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Reconstructive

Lymphatic Ultrasound in Longitudinal Decision-making for Lymphedema: A Narrative Review Integrating Conservative and Surgical Management

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Background: Lymphedema is a chronic and progressive condition that requires long-term reassessment and adaptation of treatment strategies. Although conservative therapy and surgical interventions such as lymphaticovenular anastomosis have advanced, imaging findings are not consistently integrated into longitudinal treatment decision-making, including treatment selection, timing, and target prioritization.
Methods: This narrative review synthesizes current evidence and practice-related concepts regarding lymphatic ultrasound. Topics include lymphatic vessel characterization, differentiation from veins, subcutaneous tissue evaluation, and elastography. Particular emphasis is placed on how these findings may inform conservative management, surgical planning, and serial reassessment during the disease course.
Results: Lymphatic ultrasound enables repeated, noninvasive evaluation of both lymphatic vessels and surrounding subcutaneous tissues within the same examination. When interpreted using structured approaches such as NECST (normal, ectasis, contraction, and sclerosis)–aligned vessel assessment and D-CUPS, serial ultrasound may help clinicians adjust compression strategies, identify potential windows for lymphaticovenular anastomosis, reassess treatment targets beyond the affected limb segment, and support multidisciplinary communication during follow-up. The principal conceptual contribution of this review is the integration of previously described vessel-based and tissue-based ultrasound findings into a longitudinal, practice-oriented decision framework.
Conclusions: Beyond its role as a one-time diagnostic adjunct, lymphatic ultrasound may function as a practical longitudinal assessment tool in integrated lymphedema management. By linking vessel status, tissue phenotype, conservative optimization, and surgical decision-making across the disease course, this approach may support more adaptive and patient-centered care. However, broader external validation will be necessary before this framework can be considered widely generalizable. *(Plast Reconstr Surg Glob Open 2026;14:e7892; doi: 10.1097/GOX.0000000000007892; Published online 14 July 2026.)*

INTRODUCTION

Lymphedema is a chronic, progressive condition characterized by impaired lymphatic transport and consequent changes in collecting lymphatic vessels and subcutaneous tissues. Patients may experience limb swelling, recurrent cellulitis, functional limitation, and long-term deterioration in quality of life.[1,2] Because progression unfolds over years rather than weeks or months, effective management requires accurate diagnosis plus ongoing reassessment and adaptation of treatment strategies across the disease course.[3,4]

Conservative therapy—including compression, exercise, and skin care—remains the foundation of care, whereas lymphatic surgery is increasingly adopted in selected patients.[2,5,6] Lymphoscintigraphy and indocyanine

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green (ICG) lymphography play important roles in evaluating lymphatic dysfunction.[1,3] However, these modalities are typically performed at discrete time points and may be impractical for frequent longitudinal assessment in routine practice.[3,7] As a result, clinicians often face uncertainty about when to escalate therapy, which surgical strategy to select, and which anatomical regions should be prioritized.[4,8]

Lymphatic ultrasound has emerged as a promising noninvasive modality for visualizing lymphatic vessels and surrounding soft tissues.[9–11] High-frequency ultrasound enables direct assessment of collecting lymphatic vessels and characterization of subcutaneous tissue features such as fluid accumulation, fat hypertrophy, and fibrosis.[9,10,12] Because it can be repeated in outpatient settings, ultrasound is well suited to longitudinal monitoring.[7,11]

Despite these advantages, lymphatic ultrasound is still most often discussed as a diagnostic adjunct rather than a tool for guiding ongoing decision-making.[1,3] Frameworks that link ultrasound findings to treatment selection, timing, and target prioritization remain limited.[4,8] Two developments are particularly relevant. The NECST classification (normal, ectasis, contraction, and sclerosis) describes progressive degenerative changes in collecting lymphatic vessels based on histological evaluation. (**See Video [online]**, which demonstrates NECST-related morphological progression and D-CUPS-based differentiation between lymphatic vessels and veins using schematic animation and ultrasound clips.)[13] When interpreted with ultrasound, NECST provides a clinically accessible method to estimate vessel condition before intervention.[14] In parallel, reliable differentiation between lymphatic vessels and small veins is essential, especially in advanced lymphedema, in which structural resemblance may occur.[15] Structured approaches such as D-CUPS combine multiple ultrasound features to improve identification reliability (**see Video [online]**).[16,17]

Several of these interpretive concepts have been described in prior publications from our group and are therefore not presented here as newly introduced diagnostic criteria. However, most previous studies have focused on individual imaging techniques or interpretive criteria rather than on how ultrasound findings can be integrated into longitudinal clinical decision-making across the disease course.

In particular, the potential role of lymphatic ultrasound in linking conservative treatment optimization, surgical timing, and reassessment of anatomical targets over time has not been systematically synthesized. The present narrative review therefore aims to integrate previously described ultrasound-based concepts—including vessel morphology assessment, differentiation from veins, and subcutaneous tissue characterization—into a longitudinal, practice-oriented framework for lymphedema management. Rather than introducing a new diagnostic classification, this review proposes a conceptual model in which serial lymphatic ultrasound may support treatment selection, target prioritization, and strategy adaptation throughout the clinical course.

Takeaways

Question: How can clinicians monitor progressive lymphatic dysfunction and choose conservative treatment, complex decongestive therapy, or lymphaticovenular anastomosis when one-time imaging offers limited guidance?

Findings: This narrative review presents lymphatic ultrasound as a practical, repeatable decision-support tool for daily lymphedema practice. Serial assessment of lymphatic vessels and subcutaneous tissue can guide compression and complex decongestive therapy, identify lymphaticovenular anastomosis feasibility and timing, prioritize targets beyond limb swelling, and document response over time. Structured NECST and D-CUPS interpretation may improve reliability and multidisciplinary communication among surgeons, therapists, and patients.

Meaning: Longitudinal lymphatic ultrasound helps clinicians personalize lymphedema care by matching treatment intensity to changing lymphatic function.

MATERIALS AND METHODS

Study Design and Objective

This narrative review synthesized current evidence and clinical concepts on lymphatic ultrasound in lymphedema management. The primary objective was to conceptualize lymphatic ultrasound as a longitudinal decision-support framework integrating conservative and surgical strategies across the disease course rather than as a one-time diagnostic modality.[3,4] This review was designed as a narrative synthesis rather than a systematic review, with emphasis on clinically relevant concepts that may inform longitudinal decision-making in routine practice.

Literature Search Strategy

PubMed was searched for English-language publications from January 2000 to January 2026. Seminal studies published before 2010 were included when essential for conceptual development (eg, lymphatic vessel pathology).[13,18] Search terms combined “lymphedema” with “lymphatic ultrasound,” “ultrasonography,” “elastography,” “lymphaticovenular anastomosis (LVA),” “vascularized lymph node transfer (VLNT),” “liposuction,” “compression pressure,” “interface pressure,” “PicoPress,” “multidisciplinary,” “shared decision-making,” and “adherence.” Reference lists of key articles were screened to identify additional relevant publications.[3] Because the purpose of this review was conceptual synthesis rather than quantitative meta-analysis, the search strategy prioritized studies that provided clinically transferable insights into ultrasound-based assessment and management of lymphedema.

Eligibility Criteria

Studies were eligible if they provided clinical or conceptual insights into the following:

1. Ultrasound assessment of lymphatic vessels and/or subcutaneous tissues, including elastography[9,10,12,19,20];
2. Lymphatic vessel pathology, progression, or differentiation relevant to treatment selection (eg, NECST, D-CUPS)[8,13,14,16,17,21–24];
3. Integration of conservative therapy and surgical interventions[2,4,6,8];
4. Practical or quantitative aspects of compression optimization[18,25–27]; or
5. Multidisciplinary implementation, patient education, or adherence in chronic care.[4,28–30]

Studies were excluded if they lacked transferable relevance to ultrasound-based decision-making in lymphedema or consisted solely of isolated case reports with limited generalizability, unless they provided essential conceptual insights.[3] Because this was a narrative review, formal risk-of-bias scoring and quantitative pooling were not performed; instead, emphasis was placed on conceptual relevance and applicability to longitudinal clinical management.

Data Extraction and Synthesis

Data were synthesized qualitatively with emphasis on clinical decision-making and implementability. Findings were categorized into 6 domains:

1. Tissue characterization with ultrasound and elastography[9,10,12,19,20,31];
2. Vessel progression and ultrasound-based NECST assessment[13,14,22,23];
3. Differentiation of collectors from veins (D-CUPS)[15–17,21,24];
4. Noncontrast ultrasound for diagnosis and longitudinal monitoring[1,3,7,11,32,33];
5. Compression optimization and lifestyle intervention[5,18,25–27,34,35]; and
6. Multidisciplinary implementation and shared decision-making.[2,4,6,28–30]

These domains were integrated into a longitudinal framework and summarized using main-text figures and tables, with additional illustrative materials provided as supplemental digital content. Several of the interpretive frameworks discussed in this review have been described in prior publications from our group; in the present work, they are synthesized together with related literature to illustrate how ultrasound findings may be incorporated into a longitudinal clinical decision framework.

Implementation Example and Quality Assurance

As an implementation example, our team applies a lymphatic ultrasound-centered approach to support longitudinal decision-making. Assessment is performed not only on the affected limb but also on anatomically relevant proximal regions to identify upstream targets.[8,22,31] Roles are defined: physicians determine overall strategies, and therapists implement conservative management based on shared ultrasound findings.

Therapist-performed ultrasound is supported through structured education (video-based learning, supervised practice with standardized manuals, and internal competency assessment).[4,24,28] To maintain quality, joint review sessions are conducted, and images are routinely shared with patients (and family members when appropriate) to facilitate understanding and shared decision-making.[29,30] This implementation example is presented to illustrate feasibility and workflow rather than to define a mandatory protocol. Competency is determined through structured training and internal quality assurance rather than by professional role alone, and similar models may also involve sonographers or surgeons depending on institutional resources. Final decisions integrate ultrasound findings with symptoms, skin condition, cellulitis history, and venous and arterial evaluation.[3,4]

RESULTS

Dual Assessment: Lymphatic Vessels and Subcutaneous Tissues

Lymphatic ultrasound enabled dual assessment of collecting lymphatic vessels and surrounding subcutaneous tissue. Vessel-level findings included visualization, caliber, wall characteristics, and degrees of dilation or sclerosis, whereas tissue-level findings reflected fluid-dominant edema, fat hypertrophy, and fibrosis.[9,10,12] This dual assessment provides structural information beyond limb volume or circumference alone, enabling simultaneous visualization of lymphatic vessels and tissue composition within the same examination. Serial ultrasound evaluation allows repeated observation of these vessel and tissue features during the clinical course. (**See figure, Supplemental Digital Content 1**, which demonstrates simultaneous assessment of lymphatic vessels and surrounding tissue layers on lymphatic ultrasound, **https://links.lww.com/PRSGO/F16**.)[31] These integrated vessel- and tissue-level findings can be incorporated into a conceptual framework for treatment target identification and longitudinal reassessment (Table 1).

Vessel Progression and Ultrasound-based NECST Assessment

Progressive morphological changes in collecting lymphatic vessels have been conceptually summarized by the NECST classification.[13] Representative schematic, ultrasound, and intraoperative appearances are shown. (**See figure, Supplemental Digital Content 2**, which illustrates the NECST classification and corresponding ultrasound and intraoperative findings, **https://links.lww.com/PRSGO/F17**.)

Histological studies describe a continuum from luminal dilation to wall thickening and eventual obliteration.[13] When interpreted with ultrasound, NECST-based assessment provides a practical method for estimating vessel morphology and stage of degeneration before intervention. Ectatic vessels may correspond to relatively preserved stages, whereas contraction or sclerosis patterns represent more advanced structural degeneration. NECST patterns may coexist within different regions of the same limb,

Table 1. Ultrasound-based Conceptual Framework for Treatment Target Identification in Lymphedema

Key Lymphatic Ultrasound Findings	Primary Treatment Target Area	Recommended Conservative Management	Recommended Surgical Option	Suggested Reevaluation Interval	Key Explanation for Patients and Families
Clearly dilated collecting lymphatic vessels with preserved wall compliance (NECST: normal/ectasis), with subcutaneous fluid-dominant edema	Lower limb ± lower abdomen/genital region; upper limb ± axilla/anterior chest	Optimize compression pressure based on measurement; progressive exercise; skin care	LVA as first-line option	4–8 wk after optimization of conservative therapy	Dilated lymphatic vessels are still functional, making bypass surgery feasible
Poorly visualized or sclerotic lymphatic vessels (NECST: sclerosis dominant), fibrotic subcutaneous tissue	Whole lymphatic territory including trunk	Focus on maintenance-oriented compression, skin protection, and weight control	VLNT	8–12 wk after global reassessment	Native lymphatic pathways are severely impaired; alternative drainage routes are required
Mixed pattern of dilated and sclerotic lymphatic vessels with regional heterogeneity	Region with dominant pathological findings	Targeted compression and lifestyle modification according to dominant region	Stepwise strategy: LVA where feasible; VLNT for residual dysfunction	4–8 wk with short-cycle reassessment	Different regions show different disease stages; combined strategies are reasonable
Minimal subcutaneous fluid accumulation with predominant adipose tissue hypertrophy	Affected limb contour and body weight–related areas	Minimize compression burden; prioritize weight control and physical activity	Liposuction (if conservative measures are insufficient)	8–12 wk after lifestyle intervention	Limb enlargement is mainly due to fat accumulation rather than lymphatic fluid
Prominent subcutaneous edema in truncal regions (lower abdomen, groin, axilla, chest)	Truncal lymphatic pathways prioritized over distal limb	Compression garments targeting trunk; posture and movement guidance	Surgical options considered after truncal response evaluation	4–8 wk after targeted intervention	Proximal lymphatic congestion drives distal swelling
Emergence of newly dilated collecting lymphatic vessels during conservative therapy	Newly identified lymphatic region	Maintain optimized conservative therapy while preparing surgical conditions	Reevaluation for LVA (window of opportunity)	2–6 wk with short-cycle reassessment	Improved tissue conditions allow surgical bypass to become feasible
Signs of acute inflammation or recurrent cellulitis	Inflamed region and proximal drainage area	Prioritize infection control and skin protection; avoid excessive compression	Surgery deferred until inflammation resolves	1–2 wk	Safety first: stabilize inflammation before further intervention
Tubular structures resembling veins on ultrasound requiring differentiation	Planned surgical field	Use multicriteria ultrasound assessment (eg, D-CUPS)	Improved surgical planning accuracy	At each preoperative assessment	Multiple ultrasound features are needed to avoid misidentification
Persistent edema despite compression, suggesting inadequate pressure or mismatched target	Residual edematous region	Redesign compression strategy with pressure measurement	Surgical indication reconsidered after optimization	2–4 wk	Correct pressure and location are essential for effective conservative therapy

This table provides a conceptual decision-support summary, and the suggested reevaluation intervals are practice-informed examples that should be individualized.
LVA, lymphaticovenular anastomosis; VLNT, vascularized lymph node transfer.

supporting the use of multiregion scanning rather than reliance on a single observation point (Table 2).[22]

Differentiation From Veins: The D-CUPS Approach

Accurate differentiation of collecting lymphatic vessels from small veins is essential in ultrasound-based evaluation. In advanced lymphedema, dilated collectors may resemble venous structures, increasing the risk of misidentification.[15] The D-CUPS approach combines several ultrasound features—including Doppler signal absence, crossing patterns, uncollapsibility, parallel course, and superficial fascial location—to improve identification reliability when these findings are interpreted together. (**See figure, Supplemental Digital Content 3**, which summarizes the D-CUPS framework and the parallel sign, **https://links.lww.com/PRSGO/F18**.)[16,17] Observational studies indicate that lymphatic vessels in healthy individuals are typically small and collapsible, whereas pathologically dilated collectors in lymphedema often appear enlarged and less collapsible.[21]

Noncontrast Ultrasound for Diagnosis and Longitudinal Monitoring

High-resolution lymphatic ultrasound combined with structured interpretation may identify lymphatic dysfunction without routine use of contrast agents.[3,11] Because ultrasound can be performed repeatedly in outpatient settings, it may be used for serial observation of lymphatic structures during follow-up. Although ICG lymphography and lymphoscintigraphy remain important for comprehensive lymphatic mapping in selected cases, noncontrast ultrasound provides a practical modality for repeated

Table 2. NECST-aligned Lymphatic Vessel Staging and Corresponding Ultrasound Findings

NECST Type	Key Ultrasound Features (Typical)	Patho-physiologic Interpretation (Conceptual)	Clinical Implication	Strategy: Conservative Care	Strategy: Surgery (Direction)	Suggested Longitudinal Trigger to Update Strategy
N (normal)	Visualizable lymphatic vessel without marked dilation; relatively thin wall; preserved compliance; stable appearance	Lymphatic reserve preserved; dysfunction may be mild/early or regional	Window for nonsurgical optimization often exists	Prioritize education, lifestyle optimization, and tailored compression; monitor rather than overtreat	LVA usually not first-line unless clear symptomatic mismatch and suitable dilated collectors appear	If symptoms progress or subcutaneous fluid increases, reassess target areas and consider transition toward E-type pathway
E (ectasis)	Clearly dilated collecting lymphatic vessel; wall relatively preserved; often identifiable with multisign criteria; robust collector-like appearance	Intralymphatic pressure elevation with still-patent pathway; high likelihood of surgical feasibility	Best surgical window for LVA in many cases	Optimize compression pressure (measured) and promote safe activity; use ultrasound to identify dominant target regions	LVA favored when suitable venules/targets present; consider staged approach if mixed	If dilation decreases but symptoms persist, reassess tissue component (fat/fibrosis) and consider additional/alternative strategies
C (contraction)	Narrowed lumen with increased wall echogenicity/irregularity; reduced compliance; string-like and harder to trace	Transition phase toward sclerosis; partial patency may remain but surgical success may be variable	Borderline window: decisions depend on combined vessel + tissue status	Focus on reproducible maintenance plan; prioritize adherence; address proximal targets (trunk) when relevant	Selective LVA may be considered in localized segments; consider early discussion of VLNT if progression suspected	If vessel becomes poorly visualized or tissue fibrosis dominates, shift toward VLNT-focused planning
S (sclerosis)	Poorly visualized or nonvisualizable collector; markedly echogenic, stiff-appearing structure; discontinuity; advanced tissue changes often coexist	Advanced sclerosis/obliteration; patency low; bypass feasibility reduced	LVA less likely to be effective as a primary strategy	Maintenance-oriented compression and skin protection; shift emphasis to weight/activity and quality of life	VLNT is often more rational; consider debulking/liposuction if fat-dominant phenotype	If fluid becomes minimal and fat hypertrophy dominates, evaluate candidacy for debulking (liposuction)
Mixed/heterogeneous	Different NECST patterns in different regions; localized E-type collectors with coexisting C/S elsewhere	Spatial heterogeneity; treatable windows may coexist with irreversible segments	Requires target prioritization and staged strategy	Site-specific compression and lifestyle plan; focus on dominant pathophysiology	Staged strategy: LVA where E-type exists + VLNT/debulking as needed	Reassess at short intervals to capture emerging E-type collectors or progression to S-type

This table links typical ultrasound features with conceptual pathophysiologic interpretation and potential management implications.
LVA, lymphaticovenular anastomosis; VLNT, vascularized lymph node transfer.

clinical assessment.[1,3] Region-based scanning protocols suggest that ultrasound examinations can be completed within a short time while maintaining high visualization rates, supporting practical integration into longitudinal care (Fig. 1).[7]

Optimization of Conservative Therapy: Compression Pressure and Lifestyle

Compression therapy remains a central component of lymphedema management. However, delivered interface pressure may vary substantially even among trained therapists performing similar techniques.[25,26] Objective pressure measurement allows quantification of interface pressure and may support adjustment of compression strategies. Ultrasound findings describing tissue composition—such as fluid-dominant edema or adipose enlargement—may provide additional information during evaluation of treatment response.[9,10] Evidence indicates that appropriately prescribed exercise does not exacerbate lymphedema and may improve function and symptom control.[5,34] Intentional weight reduction may improve severity in selected populations.[35]

Multidisciplinary Implementation and Shared Decision-making

Lymphatic ultrasound may serve as a shared imaging reference among surgeons, therapists, and other professionals involved in lymphedema care.[4,28] Visual presentation of ultrasound findings may facilitate communication among clinicians and support patient understanding during follow-up consultations. Programs integrating surgical and conservative strategies have been reported to improve outcomes compared with single-modality approaches.[2,6]

Implementation Example (Illustrative Case)

An illustrative inpatient conservative program has also reported individualized compression adjustment using objective interface-pressure measurement, with ultrasound

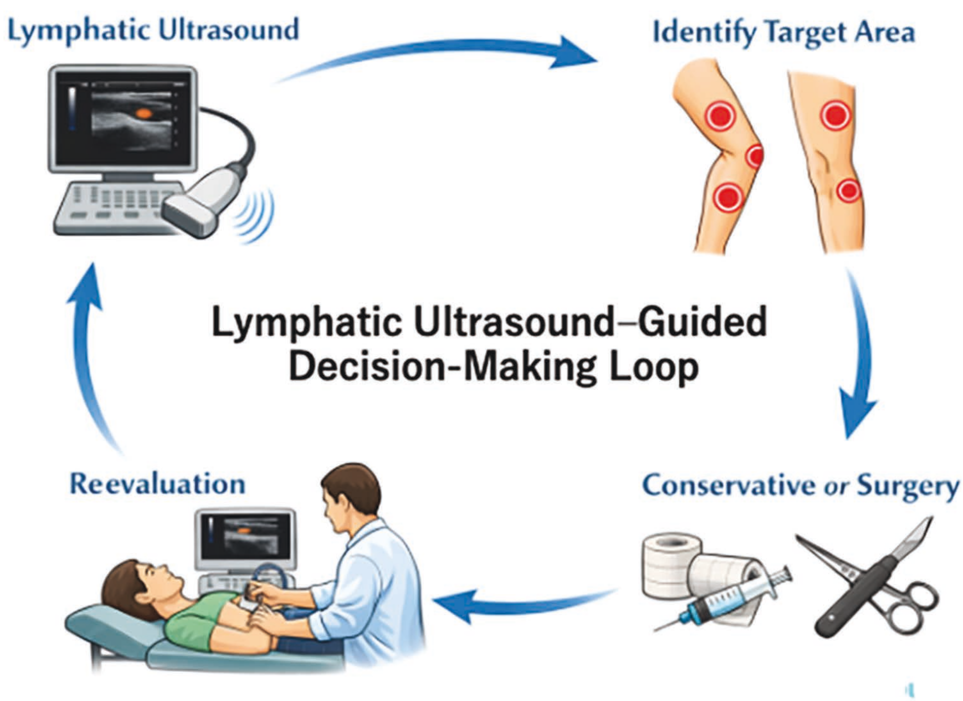

Fig. 1. Lymphatic ultrasound–guided longitudinal assessment loop for lymphedema management. This schematic illustrates how serial lymphatic ultrasound findings may guide treatment selection, follow-up reassessment, and the adaptation of conservative and surgical strategies over time.

findings referenced during treatment planning, supporting the feasibility of incorporating ultrasound-informed feedback into multidisciplinary care.[36]

DISCUSSION

What This Review Adds: Reframing Lymphatic Ultrasound as a Longitudinal Decision-support Framework

The principal contribution of this review is not the introduction of a new diagnostic classification. Rather, it is the integration of previously described ultrasound-based concepts—including vessel morphology assessment, differentiation from veins, tissue phenotyping, and serial reassessment—into a longitudinal, practice-oriented framework for lymphedema management.[1,3]

Rather than replacing established imaging modalities, lymphatic ultrasound may complement them by enabling repeated observation of lymphatic vessels and surrounding tissues during routine follow-up. This characteristic allows ultrasound findings to be incorporated into an adaptive decision process in which treatment priorities and target regions can be reassessed as disease status changes or responds to intervention (Figs. 1, 2).

NECST as a Guide to Treatment Strategy

The NECST classification was originally proposed to describe progressive degenerative changes in collecting lymphatic vessels based on histological observations (**see Video [online]**).[13] Several elements of NECST-based interpretation discussed here derive from prior publications by our group and related studies. In the present review, these concepts are considered together with broader literature to illustrate how vessel morphology may inform longitudinal clinical reasoning. Applied to ultrasound, NECST provides a clinically accessible approximation of vessel degeneration (Table 2).[14,22,23] Ectatic collectors may correspond to relatively preserved stages in which luminal patency and compliance remain present, whereas contraction or sclerosis patterns represent more advanced structural degeneration. NECST therefore serves as a practical interpretive framework aligning ultrasound observations with expected vessel condition and potential therapeutic considerations.[3,8]

D-CUPS and Diagnostic Reliability

Accurate differentiation of lymphatic collectors from small veins is essential for ultrasound-based interpretation. In advanced lymphedema, dilated collectors may resemble venous structures.[15]

Structured approaches such as D-CUPS combine multiple ultrasound features to improve identification reliability (**Supplemental Digital Content 3**, **https://links.lww.com/PRSGO/F18**; **Video [online]**).[16,17] Within this conceptual model, NECST may provide information about vessel degeneration, whereas D-CUPS supports confirmation that the observed structure represents a lymphatic collector rather than a vein. Because D-CUPS relies on pattern recognition, diagnostic reliability may depend on operator experience, equipment characteristics, and training.[4,24] These factors highlight the importance of structured education and quality-assurance processes when implementing lymphatic ultrasound in clinical practice.

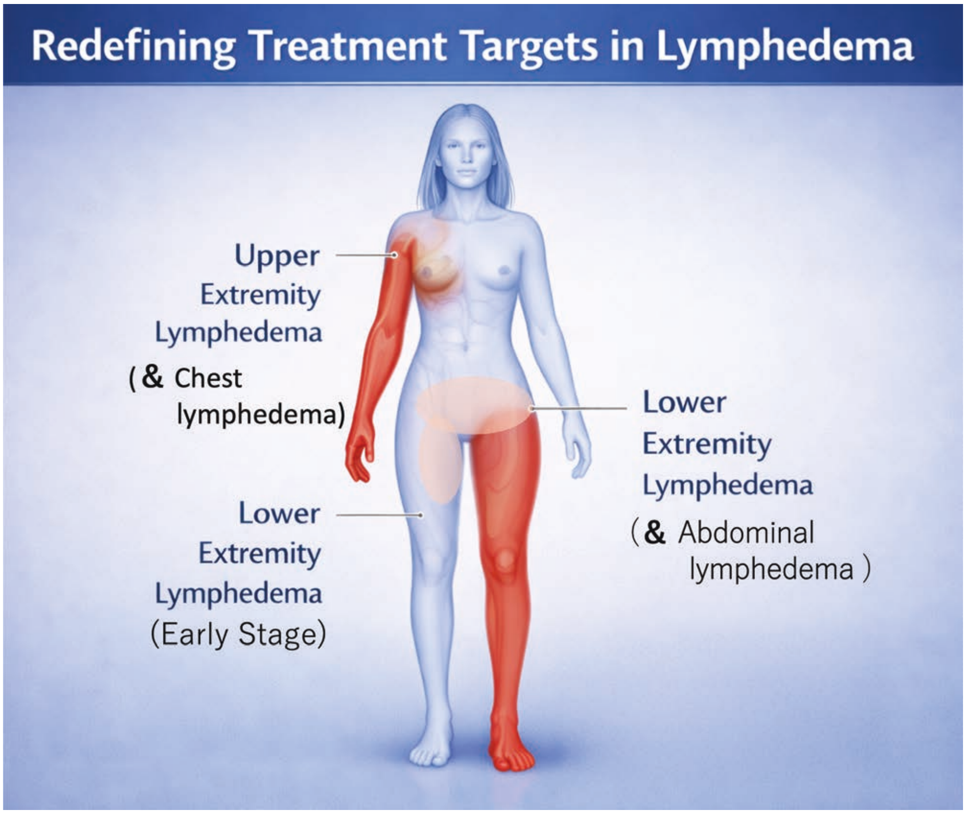

Fig. 2. Ultrasound-based identification of regional treatment targets in lymphedema. This schematic highlights how lymphatic dysfunction in the limb and adjacent proximal regions may influence treatment prioritization; red indicates primary targets, and orange indicates secondary targets.

Expanding Treatment Targets Beyond the Limb

Lymphatic ultrasound assessment may also broaden clinical attention beyond the visibly affected limb segment. Proximal truncal or regional lymphatic dysfunction can contribute to persistent symptoms or recurrence (Fig. 2).[31] Recognition of spatial heterogeneity in lymphatic dysfunction suggests that treatment targets may extend beyond the most visibly swollen region. Regional variation in subcutaneous tissue changes may therefore support targeted intervention strategies rather than uniform limb-wide treatment.[9,31]

Conservative Therapy and Lifestyle Adaptation

Compression therapy remains a cornerstone of lymphedema care. However, delivered interface pressure can vary substantially even when similar techniques or garments are used.[25,26] Objective pressure measurement interpreted alongside ultrasound findings may support individualized compression adjustment, balancing efficacy, safety, and patient comfort.[18,27]

Ultrasound phenotyping—such as differentiation between fluid-dominant and adipose-dominant enlargement—may provide additional information when tailoring conservative strategies.[9,12] Given the heterogeneous evidence regarding optimal compression protocols and lifestyle interventions, iterative adjustment guided by objective findings may represent a pragmatic approach in long-term care.

Rationale for Suggested Reevaluation Intervals

The suggested reevaluation intervals presented in this framework are intended as pragmatic, practice-informed time frames rather than evidence-graded mandates. Shorter intervals may be appropriate after major treatment changes, during unstable symptoms, or when cellulitis, rapidly evolving tissue changes, or potential surgical windows are being considered. Longer intervals may be reasonable during stable follow-up, particularly when the purpose is surveillance of compression fit, tissue status, or postoperative change. In our local practice, stable patients are often reassessed when compression garments are renewed, and postoperative ultrasound is commonly performed around 6 months after lymphaticovenular anastomosis; these are implementation examples rather than universal recommendations.

Multidisciplinary and Patient-centered Implementation

Ultrasound findings may function as a shared reference among surgeons, therapists, and other professionals involved in lymphedema management.[4,28] Because ultrasound images can be reviewed in real time during clinical encounters, they may facilitate communication among team members and support shared decision-making with patients. Visual feedback from imaging may also influence patient understanding and adherence to long-term self-management strategies.[29,30]

From an implementation perspective, the principal determinant of quality is not the professional role itself but structured training, supervised practice, and ongoing quality assurance. Therapist-performed ultrasound may be particularly useful when conservative management is being adjusted because imaging findings can be linked directly to compression, skin care, exercise, and self-management instruction. Sonographer-performed ultrasound may improve workflow scalability and acquisition consistency, whereas surgeon-performed ultrasound may be especially valuable for preoperative mapping and target selection. Key barriers to wider implementation include access to high-frequency equipment, protected training time, standardized manuals, supervised image review, and reimbursement or workflow constraints. An illustrative implementation framework is provided. **(See table, Supplemental Digital Content 4**, which summarizes an illustrative implementation framework for lymphatic ultrasound-centered lymphedema management, **https://links.lww.com/PRSGO/F19**.)

Limitations and Clinical Considerations

This study represents a narrative review rather than a systematic review or meta-analysis. Accordingly, quantitative effect estimates were not calculated, and selection bias cannot be completely excluded.[3] Ultrasound interpretation is operator-dependent, and broader validation of ultrasound-based NECST interpretation and D-CUPS across institutions is still needed.[3,24] Noncontrast ultrasound also does not replace lymphoscintigraphy or ICG lymphography when comprehensive lymphatic mapping or deep lymphatic evaluation is required.[1,3] In addition, several interpretive frameworks discussed in this review originate from prior work by our group, and further multi-institutional validation is required before these concepts can be considered widely generalizable.

Future Directions

Future studies should prioritize multi-institutional validation of ultrasound-based criteria, standardized reporting of ultrasound findings, and correlation of longitudinal imaging changes with clinically meaningful outcomes. In particular, prospective studies linking serial ultrasound observations with outcomes such as cellulitis frequency, functional status, and quality of life would strengthen the evidence base. Technological developments, including high-resolution probes, elastography, and artificial intelligence–assisted interpretation, may further improve reproducibility and scalability of lymphatic ultrasound assessment.[20,32]

CONCLUSIONS

This narrative review synthesizes existing evidence and conceptual developments related to lymphatic ultrasound and illustrates how these findings may be incorporated into a longitudinal clinical decision framework for lymphedema management. By enabling repeated, noninvasive assessment of both lymphatic vessels and subcutaneous tissues, ultrasound may support integration of conservative and surgical strategies during longitudinal follow-up. Rather than functioning solely as a one-time diagnostic adjunct, serial ultrasound assessment may contribute to adaptive, patient-specific clinical reasoning aligned with the chronic and progressive nature of lymphedema. With appropriate training, quality assurance, and complementary imaging when indicated, ultrasound-centered evaluation may represent a practical component of multidisciplinary lymphedema care. However, broader multi-institutional validation will be necessary before the proposed framework can be considered widely generalizable.

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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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