Indications for Operative Rib Fixation

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Disclosures

• Honoraria for teaching from Acute Innovations
How Can a Rib Fracture Kill You?

Respiratory failure
- Pain and loss of tidal volume
- Paradoxical movement of chest wall and loss of bellows
- Increased intrapulmonary shunt and V/Q mismatch
- Worsened by aggressive fluid resuscitation

PNEUMONIA
Babak’s Belief System

• A patient with severe rib fractures as the main injury who requires a tracheostomy without having undergone ORIF of the fractures did not receive appropriate care
Rib Fracture Number

- 1-2 rib fractures
- 3-4 rib fractures
- 7 or more rib fractures

N=711, 1987-1992

Rib Fracture Pattern: Flail Chest

Synergistic effect- increase age with morbidity and mortality

Rib Fracture – Age and Number

http://www.east.org/education/online/traumacasts/detail/64/rib-fracture-plating-why-and-how
http://www.east.org/education/online/traumacasts/detail/18/rib-fractures-and-mortality-dr-luchette

Rib Fracture plus Pulmonary Contusion

Days to Liberation from Ventilator

The Physical Exam!

- Vital capacity < 55% of predicted
  - “Take a deep breath” or “cough”
- Inability to talk in full sentences
- “I’m ok so long as I don’t move”

- Timing of procedure: **EARLY**
The Southwestern Surgical Congress

Predicting outcome of patients with chest wall injury

Crystal M. Pressley, M.D., M.P.H., William R. Fry, M.D., Allan S. Philp, M.D., Stephen D. Berry, M.D., R. Stephen Smith, M.D.

Table 1  Chest wall trauma scoring system

<table>
<thead>
<tr>
<th>Age (y)</th>
<th>Number of rib fractures</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;45 = 1 point</td>
<td>&lt;3 = 1 point</td>
</tr>
<tr>
<td>45–65 = 2 points</td>
<td>3–5 = 2 points</td>
</tr>
<tr>
<td>&gt;65 = 3 points</td>
<td>&gt;5 = 3 points</td>
</tr>
<tr>
<td>Score: ___</td>
<td>Score: ___</td>
</tr>
<tr>
<td>Pulmonary contusion</td>
<td>Bilateral rib fractures</td>
</tr>
<tr>
<td>None = 0 points</td>
<td>No = 0 points</td>
</tr>
<tr>
<td>Mild = 1 point</td>
<td>Yes = 2 points</td>
</tr>
<tr>
<td>Severe = 2 points</td>
<td></td>
</tr>
<tr>
<td>Bilateral = 3 points</td>
<td></td>
</tr>
<tr>
<td>Score: ___</td>
<td>Score: ___</td>
</tr>
<tr>
<td>Total score: ___</td>
<td></td>
</tr>
</tbody>
</table>

>6 is bad
# Scoring Systems - CTS

## A chest trauma scoring system to predict outcomes

Jennifer Chen, MD, Elan Jeremitsky, MD, Frances Philp, MS, William Fry, MD, and R. Stephen Smith, MD, Pittsburgh, PA, Lowell, MA, and Columbia, SC

### Table 1. Chest scoring system

<table>
<thead>
<tr>
<th></th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age score</td>
<td></td>
</tr>
<tr>
<td>&lt;45 y</td>
<td>1</td>
</tr>
<tr>
<td>45–65 y</td>
<td>2</td>
</tr>
<tr>
<td>&gt;65 y</td>
<td>3</td>
</tr>
<tr>
<td>Pulmonary contusion score</td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>0</td>
</tr>
<tr>
<td>Unilateral minor</td>
<td>1</td>
</tr>
<tr>
<td>Bilateral minor</td>
<td>2</td>
</tr>
<tr>
<td>Unilateral major</td>
<td>3</td>
</tr>
<tr>
<td>Bilateral major</td>
<td>4</td>
</tr>
<tr>
<td>Rib score</td>
<td></td>
</tr>
<tr>
<td>&lt;3 RIBFX</td>
<td>1</td>
</tr>
<tr>
<td>3–5 RIBFX</td>
<td>2</td>
</tr>
<tr>
<td>&gt;5 RIBFX</td>
<td>3</td>
</tr>
<tr>
<td>Bilateral RIBFX</td>
<td>4</td>
</tr>
<tr>
<td>No</td>
<td>0</td>
</tr>
<tr>
<td>Yes</td>
<td>2</td>
</tr>
</tbody>
</table>

*>4 is bad*
Scoring Systems - RibScore

RibScore: A novel radiographic score based on fracture pattern that predicts pneumonia, respiratory failure, and tracheostomy

Brandon C. Chapman, MD, Benoit Herbert, MD, Maria Rodil, Jennifer Salotto, MD, Robert T. Stovall, MD, Walter Biffl, MD, Jeffrey Johnson, MD, Clay Cothren Burlew, MD, Carlton Barnett, MD, Charles Fox, MD, Ernest E. Moore, MD, Gregory J. Jurkovich, MD, and Fredric M. Pieracci, MD, MPH, Denver, Colorado

6 or more rib fx 1 point
Bilateral rib fx 1 point
Flail chest 1 point
3 or more bicortical fx 1 point
1st rib fx 1 point
1 or more fx in each of 3 anatomic areas 1 point

>3 is bad
### TABLE 4. Comparison of the ROC C Statistic for Each Scoring System

<table>
<thead>
<tr>
<th></th>
<th>OIS Chest</th>
<th>RFS</th>
<th>CTS</th>
<th>RibScore</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory failure</td>
<td>0.61</td>
<td>0.61</td>
<td>0.62</td>
<td>0.69</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>0.60</td>
<td>0.66</td>
<td>0.63</td>
<td>0.71</td>
</tr>
<tr>
<td>Tracheostomy</td>
<td>0.66</td>
<td>0.68</td>
<td>0.67</td>
<td>0.75</td>
</tr>
</tbody>
</table>

OIS Chest, OIS chest wall grade.

*J Trauma Acute Care Surg*  
*Volume 80, Number 1*
The “BEST” Scoring System

• Easy to calculate
• Objectively assess pulm contusion and PNA
• Validated prospectively
• Can be used to determine that mortality improves (ie score changes) following plating
• Acute fx vs Chronic non-union/malunion?
Rib Fracture Plating Guideline

Does the patient have a flail chest or multiple severely displaced rib fractures?  

- Yes: Is the patient intubated?  
  - Yes: Does the patient need a non-emergent ipsilateral thoracotomy?  
    - Yes: Plating not indicated. Consult pain service. Reassess need for plating based on factors below  
    - No: Plate ribs  
  - No: Is the patient unstable OR have severe pulmonary contusion precluding extubation?  
    - Yes: Plating not indicated now. Reassess when stable  
    - No: Plating not indicated.

Other Factors to consider:

1. Chest wall deformity
2. Pain
3. Non-union/malunion after 2 months
4. Restrictive respiratory pattern on pulmonary function testing

When indicated, rib plating should be carried out as soon as possible following injury

This is a guideline only and does not constitute a standard of care or hospital policy.

Babak Sarani, MD, FACS, FCCM
Director, Trauma and Acute Care Surgery

Date: 3/1/2013
Medical Management

- Paravertebral or epidural catheter (EAST level 1 PMG)
- Ketamine gtt
- RTC acetaminophen and celecoxib
- PCA hydromorphone – demand dose only, convert to po ASAP
To ORIF or Not to ORIF

• 50 yo male is intubated for pain due to right 3-8 rib fx with ribs 4-6 being flail segments.
• RSBI score is < 100 and pt “looks good” while intubated, but is on ketamine gtt, PVB, PCA?
  – A. Extubate and ORIF if he fails extubation
  – B. ORIF ribs without a trial of extubation
# Pain Control with Rib Fixation

## Table 2
Rib fracture pain assessment done at 5, 15, and 30 post operative days.

<table>
<thead>
<tr>
<th>Pain assessment scale</th>
<th>Operative group (mean)</th>
<th>Control group (mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post Operative Day$^a$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>9.15</td>
<td>6.25</td>
</tr>
<tr>
<td>15</td>
<td>2.31</td>
<td>5.96</td>
</tr>
<tr>
<td>30</td>
<td>1.12</td>
<td>4.50</td>
</tr>
</tbody>
</table>

$^a$ For conservative group 1st day was calculated from 12th day of presentation.