History of Trauma EMS:

Highway Safety Act of 1966 - resulted from the first studies of trauma and found that victims not only suffered from the vehicle collisions but also the lack of an organized approach to definitive care. This act paid the foundation for modern EMS.

Trauma Care Systems Planning and Development Act of 1990 - establishes guidelines, funding, and state level leadership and support for the development of trauma systems.

Three phases of trauma care:

1. Preincident - Public education. Wear seatbelts for example.
2. Incident - Trauma event.
3. Postincident - Providing emergency care to victim.

Specialty Centers

American College of Surgeons - Position Paper on Trauma Center Designation in 1980 resulted in more than 700 trauma systems to date. 4 levels of trauma centers.
• Surgical, medical, mental, burns, nuero, cardiac, limb reattachment.

• Can provide definitive treatment.

• Also most commonly associated with a medical teaching institution.

• Referred to as a regional trauma center.

Level II

• Referred to as area trauma centers.

• Facility has an increased commitment to trauma care but not as much as a level I.

• Purpose is to treat the most common trauma emergencies but only stabilize the most serious and transport specialty cases to the regional trauma center.

Level III

• Referred to as community trauma centers.

• Some surgical capability.

• Stabilize and transport to higher level center.

Level IV

• May be all that is available for a rural community or hospital that has limited trauma capabilities.

• Usually victim is transported via helicopter to a higher level center.
Other types of advertised specialty centers may include: poison control, burn centers, pediatric, cardiac, stroke, hyperbaric centers.

Transport consideration:

- Patients needs and conditions.
- Based on medical direction.
- Ground versus air is can the patient get to definitive care within 1 hour of insult.
- Weather.
- Traffic.
- Time of day.

NEWTON'S 3 LAWS

- Newton's First Law: Law of Inertia - Body at rest stays at rest, a body at motion stays in motion unless acted upon by outside force.
First part of the law; A vehicle in motion will absorb the energy to slow. Movement to rest.

Second part of the law; A stopped vehicle will absorb the energy and move. Rest to movement.

- Newton's Second Law: Force energy equals half the mass times velocity squared. Simply put speed kills more than weight.

- Conservation of energy law: Energy cannot be created nor destroyed, just changes form.

- For every reaction there is an equal and opposite reactions. (example, when a marble hits another the moving marble will recoil back once hitting the stationary marble)

KINETIC ENERGY

- Velocity (speed) versus weight.

- Velocity (speed) will always do more damage than size. (Newton's 2nd law).

- What does more damage a bus at 40MPH or a sports car at 90MPH. The answer is the sports car - always.
DEFINITIONS

- Kinematics is defined as energy change.
- Accident is defined as event of chance or unknown.
- Collision result from carelessness. Thus we call a vehicle crash a “motor vehicle collision” not a “motor vehicle accident”.
- Velocity is speed.
- Cavitation is such speed that body tissue is “knocked out of place”, “shattered”.
- Stared windshield – head hits glass.

THE NUMBERS

- Unexpected traumatic injuries are 140,000 deaths per year.
- Automobile account for 40,000 deaths per year.
- Penetrating trauma accounts for 40,000 deaths per year.
- Injuries by vehicle trauma totaled 3,125,000 per year.
Golden Hour

- Defined as the first hour after a insult to the body which results in the best outcome if definitive care is delivered.
- EMS is assigned 10 minutes on scene time.
- May be delayed if extrication/rescue is needed or airway management.

THREE PHASES OF A CRASH

- 1st Car metal hits tree.
- 2nd Skeletal system hits car metal.
- 3rd Organs hit skeletal.
- 4th If an unlucky person gets struck by flying items not secured.
- For testing in an MVC there is always a minimum of first three collisions. During a fall it may only be skeleton hits ground and organs hit skeleton.
TWO TYPES OF TRAUMA

• Penetrating.

• Blunt – most common form of trauma.

MOTOR VEHICLE COLLISIONS

• Frontal – sudden deceleration; leads to organ shearing (tear), i.e. liver and spleen.

• Rear impact – sudden acceleration – cause for whiplash.

• Lateral – most fatal– the body does not bend sideways.

• Rotations – clipped in corner and sent spinning.

• Rollover – most fatal if ejected or not restrained. If no visible signs of injury, must always suspect internal injury and should be evaluated.

• Note: Ejections almost always fatal.

• Note: As a general rule the smaller the vehicles the more likely severe injuries will result.
• Up and over – more head and chest trauma which results in a higher mortality rate.

• Down and under – more leg, pelvis trauma.

AIRBAGS

• Hurt but better than hitting the car.

• Can cause facial fractures, abrasions, broken hands.

• Deploys at greater than 200MPH.

• Powder is not hazardous.

• If frontal impact and airbag not deployed be careful, it may go off at any time.

• If person is within 10 inches of airbag when deployed it is fatal.

PEDESTRIAN INJURY

• Kids face the car like a deer.

• Adults try to turn away.

• Kids likely to go down and under.

• Adults up and over.
FALLS

- Falls from 2 to 3 times the person height are considered dangerous. Most humans can fall out 2nd and 3rd story windows and live.

- Must consider on all falls; what part hit first, how hard was the surface they landed on, and how high.

- If head or feet hit first the spine is compressed. Axial compressions.

- Children always tend to fall/land head first due to weight of head. Adults that fall over 15 feet tend to land on their feet.

- Note: shallow water diving always suspect spinal injury and maintain C-spine.

BLAST INJURIES

- First wave (primary blast injuries) is pressure/shock wave. Affects hearing, hollow organs, eardrum rupture, lung damage from heat, eyes blood shot, etc... Pulmonary/lung injuries are the most serious related trauma from an explosion.

- Second wave (secondary blast injuries) is flying stuff, and third is when victim is thrown from blast.
• Tertiary Blast Injuries - Third phase - victims are propelled through space by an explosion and strike stationary objects. Structural collapse may be possible leading to entrapment.

WEAPONS

• The greater the velocity (speed) the more direct the path and allows for better accuracy.

• Tumbling bullets; In the air a tumbling bullet is not accurate. This is why most hand guns and rifles barrels spin the bullet to cut better through the air. When a spinning bullet hits the body it must spin faster to maintain speed cutting through the tissue. Since speed increase is not possible once tissue is hit the bullet will slow and tumble. As a result the tumbling will increase surface area of the bullet which will increase energy transfer causing more body tissue damage.

• Handguns; Bullet is more blunt and results in a higher release and distribution of energy. This results in more local damage to where the bullet traveled.

• Cavitation (shock wave) is tolerated better by fluid and air filled spaces than solid organs. Liver and spleen (and organs like them) are most susceptible to damage.

• Mushrooming bullets is when the bullet hits tissue and the tip of the bullet slows and the butt is traveling faster. The result will flatten the bullet and make more surface area. This will result in more damage.
• The exit wounds of a gunshot injury reflects the potential energy better than the entrance wound. The shock wave travels faster and outward resulting in a larger tearing exit wound.

• When a bullet yaws or tumbles in the air it will cause more damage to surface hit. Problem is accuracy decreases along with distance.

• Low velocity weapons are mostly hand held – ice pick, knife, fist. An arrow is also a low velocity weapon. Low velocity weapons limits injury to areas in which the object comes directly into contact with.

Knife wounds; women stab down and men stab up as a general rule but not an absolute.

• Medium velocity weapons are hand guns and small rifles.

• High velocity weapons are hunting rifles (largest cavitations or shock wave)

• Shotguns fall under low, med and high velocity depending on distance and load.

GUN SHOT WOUNDS

• Exit is larger than entrance.
• Most gunshot wounds to chest do not bleed externally. All bleeding is internal.

• Bullets do not follow a straight line through the body in many cases. They are more likely to go straight through if only soft tissue is hit.

All-Terrain Vehicles - Higher center of gravity than motorcycles. They are more difficult to steer.