• I have no relevant financial relationships to disclose
Objectives

- Define mass casualty triage
- Discuss principles of triage decision-making
- Describe triage outcomes

Triage

- “To sort”
- But... for whom?
- Dominique Jean-Larrey, 1797
Triage

The best plan that can be adopted in such emergencies, to prevent the evil consequences of leaving soldiers who are severely wounded without assistance, is to place the ambulances as near as possible to the line of the battle, and to establish headquarters, to which all the wounded, who require delicate operations, shall be collected to be operated upon by the surgeon-general.

Those who are dangerously wounded should receive the first attention, without regard to rank or distinction. They who are injured in a less degree may wait until their brethren-in-arms, who are badly mutilated, have been operated and dressed; otherwise the latter would not survive many hours; rarely until the next day. Besides, with a slight wound, it is easy to repair to the hospital of the first or second line, especially for the officers who generally have means of transportation. Finally, life is not endangered by such wounds.

Normal Operations

• Ample human and material resources available providing the greatest good for the individual
• CDC Guidelines for Field Triage of Injured Patients
Mass Casualty Operations
- Injured overwhelm available resources, often time-sensitive
- Greatest good for the injured population

Triage Spectrum
- Ample resource – urban trauma
- Limited resource – rural trauma
- Decisions made in consideration of the patient, casualty population, and incident specifics

Triage Spectrum
- System performance measured
- With limited ‘system,’ rural setting more susceptible to error and thus mortality
Mass Casualty Triage

- Sort and prioritize
- Greatest good for greatest number
- Challenge – Find the critically injured (20%)

Mass Casualty Triage

- Nothing is more difficult, and therefore more precious, than to be able to decide
- Decisions in context
- May be wrong, cannot be in doubt

Triage Decision-Making
Sequential Decision-Making

- Scene, hospital control point, ED, OR, ICU, etc.
- Phased interventions, frequent re-evaluation
- Rationing


Scene

- Decision – alive or dead?
- Significant bystander involvement
- Minimize additional casualties from scene hazards

Rebecca Anderson, LPN, 37
Casualty Collection Point

• Decision – critically injured or not?
• Second triage decision point, transport priorities
• SALT
  – Sort
  – Assess
  – Life-Saving Interventions
  – Transport
Life-Saving Interventions

- Open airway (NPA, OPA), consider BVM
- Control hemorrhage
  - Direct pressure, hemostatic agents, tourniquets
- Chest decompression
- Decisions in context

Tourniquets

- Life-threatening hemorrhage
  - Traumatic amputation
  - Uncontrolled hemorrhage despite direct pressure
- Timed application
  - Cessation of arterial hemorrhage
  - Loss of distal pulse
Facility Triage

- Decision – immediate, delayed, minimal, expectant, dead
- Senior EM physician and trauma surgeon
- Outside the secure facility
- Concurrent knowledge of resources

Facility Triage

- Many will self-triage to facility, have a place for them
- Surge of non-critical followed by critical
- 1 hour, 50%

Madrid

- Train bombings, 2004, 10 detonations on 4 trains
- 177 fatally injured
- 2,000 injured, more than 50% care at 2 hospitals
  - 15 available
  - 312 casualties at GMUGH, 272 at 2.5 hrs
- Similar to OKC experience

Sustained Response
- Surge capacity – expand space for casualty flow
- Surge capability – ability to provide necessary casualty care phased over time
- Shift into and sustain a ‘tactical medicine’ approach for hours

Multidimensional Injury

Patient Care
- TBI, solid organs, extremities – MVC
- Fracture/dislocations, wounds – natural
- Fracture/dislocation, wound, inhalations injury, burn/crush – collapse
- Cavitary hemorrhage – penetrating trauma

CDC. Post-earthquake Injuries Treated at a Field Hospital – Haiti 2010. MMWR 2011;59: 1673-1677
Patient Care

• Wide application of “damage control”
• General and orthopedic surgeons
• Definitive care achieved over subsequent days
• Early transfer to regional facilities

Outcomes

Studying Triage

• Descriptive review
• Decision audits
• Computer modeling
• Expert-consensus panels
Computer Modeling

• Estimating geographic distribution of patients, TC resource usage, and mortality
• Mean mortality rates 26 – 42%
• Out-of-hospital mortality increases, in-hospital mortality decreases as disaster scenario enlarges

Challenges

• Mass provider/media/worried well management
• Casualty flow bottlenecks
• Definitive, rather than phased care process
• Lack of documentation (or over-documentation)

Relevant Outcomes

• Critical mortality rate
  – Critically injured* died / critically injured* total
• Triage accuracy

<table>
<thead>
<tr>
<th></th>
<th>Critically injured</th>
<th>Non-critically injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triage to critically injured</td>
<td>True (+)</td>
<td>False (+)</td>
</tr>
<tr>
<td>Triage to non-critically injured</td>
<td>False (-)</td>
<td>True (-)</td>
</tr>
</tbody>
</table>

*ISS ≥15
Madrid

- 312 casualties
  - 91 hospitalized
  - 29 critically injured
  - 5 deaths
- Overall mortality = 1.6%
- Critical mortality rate = 17%

Over-triage

- Typically annoying, but not dangerous
- Mass casualty situation, loss of critical resource
- Strong association with increased critical mortality

Single vs. Sequential Triage

Hirshberg, JTrauma, 2010;69:1074-1082
Improving Quality

• Military – TCCC, Ranger First Responder Program
• Civilian – The Hartford Consensus, B-Con

Summary Points

• Mass casualty triage mandates sequential decisions to find critically injured
• Disaster mindset
• Essential outcome – critical mortality rate


Pons PT, Chapleau W. The Hartford Consensus on Active Shooters: Implementing the Continuum of Prehospital Trauma Response. /Emerg Med. 2015 Dec;4(6):878-85