Acute Management of Spinal Cord Injuries and Associated Problems

Jennifer Malone, PA-C
Nurse Practitioner, Neurosurgery/Trauma,
Intermountain Medical Center, Intermountain Healthcare;
Salt Lake City, Utah

Objectives:
• Define the following in relation to patient care: spinal shock, neurogenic shock, complete vs incomplete spinal cord injury, central spinal cord syndrome
• Identify treatment options for spinal cord injuries and associated problems
• List specific goals of care related to spinal cord injury: ex. Bowel care, pressure ulcer prevention, etc.
Traumatic Spinal Cord Injury

Jenna Malone, PA-C, Neurosurgery and Trauma
Excellence in Trauma and Critical Care Conference
Objectives

- Case
- TSCI Incidence & Epidemiology
- Basic Anatomy and Function of Spinal Column
- Common types of cord injury and their presentation
- AANS/ CNS SCI Tx Guidelines
Case

- 35 yo MTB Big Cottonwood Canyon, found down/ resp arrest?, rescue breathing initiated on scene, return of spont resp, pt GCS 15 on waking but unable to move extremities
- Motor exam in trauma bay 0/5 UE, 0/5 L LE, 1/5 R LE dorsi/plantarflexion only (toe wiggle)
- Sensation to light touch present in R forearm and hand, L lateral leg
TSCI

- Approx 12 to 14,000 per year in U.S.
- 200,000 living with TSCI in U.S. (CDC 2010)
- MVC 47%, Falls 23%, Violence/ GSW 14%, Sports 9%
- Prior to 2000, median age 22, now 38
- 80% cases = male
- 25% cases = ETOH
- 20% of SCI pts have second spinal injury
- 56% new SCI = cervical
**FIGURE 7.19** The Cervical Vertebrae. The atlas (C₁) and axis (C₂).
Anatomy & Function

- Cervical nerves 3-5 form phrenic nerve: diaphragmatic innervation
- T1-6: intercostals and trunk above waist
Normal CT Cspine
Autonomic fibers descend and synapse with cell bodies in the intermediolateral columns

Sympathetic fibers: T1- L2

Parasympathetic fibers: S2- S4 and CN X, vagus

Cardiac accelerators: T1-4

Disruption of descendent pathways results in decreased sympathetic activity AND unopposed parasympathetic activity via intact vagal nerve (CN X)
Traumatic SCI

- Major causes of death in TSCI
  - Aspiration
  - Shock
- ABCDE
- O2, Control hemorrhage, Access, Fluids
- Remember the basics
Neurogenic Shock

- Hypotension following SCI, 2/2 interruption of sympathetics
- Loss of vascular tone below level of injury (also leaves parasympathetics unopposed = bradycardia)
- Loss of muscle tone in skeletal muscle below injury; venous pooling (acute and chronic issue)
- Blood loss from associated wounds/ hypovolemia
Complete SCI

- No motor or sensory function more than 3 segments below level of injury
- 3% of pts with complete injury on initial exam have some recovery within 24 hrs
- Persistence of complete SCI after 24 hrs= no distal function will recover
Incomplete SCI

- any residual motor or sensory fct > 3 segments below level of injury
- Central Cord Syndrome: most common
- Brown-Sequard Syndrome: 2-4% SCI, penetrating injuries (GSW, stab). Contralat pain & temp loss, Ipsilat motor & vibration/propriocept
- Anterior Cord Syndrome: injury to anterior spinal artery
- Posterior Cord Syndrome: rare. Dysesthesias neck, upper arms, torso
OR for urgent reduction of C2 fx and placement of halo vest for stabilization
Central Cord Syndrome

- Acute hyperextension
- Most often older pt w pre-existing stenosis 2/2 osteophytes/ bone spurs or congenital stenosis
- Long tract fibers innervating UE in center of cord, vascular watershed area, more susceptible to edema
- 90% pts able to walk with assistance w/in 5 days
- Recovery usually incomplete, related to severity and pt age
Central canal prone to edema

UE motor fibers more centrally located in cord

Distal fct > Proximal
Surgical Tx

- **Closed vs open reduction:** closed an option only in Cspine injuries
- **Studies:** animals suggest better outcome w early decompression, but older case reports suggest earlier surgery = more complications, poss poorer neuro outcome 2/2 vulnerable, injured cord
- **No evidence-based guidelines re indications for & timing of surgery**
Timing of Surgery

- Retrospective comparison of clinical outcomes of early (< or = 24 hrs) vs late (> 24 hrs p injury) surgery. n= 50
- Early surgery indicated in CCS 2/2 acute disc herniation or fx/ disloc (signif greater overall motor improvement, p= 0.04)
- No benefit if CCS 2/2 stenosis or spondylosis
Surgical Tx

- Reasons for early surgical stabilization/intervention
- Deteriorating fct in Incomplete SCI
- Studies suggesting any benefit from early surgery did not show this benefit in Complete SCI pts
- If no contraindications, early stabilization may allow for earlier mobilization/shorter ICU stay
2002 AANS and CNS published guidelines and level of evidence supporting each Standards (high degree of clinical certainty) Guidelines, and Options Two options re BP: avoid SBP< 90 in acute period (theory that even one episode hypotension may cause secondary injury from inc’ed cord ischemia), and drive MAP to 85 to 90mmHg x 7 days to improve cord perfusion
ICU Care: Pressors

- **Acute setting:** Levophed or Dopamine (avoid Phenylephrine/ Neosyneph as non-inotropic & poss reflex bradycardia). Only AFTER or WITH adequate fluid resuscitation.

- **Subacute/ chronic:** Midodrine- centrally acting alpha1 agonist, increases arteriolar and venous tone, helps with orthostatic hypotension.


- “…rectifying hypotension one of the only clinical interventions that appear to influence neurologic outcome after ASCI” but paucity of data, low incidence= pt recruitment into RCTs difficult, variability of spontaneous neuro recovery in incomp SCI

- What should target MAP be, for how long and w what drugs?
STICU SCI Tx

- MAP goal 80-90 for max cord perfusion x 72 hrs
- Fluids: crystalloid, colloid
- Pressors: Levo
- Atropine for bradycardia
- O2
- DVT prophylaxis
- NGT to suction (decrease risk of aspiration and of paralytic ileus)
- Foley
- Temp regulation
- Mg/K/PO4: hypotension and hypovolemia cause inc’ed aldosterone= inc’ed K+ secretion, hypokalemia
STICU SCI Tx

- Weakness of diaphragm and chest wall muscles = impaired clearance of secretions, atelectasis, hypoventilation
- Early intubation
- Early chest physiotherapy
- Tracheostomy w/in 7-10 days
- Log roll pt q 2-3 hrs to avoid pressure sores
- Consider rotating bed
DVT Prophylaxis

- Overall mortality from DVT is 9% in SCI pts
- **Standard:** Low Molecular Weight Heparin, or SQ Heparin combined with SCDs x 3 mos
- **Guideline/ NOT recommended:**
  - Low-dose Heparin alone
  - PO anticoag alone (acutely)
- **Option:** prophylactic placement of IVC filter for pts who are not candidates for anticoag
- **Option:** monitor with duplex doppler US
What about Steroids???


2002: Evidence suggesting harmful side effects is more consistent than any demonstrated clinical benefit

2012 update: Not recommended
Previously only tx suggested in clinical trials to improve outcomes (? BP)

Widespread criticism of original studies suggesting benefit, never reproduced

Pts receiving longer duration (48 hrs vs 24) = more severe sepsis and PNA

Progress: 2006 survey surgeons, 89% vs 2014, 56%. Schroeder, G et al.
Questions?

Thank you!


Dermatome: an area of skin innervated by a single spinal cord level

- T4: nipple line
- T10: umbilicus
C5: deltoid, biceps, brachioradialis
- Shoulder abduction, elbow flexion

C6: supinator
- Wrist extension, supination

C7: triceps
- Elbow extension, wrist flexion, pronation

C8: finger flexors/ grip

T1: finger adduction
ASIA Impairment Scale

- **American Spinal Injury Association**
- **A: Complete**
- **B: Incomplete- Sensory preserved but no motor below the injury level**
- **C: Incomplete- Motor preserved below injury level, more than 1/2 key muscles below injury motor < 3**
- **D: Incomplete- Motor fct preserved below injury level, > half key muscles below injury motor > or = 3**
- **E: Normal**