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Reconstructive

Systematic Review of Outcomes of Omental Free Flap in the Management of Lymphedema

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Background: The omentum has unique angiogenic and immunologic properties, and its low risk of donor-site lymphedema makes it an ideal donor site for lymph node transfer. However, it is unpopular due to the technicalities and the possibility of donor site–related abdominal complications during its harvest.
Methods: A systematic review was conducted on March 24, 2024, using PubMed, Scopus, and Ovid MEDLINE databases. The search terms "omental flap," "omentum flap," "lymphedema," and "free flap" yielded 99 articles. Only 7 full-text articles published within the past 25 years focusing on omental free flap for lymphedema management were included.
Results: The review included 7 studies comprising 131 patients, predominantly women, with an average age of 54.75 years, most of whom had secondary lymphedema, primarily due to breast cancer. Clinical outcome measures showed significant limb volume reduction and improved lymphatic drainage, whereas patient-reported outcome measures indicated overall patient satisfaction and improved quality of life. The flap failure rate was 0.75%, and partial flap necrosis occurred in 2.25% of cases. Common donor-site complications included abdominal tension (2.29%) and dyspepsia (1.53%).
Conclusions: This systematic review highlights the promising outcomes of omental free flap in lymphedema management, with low complication rates and significant improvements in both clinical and patient-reported outcomes. *(Plast Reconstr Surg Glob Open 2025;13:e6716; doi: 10.1097/GOX.0000000000006716; Published online 25 April 2025.)*

INTRODUCTION

Lymphedema is a chronic, progressively worsening, and frequently disabling condition caused by the buildup of lymphatic fluid in tissues, resulting in substantial fibrosis, clinically significant swelling, patient discomfort, and an increased likelihood of recurring infections, affecting approximately 250 million people worldwide.[1] Lymphedema can be classified into 2 types: primary and secondary. Primary lymphedema is typically due to inherent defects in the lymphatic vessels. In contrast, secondary lymphedema results from acquired damage to the lymphatic system due to infection, trauma, or cancer. In developed countries, it is predominantly linked to malignancies, particularly breast cancer, and the associated therapeutic interventions including lymph node dissection and radiation therapy.[2]

The management of lymphedema includes complete decongestive therapy, which is the gold standard for early-stage lymphedema, and incorporates manual lymphatic drainage, compression techniques, physical exercise, and meticulous skin care. However, this treatment requires training and strong patient compliance, often making it challenging for patients to maintain.[3] As a result, the management of both early and advanced lymphedema has increasingly shifted toward surgical interventions, particularly when conservative treatments are insufficient. Surgical options for lymphedema management range from ablative procedures, such as debulking procedures, to more advanced physiological procedures, such as lymphaticovenous anastomosis and vascularized lymph node transfer (VLNT). Ablative procedures focus on eliminating excess fibrotic tissue and decreasing the size of the affected limb, but they do not target the underlying lymphatic dysfunction. In contrast, physiological procedures aim to reestablish lymphatic drainage by forming new lymphatic pathways, as seen in lymphaticovenous anastomosis, or by transplanting functional lymph nodes, as done in VLNT.[4]

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Among these options, VLNT has gained significant attention as the transplanted lymph nodes can promote the growth of new lymphatic vessels that promote drainage of lymphatic fluid and reverse the symptoms of lymphedema. Multiple donor sites for lymph node harvesting have been explored, including the groin,[5] submental region,[6] supraclavicular area,[7] lateral thoracic wall,[8] and the omentum.[9] Each of these donor sites offers distinct advantages and limitations, influencing the choice of procedure based on patient-specific factors. Omental lymph node transfer has exceptional angiogenic and immunologic properties, making it an ideal candidate for lymph node transfer. Additionally, using the omentum as a donor site carries minimal risk of donor-site lymphedema, which is a significant concern when harvesting lymph nodes from the extremities. However, one of the main limitations of this technique is the need for an additional operating general surgeon to perform the abdominal harvest of the omental flap, and another is the risk of intraperitoneal organ injury.[10]

Although individual studies have reported promising outcomes, there remains variability in success rates, complications at both donor and recipient sites, and long-term efficacy. A comprehensive review of these studies will provide valuable insights into the benefits and limitations of this technique, helping to refine surgical practices and guide future research.

METHODS

Search Strategy and Article Selection

The present systematic review was carried out on March 24, 2024, by searching of scientific articles published over the last 25 years from 1998 to February 2024, in 3 databases: PubMed, Scopus and Ovid MEDLINE. This study was prospectively registered in PROSPERO (CRD42024522267).[11] The search terms used were as follows: "omental flap," "omentum flap," "lymphedema," and "free flap," with "or"/"and" fillers included during the keyword search.

The number of studies screened, assessed for eligibility, and included in this review, with reasons for exclusion are presented in the preferred reporting items for systematic reviews and meta-analyses[12] flow diagram (Fig. 1). Our initial literature search resulted in a total of 99 results. Two reviewers independently screened these results by title and abstract, which presented 28 studies. After removal of duplicate articles, a full-text review was done on a total of 20 articles, of which 7 articles fulfilled the inclusion criteria and were finally selected for systemic review.

Inclusion Criteria and Exclusion Criteria

Articles published during the period from January 1, 1998, to February 29, 2024, in the English language, were included. All original studies, including randomized control trials, cohort studies (prospective/retrospective), and case series that reported omental free flap for the treatment of lymphedema were included. Exclusion criteria included focusing on:

1. omental free flap for soft tissue reconstruction and not for lymphedema,
2. omental free flap surgery in combination with adjunct procedures such as liposuction or excisional procedures,
3. technique of flap harvest only,
4. review articles/case reports,
5. abstracts only,
6. articles not written in English,
7. cadaveric or animal-based studies.

Takeaways

Question: Is the omental free flap a worthwhile option for the treatment of lymphedema of limbs, considering its benefits versus donor-site risks?

Findings: This is the first systematic review to analyze the outcomes of the omental free flap in lymphedema of limb management. Seven studies with 131 patients, mostly women with secondary lymphedema, were noted. The flap significantly reduced limb volume, improved lymphatic function, and had high patient satisfaction in most of the studies. Donor-site complications were minimal, with abdominal tension reported in 2.29% of cases and dyspepsia in 1.53%.

Meaning: The omental free flap offers substantial benefits for lymphedema treatment with minimal donor-site risks, making it a viable surgical option.

Data Extraction

Data were collected using the PICO framework, focusing on the population, intervention, comparison, and outcomes. The population included individuals undergoing omental free flap procedures for lymphedema management. The intervention was the use of the omental free flap. The primary outcome measured was the success rate of the flap and improvement in lymphedema symptoms, whereas secondary outcomes included the overall number of complications at both the recipient and donor sites. Flap success was defined as cases where no additional procedures were required and no instances of total or partial failure occurred.

RESULTS

The systematic search initially identified 99 articles across 3 databases: PubMed (n = 28), Scopus (n = 38), and Ovid MEDLINE (n = 33). After the removal of 51 duplicates and screening based on titles and abstracts, 28 studies were excluded for not meeting the relevance criteria. The remaining 20 studies underwent full-text review, resulting in the exclusion of 13 studies for various reasons, including irrelevance to the review topic (n = 1), animal-based studies (n = 4), individual case reports (n = 6), and lack of availability of full texts (n = 2). This process resulted in the inclusion of 7 studies in the final systematic review (Fig. 1).

The quality of the studies was assessed using the methodological index for nonrandomized studies (MINORS)[13]

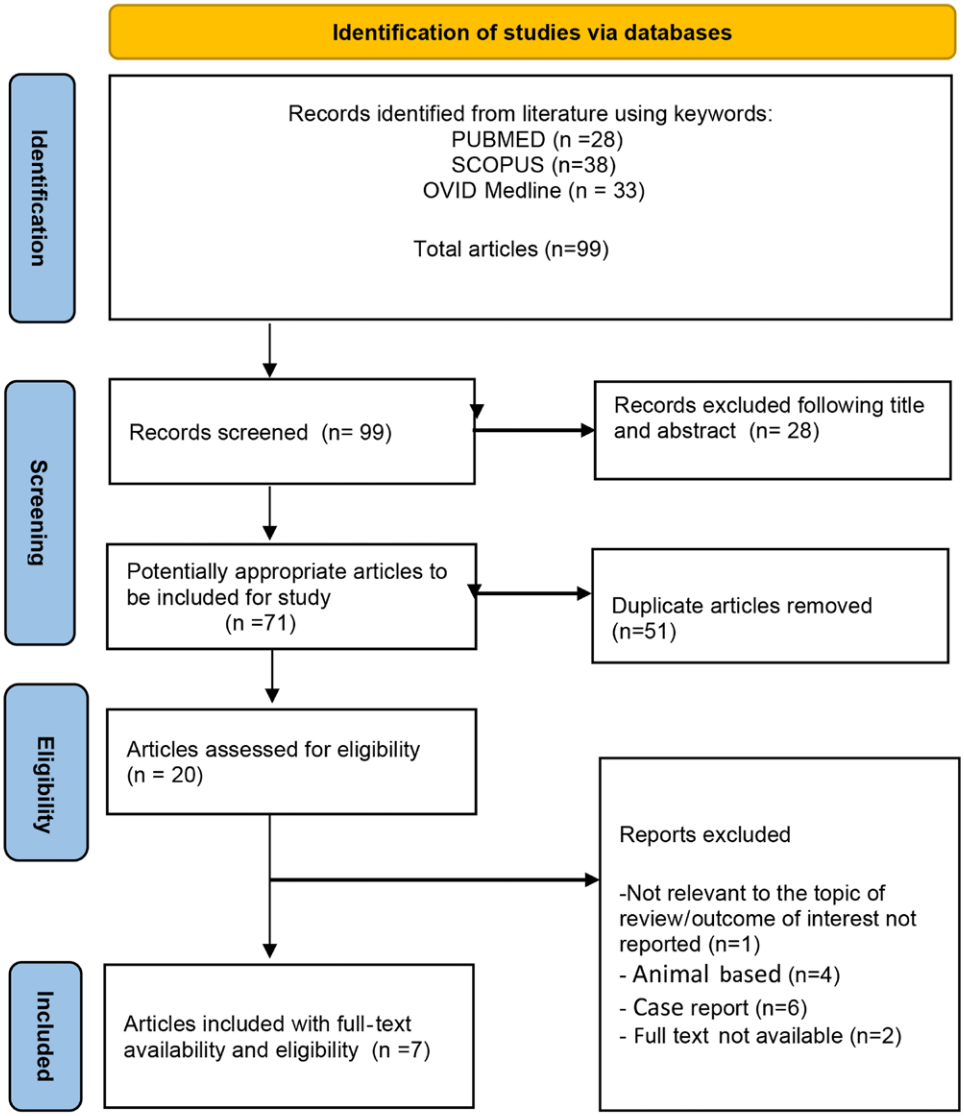

Fig. 1. PRISMA flow diagram of the study selection process. PRISMA, preferred reporting items for systematic reviews and meta-analyses.

criteria (Table 1). The included studies were a mix of prospective and retrospective designs. The MINORS score was reported as a percentage of the global ideal score. For this review, a score of equal to or less than 8 was considered to be poor quality, 9–14 moderate quality, and 15–16 good quality for noncomparative studies. Cutoff points were equal to or less than 14, 15–22, and 23–24 for poor, moderate, and good, respectively, for comparative studies.[21] The mean MINORS score for noncomparative studies was 10.4 (range 9–12), and for comparative studies, it was 13 (range 10–16).

The items are scored 0 (not reported, red box), 1 (reported but inadequate, yellow box), or 2 (reported and adequate, green box). Color scheme for total MINORS score: poor (red), moderate (yellow), and good quality (green). The global ideal score is 16 for noncomparative studies and 24 for comparative studies.

Due to the nature of the clinical studies, all included research exhibited a lower quality assessment score, primarily because of the absence of control groups and the lack of clear reporting on the inclusion of consecutive patients. The most significant variations in quality assessment stemmed from the failure to report on patient attrition and the absence of a prospective calculation for study size. Although none of the studies attained an ideal score, the resulting MINORS scores suggested a low risk of bias in most cases. The failure of any study to achieve the optimal MINORS score indicates potential improvements in study design, particularly with respect to comprehensive patient follow-up reporting. Nevertheless, most studies were assessed as having a low risk of bias based on the MINORS criteria.

One study by Myung et al[14] explored various procedures, including suction-assisted lipectomy with lymphovenous anastomosis, autologous breast reconstruction using a muscle-sparing transverse rectus abdominis muscle flap combined with inguinal lymph node transfer, and VLNT with a free omental flap. However, the analysis was

Table 1. Study Quality Assessment (MINORS Score)[13]

	Myung et al, 2023[14]	Crowley et al, 2024[15]	Felmerer et al, 2021[16]	Di Taranto et al, 2020[17]	Johnson et al, 2019[18]	Nguyen et al, 2017[19]	Egorov et al, 1994[20]
1. Clearly stated aim	2	2	2	2	2	2	2
2. Inclusion of consecutive patients	1	0	0	0	2	2	0
3. Prospective collection of data	0	1	1	2	2	2	1
4. End points appropriate to the aim of the study	2	2	1	2	2	2	2
5. Unbiased assessment of study endpoint	2	2	1	2	2	2	2
6. Follow-up period appropriate to the aim of the study	2	2	1	2	1	2	2
7. Loss to follow-up less than 5%	1	0	0	0	0	0	1
8. Prospective calculation of the study size	0	0	0	0	0	0	0
Additional criteria for comparative study							
9. An adequate control group	0		0				
10. Contemporary group	2		2				
11. Baseline equivalence of groups	2		1				
12. Adequate statistical analysis	2		1				
Total MINORS score, n (%)	16 (66.7)	9 (56.3)	10 (41.7)	10 (62.5)	11 (68.8)	12 (75)	10 (62.5)
Maximum possible score	24	16	24	16	16	16	16

The items are scored 0 (not reported, red box), 1 (reported but inadequate, yellow box), or 2 (reported and adequate, green box). Color scheme for total MINORS score: poor (red), moderate (yellow), and good quality (green).

limited to patients who underwent surgery involving the VLNT with a free omental flap. Similarly, Felmerer et al[16] reviewed treatments for secondary leg lymphedema, discussing robot-assisted omental lymph node transplantation, supraclavicular lymph node transplantation, and lymph vessel transplantation. However, only data from patients who received robot-assisted omental lymph node transplantations were included in the analysis.

Table 2 shows that the studies reviewed included a total of 131 patients who underwent omental free flap procedures, with a mean age of approximately 54.75 years (±2.63 y). Notably, 2 patients presented with bilateral limb involvement, resulting in a total of 133 limbs being treated with omental flaps in 2 studies.[15,19] The majority of these patients were women (n = 103), whereas a smaller proportion were men (n = 8); 1 study did not report the sex of 21 patients. The sample sizes of the included studies varied from 7 to 42 patients, with an average of 18.71 ± 11.65 patients per study. These studies were conducted across multiple countries, including 3 from the United States, and spanned a period from 1994 to 2023. The methodological designs of the studies included 4 prospective and 3 retrospective studies. The mean follow-up period for 6 of these studies was 17.96 ± 6.97 months. Outcome measures were diverse, with an average of 2.86 (range 1–5) outcome variables reported per study (Fig. 2).

The review encompassed both primary (n = 21) and secondary (n = 112) lymphedema cases, with the majority being secondary. The most common pathology of secondary lymphedema was breast cancer–related lymphedema (n = 67), followed by gynecologic cancers (n = 21), and no specific pathologies were identified in one of the studies for 21 patients. The surgical approaches for harvesting the omental flaps varied across studies, including laparotomy (n = 36), robotic surgery (n = 18), and laparoscopic methods (n = 51). The technique was not reported for 26 patients in 1 study (Table 3).

The staging of lymphedema was documented in 5 studies using the International Society of Lymphology classification and in 1 study using the modified indocyanine green lymphography staging system. According to the International Society of Lymphology classification, 33 patients were classified as having stage III lymphedema, 32 patients as having stage II, and 1 patient as having stage I. Three patients underwent prophylactic intervention. Using the modified indocyanine green lymphography staging system, 15 patients were categorized as having stage 5 lymphedema, 18 patients as having stage 4, and 9 patients as having stage 3. One study did not report the staging of lymphedema among its included patients. Of the total patient population, 71 were treated for upper limb lymphedema, whereas 62 were treated for lower limb lymphedema.

Table 4 provides a comprehensive overview of the outcome measures reported across 27 studies, encompassing both patient-reported outcome measures (PROMs) and clinical outcome measures. Volume reduction of the affected limb was the most frequently reported clinical outcome (n = 5), followed by the incidence of infection, cellulitis, or erysipelas (n = 3), and the use of lymphoscintigraphy (n = 3). In contrast, PROMs such as qualitative assessments were reported less frequently (n = 3), indicating a potential gap in patient-centered evaluation metrics.

Table 2. Characteristics of Included Studies

No.	Study, Year	Study Design	Concurrent Procedure for Lymphedema	Country*	Sample Size	Sex (M/F)	Mean Age, y	Mean Follow-up, mo	No./Name Outcome Measures
1	Myung et al, 2023[14]	Retrospective	LVA	Korea	26	F	52.1 ± 11.9	29.2 ± 6.5	3/Postoperative change in the percentage difference in the volume of the affected limb compared with the contralateral limb, LYMPH-Q, and bioelectrical impedance analysis
2	Crowley et al, 2024[15]	Retrospective	—	United States	7†	F	52.3	14.6	1/Pre- and postoperative excess volume difference of the affected limb
3	Felmerer et al, 2021[16]	Prospective	—	Germany	18	1 M, 17 F	57.45 ± 8.02	18 ± 3.48	1/Recurrent erysipelas
4	Di Taranto et al, 2020[17]	Prospective	—	Taiwan	10	2 M,8 F	57.8	24.1	4/Mean circumference reduction rate, lymphoscintigraphy, skin tonicity, and cellulitis
5	Johnson et al, 2018[18]	Retrospective	—	United States	7	F	56.9	7.9	4/Pre- and postoperative excess volume difference of the affected limb, L-Dex, lymphedema quality of life (LYMQOL), postoperative MRA imaging of an operative extremity after flap inset
6	Nguyen et al, 2017[19]	Prospective	LVA (23); patent efferent flap lymphatic for LVA (18)	United States	42†	5 M, 37 F	52	14	5/Qualitative assessment (swelling, fatigue, heaviness, tightness, stiffness, sleep loss, aching, and skin quality), pre- and postoperative excess volume of the affected limb compared with the unaffected limb (%), lymphoscintigraphy with SPECT/computed tomography scan of the affected lymph node basins, ICG lymphography, and cellulitis
7	Egorov et al, 1994[20]	Prospective	LVA (21)	Russia	21	NR	NR	NR	2/Postoperative volume reduction of the affected limb, lymphoscintigraphy

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†One patient had bilateral limb involvement.
ICG, indocyanine green; L-Dex, lymphedema index; LVA, lymphovenous anastomosis; MRA, magnetic resonance angiogram; NR, not reported; SPECT, single photon emission computed tomography.

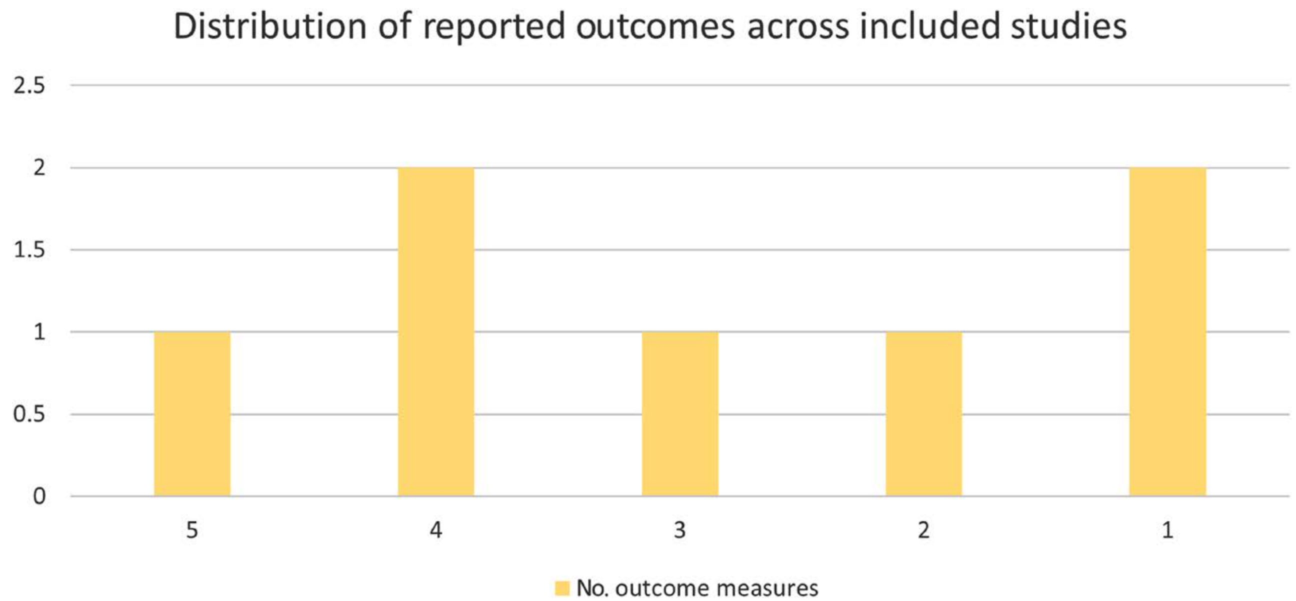

Fig. 2. Number of outcome measures reported per included study.

Table 3. Operative and Pathological Characteristics of the Patients Included in the Studies

No.	Study, Year	Primary Versus Secondary	Pathology (No. of Patients)	Technique of Harvest	Stage (No. of Limbs)	Site
1	Myung et al, 2023[14]	Secondary	• Breast cancer–related lymphedema (26)	• Not reported	International Society of Lymphology • Stage 3 (26)	• Upper limb (26)
2	Crowley et al, 2024[15]	Secondary	• Breast cancer–related lymphedema (**7**)	• Laparotomy (5) • Laparoscopic (2)	International Society of Lymphology • Prophylactic intervention (3) • Stage 1 (1) • Stage 2 (4)	• Upper limb (8)
3	Felmerer et al, 2021[16]	Secondary	• Breast cancer–related lymphedema (10) • Gynecologic cancer (4) • Thigh liposarcoma (1) • Penis squamous cell carcinoma (1) • Melanoma (1) • Peripheral neuroectodermal tumor (1)	• Robot-assisted (da Vinci Xi)	International Society of Lymphology • Stage 2 (15) • Stage 3 (3)	• Upper limb (10) • Lower limb (8)
4	Di Taranto et al, 2020[17]	Secondary	• Gynecologic cancer (5) • Urologic cancer (3) • Melanoma (1) • Anal cancer (1)	• Laparoscopic	International Society of Lymphology • Stage 2 (6) • Stage 3 (4)	• Lower limb (10)
5	Johnson et al, 2019[18]	Secondary	Breast cancer–related lymphedema (7)	• Laparotomy	International Society of Lymphology • Stage 2 (7)	• Upper limb (7)
6	Nguyen et al, 2017[19]	Primary and secondary	• Primary lymphedema (2) • Breast cancer–related lymphedema (16) • Gynecologic cancer (12) • Lymphoma (5) • Trauma, (3) • Sarcoma (1) • Not reported (3)	• Laparotomy (3) • Laparoscopic (39)	Modified ICG lymphography • Stage 3 (9) • Stage 4 (18) • Stage 5 (15)	• Upper limb (19) • Lower limb (24)
7	Egorov et al, 1994[20]	Primary and secondary	• Primary lymphedema (19) • Secondary lymphedema (2).	• Laparotomy	• Not reported	• Upper limb (1) • Lower limb (20)

ICG, indocyanine green; SPECT, single photon emission computed tomography.

Table 4. Reporting of Outcome Measures

Outcome Score	No. of Studies (%)	PROM or COM*
Volume reduction (pre- and postoperative excess volume difference of the affected limb)	3 (42.85)	COM
Volume reduction (compared with the contralateral limb)	2 (28.57)	COM
Bioimpedance analysis	1 (14.29)	COM
Qualitative assessment (swelling, fatigue, heaviness, tightness, stiffness, sleep loss, aching, and skin quality)	1 (14.29)	PROM
LYMPH-Q questionnaire	1 (14.29)	PROM
Lymphedema quality of life (LYMQOL)	1 (14.29)	PROM
Skin tonicity	1 (14.29)	COM
Infection/cellulitis/erysipelas	3 (42.85)	COM
Lymphoscintigraphy	3 (42.85)	COM
ICG lymphography	1 (14.29)	COM
Postoperative MRA	1 (14.29)	COM
L-Dex	1 (14.29)	COM
Limb circumference reduction rate	1 (14.29)	COM

*PROM or COM, patient-reported outcome measures or clinical outcome measures.
ICG, indocyanine green; L-Dex, lymphedema index; MRA, magnetic resonance angiogram.

The table emphasizes the variability in outcome reporting across studies, which may affect the comparability of results and the overall synthesis of evidence.

Table 5 presents the specific time points at which PROMs were administered and describes patient outcomes, including postoperative changes. A total of 20 outcomes were reported across the 7 included studies. These outcomes encompass volume reductions in the affected limb, improvements in LYMPH-Q scores, enhanced results in bioimpedance analysis, and reductions in recurrent

Table 5. Time Points at Which Outcomes Were Measured and Description of Outcome

No.	Study, Year	PROM/COM	Time Points	Outcome
1	Myung et al, 2023[14]	Postoperative change in the percentage difference in the volume of the affected limb compared with the contralateral limb	6 mo and at 1 y postoperatively	The omental VLNT groups demonstrated a reduction in limb volume postoperatively when compared with their preoperative measurements, decreasing from 1.31 ± 0.19 to 1.20 ± 0.11 at 12 mo after surgery (P > 0.05)
		LYMPH-Q	6 mo and at 1-y postoperatively	LYMPH-Q scores decreased substantially from 70 to 50 at 12 mo postoperatively, and the omental VLNT group exhibited the least degree of improvement among the 2 comparative groups (MSTRAM + nonomental VLNT and SAL + LVA) with a statistically significant difference observed in the intergroup comparison (P = 0.01)
		Bioelectrical impedance analysis (Interlimb impedance ratio) (1 and 5 kHz)	6 mo and at 1-y postoperatively	The bioimpedance analysis indicated that postoperative improvement levels were statistically significant across all 3 groups compared with preoperative values (P = 0.02). The omental VLNT group showed the most significant improvement among the 2 comparative groups—MSTRAM + nonomental VLNT and SAL + LVA—demonstrating a superior impedance ratio at both 1 and 5 kHz compared with the contralateral normal limb, with values of 1.61 ± 0.21 and 1.24 ± 0.28 versus 1.62 ± 0.19 and 1.24 ± 0.27, respectively
2	Crowley et al, 2024[15]	Pre- and postoperative excess volume difference of the affected limb	Variable (from 4 to 12 mo postoperatively)	Patients experienced a reduction in swelling, with a mean pre- and postoperative excess volume difference in the affected limb of 134.5 ± 189.12 mL
3	Felmerer et al, 2021[16]	Recurrent erysipelas	Not specified (from 12 to 27 mo postoperatively)	None of these patients suffered from recurrent erysipelas
4	Di Taranto et al, 2020[17]	Mean circumference reduction rate	Patients were followed up once a week for the first month, after surgery for early detection of complications and then every month for the first year and then yearly	The mean reduction rates in limb circumference were 25.1% ± 3.2% above the knee, 23.5% ± 2.8% below the knee, 23.4% ± 5.9% above the ankle, and 15.2% ± 3.6% at the foot level, despite the bulk of the flap. Statistical analysis revealed a significant difference in circumference measurements across all levels (P < 0.01)
		Lymphoscintigraphy	1-y postoperatively	Enhanced lymphatic drainage, with no evidence of residual tracer backflow on the postoperative imaging. Additionally, in some patients, postoperative images demonstrated the presence of newly formed lymphatic vessels at the site of the transposed flap, indicating a complete restoration of the lymphatic network
		Skin tonicity	1-y postoperatively	Overall decrease in tonicity by 6.5% ± 1.2% from preoperative levels (P < 0.05)
		Cellulitis	Not specified (from 23 to 35 mo postoperatively)	No episodes of infection were recorded during the follow-up period, with a significant decrease in the episodes of cellulitis from the preoperative period (P < 0.05)
5	Johnson et al, 2019[18]	Pre- and postoperative excess volume difference of the affected limb	Variable (from 1 to 14 mo postoperatively)	Patients with a minimum of 6-mo follow-up, showed the mean excess volume reduction by 41.3%
		L-Dex	Variable (from 1 to 14 mo postoperatively)	Mean decrease in L-Dex value was 8.6 units (n = 6 patients)
		Lymphedema quality of life (LYMQOL)	Variable (from 1 to 14 mo postoperatively)	Significant improvement with mean percent increases of 25% (mood), 23% (symptoms), 33% (function), and 30% (appearance). The quality-of-life domain score increased by a mean of 27% at 3 mo of follow-up
		Postoperative MRA imaging of an operative extremity after flap inset	Not specified	No findings reported

(*Continued*)

Table 5. ***Continued***

No.	Study, Year	PROM/COM	Time Points	Outcome
6	Nguyen et al, 2017[19]	Qualitative assessment (swelling, fatigue, heaviness, tightness, stiffness, sleep loss, aching, and skin quality)	Not specified (from 3 to 32 mo postoperatively)	Improvements in swelling, fatigue, heaviness, tightness, stiffness, sleep loss, aching, and skin quality in 83% (n = 35) of patients; 16% (n = 7) patients did not report improvement
		Pre- and postoperative excess volume of the affected limb compared with the unaffected limb (%)	3, 6, and 12 mo postoperatively	The mean volumetric improvement was 22%, ranging from a 74% improvement to a 35% worsening, with 4 patients exhibiting worsening
		Lymphoscintigraphy with SPECT/computed tomography scan of the affected lymph node basins	1-y postoperatively	Viable lymphatic transfers, showing enhanced extremity drainage with tracer accumulation within the flap
		ICG lymphography	1-y postoperatively	Passive uptake of the dye into the flap, with concentration observed at the lymph nodes and lymphatic lakes
		Cellulitis	Not specified (from 3 to 32 mo postoperatively)	Postoperative cellulitis observed in only 5% of patients (n = 2/42)
7	Egorov et al, 1994[20]	Postoperative volume reduction of the affected limb; lymphoscintigraphy	3, 6, 9, 12, 18, and 24 mo postoperatively	Of the 21 patients, 2 were lost to follow-up. The remaining 14 patients showed significant improvement in lymphedema with more than a 50% reduction in swelling, whereas 5 patients achieved satisfactory results with a 25%–50% reduction
		Lymphoscintigraphy	Not reported	The uptake of tracer in regional nodes on the lymphedema limb was the same before and after the operation, with no changes in the draining pattern

ICG, indocyanine green; L-Dex, lymphedema index; LVA, lymphovascular anastomosis; MRA, magnetic resonance angiogram; MSTRAM, muscle-sparing transversus rectus abdominis muscle flap; nonomental VLNT, superior circumflex iliac artery perforator or superficial inferior epigastric artery lymphatic flap; SAL, suction-assisted liposuction.

Table 6. Complications Associated With Recipient and Donor Sites

No.	Study, Year (Sample Size)	Recipient-site Complications (n = 133)	Donor-site Complications (n = 131)
1	Myung et al, 2023[14] (n = 26)	None	None
2	Crowley et al, 2024[15] (n = 7)	None	Abdominal wound dehiscence, n = 1 (0.76%)
3	Felmerer et al, 2021[16] (n = 18)	None	Abdominal tension, n = 3 (2.29%)
4	Di Taranto et al, 2020[17] (n = 10)	Partial graft failure, n = 1 (0.75%)	None
5	Johnson et al, 2019[18] (n = 7)	None	None
6	Nguyen et al, 2017[19] (n = 42)	• Flap loss, n = 1 (0.75%) • Postoperative cellulitis, n = 2 (1.5%) • Hematomas, n = 2 (1.5%) • Seromas, n = 2 (1.5%)	Pancreatitis, n = 1 (0.76%)
7	Egorov et al, 1994[20] (n = 21)	• Partial necrosis of flap, n = 2 (1.5%) • Groin wound infection, n = 1 (0.75%) • Prolonged lymphorrhea, n = 2 (1.5%)	Dyspepsia, n = 2 (1.53%)

erysipelas/cellulitis, among others. These findings collectively summarize the effectiveness of the omental VLNT procedure at various time points postoperatively.

Table 6 outlines complications related to both recipient and donor sites across the various studies reviewed. Notably, 4 studies reported no recipient-site complications in 120 patients (90.22%), whereas 3 studies reported complications at the recipient site in 13 patients (9.77%). Donor-site complications were reported in 4 studies involving 7 patients (5.34%), whereas 3 studies reported no donor-site complications in 124 patients (94.65%). Among the 133 limbs treated with omental flaps, 1 flap failure was reported (0.75%). For the calculation of complication rates at the recipient site, the denominator was based on the total number of treated limbs (133), whereas the calculation for donor-site complication rates used the total number of patients (131) as the denominator.

DISCUSSION

The literature on omental free flaps has been relatively sparse. By consolidating existing research specifically on omental free flaps, this review fills a critical gap and provides a targeted analysis of this technique. Liu et al cited that Jobet and Lambell[22] first reported the use of the great omentum in reconstructive surgery for treating intestinal wounds in 1926. Since then, it has been used for the coverage of soft tissue defects (mediastinum,[23] sacral wound,[24] etc.). The Romanian surgeon Kiricuta[25] was the first to demonstrate the versatility of pedicled omentum in reconstructing extraperitoneal soft tissue defects, notably for vesicovaginal fistula repair and for breast reconstruction. In 1968, Goldsmith and De los Santos[26] reported using the pedicled omentum to address the chronic lymphedema by mobilizing the omentum up to the knee or elbow in the limbs. Despite the promising concept, donor-site complications such as iatrogenic hernia,[27] pancreatitis, or injury to surrounding abdominal structures have limited its widespread adoption.[10,27] The concept of employing the omentum as a biological drain for lymphedema management was first introduced by Sokolovsky, as cited by Egorov et al in their paper,[20] in 1925. The technique has undergone substantial refinement since then. The advent of microsurgery revitalized interest in the omental flap, with McLean and Buncke[28] reporting its use as a free flap to cover a full-thickness scalp defect in 1972. In 2006, Nakajima et al[29] further demonstrated its potential for lymphedema management, reporting improved upper extremity function in a patient with breast cancer–related lymphedema. The refinement of harvesting techniques has played a critical role in enhancing the utility of the omental flap, such as the Saltz et al[30] laparoscopic-assisted harvest in 1993 and the Ciudad et al[31] robotic-assisted harvest in 2016, which have significantly reduced intra-abdominal complications and improved postoperative outcomes.

This review specifically focuses on omental free flap procedures, providing an in-depth analysis of this surgical technique. The review incorporates studies with both prospective and retrospective designs, capturing a broad spectrum of evidence that reflects real-world clinical practices. Most studies included in the review exhibited moderate methodological quality, highlighting the need for more rigorously designed research. Although current evidence supports the use of omental free flaps, future research must address key gaps through randomized controlled trials, larger sample sizes, standardized outcome measures, longer follow-up periods, and comparative studies. Improving methodological quality will not only validate existing findings but will also strengthen the evidence base on the efficacy and safety of omental free flap procedures.

Most studies emphasized clinical outcome measures, whereas relatively few prioritized PROMs. This underscores a gap in the literature in assessing the broader impact of surgical outcomes, because lymphedema significantly disrupts an individual's daily routines and overall quality of life. Improved patient-reported outcomes, including reduced swelling, fatigue, and improved skin quality, highlight the procedure's effectiveness in improving the quality of life for those with lymphedema.

Studies consistently reported a significant reduction in limb volume following omental free flap procedures. Improved lymphatic function, as noted in postoperative lymphoscintigraphy and reduced cellulitis incidence, suggest that this procedure enhances overall lymphatic health by enhancing drainage. These outcomes are particularly critical in managing lymphedema, which is associated with physical discomfort, impaired mobility, and decreased quality of life.

The review highlights inconsistencies in follow-up durations and assessment intervals across studies. These variations affect the ability to evaluate long-term outcomes and the durability of treatment. Variations in flap harvest methods, insertion sites, and recipient vessels can impact results and complicate comparisons. Patient-specific factors, such as obesity[14,32] and the presence of comorbid conditions can influence surgical outcomes, necessitating tailored surgical techniques and comprehensive preoperative assessments.

The omental flap is considered superior to other lymph node flaps due to its safety in preventing iatrogenic lymphedema and because omental lymph node flap typically contains about 15 lymph nodes (range 1–49), including micro lymph nodes smaller than 1.5 mm. This is typically higher compared with lymph nodes found in flaps taken from superficial sites such as the inguinal, cervical, lateral thoracic, or submental areas. The higher number of lymph nodes in the omental flap may contribute to better patient outcomes.[32,33] The greater omentum includes clusters of lymph nodes (specifically level 4ab along the left gastroepiploic vessels and level 4d along the right gastroepiploic vessels) as well as lymphatic ducts that facilitate effective drainage.

The greater omental lymph node flap offers several advantages, including a plentiful supply of lymph nodes, a pedicle with a moderate diameter, minimal risk of donor-site lymphedema, and small incisions in discreet locations, which typically result in minimal scarring. However, in practice, omental lymph nodes are not typically the first choice for managing lymphedema due to limitations such as the need for general surgical involvement, longer operative times, and incapability of primary closure, aesthetic concerns at the recipient site, the risk of intraperitoneal organ injury, and conversion to an open method.[34] Specialized centers with expertise in minimally invasive and microsurgical techniques can help mitigate these concerns.

Recent advancements, such as laparoscopic and robotic-assisted techniques, have improved the safety profile of omental flap procedures. The reduced donor-site morbidity and minimized postoperative complications are notable benefits. In 2023, Crowley et al[15] demonstrated omental VLNT in conjunction with breast reconstruction, reporting minimal complications and favorable outcomes. In 2021, Felmerer et al[16] demonstrated that robotic-assisted omental VLNT offered a superior safety profile and lower donor-site morbidity compared with other techniques. Di Taranto et al[17] focused on using omental flaps for severe lower limb lymphedema, demonstrating effective ulcer management and reconstruction. Johnson et al[18] reported beneficial outcomes from using flow-through free omental flaps for unilateral breast cancer–related lymphedema, further contributing to the growing evidence base.

Recipient-site complications, including partial graft failure, postoperative cellulitis, hematomas, and seromas, were reported in 9.77% of cases. These were managed with secondary surgical interventions, such as drainage of hematomas and seromas, or debridement. Although these complications were manageable with appropriate clinical interventions, their occurrence highlights the need for careful surgical technique and postoperative care to minimize risks. The relatively low rate of donor-site complications suggests that omental free flap procedures have a favorable safety profile. Notably, only 1 case of flap failure was reported among the 133 treated limbs, indicating a high success rate (99.25%).

Omental flap procedures should be considered as part of a multimodal approach to lymphedema management, potentially in combination with other surgical and nonsurgical interventions.

CONCLUSIONS

Although the omental free flap technique for managing lymphedema shows potential, further high-quality research is necessary to confirm its long-term efficacy and safety. Improved study designs, such as randomized controlled trials and consistent outcome reporting, are needed to advance understanding and application of this approach. The review emphasizes the importance of continued research to fill existing gaps and enhance evidence quality.

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DISCLOSURE

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

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