ABSTRACT
Negative pressure wound therapy with intermittent instillation of rifampin for the treatment of an infected vascular bypass graft

Prosthetic vascular graft infection after infrainguinal arterial bypass revascularization is a serious complication occurring in nearly 5% of procedures.1,2 Traditionally, treatment of these complications involves graft excision and reconstruction with extra-anatomic bypass; however, these complex procedures are associated with a high rate of limb loss and mortality.1,3,4 A paradigm shift based on local wound treatment with preservation of the infected graft has resulted in improved outcomes using a combination of débridement and intravenous culture-directed antibiotic therapy, with either subsequent muscle flap coverage or, more recently, negative pressure wound therapy (NPWT) with vacuum-assisted closure of the wound.5,6 The recent resurgence of NPWT with intermittent instillation of fluid (NPWTi) presents a new opportunity in the treatment of infected prosthetic grafts after revascularization. The ability to provide local instillation of culture-directed antibiotic solutions combined with NPWT helps maximize the likelihood of resolution of infection and subsequent successful wound closure with graft preservation. A review of the literature revealed no reported cases involving the use of NPWTi with antibiotic solution for the treatment of deep perivascular groin wound and prosthetic graft infection after lower limb arterial bypass. Here we present a case using this modality for wound care and graft salvage after failed muscle flap coverage. The patient’s consent was acquired for the writing of this case report and display of photographs.

CASE REPORT
The patient is a 78-year-old man with hypertension, hyperlipidemia, type 2 diabetes (hemoglobin A1c, 7.1%), atrial fibrillation, peripheral artery disease, and chronic nonhealing lower extremity wounds. Three years before admission, the patient required a left below-knee amputation for an infected nonhealing foot wound. He received a right common femoral artery to posterior tibial artery bypass using a native saphenous vein graft in the past, which subsequently occluded, and required revision of the bypass with a polytetrafluoroethylene graft from the right common femoral artery to the posterior tibial artery. Given the prosthetic nature of the graft and because he had a copious amount of scar tissue in the groin from previous bypass surgery, the decision was made to cover the graft prophylactically with a sartorius muscle flap. We routinely use groin prophylactic muscle flap during secondary groin procedures. The sartorius muscle flap provides durable muscle coverage of the graft and can accelerate healing. This method has been reported in the literature as an effective means to control infection and to maintain the graft.12,13 As is typical for our institution’s protocol, we placed a drain at the muscle harvest site for possible seroma formation and used dry dressings with subsequent dressing changes every 2 days in the postoperative period.

Despite sartorius coverage, the patient was readmitted to the hospital 10 days postoperatively with groin wound dehiscence and foul-smelling discharge. Cultures from fluid around the graft were positive, which suggested graft infection. He was admitted with fever, chills, and obvious systemic infection. On
The patient subsequently underwent two more washouts, with a rifampin instillation solution used between washouts. After the second washout, he was found to be culture negative, which was the intended end point of the instillation treatment. The graft was always protected by a nonadherent layer of wound dressing material during washouts to prevent direct exposure. A final operation was performed to readvance the sartorius flap and to close the defect over two drains. The patient did well postoperatively. At 2-year follow-up, the graft was still patent, and he had no further wound complications. The Fig shows the patient’s closed groin wound at 3 years after treatment with NPWTi and rifampin.

DISCUSSION
Surgical site infections and subsequent vascular graft infections are among the most feared complications in vascular surgery. The incidence of infrainguinal prosthetic graft infections (as occurred in our patient) has been reported to be 4.7%, with amputation and mortality rates as high as 52% and 58%, respectively.4,15 Traditional treatment consists of removal of the infected graft and subsequent extra-anatomic revascularization, a procedure that similarly results in a high rate of limb loss and mortality.1,4 This traditional treatment is required in four conditions: disruption of the vascular anastomosis, infection of the entirety of the graft, uncontrolled sepsis, and infection with Pseudomonas aeruginosa.14 In the absence of any of these conditions, the treatment paradigm has shifted toward aggressive débridement and intravenous antibiotics, followed by either muscle flap coverage or NPWT placement. Muscle flap coverage has been reported to have up to 75% initial success rate; however, there is evidence of reinfection in up to 35% of cases.10,11 Commonly used muscle flaps include the sartorius and the rectus femoris. However, as evidenced in the case of our patient, muscle flaps can fail and are susceptible to reinfection, which requires a new treatment plan. Several case reports have shown resolution of infection with débridement, culture-directed intravenous antibiotic therapy, and use of NPWT technology on the site, allowing preservation of the graft.5-11 Early use of NPWT technology to close infected groin wounds and to salvage infected grafts has been reported in patients who were unsuitable surgical candidates for muscle flap closure. These few cases show promise in achieving complete wound closure using a combination of débridement, culture-directed intravenous antibiotic therapy, and NPWT placement.5,6,9 These reports led to additional case series using vacuum-assisted closure after débridement and intravenous antibiotics, with good rates of complete closure and infection resolution.5,6,9 Furthermore, despite the manufacturer’s reported contraindication to NPWT use in wounds with exposed vessels or vascular grafts, various techniques
have been shown to be safe, including covering of the vessels and grafts with nonocclusive dressings, use of dual sponges, and relatively low-pressure NPWT.\textsuperscript{5,6,8,9} NPWTi has been available for nearly 15 years but was not widely used until the newest generation system was released in 2013.\textsuperscript{10} The initial international expert guidelines acknowledged the potential utility of intermittent instillation of antimicrobial fluids combined with vacuum-assisted closure therapy in both acute and chronic wounds and even in exposed orthopedic hardware but did not address the possible utility in infected vascular grafts. In 2014, Kim et al\textsuperscript{17} reported a retrospective trial of 142 hospitalized patients with acutely and chronically infected wounds and found that the patients receiving NPWT with instillation of polyhexanide-betaine solution required fewer operating room visits and a decreased overall hospital stay than patients receiving conventional NPWT. More recently, Kim et al\textsuperscript{18} compared outcomes of NPWTi using normal saline vs polyhexanide-betaine solution in 123 hospitalized patients with acute and chronic wounds and found no significant difference between the solutions used. Despite the efficacy of polyhexanide-betaine, rifampin was used as an instillation fluid because the vascular surgery literature supports the replacement of infected endovascular aneurysm repair and thoracic endovascular aortic repair with a rifampin-impregnated Dacron graft.

We were unable to find any case reports of infected prosthetic vascular grafts treated with NPWTi. Given the evidence for NPWT without instillation in the treatment of infected infrainguinal prosthetic vascular grafts as well as evidence showing improved outcomes of NPWTi over simple NPWT in acute wounds, we believe that NPWTi is a logical next step in the treatment of these infected grafts. Instillation of culture-guided antibiotic solutions in addition to débridement, intravenous antibiotics, and NPWT presents a promising approach.

CONCLUSIONS
As with conventional NPWT, NPWTi is a treatment modality that can be used either primarily after débridement or secondarily after failure of muscle flap coverage (as in our case). Furthermore, this versatile treatment can be used to completion of wound healing or simply as a means to stabilize the wound and to resolve the infection before definitive closure with a subsequent muscle flap. Given the lack of reported use of NPWTi technology for the purpose of treating infected prosthetic vascular grafts, we believe additional research is required in this field to investigate the efficacy of this new therapy option.

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