Primary selection of a pedicled rectus femoris flap for protection of aortic graft

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ABSTRACT

The rectus femoris pedicled muscle flap is a widely used option for coverage of infected vascular grafts in groin reconstruction as well as in reconstruction of abdominal wall defects. Here we present the case of primary placement of a pedicled rectus femoris flap to provide well-vascularized tissue interposed between an aortic Dacron interposition graft and bowel. This previously undescribed use of the rectus femoris proves to be an indispensable method when the more common alternatives, such as omental and rectus abdominis flaps, are not available. (J Vasc Surg Cases and Innovative Techniques 2019;5:512-7.)

Keywords: Rectus femoris flap; Aortic graft; Pedicled muscle flap

Penetrating trauma to the subdiaphragmatic aorta is a challenging injury confronting surgeons treating abdominal trauma. The mortality rates of these injuries range from 52% to 73%.1 Once initial control of arterial hemorrhage is achieved, there are several different surgical approaches to aortic reconstruction. In cases that involve ballistic injury, distant flap options may need to be considered. Dacron prostheses are often employed successfully in treatment of abdominal aortic injury.2 Omental flaps have been employed in the past century for coverage of the aortic prosthesis.3 We present the previously undescribed case of a pedicled rectus femoris muscle flap for autogenous tissue coverage of an aortic interposition graft. We found use of the muscle indispensable in this particular case and suggest its consideration when local options like omentum and rectus abdominal tissue are not available. The patient’s consent was obtained to publish the case details.

CASE REPORT

A 27-year-old woman presented to the trauma center with a gunshot wound to her posterior right paraspinal lumbar region. She was hemodynamically unstable, and thus a transfusion protocol was initiated along with an emergent exploratory laparotomy. The patient had a retroperitoneal hematoma causing elevated hemidiaphragm and a 2-cm right lateral side wall aortic injury below the level of the renal arteries. The vascular team performed an abdominal aortic repair with a 16-mm Dacron interposition graft. At the conclusion of the graft interposition, there were strong pulses over the distal aorta, external iliac arteries, and bilateral common femoral arteries.

On examination of the colon, there was injury involving >50% of the bowel wall along with feculent spillage. Because of the risk of infection, a combination of therapies were initiated; intravenous antibiotics and a series of abdominal washouts containing antibiotic fluid began at day 6 along with the placement of antibiotic beads around the aorta. The patient was left in discontinuity and the abdomen remained open with the ABThera device (Acelity, San Antonio, Tex). The reconstructive surgery service was consulted after débridement of the retroperitoneum to evaluate options for coverage of the exposed graft.

Because of destruction of >50% of the abdominal muscles from the initial ballistic injury, a pedicled rectus abdominis flap was not an option. On day 9 of the patient’s initial presentation, we elected to perform a rectus femoris muscle fascial flap for aortic graft coverage. The trauma surgery service removed the antibiotic beads, performed an end-ileostomy, and closed the abdomen. Preoperative computed tomography scan showed post-aortic graft placement approximately 2 cm below the ostium of the superior mesenteric artery, just below the level of the renal artery takeoff and terminating 2.6 cm proximal to the aortic bifurcation for a total length of 12 cm of exposed aortic graft requiring coverage (Fig 1). An incision was made in a retroperitoneal, anterior superior iliac spine to the middle of the patella. The muscle fascia was encountered and opened superiorly. A 4-cm slip of fascia was left attached to the distal aspect of the rectus femoris muscle to provide additional length to secure the distal portion of the flap to the superior aspect of the retroperitoneum (Fig 2, A). The medial and lateral aspects of the rectus femoris were

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identified between the vastus lateralis and vastus medialis muscles (Fig 2, B). The pedicle was delineated approximately 10 cm distal to the pubic tubercle (Fig 3, A). The descending branch of the lateral circumflex femoral artery and its perforator to the rectus femoris were identified as well. The rectus femoris was dissected away from its lateral and medial borders and then divided at the tendinous insertion on the patella. On circumferential dissection, the muscle was determined to be of adequate reach for the desired retroperitoneal placement. The vascular team then performed an infrainguinal ligament dissection along a plane between the femoral sheath and the inguinal ligament. The flap was then transposed under the sartorius, below the inguinal ligament, and into the retroperitoneal cavity (Fig 3, B). This then provided tension-free coverage of the aortic graft without stress on the flap’s pedicle. A pencil Doppler probe was subsequently used to assess the integrity of the pedicle, which was found to have strong biphasic signals. The fascia of the rectus femoris flap was inset to the surrounding psoas major and the tissue surrounding the aortic graft (Fig 4). The donor thigh was closed in layers with two 19F round drains left in place because of significant edema (Fig 5). The entire procedure from dissection to inset and thigh closure was completed in 2 hours.

Although the patient had a prolonged hospital course because of respiratory, renal, and spinal injuries, there were no noted complications related to the rectus femoris flap or

![Fig 1. A, Dacron interposition aortic graft intraoperative view. B, Three-dimensional computed tomography image reconstruction with surrounding antibiotic beads.](image)
aortic graft. The donor site incision healed without incident. One month after surgery, all sutures and drains were removed. The aortic graft was intact, with no evidence of fistula formation or fluid collections on follow-up imaging. The patient was transferred to rehabilitation at 2 months after trauma for continued physical therapy and wound care. On assessment at 5 months after injury, the patient was found to have good wound healing. Antibiotics as well as enoxaparin therapy for anticoagulation will be continued throughout the course of this patient’s life.

**DISCUSSION**

The pedicled rectus femoris muscle flap has been used in the past with success for abdominal wall reconstruction or for coverage of infected arterial groin grafts. This case suggests, however, that the rectus femoris muscle flap can be used in a novel manner for optimum choice to cover aortic grafts when more traditional flaps are unavailable. The rectus femoris is a long, bulky muscle with a wide arc of rotation and a robust blood supply from the deep femoral artery.

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Fig 2. **A.** Rectus femoris with slip of fascia intact at distal end. **B.** Rectus femoris free from vastus lateralis and medialis.
that provides effective coverage to a larger wound area.

Because omentum was unavailable in this case, a pedicled rectus femoris muscle was positioned between the aortic graft and the peritoneal cavity to prevent an aortoenteric fistula. The vascularized rectus femoris tissue flap covered the aortic graft in a tension-free manner, provided bulk to obliterate dead space around the graft site, and provided viable tissue to increase oxygenated blood and antibiotic flow to a site potentially at high risk of infection. Bringing well-vascularized tissue to synthetic graft sites has been shown to improve healing time and to lower bacterial counts.\(^3\) In addition, because the timing between graft infection presentation and muscle flap coverage seems to be one of the most important predictors of a successful graft outcome and lower morbidity and mortality, it was decided in this case to perform a prophylactic rectus femoris flap particularly because of a contaminated operative field.

Flap selection is often based on several factors, such as size of the defect, risk for infection, assessment of muscle, and extent and location of the vascular disease.\(^5\) The type of muscle flap used has also been shown to affect the overall salvage rate of infected vascular grafts. A 2015 study of 244 patients undergoing either

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**Fig 3.** A, Identification of the lateral circumflex femoral artery. B, Rectus femoris tunneled below inguinal ligament with sartorius over rotated flap.
prophylactic or salvage muscle flap coverage concluded that sartorius muscle flaps are better suited in prophylactic settings and salvage procedures in which the wound bed is small, whereas rectus femoris flaps are more appropriate for larger salvage operations. However, this study and the majority of available literature describe the use of muscle flaps in the presence of active infection at the groin site. We could find no case of a rectus muscle flap for aortic graft coverage to prevent infection.

**CONCLUSIONS**

Graft exposure and associated infection are well-known risk factors of graft failure increasing the risk of mortality. In trial studies to decrease the risks, complications, and bills of service, there is a growing trend for use of the
Therefore, we elected to apply this principle of proactive preventive treatment by performing a muscle flap in a patient requiring aortic grafting. The placement of the rectus femoris flap can be considered at the initial insertion of the aortic graft before the onset of infection in cases in which local options, such as the omentum and rectus abdominis flaps, are found to be compromised from penetrating intra-abdominal injuries.

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