Negative pressure wound therapy for surgical site infection after sternotomy and its role in preparing the wound for reconstruction

Eyal Schwartzmann,1 Micah Sy,1 Mehul Sharma1, Bartosz Mańkowski2, Marek Jemielity3, Bartłomiej Perek3

1Student Scientific Group, English Division, Poznan University of Medical Sciences, Poznan, Poland
2Department of Maxillofacial Surgery, Poznan University of Medical Sciences, Poznan, Poland
3Department of Cardiac Surgery and Transplantology, Poznan University of Medical Sciences, Poznan, Poland

Kardiochirurgia i Torakochirurgia Polska 2021; 18 (3): 190-191

Surgical site infection (SSI) involving the mediastinum after cardiac surgical procedures carried out through median sternotomy is associated with significant mortality and morbidity [1]. Up to now a few methods have been describe to treat such severe adverse events in the early postoperative period [2]. One of them is negative pressure wound therapy (NPWT) [3]. Since its introduction by Argenta and Morykwas, NPWT has been an efficacious method, in terms of improved early and long-term outcomes, of managing SSI after cardiac surgical procedures [4]. This method was also proved to be of paramount importance in assisting wound healing in subjects at the highest risk for developing SSI, such as obese, insulin-treated diabetic and chronic obstructive pulmonary disease (COPD) patients [3]. In some individuals it may enable the infected wound to be closed definitely by playing the role of the intermediate stage before either placing mattress adapting skin sutures or transferring different local free cutaneous flaps with/without muscle tissue.

Herein we describe a patient history that illustrates not only the occurrence of post-sternotomy SSI in a high-risk patient, but also the benefits of NPWT in particularly challenging extensive infection-related loss of the thoracic and abdominal wall. A 69-year-old man was admitted to the Department of Cardiac Surgery in early September 2020 complaining of retrosternal pain and easy fatigability. The patient’s past medical history was gathered and revealed a history of two percutaneous coronary interventions (PCIs) of left anterior descending (LAD) and right coronary arteries (RCA). The comorbidities such as obesity, COPD, arterial hypertension, and diabetes mellitus were diagnosed. He had a history of two percutaneous coronary interventions (PCIs) and two cerebrovascular accidents (in 2001 and 2006). Of note, he has been an active heavy smoker (at least one pack per day) for more than 40 years. Additionally, the preoperative computed tomography (CT) revealed severe calcifications in all segments of the aorta as well as in celiac trunk. Eventually having in mind all risk factors he was qualified by the Heart Team for aortic valve replacement and coronary artery bypass grafting. During primary surgery severe calcification in the ascending aorta prevented safe application of cardio-pulmonary bypass and only the left internal mammary artery (LIMA) was implanted to the left anterior descending artery (LAD). A week later, due to instability he had repeat sternal reosteosynthesis with stainless wires and active mediastinal drainage then the transcatheter aortic valve implantation (TAVI) procedure was successfully performed. Unfortunately, after the following few days he again developed severe infection with sternal dehiscence. Repeat surgery revealed extensive infection of the bone with mediastinum exposure (type IV according to the classification proposed by Anger et al. [5]). NPWT was initiated with several changes of the foam but due to skin loss, closure with direct skin mattress sutures was impossible. Many pathogens were detected to cause sternal infections in around the chest wounds, mainly Klebsiella pneumoniae, Pseudomonas aeruginosa, Proteus mirabilis and Stenotrophomonas maltophilia. Antibiotics were administered periodically usually with vancomycin and linezolid. Eventually, after consultation with the plastic surgeon, reconstruction with a reversed pedicled rectus abdominis flap with a skin island was performed (Figure 1 A). However, due to infection of the abdominal wall, NPWT was again applied, but this time predominantly on the abdominal wall (Figure 1 B). It took 6 weeks to prepare the tissue base for intermediate thickness skin grafting (Figure 1 C) that eventually enabled wound closure. The patient spent 5 months in our department.

SSI after cardiac surgical procedures leading to mediastinitis has been considered as one of the most serious complications. Although its incidence is not high, ranging between 1% and 3.4%, it is still associated with mortality rates of 10% to more than 30% and prolonged hospitaliza-
tion [3, 4]. In our case, the patient had to be treated for approximately 5 months. However, the latest advances in surgical techniques and better understanding of the pathophysiology have led to better results in recent years [6, 7]. NPWT has made a major contribution to such recent outcomes even in high risk patients with well-known risk factors [7]. After reviewing both our patient’s medical history and these risk factors, we decided to initiate vacuum-assisted therapy early after failure of the only attempt of sternal bone re-stabilization.

This vacuum-assisted wound closure technique that uses subatmospheric pressure applied locally to a surgical site allows continuous, open drainage of exudate while maintaining sternal stability and wound isolation. It was also proven to increase dermal perfusion and granulation tissue formation, reduce edema and interstitial tissue fluid, reverse tissue expansion and reduce bacterial colonization [6]. We are sure that many aforementioned mechanisms of NPWT were of paramount importance in our patient. Due to infection-related skin damage, primary closure was not possible; therefore we treated the patient with NPWT to create optimal conditions for an intermediate skin transplant, which was successful.

Variability in NPWT application and general techniques for wound management and debridement among surgeons also present a challenge to standardized use of NPWT. The authors of this report hope to contribute and encourage further discussion and research for a systematic approach to NPWT as management after postoperative SSI.

**Disclosure**

The authors report no conflict of interest.

**References**

1. Sá MP, Silva DO, Lima EN, Lima Rde C, Silva FP, Rueda FG, Escobar RR, Cavalcanti PE. Postoperative mediastinitis in cardiovascular surgery postoperation. Analysis of 1038 consecutive surgeries. Rev Bras Cir Cardiovasc 2010; 25: 19-24.
2. Ennker IC, Pietrowski D, Vöhringer L, Kojici B, Albert A, Vogt PM, Ennker J. Surgical debridement, vacuum therapy and pectoralis plasty in poststernotomy mediastinitis. J Plast Reconstr Aesthet Surg 2009; 62: 1479-1483.
3. Ennker IC, Malkoc A, Pietrowski D, Vogt PM, Ennker J, Albert A. The concept of negative pressure wound therapy (NPWT) after poststernotomy mediastinitis: a single center experience with 54 patients. J Cardiothorac Surg 2009; 4: 5.
4. Deniz H, Gokaslan G, Arslanoglu Y, Ozcaliskan Q, Guzel G, Yasim A, Ustunsoy H. Treatment outcomes of postoperative mediastinitis in cardiac surgery; negative pressure wound therapy versus conventional treatment. J Cardiothorac Surg 2012; 7: 67.
5. Anger J, Dantas DC, Arnoni RT, Farsky PS. A new classification of post-sternotomy dehiscence. Rev Bras Cir Cardiovasc 2015; 30: 114-118.
6. Goh SS. Post-sternotomy mediastinitis in the modern era. J Card Surg 2017; 32: 556-566.
7. Kaul R. Sternal reconstruction after post-sternotomy mediastinitis. J Cardiothorac Surg 2017; 12: 94.