Clinical Pearls from the Preventable Mortality Review Committee

Management of Acute Traumatic Spinal Cord Injury (SCI)

Management of traumatic spinal cord injury is directed at preventing secondary insults, most notably hypotension with subsequent cord hypoperfusion. This can occur because cervical and upper thoracic spine injuries injuries can result in vasoplegia and spinal shock due to loss of sympathetic tone.[1-5]

It is *vitally* important to <u>first</u> assess for and rule out hemorrhage as a source of hypotension. After hemorrhage has been excluded, resuscitation efforts initially include volume resuscitation with caution against fluid overload while being mindful of patient comorbidities and concomitant injuries (CHF, pulm contusions, etc).

Inotropic support: Based on low-grade retrospective studies, current recommendations are to maintain the MAP (mean arterial pressure) of at least 85 for seven days after injury or a stable neurologic exam is achieved for 24 hrs post decompression.[1-5] CVL and arterial lines are recommended.

Levophed (norepinephrine) is the agent recommended to achieve this because it has alpha and beta adrenergic activity.[1-5]

It is essential to rule out bleeding, anemia, or volume depletion because they can be missed if vasopressor requirements are increased without reevaluation.   Maintaining a hemoglobin of > 8g/dl may help minimize the required volume of vasopressors.[6] Minimizing vasopressor support is important because of sizable percentage of patients started on them to maintain MAP develop cardiac complications, most commonly arrhythmias.

Steroid therapy: NO definitive proof exists for using steroids to treat SCI.[7-8] Additionally, steroids increase risk of infections, GI bleeding, hyperglycemia and death.

"IDEAL" Timing of surgical Decompression/Stabilization:[13]

1. Cervical SCI should ideally be addressed within 24 hours of presentation
2. Thoracolumbar SCI ideally should be addressed within 72 hours of presentation

Venous thromboembolism (VTE) prophylaxis: SCI patients are at increased risk for developing VTE ranging as high as 40 to 70% typically developing between 72hrs and two weeks after SCI.[9] Mechanical prophylaxis can be initiated immediately after injury. Chemoprophylaxis using low molecular weight heparin (LMWH) should be started as soon as possible or 24 hrs after surgical decompression.[10] Giving chemical VTE prophylaxis before spinal cord injury and holding it the morning of surgery should be considered if surgery is going to be delayed for a few days. Sequential compression Devices (SCDs) should be used while chemical VTE prophylaxis is being held for surgery. Prophylactic IVC filters have no identified benefit.[11-12]

Tracheostomy: Early tracheostomy following high SCI, especially cervical injuries that affect the phrenic nerve and diaphragm (above C5), improves outcomes, reduces morbidity and mortality, and decreases hospital length of stay.[14-15] Patients with thoracic SCI may also benefit from tracheostomy if the respiratory failure results from thoracic injuries, e.g., rib fx, contusions, etc.

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These guidelines were prepared by the ADH (trauma medical consultant) and members of the Arkansas State Preventable Mortality Committee. They are intended to serve as guidelines based on a review of the current medical literature. They are not intended to be used a strict policies or protocols. Their use is at the discretion of the managing physician.

Arkansas Trauma System

Open Abdomen

Damage control laparotomy (DCL) and the management of the open abdomen (OA) or temporary abdominal closure (TAC) often go together. DCL is usually done emergently in major abdominal trauma to gain control of bleeding and stop contamination from bowel perforations.

If the patient has liver bleeding that will only stop with packing or is coagulopathic, hypothermic, or hemodynamically unstable, leaving the abdominal fascia open with specialized techniques allows time to resuscitate, stabilize, and warm the patient. OA is also used for a badly infected or contaminated peritoneal cavity or bowel with questionable vascular flow to allow a "second look" into the abdomen to check for integrity of GI anastomoses or assess bowel viability before more resection or anastomosis.

Usually, the abdomen is temporarily closed with negative pressure wound therapy (NPWT) over a plastic sheet covering the bowel. This can be hand-constructed from abdominal draping sheets OR towels, & suction drains, or commercially available kits (such as Abthera©).[i]

The patient is typically returned to the OR for a second look procedure within 12-36 hours to remove packs and complete the index operation.

This take-back and closure of the abdomen fascia should be attempted as early as possible, as abdomen fascial closure becomes much more difficult each day, increasing the risk of hernia, infection, and entero-atmospheric GI fistulas.[ii]

Edema of the bowel and intraabdominal contents may prevent the closure of the fascia. Several techniques can be used. An infusion of 3% saline at 30ml per hour IV for the first 72 hours of an open abdomen has been shown to increase first closure rates without causing harm to the patient. During this protocol, additional iv fluids should be given as indicated, but other "maintenance fluids" should not be ordered.[iii] [iv]

Direct peritoneal resuscitation with 2.5% peritoneal dialysis solution to irrigate the abdomen while it is left open has been shown to increase the chances of fascial closure and decrease abscesses. In these cases, a catheter is placed in the abdomen to infuse the dialysis solution at ~400ml per hour while a negative-pressure dressing removes the fluid from the abdomen until the patient returns to the OR for fascial closure.[v] [vi]

Use of soft plastic sheeting (Mepitel© or Abthera©) between the abdominal wall and bowel, while the patient has an open abdomen is important and will help prevent the dreaded complication of enteroatmospheric fistula formation.[vii] These fistulas are often caused by adhesions between the bowel and underside of the abdominal wall, leading to excess tension across the bowel as the abdominal wall muscles contract. This tension and pressure can lead to bowel perforation and the development of an enteroatmospheric fistula.

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Tension Pneumothorax Needle Decompression

Tension pneumothorax is a well-described cause of early and rapid death in trauma patients (3-4% of military trauma deaths). It results from an obstructive (or cardiogenic) shock from high pressure outside of the lung in the chest, preventing the return of venous blood to the heart.

The treatment is rapid decompression of this excess air in the pleural space. This is typically done in a hospital with a chest tube; however, this is more difficult in the prehospital setting. As a result, needle decompression with an angiocatheter over an introducer needle was described. Initially, the second intercostal space at the mid-clavicular line was described. Unfortunately, this location is often difficult to discern, thicker than other areas of the chest, and potentially dangerous with mammary arteries traversing near this location.

As a result, the **4-5 intercostal space at the anterior axillary line is now recommended (C below; between the pectoralis major and latissimus dorsi)**. Numerous studies have also shown that 14-gauge 8-cm long angiocatheters are required to reliably gain access to and decompress the pleural space.

A = 2nd intercostal mid-clavicle line
B = 4-5th intercostal mid-axillary line
C = 4-5th intercostal anterior-axillary

Finger thoracostomy is another method for decompressing a tension pneumothorax, but it is more challenging in the pre-hospital space, and it results in a large wound that is more prone to infection; thus, we believe it should be reserved for patients in cardiac arrest.
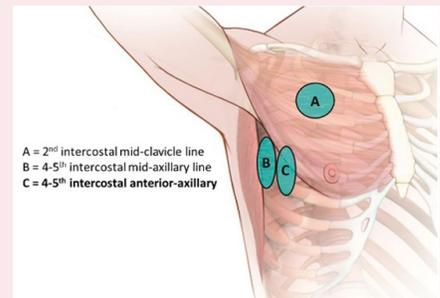
Other notes on needle decompression or finger thoracotomy:
- It can take up to a minute for the lung to fully expand after needle decompression so do not expect immediate results.
- Angiocatheters with "blood control valves" prevent fluid or air from flowing through the catheter, so they should not be used for needle decompression.
- Angiocatheters used for needle decompression can become kinked, so decompression may need to be repeated, esp. during extended transport.
- Needle decompression or finger thoracotomy are not definitive treatments for tension pneumothorax, so if there is a pneumothorax and the patient survives, a chest tube will need to be placed.
- Needle decompression attempts do not always enter the pleural space and are often attempted for patients who do not need them, so not every patient who received one in the pre-hospital space needs a chest tube, esp. patients in whom the catheter did not enter the chest or in whom there is not a pneumothorax on CT of the chest.

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