Trauma Case Reports 27 (2020) 100305

Contents lists available at ScienceDirect

Trauma Case Reports

journal homepage: www.elsevier.com/locate/tcr

Case Report

Delayed post-traumatic presentation of severe sternal osteomyelitis: A strong multidisciplinary effort and a novel reconstruction technique for a challenging case

Alessandro Tamburrini[a,*], Hanad Ahmed[b], Thomas Talbot[a], Oliver Harrison[a], Mansoor Khan[c], Simon Tilley[d], Aiman Alzetani[a]

[a] Thoracic Surgery Unit, Southampton University Hospital, UK
[b] Medical School, Southampton University Hospital, UK
[c] Plastic and Reconstructive Surgery Unit, Southampton University Hospital, UK
[d] Trauma and Orthopaedic Unit, Southampton University Hospital, UK

ARTICLE INFO

Keywords:
Sternal osteomyelitis
Chest wall trauma
Chest wall reconstruction

ABSTRACT

Sternal osteomyelitis is a morbid and challenging condition, which can rarely occur after trauma, with no established consensus over best therapeutic options. In this case, a 47-year-old man with history of intravenous drug use presented 11 weeks after a minor blunt chest trauma with a severe necrotizing osteomyelitis involving sternum, muscles, fascia and subcutaneous tissue and positive blood cultures for Methicillin Sensitive *Staphylococcus aureus*. Alongside tailored antibiotic therapy, extensive surgical debridement was performed, leaving a full thickness 3 × 4 cm sternal defect and a large skin defect. After 4 weeks of antibiotics and Vacuum-Assisted-Closure pump, a novel reconstruction technique was utilized, with full collaborations of thoracic surgeons, orthopaedic surgeons and plastic surgeons. An autologous tricortical iliac crest bone graft was harvested and shaped to fit the full-thickness sternal defect, while two titanium sigmoid-shaped clavicle plates were used for internal fixation of the autograft. The large skin defect was covered with a pedicled myocutaneous latissimus dorsi flap. Integrity and stability of the chest wall was fully restored, and infection was completely eradicated. No complications occurred and the patient was well at the 18 months follow-up. To the best of our knowledge, this is the first report on autologous iliac crest bone graft in the treatment of sternal osteomyelitis. In this case, it proved to be a viable therapeutic option, providing good long-term clinical and cosmetic results.

Introduction

Sternal osteomyelitis (SO) is a rare but potentially devastating condition. In most cases, it is observed as a serious and sometimes fatal complication of deep sternal wound infections after cardiac surgery [1]. After traumas, SO is of very rare occurrence [2] while an osteomyelitis presenting in absence of any contiguous focus of infection (primary osteomyelitis) is even more uncommon, accounting for 0.3% of all cases in literature [3]. Treatment can present significant challenges, since no general consensus over appropriate management is currently in place [1,4]. We herein describe a very severe and challenging case of SO, presenting several weeks following a minor blunt trauma, where a strong collaboration between surgical specialties resulted in successful treatment and

* Corresponding author at: Wessex Cardiothoracic Centre, Southampton University Hospital, Tremona Road, SO16 6YD Southampton, UK.
E-mail address: Alessandro.Tamburrini@uhs.nhs.uk (A. Tamburrini).

https://doi.org/10.1016/j.tcr.2020.100305
Accepted 3 May 2020

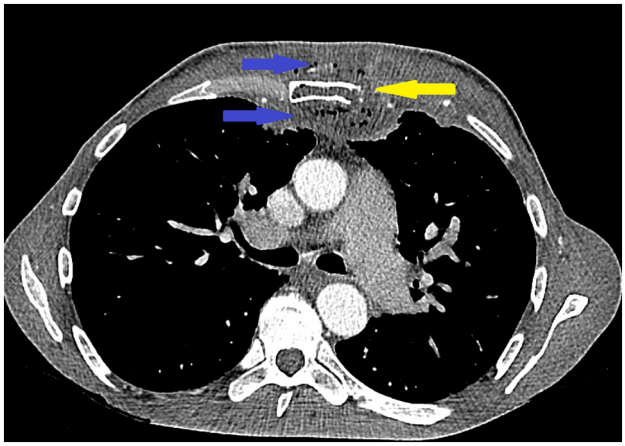

Fig. 1. CT scan at presentations shows extensive gas-containing collections superficial and deep to the body of the sternum (blue arrows) and evidence of osteolytic changes and cortical disruption (yellow arrow). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

development of a novel reconstruction technique.

Case presentation

A 47-year-old man presented to the emergency department with a four-week history of generalised weakness, and a five-day history of localized pain and extensive swelling overlying his sternum. His past medical history was consistent of hepatitis C, intravenous drug use and a previously sustained (11 weeks prior) minor blunt chest trauma, resulting in an undisplaced transverse sternal fracture which had not required hospital admission. On physical examination, temperature was 38.7°, blood pressure 143/73 mmHg and heart rate 110 beats/min. Laboratory findings showed high white blood cell count (20.6 × 10^9/L) with neutrophilia (18.2 × 10^9/L) and elevated C-reactive protein (343 mg/L). Upon chest examination, a large, erythematous, fluctuant and tender mass was palpable, extending bilaterally and inferiorly from the sternomanubrial angle. Blood cultures were also obtained and they revealed positivity for Methicillin Sensitive *Staphylococcus aureus* (MSSA).

The chest computed tomography (CT) scan demonstrated large gas containing collections within the subcutaneous tissues, superficial and deep to the sternum, measuring 20 × 103 × 87 mm (APxTRxCC) and 18 × 74 × 69 mm (APxTRxCC) respectively. The collections also extended to the right pectoralis muscle and the left third costochondral junction. The deep collections were closely applied to the mediastinal fat and poorly defined lytic foci were seen within the full thickness of the sternum and the left third costochondral junction, with prominent cortical disruption (Fig. 1).

These radiological findings together with the clinical picture and the striking signs of sepsis appeared consistent with a severe necrotizing sternal osteomyelitis and mediastinitis. Urgent surgical exploration was deemed necessary.

Upon superficial incision over the sternum, multiple tracks and multi-loculated pockets of pus were found in the soft tissue extending laterally into both pectoralis muscles and deep into the mediastinum. The mid-portion of the sternum was extensively obliterated and almost entirely replaced by pus. An extensive debridement of the infected area was performed, entailing copious removal of full-thickness osteomyelitic sternum, pectoralis muscles tissue, subcutaneous tissue and skin, thus leaving a large defect (Fig. 2) which was provisionally covered with a Vacuum Assisted Closure (VAC)-pump. Aggressive broad-spectrum intravenous antibiotic therapy was immediately established, and later tailored to the results of blood cultures (MSSA) and wound swabs. After 4 weeks of antibiotic therapy and VAC-pump therapy, and 3 consecutive negative wound swabs, definitive surgery with closure of the defect was deemed appropriate. Given the complexity of the case, a multidisciplinary approach with involvement of thoracic surgeons, orthopaedic surgeons and plastic surgeons was necessary. In this setting, a novel reconstructive technique was utilized. A 3 × 4 cm autologous tricortical bone graft was harvested from the right iliac crest and shaped to fit the full-thickness sternal defect site. Two titanium sigmoid-shaped clavicle plates (VariAx, Stryker®) were then used for internal fixation of the autograft (Fig. 3). Finally, an 8 × 15 cm right-sided latissimus dorsi myocutaneous pedicled flap was developed, mobilised and advanced to cover the large skin defect.

Post-operative recovery was unremarkable and the patient was discharged 8 days after surgery, with excellent functional and cosmetic result (Fig. 4). A CT-scan at 3 months follow-up showed good sternal alignment with complete resolution of the infection. The patient was clinically well at the 18 months follow-up.

Discussion

Osteomyelitis of the sternum is a rare, albeit significantly morbid and potentially fatal condition, which often presents diagnostic and therapeutic challenges. Deep sternal wound infections following sternotomy after cardiac surgery remain the most common cause

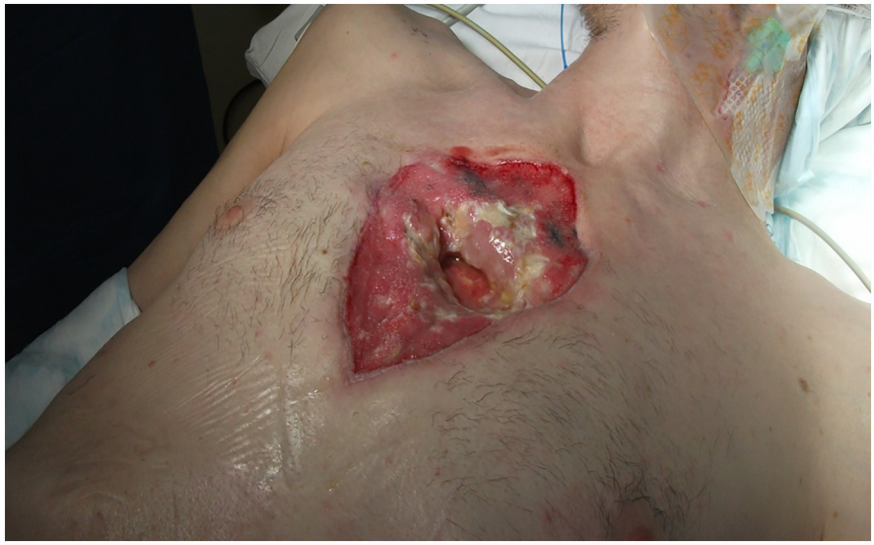

Fig. 2. Intraoperative appearance after initial surgical debridement, with central full thickness sternal defect, necrosis of muscles and subcutaneous tissues and large skin defect.

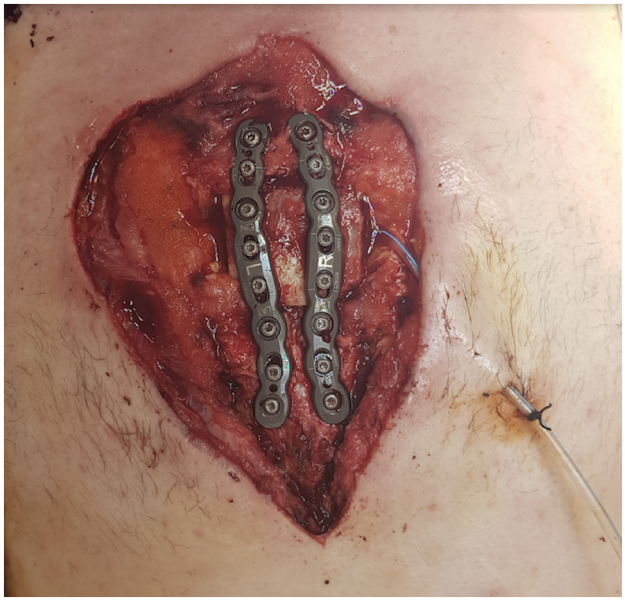

Fig. 3. Intraoperative appearance of tricortical iliac crest autologous bone graft, fitted in the sternal defect and fixed with sigmoid-shaped titanium plates.

of SO, occurring in 0.5–6.8% of cases, with a 7–35% mortality rate [1]. After trauma, SO occurs in very rare instances [2], and cases presenting without a known contiguous focus of infection (primary osteomyelitis) are even less common, accounting for only 0.3% of reports [3]. Nonetheless, the actual concept of primary SO may sometimes be debatable, since cases clearly defined as “primary” by some authors, still appear to be secondary to traumas [4,5]. Intravenous drug use, diabetes, immunodeficiency and staphylococcal infection are recognized risk factors for this rare condition [3]. Our patient was indeed an intravenous drug user and staphylococcus was the isolated germ. Compared to other similar cases [6,7] however, where SO occurred 3–4 weeks after sternal trauma, our patient developed SO nearly 3 months following a minimal sternal fracture. In this regard, the post-traumatic presentation was a rather delayed one. Treatment of SO can be very challenging as clear consensus over the best therapeutic option lacks [1,4]. Antibiotic therapy and surgical debridement followed by soft tissue reconstruction and defect coverage, generally with pectoralis muscles flaps, is the most common therapeutic option [1,4]. The use of VAC-pump, either as a single therapy or as a “bridge” before definitive surgical closure, has recently gained an established and prominent role within the treatment modalities [4]. In our case, due to the extensive nature of the defect and the impossibility to perform immediate reconstruction, the VAC device helped promote formation

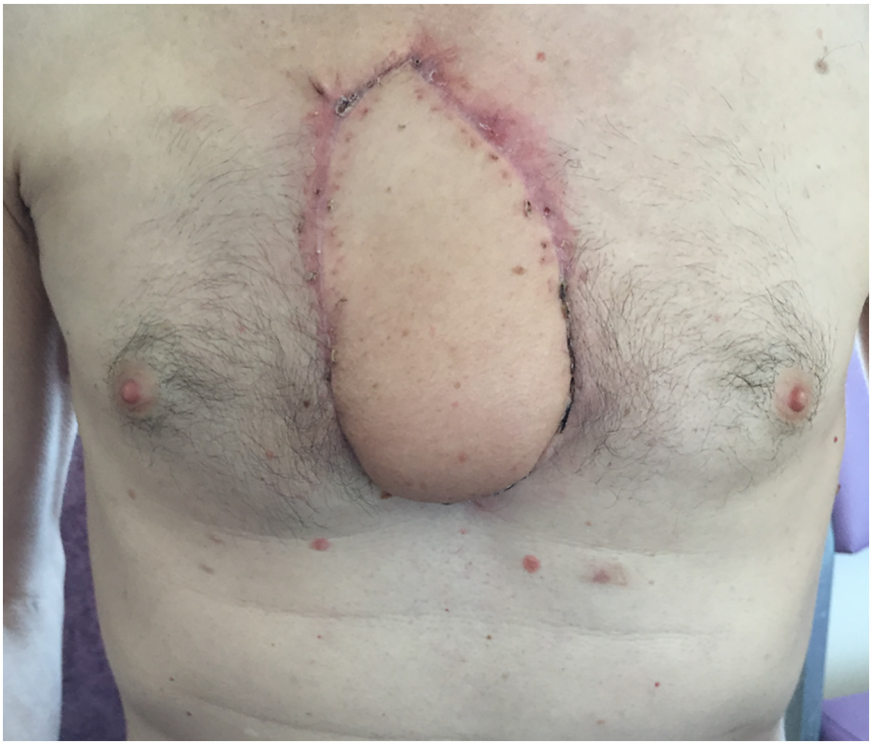

Fig. 4. Pre-discharge appearance of the wound with good cosmetic appearance.

of granulation tissue and expedited wound healing. The definitive reconstruction technique that we utilized is a novel one in chest wall reconstruction for SO, as it entailed the use of an autologous iliac crest tricortical bone graft to completely fill the full-thickness sternal defect. Despite synthetic materials such as polytetrafluoroethylene, methyl-methacrylate, and marlex meshes are widely available and more commonly used, they pose challenges in large full thickness defects, as they may provide inadequate support [8], and have a high risk of rejection [9]. The use of allografts in sternal reconstruction has also been reported for oncological cases with good results [8], but concern over their limited availability and the possibility of biological rejection has to be considered, especially in the setting of infections. Our use of bone autograft provided a strong support to the titanium plates and achieved chest wall integrity and stability, without concerns of biological tolerance. In the absence of pectoralis muscles, the wide defect was covered with the latissimus dorsi myocutaneous pedicled flap, which ensured adequate vascularization and good cosmesis. To the best of our knowledge, this is the first report on autologous iliac crest tricortical bone graft in the treatment of sternal defect for SO, as mainly autologous ribs [9] and fibula [10] have been described in chest wall reconstruction.

Conclusions

This case shows how SO can present even several weeks after a minor trauma and yield significant challenges to its treatment. In the absence of an established consensus over best management, a strong multidisciplinary effort is necessary to provide adequate, tailored therapeutic options. The use of the autologous iliac crest tricortical graft can be a viable new method for the reconstruction of sternal defects in these patients.

References

[1] P. Cotogni, C. Barbero, M. Rinaldi, Deep sternal wound infection after cardiac surgery: evidences and controversies, World J Crit Care Med 4 (4) (2015) 265–273.
[2] A. Khoriati, R. Rajakulasingam, R. Shah, Sternal fractures and their management, J Emerg Trauma Shock 6 (2) (2013) 113–116.
[3] Y.N. Jang, H.S. Sohn, S.Y. Cho, S.M. Choi, Primary sternal osteomyelitis caused by Staphylococcus aureus in an immunocompetent adult, Infect Chemother 49 (3) (2017) 223–226.
[4] C.D. Lopez, J.B. Hill, C. Stavropoulos, O.Z. Lerman, Primary sternal osteomyelitis: a case report and review, Plast Reconstr Surg Glob Open 7 (6) (2019) e2120.
[5] C.A. Kelly, M.N. Chetty, Primary sternal osteomyelitis, Thorax 40 (1985) 872–873.
[6] N.N. Patel, G.J. Murphy, M. Hamilton, Traumatic sternal abscess with mediastinal involvement, Ann. Thorac. Surg. 86 (2008) 1997.
[7] T. Velissaris, D. Pontefract, S. Ohri, A giant sternal abscess following traumatic sternal fracture, Eur. J. Cardiothorac. Surg. 22 (2002) 439.
[8] S. Sanna, J. Brandolini, A. Pardolesi, D. Argnani, M. Mengozzi, A. Dell'Amore, P. Solli, Materials and techniques in chest wall reconstruction: a review, J Vis Surg 3 (2017) 95.
[9] P.G. Arnold, P.C. Pairolero, Chest-wall reconstruction: an account of 500 consecutive patients, Plast. Reconstr. Surg. 98 (5) (1996) 804–810.
[10] R. Szumniak, A. Maciejewski, The use of fibula free flap for reconstruction of anterior chest wall full-thickness defects, Open Journal of Thoracic Surgery 3 (2013) 107–110.