DISCLOSURE

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

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e Lymphatic Drainage Reconstitution in DIEP Flap Procedures

The deep inferior epigastric perforator (DIEP) flap transfer is the gold standard of breast reconstruction in many clinical scenarios, with more than 9000 performed in the United States in 2017. However, the overall complication rate for this procedure is greater than 40 percent in large series[1,2] and includes infection, delayed wound healing, skin necrosis, and fat necrosis. The lymphatic system plays many important roles in fluid homeostasis and immunology, with dysfunction leading to infection, lymphedema, and pain. The potential role of lymphatic reconstitution in microsurgical breast reconstruction has not previously been studied.

Specifically, studies have documented lymphatic reconstitution after free tissue transfer without the need to directly anastomose the lymphatic channels.[3,4] Moreover, a recent report suggested that aligning free flaps so that divided donor and recipient lymphatic channels come into proximity improves lymphatic reconstitution.[5] In this report, seven free tissue transfer patients underwent intraoperative indocyanine green lymphography to determine lymph channel orientation, with flaps inset to align the lymph channels of the flap and the recipient site. All patients underwent repeated indocyanine green lymphography at 3 months postoperatively. Ninety-six percent of the free flaps had reconstitution if lymphatic channels were aligned during surgery, whereas 0 percent of the larger series of free flaps demonstrated reconstitution if lymphatic channels were not aligned in the operating room.

Interestingly, neither the mapping of lymphatics in DIEPs nor studying alignment of these lymphatics at time of transfer to the chest has previously been described. We are undertaking a pilot randomized clinical study to map the superficial lymphatic drainage of DIEP flaps during breast reconstruction. Intraoperatively, patients randomized into the study arm will have their DIEP flap lymphatics aligned with lymphatics at the recipient site. All patients will undergo indocyanine green lymphography to determine native lymphatic drainage of the planned abdominal flap [**see Figure, Supplemental Digital Content 1**, which shows overlay of intraoperative indocyanine green fluorescence lymphangiography images and white light images of a right abdominal flap before incision. Five injection points were used, based on the center of the marked flap border. The main lymphatic drainage of the flap is seen to track to the right inguinal area, ***http://links.lww.com/PRS/E670***.] and the chest recipient site. Flaps of patients in the control arm will be oriented for inset based on flap shape, pedicle anatomy, and recipient vessel anatomy, regardless of mapped lymphatic patterns. Postoperative indocyanine green lymphangiograms will be used to record time to lymphatic reconstitution. [**see Figure, Supplemental Digital Content 2**, which shows overlay of postoperative indocyanine green fluorescence lymphangiography images and white light images of the right abdominal DIEP flap after transfer to the left chest, at 3-week follow-up. Five injection points were used based on the center of the skin paddle. Lymphatic drainage is seen to progress past the suture line, superomedially, ***http://links.lww.com/PRS/E671***.] Ultimately, we are interested in studying the potential affects lymphatic alignment may have on postoperative outcomes, including complications.

This pilot study was approved by the Beth Israel Deaconess Medical Center Institutional Review Board and is funded by the Facilitating Innovative Research and Surgical Trials Program at the Beth Israel Deaconess Medical Center, Boston, Massachusetts.

Although our pilot study's primary goal is to establish feasibility, we hypothesize that the abdomen will have a relatively constant lymphatic drainage pattern before flap harvest, and that flaps will re-establish lymphatic drainage over the course of the first 2 to 4 postoperative weeks. We further hypothesize that the time to reconstitution will be reduced by intraoperative aligning of the divided lymphatic channels, without the need for performing a direct anastomosis between the divided ends, and that this improved drainage will lead to a lower rate of local complications, such as delayed healing and infection. Ultimately, a randomized control trial would be required to rigorously study these hypotheses.

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The Case for Palliative Reconstruction

The American College of Surgeons defines surgical palliative care as interdisciplinary care the delivery of which is chiefly concerned with relief of suffering.[1] In essence, palliative surgery is offered to improve quality of life, while providing negligible survival benefit. Surgical palliation has been utilized by several disciplines, including general surgery, neurosurgery, orthopedic surgery, otolaryngology, and gynecology. Frequently, it is used in the setting of malignancy for pain and symptomatic relief.[2]

Less commonly, palliative surgery is used for complex reconstruction. There is concern that an extensive extirpative operation requiring formal reconstruction may be inappropriate in terminal patients. While this concern is valid, we contend that palliative reconstruction is clinically and ethically justified in appropriate settings and offer a case example in support.

A 96-year-old, highly functional man with a history of sarcoma to the left thigh presented with undifferentiated pleomorphic sarcoma to the lateral right knee with intraarticular involvement (Fig. 1). Above-knee amputation was recommended; however, the patient rejected this, as his most important concerns were leg preservation and ambulation. Aggressive tumor growth limiting ambulation and impending lesion ulceration rendered nonsurgical options suboptimal. Therefore, he underwent radical resection with planned positive margins. [**See Figure, Supplemental Digital Content 1**, which shows deep surface of excised specimen, ***http://links.lww.com/PRS/E672***.] Prior radiotherapy and exposure of vital structures (Fig. 2) necessitated reconstruction with vascularized tissue using a free vastus lateralis flap. [**See Figure, Supplemental Digital Content 2**, which shows defect coverage with free vastus lateralis flap (anastomosed to lateral geniculate vessels) and dermal regeneration matrix, ***http://links.lww.com/PRS/E673***.] The flap was covered with a dermal regeneration template, followed by staged skin grafting. [**See Figure, Supplemental Digital Content 3,** which shows meshed split-thickness skin graft overlying flap, ***http://links.lww.com/PRS/E674***.] This approach facilitated fulfillment of the patient's wishes, namely, leg salvage and ability to ambulate, and provided effective palliation.

There is a paucity of literature examining palliative reconstruction in plastic surgery. Few reports have suggested that it is effective and safe.[3] Nevertheless, its implementation in practice has been limited. This is due to significant risks associated with complex reconstruction in general, including physiologic risks and economic implications.[4] Further, it remains unknown whether palliative reconstruction actually translates to improved quality of life. An additional factor potentially responsible for its restricted application relates to reduced surgeon comfort/experience with reconstruction in terminal patients.

Interestingly, palliative surgery is similar to reconstructive surgery in that they both aim to provide symptomatic and quality-of-life improvement without survival benefit. They differ in patient selection (i.e., reconstructive surgery is not limited to dying patients). The two are not mutually exclusive, however. As with the case

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