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Article

DRAIN AND DEBULK: A DUAL APPROACH TO ADVANCED LOWER LIMB LYMPHEDEMA USING SIMULTANEOUS LVB AND LYMPH-SPARING LIPOSUCTION

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ABSTRACT

Background: Advanced-stage lymphedema is characterized by lymphatic dysfunction and fibroadipose overgrowth. Single-modality treatments, such as lymphaticovenous bypass (LVB) or liposuction alone, are often inadequate. This case series evaluates the safety and outcomes of simultaneous LVB and lymph-sparing liposuction in advanced lower-limb disease.
Method: We conducted a case series involving four patients (n=4) with secondary lower limb lymphedema (ISL stage II–III; LDB stage IV–V). All underwent simultaneous LVB and lymph-sparing liposuction. Limb volume was calculated using the truncated cone formula at baseline, 1 week, and 12 months postoperatively. Quality of life was measured using the LYMPH-Q questionnaire. One patient with bilateral lymphedema received LVB on both limbs but underwent liposuction on only one, allowing for direct internal comparison.
Results: In all four patients patients demonstrated immediate postoperative limb volume reductions ranging from 12.13% to 37.68%, with further improvements at 12 months (up to 42.1%). Quality of life scores significantly increased, with improvements of up to 37.29%. In the bilateral case, the limb treated with both LVB and liposuction showed superior outcomes compared to the limb treated with LVB alone. No major complications occurred.
Conclusions: Simultaneous LVB and lymph-sparing liposuction is a safe and effective treatment for advanced lymphedema. This dual-modality approach addresses both fluid accumulation and fibrotic hypertrophy, resulting in better functional and aesthetic outcomes than either technique alone. Larger studies with longer follow-up are needed to confirm these findings and optimize patient selection.
***Keywords**: Lymphedema, Lymphaticovenous Bypass, Liposuction, Microsurgery*

Latar Belakang: Limfedema stadium lanjut ditandai oleh disfungsi limfatik dan pertumbuhan berlebih jaringan fibro-adiposa. Terapi tunggal, seperti lymphaticovenous bypass (LVB) atau liposuksi saja, sering kali tidak memadai. Seri kasus ini mengevaluasi keamanan serta luaran dari prosedur simultan LVB dan liposuksi yang mempertahankan jaringan limfatik pada penyakit ekstremitas bawah stadium lanjut.
Metode: Kami melaksanakan seri kasus yang melibatkan empat pasien (n=4) dengan limfedema ekstremitas bawah sekunder (stadium II–III menurut ISL; stadium IV–V menurut LDB). Seluruh pasien menjalani prosedur simultan LVB dan liposuksi dengan teknik lymph-sparing. Volume tungkai dihitung menggunakan rumus kerucut terpotong pada saat dasar (baseline), 1 minggu, dan 12 bulan pascaoperasi. Kualitas hidup dinilai menggunakan kuesioner LYMPH-Q. Pada satu pasien dengan limfedema bilateral, dilakukan LVB pada kedua tungkai, namun liposuksi hanya pada salah satunya, sehingga memungkinkan perbandingan internal secara langsung.
Hasil: Keempat pasien menunjukkan penurunan volume tungkai segera pascaoperasi dengan kisaran 12,13% hingga 37,68%, dan peningkatan lebih lanjut pada 12 bulan (hingga 42,1%). Skor kualitas hidup meningkat signifikan, dengan perbaikan hingga 37,29%. Pada kasus bilateral, tungkai yang diterapi dengan kombinasi LVB dan liposuksi menunjukkan hasil yang lebih superior dibandingkan tungkai yang hanya diterapi dengan LVB. Tidak terdapat komplikasi mayor.
Kesimpulan: Prosedur simultan LVB dan liposuksi dengan teknik lymph-sparing terbukti aman dan efektif untuk penatalaksanaan limfedema stadium lanjut. Pendekatan multimodal ini mengatasi akumulasi cairan sekaligus hipertrofi fibrotik, sehingga memberikan hasil fungsional dan estetik yang lebih baik dibandingkan dengan penggunaan salah satu teknik saja. Studi dengan jumlah sampel lebih besar dan tindak lanjut jangka panjang masih diperlukan untuk mengonfirmasi temuan ini serta mengoptimalkan seleksi pasien.
Kata Kunci: *Limfedema, Lymphaticovenous Bypass, Liposuksi, Bedah Mikroskopik*

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Conflicts of Interest Statement:
The author(s) listed in this manuscript declare the absence of any conflict of interest on the subject matter or materials discussed.

INTRODUCTION

Lymphedema is a chronic, progressive disease characterized by impaired lymph transport with secondary tissue changes—protein-rich fluid accumulation, inflammation, and fibroadipose hypertrophy—that lead to pain, recurrent infections, functional limitation, and reduced quality of life. Staging systems (e.g., ISL and fat-versus-fluid frameworks) emphasize how advanced disease is dominated by adipose and fibrotic deposition, which limits responsiveness to conservative measures alone[1].

Physiologic microsurgery such as lymphaticovenous bypass (LVB) restores lymph flow by diverting lymph into the venous system and has demonstrated safety and symptomatic benefit, particularly in earlier stages where functional lymphatic channels remain. However, in advanced limbs with substantial fibroadipose overgrowth, LVB alone may provide incomplete volume reduction[2].

Conversely, lymph-sparing liposuction (LSL) debulks excess adipose/fibrotic tissue and can achieve durable volume reduction—especially when combined with lifelong compression—but it does not re-establish lymphatic physiology, leaving a risk of persistent lymphatic dysfunction. Recent series in lower-extremity lymphedema report marked and sustained reductions after liposuction with controlled compression therapy, underscoring its role for advanced disease[3].

These complementary strengths support a combined approach. Emerging data suggest that one-stage treatment pairing LVB (or LVA) with immediate lymph-sparing liposuction can simultaneously address fluid overload and fibroadipose hypertrophy, yielding greater volume reduction, fewer cellulitis episodes, and improved function compared with either technique alone. Narrative reviews and retrospective series published in 2024–2025 describe feasibility and encouraging outcomes of combined physiologic–excisional surgery in cancer-related and primary lymphedema[4].

Patient-reported outcomes are increasingly emphasized. The LYMPH-Q (upper-extremity module and adaptations) and newer lymphedema-specific PROMs have undergone contemporary development/validation and are recommended to capture health-related quality of life changes after lymphedema interventions. Incorporating such measures complements objective limb-volume metrics and aligns with value-based care.

Given these gaps and opportunities, we report a case series of advanced lower-limb lymphedema treated with simultaneous LVB and lymph-sparing liposuction, evaluating early and mid-term volume change and quality-of-life outcomes to inform the role of this dual-modality strategy.

METHOD

Study Design and Patients

Between August 2024 and August 2025, four patients with advanced secondary lower-limb lymphedema underwent simultaneous LVB and lymph-sparing liposuction at Dr. Cipto Mangunkusumo Hospital. Inclusion criteria were International Society of Lymphology (ISL) stage II–III with corresponding Lymphedema Dermal Backflow (LDB) stage IV–V on indocyanine green (ICG) lymphography. Patients with infection, uncontrolled comorbidities, or anesthesia contraindications were excluded. All participants provided written informed consent, and the study was approved by the institutional review board.

Surgical Technique

All procedures were performed under general anesthesia in the supine position with proximal thigh tourniquet control.

LVB: Functional lymphatic channels were identified using ICG lymphography. Small incisions were made at mapped sites, and lymphatic vessels (0.3–0.8 mm) were dissected and anastomosed end-to-end or end-to-side to adjacent venules of similar caliber using 11-0 or 12-0 nylon under high magnification. Two to four anastomoses were performed per limb, with patency confirmed intraoperatively by repeat ICG injection.

Lymph-sparing liposuction: Following LVB, tumescent solution (Klein's) was infiltrated, and liposuction was performed using 2–3 mm cannulas. Mapping was used to preserve

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functional lymphatic pathways. Aspirated volumes were recorded. Hemostasis was secured, and incisions closed with fine sutures.

Postoperative care: All patients received compression dressings immediately post-op and were fitted with custom compression garments, which were encouraged for continuous use.

Outcome Measures

- **Limb volume**: calculated using the truncated cone formula at baseline, 1 week, and 12 months.
- **Quality of life**: assessed using the LYMPH-Q questionnaire.
- **Complications**: all intraoperative and postoperative adverse events were recorded.

RESULTS

Patient Characteristics

Four patients (three women, one man; mean age 45.5 years, range 27–57) with advanced lower-limb lymphedema (ISL II–III; LDB IV–V) were treated. Etiologies included cervical cancer treatment (n=1), idiopathic praecox lymphedema (n=1), and longstanding bilateral lymphedema with prior misdiagnosis as deep vein thrombosis (n=2). One bilateral case enabled direct intra-patient comparison between LVB alone and combined LVB + liposuction.

Case 1 (Secondary, Malignant)

A 48-year-old woman developed right lower-limb lymphedema following treatment for cervical cancer, including hysterectomy, bilateral salpingo-oophorectomy, chemotherapy, and radiotherapy. Despite adherence to conservative therapy, she had persistent swelling and functional limitation. She underwent simultaneous LVB and lymph-sparing liposuction, achieving an immediate volume reduction of 24.2% and 30.5% at 12 months. Her LYMPH-Q score improved by 37.3%.

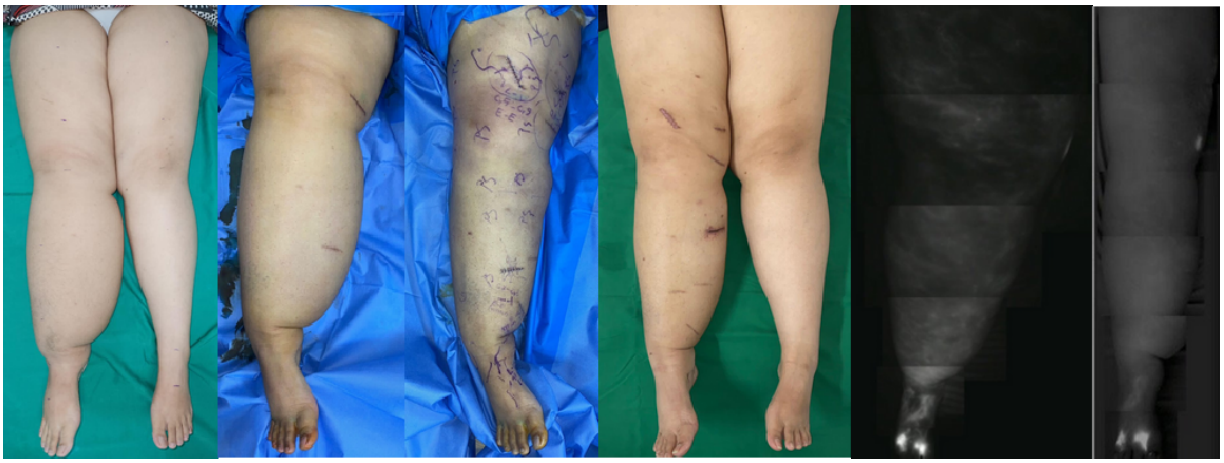

Figure 1. Pre-op and 7-month post-op images of the right lower limb showing visible volume reduction and improved contour after LVB + liposuction.

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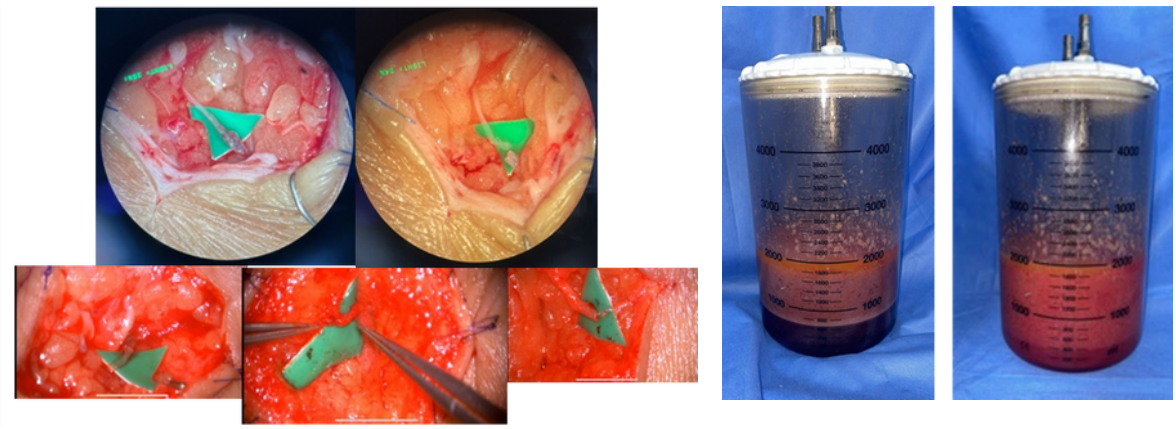

Figure 2. Intraoperative view showing LVB site and aspirated volume following liposuction.

Case 2 (Secondary, Tarda)

A 50-year-old woman presented with bilateral lower-limb lymphedema of 3 years' duration. She underwent LVB and liposuction on the right limb, while the left limb was treated with LVB alone, allowing direct comparison. The right limb achieved a 22.7% immediate reduction and 28.9% at 12 months, compared with only 6.6% and 10.2% on the left. Quality of life improved by 31.6%. A small area of skin necrosis at a liposuction incision healed with split-thickness skin grafting.

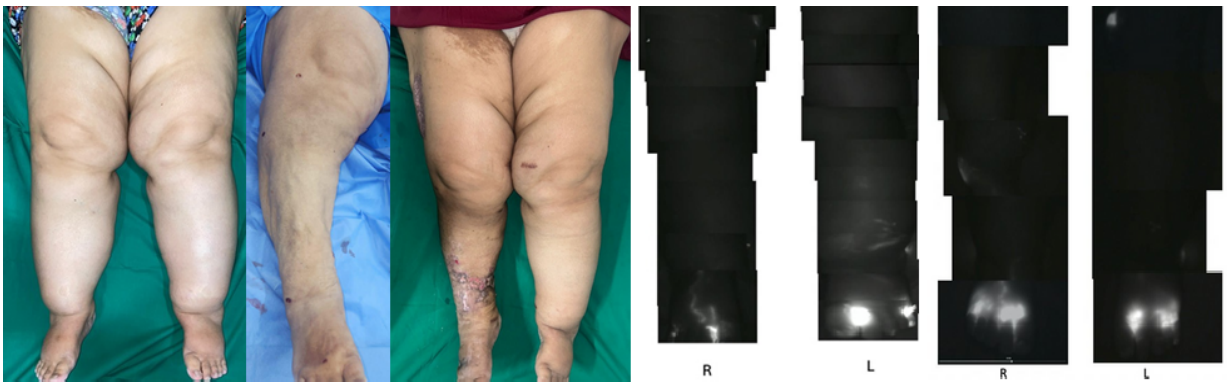

Figure 3. Comparison of right (LVB + liposuction) and left (LVB only) limbs. Also shows skin necrosis on the right side, followed by healing after STSG.

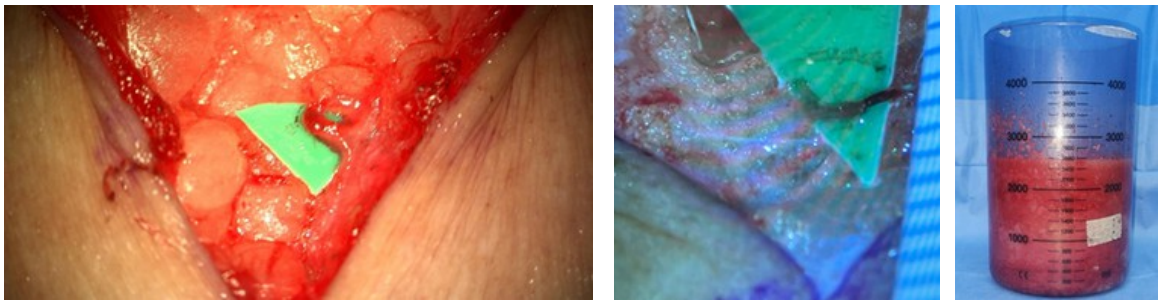

Figure 4. Intraoperative view showing LVB site and aspirated volume following liposuction.

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Case 3 (Secondary, Praecox)

A 27-year-old woman had left lower-limb lymphedema since age 14, initially misdiagnosed as deep vein thrombosis and treated ineffectively for six years. She underwent simultaneous LVB and lymph-sparing liposuction, achieving the most substantial improvement: 37.7% immediate reduction, 42.1% at 12 months, and a 37.0% increase in LYMPH-Q score.

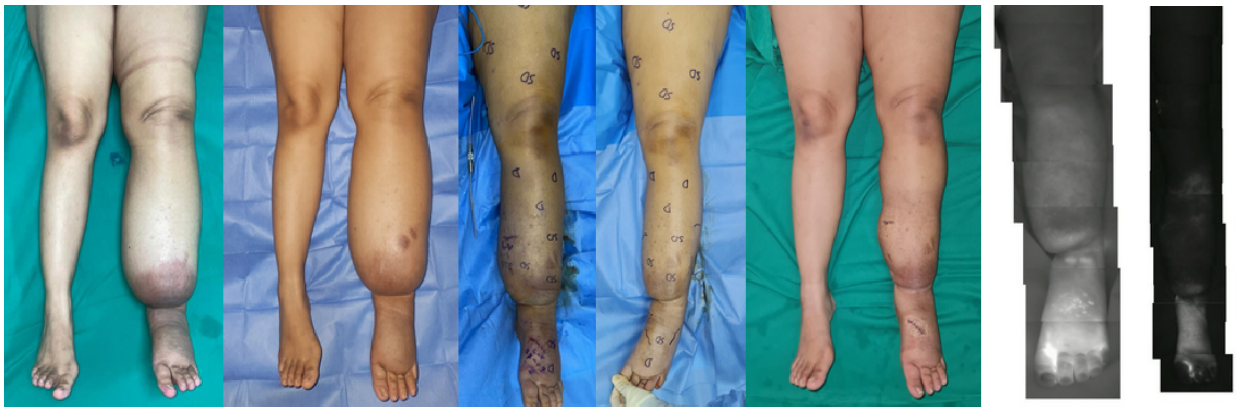

Figure 5. Pre-op and post-op images of the left lower limb showing significant volume reduction and symmetry restoration at 12 months.

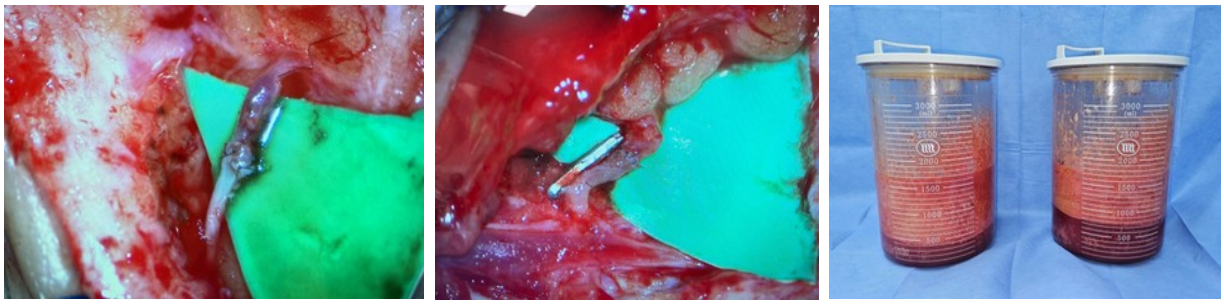

Figure 6. Intraoperative view showing LVB site and aspirated fat volume following liposuction

Case 4 (Secondary, Praecox)

A 57-year-old man had bilateral lower-limb lymphedema since early adulthood, also misdiagnosed as deep vein thrombosis for several years. Progressive functional impairment prompted surgical intervention. Following LVB and liposuction, he achieved 12.1% immediate reduction, 15.7% at 12 months, and a 20% improvement in quality of life.

Figure 7. Pre-op and 12-month post-op views of bilateral lower limbs showing moderate volume reduction, especially in areas treated with LVB + liposuction.

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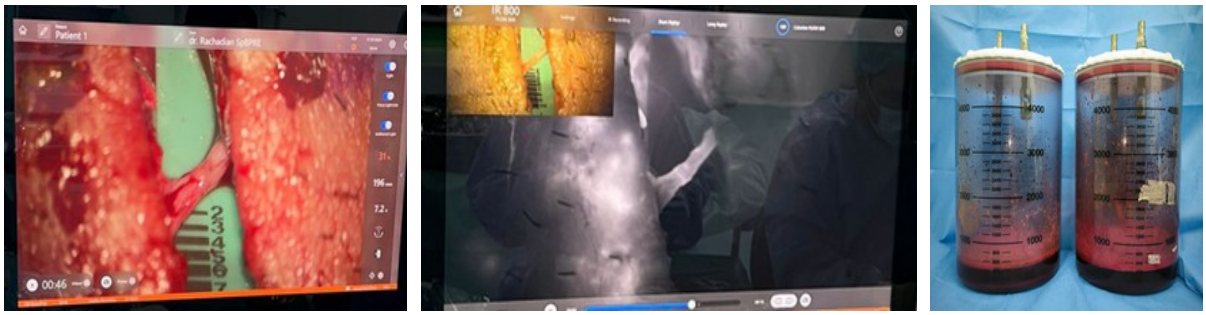

Figure 8. Intraoperative view showing LVB site and aspirated fat volume following liposuction

Summary

All patients demonstrated immediate postoperative volume reduction ranging from 12.1% to 37.7%. At 12 months, additional improvement was observed, with maximum reduction reaching 42.1% compared to baseline. Quality of life, measured using the LYMPH-Q questionnaire, showed consistent improvement across domains of symptoms, function, and psychosocial well-being. Overall scores increased by 20–37% at 12 months compared with baseline. The greatest improvement (37.3%) was observed in the patient with malignant secondary lymphedema.

Table 1. Percentage volume reduction at immediate, 1 week, and 12 months follow-up.

Case	Etiology	ISL	LDB	Procedure	Immediate Reduction (%)	12-Month Reduction (%)	QoL Improvement (%)	Complications
1	Secondary (tarda, bilateral)	II-III	V	LVB+liposuction	254.2	30.5	37.3	None
2 right	Secondary (tarda, bilateral)	II-III	V	LVB+liposuction	22.7	28.9	31.6	Skin necrosis, healed with STSG
2 left	Secondary (tarda, bilateral)	II-III	V	LVB only	6.6	10.2	31.6	None
3	Secondary (praecox)	II-III	V	LVB+liposuction	37.7	42.1	37	None
4	Secondary praceox	II-III	V	LVB+liposuction	12.1	15.7	20	None

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Complications

No major intraoperative or postoperative complications were noted. One patient (Case 2) developed a localized area of skin necrosis at a liposuction incision site, which healed uneventfully following debridement and split-thickness skin grafting. No cases of infection, bleeding requiring reoperation, or venous thrombosis occurred.

DISCUSSION

This case series demonstrates that simultaneous lymphaticovenous bypass (LVB) and lymph-sparing liposuction can be performed safely in patients with advanced lower-extremity lymphedema and provides superior outcomes compared with either modality alone. All four patients achieved meaningful volume reduction and quality-of-life improvement, with results maintained at 12 months. In the bilateral case, the limb treated with the dual approach achieved almost three-fold greater reduction compared to the limb treated with LVB alone, underscoring the additive effect of combining physiologic and debulking techniques.

Physiologic vs. Excisional Strategies

LVB has been established as an effective physiologic procedure for early-stage lymphedema, restoring lymphatic drainage through supermicrosurgical anastomosis[6,7]. However, its effectiveness diminishes in advanced disease due to lymphatic sclerosis and adipose-fibrotic overgrowth. Conversely, liposuction offers significant debulking in later stages but cannot restore lymphatic physiology, leaving a risk of recurrence without lifelong compression[8–10]. Our results align with prior studies showing that liposuction yields durable reductions in limb volume[8], but highlight that integration with LVB enhances both functional and symptomatic recovery.

Dual-Modality Approaches

Recent literature supports combining physiologic and excisional methods to address both the fluid and solid components of lymphedema. Gabriele et al. [11] reported improved outcomes with one-stage lymphatico-venular anastomosis and liposuction in cancer-related lymphedema, while Brorson and colleagues demonstrated long-term stability of liposuction results under compression[8]. Narrative reviews and consensus articles have also emphasized the value of modern combined lymphatic surgery[12-14]. Our series adds to this evidence, suggesting that simultaneous procedures are feasible and effective even in lower-limb disease, which is often more disabling and less studied than upper-limb lymphedema.

Patient-Reported Outcomes

All patients in this series experienced measurable improvements on the LYMPH-Q questionnaire, consistent with the growing emphasis on validated patient-reported outcome measures in lymphedema surgery[15-17]. Such instruments complement objective volume data, capturing the psychosocial and functional dimensions of the disease and aligning with value-based care models.

Safety Profile

No major complications occurred, and the only adverse event—localized skin necrosis—resolved with conservative surgical management. This is comparable to complication rates reported in other liposuction and LVB series[10,11]. These findings suggest that dual-modality surgery can be performed safely by experienced microsurgeons with careful lymphatic mapping.

Limitations and Future Directions

The limitations of this study include its small sample size, short follow-up, and lack of objective postoperative lymphatic imaging (e.g., ICG or MR lymphangiography). Larger prospective cohorts with longer follow-up are needed to evaluate durability, recurrence, and cost-effectiveness. Future research should also explore standardized algorithms for patient selection based on ISL and LDB staging[7,14], as well as the potential role of novel imaging and lymphatic-sparing techniques to further optimize outcomes.

CONCLUSION

Simultaneous LVB and lymph-sparing liposuction represent a promising dual-modality approach for advanced lower-limb lymphedema,

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achieving significant improvements in both limb volume and quality of life with minimal morbidity.

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