A combination of hydro-debridement with pulsed lavage and negative pressure wound therapies may enhance outcomes

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Abstract

Deep sternal wound infection (DSWI) with prosthetic graft infection is a rare, though lethal, complication after cardiovascular surgery via median sternotomy. This commentary is a review of a report by Takagi et al. published in the Journal of Cardiac Surgery that reported favorable outcomes in patients with DWSI with prosthetic graft infection treated with an enhanced strategy consisting of hydro-debridement with pulsed lavage and negative pressure wound therapies.

Commentary: A combination of hydro-debridement with pulsed lavage and negative pressure wound therapies may enhance outcomes

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Running title: Enhanced hydro-debridement with NPWT

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Abstract

Deep sternal wound infection (DSWI) with prosthetic graft infection is a rare, though lethal, complication after cardiovascular surgery via median sternotomy. This commentary is a review of a report by Takagi et al.

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COMMENTARY

The in-hospital mortality rate of deep sternal wound infection (DSWI) has decreased from 14-47% to 0-15% since the introduction of negative pressure wound therapy (NPWT).[1-4] While the incidence of thoracic prosthetic graft infection is rare, the mortality rate is as high as 25-75% due to severe infections that require radical and extensive interventions due to aortic replacement, pseudoaneurysms, aorto-esophageal fistulae, aorto-bronchial fistulae, and vegetation inside the graft.[5,6] Prosthetic graft infection rarely occurs after aortic surgery via a median sternotomy, though this type of infection also has a high mortality rate. However, the pathology of DSWI with prosthetic graft infection is different than that of prosthetic graft infection without DWSI, as DSWI often includes sternal osteomyelitis, which may affect the treatment strategy. In addition, prosthetic graft infections present in both the early and late postoperative periods, and their presentation affects the treatment strategy. Patients with a prosthetic graft infection in the early postoperative period do not tolerate the radical and extensive re-replacement of the prosthetic graft that requires a long operation and circulatory arrest with or without hypothermia due to their critical condition, insufficient recovery from the primary operation, and bacteremia with or without sepsis. Umminer et al. reported that graft-sparing techniques are safe and effective in patients with early-onset prosthetic graft infection, especially within one month after the primary operation.[7] Therefore, graft sparing salvage treatment for DSWI with prosthetic graft infection may be preferable in high-risk patients, especially those with early onset infections. However, a radical re-replacement of the infected graft with a self-made tube, homograft, or rifampicin-soaked grafts remains the best treatment option in patients with pseudoaneurysm, fistula formation, and vegetation.[8,9]

Various salvage treatments for DSWI or DSWI with prosthetic graft infection have been reported.[3,4,10-13] The surgical debridement of infected tissues and removal of purulent tissue must be conducted immediately when DSWI with prosthetic graft infection is diagnosed to reduce the bacterial population, control the infection, and ameliorate the patient's condition. NPWT is a standard treatment for patients with DSWI after debridement as it stabilizes the thoracic cage and controls the bacterial infection.[3,4] Saiki et al. reported the effectiveness of NPWT for patients with DSWI with prosthetic graft infection.[14] NPWT with continuous or intermittent irrigation is a useful treatment for patients with DSWI with prosthetic graft infection, resulting in good outcomes, decreased mortality, and decreased recurrent infection rates.[10,11] A previous study reported that NPWT with continuous irrigation improved hospital mortality from 50% to 16.7% in patients with DSWI with prosthetic graft infection.[10]Continuous or intermittent irrigation and drainage contributes to the control of bacterial infections by washing the purulent and necrotic tissues, a strategy termed hydro-debridement. Takagi et al. proposed a combination therapy of hydro-debridement with pulsed lavage and NPWT for patients with DSWI with prosthetic graft infection.[15]In their study, intermittent hydro-debridement with pulsed lavage consisted of a high volume of saline solution and 0.005% gentian violet and significantly reduced the number of bacteria and the surgical site infection rate.[16] Moreover, pulsed lavage with gentian violet facilitated the removal of necrotic tissues.[17]We suspect that hydro-debridement with pulsed lavage and gentian violet enable the debridement in the entire mediastinum, including the gap between the prosthetic grafts and the narrow space dorsal to the prosthetic graft, which controls the local infection. However, this strategy could result in ventricular arrhythmia or bleeding from the organs.

Reconstruction with tissue flaps has also been reported as a useful salvage treatment for patients with DSWI and DSWI with prosthetic graft infection.[4,13] Muscle or omentum tissue flaps are created to fill wide-ranging tissue defects and promote a bactericidal effect and wound healing. Omental flaps have been reported as superior to muscle flaps due to their neovascularization ability, which promotes immunological processes and enhances the antibiotic concentration; wound secretion absorption; and the flexible shape that fills dead space. However, the use of omental flaps may lead to hernia formation or decreased vital capacity.[13,18,19] In contrast, another previous study reported that muscle and omental flaps are insufficient to treat patients with DSWI and do not significantly reduce the in-hospital mortality rate.[20] Several previous

studies have reported excellent outcomes after NPWT followed by tissue flaps for patients with DSWI.[4] These findings suggest the importance of controlling the local infection prior to the use of tissue flaps. Therefore, NPWT with hydro-debridement allows for the eradication and sterilization of the local prosthetic graft and mediastinum infection. The use of NPWT with hydro-debridement as a bridge therapy to omental flaps may be an alternative treatment for DSWI with prosthetic graft infection in high-risk patients. Recently, multidisciplinary strategies including collaboration with a plastic surgeon for proper debridement, NPWT with irrigation, and tissue flaps have been recommended for patients with DSWI with vascular graft infection, as this strategy reduces mortality and has good outcomes.[10,11] Nevertheless, more studies are needed to identify the effectiveness of this enhanced combination therapy for patients with DSWI with prosthetic graft infection, as recurrent infections may occur if the infected prosthetic graft is not removed.

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