VANDERBILT UNIVERSITY HOSPITAL CHEST PROTOCOL FOR BLUNT FORCE THORACIC TRAUMA

Policy Description:

Managing patients with multiple rib fractures or flail chest requires significant health care resources including intensive care unit monitoring, ventilator management [1-3], surveillance and treatment of pneumonia, and pain management protocol. Both acute complications and long-term disabilities occur as a result of this very common pattern of thoracic trauma.

In a retrospective review of 64,750 civilian trauma patients in the National Trauma Databank (NTDB) with 1 or more rib fractures, mortality in the entire cohort was 10%[1]. Mortality increased stepwise with each additional fracture to a maximum of 34.4% with 8 or more fractures. Epidural analgesia was used in only 2.2% of patients but significantly reduced mortality in patients with 2 rib fractures and 4 or more rib fractures. For patients with 8 rib fractures, only 7% received an epidural catheter; however, those who did had a 98% survival as compared to a 65% survival without an epidural. Consideration for single or multiple paravertebral catheters should also be considered when an epidural catheter is contraindicated or technically unsuccessful as there is evidence of efficacy similar to epidurals with fewer contraindications and hypotension [4].

The nationwide opioid abuse epidemic has increased awareness of how acute pain is managed. A joint practice guideline from trauma surgeons and anesthesiologists conditionally recommends use of multimodal analgesia rather than opioids alone in patients with blunt thoracic trauma (10). Emphasis should be on reducing the duration and dosage of opioids as much as possible. Multimodal approaches involving non-steroidal anti-inflammatory drugs (NSAIDs) and GABA-analogs (gabapentin and pregabalin) have been shown to improve perioperative pain control and have been adapted as an initial approach for blunt chest wall injury [5-7].

Use of a rib fracture protocol has recently been shown to reduce ICU length of stay, hospital length of stay, and pneumonia in patients with rib fractures [3]. There was also a trend towards reduced mortality. This protocol involved a multidisciplinary approach involving the trauma team, anesthesia pain service, advanced care practitioners, physical therapy, and nutrition.

Long-term outcomes are similarly poor in these patients. Civilian studies indicate that the morbidity and lost productivity in patients suffering thoracic trauma is substantial even in the relatively young and those with minimal injuries. For example, patients with rib fractures are significantly more disabled at 30 days post injury when compared with patients with chronic medical illness and lose an average of 70 days of work or usual activity during their acute recovery [8].

From a functional standpoint, a 2009 study found that for up to 2 years after pulmonary contusion and rib fractures, multiple parameters on pulmonary function testing and exercise tolerance are compromised with VO_{2max} of 60% predicted[9]. In patients with flail chest, over 50% develop permanent morbidity with persistent chest wall pain or deformity being the most common long-term problems [10, 11]. As many as 40% of these patients still had not returned to work one year after their injury.

The challenge, therefore, is to identify treatment strategies that improve both short and long term outcomes in patients with severe chest wall trauma. We believe a multidisciplinary approach is warranted at VUH given the frequency of rib fractures in our patient population and the potential benefits to having a treatment protocol for managing acute fractures and a multi-modal approach to avoiding long-term disability (Appendix A).

Policy Statement:

1. This policy applies to trauma patients with rib fractures who are admitted to the Trauma service. Patients who meet the defined criteria will be managed according to this protocol as detailed in Appendix A.

2. The key pain management decisions are: 1) implementation of basic multimodal analgesia (acetaminophen, low-dose oral opioid, NSAID) unless contraindicated; 2) need for additional pain adjuncts beyond basic multimodal pain control (gabapentinoids, atypical oral medications, regional anesthesia techniques, IV lidocaine infusion, IV ketamine infusion, etc.); 3) the need for operative stabilization of dislocated fractures or a flail chest; 4) patient suitability for regional anesthetic procedures; and 5) analgesic requirements at discharge (drug, dose, and duration). An attending trauma surgeon and attending anesthesiologist on the Acute Pain Service (APS) will be involved in these decisions and the APS plan will be communicated to the Trauma provider team.

3. If the patient has a flail chest, displaced rib fractures causing significant chest wall deformity, a need for surgical intervention in the chest in the setting of multiple rib fractures, or chronic pain from rib fractures, operative stabilization of the fractures should be considered. This does not replace the need for multimodal pain control.

4. Pain management beyond basic multimodal oral pain regimen will be managed primarily by APS. Management recommendations will be communicated to the Trauma team by the APS service. Regional anesthesia solutions and IV analgesic infusions (including but not limited to lidocaine and ketamine) will be ordered directly by APS. Management decisions such as placement or non-placement or regional anesthetics and the use of IV analgesic infusions will be communicated to the responsible trauma staff.

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Reviewed By:
Bradley Dennis, MD
Brian Allen, MD

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VUMC Rib Fracture Management Pathway

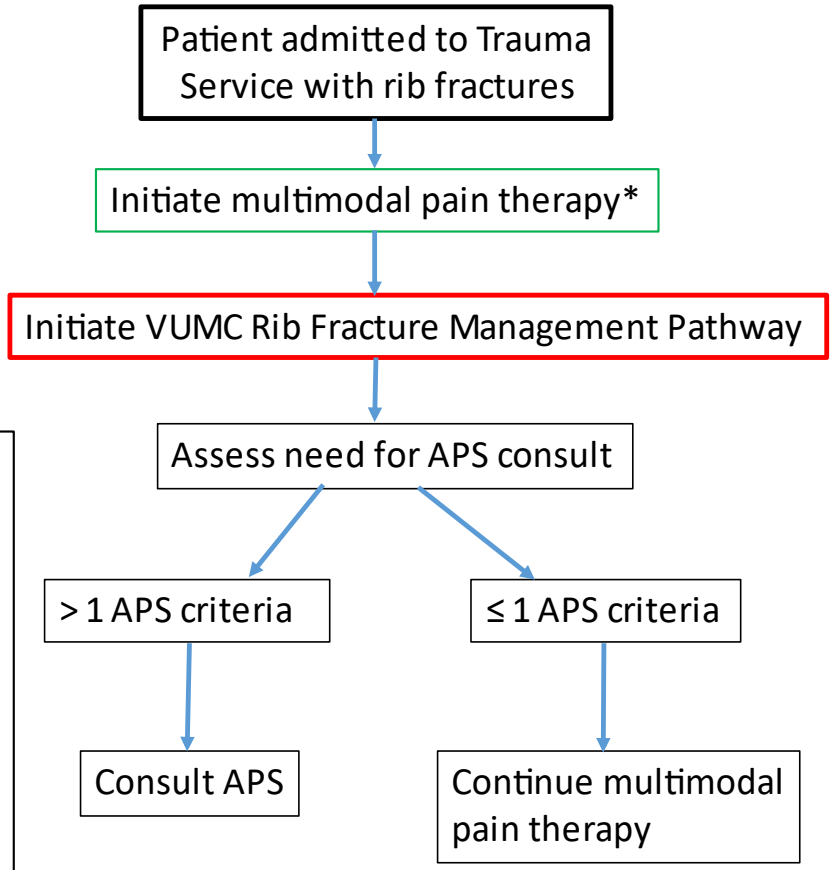
- Incentive Spirometry with goals:
  - 10 reps/hr,
  - ≥ 15 mL/kg within best flow rate. Roughly 1000 - 1500 mL in adults
- RT evaluation
- PT consult for early mobility
- Maintain euvolemia

Criteria for Acute Pain Service (APS) consult:

Age ≥ 45
# of rib Fx > 3
Daily IS volume ≤ 15 mL/kg
Pain (at rest and with cough) ≥ 5/10
Present of admission medications:

- ≥60 MME (milligram morphine equivalent) per day
- Current buprenorphine (Suboxone) or methadone use

Appendix A: Vanderbilt Rib Fracture Protocol



*Multimodal Pain Therapy:

- NSAIDs
- Tylenol
- +/- opioids (oral preferred over IV; consider PCA if IV required)
- Gabapentinoids (if indicated)

RT evaluation includes assessment for:

- Adequacy of oxygenation/ventilation
- Alveolar recruitment
- Need for bronchodilators
- Secretion management

Appendix B: APS Consult Guidelines

APS Consult considerations

The APS will:

- Evaluate patients within 6 hours of consultation
- Reassess 18-36 hours after initial evaluation
- Place and maintain epidural or other perineural catheters in place for 3-5 days (up to 7 in special circumstances)
- Consider alternative blocks or other analgesic infusions if epidural contraindicated or unilateral injury
- Provide daily follow-up while TEC or other nerve catheters in place or IV infusions running
- Consider regional techniques for intubated patients (RASS -2 to +1) with anticipated extubation in the next 24hrs
- Confer with Trauma team on catheter day 3 & 4 to consider whether catheter discontinuation would facilitate patient discharge or whether catheter should be maintained to days 5-7
- Discuss with Trauma Faculty if regional anesthesia contraindicated

Thoracic Epidural Contraindications

- Labs: Platelets < 80,000, INR ≥ 1.5, elevated PTT
- Medications: anticoagulants, antiplatelet agents, or the inability to rule out the use of these medications (see Appendix C)
- Infection: Systemic or insertion site infection
- Certain traumatic injuries: Epidural or spinal cord hematoma, TBI with midline shift, spinal cord injury, operative spine fractures adjacent to insertion site
- Epidural contraindications may not preclude other blocks

Barriers to Regional Anesthesia– though not contraindications, these may make regional anesthesia challenging or require changes in timing or technique

- Deep sedation: < RASS -3
- Injuries requiring placement in traction (acetabular fracture, etc.)
- Patient distant from extubation or ventilator weaning
- Inability to provide consent or identify surrogate decision-maker
- Operative spine fractures (away from insertion site) or pending spine evaluation

Appendix C: Anticoagulation guidelines for regional anesthesia

2018 American Society of Regional Anesthesia and Pain Medicine (ASRA) Guidelines
https://doi.org/10.1097/aap.0000000000000763 or https://rapm.bmj.com/content/rapm/43/3/263.full.pdf

Medication	Prior to procedure	With catheter in place	Prior to removal	After catheter removal
Heparin				
SC Heparin TID (≤ 5000 units)	Hold AM dose	Hold until after placement	Hold AM dose	Resume 1 hour after removal
SC Heparin (>5000 units)	Hold AM dose , wait until PTT<40	AVOID WHILE CATHETER IN PLACE		
IV Heparin	Hold infusion 4-6 hrs, wait until PTT<40			
Low Molecular Weight Heparin				
Prophylactic dose (30 mg SQ BID, 40 mg SQ BID)	**Do not order if patient being evaluated by APS. Hold 12 hrs**	AVOID WHILE CATHETER IN PLACE		Resume 4 hours after removal
Therapeutic dose (1 mg/kg SC BID or 1.5 mg/kg daily)	Hold 24 hrs			
Vitamin K antagonist				
Warfarin	Hold until INR <1.5	AVOID WHILE CATHETER IN PLACE	INR <1.5	May start immediately
Anti-platelets				
Aspirin	NO RESTRICTIONS			
Plavix	Hold for 7 days	AVOID WHILE CATHETER IN PLACE		Hold loading dose for 6 hours after removal. If NO LOADING DOSE, may start immediately.