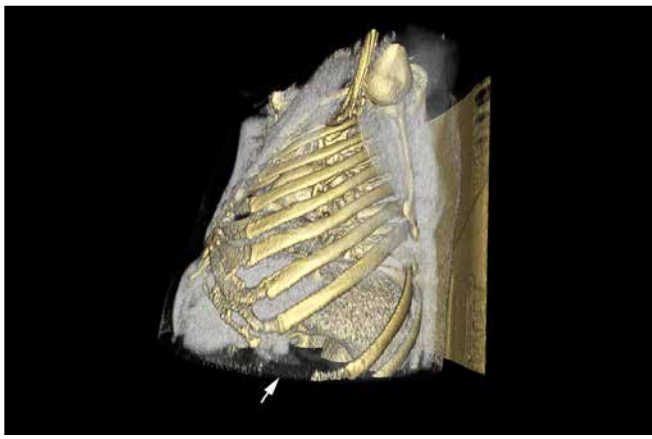
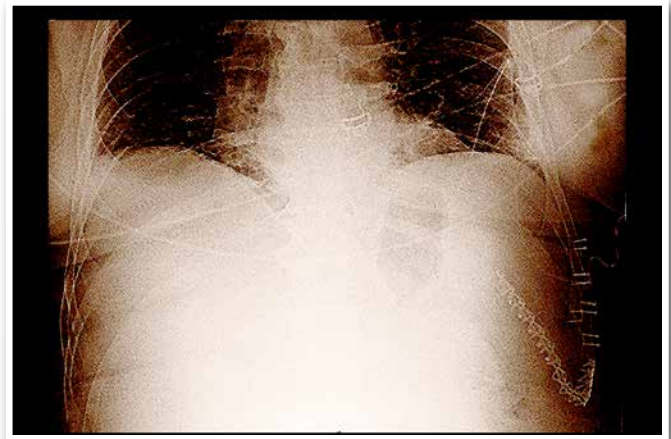


Reconstruction for the Sequelae of Non-Healing Chest Wall Injury



► **Figure 1:** A 3-D CT scan demonstrating the breach and separation at the 10th rib on the left side resulting from a costal cartilage tear.



► **Figure 2:** A chest x-ray of the same patient shows the titanium plate reconstruction of the costal margin (right).

► Surgeons with the [Penn Center for Chest Wall Trauma](#) have initiated a new clinical program focused on the repair and reconstruction of chronic and non-healing chest wall injury to complement the Division’s renowned program for the treatment of complex injuries and conditions associated with acute chest trauma.

Led by Adam Shiroff, MD, FACS, the new clinical **Chest Wall Reconstruction after Injury Program** is dedicated to improving the lives of patients who have, for any reason, not healed in an acceptable manner free of pain and deformity after chest wall injury. Services provided by the program are offered on an elective basis.

The primary defense system for the internal organs, the chest wall structure is both rigid to permit the framework for the shoulders and ribs and elastic to promote respiratory movement. Injuries to the ribs can be particularly troublesome. The process of inspiration involves the coordination of the ribs, diaphragm, intercostal muscles and related ligaments to produce an average 20,000 breaths a day.¹ This unceasing movement can aggravate and prevent healing when rib fracture or injury occurs, producing chronic pain, complications, increased morbidity and heightened risk of mortality.

Patients who benefit from evaluation for non-healing or chronic rib or sternal injury include those experiencing chronic pain at the site of old fractures, a feeling of bony movement described as “popping” or “clicking,” the sensation of a rib getting “stuck” or caught on surrounding chest wall structures, the inability to lay or sleep on the side that was previously injured, and pain that radiates in a dermatomal distribution around the anterior chest.

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CASE STUDY

Mr. J, a 46-year-old male, was referred to the Penn Center for Chest Trauma for evaluation following a two year history of chest wall pain initiated by a power-lifting injury.

At presentation, Mr. J recounted a year of mounting pain and debility punctuated by repeated imaging studies to obtain a definitive diagnosis, and ending with an exploratory surgery that identified a discreet costochondral separation at the left 10th rib. An attempted cartilage repair during this surgery failed several months later, precipitating further injury and an increasing breach between rib 10 and the thoracic cage (Figure 1).

Although Mr. J was relatively healthy, his injury was a source of aggravation that interfered with sleep, work, ambulation and other normal daily activities. His prescriptions, originally only for NSAIDs as needed, now included daily opioid medications.

After a consultation with Dr. Shiroff, a treatment strategy was initiated involving the creation of a 3-D printed model of Mr. J’s full ribcage to permit approach planning and plating design. The model was the template for titanium plates fastened at the anterior and posterior of the torn costal cartilage during Mr. J’s three-hour surgery, which also incorporated suspension plates at the rib to promote osteosynthesis and healing (Figure 2).

Discharged to home on the day after his surgery, Mr. J had an unremarkable recovery. At two weeks, he was successfully weaned from his pre-op opioid medications, and began physical therapy. By six weeks, he was able to resume most tasks of daily living with little to no associated pain.

Reference

1. Clemens MW, Evans KK, Mardini S, Arnold PG. Introduction to Chest Wall Reconstruction: Anatomy and Physiology of the Chest and Indications for Chest Wall Reconstruction. *Semin Plast Surg* 2011;25:5–15.

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Using advanced imaging technology, 3-D printing and the latest surgical techniques, the Chest Wall Reconstruction after Injury Program has the objective of restoring patients to their highest functioning self, free of symptom that limit daily activities or the need for chronic pain medication.

At initial consultation the patient will be met and examined by an experienced chest wall surgeon. At this meeting, recent (<3 months is preferred) CT scan imaging will be reviewed with the patient and a careful plan will be described.

Cases similar to the patients' will be incorporated to help set expectations appropriately. A path forward will be presented at initial presentation to outline the involvement of other subspecialists if needed, pre-operative management of symptoms, the operation itself, recovery and follow up.

FACULTY TEAM

Led by Adam Shiroff, MD, FACS, the Chest Wall Reconstruction after Injury Program at Penn Medicine provides specialized consultation, operative and non-operative management of the post-acute sequelae of chest wall injury, including chronic rib fractures, mal- or non-union of existing rib fractures, sternal fractures and dislocations, costal margin ruptures and slipping rib syndrome, among other complex chronic conditions.

Performing Chest Wall Reconstruction after Injury at Penn Medicine

Adam M. Shiroff, MD, FACS

*Director, Penn Center for Chest Trauma
Associate Professor of Surgery*

Virtual Case Conferencing

Virtual case conferencing is available with Dr. Shiroff to determine if your patient would benefit from chest wall reconstruction. For questions, or to schedule a time to connect with Dr. Shiroff, please contact Lauren Plunkett at 215.662.9207.

Contact for Chest Wall Reconstruction Program

Lauren Plunkett

Administrative Assistant

The Penn Center for Chest Trauma

Penn Medicine Level 1 Trauma Center
215.662.9207

Email: Lauren.Plunkett@uphs.upenn.edu

ACCESS

Penn Traumatology, Surgical Critical Care and Emergency Surgery

Penn Medicine University City

4th Floor
3737 Market Street
Philadelphia, PA 19104