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Reconstructive

Arteriovenous Loops for Free Flaps to the Abdomen and Pelvis: Case Reports and Pearls

Puja Jagasia, BA
Shivani A. Shah, MD, MBA
Kazimir Bagdady, BS
Gregory A. Dumanian, MD
Megan E. Fracol, MD

Summary: Arteriovenous (AV) loops formed from the greater saphenous vein and femoral artery can facilitate free tissue transfer to the abdomen or pelvis when adequate recipient vessels are not available. Here, we present the application of this technique in 3 cases where patients had significant abdominal or pelvic defects due to oncological resection or trauma. AV loops were successfully created using a saphenous vein turned up into the femoral artery at the level of the groin. These loops were then tunneled through the groin and cut back to form recipient vessels for anterolateral thigh (ALT) flaps in a single-stage procedure. In all 3 cases, AV loops constructed with this technique served as reliable conduits for free ALT flaps. Only 1 complication occurred. Following a drop in tissue oximetry, 1 patient was taken back to the operating room. A stitch was found to be compressing the pedicle. Following release, no further complications were observed and all patients achieved complete wound healing. In this article, we highlight key surgical techniques to maintain the orientation of the vein during AV loop anastomosis, which prevents kinking. We provide technical insights regarding tunneling the AV loop through the groin without compression, anchoring the pedicle appropriately, and positioning the ALT flap anastomosis. Our success with this technique underscores its potential in facilitating complex pelvic and abdominal reconstruction. *(Plast Reconstr Surg Glob Open 2025; 13:e6530; doi: 10.1097/GOX.0000000000006530; Published online 7 February 2025.)*

INTRODUCTION

Free flaps to the abdomen and pelvis typically use recipient vessels that are abdominally based, such as the inferior epigastric vessels.[1–4] Many patients may have poor recipient vessels from prior surgery or trauma, posing a challenge. Positioning the pedicle such that there is appropriate anchoring for pelvic flaps and no compression while exiting the anterior fascia for abdominal flaps also poses a challenge.

Arteriovenous (AV) loops created from the greater saphenous vein (GSV) and femoral artery can facilitate free tissue transfer to the abdomen or pelvis when other recipient vessels are not available. Using this technique allows for the pedicle to be secured on the lower abdominal wall with enough length without kinking. Here, we describe the application of this technique through 3 cases.

In the first case, a 69-year-old man with a history of osteomyelitis of the pubic symphysis, abdominoperineal resection, radiation, and prior omental flap to the pelvis presented for pubic symphysis debridement. After debridement, a 5-cm-wide pelvic defect extended from below the rectus muscles to the tip of the coccyx. The second case involved a 69-year-old man with a history of rectal cancer, neoadjuvant chemotherapy/radiation, open lower anterior resection with coloanal anastomosis, and diverting loop ileostomy with ileal conduit. He presented with bilateral ostomies placed through the rectus muscles, eliminating the option for a pedicled rectus abdominis-based flap. The final case involved a 19-year-old man after a significant pelvic trauma after a vehicular crush injury. Four days after anterior pelvic external fixation, the decision was made to move forward with definitive fixation of the pelvic ring followed by a local flap to cover the defect seen in Figure 1. A large, 18 × 30 cm subtotal anterolateral

From the Division of Plastic Surgery, Department of Surgery, Northwestern Feinberg School of Medicine, Chicago, IL.

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thigh (ALT) flap was designed. However, the dissected vessels were unable to provide adequate length for the flap to cover the defect, which necessitated conversion to a free flap.

In each case, an ALT free flap was used for pelvic coverage, and abdominally based recipient vessels were of poor quality. Instead, an AV loop was created by anastomosing the GSV to either the common or superficial femoral artery in an end-to-side fashion with 7-0 or 8-0 prolene (Fig. 2A). This created a 30-cm AV loop, which was then passed through a tunnel from the groin into the abdomen (Fig. 2B). The ALT flap was loosely inset into the pelvis to determine the required length of the recipient vessels, and the AV loop was cut back accordingly.

The veins were coupled with a coupler or 7-0 prolene, and the artery was anastomosed end-to-end using 7-0 or 8-0 prolene. All patients were discharged between postoperative day (POD) 9 and POD 29. The only complication occurred on POD 1 of the second case after an acute drop in tissue oximetry. Upon exploration, a single stitch was found compressing the pedicle. After the release of the stitch, oxygen saturation readings normalized. The patient developed a postoperative fluid collection in the pelvis that resolved with drain placement. At the latest follow-up, which ranged from postoperative months 3 to 13, all patients had healed well with no further complications. Figure 3 shows a 1-year postoperative photograph of case 3.

DISCUSSION

Our surgical technique of using a GSV and femoral artery AV loop to form recipient vessels for pelvic and abdominal free flaps can be advantageous when applied to patients with suboptimal recipient vessels due to prior surgery or trauma. It also allows flaps to reach higher on the abdomen without tension. (**See figure, Supplemental Digital Content 1**, which displays a diagram of the AV loop showing key technical points. First, all fascial attachments around the GSV must be released to its origin at the femoral vein to allow for maximum mobility. Next, the anastomosis should be beveled at an angle such that the vein travels in the superior direction, toward the abdomen. Finally, there are multiple places at which to divide the AV loop, which should be chosen based on the required length of recipient vessels, **http://links.lww.com/PRSGO/D847**.) First, when flipping the vein up toward the groin, it is important to maintain orientation and avoid any twist in the vein. We routinely mark the medial side with a 7-0 prolene and the lateral side with a 7-0 nylon before flipping upward to help maintain orientation. While flipping upward, we hold the distal vein out to length until bringing it to touch the femoral artery to again prevent any spiral in the vessel. The anastomosis between the GSV and femoral artery should be beveled such that the vein takes off from the artery in a superior direction. All fascial attachments around the GSV should be released to the level of its takeoff from the femoral vein so that it can travel superiorly without kinking. It is not uncommon to get some spasm initially in the AV loop, but it should be visibly pulsating by the time the pedicle anastomosis is performed. If not visibly pulsating, then troubleshooting should be done before proceeding with the pedicle anastomosis (oftentimes this is due to a spiral in the loop, and untwisting of the spiral immediately reestablishes pulsatile flow). A wide tunnel should be created between the groin and the abdomen to avoid any compression. The point of anastomosis between the flap pedicle and the AV loop should be located on the anterior abdominal wall, not free-floating in the pelvis. The flap itself should make the turn into the pelvis to avoid pressure or kinking on the pedicle. Finally, we have not found it necessary to break this into 2 stages. We find the AV loop itself is at higher risk of kinking if left for a second stage due to the lack of firm attachments before anastomosis to a pedicle.

This technique is not without its limitations. In cases that necessitate this approach, patients may also have trauma or vascular conditions that affect the femoral vein and artery, which would prevent the creation of this AV

Takeaways

Question: What surgical technique can be used for free tissue transfer to the abdomen or pelvis in cases when abdominally based recipient vessels are not available?

Findings: Here, we present the application of a technique that utilizes arteriovenous (AV) loops to create recipient vessels and facilitate free tissue transfer in 3 cases where patients had significant abdominal or pelvic defects due to oncological resection or trauma. We highlight key surgical techniques regarding AV loop creation, anchoring the pedicle appropriately, and positioning the anastomosis.

Meaning: AV loops formed from the greater saphenous vein and femoral artery can facilitate free tissue transfer to the abdomen or pelvis when other adequate recipient vessels are not available.

Fig. 1. Defect needing free flap closure following vehicular crush injuries and internal fixation of pelvic ring (case 3).

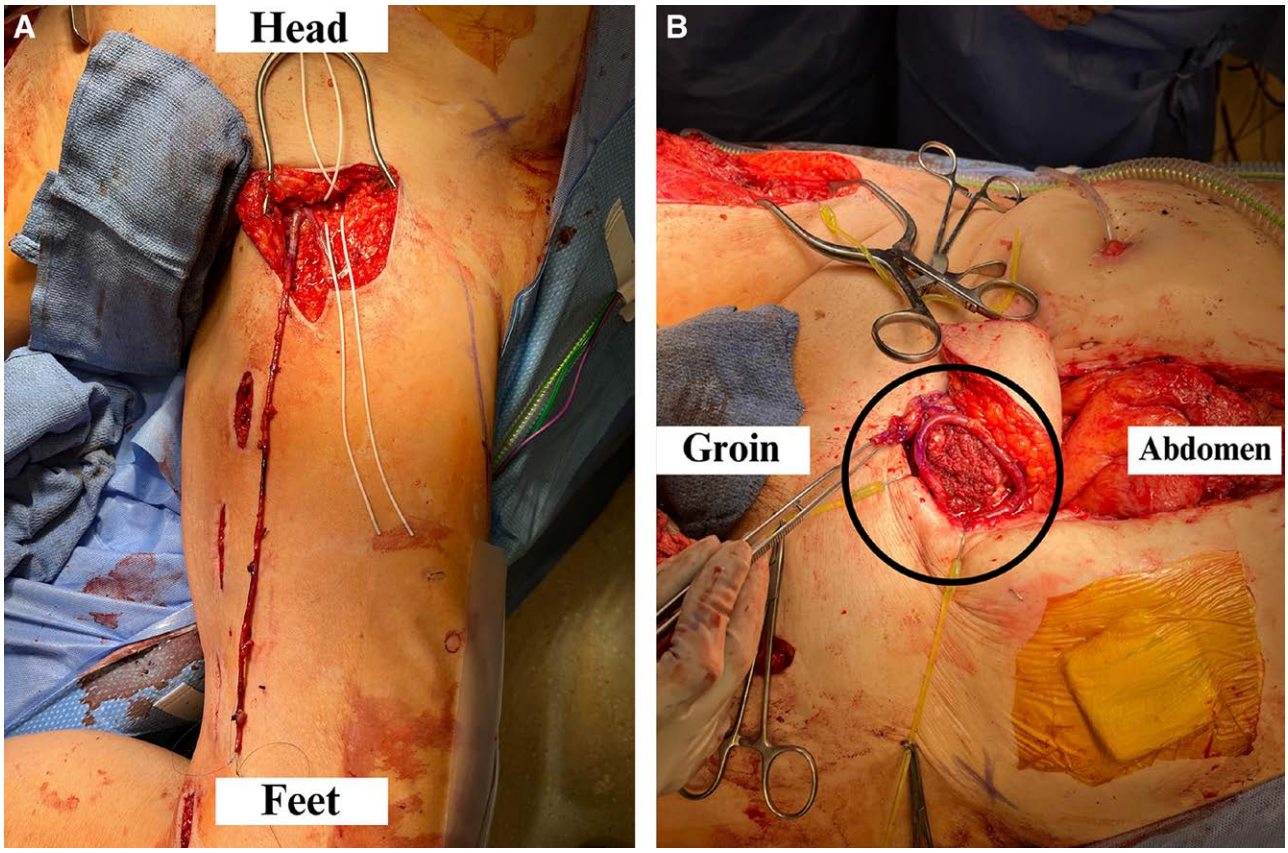

Fig. 2. Intraoperative photos. A, GSV dissected with marking sutures on the distal end to maintain medial/lateral orientation. B, AV loop (circled) tunneled from the groin to the abdomen.

Fig. 3. One-year postoperative result following ALT flap to cover pelvic defect and skin grafting to donor site (case 3).

loop. We typically get a venous duplex study preoperatively to confirm GSV patency. Additionally, AV loop creation is associated with increased cardiac output and dilation of all cardiac chambers, which may limit its application to patients with cardiovascular conditions such as heart failure.[5,6] Successful application of this technique requires a surgeon skilled in microsurgery. This does require an additional anastomosis, increasing the risk of anastomotic failure.

Nevertheless, our technique allows for successful free tissue transfer to the abdomen or pelvis in the absence of abdominal recipient vessels. By utilizing the GSV and femoral artery to create an AV loop, surgeons can ensure adequate recipient vessel length and positioning that allow for optimal placement of abdominal and pelvic free flaps.

Megan Fracol, MD
Division of Plastic Surgery
Northwestern Memorial Hospital
259 E Erie St, Suite 2060
Chicago, IL 60611
E-mail: mfracol@nm.org

DISCLOSURE

The authors have no financial interest to declare in relation to the content of this article.

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