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IDEAS AND INNOVATIONS

Reconstructive

Management of Free Fillet Flap Transfers in Large Oncologic Resections

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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.)*

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.

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PATIENTS AND METHODS

The case series was deemed exempt by the institutional review board. A retrospective review of eight patient medical records was done between the years of 2013 and 2021 at the Mayo Clinic in Arizona.

RESULTS

We identified four women and four men with ages ranging between 24 and 66 years. All indications for ablation were curative. Defect sizes ranged from 16×20

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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 supplying the free fillet flap was made. The fillet flap was removed, and the final reconstruction was done with a free serratus and latissimus dorsi myocutaneous flap.

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.

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.[2–9] Kreutz-Rodriguez et al[8] 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.[9]

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[3] 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	F	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

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	Pedicled	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	Pedicled	None	Pedicled	33 × 42 cm	None
2F	Forequarter	Free	Right arm fillet flap	Brachial artery and veins (venae comitantes)	Lingual artery and anterior cervical vein	2+ h	End to side (4 mm in diameter)	17 × 25 cm	Massive transfusion protocol, coagulopathy, flap failure—arterial and venous thrombosis
3	Forequarter	Pedicled	Trapezius	Distal blood supply	Pedicled	None	Pedicled	60 × 30 cm	None
3F	Hemipelvectomy	Free	Right lower leg fillet flap	Femoral artery and vein	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
4	Hemipelvectomy	Pedicled	Lower leg filet	Femoral artery and vein	Pedicled	None	Pedicled	52 × 21 cm	None
4F	Hemipelvectomy	Free	Lower leg filet	Femoral artery and vein	AV loop on contralateral side	50 min	End to end (4–5 mm diameter)	16 × 20 cm	Massive transfusion protocol. Postoperative day 0—PEA, clamping the vessels supplying the flap

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

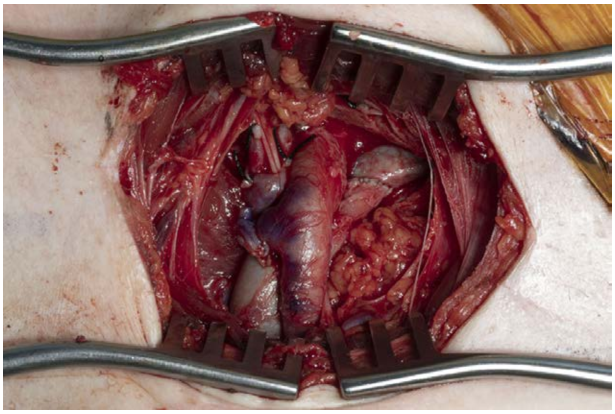

Fig. 2. End to side anastomosis of SFA and SFV to subclavian artery and vein in the right upper chest.

flap harvest before limb amputation, and reported one case of flap revascularization before the ablation.

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 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.[6] Nonetheless, in the head and neck literature, postoperative complications were positively correlated with the administration of one or more units of blood products.[10]

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.

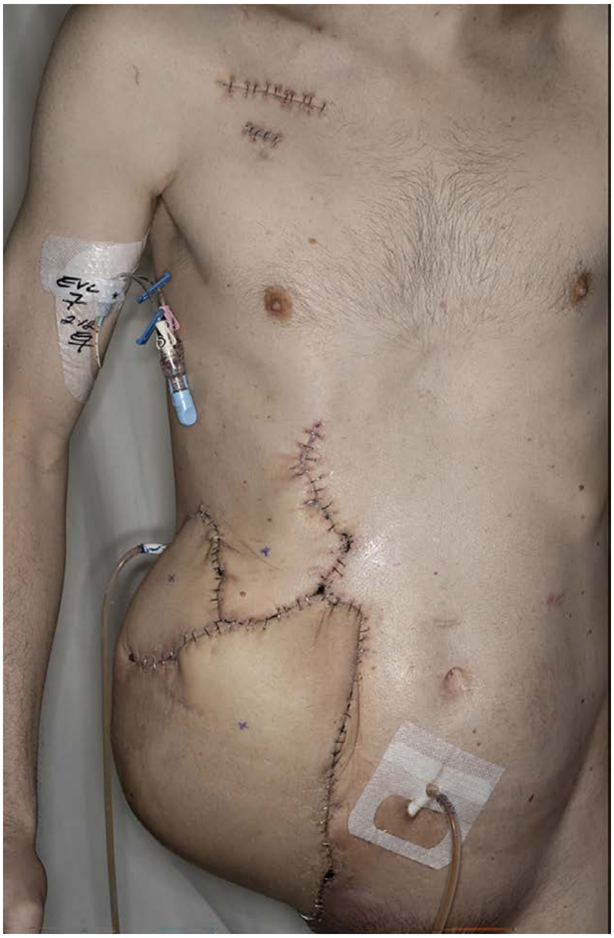

Fig. 3. Reconstructed fillet flap over the right lower abdomen 27 days postoperatively.

As the tumor ablation and reconstruction teams, we must identify an algorithm for hemodynamic control in order to limit intraoperative blood loss.

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. However, more analysis needs to be done to minimize hemodynamic decompensation and initiation of massive transfusion protocols.

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