Case
- 70 y/o M, falls from ladder while cleaning out the gutters
- PMH: Atrial fibrillation on Coumadin, HTN on Atenolol, COPD on intermittent inhalers
- Injuries: 4 rib fractures on left with pneumothorax requiring chest tube
- Stable, GCS 15

Hospital Course
- Admitted to the ward
- IV Morphine via PCA
- Looks good first 24 hours then delirious at night, given haldol
- Next day increased work of breathing, CXR suggests aspiration vs pneumonia
- Patient requires intubation, transfer to the ICU
- Dies on PID 10 with failure to wean from vent/sepsis
Epidemiology

- Rib fractures in 10-26% of patients presenting to trauma centers
- NTDB 10% mortality patients with rib fxs
- Increased risk in elderly: 60/100,000 persons
- 50% elderly patients with rib fx: Ground level fall

Relationship of Pneumonia to Rib Fracture Number

Relationship of Mortality & Rib Fracture Number
Rib Fractures Management

- Pain Management
- Respiratory therapy
  - Every 10% increase in vital capacity in the first 48 hrs associated with 36% reduction in pulmonary complications
- Care Pathways
  - A TQIP approach!

Multimodal Systemic Analgesia

- Home pain regimen restarted (psychoactive medications and long acting opioids)
- Acetaminophen 1000mg po/IV if NPO (reduce dose for liver disease or elderly)
- Gabapentin 300mg po q8 (age appropriate dose adjustment)
- Toradol 7.5-15mg IV Q6 or Celecoxib 200mg po BID (Hold for renal dysfunction or bleeding risk)
- PCA or po opioid started, titrated to effect/side effects

Problems with IV Narcotics

- Excessive sedation: depression of respiratory drive
- Risk of delerium especially in elderly
- Increased risk of aspiration
Options for Regional Analgesia

- Epidural catheter
- Paravertebral catheter
- Intrapleural infusion
- Intercostal nerve blocks

Regional Analgesia

- Mackersie et al, J Trauma 1991
  - Randomized comparison of epidural vs IV fentanyl
  - Improved pain scores and PFTs, no cases of nosocomial pneumonia in either group
- Wu et al, J Trauma 1999
  - Retrospective comparison of epidural vs PCA
  - Better pain scores in epidural group, no difference in pulmonary complications but significant selection bias
  - Randomized comparison epidural vs PCA
  - Better pain scores & PFTs in epidural group

HMC study 2004

<table>
<thead>
<tr>
<th></th>
<th>OR/IRR</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumonia*</td>
<td>6.0</td>
<td>1.0-35</td>
<td>0.05</td>
</tr>
<tr>
<td>Ventilator Days**</td>
<td>2.0</td>
<td>1.62-2.55</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Adjusted for: pulmonary contusion, flail segment, chest tube and Apache II
**Stratified for Pulmonary Contusion

Bulger et al, Surgery 2004
NSCOT study
- Multicenter analysis 836 patients meeting eligibility criteria for an epidural after rib fractures
- Only 12% (n=100) had epidurals placed
- Trauma centers more likely to place epidural than non-trauma centers
- Epidural associated with a significant reduction in the odds of death at 30, 60, and 365 days after multivariate analysis
  Gage et al, J Trauma Acute Care Surg 2014

Contraindications to Epidurals
- Controversy among pain service directors
- Most common contraindications
  - Coagulopathy
  - Spine fracture in area of catheter placement
  - Neurologic deficit from spinal cord injury
  - Instability of the patient
  - Unable to position the patient
- Need to consider timing of DVT prophylaxis (Lovenox) if planning epidural

Paravertebral Catheters
- Unilateral fractures
- Potentially fewer contraindications than epidurals
- Less risk of epidural hematoma
- 3 studies suggesting equivalent performance to epidural for unilateral fractures
Treatment Plan for Patients w/ Rib Fractures

- Consider ICU admission even in the absence of associated injuries
  - Age > 65, 3 or more rib fractures
- Aggressive pulmonary therapy by bedside nurse and respiratory therapist
- Pain management by a dedicated team
  - Avoid benzodiazepines in elderly
- Early consideration for epidural or paravertebral placement to optimize pain control
- Development of Rib fracture management pathway

Care Pathways

- Todd et al, Houston
  - Pathway for patients > age 45 with 4 or more rib fractures
  - Close monitoring pain and cough scores and performance on incentive spirometry
  - Engagement of respiratory therapy, physical therapy and dedicated pain management team
  - Patients on pathway: Shorter ICU and hospital stay and lower mortality

Wellspan York Hospital

- TQIP meeting presentation 2014
- Developed PIC score
  - Pain/Inspiration/Cough
- Patient and Family Engagement in tracking PIC scores
- Reduction in unexpected ICU admissions for respiratory complications
Components of HMC Pathway

- Defines criteria for ICU vs ward admission
- Defines specific roles and charting expectations for nurses and RT
- Pain management guidelines
  - Standardized initial multi-modal systemic therapy
  - Emphasizes consult of Acute Pain service and establishes indications and contraindications for epidural/paravertebral catheters
- Defines timing of initiation of DVT prophylaxis
Components of HMC Pathway

- Incentive spirometry goal and alert levels set by RT
- PIC scores charted hourly in ICU and q4hrs on ward
- PIC scoreboard posted in room
- Low scores prompt physician call triggers
- Family/Patient engaged in trying to improve their score

Standardization of Pain Service Recommendations

**Acute Pain Management Guidelines for Chest Trauma Patients**

- **Purpose**: Appropriate pain management for chest trauma patients, emphasis on pain, ROM, and family involvement.

<table>
<thead>
<tr>
<th>Acute Pain Management Guideline for Chest Trauma Patients</th>
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<tbody>
<tr>
<td>PRIMARY TEAM to activate: MED ICU/ICU, STAFF, ANESTHESIA</td>
</tr>
<tr>
<td>1. Initial pain regimen established (pre-hospital medications and timing of first opioid)</td>
</tr>
<tr>
<td>2. Administer initial 100mg q 6h PO (or IV f/u) of IV for grade 3 pain, patients under 18 increase by 50%</td>
</tr>
<tr>
<td>3. Calamine 30x/day PO q8hs, mom and age appropriate dose (or f/u)</td>
</tr>
<tr>
<td>4. TED (5-6mm-IV q 6x or Carbocur 20mg PO bid)</td>
</tr>
<tr>
<td>5. PIC or PO opioid charted, and titrated up to affect or side effects</td>
</tr>
</tbody>
</table>

Patient & Family Brochure
What about operative fixation?

- Indications?
  - Flail chest with failure to wean from mechanical ventilation
  - Pain refractory to conventional treatment
  - Significant chest wall deformity or soft tissue injury
  - Delayed non-union
  - Significant displacement noted during thoracotomy for other indication

RCTs

- 37 Flail chest patients on mech ventilation
  - Operative patients: decrease in ventilator days & pneumonia, better pulmonary function at one month and higher return to work at 6 months
- 40 patients Flail chest (surgery vs plaster)
  - Operative patients: decrease in need for mechanical ventilation and pneumonia
- 46 patients Flail chest on ventilation
  - Decrease in ICU LOS but no difference in long term outcomes

Summary

- Rib fracture patients at high risk for in hospital complications especially if elderly
- Inpatient pathways that address pain management and respiratory care may improve outcome
- Selected patients may be candidates for operative fixation
QUESTIONS?

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9/19/2016