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Experience with Porcine Acellular Dermal Collagen Mesh (Permacol™ Surgical Implant) in Chest Wall Reconstruction after Resection for Rib Osteomyelitis

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Abstract

Chest wall reconstruction after rib resection is essential to ensuring chest wall stability, avoiding flail chest and pulmonary hernia, and improving pulmonary function. Traditionally, a synthetic mesh and a musculocutaneous flap have been used to bridge the chest wall defect. However, a risk of secondary prosthesis infection exists. Acellular dermal collagen mesh implants (Permacol™) are indicated for the reconstruction and reformation of human soft connective tissue. A case of a complex chest wall reconstruction after rib resection for osteomyelitis due to staphylococcus aureus infection in a malnourished, immunosuppressed, and methadone-addicted patient is presented. The patient underwent a left posterolateral thoracotomy and chest wall resection, involving three ribs and the soft tissues overlying an infected cutaneous fistula. The chest wall was reconstructed using a 28 × 18 cm piece of porcine sterile acellular dermal collagen mesh. A successful chest wall repair was achieved with no incisional herniation and with complete mesh incorporation, allowing physiologic respiratory movements. A typical wound seroma developed and resorbed over the following months. There was no infection. In conclusion, this case report suggests that Permacol™ surgical implant can be used successfully as an alternative to synthetic mesh in reconstruction of an infected chest wall.

Keywords

Osteomyelitis, Permacol, Rib, Thoracotomy, Thoracic Wall, Chest Wall

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1. Introduction

Reconstruction of chest wall defects after rib resection is crucial to safeguard the stability of the chest, to avoid flail chest and to improve pulmonary function. The most common indications for resection and reconstruction are primitive or metastatic tumour resection, infections, necrosis induced by radiotherapy, trauma, and herniation [1].

The success of various reconstruction materials depends on the experience of both the surgeon and the institution. Traditionally, synthetic mesh and a muscular flap are used to cover the chest wall defect. However, there is a risk of secondary infection of the wound and the prosthesis. Biological meshes are becoming more common in the repair of infected fields. In this case study, a crosslinked porcine dermal collagen mesh (Permacol™ surgical implant, Covidien, Mansfield, MA) was shown to be successful after rib resection for staphylococcus osteomyelitis in an immunosuppressed patient.

2. Case Report

A 25-year-old male presented to the emergency room with thoracic trauma caused by a fall. He suffered from mental and growth retardation, schizophrenia, and was addicted to methadone. Chest radiography was normal and the patient was treated with anti-inflammatory medication and sent home. A week later the patient was admitted to the emergency room for dyspnea. Clinical examination showed a thoracic wall deformity, crepitation upon rib palpation, and a phlegmon along the anterior axillary line. The patient exhibited tachypnea, with oxygen saturation at 94% on room air. A blood test revealed an inflammatory syndrome with elevated leucocytes and C-reactive protein. Chest radiography showed a pneumothorax and pleural effusion. A thoracic drain was inserted. The next day, a CT scan showed a complex pleural effusion with enhancement of contrast at the periphery, suggesting a left thoracic empyema, measuring 10 × 12 × 1.4 cm and covering the left diaphragmatic cupola. There was also a fracture of the anterior arc of left ribs five and seven. A culture from the thoracic drain identified Staphylococcus Aureus susceptible to oxacillin. The patient was treated with Dalacin in the hospital for a few weeks, and then sent home in general good condition. Two months later the patient returned to the emergency room presenting with a thoracic wall abscess. Osteomyelitis was strongly suspected and staphylococcus aureus was again identified on tissue sampling. A new CT scan confirmed multifocal osteolysis of left ribs five and seven and the presence of intraosseus gas communicating with subcutaneous tissues. The indication for rib resection was supported by eight weeks of failed antibiotic treatment, expansion of the lesion with cutaneous exposure of the underlying rib.

The patient underwent a left posterolateral thoracotomy and resection of a portion of the chest wall, involving three ribs (five to seven) and the overlying soft tissues surrounding a cutaneous fistula (**Figure 1**, **Figure 2**).

A 28 × 18 × 1.5 cm sheet of Permacol™ surgical implant was fixed by Maxon™ 0 synthetic absorbable sutures (Covidien) (**Figure 3**).

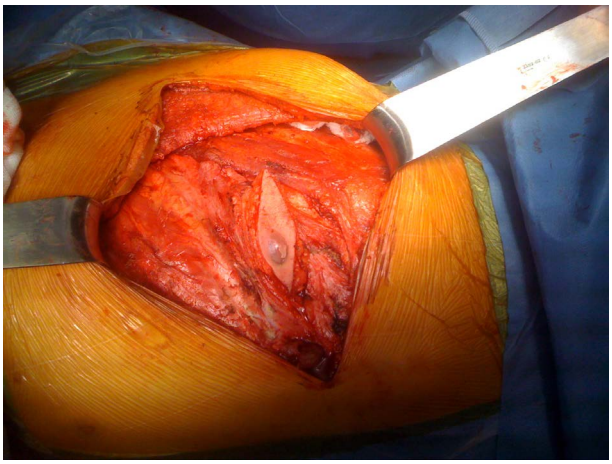

Figure 1. Osteomyelitis involving three ribs (five to seven) and overlying soft tissues surrounding a cutaneous fistula.

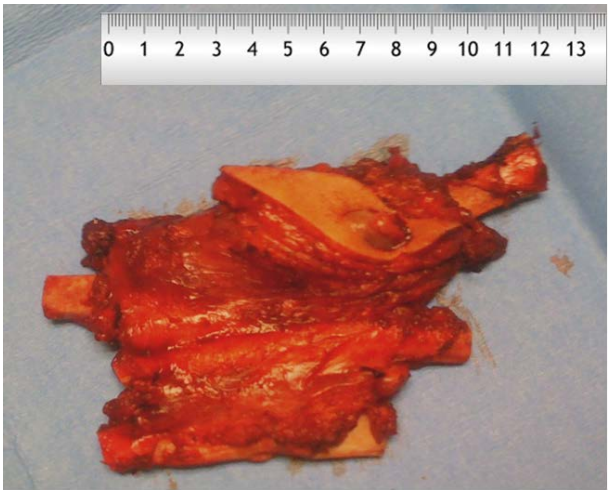

Figure 2. Resection of a part of the chest wall, involving three ribs (five to seven) and the soft and muscular tissues overlying a cutaneous fistula (resection piece).

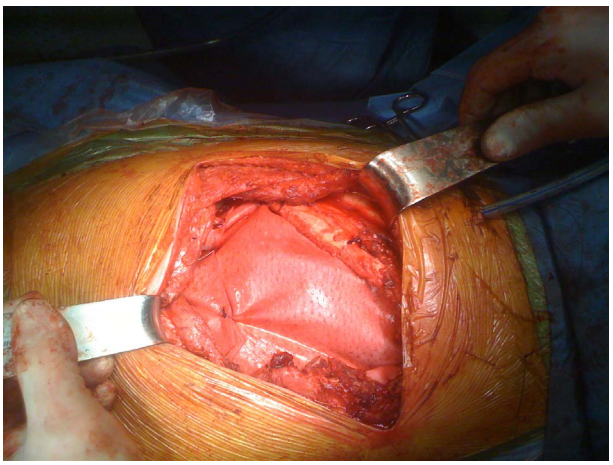

Figure 3. Reconstruction with a sheet of Permacol™ surgical implant fixed by Maxon™ 0 synthetic absorbable sutures.

Pathological examination of the surgical specimen confirmed the presence of necrotic osteomyelitis with ulceration formation of an abscess. Antibiotic treatment was continued for about two weeks after surgery. The thoracic drains were removed on postoperative day five.

The patient immediately developed a seroma at the surgical resection site, which was evacuated regularly by needle aspiration for about two weeks. There was no evidence of reinfection.

Two months post-surgery, a CT scan revealed a homogeneous incorporation of the mesh and a solid anterolateral hemithoracoplasty.

3. Discussion

Thoracic wall reconstruction has not only an aesthetic purpose but also is essential to restoring proper chest wall mechanics to maintain optimal pulmonary function. The most common indications for rib resection are resection of primary or metastatic tumours, necrosis induced by radiotherapy, infection, and trauma [1].

Failure to repair the chest wall defect could result in a flail chest and pulmonary hernia. A flail chest occurs when multiple adjacent ribs are broken, forming a segment of the thoracic wall that can move independently and paradoxically in the opposite direction of the rest of the chest. This paradoxical movement increases respiratory work and causes respiratory distress [2] [3]. Traditionally a synthetic mesh and a musculocutaneous flap have

been used to cover the chest wall defect; however, this technique is associated with a possible risk of secondary infection of the prosthesis. Polypropylene meshes are used for their resistant properties, but are contraindicated for use in contaminated fields. Approximately 6% of patients treated with polypropylene mesh experience secondary infection of the prosthesis, increasing as a function of patient comorbidity status (e.g. malnutrition, immunosuppression), and typically necessitating removal of the prosthesis [2].

Permacol™ surgical implant is a crosslinked porcine-derived acellular dermal collagen matrix with an architecture similar to human collagen. Since the product is acellular, it does not provoke immunogenic reactions. The crosslinking structure enhances both resistance to collagenases and long-term durability. The mesh is progressively incorporated into the surrounding tissues by invasion of human cells and vascularization. Formation of blood vessels during the neoangiogenesis process allows antibiotics to be carried easily into the site. The surface of the device also prevents the formation of a biofilm. For these reasons, Permacol™ surgical implant is suitable as an alternative to synthetic mesh in the reconstruction of chest wall defects in contaminated fields and at sites that are at risk of infection [3]-[5].

4. Conclusion

This case report suggests that Permacol™ surgical implant is a suitable alternative to synthetic mesh in the reconstruction of chest wall defects in infected fields. The mesh is completely incorporated into the body and provides the same resistance properties as synthetic mesh. In addition, it allows penetration of antibiotics into infected tissues, supporting the comprehensive treatment strategy. Our results suggest that in the case of a malnourished and immunosuppressed patient presenting with significant infection, complex reconstruction of the chest wall with Permacol™ surgical implant provides excellent short- and long-term results.

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