

**Operative versus Nonoperative Treatment of Acute Unstable Chest Wall Injuries:
A Multicenter Randomized Controlled Trial**

*Niloofar Dehghan, FRCSC, MD, MSc; Aaron Nauth, MD; Emil H. Schemitsch, MD;
Milena Vicente, RN; Richard Jenkinson, MD; Hans J. Kreder, MD;
Michael D. McKee, MD, FRCSC; Canadian Orthopaedic Trauma Society (COTS);
Unstable Chest Wall RCT Study Investigators
St. Michael's Hospital, Toronto, ON, Canada*

Purpose: Unstable chest wall injuries have high rates of mortality and morbidity. These injuries can lead to respiratory dysfunction, and are associated with high rates of pneumonia, sepsis, prolonged ICU stays, and increased health-care costs. Numerous studies have demonstrated improved outcomes with surgical fixation compared to non-operative treatment. However, an adequately powered multicenter randomized controlled study using modern fixation techniques has been lacking.

Methods: We present a multicenter, prospective, randomized controlled trial comparing surgical fixation of acute, unstable chest wall injuries with the current standard of nonoperative management. Patients aged 16-85 years with a flail chest (3 or more consecutive, segmental, displaced rib fractures), or severe deformity of the chest wall, were recruited from multiple trauma centers across North America. Exclusion criteria included: severe pulmonary contusion, severe head trauma, randomization >72 hours from injury, inability to perform surgical fixation within 96 hours from injury (in those randomized to surgery), fractures of the floating ribs, or fractures adjacent to the spine not amenable to surgical fixation. Patients were seen in follow-up for 1 year. The primary outcome was days free from mechanical ventilation in the first 28 days following injury. Secondary outcomes were days in ICU, rates of pneumonia, sepsis, need for tracheostomy, mortality, general health outcomes, pulmonary function testing, and other complications of treatment. A sample size of 206 was required to detect a difference of 2 ventilator-free days between the 2 groups, using a 2-tailed alpha error of 0.05 and a power of 0.80.

Results: A total of 207 patients were recruited from 15 sites across Canada and USA, from 2011-2018. 99 patients were randomized to nonoperative treatment, and 108 were randomized to surgical fixation. Overall, the mean age was 53 years, and 75% of patients were male. The commonest mechanisms of injury were: motor vehicle collisions (34%), falls (20%), motorcycle collisions (14%), and pedestrian injuries (11%). The mean ISS at admission was 26, and patients had a mean of 10 rib fractures. 89% of patients had pneumothorax, 76% had hemothorax, and 54% had pulmonary contusion. There were no differences between the 2 groups in terms of demographics. The final results will be available and presented at the OTA meeting in Denver.

Conclusion: This is the largest randomized controlled trial to date, comparing surgical fixation to nonoperative treatment of unstable chest wall and flail chest injuries. The results of this study will shed light on the best treatment options for patients with such injuries, help understand outcomes, and guide treatment. The final results will be available and presented at the OTA meeting in Denver.