<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2160</td>
<td>Tertiary peritonitis: A disease that should not be ignored</td>
<td>Marques HS, Araújo GRL, da Silva FAF, de Brito BB, Versiani PVD, Caires JS, Milet TC, de Melo FF</td>
</tr>
<tr>
<td>2170</td>
<td>SARS-CoV-2, surgeons and surgical masks</td>
<td>Khalil MI, Banik GR, Mansoor S, Alqahtani AS, Rashid H</td>
</tr>
<tr>
<td>2181</td>
<td>Iguratimod promotes transformation of mononuclear macrophages in elderly patients with rheumatoid arthritis by nuclear factor-κB pathway</td>
<td>Liu S, Song LP, Li RB, Feng LH, Zhu H</td>
</tr>
<tr>
<td>2247</td>
<td>Effect of suspension training on neuromuscular function, postural control, and knee kinematics in anterior cruciate ligament reconstruction patients</td>
<td>Huang DD, Chen LH, Yu Z, Chen QJ, Lai JN, Li HH, Liu G</td>
</tr>
<tr>
<td>2259</td>
<td>Turner syndrome with positive SRY gene and non-classical congenital adrenal hyperplasia: A case report</td>
<td>He MN, Zhao SC, Li JM, Tong LL, Fan XZ, Xue YM, Lin XH, Cao Y</td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
<td>Authors</td>
</tr>
<tr>
<td>------</td>
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<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2274</td>
<td>Bilateral retrocorneal hyaline scrolls secondary to asymptomatic congenital syphilis: A case report</td>
<td>Jin YQ, Hu YP, Dai Q, Wu SQ</td>
</tr>
<tr>
<td>2281</td>
<td>Recurrent undifferentiated embryonal sarcoma of the liver in adult patient treated by pembrolizumab: A case report</td>
<td>Yu XH, Huang J, Ge NJ, Yang YF, Zhao JY</td>
</tr>
<tr>
<td>2289</td>
<td>Adult onset type 2 familial hemophagocytic lymphohistiocytosis with PRF1 c.65delC/c.163C&gt;T compound heterozygous mutations: A case report</td>
<td>Liu XY, Nie YB, Chen XJ, Gao XH, Zhai LJ, Min FL</td>
</tr>
<tr>
<td>2296</td>
<td>Salvage of vascular graft infections via vacuum sealing drainage and rectus femoris muscle flap transposition: A case report</td>
<td>Zhang P, Tao FL, Li QH, Zhou DS, Liu FX</td>
</tr>
<tr>
<td>2302</td>
<td>Innovative chest wall reconstruction with a locking plate and cement spacer after radical resection of chondrosarcoma in the sternum: A case report</td>
<td>Lin CW, Ho TY, Yeh CW, Chen HT, Chiang IP, Fong YC</td>
</tr>
<tr>
<td>2312</td>
<td>Changes in sleep parameters following biomimetic oral appliance therapy: A case report</td>
<td>Singh GD, Kherani S</td>
</tr>
<tr>
<td>2320</td>
<td>Bone remodeling in sigmoid sinus diverticulum after stenting for transverse sinus stenosis in pulsatile tinnitus: A case report</td>
<td>Qiu XY, Zhao PF, Ding HY, Li XS, Lv H, Yang ZH, Gong SS, Jin L, Wang ZC</td>
</tr>
<tr>
<td>2326</td>
<td>Prolonged use of bedaquiline in two patients with pulmonary extensively drug-resistant tuberculosis: Two case reports</td>
<td>Gao JT, Xie L, Ma LP, Shu W, Zhang LJ, Ning YJ, Xie SH, Liu YH, Gao MQ</td>
</tr>
<tr>
<td>2334</td>
<td>Low-grade mucinous appendiceal neoplasm mimicking an ovarian lesion: A case report and review of literature</td>
<td>Borges AL, Reis-de-Carvalho C, Chorão M, Pereira H, Djokovic D</td>
</tr>
<tr>
<td>2344</td>
<td>Granulomatosis with polyangiitis presenting as high fever with diffuse alveolar hemorrhage and otitis media: A case report</td>
<td>Li XJ, Yang L, Yan XF, Zhan CT, Liu JH</td>
</tr>
<tr>
<td>2352</td>
<td>Primary intramedullary melanoma of lumbar spinal cord: A case report</td>
<td>Sun LD, Chu X, Xu L, Fan XZ, Qian Y, Zuo DM</td>
</tr>
<tr>
<td>Page</td>
<td>Title</td>
<td>Authors</td>
</tr>
<tr>
<td>------</td>
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<td>--------------------------------</td>
</tr>
<tr>
<td>2367</td>
<td>Nocardia cyriacigeorgica infection in a patient with pulmonary sequestration: A case report</td>
<td>Lin J, Wu XM, Peng MF</td>
</tr>
<tr>
<td>2380</td>
<td>Solitary bone plasmacytoma of the upper cervical spine: A case report</td>
<td>Li RJ, Li XF, Jiang WM</td>
</tr>
<tr>
<td>2386</td>
<td>Two-stage transcrestal sinus floor elevation-insight into replantation: Six case reports</td>
<td>Lin ZZ, Xu DQ, Ye ZY, Wang GG, Ding X</td>
</tr>
</tbody>
</table>
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Salvage of vascular graft infections via vacuum sealing drainage and rectus femoris muscle flap transposition: A case report

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Author contributions: Zhang P, Zhou DS, and Tao FL were the patient’s respiratory physicians; Li QH and Liu FX performed the radiological diagnosis and contributed to manuscript drafting; Li QH and Liu FX performed the pathological diagnosis and contributed to manuscript drafting; Zhang P, Tao FL, Li QH, Zhou DS, and Liu FX performed the literature review and contributed to manuscript drafting; Zhang P and Liu FX were responsible for the revision of the manuscript for important intellectual content; all authors issued final approval for the version to be submitted.

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Abstract

BACKGROUND
The management of vascular graft infections continues to be a significant challenge in a clinical situation. The aim of this report is to illustrate the novel vacuum sealing drainage (VSD) technique and rectus femoris muscle flap transposition for vascular graft infections, and to evaluate the prospective of future testing of this surgical procedure.

CASE SUMMARY
We report the case of a 32-year-old male patient, who presented a severe infected groin wound with biological vascular graft *Acinetobacter baumannii* infection resulting in extensive graft exposure. Using the VSD and muscle flap transposition, the groin wound and vascular graft infection were finally treated successfully.

CONCLUSION
Our case report highlights that VSD technique and rectus femoris muscle flap transposition could be considered in patients presenting with a severe infected groin wound with biological vascular graft *Acinetobacter baumannii* infection resulting in extensive graft exposure, especially in consideration of treatable conditions.

Key Words: Vascular graft; Infection; Muscle flap transposition; Rectus femoris muscle flap; Vacuum sealing drainage; Case report; Trauma

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A 32-year-old male patient was transferred to our hospital because of hip and lower limb injuries caused by heavy objects. The initial diagnosis was left femoral artery defect injury and lower limb injuries. The left femoral artery defect injury was treated by anastomosis with artificial vascular graft (approximately 10 cm in length) and lower limbs injuries were managed using femoral external fixation. After 14 d, a recurrent deep right wound developed, with an exposure of the artificial vascular graft at the distal anastomosis level and underlying tissue necrosis. His family history and past history had nothing notable.

**History of present illness**

The patient had no major trauma or damage to the blood vessels before.

**Personal and family history**

There is nothing special about the patient’s personal and family history.

**Physical examination**

In the physical examination, the external fixator was firmly fixed. An obvious severe inguinal infection and extensive exposure of an artificial vascular graft (approximately 3.5 cm in length) that was not embedded in the surrounding tissues, with underlying tissue necrosis, were observed. The peripheral sensation of the left lower limb was normal, the peripheral blood supply of left lower limb was good, and left dorsalis
pedis artery and posterior tibial artery pulsation was touched.

**Laboratory examinations**
Repeated bacteriological cultures were positive for *Acinetobacter baumannii*.

**Imaging examinations**
The first computed tomography angiography was performed in another hospital, which revealed that the left femoral artery defect injury was repaired by anastomosis with an artificial vascular graft (Figure 1).

**FINAL DIAGNOSIS**
Based on imaging findings and the pathogenic microorganism identified, we finally diagnosed the patient with an obvious severe inguinal infection caused by *Acinetobacter baumannii* and extensive exposure of the artificial vascular graft (approximately 3.5 cm in length) that was not embedded in the surrounding tissues.

**TREATMENT**
The artificial vascular graft was completely excised and the blood flow was unimpeded fortunately (Video). After initial debridement of the perivascular necrotic tissue, a continuous VSD device of 125 mmHg (17 kPa) was applied in the inguinal wound. A silicon-based dressing was used for coverage of the visible graft material and native artery in the wound; regular changes of the dressings were usually done in the ward (Figure 2).

**OUTCOME AND FOLLOW-UP**
Two weeks later, the wound was closed to protect both the anastomosis and the artificial vascular graft using rectus femoris muscle flap transposition. The large infected surgical wound was filled with a muscle flap adjacent to the biological graft and no bleeding was detected from both the anastomosis and the arterial wall. We did not add any antibiotic for *Acinetobacter baumannii* infection because of the antibiotic resistance. The muscle flap survived and the wound of the patient at risk healed successfully after 3 wk.

**DISCUSSION**
Vascular graft infection due to injury rarely involves the femoral region. It remains one of the most challenging complications in vascular trauma surgery. Local muscle flap transposition demonstrated the promising performance in the treatment of low-grade infections in the early stage but carried an unreasonable risk of failure in the high-grade infections sustained by high-virulence bacteria [1-3,5-9,11].

In our opinion, the careful analysis of patient’s medical history is particularly important. Infection occurring after the left femoral artery surgical revascularization, culture positivity for *Acinetobacter baumannii* and methicillin-resistant species, and exposure of the arterial-graft anastomosis were poor prognostic indicators for graft preservation. Furthermore, the wound infection in the groin had exposed the anastomosis and failed prior debridement and antibiotic treatment. Moreover, due to the poor general condition of the wound infected by *Acinetobacter baumannii*, surgeries including VSD and muscle flap transposition were not conducted simultaneously. Several studies have revealed a significantly increased risk for graft infection in the groin when multiple repeated surgeries were conducted [12-14].

Previous studies have reported many risk factors for vascular graft infections, such as groin incisions, wound infections, and comorbidities. A retrospective study involving 39 of 438 patients with a vascular graft infection demonstrated that renal insufficiency, hemorrhage, incisional surgical site infections, and longer procedure time could increase the risk factor for vascular graft infections. A retrospective and descriptive study including 223 patients receiving abdominal or lower extremity
Zhang P et al. Salvage of vascular graft infections

Figure 1 Computed tomography angiography. The left femoral artery defect injury was repaired by anastomosis with an artificial vascular graft.

Figure 2 A severe inguinal wound infected with *Acinetobacter baumannii* at 2 wk after surgery. The graft infection was treated by the vacuum sealing drainage (VSD) procedure (negative pressure wound therapy with 125 mmHg was commenced). A: Preoperative appearance; B: The graft was uncovered for a distance of 3.5 cm after the VSD procedure; C: The artificial graft was exposed in the right groin region and the wound revised by rectus femoris muscle flap transposition; D: The muscle flap survived and the wound of the patient at risk healed successfully after 3 wk.

Revascularization surgery identified risk factors for vascular graft infections and revealed that diabetes mellitus, hemoglobin A1c more than 7.0, blood glucose more than 180 mg/dL, and lack of mobility were preoperative risk factors; perioperative hypoxemia and hemostatic agents were intraoperative factors; admission to skilled nursing facility or acute rehabilitation facility and unscheduled clinic visits were postoperative factors. The warm, wet environment in the groin area combined with innumerable skin folds leads to a high burden of bacteria, which makes deep perivascular infected groin wounds particularly challenging to heal\cite{17,18}. VSD strategy and graft preservation had been warned in case of *Acinetobacter baumannii* infection and sepsis; however, the wound of our patient at risk healed successfully. In our case, the initial operation was conducted to reduce infection of the groin wound and vascular graft. Our surgical team had long-standing experience in the treatment of various wounds by using the VSD method, which can be useful in the prevention of peripheral arterial injury in certain challenging cases and in the development of a...
To our knowledge, active wound treatment with VSD therapy is considered a vital important modality to accelerate wound healing and improve prognosis. Selective adjunctive strategies including muscle flap coverage probably contributed to the cover of dead space, and a decreased time of wound healing and risk of recurrent infections\(^5\). The muscle flap combined with VSD therapy can be useful for speeding up wound healing\(^5\).

Several studies demonstrated the excellent performance in the use of muscle flaps for treating chronically wound beds infected with various pathogenic organisms\(^3\)\(^5\)\(^6\). These flaps have been shown to reduce healing time, lower wound bed bacterial count, improve antibiotic delivery, and obliterate dead space, thus decreasing the possibility of recurrent infection. In the present case, the muscle flap coverage was used for stable wound coverage regardless of the fate of the graft.

In addition to aggressive serial debridement and VSD, the rectus femoris muscle flap provided the best solution to promote healing of the infected field in this case. While the underlying mechanisms and biological effects of the muscle flap on the injured vessel wall remain to be proven, it is possible conduct trials with this technique to significantly improve limb salvage rates and avoid the related requirement to resort to extra-anatomic bypass, which carries high morbidity and mortality. In our opinion, with multidisciplinary treatment of malnutrition, infection, and local wound coverage along with the creative use of muscle flap closures, improved graft salvage rates and markedly increased limb salvage rates can be achieved.

**CONCLUSION**

This case highlights that VSD technique and rectus femoris muscle flap transposition could be considered in patients presenting with a severe infected groin wound with *Acinetobacter baumannii* biological vascular graft infection resulting in extensive graft exposure, especially in consideration of treatable conditions.

**REFERENCES**


