

Liposuction as a Treatment for Lipedema: A Scoping Review

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Background: Lipedema is the progressive symmetrical deposition of subcutaneous fat and fluid in the lower body, ordinarily sparing the trunk, upper limbs, face, and neck. It may follow an autosomal dominant inheritance pattern. The gold standard treatment for lipedema is complete decongestive therapy, consisting of manual lymphatic drainage and compression garments. This scoping review assessed the existing literature on the effectiveness of liposuction as an alternative treatment for lipedema.

Methods: A scoping review of electronically available literature within PubMed, Scopus, and Cochrane focused on liposuction as a treatment for lipedema considering the following inclusion criteria: human studies, case series of 10 or more, controlled trials, randomized controlled trials, patient-reported outcome measurement studies, survey analyses, descriptive studies, retrospective analyses, recurrence included, follow-up of 6 months or more, age 18 years or older, and treatment modality being liposuction.

Results: Thirteen studies were selected. Nine studies reported decreased compression therapy use among patients following liposuction. No studies reported a long-term increase in compression therapy following liposuction. Studies found self-reported improvements in pain, mobility, bruising, and overall quality of life for patients following liposuction, many of whom had previously been on compressive therapy. Studies reported low rates of serious adverse events following liposuction, including deep vein thrombosis, pulmonary embolism, and infection.

Conclusions: These results suggest that liposuction can be a viable treatment alternative to compression therapy for lipedema in patients whose compression therapy has not been helpful. However, there is not enough evidence to say whether liposuction is as effective as compression for patients first presenting with lipedema. (*Plast Reconstr Surg Glob Open* 2024; 12:e5952; doi: 10.1097/GOX.0000000000005952; Published online 2 July 2024.)

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INTRODUCTION

Lipedema is a chronic condition of the subcutaneous adipose tissue on female individuals' lower abdomen, hips, buttocks, and limbs that spares the trunk, hands, and feet. Patients experience pain, swelling, and numbness, which may lead to disability and decreased quality of life (QoL).¹ One in nine women is affected in the United States, and its global prevalence ranges between 10% and 15%.^{1,2}

Although initially described in the 1940s,^{3,4} the pathophysiology of lipedema remains poorly understood. However, it is known that it does not respond appropriately to diet, exercise, or even bariatric surgery. It affects mostly

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women, following an autosomal dominant inheritance,⁵ and its onset correlates with estrogen peaks in life.⁶ Historically, it has been confused with obesity or lymphedema due to increased leg volume. Misdiagnosis represents a challenge for the physician because it can delay diagnosis and appropriate treatment.⁷ The diagnostic criteria are disproportionate fat distribution, little influence of weight loss on fat distribution, easy bruising/pain, sensitivity to touch, and no pain improvement with extremity elevation.⁸ Imaging does not contribute to its diagnosis.⁹ It is classified into stages that progressively worsen in appearance, pain, and volume based on morphology. Early stages (I, II) have a normal lymphatic system¹⁰ that progressively becomes affected by the number and size of fat cells, obstructing lymphatic drainage and causing fluid buildup (stage IV).¹¹

Recent research has explored various treatments with varying outcomes. The Ketogenic diet has been suggested as a potential intervention for improving fat accumulation and pain due to its antiinflammatory properties.¹² Additional evidence is required to ascertain its efficacy.

The current gold standard, complete decongestive therapy (CDT), is a conservative treatment involving manual lymphatic drainage and compression.¹³ Although CDT can potentially enhance volume reduction and improve pain and mobility in lipedema, its practicality is hindered by its time-consuming nature, high cost, and the necessity for ongoing provider involvement to sustain results.^{14,15} Some studies have explored alternative treatments for lipedema, including bariatric surgery and liposuction. An analysis of 13 obese patients with lipedema who underwent bariatric surgery showed no pain improvement after two years.¹⁶ Another study with 31 similar patients found a significant reduction in lower limb volume 45 months postsurgery.¹⁷ Despite conflicting results, bariatric surgery may be an option for lipedema patients meeting surgical criteria.

Liposuction is the second most common cosmetic surgery in the United States and the most common among patients aged 35–64 years.¹⁸ The history of liposuction dates back to 1921 when an attempt on a dancer's knee resulted in an amputation.¹⁹ Over time, techniques were refined, culminating in Illouz's introduction of the wetting solution technique in 1983, significantly enhancing safety.²⁰ This method involves injecting a local anesthetic (lidocaine) with epinephrine diluted in Ringer's lactate/normal saline into the subcutaneous tissue before aspiration, aiding in hemostasis, anesthesia, and adipocyte emulsification.²¹ Liposuction removes fat, sparing the lymphatics, and prevents future fat deposition in treated areas.

The increasing use of liposuction for treating lipedema lacks sufficient evidence regarding its long-term effectiveness due to limited and heterogeneous literature, making statistical analysis challenging. To bridge this gap comprehensively, a scoping review was undertaken. This study aimed to synthesize relevant research on liposuction for lipedema treatment, emphasizing longer-term follow-up and comprehensive evaluation of both qualitative and quantitative outcomes. This review seeks to enhance understanding of liposuction's effectiveness in managing lipedema, guiding clinical practice and future research.

Takeaways

Question: Is liposuction an effective treatment modality for patients with lipedema?

Findings: A scoping review focused on liposuction as a treatment for lipedema identified 13 articles. Nine studies reported decreased compression therapy use among patients following liposuction, and no studies reported a long-term increase in compression therapy following liposuction. Rates of serious adverse events were low. Liposuction can be a viable alternative to compression therapy in patients whose compression therapy has not been helpful. There is not enough evidence to say whether liposuction is as effective as compression therapy for newly diagnosed patients without prior treatment.

Meaning: Liposuction may help patients with lipedema beyond aesthetic purposes.

METHODS

Search Strategy

A literature search was performed among three databases (PubMed, Scopus, and Cochrane Library), with no date restriction but limited to publications in English. The search was carried out from October 3 to November 3, 2022, and was performed with MeSH terms/entry terms as follows: “(Lipedema) OR (lipoedema) OR (lipo-lymphedema) OR (lipolymphedema) AND (standard of care) OR (treatment) OR (surgery) OR (surgical) OR (lymph-sparing) OR (outcome) OR (outcomes) OR (liposuction) OR (recurrence).” In addition, an independent manual search was conducted using terms adapted for each database, including gray literature and relevant journals in the field. A manual search was also conducted using the reference lists of relevant review studies. Alerts were established for each database to keep the search strategy current. Two independent reviewers (M.B.C. and N.R.) conducted article screening and data extraction. In case of disagreement, a third reviewer (F.P.S.G.) adjudicated. Article citations were also assessed for relevance and included if they met the criteria.

Eligibility Criteria

Studies were included if they met the following criteria: human studies, case series of 10 or more, controlled trials, randomized controlled trials, patient-reported outcome measurement (PROM) studies, survey analyses, descriptive studies, retrospective analyses, recurrence included, follow-up of 6 months or more, age 18 years or older, and treatment modality being liposuction. Studies were excluded if they had these criteria: reviews, case reports of fewer than 10, animal studies, in vitro studies, book chapters, no abstract, age younger than 18 years, follow-up of less than 6 months, language other than English, treatment modality not liposuction.

RESULTS

Main Characteristics

Most of the studies were retrospective^{13,21–26}; two were single-arm, single-center before and after nonrandomized

studies^{27,28}; one was a comparative study²⁹; two were epidemiological studies^{30,31}, and one was a longitudinal study.³² The total number of patients included in this review is 1204. Most of the studies presented the patients' mean age^{21–27,29,30}; two presented the median age,^{13,28} and two did not report it.^{31,32} The race and ethnicity of the patients were shown in one study.³⁰ In eight studies, the gender of the patients was explicitly indicated, with all participants identified as women.^{21–26,29,30} Three studies used validated PROMs,^{26,27,30} and five used surveys.^{13,25,28,31,32} The PROMs used were the Freiburg Life Quality Assessment (FLQA-I),^{26,27} the Low Extremity Functional Scale (BSQ-34), and the Body Shape Questionnaire (LEFS).³⁰ (See table, Supplemental Digital Content 1, which displays main characteristics from included studies. <http://links.lww.com/PRSGO/D329>.)

Weight and Body Mass Index

Regarding anthropometric measurements, three studies^{23,25,31} solely reported weight, whereas two studies reported body mass index (BMI),^{24,26,28,32} without revealing any significant decreases. Two studies noted significantly reduced BMI,^{24,28} and two^{13,30} reported a substantial reduction in weight and BMI.

Location of the Affected Areas

Eight of 13 articles mentioned the body areas mainly affected in patients with lipedema^{13,21,24,27–30,32} before liposuction. Six of these described upper extremity involvement in some of their patients.^{13,21,24,28,30,32} One of them³⁰ reported lipedema in the abdomen for 66% of its cohort. One article did not report the preoperative location of lipedema.²⁵ The remaining studies reported other body areas subjected to liposuction^{22,23,26,31}. (See table, Supplemental Digital Content 2, which displays preoperative and postoperative data. <http://links.lww.com/PRSGO/D330>.) (See table, Supplemental Digital Content 3, which displays quantitative assessment. <http://links.lww.com/PRSGO/D331>.)

Lipedema Stage

Eleven of 13 studies mentioned the lipedema stage (See table, Supplemental Digital Content 2, <http://links.lww.com/PRSGO/D330>). Eight studies reported stage II as the most frequent among its patients.^{13,21,23–25,28,30,31} Two studies reported stage III as the most prevalent.^{26,32} One study reported patients with only stages I and II,²² and two did not report it.^{27,29}

Spontaneous Pain

Eight studies used a 10-point visual analogue scale^{13,21,24,27,28,30–32} to report reduced spontaneous pain postoperatively. Seven articles reported a statistically significant postoperative decrease in spontaneous pain,^{13,21,24,27,28,30,32} whereas one³¹ reported decreased pain after surgery without specifying its statistical significance. Two studies used a five-point scale from 0 (none) to 4 (very strong) to report a significant reduction in spontaneous pain^{23,25} after liposuction. One study reported pain improvement postoperatively without specifying

significance²². (See table, Supplemental Digital Content 4, which displays continued quantitative assessment. <http://links.lww.com/PRSGO/D332>.)

Bruising

Ten of 13 articles reported preoperative and postoperative bruising.^{13,21–23,25,27,28,30–32} Nine studies reported a significant reduction in bruising postliposuction, and one reported a reduction without mentioning its significance.³¹ Six studies used a 10-point visual analogue scale to assess this outcome,^{13,22,27,28,30,32} two used a five-point scale,^{23,25} and two^{21,31} did not specify the scale used. Three studies reported outcomes as median,^{24,28} nine as mean,^{13,21–23,25,27,30–32} and one was unclear about it.³¹ (See table, Supplemental Digital Content 4, <http://links.lww.com/PRSGO/D332>.)

Comorbidities

Five of 13 articles reported preoperative comorbidities.^{21,24,28,30,31} Herbst et al³⁰ listed hypermobile joints as a comorbidity, whereas the rest discussed 17 additional comorbidities.^{21,24,28,31} Wollina et al²¹ documented hypertension, obesity, atopic disease, osteoarthritis, lymphedema, and varicose veins. Ghods et al²⁴ reported obesity, depression, hypothyroidism, migraine, menstrual irregularities, hyperlipidemia, and dermatoses. Bauer et al³¹ and Kruppa et al²⁸ shared findings on 12 common comorbidities, encompassing hypertension, osteoarthritis, depression, hypothyroidism, allergies, migraine, sleep disorders, asthma, gastrointestinal disorders, diabetes, polycystic ovary syndrome, and hyperlipidemia (See table, Supplemental Digital Content 2, <http://links.lww.com/PRSGO/D330>.)

Number of Operations per Patient

Nine of 13 studies reported the number of liposuctions performed per patient.^{22,24,26–28,30–32} Most of these studies reported a mean of three or fewer liposuctions per patient^{13,22,26,27,30,32} (See table, Supplemental Digital Content 2, <http://links.lww.com/PRSGO/D330>.)

Follow-up Period

All studies mentioned the postoperative follow-up period (See table, Supplemental Digital Content 2, <http://links.lww.com/PRSGO/D330>). Ten studies^{13,22,23,25–27,29–32} mentioned it as a mean, with the shortest follow-up period being 6 months^{26,27,29} and the longest ones being 82 months (6.8 years) and 12 years.^{23,25} Two studies^{24,28} reported follow-up as a median of 20 months, and one study²¹ as a median of 2.0 ± 2.1 years.

Maximum Age Limit

There was no upper age limit for inclusion in the reviewed studies. Nevertheless, the maximum average age was 54.1 years,²⁵ and the minimum age reported was a mean of 37.7 years^{22,23} and a median of 35 years¹³ (See table, Supplemental Digital Content 1, <http://links.lww.com/PRSGO/D329>.)

Limitations of the Studies

Four articles highlighted a low number of subjects as a limitation,^{24–26,29} whereas others with fewer subjects did not.^{13,22,27,32} Subjective self-assessment by patients formed

the basis of results in all studies except one.²⁹ Additionally, three studies had short follow-ups of 6 months. Seven studies exhibited unequal distribution of lipedema stages among patients; two studies included patients with only stages I and II,^{13,25} whereas others included mainly stage II^{23,30,31} or a mix of stages II and III.^{21,32}

All the studies in this review, except two,^{27,29} were retrospective. Only one comparative study included a control group.²⁹ Quantitative measurement of fatty tissue volume reduction was not conducted in one study.³² One article reported recall bias and lack of race and ethnicity diversity as limitations.³⁰ All studies were single-center except for two.^{30,31} One article mentioned using a questionnaire validated for a different pathology as a limitation.²⁶

Adverse Events/Complications of Treatment

Eight of 13 studies reported adverse events after surgery.^{21–24,27,28,30,32} Three articles reported no postoperative complications.^{25,29,31} Two studies reported unspecified insignificant complications^{13,26} (See table, Supplemental Digital Content 2, <http://links.lww.com/PRSGO/D330>).

Mobility

Six of the 13 studies reported pre- and postoperative mobility.^{13,21,23,25,27,30} All but one of the six studies²¹ reported a statistically significant improvement in postoperative mobility (See table, Supplemental Digital Content 4, <http://links.lww.com/PRSGO/D332>).

Volume or Circumference of the Lower Limb

Of the 13 articles, two mentioned lower limb circumference improvement,^{21,23} and one reported a postoperative leg volume reduction.²⁷ None of these articles mentioned whether these results were statistically significant (See table, Supplemental Digital Content 3, <http://links.lww.com/PRSGO/D331>).

Quality of Life

Seven of the 13 studies mentioned QoL.^{22,23,25–27,30,32} Five reported a significant improvement in this outcome after liposuction^{23,26,27,30,32} (See table, Supplemental Digital Content 4, <http://links.lww.com/PRSGO/D332>).

Compression Therapy

Six studies reported a decrease in compressive therapy requirements postliposuction.^{13,21,23,25,27,31} Three studies reported decreased mean compression therapy scores.^{26,28,32} One study³⁰ reported a transient increase in postoperative compression use that resolved in 3 months. No studies reported a long-term increase in compressive therapy use postliposuction (See table, Supplemental Digital Content 4, <http://links.lww.com/PRSGO/D332>).

DISCUSSION

This scoping review aimed to identify and summarize the extent of knowledge about liposuction as a treatment for lipedema and to help guide future studies in this area. Thirteen studies involving 1204 patients were analyzed, seven being retrospective studies and the remainder

including before-and-after comparative, epidemiological, or longitudinal studies (See table, Supplemental Digital Content 1, <http://links.lww.com/PRSGO/D329>). While CDT is the current standard treatment for lipedema, none of the studies were randomized controlled trials, allowing for a direct comparison with liposuction outcomes. However, nine studies^{13,21,23,25–28,31,32} noted reduced use of compression therapy among patients postliposuction, with no reports of increased long-term reliance on compression therapy. In addition, studies found self-reported improvements in pain, mobility, bruising, and overall QoL for patients postliposuction, many of whom had previously been on compressive therapy (See Supplemental Digital Content 4, <http://links.lww.com/PRSGO/D332>).

Studies reported low rates of serious adverse events following liposuction, including deep vein thrombosis,^{27,30} pulmonary embolism,³⁰ and infection^{23,24,28,30} (See Supplemental table 2, <http://links.lww.com/PRSGO/D330>). The most common adverse events were fibrosis, wrinkles, and sagging skin³⁰ (See Supplemental Digital Content 2, <http://links.lww.com/PRSGO/D330>).

Liposuction shows promise as a lipedema treatment, especially for those unresponsive to CDT. However, further research is needed to compare its effectiveness to compression therapy for newly diagnosed patients without prior treatments. Various liposuction techniques offer different advantages and considerations. Suction-assisted lipectomy (SAL) involves using negative pressure generated by a syringe to operate a small-volume blunt-tip suction cannula, effectively removing fat.³³

Power-assisted liposuction (PAL) uses an electric vacuum pump to rapidly oscillate the cannula back and forth,³⁴ which is advantageous for large tissue volumes and densely fibrous areas. Water-assisted liposuction (WAL) uses a slightly pressurized saline stream to dislodge and extract fat without damaging the fat cells.³⁴ Ultrasound-assisted liposuction (UAL) uses ultrasound energy to emulsify fat before removal.³⁵ Laser-assisted liposuction (LAL) entails inserting a laser fiber through a small incision to melt fat and reduce bleeding, although precautions are necessary to prevent internal burns.³⁶ Each technique offers specific benefits. For instance, UAL is linked to reduced blood loss, lower revision, and conversion rates to open gynecomastia treatment compared with SAL.^{37–39} UAL and LAL have been linked to reduced hemoglobin/hematocrit in high-volume lipoaspirates.^{39,40} LAL has shown superiority over SAL for submental skin tightening.⁴¹ However, besides these exceptions, there is no significant added benefit from incorporating UAL or LAL into routine practice.⁴² In this review, five studies used PAL,^{22,23,25–27} one used WAL,¹³ three used PAL or WAL,^{24,28,30} and one used PAL or LAL.²¹ (See table, Supplemental Digital Content 5, which displays supporting information. <http://links.lww.com/PRSGO/D333>.)

Discerning between lipedema and lymphedema is challenging in clinical practice. The main contrast lies in subcutaneous adipose tissue hypertrophy in lipedema.⁴³ Lipedema edema is typically nonpitting, especially initially, with a negative Stemmer sign.⁴⁴ It mainly affects the lower extremities, sparing the feet. Adipose tissue expansion

leads to extracellular matrix remodeling, inflammation, and fibrosis, potentially resulting in lipolymphedema, where lymphatic dysfunction exacerbates swelling, extending into the interstitial space. Patients experience pitting and nonpitting edema in such cases and may then exhibit a positive Stemmer sign (inability to pinch/roll the skin in the foot's first web space).⁴⁵ Treatment focuses on reducing subcutaneous fat volume, often through large-volume liposuction, followed by chronic compression therapies. In congenital or acquired lymphedema, initial edema arises in the interstitium due to lymphatic dysfunction, resulting in pitting edema without sparing the foot and a positive Stemmer sign. Lymphoscintigraphy can aid in diagnosis with high sensitivity and specificity.⁴⁶

In the early stages, efforts concentrate on restoring lymphatic function through lymphaticovenous bypass or lymph node vascularized transfer. Later stages may involve fat hypertrophy, requiring treatment aimed at both lymphatic drainage restoration and debulking surgery, often involving large-volume liposuction followed by compression therapy.⁴⁷ The evidence for refractory lipedema cases postliposuction is limited. However, it is important to acknowledge that lipoaspiration, which is not extensive in terms of fat removal, can be ineffective and repeated. Direct excision is an alternative treatment option, allowing for future liposuction or excisions with caution regarding the previously altered blood supply.

Treating lipedema in obese patients is challenging due to postoperative compression issues and increased risk of complications.⁴⁸ These patients often experience heightened sensitivity to fat shaming and are mislabeled as simply obese without recognition of their underlying condition.⁴⁹ Ideally, efforts to address the obesity aspect of their condition should be prioritized before considering liposuction, which is a standard recommendation. Complications are expected to be higher in patients with higher BMI, requiring careful evaluation in each case.⁵⁰

Future research should focus on comparing compression and liposuction directly, particularly in patients without prior treatment. Current studies often involve patients whose compressive therapy failed, potentially skewing results. Additionally, studies should investigate patient factors/comorbidities that impact the effectiveness of liposuction. One study²⁸ found that stage I and II lipedema patients required significantly less compression postliposuction than stage III patients, suggesting further examination of clinical findings that could predict treatment outcomes. Lastly, studies should explore lipedema pathophysiology to uncover coexisting aggravating conditions, such as chronic venous insufficiency, obesity, and lymphedema.⁵⁰ Understanding these processes may better improve intervention before clinical symptoms arise.

This review has limitations. It excluded non-English studies and case reports, potentially missing relevant data. Additionally, it's a scoping, not systematic, review, offering an overview rather than a detailed statistical analysis. Heterogeneity among studies, especially in follow-up and outcomes, complicates determining treatment efficacy. The review focuses on adipose tissue reduction methods, neglecting holistic lipedema care, including psychosocial

factors (mental health) and symptom (pain) management. Further research is needed to address all dimensions of lipedema therapy comprehensively.

CONCLUSIONS

Thirteen studies involving 1204 patients assessed liposuction's efficacy for lipedema treatment. Retrospective analyses consistently reported that liposuction reduced reliance on compression therapy, relieved pain, improved mobility, reduced bruising, and enhanced QoL. Severe adverse effects were rare. Liposuction appears promising for lipedema, particularly after failed conservative therapies. However, further research, including controlled trials with longer follow-up (≥ 1 year), qualitative/quantitative standardized outcome measures, and comprehensive data collection, is needed to fully understand its effectiveness compared with CDT.

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DISCLOSURE

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

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