Preservation of infected and exposed vascular grafts using vacuum assisted closure without muscle flap coverage

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The most widely used techniques for graft preservation after localized graft infections are muscle flap closure or antibacterial dressings and irrigations after débridement. Vacuum assisted closure (VAC) has been increasingly used for complex wounds in vascular surgery, including groin infections, but not directly on exposed bypass grafts as a stand-alone technique. We used the VAC system after wound débridement in four patients with fully exposed synthetic bypass grafts who were too unstable or risky for further operative interventions. Mean duration of VAC use was 22.8 days (range, 6 to 53 days), with time to total wound closure of 30 to 63 days (mean, 41 days). There were no reinfections with 11 to 25 months’ follow-up (mean, 18.3 months). For high-risk surgical patients with a fully exposed infected prosthetic vascular graft, VAC therapy along with aggressive débridement and antibiotic therapy may be an effective alternative to current management strategies. (J Vasc Surg 2005;42:989-92.)

Groin infections involving vascular grafts are reported to occur in 1% to 5% of bypasses and are associated with 10% to 70% amputation rates and 10% to 20% mortality rates.1,2 Traditionally, graft excision and extra-anatomic or in situ bypass have been the treatment of choice for the treatment of infected bypass grafts. Because of the high morbidity and mortality of these operations, various graft preservation techniques have been increasingly utilized in an attempt to improve outcomes.3-5

Graft preservation is feasible when the anastomosis is intact, the whole graft is not involved with infection, the patient has no systemic signs of sepsis, the graft is patent, and the offending organism is not Pseudomonas aeruginosa.6 Aggressive débridement, intravenous antibiotics, and various muscle flaps have been the standard approach in these patients, with a reported re-infection rate of 0% to 35%.7-11

Local wound care without muscle flap closure has been reported in patients who are not candidates for a major reoperation (high risk, extensive fibrosis, poor nutritional status) with ≥75% initial success rate.10,12

The use of vacuum assisted closure systems (VAC, Kinetic Concepts, Inc, San Antonio, Tex) has been reported extensively in a variety of wounds and as an adjunct to débridement in exposed vascular graft infections before muscle flap closure.9 The use of VAC systems without an adjunctive muscle flap cover has recently been reported after repair of infected pseudoaneurysms13 as well as in post-operative groin infections after patch angioplasties,14,15 bypass procedures using vein,16 and synthetic grafts with minimal graft exposure.17,18 In this report, we share our experience with the use of the VAC system in four patients with fully exposed grafts as a less invasive means of graft preservation and as an effective alternative to routine muscle flap closure.

CASE REPORTS

A 69-year-old obese man with a history of stable angina and tobacco abuse presented with disabling claudication at 20 yards and an ankle-brachial index of 0.3 bilaterally. A transbrachial angiogram showed juxtarenal aortic occlusion, and a right axillary-bifemoral bypass was performed. He presented 12 days later with left groin erythema and purulent drainage, fever (100.5°F), and leukocytosis (white blood cell count of 20,000/mm³). Computerized axial tomography (CT) scan showed a left groin fluid collection extending to the anastomosis (Fig 1), and he was taken to the operating room for débridement. This resulted in an 8-×7-cm wound with exposed but intact anastomosis. The cultures from the wound and blood grew methicillin-sensitive Staphylococcus aureus (MSSA). The patient developed respiratory failure and remained intubated for 12 days. A VAC system was placed because...
he was too sick for muscle flap closure. His wound improved dramatically, and we transferred him to the rehabilitation floor on postoperative day (POD) 29. The VAC was discontinued after 53 days and he was discharged home with a healed wound on POD 67.

The patient received 3 months of culture-directed intravenous antibiotics, and a repeat CT scan done 9 months postoperatively showed no signs of infection (Fig 2). He remains free of infection after 15 months.

Summary of all cases. All patients were men, with a mean age of 58.8 (range, 44 to 68) (Table). The initial procedures were performed for nonhealing wounds in two patients, rest pain in one, and disabling claudication in one. All patients had polytetrafluoroethylene (PTFE) grafts implanted. In addition, patient 2 had a reversed greater saphenous vein-graft with inflow from an axillary-femoral graft (PTFE) that had been performed for a failed aorto-bifemoral graft.

The time to presentation with infection was 11 to 72 days. All wounds were débrided in the operating room after local exploration, a CT examination, or both, showed evidence of graft involvement (Szilagyi grade III). All except one patient had exposed anastomoses after débridement, and the wounds measured between 2 × 3 cm and 7 × 8 cm. Cultures revealed methicillin-resistant *S. aureus* (MRSA) (n = 1), MSSA (n = 1), *Escherichia coli* (n = 1), and mixed infection (n = 1). The albumin levels after the débridement varied from 1.7 to 3.8 g/dL (mean ± SD, 2.5 ± 0.91 g/dL).

Muscle flap closure was not attempted in these patients because of poor medical condition or because they had multiply operated groins with severe fibrosis. Instead, the VAC system was applied beginning 1 to 3 days after the initial débridement. Constant suction (125 mm Hg) was used. Nonadhering dressing (Kendall, Curity, Tyco Healthcare, Mansfield, Mass) or Silvasorb silver antimicrobial perforated sheet (Medline, Mundelein, Ill) were used to keep the sponge from coming in direct contact with the anastomoses. Repeat minor débridements were performed at bedside when needed (2 to 3 times per patient), with no repeat major débridements needed in the operating room. All patients were kept on culture-directed intravenous antibiotics for 6 to 24 weeks, depending on the exposure of the anastomoses and the virulence of the cultured bacteria.

Mean duration of VAC use was 22.8 days (range, 6 to 53 days). The time to total wound closure was 30 to 63 days (mean, 41 days). The hospital stay was 11 to 31 days (mean, 21 days). The length of rehabilitation center stay was 0 to 57 days (mean, 34 days). After the development of granulation tissue around the exposed anastomoses, two patients were sent to a rehabilitation center with VAC systems for 13 and 28 days.

There were no re-infections with 11 to 25 months’ follow-up (mean, 18.3 months). One patient who had femoral endarterec-

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Table. Patient characteristics

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age</th>
<th>Initial procedure</th>
<th>Time to infection (days)</th>
<th>Organism</th>
<th>Duration VAC use/hospital LOS/rehab LOS (days)</th>
<th>Wound closure (days)</th>
<th>Follow up (months)/reinfection/graft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>44</td>
<td>Fem-PT</td>
<td>11</td>
<td>Enterococci, <em>S. epidermidis</em>, <em>Bacteroides</em></td>
<td>11/13/42</td>
<td>33</td>
<td>25/no/intact, occluded</td>
</tr>
<tr>
<td>2</td>
<td>67</td>
<td>Fem-pop</td>
<td>14</td>
<td><em>E. coli</em></td>
<td>6/31/0</td>
<td>30</td>
<td>22/no/intact</td>
</tr>
<tr>
<td>3</td>
<td>69</td>
<td>Ax-bifem</td>
<td>12</td>
<td>MSSA</td>
<td>53/29/38</td>
<td>63</td>
<td>15/no/intact</td>
</tr>
<tr>
<td>4</td>
<td>55</td>
<td>Fem-PT</td>
<td>72</td>
<td>MRSA</td>
<td>21/11/57</td>
<td>38</td>
<td>11/no/intact</td>
</tr>
</tbody>
</table>

LOS, Length of stay; Rehab, rehabilitation center; Fem-PT, femoral-posterior tibial bypass; Fem-pop, femoropopliteal bypass; Ax-bifem, axillary-bifemoral bypass; MSSA, methicillin susceptible *S. aureus*; VAC, vacuum assisted closure.
tomy concomitant with femoral-distal bypass had a graft occlusion at 14 months. This patient has a healed wound, with nondisabling claudication and an intact uninfected graft.

DISCUSSION

Groin infections after bypass procedures remain a major source of morbidity and mortality.\(^1,2\) Graft removal with either in situ or extra-anatomic bypass remains the standard treatment for patients with a disrupted anastomosis, total graft infection, uncontrolled sepsis, an occluded infected graft, or *Pseudomonas* infection.\(^6\) However, graft preservation techniques have been developed in lieu of graft removal because of the high morbidity and mortality associated with this approach. Graft preservation approaches include radical débridement followed by muscle flap closure simultaneously or later in good-risk patients when feasible. Local wound care without muscle flap closure has been reported with varying degrees of success, and up to 75% of patients may completely heal with this approach alone.\(^10\)

The role of muscle flap closure of exposed grafts is well documented and is associated with a >90% initial success rate. However, re-infection may occur in as many as 35% of patients,\(^7\) and a significant number of patients are not good candidates for muscle flap closure secondary to poor medical condition or inadequate nutritional status.

VAC therapy has been increasingly used in wounds with exposed bone, tendons, and hardware and recently has been reported as an adjunctive measure after groin infections involving exposed bypass grafts as a means of decreasing the time to granulation tissue formation before muscle flap closure.\(^9\) These investigators used the VAC system in four of nine patients, after initial débridement, for 3 to 14 days before a muscle flap was used to cover the graft. The time to flap closure was 5 days shorter in the patients with VAC use, although the difference was not significant because of the small sample size.

VAC therapy has been used after infected pseudoaneurysm débridement with primary or vein patch closure of the femoral artery,\(^13\) after groin infections following endarterectomy and synthetic patch closure,\(^14,15\) and after an infected groin wound with an exposed vein graft.\(^16\) Pinocy et al\(^14\) reported on the use of VAC without any muscle coverage in 24 patients with groin infections. The series included 18 patients with synthetic patches after endarterectomy and six patients with aortobifemoral bypass grafts, with 100% healing without re-infection in 12 months. The authors used the VAC as a modified closed-suction drain system, suturing the skin closed over the sponge in most of the patients. Three patients with large wounds required an adhesive system rather than temporary skin closure, as was the case with all of the patients in our series. The wounds were re-explored at 7 days with a new sponge placed, and all wounds were primarily closed after 14 days. In their report, graft exposure was defined as visualization of suture or graft material in the wound. At the time of débridement, the authors avoided contact with the vessel and prosthesis “to avoid spreading the infection.”\(^14\) Compared with those described in our report, the wounds treated in their series seem less extensive, with minimal graft exposure. All patients in our series had necrotic infected tissue in contact with the prosthetic grafts, with associated large skin defects that precluded primary skin closure.

The effect of VAC on the reduction of bacterial content in wounds has been reported.\(^17\) Removing excess fluid from the wound may cause increased lymphatic and blood flow, with greater amounts of oxygen available for oxidative burst causing bacterial killing. One concern with the VAC use on exposed grafts is the closeness of the sponge to the anastomosis, artery, or the vein-graft itself, and a nonadherent dressing use between the graft and the VAC sponge has proven to be effective in our and others’ experiences.\(^9\)

The impact of VAC closure on the length of hospital stay is difficult to evaluate from this limited experience. However, two of the four patients in our small series were discharged from the hospital (to home or rehabilitation center) with an additional 13 and 28 days of VAC use. Further evaluation is needed to understand if use of the VAC system results in shortened hospital stays for patients with graft infections.

After initial débridement, use of VAC system on exposed grafts appears to be safe. The VAC may be used as a bridge to muscle flap closure while providing time to resuscitate the critically ill and unstable patient, improve nutritional status, and control infection with repeat débridements and intravenous antibiotics. Our experience supports the notion that in those who continue to be poor candidates for muscle flap closure, or if the graft is totally covered with granulation tissue before a muscle flap is attempted, the VAC system may end up being the only modality utilized for wound closure, with complete wound healing expected in most patients. We share the impression of Colwell et al\(^9\) that the VAC system may speed the process of granulation tissue formation. However, more data are needed to compare VAC closure with other local wound treatments.

CONCLUSION

The VAC system appears to be safe and effective for patients with prosthetic graft infections in a selected group of patients. To our knowledge, this is the first report of the stand-alone use of VAC system in the treatment of wound infections with fully exposed vascular bypass grafts, and anastomoses.

REFERENCES


Dosioglu et al 991


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