

# Power-Assisted Liposuction: An Important Tool in the Surgical Management of Lymphedema Patients

Melisa D. Granoff, BA, Jaime Pardo, MD, and Dhruv Singhal, MD

## Abstract

**Background:** Debulking via power-assisted liposuction has been established internationally as the gold standard for patients with chronic fat-dominant lymphedema. In this study we share our experience implementing a debulking surgery program in the United States.

**Methods and Results:** A retrospective review was performed of patients who underwent debulking surgery using power-assisted liposuction at a single institution. Between December 2017 and January 2020, 39 patients with lymphedema underwent 41 extremity debulking procedures. In patients with lymphedema of the upper extremity, median excess volume reduction was 111% at 6 months and 116% at 12 months post-operatively. In patients with lymphedema of the lower extremity, excess volume reduction was 82% at 6 months and 115% at 12 months post-operatively. L-Dex and quality of life improved across all domains in upper and lower extremity patients as well.

**Conclusion:** Debulking with power-assisted liposuction is an effective treatment for chronic lymphedema, supported by improvement in both objective and subjective metrics.

**Keywords:** lymphedema, lymphatic surgery, liposuction, debulking, lipectomy

A STANDARDIZED MULTIDISCIPLINARY workup and treatment protocol is essential for the correct diagnosis and treatment of patients with extremity swelling.<sup>1</sup> When a patient is diagnosed with lymphedema, identification of a fluid- versus fat-dominant phenotype is imperative to guide appropriate surgical treatment. To correctly identify the phenotype, a T2-weighted STIR (short-T1 inversion recovery) image and fat-specific Dixon image are used at our institution (Fig. 1).<sup>2</sup> In our experience, physiological procedures, including lymphovenous bypass and vascularized lymph node transfer, are more successful in controlling fluid-dominant lymphedema. In patients with fat-dominant lymphedema, we recommend an up-front debulking procedure with a staged physiological intervention once the size of the extremity has stabilized. Hereunder, we will detail our approach and outcomes after debulking in patients with extremity lymphedema.

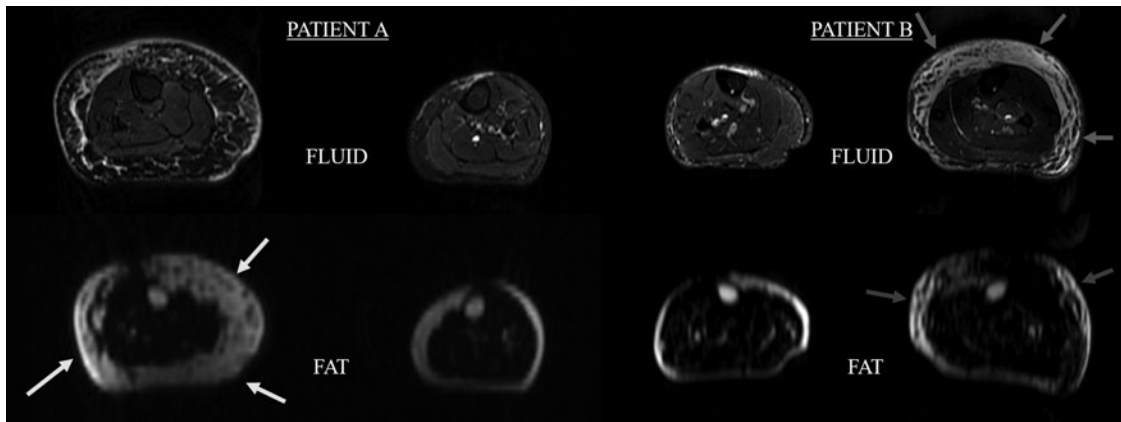
The surgical approach to perform extremity debulking at our institution was adapted from the technique developed by Håkan Brorson.<sup>3,4</sup> The limb is debulked using power-

assisted liposuction (MicroAire Surgical Instruments, VA) with custom-made 3- and 4-mm cannulas (MD Resource, CA) under tourniquet control. Custom garments are placed on the patient's extremity after the liposuction is completed up to the distal edge of the tourniquet. The tourniquet is then released and the proximal limb is tumesced with 1 or 2 L of tumescent solution for the upper and lower extremity, respectively, and liposuction of the proximal limb is performed. Upon completion, the custom garment is fully unrolled to cover the proximal limb. The intraoperative debulking aspirate collected while under tourniquet control is stored in a separate container from that collected after tourniquet release to allow for more accurate fat volume estimation.

After surgery, patients must remain in custom compression 24 hours per day. For patients with lower extremity lymphedema, waist-high (class III) and thigh-high (class II) garments are worn on top of one another during the day, and the waist-high garment alone is worn at night.<sup>5</sup> For patients with upper extremity lymphedema, a class II

Division of Plastic and Reconstructive Surgery, Department of Surgery, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts, USA.

Presented at the 2020 Centers of Excellent Summit, October 2–3, 2020.



**FIG. 1.** Fat- and fluid-dominant soft tissue swelling in cases of lower extremity lymphedema. (A) An example of severe circumferential subcutaneous fat hypertrophy in a *right* calf. The high signal intensity in this fat-specific image is identified with *white arrows*. (B) An example of extensive subcutaneous edema, identified with *three grey arrows*. Some fat hypertrophy is also present, as identified by the *two grey arrows*.

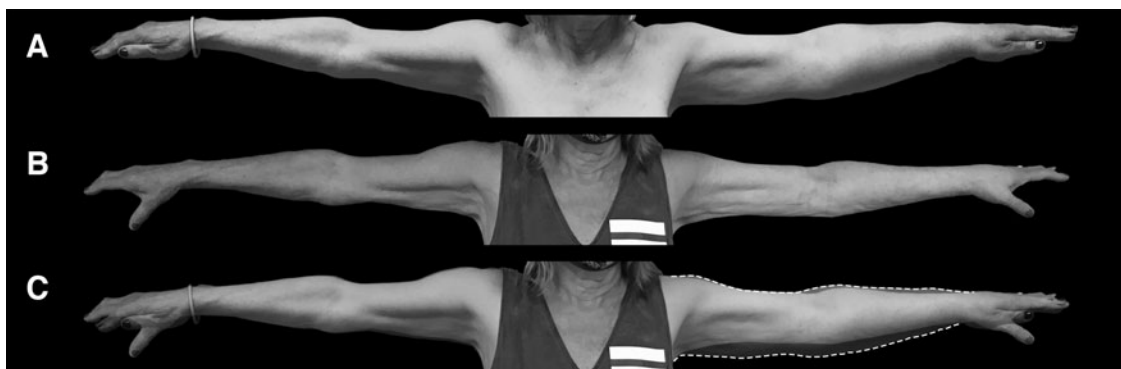
compressive sleeve and glove is worn during the day and night.<sup>5</sup> Compliance with compression is required for postoperative volume control. In the United States, the largest barrier to compliance with compression is financial, as garment coverage is insurance provider dependent and rarely entirely covered. The financial requirement of these garments is a key element of the preoperative counseling at our institution.

Between December 2017 and January 2020, 39 patients with lymphedema underwent 41 extremity debulking procedures at our institution.<sup>2</sup> For 23 patients who underwent an upper extremity debulking, objective and subjective metrics both demonstrated marked improvement (Fig. 2). Median excess volume reduction utilizing circumferential measurement was 111% at 6 months and 116% at 12 months postoperatively. Median upper extremity L-Dex was 55.2 (Q1–Q3 33–65) preoperatively versus 26.3 (Q1–Q3 14–32) at 6 months and 23.2 (Q1–Q3 17–27) at 12 months postoperatively. Subjective measurements were similarly improved. The mean overall quality of life (QOL) reported at the preoperative surgical consultation was 6.5 versus 8.3 at the last point of contact with the patients, an average of

8 months (standard deviation [SD] 4.5 months) after the debulking operation.

Eighteen debulking procedures of the lower extremity were performed during this time period. Median excess volume reduction was 82% at 6 months and 115% at 12 months postoperatively. Median lower extremity L-Dex was 68.2 (Q1–Q3 47–87) preoperatively versus 21.5 (Q1–Q3 15–37) at 6 months and 20.3 (Q1–Q3 7–46) at 12 months postoperatively. The mean overall QOL improved from 5.9 to 8.5 an average of 9.1 months after the debulking operation (SD 4.9 months).

Debulking with power-assisted liposuction is an effective treatment for chronic lymphedema, supported by improvement in both objective and subjective metrics.<sup>2</sup> Debulking can stand alone with lifelong postoperative compression, or can be the first stage in a two-part surgical treatment, where the second stage is a physiological procedure after long-term postoperative volume control is established. Although no operative or other treatment for chronic lymphedema is curative, this treatment approach shows great promise in reducing disease burden for the long term and assisting patients in resuming a more normal life.



**FIG. 2.** Patient before and after an *upper* extremity debulking. (A) Before debulking of the *left upper* extremity. (B) After debulking of the *left upper* extremity. (C) A *white dotted line* indicates the location of the affected extremity before surgery.

**References**

1. Johnson A, Fleishman A, Tran BN, et al. Developing a lymphatic surgery program: A first-year review. *Plast Reconstr Surg* 2019; 144:975e–985e.
2. Granoff M, Johnson A, Shillue K, et al. A single institution multi-disciplinary approach to power-assisted liposuction for the management of lymphedema. *Ann Surg*. 2020 [Epub ahead of print]; DOI: 10.1097/SLA.0000000000004588.
3. Brorson H, Svensson H. Complete reduction of lymphoedema of the arm by liposuction after breast cancer. *Scand J Plast Reconstr Surg Hand Surg* 1997; 31:137–143.
4. Brorson H, Svensson H. Liposuction combined with controlled compression therapy reduces arm lymphedema more effectively than controlled compression therapy alone. *Plast Reconstr Surg* 1998; 102:1058–1067; discussion 1068.
5. Ohlin K. Controlled Compression Therapy after Liposuction for Lymphedema—How to Maintain Control Over Time. Available from: <https://lymphaticnetwork.org/treating-lymphedema/the-lymphedema-symposium-2018/controlled-compression-therapy-after-liposuction-for-lymphedema>. 2018 (accessed June 11, 2020).

Address correspondence to:

*Dhruv Singhal, MD*

*Division of Plastic and Reconstructive Surgery*

*Beth Israel Deaconess Department of Surgery*

*110 Francis Street, Suite 5A*

*Boston, MA 02215*

*USA*

*E-mail: dsinghal@bidmc.harvard.edu*