18. Brunot B, Petras S, Germain P, Vinee P, Constantinesco A. Biopsy and quantitative hepatobiliary scintigraphy in evaluation of liver transplantation. *J Nucl Med* 1994;35: 1321–1327.
19. Daniel GB, Bright RM, Monnet E, Ollis P. Comparison of per-rectal portal scintigraphy using ^{99m}technetium pertechnetate to mesenteric injection of radioactive microspheres for quantification of portosystemic shunts in an experimental dog model. *Vet Radiol Ultrasound* 1990;31:175–181.
20. Susumu S, Kuroki T, Kurai O, et al. Portal circulation by technetium-99m pertechnetate per-rectal portal scintigraphy. *J Nucl Med* 1988;29:460–465.
21. Daniel GB, Bright RM, Ollis P, Shull R. Per rectal portal scintigraphy using ^{99m}Tc pertechnetate to diagnosis portosystemic shunts in dogs and cats. *J Vet Intern Med* 1991;5:23–27.
22. Fritzberg AR. Advances in the development of hepatobiliary radiopharmaceuticals. In: Fritzberg AR, ed. *Radiopharmaceuticals: progress and clinical perspectives*. Boca Raton, FL: CRC Press; 1986:90–116.
23. Loberg MD, Cooper M, Harvey E. Development of new radiopharmaceutical based on N-substitution of iminodiacetic acid. *J Nucl Med* 1976;17:633–638.
24. Loberg MD, Fields AT. Chemical structures of ^{99m}Tc-labeled N-(2,6-dimethylphenylcarbamoylmethyl) iminodiacetic acid (Tc-HIDA). *Int J Appl Radiat Iso* 1978;29:167–173.
25. O'Connor KW, Snodgrass PJ, Swonder JE, et al. A blinded prospective study comparing four current noninvasive approaches in the differential diagnosis of medical versus surgical jaundice. *Gastroenterology* 1983;84:1498–1504.
26. Center SA. Pathophysiology, laboratory diagnosis and diseases of the liver. In: Ettinger SJ, Feldman EC, eds. *Textbook of veterinary internal medicine, disease of the dog and cat*. Philadelphia: WB Saunders; 1995;1261–1312.
27. Feldman BF. Clinical pathology of the liver. In: Kirk RW, ed. *Current veterinary therapy VIII*. Philadelphia: WB Saunders; 1980:875–885.
28. Klingensmith WC, Fritzberg AR, Spitzer VM, Kuni CC, Williamson MR, Gerhold JP. Work in progress: clinical evaluation of ^{99m}Tc-trimethylbromo-IDA and ^{99m}Tc-diisopropyl-IDA for hepatobiliary imaging. *Radiology* 1997;146:181–184.
29. Nunn AD, Loberg MD, Conley RA. A structure-distribution relationship approach leading to the development of ^{99m}Tc-mebrofenin: an improved cholescintigraphic agent. *J Nucl Med* 1983;24:423–430.
30. Winograd H, Lorgue G, Keister DM. Thiacetarsamide toxicity in the normal dog. In: Soll MD, Coleman MW, Courtney CH, Jackson RF, Keough RJ, Knight DH, eds. *Proceeding of the heartworm symposium 92*. Batavia, IL: American Heartworm Society; 1992:215–222.
31. Zimmerman HJ. *Hepatotoxicity*. New York: Appleton-Century-Crofts; 1978:47–90.

Lymphoscintigraphy in Chyluria, Chyloperitoneum and Chylothorax

Margaret H. Pui and Tian-Chao Yueh

Department of Nuclear Medicine, First Affiliated Hospital of Sun Yat-Sen University of Medical Sciences, Guangzhou, People's Republic of China

Lymphoscintigraphy allows functional assessment of lymphatic transport and depiction of regional lymph nodes, is fast and nontraumatic and has no known side effects. We retrospectively analyzed lymphoscintigraphic studies to determine their efficacy in the investigation of chyluria, chyloperitoneum and chylothorax. **Methods:** Twenty-one whole-body lymphoscintigrams using ^{99m}Tc-antimony sulfide colloid or dextran were acquired in 18 patients with chyluria, chyloperitoneum and/or chylothorax. The images were reviewed to assess the rate of tracer transport and number, size and distribution of lymph vessels and nodes as well as the presence of collateral, fistula or lymph reflux. **Results:** Lymphoscintigraphy was normal (5 of 11 patients) or showed lymphatic obstruction (6 of 11 patients) in chyluria associated with filariasis. Lymphatic obstruction was demonstrated in chyloperitoneum and/or chylothorax associated with liver cirrhosis (2 patients), postoperative (1 patient) or congenital (1 patient) lymphatic dysplasia, inferior vena cava obstruction (1 patient) and nephrotic syndrome (1 patient). Enhanced lymph flow was seen in systemic lupus erythematosus (1 patient). Follow-up lymphoscintigrams showed patency of lymphovenous anastomosis (1 patient), improvement (1 patient) or no change (1 patient) in lymphatic drainage after treatment. **Conclusion:** Lymphoscintigraphy can demonstrate abnormal lymphatic drainage in chyluria, chyloperitoneum and chylothorax. It is useful for selecting patients for surgery and assessing the effect of treatment.

Key Words: chyluria; chyloperitoneum; chylothorax; lymphoscintigraphy

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Lymphangiography has been the main imaging modality in investigating chyluria, chyloperitoneum and chylothorax. It is useful for detecting abnormal retroperitoneal lymph nodes, leakage from dilated lymphatics, lymphoperitoneal and lymphaticopelvic fistulization, skipping of lymphatic chain, patency of thoracic duct and abnormal leg lymphatics (*1–3*). However, it requires tedious cannulation of lymphatics, is invasive and is not readily reproducible. It also can result in local tissue necrosis, fat embolism to the lungs, hypersensitivity reaction and exacerbation of lymphedema by the contrast material (*4*). Lymphoscintigraphy using ^{99m}Tc-sulfur microcolloid, antimony sulfide colloid, stannous phytate, rhenium sulfur colloid, human serum albumin or dextran delineates the pattern of lymphatic drainage, is fast and nontraumatic and has no known side effects (*5–6*). Use of lymphoscintigraphy in investigating chyluria, chyloperitoneum and chylothorax has been limited to a few case reports (*7–13*). We retrospectively analyzed lymphoscintigraphic studies to determine their efficacy in the investigation of chyluria, chyloperitoneum and chylothorax.

MATERIALS AND METHODS

Between June 1989 and May 1996, lymphoscintigraphy was performed on 18 patients with chyluria (9 women, 2 men), chyluria and chyloperitoneum (2 men), chyloperitoneum and chylothorax (3 women, 2 men). Follow-up scans were obtained on 3 patients, giving a total of 21 lymphoscintigraphic studies. The average patient age was 38.0 yr (range 25–57 yr), and average duration of symptoms was 4.7 yr (range 3 mo to 36 yr) for chyluria and 6.0 mo (range 10 days to 18 mo) for chyloperitoneum and chylothorax. Elephantiasis of the lower extremities was the most common associated symptom. Other associated symptoms and signs included hematuria, flank pain, dysuria, urinary frequency, oliguria, weight loss, fever, cough, anasarca, chest discomfort, dyspnea and enlarged inguinal lymph nodes. A previous history of filariasis was known in 7 of 13 patients with chyluria. Urine, peritoneal, pleural or pericardial fluid were positive for fat droplets after Sudan staining and negative for acid-fast bacilli, culture and cytology in all patients. Repeated thick-film night blood smears were also negative for microfilaria in all patients. Final diagnoses were made

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For correspondence or reprints contact: Margaret H. Pui, MD, Department of Radiology, Aga Khan University Medical Center, Stadium Rd., PO Box 3500, Karachi 74800, Pakistan.

TABLE 1
Lymphoscintigraphic Findings and Treatment

Patient no.	Age (yr)	Sex	Presentation	Lymphoscintigram	Diagnosis	Treatment
1	30	M	Chyluria	Normal	Filariasis	D, L
2	34	F	Chyluria	Normal	Filariasis	D, LVA
3	36	F	Chyluria	Normal	Filariasis	D, L
4	32	F	Chyluria	Normal	Filariasis	D, L
5	36	F	Chyluria	Normal	Filariasis	D, LVA
6	44	F	Chyluria	CO, right iliac	Filariasis	D, P, LVA
7	36	F	Chyluria	IO left iliac	Filariasis	D, L, LVA
8	43	F	Chyluria	IO left iliac, RK fistula	Filariasis	D
9	32	M	Chyluria	IO right periaortic	Filariasis	D, L
10	35	F	Chyluria	IO right periaortic	Filariasis	D
11	57	F	Chyluria	IO right periaortic	Filariasis	D, L, LVA
12	29	M	Chyluria, chyloperitoneum	EF left arm, right leg	Systemic lupus erythematosus	Prednisone
13	25	M	Chyluria, chyloperitoneum	Lymph reflux	Liver cirrhosis	LVA, peritoneo-venous shunt
14	51	M	Chyloperitoneum, chylothorax	CO Bt periaortic	Liver cirrhosis	Paracentesis supportive
15	48	F	Chyloperitoneum, chylothorax	CO Bt inguinal	Postoperative	P, paracentesis, thoracentesis
16	38	F	Chyloperitoneum, chylothorax	CO Bt periaortic	IVC obstruction	Protein infusion, paracentesis
17	46	M	Chyloperitoneum, chylothorax	CO Bt periaortic	Nephrotic syndrome	Prednisone, ranitidine
18	32	M	Chylothorax, chylopericardium	CO left arm, left periaortic	Congenital lymphatic hypoplasia	Pericardocentesis and thoracentesis

CO = complete obstruction of the lymphatics; IO = incomplete obstruction of the lymphatics; EF = enhanced lymph flow; Bt = bilateral; RK = right kidney; IVC = inferior vena cava; D = medium-chain triglyceride diet and diethylcarbamazine drug therapy; L = bilateral renal pelvic lavage with 1% silver nitrate; LVA = inguinal lymphovenous anastomosis surgery; P = lymphatic pump therapy.

by correlating lymphoscintigraphic findings with laboratory and other imaging studies, including chest radiograph, barium meal, intravenous urogram, renogram, ultrasound, CT, MRI, lymphangiogram, venogram and aortogram. The diagnoses included filariasis (11 patients), liver cirrhosis (2 patients), postoperative (1 patient) or congenital (1 patient) lymphatic dysplasia, nephrotic syndrome (1 patient), inferior vena cava (IVC) obstruction (1 patient) and systemic lupus erythematosus (1 patient).

Lymphoscintigraphy was performed using a large-field-of-view gamma camera fitted with a low-energy, general-purpose collimator. Anterior whole-body scans were acquired 5–10 min and 20–30 min after subcutaneous injection of 37 MBq ^{99m}Tc-antimony sulfide colloid (14 patients) or ^{99m}Tc-dextran (4 patients) into the first and second interdigital spaces of both feet and/or hands at a scanning speed of 15 cm/min. Delayed scans of 1–6 hr were also obtained when the early images were abnormal. Images were reviewed by two nuclear medicine physicians. Delayed transport of the tracer and/or depiction of regional lymph nodes with or without collateral, fistula, tracer extravasation or reflux and crossover filling of lymph nodes were interpreted as incomplete lymphatic obstruction. No tracer transport and/or absent regional lymph nodes were considered to be complete lymphatic obstruction.

RESULTS

Lymphoscintigraphic findings, diagnoses and treatment are summarized in Table 1. Of the 11 patients with chyluria associated with filariasis, the lymphoscintigram was normal in 5 patients and showed complete obstruction of the right iliac lymphatics in 1 patient, incomplete right periaortic lymphatic obstruction in 3 patients and incomplete left iliac lymphatic obstruction in 1 patient with and 1 patient without right renal fistulization (Figs. 1–3). Enhanced lymph flow in the left arm and right leg was demonstrated in 1 patient (Patient 12) with chyluria, chyloperitoneum and lymphedema of the left arm and right leg associated with systemic lupus erythematosus (Fig. 4). The lymphoscintigram in 1 patient (Patient 13) with chyluria and chyloperitoneum from liver cirrhosis showed reflux of the tracer into the peritoneal cavity and attenuation of radioactivity

FIGURE 1. Patient 4, a 32-yr-old woman with chyluria associated with filariasis. The anterior whole-body lymphoscintigram using ^{99m}Tc-antimony sulfide colloid is normal with prompt and symmetrical appearance of radioactivity in the lymph vessels and nodes.

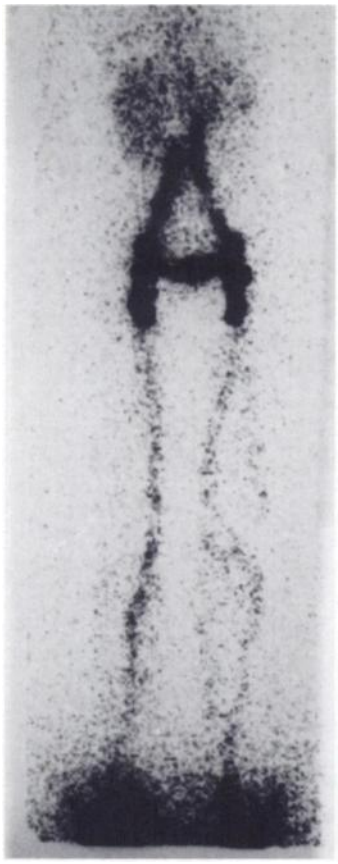

FIGURE 2. Patient 7, a 36-yr-old woman with chyluria and left leg lymphedema associated with filariasis. The ^{99m}Tc-antimony sulfide colloid scan obtained at 45-min shows incomplete left iliac lymphatic obstruction with collaterals in the left leg and delayed depiction of left iliac lymph nodes.

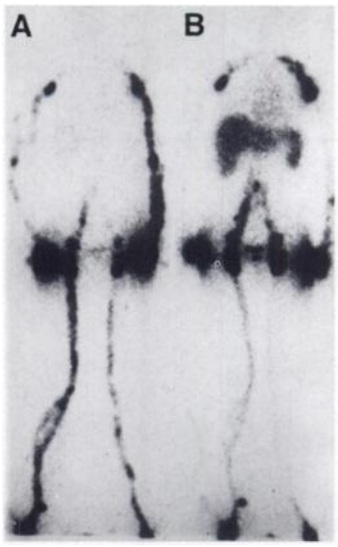

FIGURE 4. Patient 12, a 29-yr-old man with chyluria, chyloperitoneum and elephantiasis of the left arm and right leg associated with systemic lupus erythematosus. Technetium-99m-antimony sulfide colloid scans at (A) 10 min and (B) 60 min show enhanced lymph flow in the left arm and right leg.

in the bilateral iliac and periaortic lymphatics by peritoneal fluid (Fig. 5). One patient (Patient 18) with chylothorax, chylopericardium and elephantiasis of the left upper and lower extremities had congenital hypoplasia of left periaortic, iliac, leg and arm lymphatics. Of the remaining 4 patients with chyloperitoneum and chylothorax, the lymphoscintigram showed complete bilateral periaortic lymphatic obstruction.

Postoperative lymphoscintigram on 1 patient (Patient 5) showed patent left inguinal lymphovenous anastomosis (LVA) with prompt appearance of tracer in the kidneys, bladder, liver and heart (Fig. 6). A follow-up scan showed no change in 1 patient on supportive treatment for liver cirrhosis (Patient 14) and improvement of lymph flow in another patient (Patient 11) after antifilarial drug therapy, renal pelvic lavage and LVA.

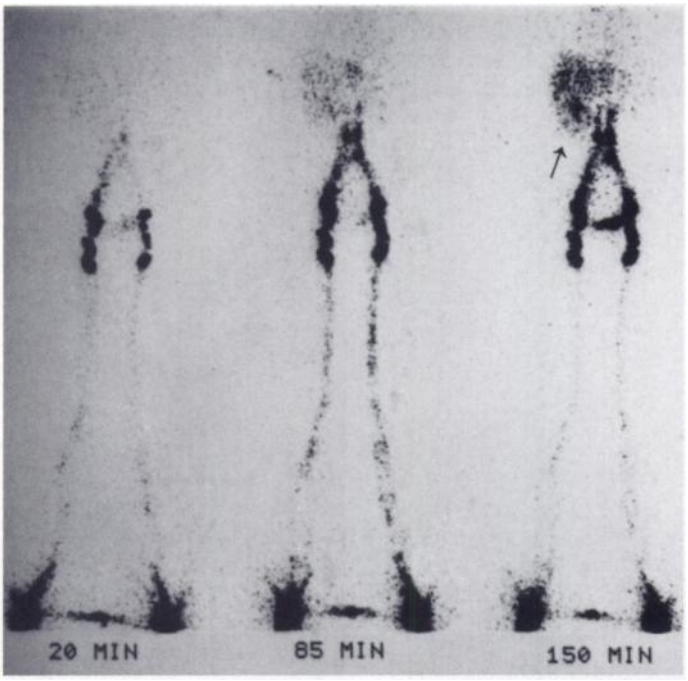

FIGURE 3. Patient 8, a 43-yr-old woman with chyluria associated with filariasis. The serial ^{99m}Tc-antimony sulfide colloid scan demonstrates incomplete obstruction with delayed tracer transport in the left iliac lymphatic vessel and delayed depiction of left inguinal nodes. Radioactivity in the right kidney at 150 min suggests lymphaticopelvic fistula (arrow).

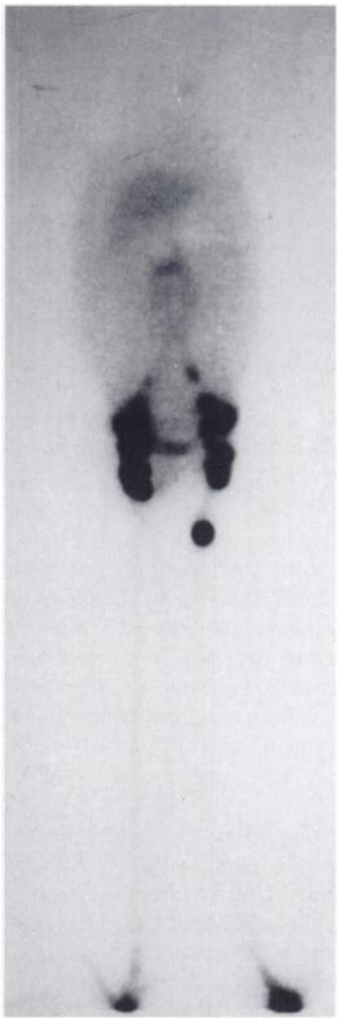

FIGURE 5. Patient 13, a 25-yr-old man with chyluria and chyloperitoneum associated with liver cirrhosis. The 60-min delayed ^{99m}Tc-antimony sulfide colloid scan shows lymph reflux with an accumulation of tracer in the peritoneal fluid and attenuation of periaortic and iliac lymphatics by ascites.

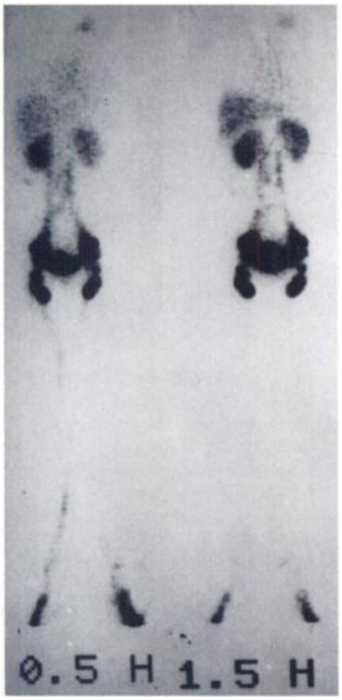

FIGURE 6. Patient 5, a 36-yr-old woman with chyluria associated with filariasis. Postoperative lymphoscintigraphy using ^{99m}Tc-antimony sulfide colloid demonstrates patent inguinal lymphovenous anastomosis with rapid appearance of radioactivity in kidneys, bladder, liver and heart.

Of the 11 patients with chyluria associated with filariasis, 2 responded to medium-chain triglyceride diet and drug treatment with diethylcarbamazine; 4 required additional bilateral renal pelvic lavage with 1% silver nitrate; inguinal LVA was performed in 5. One patient (Patient 13) with chyluria and massive lymph reflux into the peritoneal cavity on the lymphoscintigram did not respond to peritoneovenous shunt and LVA. Specific treatment of the primary disorder and/or supportive therapy with repeated therapeutic paracentesis and thoracentesis were given to the remaining 6 patients with chyloperitoneum and chylothorax.

DISCUSSION

Lymphoscintigraphy was first introduced in 1953 using ^{198}Au-colloid. Because of its high absorbed radiation at the injection site, ^{198}Au has been replaced by ^{99m}Tc-colloid, human serum albumin and dextran. Lymphoscintigraphy allows functional assessment of lymphatic transport and depiction of regional lymph nodes. After the interstitially administered tracer is taken up into the lymphatics, clearance and trapping of colloid in lymph nodes are dependent on particle size and functional status of the reticuloendothelial system. Less than 35% of colloidal particles are absorbed in 24 hr and a delay of several hours may be required to image draining nodes. Transport of dextran depends on diffusion, less on actual lymph flow and is accelerated by skeletal muscle and lymphatic contractions. Thus, total-body uptake of dextran is faster and greater than that of antimony sulfide colloid. In spite of rapid lymph node uptake rates, total popliteal lymph node sequestration of dextran has been shown to be significantly lower because of its noncolloidal nature and its instability. Dextran also can bypass reticuloendothelial activity of ilioinguinal nodes and enter from the lymphatic to venous system and increase background radioactivity. Retroperitoneal lymphatic trunks are sometimes well depicted. Dilution of tracer and background activity in the heart, lungs and liver after tracer appears in blood preclude satisfactory intrathoracic definition (*14*). In our study, the peripheral, iliac and retroperitoneal lymphatic vessels and nodes were well shown with both antimony sulfide colloid and dextran. Although the thoracic duct was not demonstrated, the left supraclavicular node was usually seen.

Chyluria may present as chylous clot, chylous clot retention, hematuria, flank pain, dysuria, weakness, fever and weight loss. There is a high content of fat, albumin and fibrin and a varying amount of erythrocytes in the urine. The total fat content is related to diet, phase of digestion, posture and exercise. Hypolipidemia, hypoproteinemia, iron deficiency anemia, malnutrition and abnormalities of the immune system can occur as a result of the disrupted fat, protein and blood metabolism. Elephantiasis may also be associated. Chyluria is a late manifestation of filariasis, a parasitic infestation endemic in southeast Asia. Other associated conditions include repeated retroperitoneal infection, especially tuberculosis, trauma, genitourinary or gastrointestinal tumors, malignancy of the thoracic duct and thyroid, ureteric stone, hydrocele, inguinal hernia and pregnancy. Filariasis is caused by *Wuchereria bancrofti* and *Brugia malayi* parasites. The adult worm lives and reproduces in peripheral lymphatics, intermittently showering the bloodstream with microfilarial offspring. Extensive local damage to lymphatic truncal walls and regional lymph nodes is produced by the adult worm. Patients present with recurrent fever, axillary or inguinal lymphadenitis, acute or chronic lymphedema, hydrocele, chyluria and cyloperitoneum. Similar to other investigators, we found lymphoscintigraphy to be useful for assessing the degree of lymphatic damage by showing delayed or absent lymph transport, dilatation of draining lymphatics with dermal collateralization, tortuous bizarre deep lymphatics, intralymphatic valvular incompetence, lymph reflux and faint or absent lymph nodes (*15*). While abnormal lymphaticourinary communication at the level of the kidney, ureter or bladder is well shown on lymphangiography, it is more difficult to detect on scintigraphy because of dilution of the tracer in the bloodstream, uptake of the radioisotope in the liver, spleen and kidneys and poor camera resolution. Radioactivity in the kidneys and bladder from free pertechnetate and normal retention may be difficult to distinguish from lymph reflux (*16*). We observed right renal lymph reflux in only one patient with chyluria. The initial diagnosis of filariasis is based on laboratory criteria using filaria-specific IgG and thick-film blood smear of night blood specimens for microfilariae. It has been shown that asymptomatic infected persons invariably have circulating microfilariae, whereas patients who have clinical manifestations and active filarial infection frequently have no detectable microfilaremia (*17*). None of the patients with chyluria associated with filariasis in our study had microfilaremia. The diagnosis of filariasis in these patients was based on a history of previous exposure, exclusion of other causes of chyluria and response to antifilarial therapy.

Chyloperitoneum and chylothorax result from interference of lymph flow at the base of the mesentery, cisterna chyli or thoracic duct caused by primary lymphatic dysplasia; infection, especially filariasis and tuberculosis; peritoneal dialysis; or lymphatic damage from neoplasm, surgery or radiation. Increased hydrodynamic pressure in the lymphatics causes backpressure with dilatation of lymph vessels, retrograde flow, collateralization and diffusion of vessel contents through walls into serous spaces or lumina, parenchyma or surfaces of organs. If the backpressure is severe enough or if there is structural disease of the lymphatics, vessel rupture occurs with free leakage. In our study, abnormal lymphatic drainage in the form of enhanced lymph flow or lymphatic obstruction was detected by lymphoscintigraphy in all patients with chyloperitoneum and chylothorax. Chyloperitoneum and chylothorax were present in one patient with IVC obstruction and two patients with liver

cirrhosis. A lymphoscintigram of one of the patients with chyloperitoneum from liver cirrhosis showed lymph reflux into the peritoneal cavity. IVC obstruction and postsinusoidal portal hypertension result in increased lymph flow through the thoracic duct from viscera due to venous stasis. Leakage of chyle from the disrupted lymph vessels and fistulas causes chyloperitoneum and chylothorax. Lymphatic drainage and transdiaphragmatic movement of chylous peritoneal fluid through the pleuroperitoneal canal have been proposed as mechanisms in the formation of chylothorax. Radioisotope migration speed may be a clue for differentiating these two mechanisms, which is more rapid in the presence of a diaphragmatic defect (*18,19*). Chyloperitoneum occurs in 52% of nephrotic syndrome patients, possibly because of bowel ischemia with resultant lacteal leakage or malabsorption (*20*).

Treatment of chyluria, chyloperitoneum and chylothorax includes fat restriction or a medium-chain triglyceride diet because synthetic triglyceride is transported from the gut directly to the liver by the portal system and is not absorbed by the lymphatics. Thus, formation of intestinal lymph and lymph flow through the thoracic duct are decreased, allowing the fistulas to seal off and the collaterals to open up. In more severe cases of chyluria it may be necessary to (a) instill 0.5%–1% silver nitrate into the renal pelvis to induce chemical lymphangitis and fibrosis of the fistulas; (b) surgically disrupt lymphaticourinary fistulas; and (c) perform renal decapsulation, LVA, renal autotransplant and nephrectomy (*21*). Lymphoscintigraphy can identify patent lymph vessels before surgery and determine the function of LVA after surgery. It is a suitable method of patient selection for surgery and follow-up (*22*). Paracentesis or peritoneovenous shunting may be effective in controlling chyloperitoneum (*23*). Intermittent thoracentesis, closed-chest drainage, pleurodesis and surgical ligation of the thoracic duct below the leakage may also be useful in treating chylothorax.

CONCLUSION

Lymphoscintigraphy can demonstrate abnormal lymphatic drainage in chyluria, chyloperitoneum and chylothorax. It is useful for selecting patients for surgery and assessing the effect of treatment.

REFERENCES

1. Akisada M, Tani S. Filarial chyluria in Japan. *Radiology* 1968;90:311–317.
2. Yu HH, Ngan H, Leong CH. Chyluria—a 10-year follow-up. *Br J Urol* 1978;50:126–133.
3. Browse NL, Wilson NM, Russo F, Al-Hassan H, Allen DR. Aetiology and treatment of chylous ascites. *Br J Surg* 1992;79:1145–1150.
4. Camiel MR, Benninghoff DL, Herman P. Chylous ascites with lymphographic demonstration of lymph leakage into the peritoneal cavity. *Gastroenterology* 1964;47:188–191.
5. McNeill GC, Witte MH, Witte CL, et al. Whole-body lymphangioscintigraphy: preferred method for initial assessment of the peripheral lymphatic system. *Radiology* 1989;172:495–502.
6. Weissleder R, Thrall JH. The lymphatic system: diagnostic imaging studies. *Radiology* 1989;172:315–317.
7. Gates GF, Dove EK, Kawchanapoon V. Thoracic duct leakage in neonatal chylothorax visualized by ^{198}Au lymphangiography. *Radiology* 1972;105:619–620.
8. Sty JR, Thomas JP, Abrams J. Radionuclide lymphography: a demonstration of surgical lymphatic interruption. *Clin Nucl Med* 1978;4:412–413.
9. Heyman S, Wilmott R. Chylothorax on technetium-99m antimony sulfide colloid scan. *J Nucl Med* 1986;27:1783–1784.
10. Lopez OL, Rodriguez-Maisano E, Delevaux JL. Thoracic duct malformations. Lymphoscintigraphic diagnoses. *Clin Nucl Med* 1986;11:479–481.
11. Gregg DC, Wells RG, Sty JR. Lymphoscintigraphy. Chylous ascites and lymphocele demonstration. *Clin Nucl Med* 1988;13:300.
12. Lu G, Shih WJ, Chou C. Technetium-99m antimony sulfate lymphoscintigraphy to demonstrate lymphatic communication between the peritoneal cavity and the scrotum. *Clin Nucl Med* 1995;20:706–708.
13. Biswas G, Samuel AM. Technetium-99m dextran lymphoscintigraphy in an infant with chylous peritoneal effusion. *Clin Nucl Med* 1996;21:341–342.
14. Juma N, Audrey T, Ege GN. Comparison as a lymphoscintigraphic agent between ^{99m}Tc dextran and ^{99m}Tc antimony sulphide colloid. *Br J Radiology* 1985;58:325–330.
15. Witte MH, Jamal S, Williams WH, et al. Lymphatic abnormalities in human filariasis as depicted by lymphangioscintigraphy. *Arch Intern Med* 1993;153:737–744.
16. Haddad MC, al-Shahed MS, Sharif HS, Miola UJ. Case report: investigation of chyluria. *Clin Radiol* 1994;49:137–139.
17. Freedman DO, de-Almeida-Filho PJ, Besh S, et al. Lymphoscintigraphic analysis of lymphatic abnormalities in symptomatic and asymptomatic human filariasis. *J Infect Dis* 1994;170:927–933.
18. Verreault J, Lepage S, Bisson G, Plante A. Ascites and right pleural effusion: demonstration of a peritoneo-pleural communication. *J Nucl Med* 1986;27:1706–1709.
19. Moss R, Hinds S, Fedullo AJ. Chylothorax: a complication of the nephrotic syndrome. *Am Rev Respir Dis* 1989;140:1436–1437.
20. Lindenbaum J, Scheidt SS. Chylous ascites and the nephrotic syndrome. *Am J Med* 1968;44:830–836.
21. Sabnis RB, Punekar SV, Desai RM, Bradoo AM, Bapat SD. Instillation of silver nitrate in the treatment of chyluria. *Br J Urol* 1992;70:660–662.
22. Gloviczki P, Fisher J, Hollier LH, et al. Microsurgical lymphovenous anastomosis for treatment of lymphedema: a critical review. *J Vasc Surg* 1988;7:647–652.
23. Ablan CJ, Littooy FN, Freeark RJ. Postoperative chylous ascites: diagnosis and treatment. *Arch Surg* 1990;125:270–273.