

Anterior Chest Wall Reconstruction with Sub-Xiphoid Hernia Repair: A Case Report

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Background	Chest wall reconstruction after sternectomy is a procedure that faces unique challenges in reconstructing a supportive yet flexible structure; techniques can be complicated when an associated hernia has developed.
Summary	We present a rare case of a patient who suffered sternal dehiscence and infection following coronary artery bypass. He required debridement and ultimate sternal resection with a pedicled TRAM flap for chest wall closure, after which he developed a symptomatic subxiphoid hernia. We performed a complex subxiphoid hernia repair and sternal reconstruction using Marlex mesh and methyl methacrylate.
Conclusion	Chest wall reconstruction following sternectomy presents a multitude of challenging considerations, which are compounded by the need for subsequent repair of hernia with limited tissue coverage. Our approach, reconstruction and repair with methyl methacrylate and Marlex mesh, satisfies the need for chest wall rigidity and protection. The extension of a Marlex mesh layer from the chest allowed for adequate coverage of the abdominal wall defect with sufficient anchoring of the prosthetic for minimization of recurrence.
Keywords	Subxiphoid hernia, sternal reconstruction, methyl methacrylate

Case Description

Sternal wound infection following major cardiac surgery is a devastating complication with significant morbidity.¹ Chest wall debridement with muscle flap coverage is routinely utilized in salvage procedures, and some centers have even advocated for prophylactic pectoralis flap coverage. In severe cases where sternectomy is required, there exist a variety of options for chest wall and sternal reconstruction. Jazsar et al originally described the use of a methyl methacrylate plate in situations where the chest wall could not be closed,² and much has been contributed to the literature on the use of different prosthetics for sternal reconstruction.^{2,3}

Development of a related subxiphoid hernia is a known complication of cardiac surgery, albeit relatively uncommon.⁴ In patients undergoing chest wall reconstruction with pedicled transverse rectus abdominus myocutaneous (TRAM) flaps, hernia is also a well-described complication with rates ranging from 5% to 13%.⁵ Concurrent repair of this atypical type of hernia presents an additional host of challenges in choosing reconstruction media and planning a multidisciplinary approach. The following case report details the complete reconstruction of anterior chest wall and simultaneous preperitoneal hernia repair.

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The patient is a 57-year-old male with past medical history of hypercholesterolemia and obesity who suffered an acute myocardial infarction during a scuba diving excursion. He was airlifted to the nearest tertiary care center, where he underwent an emergency quadruple coronary artery bypass graft. He subsequently developed a severe sternal infection requiring multiple surgical debridements over the next three years with bilateral pectoralis muscle flap advancements and, ultimately, a subtotal sternectomy and left pedicled rectus abdominus muscle flap for definitive closure. Unfortunately, the patient eventually developed a progressive subxiphoid hernia inferior to his sternal resection. He presented for evaluation and operative planning to our general and plastic surgery divisions for hernia repair and chest wall reconstruction. On physical exam, the patient was found to have a thin layer of skin and subcutaneous fat overlying his mediastinum in the area of his sternectomy with visible cardiac silhouette. He had an approximately 50 cm widened, but well-healed, incision traveling from his superior chest wall in the midline, inferiorly and obliquely to extend into the left upper and lower quadrants. A visible upper abdominal incisional hernia, immediately inferior to the anatomic location of a sternal xiphoid, was palpable and reducible with minimal tenderness, measuring approximately 10 cm in diameter. Important preoperative considerations were discussed and reviewed with the patient. Our main objectives were to provide adequate protection and stability of the chest wall, achieve reduction and adequate coverage of the hernia defect, establish a sufficient surface for anchoring the mesh to minimize risk of recurrence, and finally, protect the reconstructive materials from infection with overlying soft tissue coverage.

After appropriate cardiac clearance and informed consent, the patient was taken to the operating room. His prior scar was excised in its entirety over the site of the prior sternectomy and abdominal incisions. Adhesiolysis and subcutaneous flap mobilization was performed over the anterior abdominal wall and sternal wound. Great care was taken to separate the prior advancement pectoralis flaps from the chest wall and underlying scar tissue and pericardium. After mobilization of prior muscle flaps and definition of the sternectomy defect, the

chest wall gap measured approximately 6 x 17 cm. Sternal reconstruction was then performed using a double layer of Marlex mesh and methyl methacrylate cement with a technique similar to that described by Lardinois.³ Anchoring of both layers of mesh was achieved with tacking sutures along the rib-costal margins flanking the chest wall defect bilaterally, with insertion of the methyl methacrylate mesh between layers. Care was taken to ensure that the wound was irrigated with cold saline as the cement set to avoid any adjacent thermal injury. The inferior border of the excess mesh was left to complete the abdominal hernia repair. The previously mobilized muscle flaps were then re-inset to provide well vascularized soft tissue coverage to the neo-sternum.

The ventral hernia was then fully defined and measured to be 11 x 13 cm. The inferior layers of the Marlex mesh from the sternal reconstruction were cut to length so as to extend inferiorly serve to cover the subxiphoid hernia defect. This provided the source of a superior anchoring mechanism during the repair. The hernia sac was carefully dissected away from overlying scar tissue and subcutaneous layers, remaining completely extraperitoneal. The hernia sac was reduced in its entirety in the abdominal cavity. The Marlex mesh extension was secured superolaterally in the extraperitoneal plane to bilateral costal margins using permanent interrupted suture. The inferior aspect was secured with a preperitoneal partial underlay⁶ to the existing lateral abdominal wall fascia using horizontal mattress sutures and additional sutures were placed in the anterior fascia for further anchoring of the mesh and coverage anterior to the prosthetic (figure 1).

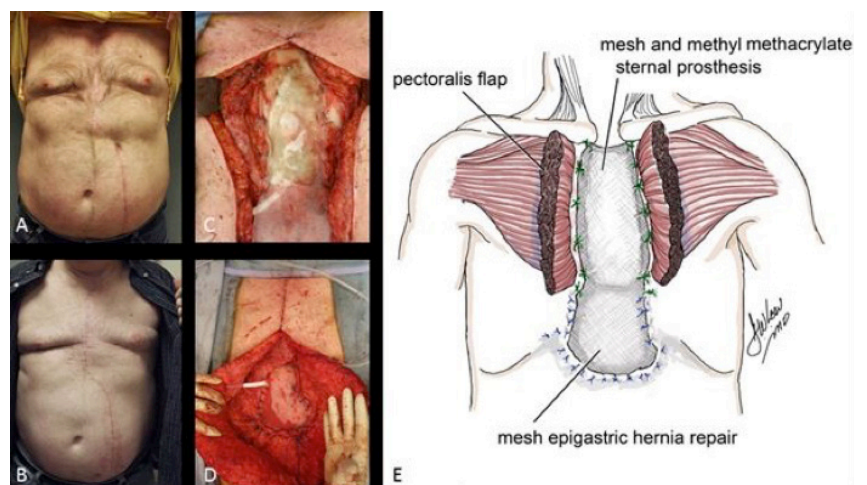


Figure 1. Sternal reconstruction and concurrent subxiphoid hernia repair with composite Marlex mesh and methyl methacrylate.

A) Pre-operative patient image of hernia. B) Post-operative patient image at 4 weeks. C) Inlay mesh-methyl methacrylate over sternal defect with anterior mesh layer extending inferiorly. D) Inferior extension of mesh with partial underlay repair of subxiphoid hernia. E) Schematic diagram of final reconstruction.

Wound closure over the reconstruction was completed in a standard layered fashion with subcutaneous drains left in place. Figure 1 illustrates the combined surgical repair. The patient had an uncomplicated postoperative course and was discharged to home on postoperative day seven. Outpatient follow-up through 12 postoperative months revealed satisfactory sternal and abdominal wall reconstruction without any evidence of infection, wound healing complications, or recurrence.

Discussion

Chest wall reconstruction after sternectomy is an involved plastic surgery operation. The primary tenants of such an undertaking are to recreate a protective anterior structure over the mediastinum and to restore a functional framework that minimizes paradoxical chest wall motion during respiration. Our experience with a complete sternectomy in the setting of multiple wound infections and subsequent debridement was both unique and strategically challenging. In addition to attenuated subcutaneous tissue and fascia in the area of the sternectomy, a hernia had formed in the uppermost aspect of the abdomen, a result of the prior pedicled rectus abdominus muscle flap. While an isolated subxiphoid hernia is rare and complicated to repair in terms of achieving adequate tissue overlap, a similar hernia that develops inferior to a sternectomy has even less surface area available for anchoring and coverage. We utilized a previously described method of methyl methacrylate cement sandwiched between two layers of Marlex mesh. Other possibilities for reconstruction materials, including biological mesh, titanium and steel implants, were considered less favorable in terms of success due to the size and location of the defect, especially in the setting of prior extensive infection and excessive soft tissue losses. We modified the aforementioned approach in a novel way by extending the superficial layer of the mesh “sandwich” to create a tongue-like projection over the subxiphoid hernia. This extension of a single piece of mesh provided an anchoring point in place of the resected xiphoid process as well as removing the need to secure a second piece of mesh to the Marlex used in the chest wall reconstruction with an additional suture line. With such an approach we were able to re-create a stable yet flexible anterior chest wall and provide an adequate hernia repair in the subxiphoid region. We propose this technique as an effective method for reconstruction of the anterior chest and abdominal walls in cases of concurrent sternectomy and hernia.

Conclusion

Chest wall reconstruction following sternectomy presents a multitude of challenging considerations, which are compounded by the need for subsequent repair of hernia with limited tissue coverage. Our approach to reconstruction and repair with methyl methacrylate and Marlex mesh satisfies the need for chest wall rigidity and protection. The extension of a Marlex mesh layer from the chest allowed for adequate coverage of the abdominal wall defect with sufficient anchoring of the prosthetic for minimization of recurrence.

Lessons Learned

In a rare case of prior sternectomy with associated subxiphoid hernia, innovative methods for chest wall reconstruction and complex hernia repair were developed. A novel approach to this presentation not previously described was implemented, resulting in a successful operation without complications or recurrence.

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