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Enhancing lymphoscintigraphic specificity of lymphoedema diagnosis in patients with lipoedema

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Summary

This study addresses the diagnostic challenges of identifying lymphoedema in patients with lipoedema using lymphoscintigraphy. Overdiagnosis of lymphoedema in this patient population is frequent and may result in reduced proposed surgical interventions. We retrospectively analyzed clinical data from patients followed for lipoedema, lymphoedema or lipolymphoedema and who underwent lymphoscintigraphy. All patients were assigned a clinical or lymphoscintigraphic diagnosis of lymphoedema and concordance between clinical and lymphoscintigraphic diagnosis was assessed. A modification of lymphoscintigraphic criteria interpretation was proposed to enhance the diagnosis specificity. We included 94 female patients (188 lower limbs). One hundred and thirty-seven limbs presented with signs of lipoedema (137/188; 72.9%) and 42 with clinical signs of lymphoedema (42/188; 22.3%). Overall, 125 limbs presented with a diagnosis of lymphoedema on lymphoscintigraphy (125/188; 66.5%). Using lymphoscintigraphy to diagnose lymphoedema in patients with lipoedema resulted in low specificity (38.3%). By adjusting the interpretation criteria of the lymphoscintigraphic anomalies, we could achieve a specificity of 80.85%, reducing the risk of overdiagnosing lymphoedema in patients with lipoedema. This study contributes to the ongoing efforts to optimize the assessment and management of patients with lipoedema and potential lymphatic involvement, by modifying the interpretation of lymphoscintigraphic criteria.

KEYWORDS
lipoedema, lymphoedema, lymphoscintigraphy

What is already known about this subject?

- Lipoedema is a chronic and progressive disease of adipose tissue, characterized by abnormal fat distribution in the lower limbs.
- As lipoedema shares some clinical features with lymphoedema and can progress to lipolymphoedema, its diagnosis may be challenging.
- Lymphoscintigraphic studies in patients with lipoedema without clinical signs of lymphoedema often reveal alterations in lymphatic function.

What this study adds?

- By adjusting the interpretation of the lymphoscintigraphic criteria, we can increase its specificity in accurately diagnosing lymphoedema in patients with lipoedema.

- Avoiding the overdiagnosis of lymphoedema could make those patients candidates for surgical treatments.
- Delayed tracer transit and reduced tracer uptake at the injection point are not specific lymphoscintigraphic criteria and do not allow discrimination between patients with lipoedema and lymphoedema.

1 | INTRODUCTION

Lipoedema is frequently mistaken for obesity or lower limb lymphoedema, remaining a poorly recognized diagnosis among healthcare professionals and posing challenges for inexperienced practitioners.[1] Approximately 1 in 10 women is believed to suffer from this chronic and progressive adipose tissue disorder, characterized by an abnormal distribution of fat, primarily affecting the lower extremities.[2]

While lipoedema and lymphoedema share some similar clinical characteristics, such as the presence of oedema, fat accumulation and the development of interstitial fibrosis, current mechanistic understanding of these diseases seems to indicate unique aspects of their underlying physiopathology.[3] Swelling and fluid accumulation in the limbs are present in both clinical settings, but the timing of onset varies. Further research is required to elucidate the specific factors contributing to lipoedema.[4]

Regarding lipoedema, complaints typically manifest during periods of hormonal change, such as puberty, pregnancy or menopause and are characterized by body disproportion, with adipose tissue hypertrophy sparing the trunk, hands and feet.[2] Patients typically complain of swollen and heavy legs, spontaneous or palpation-induced pain and frequent bruising. Currently, no specific biomarkers or imaging investigations exist for lipoedema, leaving us mainly reliant on patient history and clinical criteria.[5,6]

The clinical signs of lymphoedema typically include persistent swelling in one or more limbs, skin changes such as thickening and discolouration, and a sensation of heaviness or tightness in the affected area. The association between lipoedema and lymphoedema, referred to as lipolymphoedema, is well-documented. Although lymphoedema can manifest at any stage or during the progression of lipoedema, it is often clinically associated with advanced stages and excessive expansion of adipose tissue.[7] Recent studies have demonstrated the presence of lymphatic abnormalities in early-stage lipoedema without overt clinical signs.[8]

Lymphoedema management remains primarily conservative, although advances in microsurgical techniques have revolutionized surgical options for the treatment of lymphoedema, with data supporting their benefits.[9] Therapeutic options for lipoedema, on the other hand, are limited and essentially conservative with sometimes disappointing results. The use of compression garments or complex decongestive lymphatic therapy can reduce the pain and discomfort in the affected limbs.[10] In cases where these conservative treatments do not yield satisfactory results, surgical interventions may be considered, such as liposuction and lipectomy.[11] Tumescent liposuction has been reported as a safe and effective procedure for reducing sensitivity to pressure, oedema, bruising, functional limitations and cosmetic concerns.[12,13] Debulking procedures (lipectomy) may be considered in more complex and advanced cases.[14] However, it is important to note that these more aggressive procedures may carry a risk of secondary lymphoedema development.[15]

Despite protocol variability and limited imaging resolution, lymphoscintigraphy is still considered the gold standard imaging modality for diagnosing lymphoedema.[16,17] During their evaluation, lipoedema patients are often referred for lymphoscintigraphy and may receive a diagnosis of lymphoedema, even though they do not exhibit the clinical signs.[6,18] Post-operative lymphoedema being a reported surgical complication, overdiagnosis of lymphoedema in this patient population could result in reduced proposed surgical interventions.

In this study, we aimed to assess the efficacy of lymphoscintigraphy to accurately diagnose clinical lymphoedema in patients with lipoedema. Our objective is to analyze the lymphoscintigraphic criteria of lymphoedema in a lipoedema population and see if they correlate with clinical lymphoedema signs. Second, we proposed a modification of criteria interpretation to enhance the lymphoscintigraphy specificity. Improving this diagnosis concordance holds the potential to better identify lipoedema patients with a lymphoedema component, who could present a higher risk of post-operative complications, and to reduce the overdiagnosis of inaccurate lymphoedema.

2 | MATERIALS AND METHODS

We retrospectively reviewed patients followed in our centre (CHU UCL Namur, Plastic Surgery Department) from 2020 to 2022 for heavy or painful lower limbs and who benefited from a lymphoscintigraphy. We analyzed each leg separately and attributed a clinical diagnosis of either normal, lipoedema, lymphoedema or lipolymphoedema. We subsequently sought to identify a correlation between the clinical diagnosis and the lymphoscintigraphic diagnosis of lymphoedema.

2.1 | Clinical diagnosis

Lipoedema was diagnosed in patients exhibiting an abnormal distribution of fat in both lower limbs, a nodular appearance of this fat, a typical body morphotype (relatively thin trunk and large hips and thighs), the absence of lymphoedema signs (see below) and the presence of at least one of the following symptoms: spontaneous pain, tenderness or easy bruising. Each lower limb was then assigned an anatomical location describing the affected areas (type 1: buttocks; 2: thighs; 3: entire

lower limb; 4: arms; 5: legs only). Lipoedema of the upper limbs were not considered in our study. The severity was assessed by a severity stage (Stage 1: thickened subcutis, soft, with small, palpable nodules; Stage 2: thickened subcutis, soft, with some larger nodules; Stage 3: thickened subcutis, hardened, with large nodules, uneven skin surface and disfiguring fat deposition).[5]

We considered a clinical lymphoedema component when the lower limb exhibited persistent swelling, involvement of the dorsum of the foot, a positive Stemmer sign, an Achilles tendon obliteration and thickened skin. Patients also presented a very straight lower limb without a bossy appearance or cuff sign, as opposed to lipoedema patients. Bilaterality and symmetry were assessed on clinical pictures. Patients who initially described lipoedema complaints and subsequently developed clinical signs of lymphoedema, without surgical interventions were classified as lipolymphoedema.

2.2 | Lymphoscintigraphic diagnosis

All patients included in the study underwent lymphoscintigraphy (CHU UCL Namur, Saint-Elisabeth and Godinne sites) as a complementary examination. The Belgian national examination protocol was used, and the same analysis framework was applied to each patient.[19] After the simultaneous injection of 3 mCi of Technetium-labelled nanocolloid into the sub-cutis of the first interdigital space of each foot, a static image centred on the injection points was taken, followed by a dynamic acquisition after 30 min, centred on the inguinal regions (Phase 1). Subsequently, a whole-body static acquisition was performed, followed by dynamic acquisition at rest and during foot movements. A new whole-body static acquisition was then performed (Phase 2). After 1 h of movement (walking), a static acquisition centred on the injection points was repeated, followed by a whole-body acquisition (Phase 3). The interpretation of results was based on seven minor criteria and four major criteria. Two minor criteria on the same limb indicated the presence of moderate lymphoedema, while one major criterion was sufficient to diagnose severe lymphoedema. In our study, all moderate or severe lymphoedema were considered to have a positive diagnosis.

The minor (m) criteria corresponded to:

- m1: The limb is at rest, and the tracer does not reach the first lymph node within 30 min after interdigital injection.
- m2: A comparison of activity curves at the lymph nodes at the base of the limbs shows a 30% lower cumulative activity at the end of the resting phase in the edematous limb or the most edematous limb.
- m3: A comparison of activity curves at the lymph nodes at the base of the limbs shows a 30% lower cumulative activity at the end of the exercise phase in the edematous limb or the most edematous limb.
- m4: Following the rest phase and/or during exercise, no superficial lymphatic vascular drainage is observed, but deep lymphatic vascular drainage is demonstrated (usually associated with the visualization of one or more popliteal lymph nodes).
- m5: At the very end of the examination, the appearance of a deep intercalary lymph node (popliteal, sural).
- m6: At the very end of the examination, tracer extraction is below the normal level.
- m7: At the very end of the examination, significant extraction asymmetry (if the difference between the two extractions is greater than 25% of their average).

The major (M) criteria correspond to:

- M1: From the injection point, tracer progression through a network of superficial dermal collateralization.
- M2: Demonstration of lymphatic vascular reflux (from a vascular lesion site or at a lymph node blockage) towards the superficial dermal lymphatic network.
- M3: At the end of the examination, there is no tracer exit from the injection point (neither vessel nor lymph node observed).
- M4: At the end of the examination, there is no lymph node structure at the limb's base, or in the lower limbs, there is no visualization of iliac groups.

All data were analyzed using Rstudio (Version 1.3.1093). Fisher's exact test was used to compare categorical variables between groups. Mann–Whitney U independent-samples test was used to compare means of continuous variables. A stepwise backward logistic regression was used to enhance diagnosis specificity. Results with *p*-values less than .05 were considered statistically significant.

3 | RESULTS

3.1 | Population description

Ninety-four female patients were included in the study, resulting in a total of 188 lower limbs that received a clinical and lymphoscintigraphic diagnosis. The mean age was 43 years (range: 19–78 years) and the mean body mass index (BMI) was 28.7 kg/m^2 (range: 20.9–51.2).

3.2 | Clinical presentation

Sixty-nine patients (137/188 limbs, 72.8%) were diagnosed with lipoedema. All but one patient presented with bilateral lipoedema. As expected, the severity and location of lipoedema were symmetrical in all bilateral cases. Clinical characteristics of lipoedema are summarized in Table 1 and the distribution of severity according to type of lipoedema is shown in Figure 1.

Nineteen patients presented with bilateral lymphoedema (38/188 limbs, 20.2%) and four patients with unilateral lymphoedema (4/188

TABLE 1 Clinical and lymphoscintigraphic description.

Characteristic	Lipoedema, $N = 137$	Lymphoedema, $N = 42$	Lipolymphoedema, $N = 5$	NL[3], $N = 4$	Total, $N = 188$
Bilaterality[a]	136 (99.3%)	39 (92.8%)	4 (80.0%)	-	180 (95.7%)
Symmetry[b]	136 (99.3%)	4 (9.5%)	2 (40.0%)	-	142 (75.5%)
Stage of lipoedema					
S1	54 (39.4%)	-	2 (40.0%)	-	56 (29.8%)
S2	73 (53.3%)	-	3 (60.0%)	-	76 (40.4%)
S3	10 (7.3%)	-	-	-	10 (5.3%)
Type of lipoedema					
T1	19 (13.8%)	-	-	-	19 (10.1%)
T2	56 (40.9%)	-	3 (60.0%)	-	59 (31.4%)
T3	54 (39.4%)	-	2 (40.0%)	-	56 (29.8%)
T5	8 (5.8%)	-	-	-	8 (4.2%)
Lymphoscintigraphic diagnosis					
Lymphoedema	85 (62.0%)	34 (80.9%)	4 (80.0%)	2 (50.0%)	125 (66.5%)
NL[c]	52 (37.9%)	8 (19.0%)	1 (20.0%)	2 (50.0%)	63 (33.5%)
Concordance[d]	52 (37.9%)	33 (78.6%)	4 (80.0%)	2 (50.0%)	91 (48.4%)
Lymphoscintigraphic symmetry[e]	42 (30.6%)	2 (4.8%)	-	-	44 (23.4%)

[a]Bilaterality: number of limbs with bilaterally the same diagnosis.
[b]Symmetry: number of limbs with bilaterally identical clinical presentation.
[c]NL: normal.
[d]Concordance: number of patients with the same clinic and lymphoscintigraphic diagnosis of lymphoedema.
[e]Lymphoscintigraphic symmetry: number of patients with the presence of the same lymphoscintigraphic criteria bilaterally.

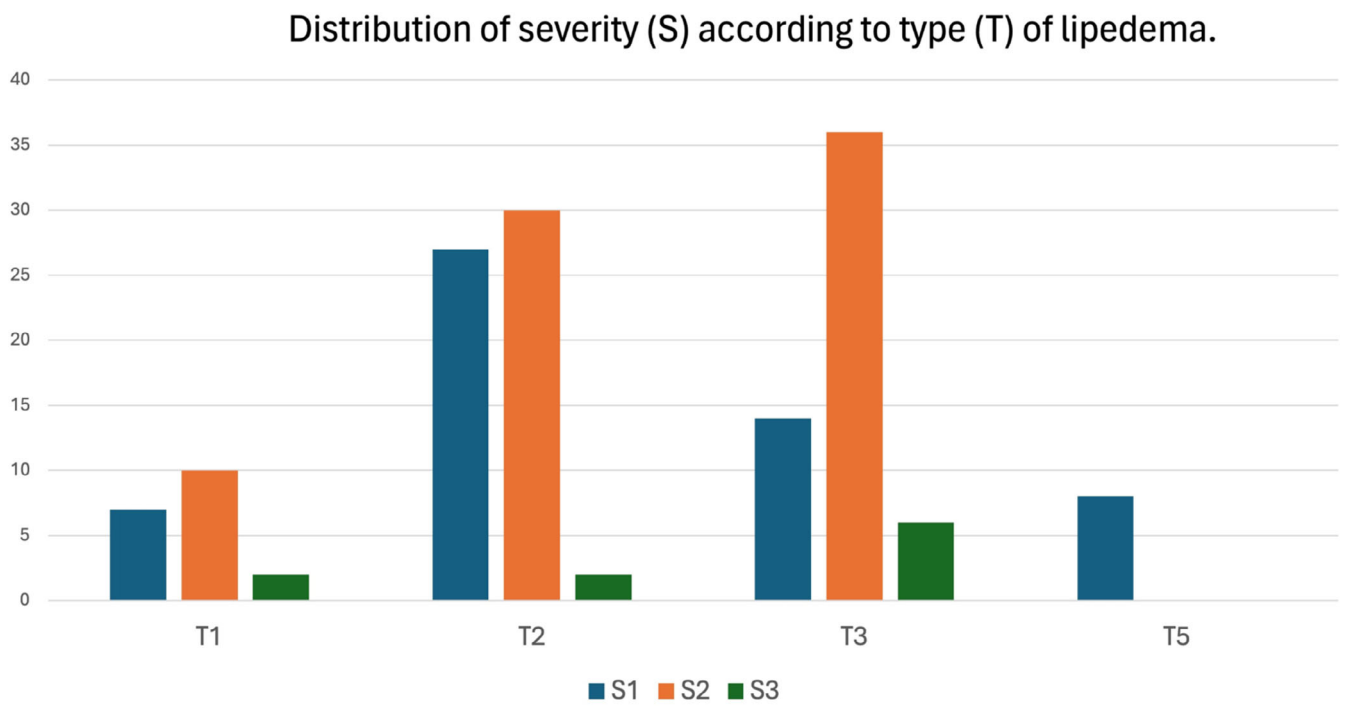

FIGURE 1 This figure shows the distribution of the severity of lipoedema according to the different types.

limbs, 2.1%), accounting for a total of 42 lower limbs presenting with clinical signs of lymphoedema without lipoedema (42/188 limbs, 22.1%). In bilateral cases, the clinical presentation of lymphoedema was asymmetrical in 91.5% of patients, as summarized in Table 1.

Three patients (5/188 limbs, 1.6%) presented with lower limbs showing both clinical signs of lipoedema and lymphoedema and were considered as lipolymphoedema patients. Two patients presented with lipolymphoedema in both legs,

and one with unilateral lipolymphoedema and a normal contralateral side.

3.3 | Lymphoscintigraphic presentation

One-hundred and twenty-five legs were diagnosed with lymphoscintigraphic signs of lymphoedema (125/188 limbs, 66.5%). Lymphoscintigraphic criteria of lymphoedema observed are summarized in Table 2. Forty-five patients presented with bilateral lymphoscintigraphic signs of lymphoedema (45/94 patients, 47.9%), but diagnostic criteria observed were asymmetric in 33 patients (33/45 patients, 73%). There was no correlation between the severity (stage) of lipoedema and the lymphoscintigraphic diagnosis of lymphoedema (Fisher's exact test; *p*-value: .2). A major criterion was found in 15% (13/137 limbs) of lipoedema lower limbs, resulting in a diagnosis of severe lymphoedema. We did not observe a statistically significant correlation between BMI and positive lymphoscintigraphic criteria, except for M3 (Mann–Whitney U; *p*-value = .011).

3.4 | Correlation between clinic and lymphoscintigraphy

Nine out of the forty-two lower limbs presenting with clinical lymphoedema didn't show lymphoscintigraphic criteria of lymphoedema (9/42 limbs, 21.4%). Out of the 125 limbs with positive lymphoscintigraphic signs of lymphoedema, only 47 limbs presented with clinical signs of lymphoedema or lipolymphoedema (42 + 5/125 limbs, 37.6%) illustrating a discordance between the observed clinical presentation and the lymphoscintigraphic description of lymphoedema. Out of the 137 lower limbs diagnosed with lipoedema, 85 (62%) had a lymphoscintigraphic diagnosis of lymphoedema without clinical signs, resulting in only 37.9% of diagnosis concordance (Table 1). Using our current protocol, lymphoscintigraphic specificity to diagnose lymphoedema was only 38.3%.

3.5 | Modification of lymphoscintigraphic criteria

To enhance the specificity of the lymphoscintigraphic diagnosis, we first made modifications to the criteria needed to establish the diagnosis, and second, we used logistic regression to adjust the weight of each criterion applied. By adding a third minor criterion to make the diagnosis of lymphoedema, we could increase the specificity up to 67.38%. By removing the minor criterion m1 or m6, which were the most frequently seen in lipoedema patients, specificity was respectively 65.25% and 60.28%. By removing both m1 and m6, we could increase the specificity up to 78.01%. Combining the addition of a third minor criterion and the subtraction of m1 and m6 results in a specificity of 80.85%. We further improved the specificity by using the step-wise backwards logistic regression and obtained a specificity of 92.20%. Lymphoscintigraphic specificity and sensibility for each model are shown in Table 3.

4 | DISCUSSION

Lower limb lymphoscintigraphy is usually performed by injecting a radiotracer into the foot, followed by imaging the tracer's migration

TABLE 2 Lymphoscintigraphic criteria.

	Clinical lipoedema		Clinical lymphoedema		Clinical lipolymphoedema		Normal	
Lymphoscintigraphy[a]	Lymph[b], *N* = 85	NL[c], *N* = 52	Lymph[b], *N* = 34	NL[c], *N* = 8	Lymph[b], *N* = 4	NL[c], *N* = 1	Lymph[b], *N* = 2	NL[c], *N* = 2
Minor criteria								
m1	77 (90.6%)	25 (48.1%)	31 (91.2%)	4 (50.0%)	4 (100.0%)	-	1 (50.0%)	-
m2	8 (9.4%)	-	11 (32.4%)	-	1 (25.0%)	-	-	-
m3	20 (23.5%)	-	9 (26.5%)	-	1 (25.0%)	-	-	-
m4	5 (5.9%)	-	3 (8.8%)	-	1 (25.0%)	-	1 (50.0%)	-
m5	19 (22.4%)	1 (1.9%)	16 (47.1%)	1 (12.5%)	1 (25.0%)	-	-	-
m6	67 (78.8%)	4 (7.7%)	28 (82.4%)	1 (12.5%)	4 (100.0%)	-	2 (100.0%)	1 (50.0%)
m7	25 (29.4%)	-	18 (52.9%)	-	3 (75.0%)	-	-	-
Major criteria								
M1	11 (12.9%)	-	17 (50.0%)	-	-	-	-	-
M2	2 (2.4%)	-	4 (11.8%)	-	-	-	-	-
M3	-	-	4 (11.8%)	-	-	-	-	-
M4	-	-	6 (17.6%)	-	-	-	1 (50.0%)	-

[a]Lymphoscintigraphy: Presence or absence of lymphoedema criteria on lymphoscintigraphy.
[b]Lymph: positive diagnosis of lymphoedema on lymphoscintigraphy.
[c]NL: negative diagnosis of lymphoedema on lymphoscintigraphy.

over several hours. While lymphoscintigraphy assesses the overall lymphatic function of a limb, it provides limited anatomical details compared to more invasive or less available methods like lymphangiography or lymphatic magnetic resonance imaging. Commonly detected anomalies in lymphoscintigraphy are delayed tracer transit, reduced uptake in regional lymph nodes, or tracer accumulation in cutaneous lymphatics, also known as dermal backflow.[20,21] Although various classification systems measure the severity of lymphatic dysfunction, there is currently no standardized one. Moreover, protocol variability and the regular development of new imaging methods add to the complexity. The lymphoscintigraphy sensitivity and specificity for diagnosing lymphoedema in patients presenting clinical signs of lymphoedema is well-documented, but limited information exists regarding lipoedema.[17] By using our current interpretation criteria, the probability having a non-pathological lymphoscintigraphy was only 38.30%. Still, lymphoscintigraphy remains the most commonly used imaging modality for diagnosing lymphoedema in patients with lipoedema.[21,22]

TABLE 3 Specificity and sensibility of lymphoscintigraphic diagnosis of lymphoedema.

Models	Specificity	Sensibility
2 minor criteria or 1 major[a]	38.30%	80.85%
3 minor criteria	67.38%	65.96%
2 minor criteria without m1	65.25%	68.09%
2 minor criteria without m6	60.28%	72.34%
2 minor criteria without m1 and m6	78.01%	68.09%
3 minor criteria without m1 and m6	80.85%	63.83%
Logistic regression	92.20%	55.32%

[a]Following the Belgian national examination protocol, positive lymphoedema diagnosis is confirmed if either two minor criteria or one major are observed.

We attempted to overcome these limitations by adjusting the interpretation of the lymphoscintigraphic criteria, and thus increasing its specificity. As observed in lipoedema patients with positive lymphoscintigraphic signs of lymphoedema, there was a high expression of minor criteria m1 (90.6%) and m6 (78.8%) indicating tracer failure to reach lymph node relays within 30 min and reduced extraction at the injection point, as illustrated in Figure 2. A recent study by Rasmussen et al.[8] showed that these criteria correspond to lymphatic anomalies more specific to patients with early-stage lipoedema without lymphoedema. Based on these observations, removing those criteria, as we did in the different modified models seemed accurate. Although the results of logistic regression are tailored to this specific cohort, it provided valuable insights. After applying this statistical

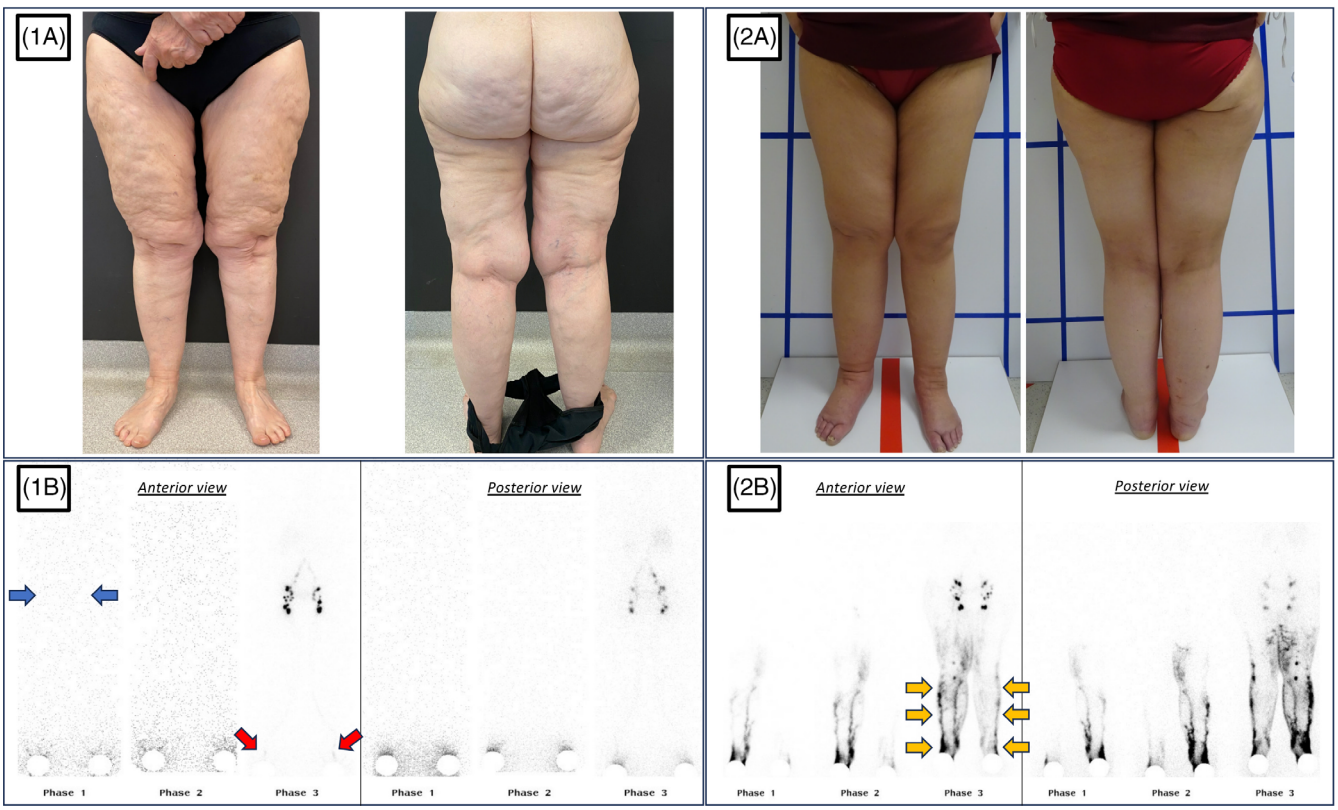

FIGURE 2 Illustration of lymphoscintigraphic alterations in patients with lipoedema and patients with lymphoedema. 1A: Anterior and posterior view of a patient with T2S2 lipoedema. 1B: Lymphoscintigraphic anomalies with minor criteria m1 (Phase 1: No inguinal nods visible 30 min after the tracer's injection; blue arrows) and m6 (Phase 3: Reduce tracer's extraction at the injection point; red arrows). 2A: Anterior and posterior view of a patient with bilateral but asymmetrical lymphoedema. 2B: Illustration of major criterion M1 (from the injection point, tracer progression through a network of superficial dermal collateralization; orange arrows) visible on both lower limbs.

model to assess the significance of the different criteria used for lymphoscintigraphic diagnosis, we observed that criteria m1, m4, m6 and M3 have been excluded, following the stepwise backwards method, as they do not increase the diagnostic specificity. In this model, only 10 lipoedema patient's lower limbs out of 137 (7.3%) would keep a lymphoscintigraphic diagnosis of lymphoedema, without clinical signs. This validates removing criteria m1 and m6, as we did in our adapted interpretation of lymphoscintigraphic diagnosis of lymphoedema.

More specific signs of lymphoedema are described in previous studies such as the presence of a dermal progression of the tracer from the injection point and dermal backflow, which refers to the abnormal retrograde flow of lymphatic fluid from the deeper lymphatic vessels back into the dermal lymphatics.[23] These anomalies correspond to our major criteria M1, as illustrated in Figure 2, and M2. It is worth mentioning that in our logistic regression model, 7 of the 10 lower limbs of lipoedema patients who keep a lymphoedema diagnosis, exhibit either M1 or M2. These results emphasize the role of M1 and M2 as probable key lymphoscintigraphic signs of lymphoedema, but this should be further investigated in prospective studies. In patients with lipoedema, it could also indicate the potential presence of subclinical lymphoedema, emphasizing the need for extra caution when considering surgical interventions. As for the lower limbs with lipolymphoedema in our study, none presented with M1 or M2, but this could be due to our limited sample size.

The literature on lymphoscintigraphy confirmed its limitations in detecting specific lymphatic anomalies in patients with lipoedema. As we also demonstrated in our study population, Forner-Cordero et al.,[24] showed lymphoscintigraphic alterations in a significant percentage of lipoedema patients (47%) at all clinical stages, without a correlation between the stage of lipoedema and the severity of lymphoscintigraphic anomalies. Chachaj et al.[25] conducted a study comparing lymphoscintigraphic results between patients diagnosed with lipoedema and those with obesity. Their findings revealed that lymphoscintigraphic anomalies were detectable prior to the onset of clinically apparent secondary lymphoedema and were consistent across both patient cohorts, showing no significant disparities. Notably, the majority of observed lymphoscintigraphic abnormalities in both groups correlated with our minor criteria, particularly m1, suggesting a potential lymphatic system overload rather than insufficiency (with dermal backflow being infrequent in their investigation). These results suggest that the lymphatic dysfunction observed in patients with lipoedema, akin to those with obesity, may stem from adipose tissue overexpansion. We did not observe a significant correlation between BMI and positive lymphoscintigraphic criteria, but this was not the aim of our study. The significant correlation observed between BMI and M3 could be explained by the fact that only 2 patients in our cohort presented with positive M3 criteria without clinical signs of lipoedema. In light of those results, while extra caution should be taken for lipoedema patients showing major criteria on lymphoscintigraphy, patients exhibiting solely minor, nonspecific criteria may benefit from operative therapy.[12]

Tartaglione et al. proposed an alternative lymphoscintigraphy protocol to enhance the differential diagnosis between lymphoedema and lipoedema. Based on multiple intradermal injections, it allows for faster examination (1 h instead of two) and better visualization of lymphatics, claiming to be optimized for patients with early-stage lipoedema.[26] This underlines the need for standardized lymphoscintigraphy protocols. Prospective studies comparing long-term outcomes before and after treatment are also necessary to better understand the lymphatic anomalies in patients with lipoedema.

The goal of our study was to enhance the specificity of lymphoscintigraphy in patients with lipoedema, thereby avoiding the overdiagnosis of lymphoedema, which would exclude them from surgical treatment options. It is important to note that the various modifications in the interpretation of lymphoscintigraphic results come with a decrease in sensitivity (55.32% after logistic regression compared to 80.85% in the initial model). This reduced sensitivity however does not have a clinical impact as in patients presenting with clinical signs of lymphoedema, surgical treatment will not be initially considered. Limitations of this study include the reliance on clinical diagnosis based on data collected during consultations and photographic examinations. The retrospective review of these diagnoses may introduce potential selection errors.

5 | CONCLUSION

Our study highlights the challenges in accurately diagnosing lymphoedema in patients with lipoedema using lymphoscintigraphy. The discordance between clinical presentation and lymphoscintigraphic description of lymphoedema in this population indicates the need for refined criteria. By adjusting the interpretation of lymphoscintigraphic results, we demonstrated the possibility of increasing lymphoscintigraphy's specificity, thereby reducing the risk of lymphoedema overdiagnosis. Our findings contribute to the ongoing efforts to optimize the assessment and management of patients with lipoedema and potential lymphatic involvement.

AUTHOR CONTRIBUTIONS

CD, GP and RvlP performed all consultations and collected data. All data, including pictures and lymphoscintigraphy's results, were reviewed by CD and HA. RG performed data analysis. HA, JC and CD wrote the main part of the paper and all authors had final approval of the submitted and published versions.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

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