
Central Nervous System Trauma

Head and Spine Injuries

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Central Nervous System (CNS) Trauma

- Head and Spinal Cord Injury
 - » Normal Structures & Function of the Brain and Spinal Cord
 - » Types of Injuries
 - » Increased Intracranial Pressure
 - » Assessment and Treatment

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Occurrence of Head Injury

- 500,000 Hospitalized per year
- 50,000 Deaths (prior to hospital arrival)
- 99,000 Lifelong Disability
- 2000 Persistent Vegetative State
- Survivors - 5 -10 yr. of Intensive Rehab Services costing > \$4 million
- Total Cost of TBI - \$48.3 billion/yr.

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Mechanism of Injury

- Blunt
- Penetrating
- Indirect
- Secondary



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Causes of Head Injury

- Motor Vehicle Crashes – 50%
- Falls – 20%
- Violence
- Sports and Recreation
- Highest Risk Category Males 14 - 24 years old



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Structures That Protect The CNS

- Scalp
- Skull
- Meninges
 - » Dura Mater
 - » Arachnoid Mater
 - » Pia Mater
- Cerebrospinal Fluid (CSF)



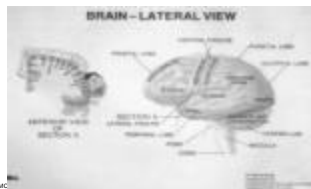
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Structure and Function Of The Brain

- Cerebrum
 - » Largest structure, located above rest of brain
 - » Responsible for sensations, voluntary motor functions, memory
- Cerebellum
 - » Located under cerebrum, towards back
 - » Responsible for coordination and balance

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Function of the Brain



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Structures Of The Brain (continued)

- Brain Stem
 - » Located at base of brain
 - » Connects brain to spinal cord
 - » Control of vital functions
 - Heart rate
 - Respiratory rate
 - Blood/pressure



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Functions Of The Brain

- **SENSORY:** Brain receives information from the environment via the five senses
- **MOTOR:** Brain directs body to react - move in response to sensory information

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Signs & Symptoms of Head Injury

- Altered LOC
- Scalp wound/swelling
- Pain
- Vision or hearing problems
- Vomiting
- Balance problems
- Seizures

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Signs & Symptoms of Head Injury

- Irregular breathing
- Decreased heart rate
- Increased B/P
- Cerebral Spinal Fluid (CSF) from ears and/or nose

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Signs & Symptoms of Head Injury



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Skull Fractures

- 3 Types
 - » Linear vs. Stellate
 - » Depressed
 - » Basilar
- Management
 - » Concurrent C-spine
 - » Sterile dressing
 - » No pressure
 - » No nasal airway



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Types Of Brain Injury

- Brain Concussion
 - » Transient LOC often caused by acceleration / deceleration forces.
 - » Usually no identifiable lesion
- Diffuse Axonal Injury (DAI)
 - » Injury to nerve fibers from stretching or shearing

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Types Of Brain Injury

- Epidural Hematoma
 - Blood between skull and dura
 - Usually arterial
 - Rapid onset



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Types Of Brain Injuries

- Subdural Hematoma
 - Blood between dura and brain
 - Venous Bleed
 - Slower onset of symptoms



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Types Of Brain Injuries



- Intracerebral Hematoma
- Deep in brain
- Often from penetrating trauma
- May be spontaneous

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Brain Injury

- All types of brain injury can cause brain swelling resulting in increased intracranial pressure (ICP)
- Elevated ICP not only indicates the presence of a problem, but can contribute to the problem
- Severe brain swelling must be controlled to prevent irreversible brain damage

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Early Signs of Increased Intracranial Pressure (ICP)

- Altered Level Of Consciousness (LOC)
 - » combativeness, restless
 - » inappropriate or repetitive questions
 - » inappropriate answering of questions
- Rapid breathing
- Nausea/Vomiting
- Headache

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Late Signs of Increased ICP

- Pupils unequal or unreactive
- Profoundly altered LOC
- Posturing
- Seizures
- Slow heart rate
- High blood pressure
- Slow, absent, or irregular breathing



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Treatment Of Patients With Late Signs Of Increased ICP

- Airway management
 - » Oral airway if tolerated
 - » Suction as necessary- anticipate vomiting
- Spinal precautions
- Mild hyperventilation
 - » Ventilate every 4 seconds - 15 times/minute
 - » Ventilate just until you see chest rise

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Loss Of Consciousness From Trauma

- EVEN AN APPARENTLY MINOR MECHANISM OF INJURY CAN CAUSE SERIOUS BRAIN INJURY
- ANY PATIENT WITH A LOSS OF CONSCIOUSNESS FROM TRAUMA SHOULD BE SEEN BY A DOCTOR

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Spine Injuries

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Occurrence of Spine Injuries

- 8,000 - 10,000 Hospitalized per year
- 4,860 - Additional, die at the scene
- Lifetime Cost: Approximately \$1,000,000 healthcare & living expenses

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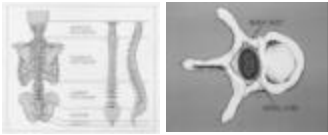
Causes of Spinal Cord Injury



- Motor Vehicle Incidents – 44%
- Acts of Violence – 24%
- Falls – 22%
- Sports – 8%
- Highest Risk Category Males 16 - 30 years old
 - » Males – 82%
 - » Females – 18%

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Structure of the Spinal Column



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Structure of the Spinal Cord



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- Elongated mass of nerve tissue
- Originates at the brainstem (top of C1)
- Ends at L1-L2 (lower rib margin)
- 31 pairs of spinal nerves



Signs & Symptoms of Spinal Injury

- Paralysis of extremities
- Pain or tenderness along spine
- Impaired breathing – diaphragm
- Loss of bowel/bladder control
- Weakness/numbness/tingling
- Priapism

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Management of Suspected Injury

- Stabilize C-Spine
- ABC's, O₂
- C-Collar
- Rapid Trauma Assessment
- Assess Circulation, Motor, and Sensory Function
- Backboard
- Reassess CMS

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Neurogenic Shock

- Impairment of motor pathways in the spinal cord resulting in:
 - Dilation of blood vessels
 - Maldistribution of blood volume
 - Slow heart rate
 - Skin warm & dry

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Ambulatory Spine Injuries

- 15 - 20% of patients will walk after a cervical spine injury.
- The ability to walk does not rule out the potential for a significant injury.

Summary



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