

Successful Surgical Stabilization of Rib Fractures Despite *Candida* Colonization of the Mediastinum

Tammy Ju, MD, Lisbi Rivas, MD, and
Babak Sarani, MD, FACS

Department of General Surgery and Center for Trauma and Critical Care, The George Washington University Hospital, Washington, DC



Pleural space or chest wall infection is a contraindication to surgical stabilization of rib fractures (SSRF) because of the risk of hardware infection. However, the exact degree of risk is uncertain. SSRF is associated with a decreased need for mechanical ventilation and pneumonia. This case report describes a patient with polytrauma and *Candida* colonization of the mediastinum who successfully underwent SSRF.

(Ann Thorac Surg 2018;106:e121–3)

© 2018 by The Society of Thoracic Surgeons

Surgical stabilization of rib fractures (SSRF) in patients with flail chest has been shown to decrease length of stay, pain, need for mechanical ventilation, and mortality [1–4]. The risk of hardware infection after SSRF is between 0% and 10% in all patients [5]. To minimize this risk, severe pneumonia, pleural space infection, and mediastinal infection are considered contraindications to SSRF because of the risk of seeding the implanted hardware, which can result in a chronic infection and the need for hardware explantation. However, there are no data describing the risk versus benefit of SSRF in patients with colonization of these cavities.

Poststernotomy mediastinitis is a rare but potentially fatal complication [6]. Fungal mediastinitis after sternotomy is even more rare [7]. Because of its low incidence, fungal colonization of the mediastinum has also not been well described in the literature. Whether SSRF is safe in this setting has not been elucidated. In this case report, we describe successful SSRF in a poststernotomy trauma patient with known *Candida albicans* colonization of the mediastinum and pleural space.

A 37-year-old man presented after a high-speed motor vehicle collision. On arrival to the trauma bay, the patient was hypotensive and tachycardic, with right-sided chest wall crepitus and paradoxical breathing. Tube thoracostomy was performed. The thoracic ultrasound examination showed pericardial tamponade, and the patient required sternotomy for repair of a right atrial laceration, repair of superior vena cava injury, and right lower lobe pulmonary resection. Both the right and left

pleurae were taken down, thereby connecting the pleural and mediastinal spaces. The sternal incision was left open because of cardiac edema and diffuse bleeding related to coagulopathy. He ultimately required extracorporeal membrane oxygenation for 4 days as a result of cardiogenic shock related to blunt cardiac injury.

Once stabilized, the patient underwent computed tomography imaging, which showed right-sided fractures of ribs one to nine, with various degrees of comminution, displacement, and flail segments (Figs 1, 2). Because the patient was critically ill, SSRF was deferred during the early course of his hospital stay. After sternotomy closure on hospital day 8, the patient developed worsening leukocytosis and recurrent vasopressor-dependent shock. The sternotomy incision did not appear to be infected, but cultures from the right pleural and mediastinal chest tubes isolated *C. albicans*. Additionally, *Enterobacter* and *Pseudomonas* were isolated from bronchoalveolar lavage specimens. Treatment with meropenem and fluconazole was initiated. Blood culture results remained negative. Despite 10 days of antibiotic and antifungal treatment, the white blood cell count remained elevated, and repeat mediastinal fluid cultures remained positive for *C. albicans*. The pneumonia had cleared on the basis of improvement in oxygen need, lack of purulent secretions, and improvement of the chest roentgenogram. The patient remained ventilator dependent because of chest wall instability. However, he was no longer vasopressor dependent, had a normally healing sternotomy skin incision, and had no evidence of sternal dehiscence or empyema. We therefore determined that the patient

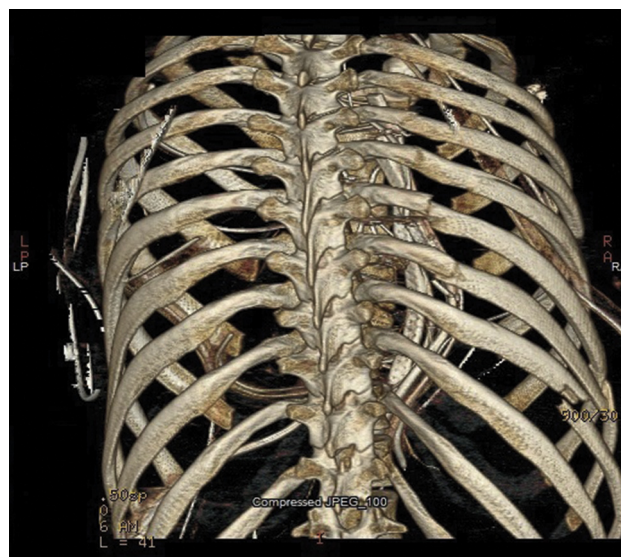


Fig 1. Posterior three-dimensional computed tomography image of the chest wall with associated rib fractures.

Accepted for publication March 4, 2018.

Address correspondence to Dr Ju, 2150 Pennsylvania Ave NW, Ste 6B-412, Washington, DC 20037; email: tammyju@gwu.edu.

Dr Sarani discloses a financial relationship with Acute Innovations, LLC.

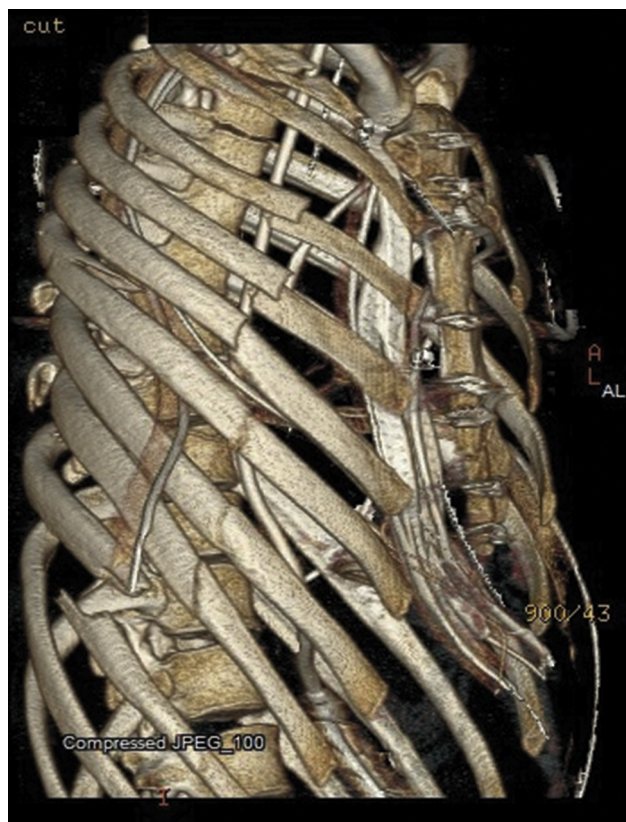


Fig 2. Right lateral three-dimensional computed tomography image of the chest wall with associated rib fractures.

likely did not have fungal mediastinitis but was persistently colonized. He underwent SSRF of five ribs with the RibLoc U+ system (Acute Innovations, Hillsboro, OR) through separate lateral and posterior thoracic incisions on hospital day 25 (Fig 3).

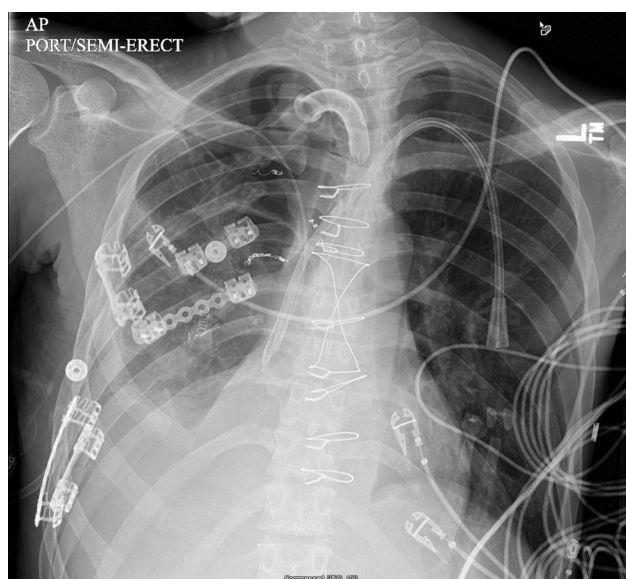


Fig 3. Anteroposterior (AP) postoperative chest roentgenogram showing rib fractures after fixation.

After SSRF, his narcotic need decreased immediately. Two days after SSRF, the patient was placed on pressure support and started on tracheostomy collar trials. He was successfully weaned from the ventilator. He did not have any complications of his sternal incision or the implanted plates and was discharged to a long-term care facility. He completed a 28-day course of antifungal therapy.

Comment

This is the first report of a patient who underwent SSRF with fungal colonization of the mediastinum and the right pleural space. It is important to discern active infection from colonization, particularly where fungal organisms with biofilm formation can adhere to drains, thereby resulting in an erroneous diagnosis of ongoing mediastinitis. Whereas our patient was presumed initially to have fungal mediastinitis with resultant septic shock, he had no clinical or radiographic evidence of sternal dehiscence or empyema [6]. We therefore surmised that the probability of ongoing, active mediastinal or pleural space infection was low and that the patient's sepsis was caused by his culture-confirmed pneumonia. The severely displaced rib fractures posed a high risk for persistent ventilator dependence, with its associated daily risk of pneumonia and death. Thus, it was believed that the risk to benefit ratio of proceeding with SSRF favored operative intervention.

Definitive diagnosis of mediastinitis typically requires imaging or clinical evidence of sternal wound breakdown, in addition to positive culture results and systemic signs of infection [5, 6, 8]. As described by Malani and associates [8], positive culture results, inflammation of the sternum, absence of other microorganisms, and clinical response to antifungal agents are all required for the diagnosis of *C. albicans* deep sternal wound infection. On this basis, our patient did not have a deep sternal wound infection secondary to *Candida*. Nonetheless, the risk of mediastinitis after cardiac surgery can be up to 3.4% [6]. Indeed, a low threshold should be in place for starting antibiotic therapy, and implantation of foreign material should be deferred if this diagnosis is entertained. However, surgeons should also be aware of the benefits of SSRF in patients with flail chest. It is therefore imperative to discern infection from colonization. Hardware implantation of hardware is safe once active infection is controlled.

SSRF has been shown to be most effective in decreasing pain and liberating patients from mechanical ventilation [3]. Prolonged mechanical ventilation is associated with recurrent pneumonia and possibly death. SSRF helped obviate the need for mechanical ventilation and its associated risks in this case. Moreover, consultation with a thoracic surgeon with expertise on management of infection and colonization of the chest can be helpful in determining the risk and benefit of SSRF. Similarly, it is incumbent on thoracic surgeons to have contemporary knowledge of the role of SSRF, which remains underused to date, in trauma patients.

In conclusion, SSRF in patients with positive microbial cultures who have no clinical or imaging findings consistent with mediastinitis or empyema may be safe and effective. This case report describes that fungal colonization of the chest is not an absolute contraindication to SSRF. Larger reports are now needed to support our experience further.

References

1. de Jong MB, Kokke MC, Hietbrink F, Leenen LP. Surgical management of rib fractures: strategies and literature review. *Scand J Surg* 2014;103:120–5.
2. Swart E, Laratta J, Slobogean G, Mehta S. Operative treatment of rib fractures in flail chest injuries: a meta-analysis and cost-effectiveness analysis. *J Orthop Trauma* 2017;31:64–70.
3. Pieracci FM, Lin Y, Rodil M, et al. A prospective, controlled clinical evaluation of surgical stabilization of severe rib fractures. *J Trauma Acute Care Surg* 2016;80:187–94.
4. Kasotakis G, Hasenboehler EA, Streib EW, et al. Operative fixation of rib fractures after blunt trauma: a practice management guideline from the Eastern Association for the Surgery of Trauma. *J Trauma Acute Care Surg* 2017;82:618–26.
5. Thiels CA, Aho JM, Naik ND, et al. Infected hardware after surgical stabilization of rib fractures: outcomes and management experience. *J Trauma Acute Care Surg* 2016;80:819–23.
6. Goh SSC. Post-sternotomy mediastinitis in the modern era. *J Card Surg* 2017;32:556–66.
7. Johnson B, Davis J, Sisneros M. Mediastinitis: could your case be a candidate for *Candida*? *Am J Case Rep* 2012;13:86–8.
8. Malani P, McNeil S, Bradley S, Kauffman C. *Candida albicans* sternal wound infections: a chronic and recurrent complication of median sternotomy. *Clin Infect Dis* 2002;35:1316–20.