



#### NERVOUS SYSTEM

- Two divisions - central and peripheral.
- Central Nervous System (CNS) is brain and spinal cord.
- Peripheral Nervous System (PNS) is everything except brain and spinal cord.
- PNS has two main functions. Sensory and Motor nerves.
- The Autonomic Nervous System - parasympathetic and sympathetic.
- Parasympathetic is "feed or breed." - After you eat you get tired. Blood is sent to GI for digestion.
- Sympathetic is "fight or flight" - In a fight blood is taken from GI and given to muscles to fight.
- Note: 20% of people ambulatory at the scene require later spinal surgery. Just because they are walking doesn't mean they are ok.

#### ANATOMY OF SPINE

- Spinal Column - bones that protect the spinal cord.
- Vertebrae Bone - The spinal column is made up of about 33 bones. (7-12-5-5-4).
- Spinal Cord - will fit in a teaspoon. The opening in the Vertebral bones that the cord travels through is only 1 to 3 mm wide.
- C1 is ATLAS - Allows wide range of motion for the head to move and pivot.

- C2 is AXIS - Keeps C1 in line. C2 has ODONTOID PROCESS a finger like protrusion that rises thru C1 to keep spine in line with head. (C2 is hangman vertebrae. When hanging someone the goal is to break C2 then they will die.)

#### MECHANISM OF INJURY

- MVC
- Auto-Pedestrian.
- Falls from 2 to 3 times the person's height.
- Motorcycle crash.
- Hanging.
- Diving - compression fractures.
- ANY UNRESPONSIVE PERSON HAS SPINAL INJURY UNTIL TOLD OTHERWISE.

#### INJURY TO THE SPINE

- Spine has natural flexion motion (bending forward), limited extension (bending backwards, and almost no lateral motion. This is why lateral MVC's cause the most fatalities.
- Compression Fractures - landing on head or feet after a fall causes axial loading. Spine has to give since it is a "S" shape structure.

- Distraction Injuries - Pulled apart. In a frontal MVC the seat belt stops the body but the head keeps going and pulls the cervical spine.
- The most commonly injured spine in descending order - C5 to C7, C1 to C2, T12 to L2.

## PARALYZED

- This can happen and the spine is not severed. If the person cannot feel or move the distal body part it can be because the cord is cut or temporary swelling had placed pressure on the spinal cord and it will not work. This is why doctors say lets wait and see.
- Paraplegic - cannot move legs. (waist down).
- Quadriplegic - cannot move legs and arms. (neck down).
- C6,C7 controls fingers and hands, and bicep.
- S1,2 Plantar flexions.
- L5 Dorsal flexions.
- C3 above - respiratory arrest.
- C4 paralysis the diaphragm.

## PARALYZED EXAMPLES

- If they are not breathing it is C4 or higher.
- If they are breathing and cannot make a six-shooter gun motion - damage is below C4 but above C6.

- If paralyzed from the waist down might be T10.
- If paralyzed from chest down might be T4.
- If fracture is above C5 you're not going to be alive (without help).
- C1, C2 most always fatal if not treated aggressively. Lucky to be alive.
- PRIAPISM in a male indicates spinal injury.

#### LANDMARKS OF SPINE

- C7 is first bony prominence you feel at the level of the shoulders.
- T4 nipple line.
- T10 umbilicus.

#### TREATMENT

- ABC's while trying to keep spine in line.
- If prone must do log roll to access airway.
- If head is bent and airway is poor must move head to neutral/sniffing position and open airway
- 100% of people without air die, only 2% of spinal cord injuries die. Look at big picture.
- Secure torso then head.
- Secure chin before forehead.
- Hands secured in straps on groin or keep arms out. DO NOT PLACE ARMS ACROSS CHEST.

- PMS checks before and after moving the patient.
- KED (short board only used on STABLE patients in seated position).
- Person at head coordinated all movement.
- Never manually release head until tied down.
- If you find a patient in any position, except standing, you must move the spine to get onto backboard.

Just try to limit unnecessary motions.

- Try the modified log roll when possible. "V" movements up and down, keeps spine in long axis.
- Standing patient is the only one that can be immobilized and not move the spine. Place long board up to patient and lower to ground.
- Once you think spine injury the patient is instructed to not move immediately. Do not say sit on the board.

## HELMET REMOVAL

- As a rule in EMS you cannot evaluate an airway unless you can touch and see the head. Most medical directors want the helmet off before the patient gets to the ED.
- What you need to know for testing; If airway patent keep on. If helmet fits with no voids keep on. If you can back board patient in neutral position keep on.

- To remove need two rescuers. As you take off the helmet it must be rotated to the back of the head to clear the nose, then reverse motion to clear back of head while sliding down the nose.

#### HEAD INJURY VERSUS SPINE INJURY

- Head injuries stay in the head. LOC changes, pupil changes, memory loss, confusion.
- Spinal injuries are out of head. Numbness, tingling, paralysis.

#### CHILDREN ON BACK BOARDS

- Head will flex so place something under the shoulders to obtain neutral position.