Management of Flail Chest (FC) and Pulmonary Contusions (PC)

BACKGROUND

- Definition: >3 adjacent ribs are each fractured in at least 2 places causing paradoxical inspiratory/expiratory chest wall movement.
- Most often occurs from blunt trauma; PC occurs in 30-75% of all blunt thoracic trauma.
- Associated with 10-20% mortality and substantial morbidity due to underlying lung contusion and chest wall instability.
- Historically, treatment consisted of tracheostomy and early mandatory mechanical ventilation; now a wide range of management options, especially regarding fluid and ventilation support.
- It is important to note that contusions typically blossom from 6-48 hours post injury.

CLINICAL PRACTICE GUIDELINES

I. **PRESENTATION:** After initial trauma workup, if physical exam is consistent with flail chest (tachypnea, tachycardia, subjective chest pain, paradoxical chest wall motion), CXR and CT chest (presuming hemodynamic stability) should be obtained.

II. **RESUSCITATION:** goal is to maintain adequate tissue perfusion and *normovolemia*. Judicious use of fluids should be employed so as to avoid fluid overload and exacerbation of blossoming contusion; a pulmonary artery catheter may be helpful to guide resuscitation.

III. **PULMONARY TOILET:** Incentive spirometry, nebulizers, chest physiotherapy, and getting out of bed when appropriate should all be utilized to avoid respiratory failure and mechanical ventilation; early consideration should be given to non-invasive methods of oxygenation and ventilation (i.e., CPAP, BiPAP), provided no contraindication exists (i.e.,Altered mental status, traumatic brain injury, suspected aspiration risk).

IV. **PAIN CONTROL:** adequate pain control is critical for avoiding splinting and need for mechanical ventilation; epidural catheter is the preferred mode of analgesia; other potential methods include systemic IV meds, PCA, intercostal nerve blocks (requires several rib injections).

V. MECHANICAL VENTILATION:

a. CPAP may be tried initially in alert, compliant patients.
b. All patients with flail chest and obvious pulmonary contusion (especially those with tenuous clinical status or concomitant injuries) require close monitoring in the ICU.
c. The need for mechanical ventilation should be based on individual patient physiology and should not be delayed if less invasive modes prove inadequate.
d. No role for steroids.

e. High frequency oscillatory ventilation (HFOV) does not improve survival but may improve oxygenation; no clear role exists for its use.

VI. **SURGICAL FIXATION:** to be considered when:

a. Patients require thoracotomy for other reasons
b. Prolonged mechanical ventilation becomes necessary
c. Severe flail chest is consistent with instability
d. There is persistent pain due to fracture malunion
e. There is loss of pulmonary function

REFERENCES

1. Pettiford, Luketitch, Landreneau, "The Management of Flail Chest." Thorac Surg Clin Vol 17 (2007) 25–33
2. Simon et al, "Management of pulmonary contusion and flail chest: An Eastern Association for the Surgery of Trauma practice management guidelines." J Trauma Acute Care Surg Vol 73 (2012) 351-361