
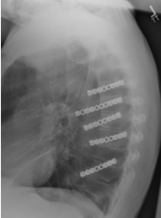


Indications for Rib Fracture Fixation



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Disclosures

- Peter L. Althausen, MD, MBA
- 6: The Orthopedic Implant Company(OIC)

The following relationship(s) exist:
6) Stock or stock options in a company

Historical Perspective

- Physicians have published on rib fracture fixation for over 100 years
- Over the last few years, the benefits of surgical stabilization have been reported in several small case series
(Althausen, Paris, Ahmed, Tanaka, Lardinois, Reber, Mouton)
- These reports suggest that ORIF shortens the duration of intubation, improves pulmonary function testing, restores chest wall continuity and allows patients to return to work.
(Tanaka, Lardinois, Mouton)

Historical Perspective

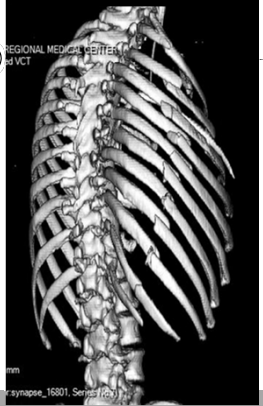
- The indications have never been very clear cut
- Over past 3 years, several authors have attempted to define this more scientifically
- Indications range from absolute to relative
- Certainly easy to see why some might think it a “lunatic fringe”
- However, for those who perform this more regularly, indications seem to be expanding

Our Indications

- Non-intubated patients with respiratory failure despite continuous epidural anesthesia
- Intubated patients with flail chest who failed to wean from the ventilator
- Patients with extensive antero-lateral flail chest and progressive displacement of fractured ribs
- Patients who required a thoracotomy due to associated intra-thoracic injury
- Revision of mal-positioned hardware
- Painful Nonunion

True Flail Chest

- The definition of flail chest varies from study to study
- We define flail chest as fractures of 4 or more ribs fractured at more than 2 sites.
- Paradoxical motion of chest wall observed



Our Results

	Operative Patients (Mean)	Non-Operative Patients (Mean)	P-Value
ICU LOS	7.6(7.43)	9.7(9.18)	0.018
Hospital LOS	11.9(7.79)	19.0(12.64)	0.006
Days on Vent	4.1(6.66)	9.7(9.18)	0.007
Tracheostomy	13.6%(3/22)	39.3%(11/28)	0.042
Pneumonia	4.6%(1/22)	25%(7/28)	0.047
Re-intubation	4.6%(1/22)	17.9%(5/28)	0.034
Home O2	4.6%(1/22)	17.9%(5/28)	0.034

Patients treated with ORIF had better outcomes across all variables

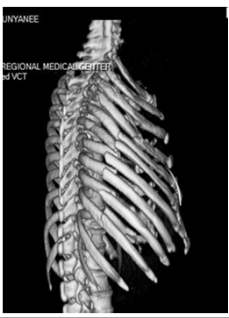
Effect of Early Operative Intervention

	Pearson Coefficient	P-Value
ICU LOS	0.487	0.029
Days on Vent	0.477	0.033
Hospital LOS	0.483	0.031

- Regression analysis in our series did show a positive correlation between time to operation and Hospital LOS, days on ventilator, and ICU LOS
- These were all statistically significant findings, suggesting that patients should receive operative intervention as soon as they can be cleared for surgery.

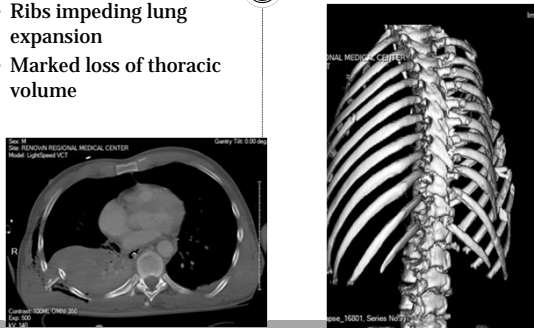
Reduction of Pain and Disability

- Multiple painful rib fractures
- Failure of narcotics or injections
- Fracture movement causing significant discomfort



Severe Displacement

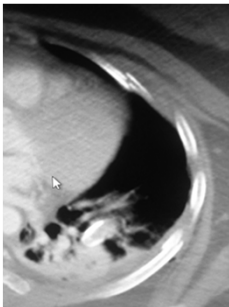
- Ribs impeding lung expansion
- Marked loss of thoracic volume



Case 18
18th REGIONAL MEDICAL CENTER
Ribs Lightened VCT
Gantry 118 0.0296
Case 18001, Series No11

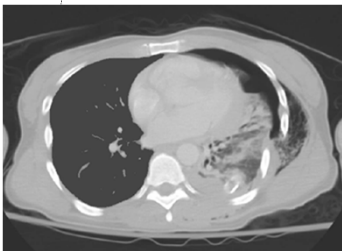
Intra-thoracic Injury

- Cases where thoracotomy performed to address injury
- Rib perforation of vital structures



Lung Herniation

- 27 year old female
- Assaulted with chair
- 8th and 9th rib fractures
- Extruded Lung
- Treated with ORIF
- Home POD 2



Nonunion

- Multiple studies exist showing benefit for painful rib nonunion
(Anavian, JOT 2009, Cho, JOT 2009, Gardenbroek, JBJS 2009)
- Diagnose with CT Scan
- Correlates with pain on physical exam
- Can use rib block to confirm diagnosis
- Treat with standard compression technique.
- No bone grafting or BMPs required

Case Study

32 y/o with painful rib nonunion for 2 years
Confirmed by CT
Treated with ORIF
Immediate relief with surgery
Pain free at 6 weeks



Revision Surgery

- Never be surprised by fixation methods you will see
- If standard orthopaedic principles were ignored, revision is often indicated
- Bone will not heal if incorrect fixation is utilized



Conclusions

- Absolute indications for rib fixation are still unclear
- The role for ORIF does appear to be expanding
- Preliminary studies have shown that when compared to non-operative cohorts, patients with flail chest treated with ORIF had
 - Shorter ICU stays
 - Decreased ventilator requirements
 - Shorter hospital LOS
 - Fewer tracheostomies
 - Less pneumonia
 - Less need for re-intubation
 - Decreased home oxygen requirements
 - Decreased overall cost
- Appears to be an advantage to early fixation
- Prospective randomized controlled studies are needed
