

SPINAL CORD INJURY (SCI) – Best Practice Guidelines

Acute spinal cord injury is defined as sudden onset damage or trauma to the spinal cord resulting in loss of tissue integrity, which can lead to impaired function, reduced mobility or sensory dysfunction.

I. Triage and Transportation (EMS)

- a. Whenever possible, transport the patients with acute SCI to a specialized SCI treatment centers or highest trauma center available.
- b. Immobilization
 - i. Spinal immobilization in patients with penetrating trauma is NOT recommended due to increased mortality from delayed resuscitation.
 - ii. Patients with any of the following may require immobilization with a cervical collar:
 1. High risk injury
 2. Focal neurological deficits
 3. Intoxication or altered mental status (AMS)
 4. Age > 65
 5. Presence of midline body tenderness of the spine
 6. Midline spinal pain with movement of the neck
 - iii. Patients without any of the above findings may be transported without a cervical collar
 - iv. Utilize the long spine board, short board, or KED ONLY for extrication purposes. Log-roll onto stretcher with collar in place and may elevate the back of the stretcher as needed for patient comfort.
 - v. The “scoop” stretcher may be utilized to move the patient onto the stretcher and then broken apart with the patient on the stretcher.
 - vi. Do NOT transport a patient to the hospital on a backboard, short board, KED, or vacuum mattress unless it is necessary for patient safety.
 - vii. Eliminate the “standing take-down” for back-boarding patients who are ambulatory after an injury. Place a collar and allow the patient to sit on the stretcher.

II. Emergency Department (ED)

- a. Trauma Activation
 - i. ACLS as needed
 - ii. ATLS protocol evaluation
 1. Airway/Breathing
 - a. Avoid Hypoxia
 - b. Assess the need for intubation
 - c. RSI/DAI with HiLo Evac ETT if needed
 - d. Sedation (if intubated) – Fentanyl drip 50 mcg/hr. IV and titrate to maintain a Richmond Agitation Sedation Score (RASS) 0 to -2.
 2. Circulation
 - a. Avoid hypotension and bradycardia

- i. MAP goal \geq 85 mmHg for blunt & incomplete penetrating SCI
 - ii. MAP goal \geq 65 for complete penetrating SCI (ASIA A)
 - b. Initial response – fluid challenge with a maximum of 2L NS bolus
 - c. Persistent hypotension – Norepinephrine 0.05 mcg/kg/min titrated to maintain MAP goals.
- iii. Remove backboard as soon as possible; transfer onto a firm, padded surface/mattress while maintaining alignment
- iv. Complete H & P
- v. Obtain the following
 1. Full activation labs
 2. ABG
 3. PCXR
 4. ECG
 5. Respiratory mechanics (non-intubated patients)
 - a. Negative inspiratory force (NIF)
 - b. Forced vital capacity (FVC)
 - c. Tidal volume (TV)
- vi. Pain management (non-intubated patients)
 1. Fentanyl 25 – 50 mcg IV q 1 hr. prn; OR
 2. Morphine 2 – 5 mg IV q 1 hr. prn
- vii. Steroid Use
 1. Methylprednisolone (MPS)
 - a. The routine use of MPS is no longer recommended
 - b. If the decision is made to use MPS it should be given in a high dose infusion within 8-hours of the SCI and only for a duration of 24-hours.
- viii. Imaging (should not delay transfer to the appropriate SCI/trauma center)
 1. Cervical Spine (Csp)
 - a. CT Scan of the Csp is the preferred imaging
 - b. MRI should be performed within 48 hrs. in patients with a possible SCI; clinical concern for cord compression due to disk protrusion, hematoma, or unstable fracture pattern; or pain out of proportion to the CT findings.
 - c. 3 views of the Csp is no longer recommended unless CT scanning is unavailable
 2. Thoracic Spine (Tsp)
 - a. Maintain a low threshold for imaging the Tsp in patients with blunt trauma

- b. Patients with cervical spine injury should have imaging of the entire spine
 - c. CT scan with high-quality thin section images to generate multiplanar reformations in the transaxial, sagittal, and coronal planes.
 - 3. Lumbar spine (Lsp)
 - a. Maintain a low threshold for imaging the Tsp in patients with blunt trauma
 - b. Patients with cervical spine injury should have imaging of the entire spine
 - c. CT scan with high-quality thin section images to generate multiplanar reformations in the transaxial, sagittal, and coronal planes.
- ix. Admission Orders per local facility – typically to a Neuro/Trauma ICU or a specialized unit caring for SCI patients depending upon the deficit level.

III. Intensive Care Unit (ICU)

- a. Neurologic
 - i. Goals
 - 1. Define the level of injury
 - 2. Set a baseline for sensory, motor, and reflex status
 - ii. Clinical management
 - 1. Consider use of the RotoREST bed
 - 2. Consider stabilization within 72 hours
 - 3. Neuro assessment and monitoring per ICU protocol
- b. Respiratory
 - i. Goals
 - 1. Decrease/prevent atelectasis
 - 2. Enhance the clearance of secretions
 - 3. Prevent pneumonia (PNA)
 - ii. Clinical management
 - 1. Monitoring: vital signs, respiratory parameters, IS q 1 hour
 - 2. Mechanical ventilation
 - a. Consider higher tidal volumes (10-15 ml/kg)
 - b. Weaning protocol once patient meets criteria
 - c. Consider diaphragm pacer placement as needed
 - 3. Institute facility's PNA prevention protocol

c. Cardiac

i. Hypotension

1. Maintain MAP \geq 85 mmHg for at least 72 hrs. – 7 days in blunt SCI
 - a. Reassess based upon clinical response
 - b. Do NOT use for patients with irreversible SCI
2. Norepinephrine: 0.05 mcg/kg/min titrate to MAP goal
3. Persistent hypotension
 - a. Check random Cortisol level
 - i. $<$ 20 and on norepi start hydrocortisone 100 mg IV q 8 hrs.
4. Midodrine 5 mg po/per tube (pt) q 8 hours
5. SCDs while in bed
6. TED hose and ACE wraps prior to getting out of bed; remove while in bed

ii. Bradycardia

1. Assess for mucous plugs
2. Atropine 0.5 mg IV q 1 hr. PRN; HR $<$ 40 or symptomatic
3. If bradycardia persists, consider
 - a. Albuterol 2 mg po/pt q 6 hrs.
 - b. Caffeine 200 mg po/pt q 12 hrs.
 - c. Robinul 0.1 – 0.2 mg IV or 1 -2 mg po/pt q 8 12 hrs.
 - d. External pacing for severe, refractory, symptomatic bradycardia

iii. Gastrointestinal

1. Stress ulcer prophylaxis: Pepcid 20 mg IV/PT/PO q 12 hrs.
2. Constipation
 - a. PT: Senna 10 mL q 12 hrs.
 - b. PO: Senna-S 2 tabs q 12 hrs.
 - c. PR: Bisacodyl (Dulcolax) 10 mg daily
 - d. If no BM within 72 hours
 - i. Sorbitol 30 mLs po/pt q 12 hrs. until results
 - ii. Milk of Magnesia 30 mLs po/pt daily
 - iii. Bisacodyl increase PR q 12 hrs.
 - iv. Miralax 17 g po/pt daily
3. Diarrhea
 - a. Hold constipation medications
 - b. Metamucil/benefiber 1 pkt po/pt q 12 hrs.
 - c. Consider loperamid/lomotil for 24 hrs. cautiously

iv. Nutrition

1. Consult Speech Therapy (ST) for swallow evaluation before po intake

2. Obtain feeding access and stop enteral support < 48 hrs.
 3. Dietitian consult
 4. Consider metabolic cart and 24 hr. urine studies for nitrogen balance
 5. Maintain euglycemia (e.g. < 1800 mg/
- v. Bladder
1. Urinary catheter insertion
 2. Consider catheter removal
 - a. No longer on IVF
 - b. Total intake < 2L/d
 - c. No diuresis
 3. Begin routine straight catheterization q 4 – 6 hrs.; < 400 mLs per attempt
 4. Condom catheter is NOT recommended
 5. Bladder scanning prn
- vi. Skin precautions
1. Cervical collar
 - a. Remove EMS collar – if not already done
 - b. Aspen Collar
 2. Consult wound care
 3. Pressure ulcer prevention guidelines
 4. Mepilex sacral dressing
 5. Maintain skin moisturized
- vii. VTE prophylaxis
1. SCDs BLE while in bed
 2. Heparin 5000 units sq q 8 hrs. (7500 U if BMI ≥ 35)
 3. Enoxaparin 72 hrs. post op or immediately if non-operative
 4. Consider IVC filter if chemoprophylaxis is contraindicated
- viii. Pain/Spasticity
1. Neuropathic pain
 - a. Gabapentin – 300 mg po/pt q 8 hours; > 65 start lower dose; OR
 - b. Pregabalin 75 po q 12 hrs.
 - c. Amitriptyline 25 mg po q hs prn depression
 2. Generalized pain
 - a. Acetaminophen 650 mg po/pt/pr q 6 hrs.
 - b. Lortab elixir 10 -15 mLs pt q 4 hrs. prn
 - c. Hydrocodone 5/325 mg 1 – 2 po q 4 hrs. prn, monitor acetaminophen
 - d. Oxycodone 5 – 10 mg pt q 4 hrs. prn
 - e. Percocet 5/325 mg 1 – 2 po q 4 hrs. prn monitor acetaminophen

3. Spasticity
 - a. Baclofen 10 mg po TID (while awake)
4. Muscle relaxants
 - a. Tizanidine (Zanaflex) 2 mg po q 8 hrs.
 - b. Methocarbamol (robaxin) 750 – 1000 mg/IV q 8 hrs.

IV. Pediatrics

- a. EMS
 - i. Maintain in neutral position
 - ii. Account for larger head size - use modified board or elevate the shoulders
- b. Imaging
 - i. Csp imaging in Pediatric patients < 3 is NOT recommended if:
 1. GCS > 13
 2. No neurologic deficits
 3. No midline Csp tenderness
 4. No painful distracting injury
 5. Are not intoxicated
 6. Do not have unexplained hypotension
 7. Not in a MVC
 8. Not a fall > 10
 9. Not a SNAT as a mechanism
 - ii. CT Csp is **recommended** for children with trauma and not meeting the above
 - iii. Csp imaging in pediatric patients > 3 is NOT recommended if:
 1. Are alert
 2. No neurologic deficits
 3. No midline Csp tenderness
 4. No painful distracting injury
 5. Are not intoxicated
- c. Treatment
 - i. Methylprednisolone – if given within 8 hrs. of injury – **controversial**
 1. 30 mg/kg IV bolus
 2. 5.4 mg/kg/hr. for 24 hours
 - ii. Respirator weaning
 - iii. VTE prophylaxis

V. References

- a. Fehlings M, Tetreault L, Wilson J, et al. A Clinical Practice Guideline for the management of Acute Spinal Cord Injury: Introduction, Rationale, and Scope. *Global Spinal Journal* 2017, Vol. 7(35) 84S – 94S.
- b. Birrer, K, Hobbs B, Cheatham M, et al. Acute Spinal Cord Injury Management. 2018 SurgicalCriticalCare.net
- c. Bickenbach J et al. International perspectives on spinal cord injury. WHO and ISCOS. ISBN 978 92 4 156466 3.
- d. Hadley H, Walters B. Introduction to the Guidelines for the Management of Acute Cervical Spine and Spinal Cord Injuries. *Neurosurgery* 72(3) March 2013 supplement.
- e. ACS TQIP best practice guidelines on imaging. 2019
- f. Rozzelle C, Aarabi B, Dhall S, et al. Management of pediatric cervical spine and spinal cord injuries. *Neurosurgery* 72:205 – 226. 2013.
- g. Management of Pediatric Trauma. *Pediatrics* 138(2). Aug 2016:e20161569

GETAC Trauma Systems Committee - Pending Approval