



## Is there a benefit from surgical stabilization of severe rib fractures?

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### Article-

Pieracci FM, Lin Y, Rodil M, Synder M, Herbert B, Tran DK, et al. A prospective, controlled clinical evaluation of surgical stabilization of severe rib fractures. *J Trauma Acute Care Surg.* 2016 February;80(2):187-94.

Rib fractures remain a common cause of morbidity and mortality in trauma patients. Surgical stabilization of rib fractures (SSRF) has been a topic of discussion for more than 20 years. But to date, less than 1% of patients are treated surgically. This is due to extremely limited data with antiquated fixations systems, and lack of adequate clinical trials. Pieracci, et al. performed a prospective clinical controlled evaluation comparing patients treated non-operatively in 2013 to those treated with fixation in 2014. Patients were selected for fixation if they were >18 years of age and had one or more of the following fracture patterns: 1) flail chest with three or more contiguous ribs fractured in two or more places; 2) three or more severely displaced fractures, defined as bi-cortical displacement; 3) 30% or greater volume loss of a hemi-thorax quantified using computed tomography of the chest; 4) any fracture pattern with failure of optimal medical management within 72 hours of injury. Patients were excluded if identified >72 hours after injury.

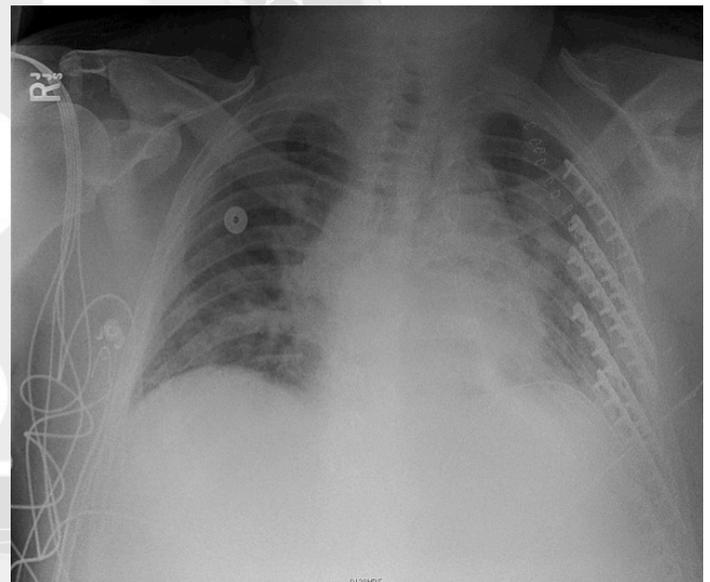


Figure 1. Chest Xray post stabilization of fractures<sup>α</sup>

All patients admitted in 2013 were managed non-operatively. Patients who presented in 2014 were managed according to the protocol if criteria were met for operative intervention and consent was obtained from the patient or surrogate. Both patient populations were managed with a standardized protocol of escalating analgesia and pulmonary toilet. Percutaneous analgesic catheters or thoracic epidurals were used routinely in the non-operative arm. One of 5 Acute Care Surgeons performed surgical fixation within 72 hours of injury. A muscle-sparing incision was made for exposure. Ribs 3 and 10 were the limits of fixation due to exposure limits. Efforts to fixate both fractures of the flail segments were attempted. No fractures within 5 cm of the transverse processes were repaired. Tube thoracostomy and percutaneous catheters were placed at the time of fixation routinely.

Outcomes evaluated included, patient demographics, comorbidities, injury patterns, respiratory failure (defined by mechanical ventilation in 24 hours or greater), pneumonia, tracheostomy, ventilator days, intensive care unit length of stay (LOS), hospital LOS, in-hospital mortality, peri-operative complications, daily best incentive spirometry, and daily narcotic requirements. Rib severity was quantified using Chest Trauma Score, RibScore and Rib Fracture Score.

Seventy patients were evaluated during the two years, 35 in the non-operative year and 35 in the fixation group. There were no significant differences between the groups when patient demographics were compared including, age, sex, mechanism of injury, body mass index, history of pulmonary disease or tobacco use. Associated injuries were similar between the groups as well with the exception of traumatic brain injury, which was more common in the non-operative group. Pulmonary injury was similar between the two groups as well with a similar incidence of pneumothorax and hemothorax. The fixation group did have a more severe fracture pattern and a higher incidence of flail chest. The most common inclusion criterion for both groups was three or more severely displaced fractures.

The fixation group had lower incidence of respiratory failure and were less likely to undergo tracheostomy. No differences were observed in the incidence of pneumonia, hospital LOS or ICU LOS. One patient in the fixation arm developed hardware infection that required removal. Daily incentive spirometry was higher in the operative group. No difference was seen in the narcotic use. Overall conclusions from the study were that surgical fixation was associated with a 76% decreased likelihood of respiratory failure and an 82% decreased likelihood of tracheostomy. There was also a noted 5-day decrease in mechanical ventilator days and improved spirometry.

This is the first prospective study performed in the United States and included a wide variety of fracture patterns with a standardized protocol for pain management, pulmonary toilet and subsequent operative fixation. Although there was no benefit in ICU LOS, hospital LOS or mortality, the decrease in ventilator days and need for tracheostomy is significant. Previous studies have proposed earlier return to work and lower narcotic use as benefits to operative fixation as well. Surgical fixation of rib fractures has a clear benefit in certain patients. The remaining question and focus of future investigations will revolve around optimal timing of fixation, fracture pattern, and specific patient comorbidities.

