Management of Free Fillet Flap Transfers in Large Oncologic Resections

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**INTRODUCTION**

A fillet flap is a reliable flap that provides healthy nonradiated otherwise discarded tissue for coverage of large oncologic resections without creating a new donor site.\(^1\) Decrease in healing time may expedite adjuvant treatment therapy and prosthetic fitting and preserve other potential myocutaneous flaps for any future reconstruction.

We reviewed eight cases of reconstruction following four hemipelvectomies, one below the knee amputation, and three forequarter amputations. All eight cases resulted in large defects that required a fillet flap for coverage (Table 1). The aim of our study was to analyze the progression of the free fillet flap outcomes and identify the steps that lead to a successful reconstruction.

**Background:** The fillet flap is a reliable flap for reconstruction of large deformities following oncologic resection. It provides healthy, nonradiated tissue for coverage with the secondary benefit of preserving other potential donor sites for reconstruction.

**Methods:** A retrospective review of the medical records of eight patients who underwent fillet flap reconstruction from 2013 to 2021 at Mayo Clinic, Arizona, were analyzed.

**Results:** Eight patients who underwent four hemipelvectomies, three forequarter amputations, and one below the knee amputation were identified. Patients’ ages ranged between 24 and 66 years. All indications for oncologic ablation were curative. Defect sizes ranged from 16×20 to 30×60 cm. Four pedicled flaps and four free fillet flaps were performed. Indication for free fillet flap was tumor invasion of local vascular structures. There was no flap loss in the pedicled group (follow-up ranged from 1 to 9 years), and one of four free fillet flaps had a successful long-term outcome (follow-up 36 months).

**Conclusions:** Successful free fillet flap reconstruction in the setting of oncologic resection is a difficult task to achieve. Changes to the management of case 3F allowed for a successful transfer. Immediate elevation and anastomosis of the flap before oncologic resection, large caliber recipient vessels and isolation from the zone of injury, protection of the anastomosis, and delay in flap inset all contributed to flap survival. It is our belief that applying these general considerations in large oncologic resections with free fillet flap transfer may aid in successful flap transfer and improve its survival odds. (Plast Reconstr Surg Glob Open 2022;10:e4689; doi: 10.1097/GOX.0000000000004689; Published online 28 November 2022.)

**DISCLOSURE**

The authors have no financial interest to declare in relation to the content of this article.
to 30×60 cm. Four pedicled and four free flaps were reviewed. Indication for free fillet flaps was oncologic invasion of local vascular structures. Pedicled fillet flaps were considered a successful outcome secondary to no flap loss with follow-up of 1–9 years. Three free fillet flaps (N = 3/4, 75%) had successful intraoperative transfers with viable flaps. However, only one (N=1/4, 25%) flap had a successful long-term survival with follow-up of 36 months (Table 2).

**FREE FILLET FLAP OPERATIVE DETAILS**

In cases 1F and 2F of lower and upper extremity free fillet flap reconstruction, the extremities were partially filleted on the operating room (OR) table and amputated. Final flap elevation was completed on the back table while the ablation continued. Both cases required venous and arterial thrombectomies with re-anastomosis. The flaps were removed with final reconstruction done with free latissimus dorsi and pedicled transverse rectus abdominis myocutaneous flaps, respectively.

Case 3F was a lower extremity free fillet flap. The flap was elevated on the superficial femoral artery and vein (SFA/V). (See Video [online], which displays the perfusion through the SFA and SFV before removal of the flap and initiation of ischemia time.) The vessels were tunneled subcutaneously, and anastomosed to the subclavian vasculature before tumor ablation (Figs. 1 and 2). The flap was not inset while the patient underwent hemodynamic stabilization in the intensive care unit (ICU). The patient was taken back to the OR on postoperative day 0 for SFV evaluation in the subcutaneous tunnel and on the second day for flap inset.

Case 4F was a lower extremity free fillet flap which was carried out in a similar fashion to case 3F. However, during hemodynamic stabilization in the ICU, the patient experienced pulseless electrical activity (PEA). Secondary to hemodynamic instability, the decision to clamp off the vessels was made. The fillet flap was removed, and the final reconstruction was done with a free serratus and latissimus dorsi myocutaneous flap.

**DISCUSSION**

Local flap coverage options for large defect reconstructions have shown an overall 39% complication rare with 35% wound infection rates and 16% flap necrosis rates. In contrast, the free fillet flap reconstruction has shown a 15%–18% complication rate consisting of partial flap necrosis and vascular compromise. Kreutz-Rodriguez et al. in their two case series of 10 and 12 free fillet flaps report only one flap loss and a 14% complication rate with wound healing and venous thrombosis.

In cases with early flap elevation protocols, ischemia time is directly dependent on the final flap elevation after limb amputation and ablation of the tumor. Furthermore, with delayed final flap elevation, donor vessels may become thrombosed secondary to stasis, hypercoagulable state, and chronic inflammation. Ver Halen et al. showed a decrease in ischemia time from 6 to 2.3 hours with routine

| Table 1. Patient Characteristics |
|----------------------------------|
| **Case** | **Year of Surgery** | **Age, y** | **Sex** | **Diagnosis** | **Origin** | **Invasion** | **Prior Surgery** |
| 1 | 2013 | 24 | M | Osteomyelitis | MVC—tibia and fibula nonunion | None | Hardware placement, multiple wound management surgeries |
| 2 | 2016 | 56 | M | High-grade pleomorphic sarcoma | Unknown | None | R shoulder mass lanced and packed in local ER 7 mo prior |
| 3 | 2021 | 43 | F | Peripheral nerve sheath tumor | Brachial plexus | None | No |
| 4 | 2021 | 26 | F | Mucinous adenocarcinoma | GI origin | None | No |
| 1F | 2014 | 54 | M | High-grade osteoblastic osteosarcoma | Right iliac bone | Right iliac vessels | LAR and ileostomy creation for stage 3 rectal cancer |
| 2F | 2019 | 66 | F | High-grade spindle cell carcinoma as well as radiation-induced sarcoma | Recurrence of a radiation-induced sarcoma | Right axilla, scapula, gleno-humeral joint, chest wall, axillary neurovascular bundle, and brachial plexus | Right axillary carcinoma resection, 2× right axillary mass resection, right axillary and anterior 2nd and 3rd rib, clavicle and pectoralis muscle resection |
| 3F | 2020 | 34 | M | High-grade chondroblastic osteosarcoma | Right iliac bone | Right common iliac, IVC | No |
| 4F | 2021 | 50 | M | Pelvic chondrosarcoma | Right hemipelvis | Mass effect on the iliac vessels, bowel, bladder, and sciatic nerve/lumbosacral plexus | No |

**Takeaways**

**Question:** What steps lead to a successful free fillet flap transfer?

**Findings:** Immediate elevation and anastomosis of the flap, large caliber recipient vessels, isolation from the zone of injury, protection of the anastomosis while the other teams ablate the tumor, and delay in flap inset during hemodynamic stabilization contributed to flap survival.

**Meaning:** Consider initiating the free fillet flap case by being the first team in the operating room that is elevating and anastomosing the flap before limb amputation in an anatomic region distant from the tumor resection.
Similarly, in case 3F, the key difference leading to a successful outcome was flap elevation and immediate anastomosis to large subclavian vessels outside the zone of injury before limb amputation and tumor ablation (Figs. 1 and 2).

Vascular anastomosis to subclavian vasculature created a technically reliable anastomosis with fast flap reperfusion and protected the patency of the anastomosis while tumor ablation continued. A designated plastic surgery team member along with Vioptix near-infrared spectroscopy were also used to safeguard the flap, while the other teams continued to work.

The decision to not inset the flap further optimized flap survival. The flap experienced congestion due to the kinking of the femoral vein in the subcutaneous tunnel, which was quickly identified and immediately explored. The flap was successfully inset and the patient was able to begin his physical therapy and adjuvant chemotherapy within 2 months of his primary resection and reconstruction (Fig. 3).

Although attempts to minimize operative time with prior day spine stabilization and ureter stent placement, the tumor resection results in a long operative day with significant blood loss. All four of the free fillet flap cases required initiation of massive transfusion protocols and hemodynamic stabilization in the ICU.

Prior studies have not found transfusion affecting flap survival in hemipelvectomy patients; however, only one of 160 cases was a free fillet flap. Nonetheless, in the head and neck literature, postoperative complications were positively correlated with the administration of one or more units of blood products.

Hemodynamic instability and the initiation of massive transfusion protocols are the one uniting factor in the four free fillet flaps, with only one flap having survived the insult. In case 4F hemodynamic instability that resulted in PEA was the deciding factor in removal of a viable flap.

### Table 2. Perioperative Details

| Case | Surgery       | Flap Vascular Supply | Flap Donor Vessels | Recipient Vessels | Ischemia Time | Anastomosis | Defect Size | Perioperative Complications |
|------|---------------|----------------------|-------------------|------------------|--------------|-------------|-------------|---------------------------|
| 1    | BKA           | Pedicled             | Distal lower leg and foot fillet flap | Anterior and posterior tibial | Pedicled | None          | Not recorded | None                     |
| 1F   | Hemipelvectomy| Free                 | Right thigh soft tissue | Femoral artery and vein | Common iliac artery and vein | 2+ hs       | End to end (1 cm in diameter) | 16 × 20 cm | Massive transfusion protocol, venous thrombosis |
| 2    | Forequarter   | Pedicled             | Right forearm fillet flap | Brachial artery and veins (venae comitantes) | Distal blood supply | 2+ h       | End to side (4 mm in diameter) | 33 × 42 cm | None |
| 2F   | Forequarter   | Free                 | Right upper arm fillet flap | Lingual artery and anterior cervical vein | Pedicled | None          | 17 × 25 cm | Massive transfusion protocol, coagulopathy, flap failure—arterial and venous thrombosis |
| 3    | Forequarter   | Pedicled             | Trapezius          | Subclavian artery and vein | 50 min     | End to side subclavian (1 cm in diameter) | 25 × 20 cm | Massive transfusion protocol, kinking of the femoral vein in the subcutaneous tunnel |
| 3F   | Hemipelvectomy| Free                 | Right lower leg fillet flap | Femoral artery and vein | Subclavian artery and vein | 50 min     | End to end (4–5 mm diameter) | 16 × 20 cm | None |
| 4    | Hemipelvectomy| Pedicled             | Lower leg fillet | Femoral artery and vein | AV loop on contralateral side | None       | 52 × 21 cm | Massive transfusion protocol. Postoperative day 0—PEA, clamping the vessels supplying the flap |
| 4F   | Hemipelvectomy| Free                 | Lower leg fillet | Femoral artery and vein | AV loop on contralateral side | 50 min     | End to end (4–5 mm diameter) | None | 52 × 21 cm | None |

Fig. 1. Filleted right lower extremity below the knee connected through the patent SFA and SFV.

Fig. 2. End to side anastomosis of SFA and SFV to subclavian artery and vein in the right upper chest.
As the tumor ablation and reconstruction teams, we must identify an algorithm for hemodynamic control in order to limit intraoperative blood loss. However, more analysis needs to be done to minimize hemodynamic decompensation and initiation of massive transfusion protocols.

**CONCLUSIONS**

We identified parameters that allowed the flap in case 3F to have a successful transfer: immediate elevation and anastomosis of the flap, large caliber recipient vessels with isolation from the zone of injury, protection of the anastomosis while the other teams work, and delay in flap inset. Nellie V. Movtchan, MD

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Fig. 3. Reconstructed fillet flap over the right lower abdomen 27 days postoperatively.