



Chest wall injury centers—how we did it

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Background

Rib fractures are a common injury and modern care of patients with rib fractures focuses on pain control and pulmonary therapy. Strategies to optimize pain control exist along a spectrum—from multimodal oral and intravenous medications, neuraxial blockade, to surgical stabilization of rib fractures (SSRF). For patients with flail chest, a flail segment, or three or more displaced rib fractures, surgical stabilization can offer decreased time on a ventilator, shorter intensive care unit and hospital stays, decreased risk of pneumonia or tracheostomy, faster return to work, decreased pain, lower mortality, lower inpatient charges and is cost-effective therapy for health insurance payors and healthcare systems (1-5). However, SSRF is underutilized and may not be available at all healthcare facilities (6,7). One solution may be development of chest wall injury centers (CWICs). Here we describe our CWIC concept, our approach to developing our respective programs, and the potential benefits of a CWIC structure.

CWIC concept

An ideal CWIC team should care for patients across the healthcare continuum—managing and providing consults on operative and non-operative acutely injured inpatients while also capable of managing outpatient referrals for chronic conditions. For inpatient care, the team should aid in management of chest wall injury and perform expedient surgical intervention when indicated for rib fractures, sternal fractures, costal margin or diaphragmatic

disruptions, among others. High-quality SSRF borrows surgical principles and techniques from trauma, orthopedics, and thoracic surgery which may be outside the comfort zone for surgeons not trained in SSRF. While the CWIC team may be a component of an inpatient trauma team, they don't necessarily have to be. If capability to perform these surgeries safely is not available within the trauma team, the CWIC team should be integrated into the trauma team workflow such that rapid evaluation of potential surgical chest wall injury is able to be performed (≤ 72 hours). While technically only one qualified chest wall surgeon is required for a CWIC, we believe 2–3 qualified chest wall surgeons should be a part of the CWIC to ensure adequate inpatient, outpatient and operating room coverage.

In addition to providing outpatient follow-up for acutely injured patients upon discharge, the outpatient component of the CWIC should be capable of managing chronic issues and complications including: hardware failure, screw migration, non- or mal-union of ribs or sternal fractures, intercostal or other chest wall hernias, diaphragmatic hernias, and costal margin injury which could range from slipped rib to costal margin rupture. This necessitates dedicated space and time for clinic, nursing or advanced care provider support, and access to a multidisciplinary team of specialists which may include orthopedic, trauma or thoracic surgery, physical therapy, or pain medicine physicians. These resources should ideally be available in-person and via telehealth to serve a large geographic area. Once established, 30–60 operative cases or more per year may be anticipated.

Table 1 Pearls for starting a CWIC and potential benefits of center development

Pearls for surgeons interested in starting a CWIC

- Align goals of the CWIC with institutional goals to increase program support
- Involve all stakeholders in the mission and vision of the CWIC
- Develop support and understanding with administration
- Join a surgical society dedicated to management of patients with chest wall injury
- Develop a guideline for patient selection
- Identify a committed mentor
- Create case review or quality-control procedure
- Ensure adequate operating room availability
- Demonstrate ongoing value and quality to the institution
- Track outcomes*
- Establish protocol for credentialing new surgeons
- Facilitate resident, advance practice provider, and nursing SSRF courses
- Educate community and regional providers and patients

Potential benefits of starting a CWIC

- Standardized management of non-operative and operative chest wall injury
- Improved patient experience and outcomes
- Advocate for chest wall injury patients
- Decreased hospital and ICU length of stay
- Decreased pneumonia rates
- Specialized care for recovering from a debilitating injury
- Opportunity to provide multidisciplinary care for acute and chronic chest wall injury
- Streamline utilization of resources and reduce cost
- Decrease disruption to other service lines
- Increase access to training for surgical management of chest wall injury
- Develop research partnerships between centers

*, one potential mechanism is the Chest Wall Injury Society's Chest Injury International Database (<https://cwisociety.org/ciid/>). CWIC, chest wall injury center; SSRF, surgical stabilization of rib fractures.

Strategies for developing a CWIC

Despite potential benefits associated with developing multidisciplinary CWICs, we have found there are still relatively few nationally. However, as the next generation of enthusiastic chest wall surgeons are gaining experience with medical, physiologic, and surgical management, CWICs represent an attractive vehicle through which practice can be standardized and fledgling surgeons supported. Given our experience with developing chest wall programs, we have several suggested pearls for surgeons interested in developing

a CWIC (*Table 1*). Joining a surgical society with experience in traumatic chest wall surgery and having mentorship either intra- or inter-institution is essential. If there is not available intra-institution mentorship, the Chest Wall Injury Society (www.cwisociety.org) offers structured mentorship. A successful mentor can be critical in helping develop a program, assist with patient selection, surgical planning including incision decisions, and complex management issues.

The importance of institutional buy-in and support cannot be understated. Leadership support from the onset

of the endeavor will become a self-fulfilling prophecy and attempting to start a CWIC program without it can be devastating. Help educate your department and administration about the quality, patient-care and financial benefits that the CWIC will bring to the patients and institution. After identifying benefits of a program, develop a plan to bridge existing patient care gaps with benchmarks that can be followed to demonstrate institutional value.

Prior to performing SSRF cases, develop a patient selection guideline and have it approved through institutional surgical leadership and administrative leadership pathways. Develop a process for regular case review incorporating a multi-disciplinary team of health care providers empowered to provide feedback. While some surgical residents and fellows are exposed to SSRF in training, unfortunately this training exposure is not ubiquitous. Institute a process for credentialing surgeons to perform SSRF. While national or international standards do not yet exist for credentialing surgeons for SSRF, we recommend any chest wall surgeon in the CWIC have at least 20 mentored chest wall repair cases (10 directly mentored and 10 with independent review), with at least 6 of these cases performed within the preceding year. Finally, establish a workflow for getting acutely injured inpatients undergoing SSRF into the operating room. These cases are often time-consuming, can require considerable operating room resources, and are ideally not performed in the middle of the night when competing priorities can lead to distraction. A functioning operative room with adequate staff and anesthesia teams should be available within 72 hours of injury, with a goal of getting these patients definitive repair within 72 hours unless prohibited by other injuries or patient physiology.

Educate your community and regional healthcare providers and patients to services offered at the CWIC. Given surgical fixation is still a relatively new option for both acute and chronic rib and sternal fractures, providers and patients are often unaware of potential benefits from surgical options. Furthermore, many providers and patients may not be aware of complications and burdens arising from un-, under-, or mis-treated rib and sternal fractures, especially if they do not deal with chest wall injury on a routine basis. This only further underscores importance of evaluation and management of these patients (whether operative or non-operative) at a hospital with a dedicated CWIC.

Conclusions

Care of patients with chest wall injury, both acute and chronic,

is undergoing a renaissance. As technology and techniques improve, a wider range of surgical and non-surgical options are available to patients with chest wall trauma. These patients with chest wall injury may benefit from care at CWICs where multidisciplinary care can be provided in collaboration with trauma, orthopedic, and thoracic services, physical therapy, and pain management. These centers and corresponding services may help improve and standardize care of the patient with chest wall injury, are financially-responsible, and provide a necessary opportunity to train the next generation of passionate chest wall surgeons and health care providers.

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References

1. Choi J, Gomez GI, Kaghazchi A, et al. Surgical

Stabilization of Rib Fracture to Mitigate Pulmonary Complication and Mortality: A Systematic Review and Bayesian Meta-Analysis. *J Am Coll Surg* 2021;232:211-219.e2.

2. Pieracci FM, Leasia K, Bauman Z, et al. A multicenter, prospective, controlled clinical trial of surgical stabilization of rib fractures in patients with severe, nonflail fracture patterns (Chest Wall Injury Society NONFLAIL). *J Trauma Acute Care Surg* 2020;88:249-57.
3. Delaplain PT, Schubl SD, Pieracci FM, et al. Chest Wall Injury Society Guideline For SSRF Indications, Contraindications And Timing. Chest Wall Injury Society 2020. Available online: <https://cwisociety.org/wp-content/uploads/2020/05/CWIS-SSRF-Guideline-01102020.pdf>
4. Coleman JR, Leasia K, Douglas IS, et al. Quantifying the expense of deferring surgical stabilization of rib fractures: Operative management of rib fractures is associated with significantly lower charges. *J Trauma Acute Care Surg* 2020;89:1032-8.
5. Choi J, Mulaney B, Laohavinij W, et al. Nationwide cost-effectiveness analysis of surgical stabilization of rib fractures by flail chest status and age groups. *J Trauma Acute Care Surg* 2021;90:451-8.
6. Mullens CL, Seamon MJ, Shiroff A, et al. A Statewide Assessment of Rib Fixation Patterns Reveals Missed Opportunities. *J Surg Res* 2019;244:205-11.
7. Choi J, Kaghazchi A, Dickerson KL, et al. Heterogeneity in managing rib fractures across non-trauma and level I, II, and III trauma centers. *Am J Surg* 2021;222:849-54.

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