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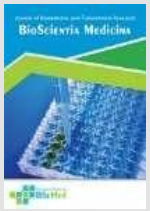

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Chylous Ascites in Pediatric Lymphangiomatosis: Definitive Localization and Surgical Guidance with ^{99m}Tc-Nanocolloid SPECT/CT

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A B S T R A C T

Background: Chylous ascites, the peritoneal accumulation of triglyceride-rich lymphatic fluid, is a rare and clinically formidable condition, especially in children. It signifies a severe disruption of the lymphatic system. Systemic lymphangiomatosis, a congenital lymphatic malformation, is an exceptionally rare underlying cause. The cornerstone of effective treatment for refractory cases is the precise localization of the lymphatic leakage, which remains a profound diagnostic challenge. **Case presentation:** We present the case of a 13-year-old female with systemic lymphangiomatosis who developed persistent, high-volume chylous ascites, with outputs reaching 1200 cc/day, following the surgical excision of an abdominal mass. Despite aggressive conservative management, the debilitating leakage continued, precipitating severe metabolic and nutritional derangements. To identify the point of extravasation, the patient underwent lymphoscintigraphy with Technetium-99m (99mTc) nanocolloid and hybrid Single Photon Emission Computed Tomography/Computed Tomography (SPECT/CT). While planar imaging confirmed a leak in the right lower abdomen, SPECT/CT provided definitive, high-resolution anatomical localization, pinpointing the site to the pre-peritoneal tissue at the level of the right anterior superior iliac spine. This finding directly guided a successful, targeted surgical repair. **Conclusion:** This case demonstrates the indispensable role of ^{99m}Tc-nanocolloid SPECT/CT in the management of complex, post-surgical chylous ascites. By transforming a two-dimensional area of suspicion into a three-dimensional, surgically-actionable target, this hybrid imaging modality provided the essential roadmap for a curative intervention where all other measures had failed. This report advocates for the integration of SPECT/CT as a standard of care in the diagnostic algorithm for refractory chylous leaks, representing a key technology that facilitates definitive treatment and fundamentally improves patient outcomes.

1. Introduction

Chylous ascites, the accumulation of chyle within the peritoneal cavity, is an uncommon and complex medical condition first described by Morton in 1691.[1] Chyle is a milky-white fluid, rich in triglycerides, chylomicrons, and lymphocytes, that is transported from the small intestine to the systemic circulation via the lymphatic system.[2] The integrity of this system, particularly the cisterna chyli and thoracic duct, is essential for normal physiological function.[3] Disruption of these lymphatic channels, whether from traumatic, obstructive, or congenital causes, can lead to the extravasation of chyle and the development of chylous ascites. While the incidence in the general population is low, estimated at approximately 1 in 20,000 hospital admissions, the condition is associated with significant morbidity and mortality, with rates reported between 40-70%, largely dependent on the underlying etiology. The failure of conservative management in high-output chylous

ascites precipitates a cascade of severe systemic consequences. The persistent loss of chyle is not merely a loss of fluid but a profound metabolic, nutritional, and immunological insult.[4] This protein-losing enteropathy leads to severe hypoalbuminemia, diminishing plasma oncotic pressure and causing anasarca, impaired wound healing, and coagulopathies from the loss of fat-soluble vitamins. Perhaps most critically, the continuous depletion of T-lymphocytes, which are recirculated through the lymphatic system, can induce a state of acquired immunodeficiency, leaving the patient vulnerable to life-threatening opportunistic infections. This clinical deterioration underscores the time-sensitive, critical need for a definitive treatment strategy.[5]

Historically, the diagnostic and therapeutic pathway for such cases has been fraught with challenges. The traditional "gold standard" for visualizing the lymphatic system, pedal contrast lymphangiography, is an invasive, technically demanding procedure requiring direct cannulation of a lymphatic vessel.[6] It is associated with significant risks, including hypersensitivity reactions and pulmonary oil embolism, and is particularly challenging in the pediatric population. Other modalities, such as magnetic resonance (MR) lymphangiography, offer a non-invasive alternative but may lack the requisite spatial and temporal resolution to pinpoint small or low-flow leaks with surgical precision. This diagnostic gap has often led to extensive, exploratory surgeries with high rates of failure and morbidity.[7] It is within this context of clinical urgency and diagnostic limitation that modern molecular imaging has emerged as a transformative solution. Among the rarest congenital causes of chylous ascites is systemic lymphangiomatosis, a diffuse, multicentric proliferation of abnormally formed lymphatic vessels. This benign but progressive condition involves the abnormal development of lymphatic channels that fail to connect with the main lymphatic system, leading to the formation of cysts and dilated vessels.[8] While lymphangiomas most commonly occur in the neck (75%) and axilla (20%), systemic lymphangiomatosis can involve multiple organ systems, including bone, spleen, lungs, and retroperitoneum, leading to a wide spectrum of clinical manifestations.[9] The development of chylous ascites in the context of lymphangiomatosis is an exceptionally rare complication, often precipitated by trauma or surgical intervention that disrupts these fragile, malformed vessels.[10]

The novelty of this case report is multifold. It presents an exceedingly rare clinical scenario—high-output, post-operative chylous ascites in a pediatric patient with underlying systemic lymphangiomatosis—and details its successful resolution. More importantly, it provides a narrative and scientific deep-dive into the modern, multidisciplinary management of such a complex condition. While lymphoscintigraphy is an established tool, the literature detailing the specific utility of ^{99m}Tc-nanocolloid SPECT/CT to provide definitive, point-source localization and directly guide a curative surgical intervention in this specific pediatric context is limited. Therefore, the aim of this study is to demonstrate the indispensable role of ^{99m}Tc-nanocolloid SPECT/CT, not just as a diagnostic test, but as the central, pivotal tool in a modern, image-guided therapeutic strategy. We aim to show how this technology bridges the critical gap between diagnostic uncertainty and surgical precision, ultimately enabling a definitive cure in a complex case where conservative management had failed.

2. Case Presentation

Written informed consent was obtained from the patient's legal guardians for the publication of this case report. A 13-year-old female was admitted to our institution on February 16th, 2024, with the chief complaint of persistent, high-volume fluid drainage from a surgical wound drain. Her medical history was significant for systemic lymphangiomatosis, diagnosed two years prior (March 1st, 2022) via a contrast-enhanced abdominal CT scan that revealed a large, multiloculated cystic mass in the right abdominal wall, multiple cystic lesions in the spleen,

and multiple lytic lesions in the scanned bones. Three weeks prior to the current admission, on February 2nd, 2024, she had undergone excisional surgery at an outside hospital for a painful abdominal mass. Post-operatively, a drain was placed, which immediately began producing milky white fluid, with a substantial daily output averaging 300 cc. Over the ensuing three weeks, the fluid character changed to a clearer serous fluid (coinciding with dietary restriction), but the high output persisted. The stated diagnosis, Systemic Lymphangiomatosis, is the foundational element of the entire clinical story. As described in Figure 1, this diagnosis was established on March 1st, 2022, via a contrast-enhanced CT that revealed not just a localized issue but a systemic condition involving a cystic abdominal mass, splenic cysts, and lytic bone lesions. This initial entry on the timeline is crucial; it informs the reader that the patient's lymphatic system was congenitally abnormal, inherently fragile, and predisposed to dysfunction. This was not a patient with a normal anatomical baseline who suffered an injury, but rather a patient with an underlying, system-wide vulnerability, a fact that becomes critically important in understanding the subsequent events. The timeline in Figure 1 then advances to the precipitating event: the Excisional Surgery on February 2nd, 2024. The figure describes this as a procedure for a painful abdominal mass, which, while clinically necessary, inadvertently triggered the central complication of this case. The outcome, as stated succinctly in the figure, was the onset of "high-output chylous drainage." This phrase is loaded with clinical significance. "Chylous" implies a direct breach of the lymphatic system, resulting in the leakage of lipid-rich fluid from the gastrointestinal tract. "High-output" signifies that the breach was not a minor, incidental leak but a significant, physiologically consequential fistula. This event marks the transition from a chronic, underlying condition to an acute, life-threatening surgical complication. The central and most graphically detailed section of the timeline in Figure 1 covers the period of Admission & Conservative Management Failure from February 16th-20th, 2024. This part of the infographic brilliantly visualizes the escalating clinical crisis. The text notes that the patient was admitted to the institution and that aggressive conservative measures, including TPN and Octreotide, were initiated. The failure of this approach is starkly illustrated by the integrated bar chart, which graphically depicts the "Daily Chylous Drain Volume." The chart shows a volatile and uncontrolled fluid loss, with volumes of 400 cc and 800 cc on different days, but the most dramatic feature is the towering red bar representing the peak output of 1200 cc on February 18th. This is the narrative climax of the clinical crisis. A loss of 1.2 liters of chyle in a single day from a 13-year-old is a catastrophic physiological event. As the figure implicitly communicates, this is not merely a loss of fluid volume but a massive and unsustainable depletion of vital proteins, fats, electrolytes, and immune cells. The figure powerfully connects this graphical data point to its direct biochemical consequence, explicitly stating that the "critically low serum albumin (2.54 g/dL) on Feb 18th" was the key factor that "prompted MDT decision for advanced imaging." This section of Figure 1 is a masterclass in data synthesis; it visually links the uncontrolled lymphatic leak (the bar chart) to its systemic metabolic impact (the albumin level) and the resulting critical clinical decision made by the multidisciplinary team. It tells a complete story of a therapeutic strategy failing in real-time, forcing the clinical team to pivot towards a more definitive solution. This pivot leads directly to the diagnostic turning point of the case, clearly labeled as Definitive Localization with SPECT/CT on February 21st, 2024. This event, as depicted in Figure 1, represents the introduction of the key technology that would ultimately resolve the crisis. The figure's text is precise and informative, stating that ^{99m}Tc-nanocolloid lymphoscintigraphy with SPECT/CT was able to "precisely identify the lymphatic leak site in the pre-peritoneal tissue of the right lower abdominal wall." The importance of this statement cannot be overstated. After the failure of systemic medical management, the clinical team was provided with an

exact, three-dimensional anatomical target. The figure effectively communicates that the problem was no longer an abstract physiological process but a concrete, localized anatomical defect that could now, for the first time, be surgically addressed with confidence. The subsequent event on the timeline, Image-Guided Surgical Repair, flows logically from this diagnostic breakthrough. The figure frames the successful surgery as a direct consequence of the imaging, emphasizing the cause-and-effect relationship. The description highlights that surgeons were "Guided by the SPECT/CT roadmap" to perform a targeted repair. The figure provides the crucial, objective evidence of the procedure's success: "Drain output ceased within 48 hours." This rapid cessation of leakage is definitive proof that the correct source of the problem was identified and successfully ligated, a feat made possible by the precision of the pre-operative imaging. Finally, the timeline in Figure 1 concludes with the Successful Outcome & Follow-up one year later. This entry provides the long-term resolution and validation of the entire clinical pathway. The descriptive terms used—"thriving," "no recurrence of ascites," "surgical site is well-healed," and "nutritional status has normalized"—collectively paint a picture of a complete and lasting cure.

Upon admission, the patient was in mild distress with stable vital signs. The abdominal examination was notable for a surgical scar on the right side with an indwelling drain connected to a surgical drain collection bag. A palpable, soft, tender, and fluctuant mass was noted in the right lower abdomen. Initial investigations focused on characterizing the fluid and assessing the patient's metabolic status. As detailed in Figure 2, fluid analysis confirmed an exudative, mononuclear-predominant fluid consistent with chyle. Serum laboratory tests (Figure 2) were significant for hemoconcentration and a critically low serum albumin of 2.54 g/dL, reflecting severe protein loss. The left panel of Figure 2, titled Physical Examination, immediately establishes a crucial clinical dichotomy. The "Patient Vitals" are presented as stable, with a blood pressure of 96/72 mmHg, a heart rate of 76 beats per minute, a respiratory rate of 20 breaths per minute, and an oxygen saturation of 99%. These metrics, in isolation, might suggest a non-critical patient. However, this apparent stability is juxtaposed against the specific and highly significant "Abdominal Findings," which tell a much more alarming story. The schematic clearly indicates the presence of a palpable, fluctuant mass, an indwelling drain, a surgical scar, and positive tenderness. This combination of findings points directly to a localized, complex post-operative complication. The fluctuant nature of the mass suggests a fluid collection, and the tenderness indicates an ongoing inflammatory process or significant tissue distension, painting a picture of a contained but active and unresolved issue at the surgical site. The elevated hemoglobin (17.4 g/dL) and hematocrit (50.0%) are classic signs of hemoconcentration, providing objective evidence that the patient was significantly volume-depleted despite her stable vital signs. The most critical finding, however, is graphically emphasized in a red circular gauge: a serum albumin level of 2.54 g/dL. This value is alarmingly low and is the central piece of evidence confirming a state of severe malnutrition. This hypoalbuminemia is a direct result of the massive loss of protein-rich chyle, a condition that impairs wound healing, reduces plasma oncotic pressure, and has profound systemic consequences. The final section of the figure, "Drained Fluid Analysis: Confirmed Chyle," provides the etiological diagnosis for the patient's deterioration. The analysis of the fluid itself confirmed that this was not a simple seroma or infectious collection. The positive Rivalta Test, high protein level (1560 mg/dL), and the overwhelming predominance of mononuclear cells (98.8%) are the classic hallmarks of chyle. This confirmed that the patient was suffering from a persistent, high-volume lymphatic leak. Figure 2 expertly tells a story in two parts: a physical examination that identified a localized problem and a set of initial investigations that revealed a severe, systemic crisis of dehydration and malnutrition, all driven by a confirmed chylous fistula.

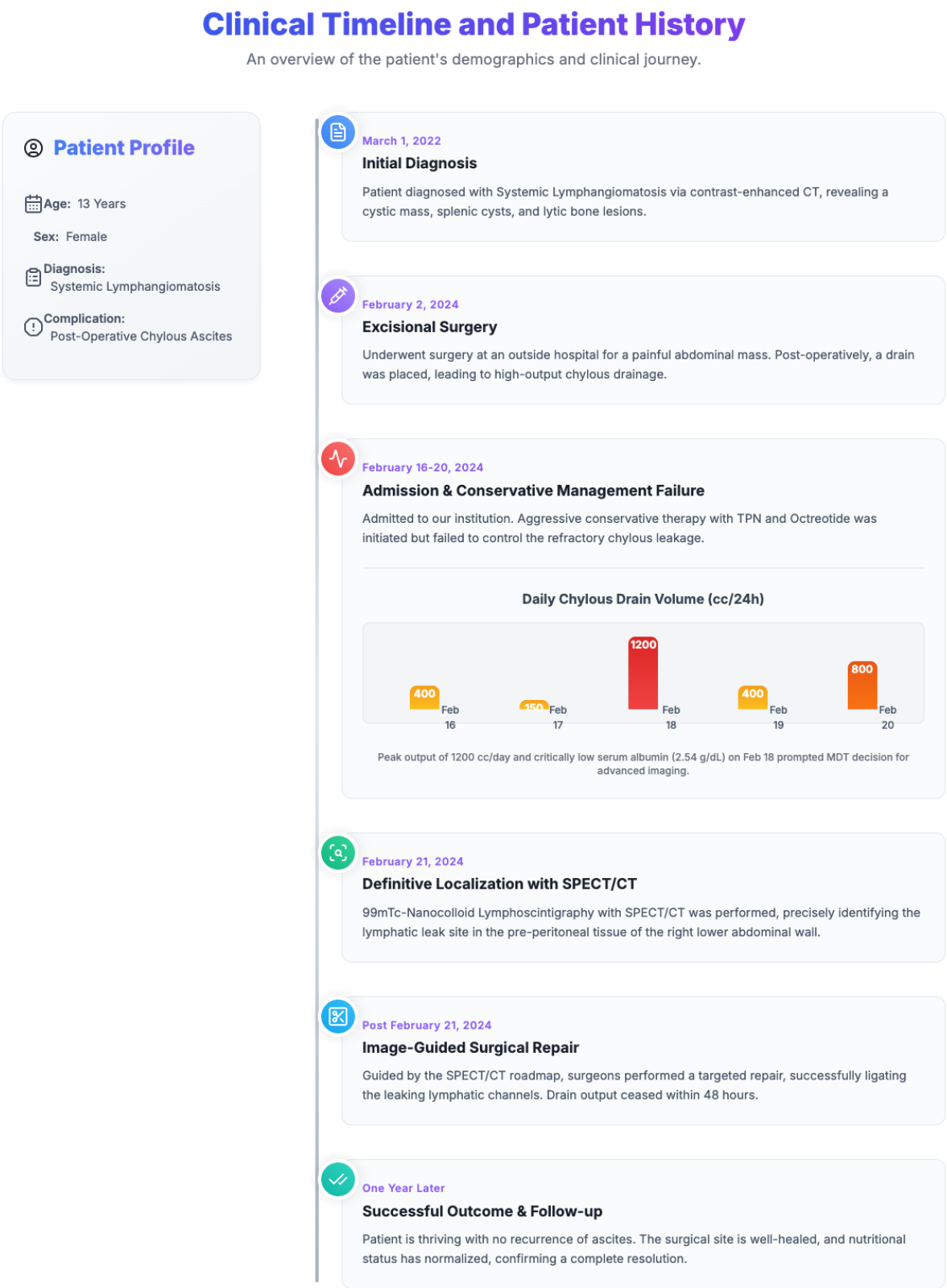

Figure 1. Clinical timeline and patient history.

Figure 2. Physical examination and initial investigations.

The patient was managed by a multidisciplinary team (MDT) involving pediatric surgery, vascular surgery, pediatric nutrition, and nuclear medicine. She was initially started on aggressive conservative therapy, including total parenteral nutrition (TPN) and intravenous octreotide (100 mcg every 8 hours). Despite these measures, the chylous leakage remained refractory, with a fluctuating but persistently high output, peaking at 1200 cc in a 24-hour period. After two weeks of failed conservative therapy, the case was presented at the weekly pediatric MDT meeting. The consensus was that the leak was physiologically significant, unlikely to resolve spontaneously, and was causing progressive clinical deterioration. The decision was made to proceed with definitive localization imaging to guide surgical intervention. The first panel Figure 3, "Conservative Management," systematically outlines the initial, non-invasive therapeutic strategy employed. The figure lists three core interventions: Total Parenteral Nutrition (TPN), Octreotide Infusion, and an MCT-Based Diet Trial. This multi-pronged approach represents the standard of care for chylous leakage, aiming to reduce the production and flow of chyle to allow the lymphatic fistula to heal spontaneously. TPN rests the gut entirely, while an MCT-based diet provides nutrition that bypasses the lymphatic system. Octreotide works systemically to decrease splanchnic circulation and gut secretions. However, the most crucial piece of information in this panel is the starkly presented "Outcome: Failure". The figure provides a clear, quantitative reason for this

conclusion: "Leakage remained refractory with persistent high-volume output, peaking at 1200 cc/day". This single data point is the lynchpin of the entire clinical narrative. A daily loss of 1.2 liters of nutrient-rich chyle is a physiologically unsustainable event, confirming that the leak was not a minor issue that could seal on its own but a major, high-pressure defect. This outcome unequivocally demonstrated the limitations of conservative therapy in this specific case, signaling that a more aggressive approach was not just warranted, but urgently required to prevent further clinical deterioration. The arrow in the center of Figure 3 visually represents the progression from a failed strategy to a new plan, leading the viewer to the second panel, "MDT Decision & Action". This section highlights the modern, collaborative approach to complex medical problems. The figure identifies the key players in the multidisciplinary team (MDT): Surgery, Nutrition, and Nuclear Medicine. This is significant because it shows that the decision was not made in a vacuum but was the result of an integrated discussion between different specialties, each bringing a crucial perspective. The surgeons required a target, the nutrition team was managing the systemic consequences of the leak, and the nuclear medicine team held the key to providing the necessary diagnostic map. The culmination of this collaboration is the "Consensus: Proceed". The figure clearly articulates the team's conclusion: "conservative measures had failed" and the action plan was to proceed with "definitive localization imaging to guide surgical intervention". Figure 3 visually chronicles a critical paradigm shift in the patient's care. It depicts the logical and evidence-based transition from a passive, medical management approach that proved futile to an active, diagnostic-led strategy aimed at providing a definitive surgical cure. It powerfully underscores that in complex cases such as this, collaborative, multidisciplinary decision-making is essential for identifying the correct therapeutic path forward.

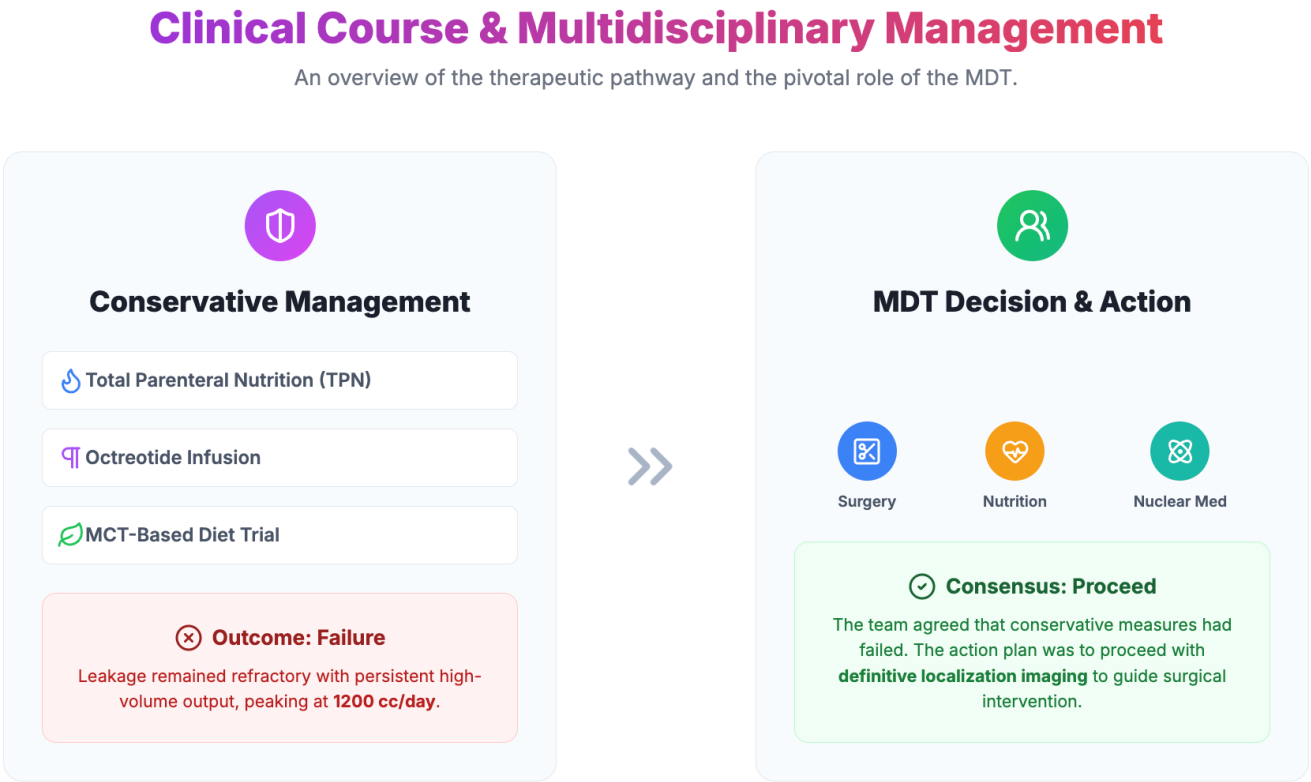

Figure 3. Clinical course and multidisciplinary management.

The patient underwent lymphoscintigraphy. The procedure involved the subcutaneous injection of 1.0 mCi (37 MBq) of ^{99m}Tc-nanocolloid, divided into two aliquots and administered into the interdigital web spaces of both feet. The initial planar images demonstrated normal and symmetric transit of the radiotracer from the injection sites up the lymphatic channels of the lower limbs, with prompt visualization of the inguinal and iliac lymph nodes. This confirmed the absence of a major central lymphatic obstruction. However, beginning on the 45-minute images and becoming progressively more intense and extensive over the 3-hour study, a large, abnormal area of radiotracer accumulation was identified in the right lower quadrant of the abdomen. The subsequent SPECT/CT provided definitive, high-resolution localization. The fused images unequivocally demonstrated that the site of extravasation was located in the pre-peritoneal and subcutaneous tissues of the right lower abdominal wall, immediately adjacent to the prior surgical scar and corresponding to the palpable mass. The images clearly delineated the focal collection of ^{99m}Tc-nanocolloid outside of the normal lymphatic channels. To provide a final layer of confirmation, a sample of the fluid from the surgical drain collection bag was analyzed with a handheld gamma probe, which registered background-corrected counts significantly above background, confirming a direct connection between the scintigraphically identified leak and the clinical fluid loss. The choice of ^{99m}Tc-Nanocolloid as the radiopharmaceutical is the first critical element. This agent consists of uniformly sized colloidal particles labeled with Technetium-99m, engineered to be small enough for ready absorption by the initial lymphatic capillaries but large enough to be retained within the lymphatic system for the duration of the imaging study. This property allows the radiotracer to act as a true physiological agent, faithfully mapping the functional pathways of lymphatic drainage. The administered dose of 1.0 mCi (37 MBq) is a carefully considered activity, adhering to the as low as reasonably achievable (ALARA) principle, especially crucial in pediatric imaging. This dose is sufficient to provide a high-quality signal for the gamma camera while minimizing the radiation exposure to the young patient. The method of administration, detailed as subcutaneous injection into the interdigital web spaces of both feet, is fundamental to the physiological nature of the study. This technique introduces the radiotracer into the interstitial fluid, where it is naturally taken up by the lymphatic capillaries, thus initiating its journey through the body's lymphatic network in the same manner as endogenous lymphatic fluid. This approach allows for a true dynamic assessment of lymphatic flow and function from the lower extremities upwards. The selection of the Siemens Symbia T2 Dual-Head SPECT/CT system is also of paramount importance. As indicated in Figure 4, this is not merely a gamma camera but a hybrid imaging device, capable of acquiring both functional nuclear medicine data (SPECT) and anatomical computed tomography (CT) data in a single session. This dual capability is the key to the diagnostic power illustrated in the subsequent panels. Finally, the acquisition protocol, involving an initial dynamic phase (0-5 minutes) followed by static images at 15, 45, 60, and 180 minutes, represents a comprehensive imaging schedule designed to capture the full spectrum of lymphatic transit, from the initial rapid flow in the lower limbs to the slower accumulation and potential extravasation in the abdominal and pelvic regions over several hours. The series of four images, acquired at sequential time points, tells a clear story. The 15-minute image shows the normal, expected physiological transit of the ^{99m}Tc-Nanocolloid. The radiotracer is seen ascending through the lymphatic channels of the lower legs and accumulating in the inguinal lymph nodes in the pelvis, indicating that the major lymphatic pathways from the injection sites are patent. However, the subsequent images reveal the pathology. At 45 minutes, a new, abnormal focus of radiotracer accumulation begins to appear in the right lower quadrant of the abdomen. This focus becomes progressively more intense and distinct on the 1-hour and 3-hour images. This temporal pattern is the

classic scintigraphic sign of an active lymphatic fistula; the radiotracer is continuously extravasating from a compromised lymphatic vessel and pooling in the surrounding tissue. As the summary note in Figure 4 expertly concludes, this "2D Finding" is crucial because it "reveals abnormal tracer accumulation in the right lower quadrant, confirming a leak." This finding provides the definitive functional evidence that validated the clinical suspicion. Yet, the note also highlights the inherent limitation of this imaging modality: it is "lacking precise anatomical depth." The two-dimensional, shadow-like nature of the planar images can show *that* a leak exists and its general location on a 2D map, but it cannot tell a surgeon whether the leak is superficial in the subcutaneous tissue, deep within the muscle, or originating from the retroperitoneum. This anatomical ambiguity is a significant barrier to planning a targeted surgical intervention. The panel displays three key images: a CT Coronal image, which provides the high-resolution anatomical background, and two fused images, a SPECT/CT Fused Coronal and a SPECT/CT Fused Transaxial view. It is in these fused images that the true diagnostic breakthrough occurs. The amorphous, two-dimensional "hotspot" seen on the planar scan is now transformed into a precise, three-dimensional signal. The intense radiotracer accumulation is no longer just "in the right lower quadrant"; it is now visualized with sub-centimeter accuracy within the specific anatomical context of the patient's body. The summary note for this section perfectly encapsulates the clinical impact of this finding. The SPECT/CT "Precisely localizes the leak (red/pink hotspot) to the pre-peritoneal tissue, providing an exact, surgically-actionable roadmap." This statement highlights the profound value of the hybrid imaging technique. The information is no longer just diagnostic; it is prescriptive. It provides the surgical team with the precise X, Y, and Z coordinates of the pathological source. This knowledge fundamentally changes the nature of the subsequent surgery, converting it from a potentially lengthy and difficult exploratory procedure into a confident, targeted, and image-guided intervention. The surgeon can now plan the optimal approach, minimize the size of the incision, avoid unnecessary dissection of healthy tissue, and proceed directly to the source of the problem. Figure 4 as a whole provides a powerful visual narrative of the modern diagnostic pathway for a complex clinical problem. It demonstrates a logical progression from a meticulous imaging protocol to the functional confirmation of a leak with planar scintigraphy, and finally to the definitive, high-precision anatomical localization with SPECT/CT that is essential for a successful therapeutic outcome.

Armed with the precise anatomical roadmap provided by the SPECT/CT scan, the patient underwent a targeted surgical repair. The surgeons were able to make a limited incision directly over the area identified by the imaging. Intraoperatively, the leaking, ectatic lymphatic channels were readily identified and meticulously ligated with sutures. The post-operative course was remarkable for the immediate and dramatic reduction in drain output, which ceased entirely within 48 hours. The drain was removed on the third post-operative day. The patient was gradually advanced to a normal diet, which she tolerated without any recurrence of ascites. At an in-person clinical follow-up one year after the definitive surgery, the patient was thriving. She reported no recurrence of abdominal swelling or any other related complaints. Her surgical wound had healed well, and her nutritional status had normalized (Figure 5).

3. Discussion

The management of this 13-year-old female with refractory, high-output chylous ascites represents a convergence of rare pathology, severe iatrogenic complication, and advanced diagnostic intervention. The successful outcome was not a foregone conclusion; it was the direct result of a logical, stepwise diagnostic and therapeutic process in which hybrid nuclear imaging played the definitive and indispensable role.[11] The foundational element of this case is the patient's underlying diagnosis of systemic lymphangiomatosis. This is not merely an incidental

finding but the central factor that predisposed her to this rare complication. Lymphangiomatosis is a congenital disorder characterized by a diffuse, multicentric proliferation of abnormally formed lymphatic vessels.[12] Unlike localized lymphangiomas, which are benign, sequestered cystic masses, systemic lymphangiomatosis involves the infiltration of multiple organ systems with a network of dilated, poorly organized, and dysfunctional lymphatic channels. These vessels are structurally deficient, lacking the normal smooth muscle architecture and valvular competence of a healthy lymphatic system. They are ectatic, fragile, and prone to leakage.[13]

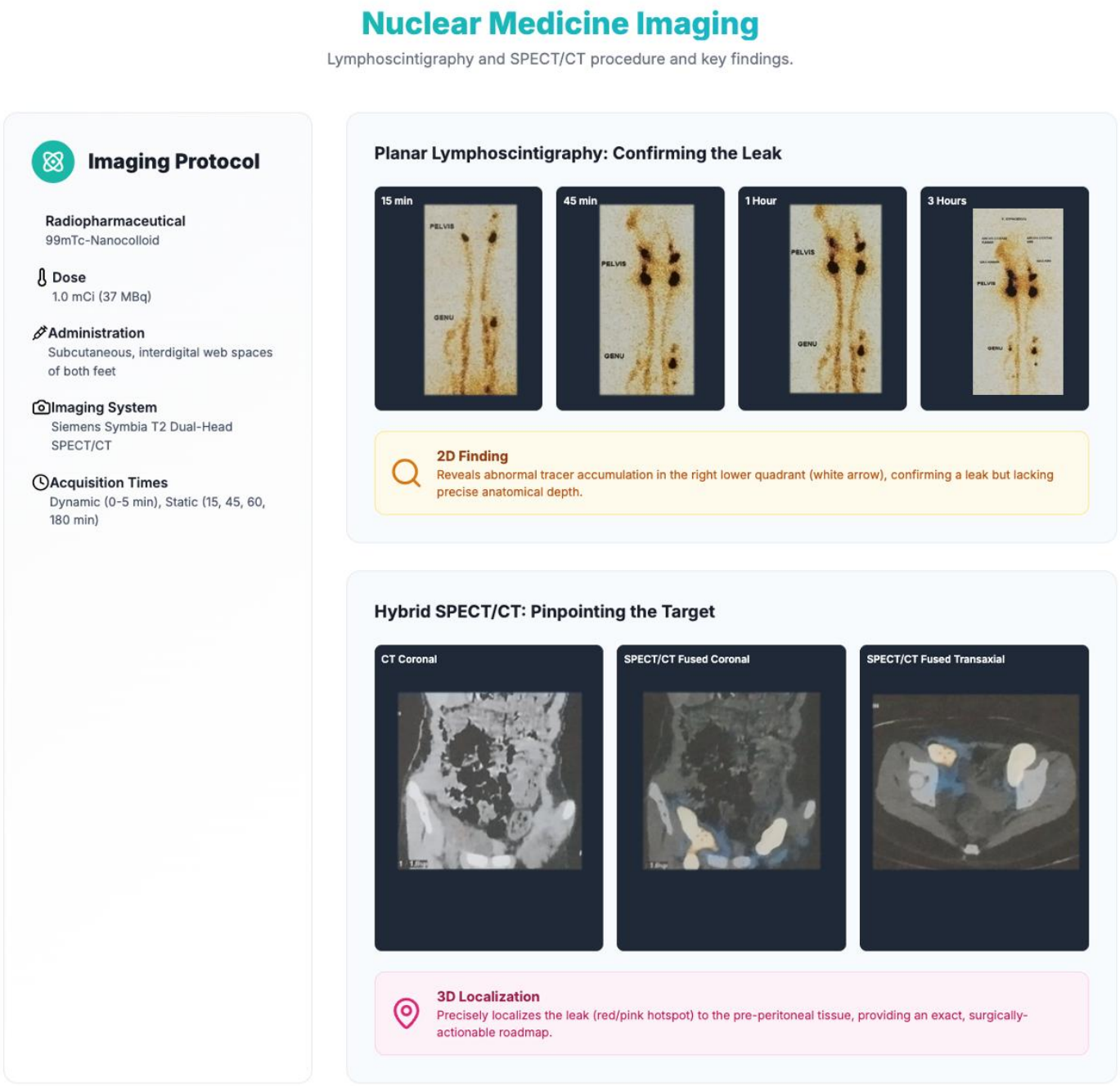

Figure 4. Nuclear medicine imaging.

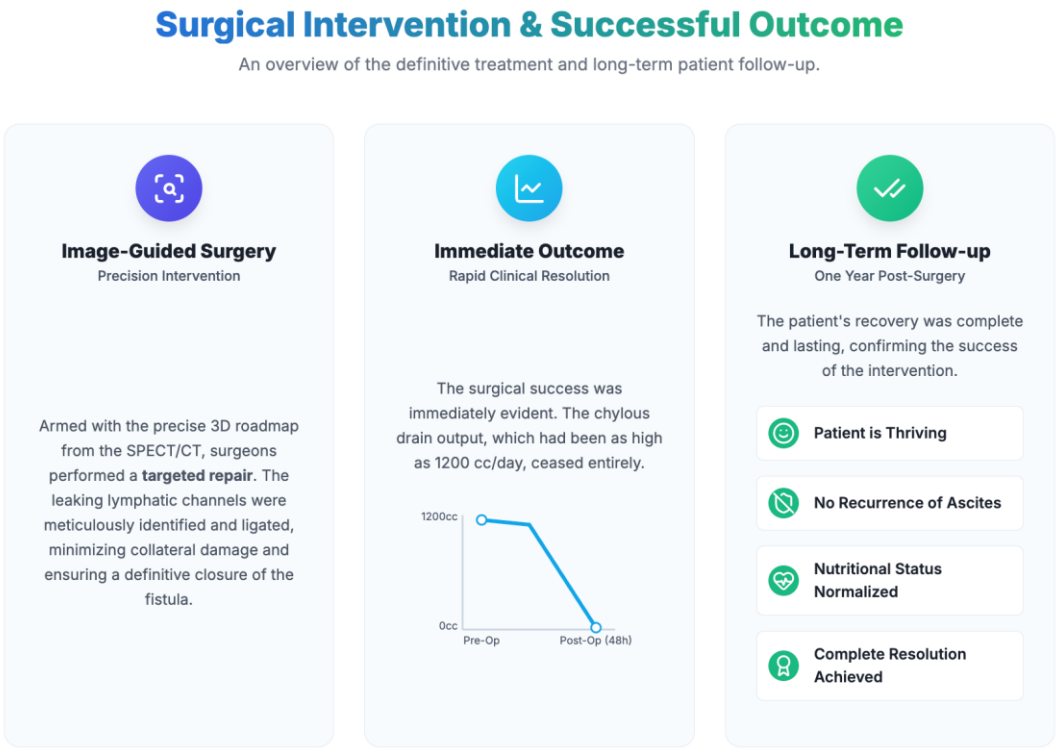

Figure 5. Surgical intervention and successful outcome.

Furthermore, they often fail to establish proper connections with the central lymphatic drainage pathways, leading to regional lymphatic stasis and hypertension. In this patient, the initial CT scan provided clear evidence of this systemic involvement, with cystic lesions noted in the spleen and lytic lesions in the bones, the latter being a classic, albeit rare, manifestation of intraosseous lymphangiomatosis. This pre-existing, anatomically compromised lymphatic network created a state of profound vulnerability.[14] Any significant physiological stressor or physical trauma could potentially overwhelm this fragile system, leading to chyle extravasation.

The precipitating event was the initial surgical excision of the abdominal mass. While clinically indicated, this procedure introduced a significant iatrogenic injury. Abdominal surgery, particularly procedures involving extensive retroperitoneal dissection, is a well-known cause of chylous ascites.[15] The surgery likely transected numerous of these abnormal, high-pressure lymphatic channels in the retroperitoneum and abdominal wall. In a patient with a normal lymphatic system, such minor injuries are often of no consequence, as robust collateral pathways and effective vessel sealing mechanisms prevent significant leakage. However, in this patient, the combination of structural vessel fragility and underlying lymphatic hypertension meant that these transected vessels were unable to seal. This created a persistent, high-volume fistula, a direct conduit between the retroperitoneal lymphatic system and the peritoneal cavity. The mechanism can be conceptualized as a "perfect storm": the surgical trauma created the opening, and the underlying lymphangiomatosis provided the sustained, high-pressure flow of chyle to maintain it. The initial presentation of milky white fluid, rich in triglycerides absorbed from the gut, which later became more serous as the patient was made nil per os, is the classic clinical signature of such a leak. Figure 6 provides a schematic illustration of this pathophysiological process.[16]

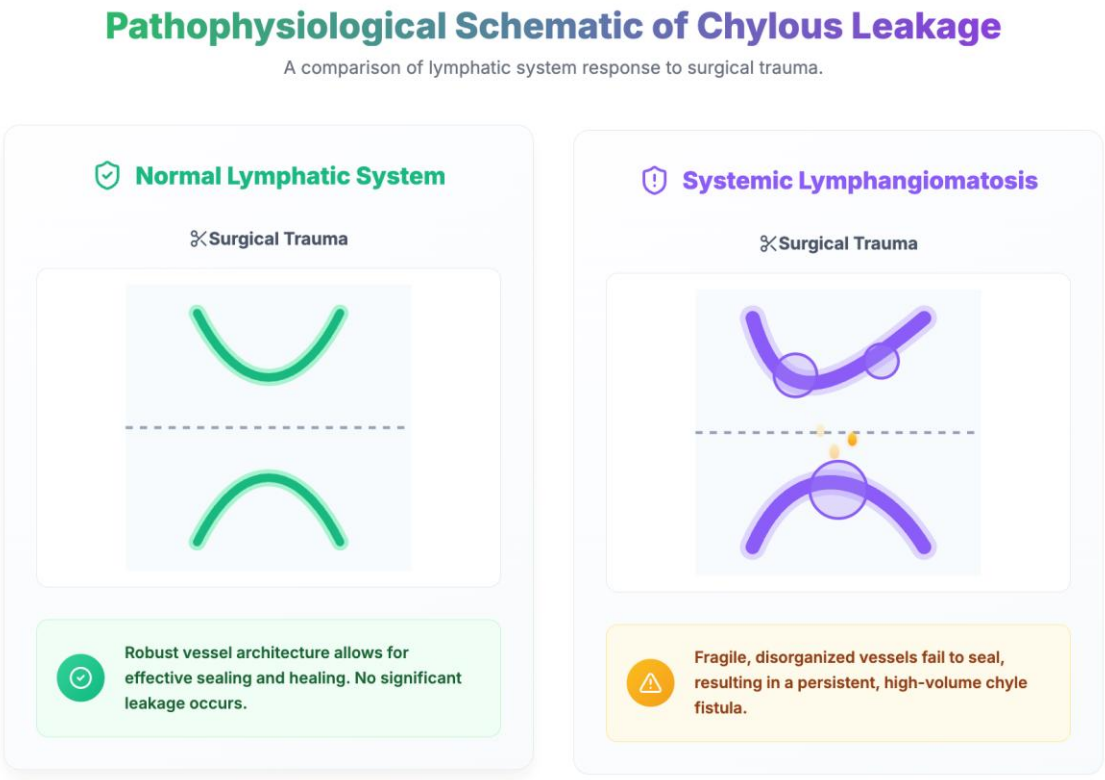

Figure 6. Pathophysiological schematic of chylous leakage.

The subsequent clinical course demonstrated the profound systemic consequences of uncontrolled chyle loss. Chyle is not simply fluid; it is a vital biological substance, rich in proteins (especially albumin), fats, fat-soluble vitamins, electrolytes, and immunologically critical lymphocytes. The persistent drainage of up to 1200 cc per day represented a massive metabolic and immunological insult. The documented hypoalbuminemia (2.54 g/dL) is a direct marker of this severe protein-losing enteropathy, leading to reduced plasma oncotic pressure, which can exacerbate fluid shifts and impair wound healing. The loss of fats and fat-soluble vitamins (A, D, E, K) leads to malnutrition and can precipitate coagulopathies.[17] Perhaps most critically, the depletion of T-lymphocytes, which are recirculated through the lymphatic system, can induce a state of acquired immunodeficiency, placing the patient at high risk for opportunistic infections. This cascade of physiological derangements explains why refractory chylous ascites is associated with such high rates of morbidity and mortality. It is a condition that cannot be left untreated. The initial management strategy rightly focused on conservative measures. The goal of this approach is to reduce the volume and pressure of chyle flow to a minimum, thereby creating a favorable physiological environment for the lymphatic fistula to heal spontaneously. This was attempted through a multi-pronged approach. Total parenteral nutrition (TPN) was instituted to completely bypass the enteric absorption of long-chain fatty acids, which are the primary drivers of chyle production. This was followed by a specialized diet rich in medium-chain triglycerides (MCTs). MCTs are unique in that they are absorbed directly into the portal venous system, circumventing the intestinal lacteals and the lymphatic system altogether. This nutritional manipulation is the cornerstone of conservative therapy. The pharmacological adjunct was octreotide, a long-acting analog of somatostatin. Octreotide has multiple beneficial effects in this context: it reduces splanchnic blood flow, decreases gastric, pancreatic,

and biliary secretions, and may have a direct constrictive effect on lymphatic vessels, all of which combine to reduce the volume of chyle produced.[18] However, in this case, the drain output remained stubbornly high. This failure of conservative therapy was a critical turning point. It strongly suggested that the fistula was not a small, low-pressure leak that could heal on its own, but rather a large, high-pressure defect in a major lymphatic channel that would require definitive closure.[19]

Once the decision was made to pursue an invasive intervention, the absolute prerequisite for success was the precise localization of the leak. Operating without a clear anatomical roadmap would involve an extensive and potentially fruitless exploratory laparotomy, with a high risk of causing further iatrogenic damage to the already compromised lymphatic system. This is where the diagnostic power of nuclear medicine became paramount. Radionuclide lymphoscintigraphy was selected as the ideal modality. The choice of ^{99m}Tc-nanocolloid as the radiopharmaceutical is significant.[20] For effective lymphatic imaging, the radiotracer must consist of particles of an optimal size—small enough to be readily absorbed by the initial lymphatic capillaries in the subcutaneous tissue, but large enough to be retained within the lymphatic system and not diffuse freely into the bloodstream. ^{99m}Tc-nanocolloid fits these criteria perfectly. In contrast to filtered ^{99m}Tc-sulfur colloid, which can have a wider and less predictable particle size distribution, nanocolloid offers more uniform particles, leading to more reliable and rapid transit from the injection site. This makes it an excellent agent for dynamic functional imaging of lymphatic flow.

The initial planar imaging phase of the study successfully answered the first critical question: was there an active leak? The dynamic and static images clearly demonstrated the normal ascent of the radiotracer up to the pelvic region, followed by the appearance of a distinct, abnormal focus of radiotracer accumulation in the right lower abdomen. The progressively intensifying nature of this accumulation over three hours was a clear scintigraphic sign of a high-volume, active leak, correlating perfectly with the clinical picture. Planar imaging, therefore, confirmed the diagnosis and provided a general location of the pathology. However, the inherent limitation of planar imaging is its two-dimensional nature. It provides a "shadowgram" of radiotracer distribution, lacking any depth information or precise anatomical context. The finding of a "leak at the projection of the right SIAS" is a functional localization, not an anatomical one. For a surgeon, this information is insufficient. The leak could be in the subcutaneous tissue, within the abdominal musculature, in the pre-peritoneal space, or arising from a retroperitoneal structure and tracking anteriorly. Each of these possibilities would require a different surgical approach.

This is the critical juncture where the hybrid imaging of SPECT/CT demonstrated its transformative value. By combining the functional data from the SPECT acquisition with the high-resolution anatomical data from a co-registered CT scan, the modality provided the missing third dimension. The fused images created a precise, three-dimensional map of the patient's anatomy, with the site of the lymphatic leak highlighted like a beacon. The SPECT/CT images definitively localized the point of extravasation to the pre-peritoneal and subcutaneous tissues of the right lower abdominal wall, immediately adjacent to the site of the prior surgical incision. This was the "smoking gun." It moved the diagnosis from a regional probability to an anatomical certainty. This level of precision is what makes SPECT/CT a true guidance tool. It provided the surgical team with an exact target, allowing them to plan their incision, anticipate the depth of dissection, and proceed directly to the source of the problem with minimal collateral disruption. The elegant final step of using a handheld gamma probe to confirm radioactivity in the drained fluid provided a direct, real-time link between the imaging findings and the patient's clinical presentation, closing the diagnostic loop.

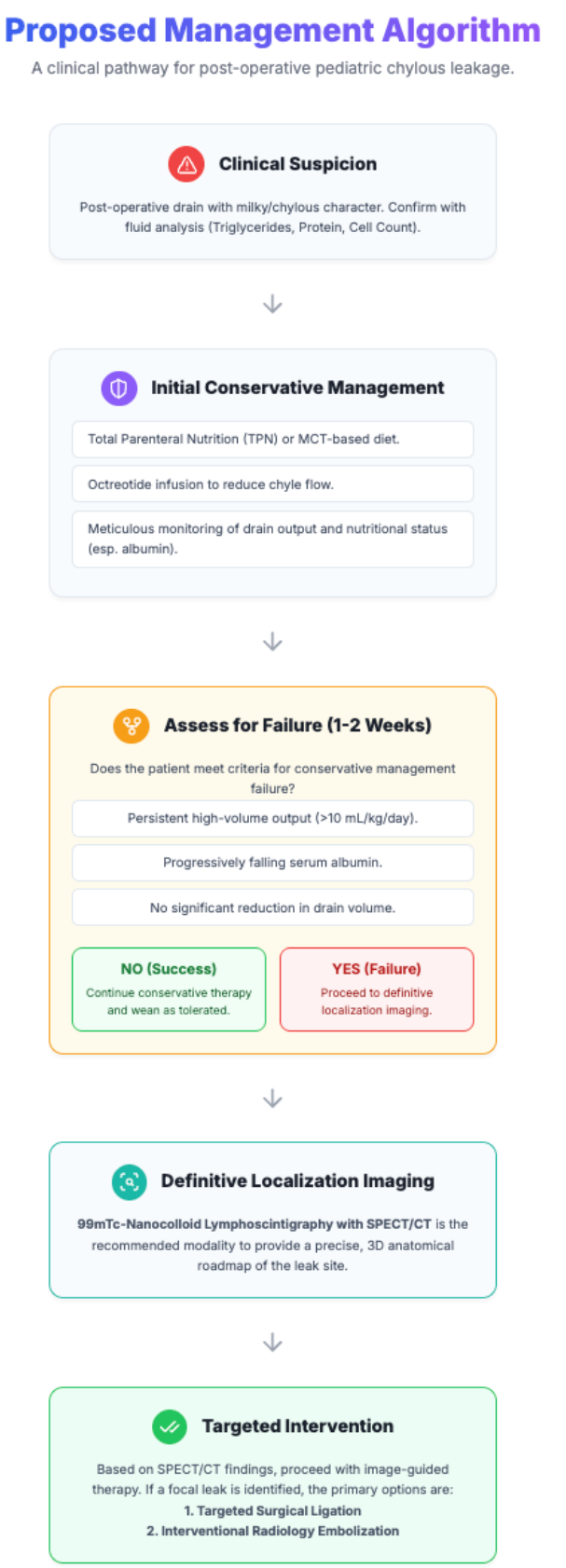

Figure 7. Proposed algorithm for management of post-operative chylous leakage.

The success of the subsequent surgery is the ultimate validation of this imaging-guided approach. Armed with the precise roadmap from the SPECT/CT, the surgeons were able to perform a targeted intervention, meticulously identifying and ligating the leaking lymphatic channels. The rapid resolution of the ascites post-operatively and the patient's excellent long-term outcome at one-year follow-up stand as a testament to the effectiveness of this strategy. This case, therefore, serves as a powerful exemplar of modern, personalized medicine, where an advanced diagnostic technology is leveraged not just to make a diagnosis, but to fundamentally alter and guide the therapeutic plan, leading to a definitive cure for a complex and life-threatening condition. The role of the multidisciplinary team (MDT) cannot be overstated. The successful outcome was a direct result of seamless collaboration. The surgeons defined the clinical problem and the need for a target; the nutritionists managed the patient's profound metabolic derangements; and the nuclear medicine team provided the essential, high-precision map that made a curative intervention possible. This case serves as a model for an integrated, interdisciplinary approach to complex medical challenges. Based on this experience, we propose a clinical algorithm for the management of similar cases (Figure 7).

4. Conclusion

This case of post-surgical chylous ascites in a pediatric patient with systemic lymphangiomatosis demonstrates the profound diagnostic capability of hybrid nuclear imaging. The failure of conservative management necessitated a more definitive therapeutic strategy, which was critically dependent on accurate leak localization. ^{99m}Tc-nanocolloid SPECT/CT proved to be the indispensable tool that bridged this diagnostic gap, transforming a generalized area of concern on planar imaging into a precise, surgically-targetable anatomical location. This fusion of functional and anatomical data provided the surgical team with an essential roadmap, enabling a focused, successful intervention that resulted in the complete and lasting resolution of a debilitating condition. This report strongly advocates for the integration of SPECT/CT into the management algorithm for complex chylous leaks, as it represents a key modality for facilitating definitive treatment and improving patient outcomes.

5. References

1. Sun Y, Wang C, Shao L. Enterogenic bacterial peritonitis and delayed chylous ascites associated with overheated peritoneal dialysis fluid infusion. Clin Kidney J. 2024; 17(8): sfae219.
2. Umar A, Faquih AE, Bilal M, Garner J. Navigating the labyrinth: Chylothorax and chylous ascites unveiled after abdominal surgery for an exceptionally rare tumor. Cureus. 2024; 16(8): e66239.
3. Karimi A, Moussa AM, Sotirchos VS, Santos E, Son S, Velayati S, et al. Effectiveness and safety of peritoneovenous (Denver) shunt placement for treatment of chylous ascites following unsuccessful lymphatic embolization. J Vasc Interv Radiol. 2025; 36(5): 910–3.
4. Lim AT, Ng YC, Choy CY. Chronic hepatitis E complicated by chylous ascites in an HIV-infected patient with previous disseminated MAC infection: a case report. ASM Case Rep. 2025.
5. Wong S, Wang M, Hirji A, Li P. Management of chylothorax and chylous ascites due to yellow nail syndrome with indwelling catheters: a case report. AME Med J. 2025; 10: 18.
6. Leite TF de O. Percutaneous lymphatic duct embolisation in postnephrectomy chylous ascites. BMJ Case Rep. 2025; 18(6): e264139.
7. Litchinko A, Monnard E, Tappero C, Egger B. Role of Lipiodol® lymphangiography in the diagnosis and management of post-operative chylous ascites. Front Radiol. 2025; 5: 1537744.

8. Baran M, Kahveci S, Aksoy B, Cagan Appak Y, Dogan G, Orsdemir Hortu H, et al. Refractory infantyl chylous ascites treatment by everolimus. Medeni Med J. 2025; 40(2): 110–3.
9. Hansalia DS, Kumar T, Sharma AV, Chigurupati SV. A rare case of Cisterna chyli direct embolization for chylous ascites (without chylothorax) post-VATS esophagectomy. Indian J Surg Oncol. 2025.
10. Yang Z, Li Y, Chen H, Bao H, Geng J, Li J, et al. Comparison of the effectiveness of inguinal lymphangiography and transjugular intrahepatic portosystemic shunt creation in cirrhosis-related chylous ascites. J Vasc Interv Radiol. 2025; 36(8): 1341–6.
11. Meram E, Monroe EJ, McKernan M, Woods MA, Ozkan OS, Swietlik JF. Portal venous decompression for treatment of portal hypertension-related refractory chylous ascites or chylothorax. J Vasc Interv Radiol. 2025; 36(8): 1336–40.
12. Yang H, Shi Y, Ji G. Accidentally encountered chylous ascites: Recurrence of peritoneal tuberculosis. J Minim Invasive Gynecol. 2025; 32(8): 659–61.
13. Ko K-Y, Chan EO-T, Chu PS-K, Man C-W, Chan SY-S. Post-prostatectomy chylous ascites treated by intranodal lymphangiography: a case report and review. Surg Pract. 2025; (1744-1633.70022).
14. Chang N-W, Wang S-C. Chylous ascites and persistent hiccups as complications after laparoscopic radical nephrectomy. BMJ Case Rep. 2025; 18(8): e267164.
15. Hantodkar R, Patel BM, Dave PS, Palkhiwala NB. Rare complication of chylous ascites following surgery and radiotherapy in endometrial carcinoma managed by diet modification: Case report. Indian J Gynecol Oncol. 2025; 23(3).
16. Mailley K, Tortajada-Roman AM, Aly M, Pang WS, Pisano U. Management of refractory chylous ascites. Urol Case Rep. 2025; 62(103130): 103130.
17. Shamohammadi M, Ramezani A, Naseh E, Gandomi-Mohammadabadi A, Zarghami SY, Garavand AA. Management of chylous ascites following pancreaticoduodenectomy surgery using radiotherapy: a case report and review of literature. Int J Surg Case Rep. 2025; 134(111640): 111640.
18. Rana SS, Chhabra P, Sharma V, Pervez N, Sharma R, Srinivasan R, et al. Disseminated lymphangiomatosis presenting as chylous ascites and diagnosed with endoscopic ultrasound. Endosc Ultrasound. 2016; 5(3): 210–1.
19. Láinez Ramos-Bossini AJ, Ruiz-Carazo E, Gálvez López R. Refractory chylothorax and chylous ascites as form of presentation of diffuse lymphangiomatosis. Med Clín (Engl Ed). 2021; 156(11): 584.
20. Nie R, Gao J, Yang W, Lu H, Ren Q. Lymphangiomatosis presented with melena and chylous ascites: a case report. Medicine (Baltimore). 2023; 102(2): e32581.