Surgical Stabilization of Rib Fractures on Extracorporeal Membrane Oxygenation

Sean Willis, DO, Luke Duncan, MD, Stephan Martone, MD, FACS, Marcel Tafen, MD, FACS

Background
Surgical Stabilization of Rib Fractures (SSRF) results in shorter duration of mechanical ventilation, less pain, lower risk of respiratory complications, and reduced mortality. However, profound respiratory failure is not conducive to operating safely on patients with severe thoracic trauma. We present the case of E.M., a 55-year-old male with refractory respiratory failure due to severe chest trauma including flail chest, continuous air leak, lung laceration and contusions following an ATV crash. E.M. underwent SSRF while on veno-venous extracorporeal membrane oxygenation (VV-ECMO).

Methods/Intervention
The patient was intubated at scene and his injuries consisted of multiple bilateral rib fractures with a right flail chest, bilateral pulmonary contusions and pneumothoraces, extensive chest wall subcutaneous emphysema, and right shoulder dislocation. Bilateral chest tubes were placed with a noted right tube air leak. On hospital day zero, the patient desaturated to the low 80’s, with an increase in right chest tube air leak.

Methods/Intervention (Continued)
Hypoxic and hypercarbic respiratory failure persisted despite 100% FiO2, PEEP=15 cmH2O. An arterial blood gas demonstrated a pH 7.11, pCO2 85, and paO2 50, P/F ratio=50 on hospital day (HD)#0. The patient was cannulated for VV-ECMO, ventilator was placed on rest settings, and the right chest tube air leak resolved. On HD#3, right SSRF of ribs 4-10 and repair of large right lung laceration was done. The patient became hypotensive in the ICU immediately after return from OR and was found to have pericardial tamponade. An emergent pericardial window was performed at bedside with immediate improvement.

Results
On HD#14, trach and PEG tube placement was done. Decannulation from ECMO was done on HD#16, and the patient was weaned from mechanical ventilation. While placement to rehab was pending, the trachestomy was decannulated. The patient was doing well at a one month follow up. E.M. was happy to tell his story, and consented to use of all materials including images for presentation.

Conclusions
This is the only third case in recent literature regarding SSRF in patients with severe chest wall trauma on ECMO. This single case highlights that SSRF on ECMO can be accomplished safely and may help liberate the patient from ECMO and mechanical ventilation sooner and contribute to the patient rehabilitation. We believe that ECMO should be considered in all cases where respiratory failure is prohibitive for SSRF. More studies should be done to tease out the benefit of SSRF with ECMO.

References
1. Youssef Fawzy, David Hindin. Rib fracture fixation in a patient on veno-venous extracorporeal membrane oxygenation following a motor vehicle collision. Trauma Surg Acute Care Open. 2022; 7(1): e001004