

Chyluria in a Postpartum Obese Female Patient

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Abstract

Chyluria characterized by the passage of milky white urine is rarely encountered these days due to the overall reduction in the number of cases of lymphatic filariasis. Though lymphatic filariasis accounts for the majority of cases of chyluria, nonparasitic causes have also been reported. Case reports of chyluria as a complication in pregnancy have been published but chyluria presenting solely as a postpartum complication has rarely been documented.

We present a case of a 29-year-old female with no known prior comorbidities, who presented with recurring complaints of the painless passage of milky white urine over the last year. Symptoms seem to have started six months post-delivery of her second child. The patient claimed significant weight gain during an otherwise normal pregnancy. She was well-built and had a BMI of 32 kg/m². Her systemic examination and baseline laboratory workup were within normal limits. Postprandial urine was milky white, rich in chylomicrons, with urine chylomicrons of 112 mg/dl. The patient was screened for filariasis, which was negative. An ultrasound of the abdomen was done to rule out the presence of a fistula, but no evidence of one was found on imaging. Tc-99m sulfur colloid scintigraphy revealed an area of abnormal tracer accumulation in the abdomen with the passage of the tracer in the urine container, confirming the presence of chyluria. The patient was recommended to undergo conservative management with dietary modification and weight reduction. She has been closely followed up and has achieved spontaneous resolution of the chyluria. Most patients with chyluria show a good response to conservative management alone as in our case. Surgical intervention is usually indicated for cases not responding to conservative management or for refractory chyluria.

Categories: Family/General Practice, Internal Medicine, Urology

Keywords: obesity-related illnesses (oris), lymphatic obstruction, technetium scintigraphy, post partum, chyluria

Introduction

Chyluria as evidenced by the passage of milky white urine represents an abnormal fistulous connection between the lymphatic system and the urinary tract. The milky white nature of urine is due to the presence of chyle, a lymphatic fluid rich in chylomicrons. Chyle normally drains via intestinal lacteals into the thoracic duct and left subclavian vein. An abnormal fistulous connection between this drainage pathway and the urinary tract can result in chyluria. Though often secondary to parasitic infections (lymphatic filariasis caused by Wuchereria bancrofti, Brugia malayi, Brugia timori, etc.), nonparasitic causes have also been found albeit less commonly. Nonparasitic causes include congenital lymphatic malformations, post-surgical lymphourinary fistulas, and obstruction to lymph flow with resultant fistula formation by either malignancy, abscesses, pregnancy, etc. [1,2]. Pregnancy is a rare cause of nonparasitic chyluria where the enlarging uterus obstructs the lymphatic flow resulting in the formation of a lymphourinary fistula [3]. Even in pregnancy, filarial etiology is usually the most common cause of chyluria. Whether of parasitic or nonparasitic etiology, the initial approach to treatment is usually conservative with weight reduction, dietary modification, and/or sclerotherapy. Mahmood et al. in their study observed a significant resolution in chyluria with conservative management alone [4]. Similar results were observed by Tan et al. in their study [5]. Refractory cases alone require surgical interventions like lymphatic dissection or the creation of lymphangiovenous anastomosis. Anthelmintic drugs like diethylcarbamazine, though beneficial in parasitic chyluria, are generally avoided in pregnancy due to the risk of teratogenic side effects. Chyluria presenting solely as a late complication of pregnancy has rarely been documented and we discuss such a case in this report.

Case Presentation

A 29-year-old female with no known prior comorbidities presented to our outpatient department with complaints of the intermittent passage of milky white urine over the last year. The passage of milky white urine had been insidious in onset, initially occasional with normal voids, and had gradually progressed to a state where she was voiding only milky white urine with occasional normal voids. There was no associated history of hematuria, abdominal pain, fever with chills, trauma, swelling of legs, rash, facial puffiness, weight loss, or recent surgery. The patient had been treated with short courses of antibiotics during the initial days of illness, suspecting a urinary tract infection. She consumed a mixed diet. Her obstetric history was P2L2 (para 2, live births 2) with two normal spontaneous vaginal deliveries. During the last pregnancy,

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the patient had gained a significant amount of weight. Six months postpartum, the patient had started developing the above-mentioned complaints. There was no history of overbearing or prolonged labor during the last pregnancy. There were no similar complaints among the family members. On examination, the patient was well-built with a BMI of 32 kg/m^2 . Her clinical examination was unremarkable except for obesity and the presence of Acanthosis nigricans on general examination. Her baseline investigations are presented in Table 1.

Lab parameter	Patient value	Reference range
Hemoglobin	12.8 gm/dl	12–15 gm/dl
Total leucocyte count	7900 cubic mm	4000–11000 cubic mm
Polymorph percentage	67.6%	45–70%
Lymphocyte percentage	19.4%	25–40%
Eosinophil percentage	2.8%	1–6%
Blood urea nitrogen	6 mg/dl	7.9–20.1 mg/dl
Creatinine	0.6 mg/dl	0.7–1.1 mg/dl
Total protein	6.6 gm/dl	6.4–8.2 gm/dl
Serum albumin	4 gm/dl	3.2–4.8 gm/dl
Serum globulin	2.6 gm/dl	2–3.5 gm/dl
Free thyroxine	1.04 ng/dl	0.8–1.8 ng/dl
Thyroid-stimulating hormone	2.20 µIU/ml	0.35–4 µIU/ml
Total cholesterol	149 mg/dl	0–200 mg/dl
Triglycerides	166 mg/dl	0–150 mg/dl
High-density lipoprotein	38 mg/dl	85–60 mg/dl
Low-density Lipoprotein	98 mg/dl	0–100 mg/dl

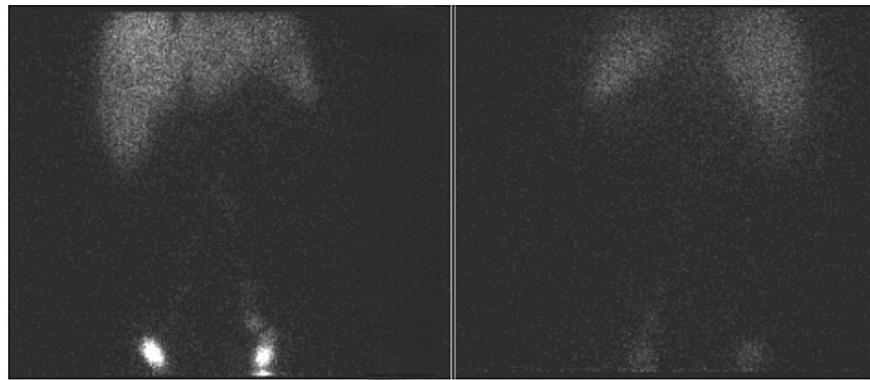
TABLE 1: Baseline blood investigations

The urine sample collected was milky white in color (Figure 1).

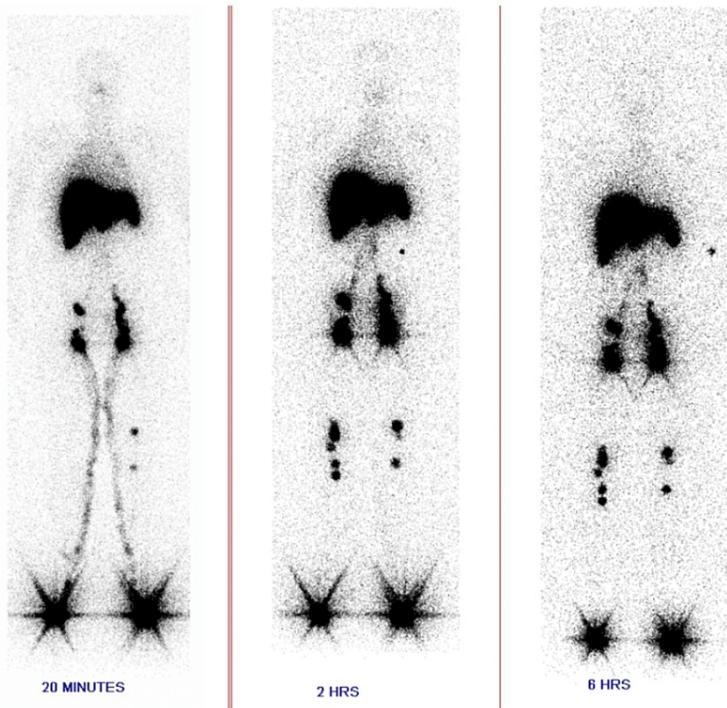


FIGURE 1: Milky white postprandial urine collected by the patient

Urinalysis revealed acidic urine with pH 5.0, containing 2+ proteinuria and corresponding to protein loss <100 mg/dl, 2-4 pus cells/high power field with no casts or crystals. Protein quantification was done, which revealed a urine protein-creatinine ratio of 1.40 (normal value: <0.2), urine spot protein of 45.2 mg/dl (normal value: <150 mg/dl), and urine spot creatinine of 33 mg/dl (normal range: 37-250 mg/dl). Urine culture revealed no growth. Urine was abundant with chylomicrons - urine spot chylomicrons measured 112 mg/dl, favoring the presence of chyluria. As part of the chyluria workup, the patient was screened for lymphatic filariasis (identification of microfilariae on blood smears), which was negative. Ultrasound of the abdomen was done to look for evidence of a lymphatic-urinary fistula. It revealed only grade 1 fatty liver with a mildly dilated left pelvicalyceal system, likely due to an overdistended bladder. With ultrasound imaging being inconclusive, the patient was then evaluated with lymphoscintigraphy. Tc-99m sulfur colloid scintigraphy was done. Figures 2-3 show the normal flow of the tracer in the lymphatic channels. Figure 4 reveals an area of abnormal tracer accumulation in the abdomen (arrows in the upper half of the image suggesting obstruction to lymphatic flow) with tracer concentration in the urine container (arrows in the lower half of the image), confirming the presence of chyluria.

**FIGURE 2: Tc-99m sulfur colloid scintigraphy**

The image shows the flow of radiotracer in the lymphatic channels after intradermal injection

**FIGURE 3: Normal flow of tracer through lymphatic channels after 20 minutes, 2 hours, and 6 hours**

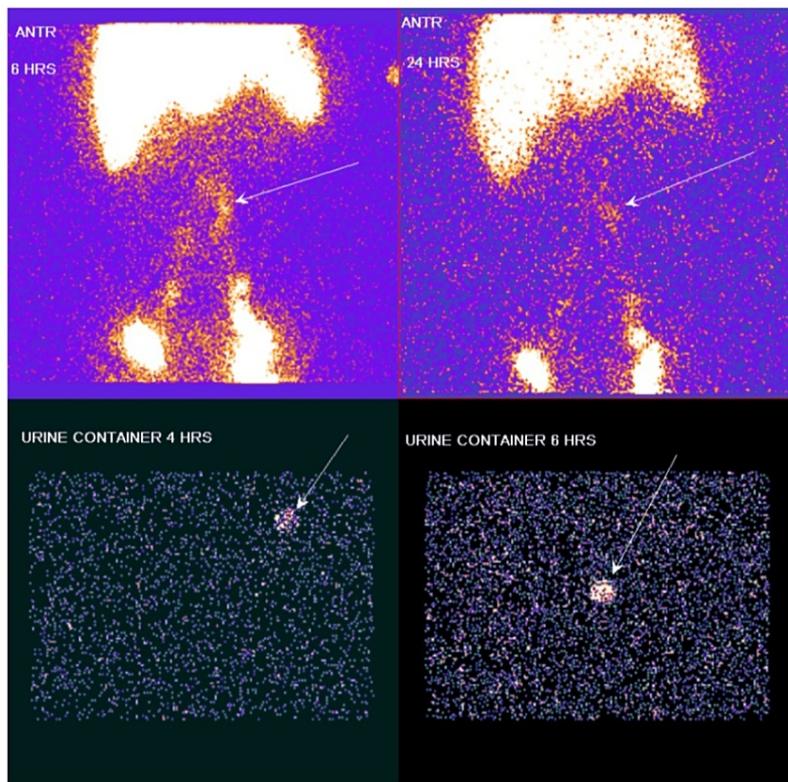


FIGURE 4: Area of abnormal tracer accumulation in the abdomen (arrows in the upper half of the image) suggestive of obstruction in lymphatic flow. Tracer excretion in urine (arrows in the lower half of the image) confirming the presence of chyluria

The patient was put on a modified diet (restriction of fatty foods, substitution with medium-chain fatty acids) and advised weight reduction and daily exercises. The patient responded well to conservative management. Her BMI dropped to 24 kg/m^2 and she had no further chyluric episodes on serial follow-ups.

Discussion

While chyluria characterized by the intermittent discharge of intestinal lymph (chyle) into the renal pelvis and urine is usually considered a harmless condition, if left untreated, it can lead to fatal outcomes. Various theories have been proposed regarding the development of chyluria; currently, two theories have been mainly highlighted as an explanation of the causative factors (obstructive and regurgitative theories) [6-7]. Chyluria, unless otherwise proven, is usually of parasitic origin; 95% of parasitic causes are attributed to *Wuchereria bancrofti*, *Brugia malayi*, and *Brugia timori* with the remaining 5% secondary to *Taenia echinococcus*, *Taenia nana*, *Ankylostomiasis*, and *Trichiniasis* [8]. Blockage of the major retroperitoneal lymphatics and thoracic duct by the mature parasite heralds the subsequent development of urinary fistulae and the occurrence of chyluria. When associated with a parasitic cause, cases can also present with concomitant genital manifestations, cellulitis, abscesses, and hematuria. Nonparasitic causes are rarer and are almost always nontropical.

Chyluria in pregnancy has been well discussed but chyluria presenting solely as a postpartum complication, as in our case, has not been documented previously. Patients classically manifest a worrying appearance of milky white urine, which can be associated with dysuria, urgency, or urinary retention secondary to chylous clots. Long-standing chyluria in both pregnant and nonpregnant populations can be associated with hypoproteinemia, edema, cachexia, weight loss, and opportunistic infections secondary to deficiencies of IgA and IgG immunoglobulins. Similar to the Date study [9], Ciferri et al. also found significant immunological disturbances in patients with chronic chyluria [10], which could be explained by the loss of lymphatic humoral and cellular elements. The diagnosis of chyluria can be confirmed by evaluating a sample of postprandial urine for chylomicrons and triglycerides [11,12]. Other differentials to be considered when encountering white urine include phosphaturia, amorphous urates, severe pyuria, lipiduria, and caseousuria due to renal TB. Chylous urine is usually acidic, which, on sedimentation, forms three layers, is rich in

triglycerides, turns transparent on adding ether, and becomes bright orange with the addition of Sudan III stain. Tools that might aid the evaluation of parasitic causes include the presence of eosinophilia, immunochromatographic tests for filaria, urine for acid-fast bacilli, or evidence of urinary tract infection. Once parasitic causes have been ruled out, nonparasitic causes have to be investigated; ultrasound abdomen and pelvis as a first-line imaging tool might help look for evidence of lymphatic-urinary fistula. If ultrasound imaging is inconclusive, fistula can be investigated by higher radiological modalities like CT or MRI or by cystoscopy, retrograde pyelography, or lymphoscintigraphy, which has therapeutic benefits as well as acts as a sclerosing agent.

There is currently no universally accepted grading system for chyluria. Available scales grade chyluria as mild, moderate, and severe based on the degree of chyluria, associated symptomatology, episode frequency, and the extent of calyceal involvement [13]. Most cases of chyluria can be managed initially with dietary modifications and weight reduction alone. The proposed hypothesis is that weight control reduces the compressive effect over the lymphatics and dietary modification in the form of substitution of long-chain fatty acids with medium-chain fatty acids and helps bypass the lacteals due to the direct absorption of medium-chain fatty acids into the portal vein. Abdominal binders may be used, which increases the abdominal pressure and reduces lympho-urinary reflux. Case reports suggesting the beneficial role of somatostatin analogs and ACE inhibitors in the management of chyluria have also been published [14,15]. In the case of parasitic chyluria, patients usually respond well to diethylcarbamazine. In cases of failed medical therapy, refractory severe chyluria with recurrent colics, and ill health due to immune suppression, surgical intervention is recommended. Available surgical interventions include (a) endoscopic sclerotherapy (EST) with either silver nitrate, povidone-iodine, or bromide; (b) surgical lymphatic dissection; and (c) microsurgery. Patients require six-monthly urine evaluations for chyle. Our patient showed spontaneous resolution of symptoms with dietary modification and weight reduction alone. Our findings correlated with those of the study by Singh et al., in which the relationship between quantity and type of dietary fat and the degree of loss of lipids in urine was studied [16].

Conclusions

Nonparasitic causes of chyluria, though uncommon, must always be evaluated in patients presenting with chyluria. In most cases, conservative management with weight reduction and dietary modification alone is enough for the complete resolution of symptoms. Surgical intervention is usually reserved for refractory cases or for patients in ill health.

Additional Information

Disclosures

Human subjects: Consent was obtained or waived by all participants in this study. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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EDUCATIONAL REVIEW

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Chyluria: non-enhanced MR lymphography

Alexandre Sabbah¹, Cedi Koumako¹, Sanaâ El Mouhadi¹, Amal Ali¹, Lise Minssen¹, Quentin Vanderbecq¹ and Lionel Arrivé^{1*}

Abstract

Chyluria is an uncommon medical condition resulting from an abnormal communication between the abdominal lymphatic system and the urinary tract, which results in the presence of chyle in the urine, making it appear milky white. Proper diagnosis is demonstrated by the concentration of urinary lipids. Worldwide, chyluria is most commonly associated with the parasite *Wuchereria bancrofti*. However, in Europe and North America, where the condition is rare, non-parasitic etiologies predominate. Identifying the cause and location of the uro-lymphatic communication is essential in guiding therapeutic management, but imaging the lymphatic channels remains a challenge. Magnetic resonance (MR) lymphography, a non-invasive free-breathing 3D high-resolution fast-recovery fast spin-echo sequence similar to that used for 3D MR cholangiopancreatography, may demonstrate the cause and location of an abnormal communication between the lymphatic system and urinary tract. In parasitic causes of chyluria, dilated lymphatics vessels communicating with the lymphatic system are demonstrated. In non-parasitic causes of chyluria channel type lymphatic malformations are the most common. Markedly dilated and dysplastic lymphatic vessels communicating with the urinary tract are demonstrated. In addition, other cystic or channel type lymphatic malformations such as thoracic, soft tissue or bone abnormalities may be observed. This review describes the abdominal lymphatic diseases leading to chyluria and presents the technique and images obtained with non-enhanced MR lymphography to enable radiologists in identifying and classifying uro-lymphatic fistulae.

Critical relevance statement: Non-enhanced MR lymphography enables the identification and categorization of uro-lymphatic fistulae.

Key points

1. Chyluria results from an abnormal communication between lymphatic and urinary systems.
2. Magnetic Resonance (MR) Lymphography is a non-invasive, non-enhanced imaging modality.
3. MR Lymphography may demonstrate the communication location between lymphatic and urinary systems.

Keywords Chyluria, Lymphatics, Filarisis, MR imaging, MR lymphography

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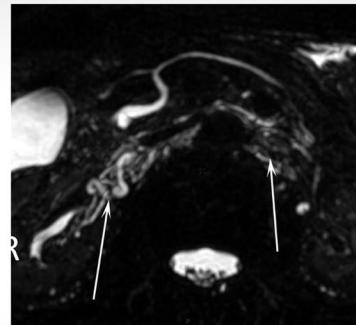
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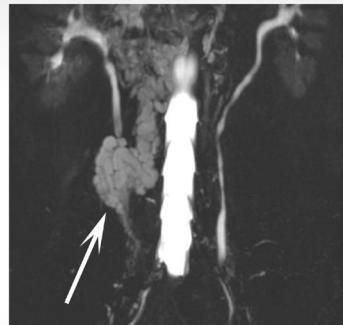
Graphical abstract

Chyluria: non-enhanced MR lymphography

- Chyluria results from an abnormal communication between lymphatic and urinary systems
- Magnetic Resonance (MR) Lymphography is a non-invasive, non-enhanced imaging modality
- MR Lymphography may demonstrate the communication location between lymphatic and urinary systems



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Non-enhanced MR lymphography enables the identification and categorization of uro-lymphatic fistulae

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Introduction

Chyluria is a rare medical condition defined by the emission of milky white urine due to the presence of chyle, an intestinal lymphatic liquid rich in lipids (chylomicrons), proteins, and lymphocytes that comes from the small intestines [1–4]. Proper diagnosis is based on an increased concentration of urinary lipids [5]. A wide range of other symptoms can be associated with chyluria, such as abdominal or pelvic pain, dysuria, hematuria, or clot colic. Hypoproteinemia with undernutrition, weight loss, and lower limb edema may also be observed. Worldwide, chyluria is most commonly associated with the parasite *Wuchereria bancrofti*, which is prevalent in parts of Asia, especially India, as well as Sub-Saharan Africa. However, in Europe and North America, where the condition is rare, non-parasitic etiologies predominate including lymphatic malformation and other uncommon causes including blunt or penetrating trauma, complications of surgery such as partial nephrectomy or retroperitoneal surgery, non-parasitic infection, malignancy and pregnancy [1–3].

Imaging techniques are principally useful for detecting and identifying the location of the uro-lymphatic fistula. However, due to its anatomical complexity and

variations, imaging of the lymphatic system remains difficult and has long been limited to the invasive and constraining technique of conventional lymphography. Non-enhanced MR lymphography based on a free-breathing 3D high-resolution fast-recovery fast spin-echo sequence similar to that used for 3D MR cholangiopancreatography, which focus only on the signal of stationary or low speed fluids, can be used for diagnosis of etiology and uro-lymphatic fistula mapping, helping in decision-making for therapeutic management. Here, we describe the anatomy of the abdominal and pelvic lymphatic system, present the causes and mechanisms of chyluria, and show the imaging features of chyluria on non-enhanced MR lymphography.

Lymphatic anatomy

The lymphatic system is a network of thin distal blindfolded vessels, larger collectors, and lymph nodes that play roles in the removal of cellular waste, proteins, and water from the interstitial space, as well as in immune protection and fat absorption from the intestine. Compared to the vascular system, the lymphatic system anatomy is markedly complex and exhibits a lot of

variants. Most of the lymphatic channels are very small, and, together with lymph nodes, they create a complex network of interlacing vessels. This complexity and variability are, in part, explained by the embryology of the lymphatic system [6]. Physiologically, the diameter of the lymphatic vessels varies in a regularly alternating way, with the thinner parts corresponding to the lymphatic valves, making the lymphatic circulation unidirectional [7]. They are easily recognized because of the characteristic alternating bands of constriction (lymphatic valves) and dilatation. These characteristics help identify the lymphatic system on MR lymphography.

Regarding the abdominal lymphatics, thin mesenteric vessels converge to become one or two mesenteric trunks, which join the intestinal trunk, collecting lymph from the stomach, pancreas, spleen, and liver. The lymph vessels from the kidneys, the deep lymphatics of the abdominal wall, the pelvic organ, and lower limbs converge to form the retroperitoneal lymph trunks (Fig. 1). The retroperitoneal lymph trunks and para-aortic vessels join to form the right and left lumbar trunks, which also converge with the intestinal trunk to constitute the cisterna chyli, just before entering the thorax through the aortic hiatus of the diaphragm and forming the thoracic duct. Typically, the cisterna chyli is a focal saccular lymphatic dilatation located at the L1–L2 level of the retrocrural space, on the right face of the abdominal aorta [6].

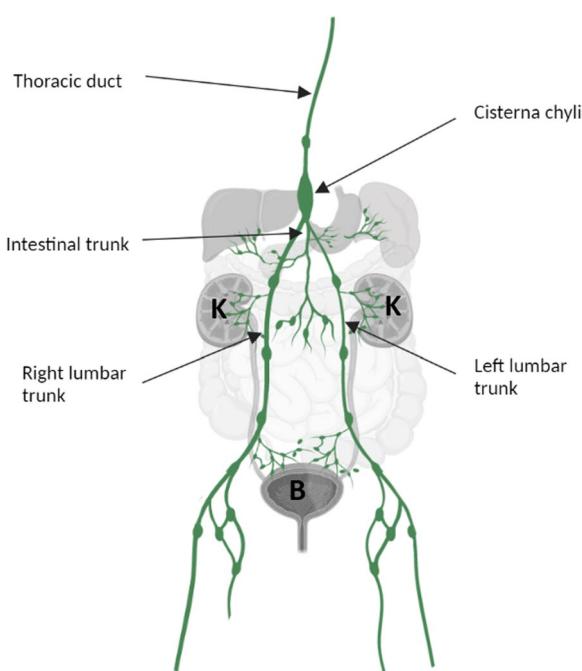


Fig. 1 Lymphatic anatomy (K: kidney, B: bladder)

Lymph reaches the blood stream as the thoracic duct flows into the junction of the left subclavian and jugular veins. However, this classical anatomy may be subject to multiple variations, such as complex anastomoses of the lumbar lymphatics, resulting in a plexus rather than a cisterna or multiple sacculations of the lymphatic channels. Cisterna chyli size may also be quite different from one patient to another, sometimes making a very large aspect known as the giant cisterna chyli [7]. A consequence of this broad anatomic variation of the cisterna is that some authors prefer to use the descriptive term “abdominal confluence of the lymphatic trunks” rather than cisterna chyli [8].

Causes of chyluria

Chyluria can be classified into parasitic and non-parasitic causes: 95% of parasitic causes are attributed to *Wuchereria bancrofti*, with the remaining 5% are secondary to *Taenia echinococcus*, *Taenia nana*, *Ankylostomiasis*, *Trichiniasis* and the malarial parasite (Table 1). Lymphatic filariasis is, by far, the most prevalent cause of chyluria in the world, reportedly affecting up to 120 million people worldwide. It is endemic in East Asia (especially in the Gangetic belt of India) and Sub-Saharan Africa [9]. Typically, parasitic chyluria affects patients between the ages of 20 and 40 years, but it can occur earlier [2]. Men and women are equally affected. The most common non-parasitic chyluria are related to lymphatic malformations mainly channel type lymphatic malformations. Other less common non-parasitic causes include blunt or penetrating trauma, complications of surgery such as partial nephrectomy or retroperitoneal surgery, infection, malignancy and pregnancy [2].

Chyluria is a rare symptom defined by the emission of milky white urine due to the presence of chyle. Chyle is an intestinal lymphatic liquid that originates from the small intestines (2–4 L/day) when the digested fatty acids, monoglycerides, fat-soluble vitamins, and other nutrients are absorbed [10]. Accordingly, this lymphatic fluid is rich in lipids (chylomicrons), proteins (mostly albumin), and lymphocytes.

Table 1 Causes of chyluria

Parasitic causes	Non-parasitic causes
<i>Wuchereria Bancrofti</i> (95%)	Lymphatic malformations
<i>Taenia echinococcus</i>	Blunt or penetrating trauma
<i>Taenia nana</i>	Complications of surgery
<i>Ankylostomiasis</i>	Non-parasitic infections
<i>Trichiniasis</i>	Malignant tumors
Malaria	Pregnancy

A wide range of other symptoms can be associated with chyluria, such as abdominal or pelvic pain, dysuria, urgency and urinary retention secondary to chylous clot, hematuria, or even clot colic. The protein leakage can lead to hypoproteinemia, simulating a nephrotic syndrome with undernutrition, weight loss, and lower limb edema [11]. However, in contrast to nephrotic syndrome, chyluria also presents with hypocholesterolemia and hypotriglyceridemia.

Chyluria implies an abnormal communication between the abdominal lymphatic system and urinary tract. Two theories, obstructive and regurgitation, are mainly used to explain the appearance of a uro-lymphatic fistula and chyluria. When associated with filariasis, the obstructive theory states that it is the obstruction of the lymphatic vessels increasing the lymphatic pressure that causes an opening into the kidney hilum, ureter, or less often the bladder. For chyluria without associated parasitic infection, most often due to a primary lymphatic malformation, the regurgitation theory states that chyluria results from a complex mechanism involving lymphatic parietal hyperpermeability, accumulation of toxic metabolites, and an inflammatory immune reaction, leading to the development of lymphatic varicosities in the vicinity of the urinary tract, resulting in the development of a fistula [12, 13].

Positive diagnosis is performed by quantification of urinary chylomicron, optimally 4 h after a meal rich in fat, as it is the most specific and sensitive test [1]. The threshold of urinary chylomicron used for the diagnosis of chyluria is >15 mg/dL [2, 14]. The main differential diagnostic is pyuria, for which altered neutrophil polynuclear cells are found in the urine [15].

Imaging workup of chyluria

Radiological techniques are principally useful for detecting and identifying the location of the uro-lymphatic fistula. However, due to its anatomical complexity and variations, the lymphatic system remains difficult to image and has long been limited to the invasive and constraining technique of conventional lymphography [16].

Non-enhanced MR lymphography

We show in this pictorial review how non-enhanced MR lymphography, based on a free-breathing 3D high-resolution fast-recovery fast spin-echo sequence similar to that used for 3D MR cholangiopancreatography, which focus only on the signal of stationary or low speed fluids, can be used to localize the uro-lymphatic fistula (Table 2).

The main difference between MR lymphography and MR cholangiopancreatography include field of view, plane orientation, and slice thickness. To include retroperitoneal lymphatic vessels and urinary tract, field of view should be larger than that used for MR

Table 2 Acquisition parameters of non-enhanced MR lymphography

Field strength	1.5 T
Sequence	3D High-Resolution fast-recovery fast spin-echo (FRFSE)
Plane	Coronal/Axial
TR (ms)	3500–4000
TE (ms)	700–884
Number of averages	1
Flip angle	90°
Matrix acquisition size	512×288
FOV (mm)	400×400
Number of slices	124–316
Slice thickness (mm)	0.8–1.4
Spacing (mm)	0
Anatomical area	Abdomen
Gating	Free breathing with respiratory gating
Acquisition time (min)	3–5

cholangiopancreatography. As an alternative to coronal plane, MR lymphography may be performed with axial source images which precisely demonstrate both anterior and posterior lymphatic vessels. Because of the small size of lymphatic vessels, very thin section source images (millimetric or submillimetric) are used. Scan time varies from 3 to 5 min, depending on the number of source images. Post-processing of the data is performed to obtain maximum intensity projection (MIP) images. Imaging at 3 Tesla results in improved signal-to-noise ratio that allows for the improvement of spatial resolution. However, motion artefact, susceptibility effect, and local field inhomogeneity distributed throughout the full set of images may decrease image quality.

MR imaging presents several advantages, including very high and unique quality contrast between soft tissues, multiplanar capability, and a non-invasive and non-irradiating character, and only a few formal contraindications (i.e., severe claustrophobia) [17]. Recent technical advances (gradient performance, pulse sequence, and coil improvement) have also made it possible to significantly reduce acquisition times, particularly due to fast spin echo and single shot fast spin echo sequences based on a very long echo train [18].

Because of the spontaneous high contrast, one can analyze the lymphatic vessels and urinary tract with a very high signal intensity. However, lymphatic vessels should be differentiated from other high signal intensity structures on MR lymphography. The bowel fluid signal is easily removed by administering pineapple juice or a diluted paramagnetic contrast material. It is simple to distinguish the lymphatic duct system from

Table 3 MR lymphography features observed in chyluria

	Frequency	MR features	Associated abnormalities
Parasitic causes	Very common in endemic area (Asia, Sub-Saharan Africa)	Dilatation of lymphatic vessels without dysplastic vessels	Lower limbs lymphedema
Lymphatic malformations	Common in Europe and North America	Marked dilatation of lymphatic vessels with dysplastic vessels	Multiple lymphatic abnormalities including soft tissues, thoracic, bone lesions
Other causes	Uncommon	Dilatation of lymphatic vessels without dysplastic vessels	None

the urinary system. Renal pelvis, ureter and bladder have characteristic shapes while lymphatic vessels are recognized because of the characteristic alternating bands of constriction (lymphatic valves) and dilatation. Furthermore signal intensity of lymphatic vessels is usually lower than that of urinary tract possibly due to the high protein concentration of lymph. Under these

conditions, it is possible to precisely locate the uro-lymphatic fistula. It is also feasible to determine the pattern of uro-lymphatic fistula (Table 3). In parasite-related chyluria obstruction of the lymphatic vessels by the parasite results in a marked dilatation of lymphatic vessels that may communicate with urinary tract. On the other hand, dysplastic vessels are not observed. In

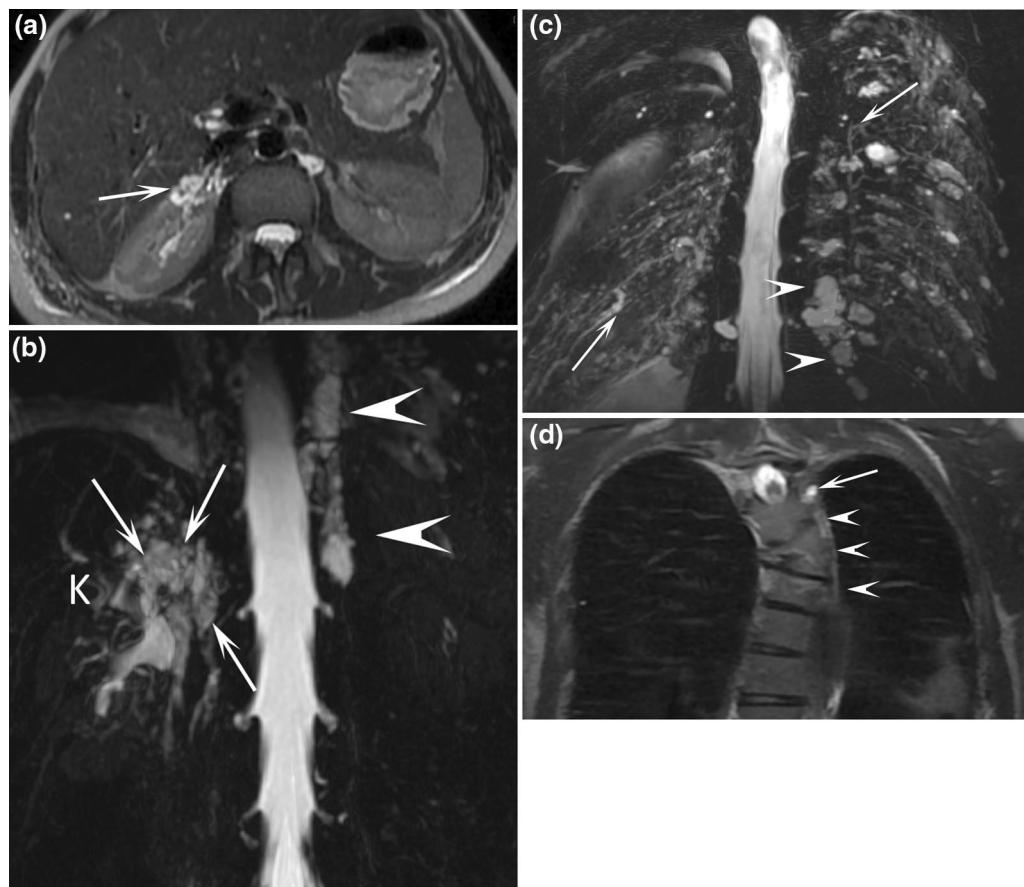


Fig. 2 38-year-old female patient with chyluria, chylothorax, and Gorham-Stout disease. Axial T2-weighted MR image (a) demonstrated dilated and enlarged lymphatic vessels in contact with the right kidney (arrow). Coronal MR lymphography with MIP reconstruction (b) demonstrated channel type lymphatic malformation (arrows) in contact with the right kidney (K). Mixed channel and cystic lymphatic malformation (arrowheads) replaced the thoracic duct. At the thoracic level, coronal MR lymphography with MIP reconstruction c demonstrated multiple dilated intercostal lymphatic vessels (arrows) with several cystic lymphatic malformations (arrowheads). Coronal T2-weighted MR image (d) demonstrated vertebral fractures, with a hyperintense signal within three vertebrae related to progressive osteolysis caused by Gorham-Stout disease (arrowheads). A cystic lymphatic malformation in contact with the vertebra was also demonstrated (arrow)

addition, it is not uncommon to demonstrate several locations of potential uro-lymphatic fistulae with non-enhanced MR lymphography. However, under these conditions, it is not possible to determine which of the fistulae are active.

Lymphatic malformations caused by abnormal development of the lymphatic system are rare somatic diseases. They present as fluid-filled cisterns, so-called cystic lymphatic malformation (previously called lymphangioma) or fluid-filled channels, so-called channel type lymphatic malformation (previously called lymphangiectasis).

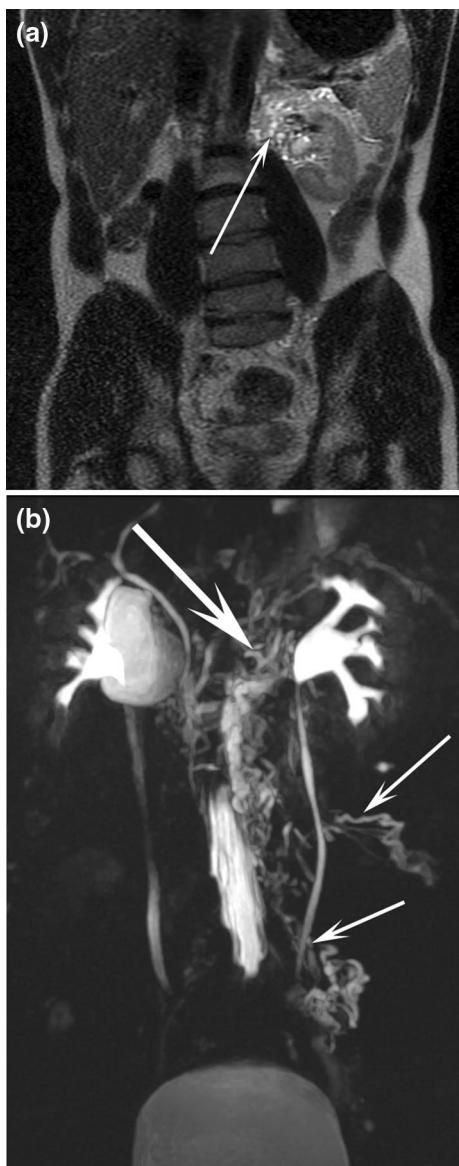


Fig. 3 37-year-old male patient with chyluria. Coronal T2-weighted MR image **a** demonstrated abnormal lymphatic vessels (arrow) in touch with the left renal pelvis, which was better seen by **(b)** coronal MR lymphography with MIP reconstruction. Dilated lymphatic vessels close to the left ureter (short arrows) were also demonstrated

Cystic lymphatic malformations are the most common congenital lymphatic anomalies. They present as lesions of variable size classified into macrocystic, microcystic, or mixed cystic lymphatic malformations. Macrocystic lymphatic malformations are large fluid-filled cavities, while microcystic and mixed cystic LMs contain small cysts. Lymphatic malformations can be found anywhere in the body, from extremities to the abdominal or thoracic cavities.

Channel type lymphatic malformations are characterized by dilation, malformation, and dysfunction of the abdominal or thoracic lymphatic vessels, leading to impaired lymph drainage and leakage of lymph (or chyle)

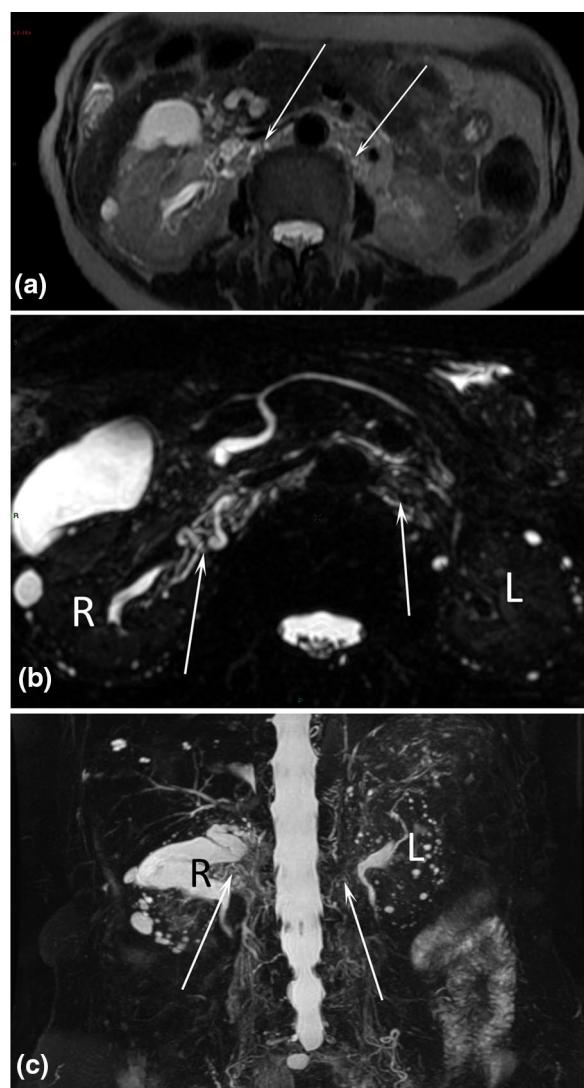


Fig. 4 83-year-old female patient with chyluria secondary to filariasis. Axial T2-weighted MR image **a** demonstrated dilated and enlarged lymphatic vessels prevailing on the right side in contact with the right and left kidneys (arrows). The dilated lymphatic vessels (arrows) were better highlighted on MR lymphography with MIP reconstruction in the axial **(b)** and coronal **(c)** planes. *R* right kidney, *L* left kidney

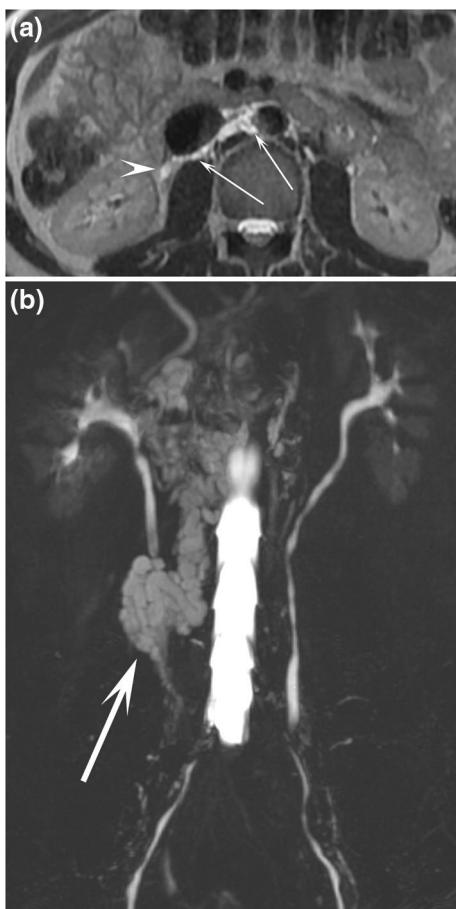


Fig. 5 35-year-old male patient with chyluria. Axial T2-weighted MR image **a** demonstrated dilatation of the retroperitoneal lymphatic vessels prevailing on the right side (arrows) and in touch with the right ureter (arrowhead). Coronal MR lymphangiography with MIP reconstruction **(b)** demonstrated a channel type lymphatic malformation (arrows) in contact with the right renal pelvis and right ureter

into the abdominal cavity (chylous ascites), thoracic cavity (chylothorax) or urinary tract (chyluria). In chyluria, channel type lymphatic malformations are the most commonly observed lymphatic abnormalities. They may be associated with cystic lymphatic malformations especially in case of complex lymphatic anomalies.

Generalized lymphatic anomaly (GLA) is characterized by diffuse or multicentric lymphatic disorders in multiple

organs, including the bones, liver, spleen, lungs, and soft tissues [10].

The large field of view of non-enhanced MR lymphangiography allowed us to image some of these associated abnormalities such as thoracic, soft tissues, or bone locations.

We classify the chyluria according to the location of the presumed uro-lymphatic communication: renal communication (Fig. 2), renal pelvis communication (Figs. 3, 4), ureteral communication (Fig. 5), or bladder communication (Fig. 6). Several patients had filariasis, but the majority were found to have lymphatic malformations. We also show different patterns of associated lymphatic malformations (Figs. 2, 7, 8).

Other imaging techniques

Contrast-enhanced MR lymphangiography uses a contrast medium composed of paramagnetic macromolecule that is injected subcutaneously and preferentially captured by the lymphatic vessels. This allows observation of the lymphatic drainage from a functional point of view, with a better spatial resolution than lymphoscintigraphy [19].

The introduction of intranodal MR lymphangiography has led to enhanced success rates and reduced procedure times when compared to traditional fluoroscopic pedal lymphangiography [20]. In dynamic contrast-enhanced MR lymphangiography, the contrast agent is injected through the inguinal lymph nodes. Sequential acquisition of T1-weighted sequences enables the assessment of both anatomical features and lymph flow rate, yielding dynamic flow results [20]. This technique may be particularly valuable in cases such as uro-lymphatic fistula responsible for chyluria, where the search extends beyond the lymphatic system to identify lymph leaks.

Conventional lymphangiography, performed after locating the lymphatics of the dorsum of the foot by injecting methylene blue and slow injection of iodinated contrast medium, is rarely used but can still be useful to inform on the site, size, and number of uro-lymphatic communications prior to surgery [16, 21]. However, this technique is operator-dependent, invasive, and contraindicated in cases of lower limb lymphedema. Foot injection may be replaced by lymph node injection.

(See figure on next page.)

Fig. 6 44-year-old female patient with chyluria. Sagittal T2-weighted MR image **(a)** and T1-weighted MR image with fat saturation **(b)** demonstrated an intravesical fat-fluid level (arrows) and chylous clot (C). Coronal MR lymphangiography with MIP reconstruction **c** demonstrated a channel type lymphatic malformation (arrows) in touch with both faces of the bladder. Coronal MR lymphangiography with MIP reconstruction **(d)** demonstrated bilateral lower limb lymphedema (L) that was more severe on the left side with dilatation of lymphatic vessels (arrows). Corresponding coronal T2-weighted MR image **(e)** showed bilateral congenital deformities of the ankles and feet

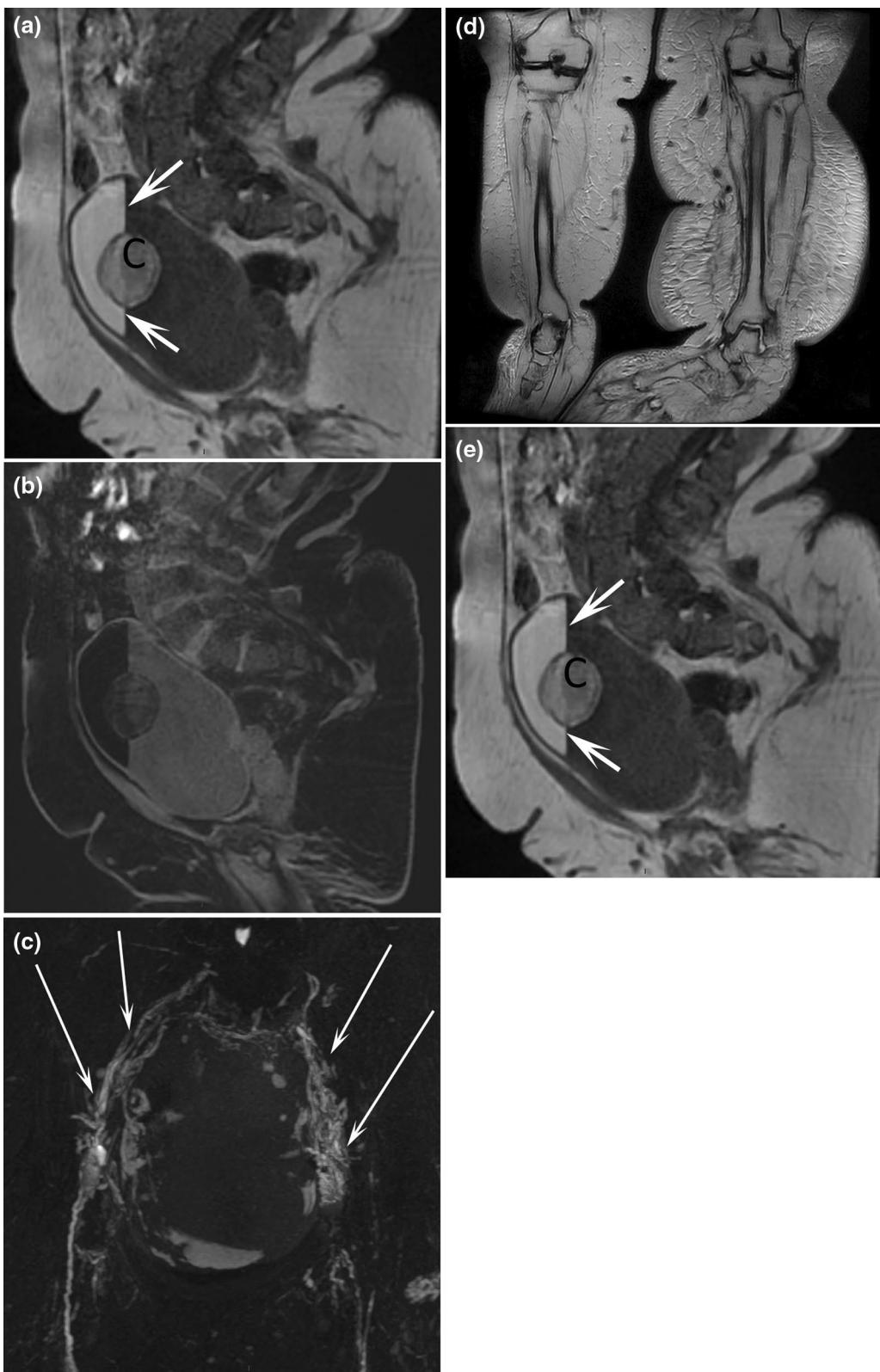


Fig. 6 (See legend on previous page.)

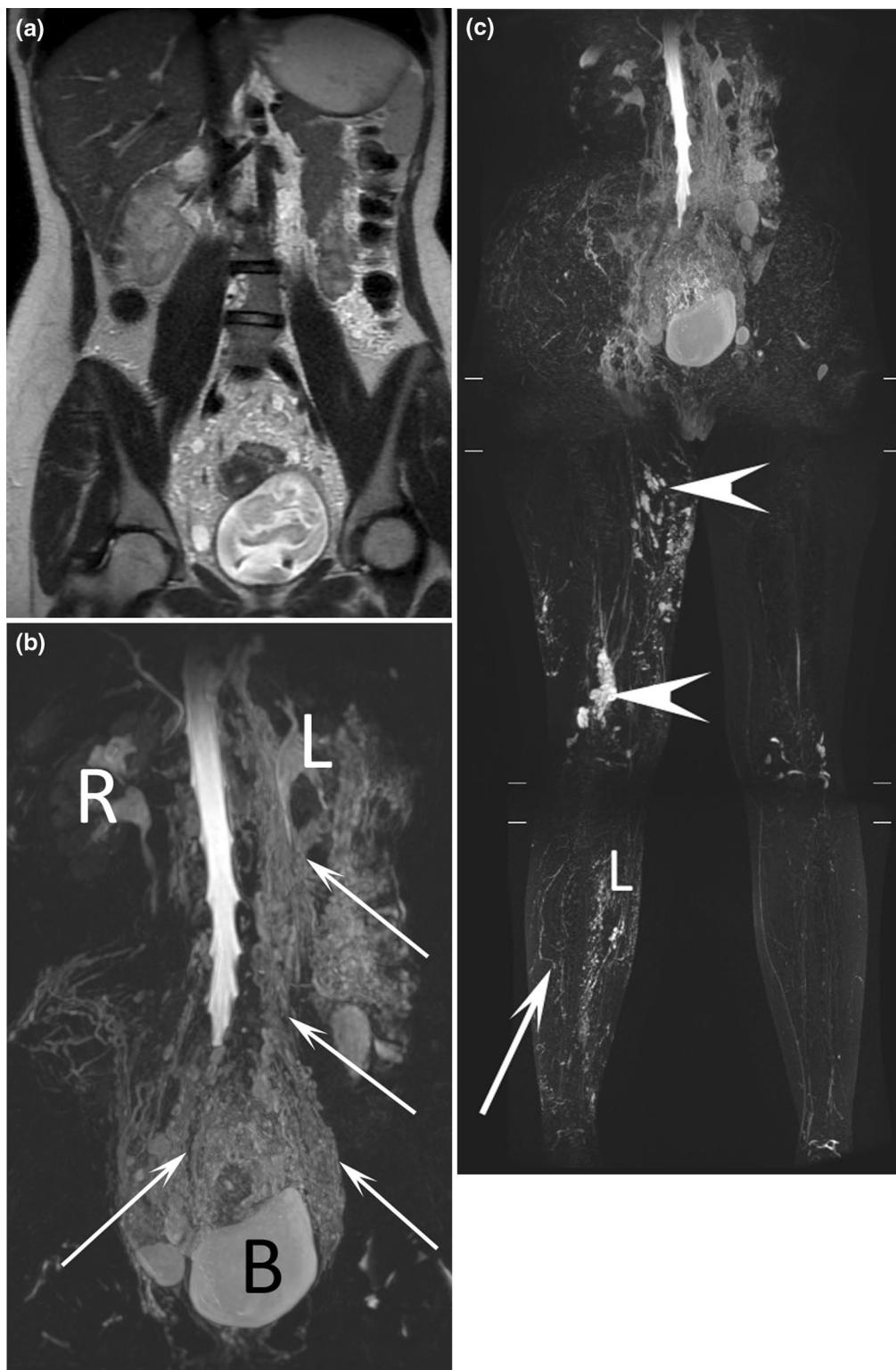


Fig. 7 17-year-old female patient with chyluria and vaginal chylous discharge. Coronal T2-weighted MR image **a** demonstrated abnormal lymphatic vessels in the abdomen, pelvis, and retroperitoneum, which were better seen with **(b)** coronal MR lymphography with MIP reconstruction. Dilated lymphatic vessels (arrows) close to the bladder, ureters, colon, and uterine cervix were also demonstrated. *R* right kidney, *L* left kidney. This patient also presented with right lower limb lymphedema (*L*) and cystic lymphatic malformations (arrows) on coronal MR lymphography with MIP reconstruction **(c)**

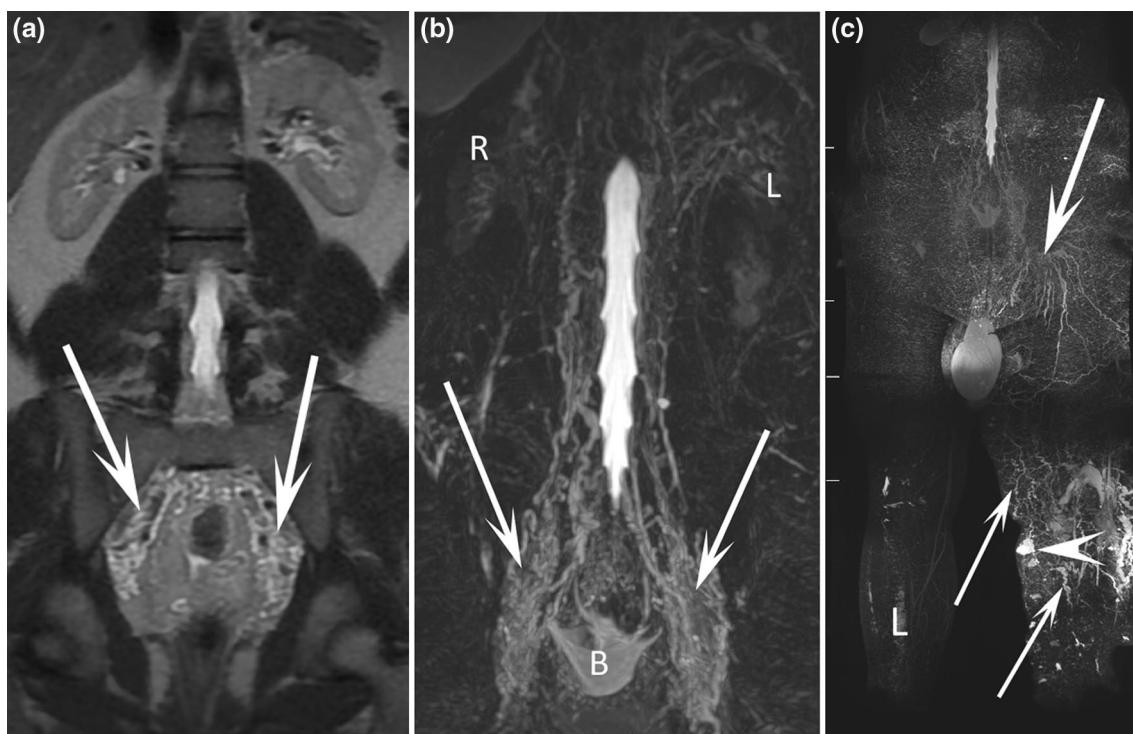


Fig. 8 17-year-old male patient with chyluria, hydrocele, and bilateral lymphedema of the lower limbs. Coronal T2-weighted MR image (a) and coronal MR lymphography with MIP reconstruction (b) demonstrated widespread dilated lymphatic vessel development along the urinary tract from the retroperitoneum to the bladder (arrows). R right kidney, L left kidney. Coronal MR lymphography with MIP reconstruction (c) demonstrated major lymphatic dysplasia at the root of the left lower limb (arrows) and the presence of several cystic lymphatic malformations (arrowhead) of the soft tissues

In 2018, Dong et al. [22] described how they used CT within 60 min after conventional lymphography to identify lymphatic anomalies and the distribution of collateral lymphatic vessels. This technique has the same disadvantages as conventional lymphography.

Lymphangioscintigraphy is a functional imaging technique using, mainly, ^{99m}Tc sulfur microcolloid to explore chyluria and can demonstrate abnormal lymphatic drainage. However, the spatial resolution remains suboptimal [23].

Therapeutic implications

Management is based on identifying the cause of chyluria and its specific pattern and depends on the severity of the chyluria and presence of associated symptoms. MR lymphography is of prime importance to determine the specific mechanism of uro-lymphatic fistula.

Conservative management including a low fat diet with a high fluid intake has a success rate of more than 70% [24]. For the patients with suspected filarial infection, medication is used in combination with dietary modifications. Diethylcarbamazine, ivermectin and albendazole are the most commonly used medications [2].

The most commonly used minimally invasive techniques is sclerotherapy that is indicated in patients that have failed conservative or medical treatments. Sclerotherapy, when instilled into the urinary tract, reaches the lymphatics via the uro-lymphatic fistula. It then induces a chemical lymphangitis with the edema causing blockage of lymphatics and resulting in relief [25].

Invasive management of chyluria is reserved for those with major symptoms and in whom medical or minimally invasive treatment options have failed. The operative techniques described for chyluria include uro-lymphatic disconnection and creation of lymphovenous anastomoses. For these patients evaluation with MR lymphography is very important. Indeed, it is necessary to specify if the site of uro-lymphatic fistula is single or multiple and if there are diffuse anomalies of the lymphatic system. When the uro-lymphatic fistula is localized to a single site, uro-lymphatic disconnection appears to be the optimal solution. However, in cases where the anomalies are widespread, lymphovenous anastomoses are preferred [26].

Conclusion

This pictorial review shows how non-enhanced MR lymphography based on heavily T2-weighted fast spin-echo sequences and MIP reconstructions provides a non-invasive, non-irradiating, and well-detailed imaging modality for patients presenting with chyluria. This technique allows radiologists to evaluate the lymphatic system and its numerous anatomic variations, to map one or several lymphatic anomalies, and to precisely locate a urolymphatic fistula. Additional research can be dedicated to optimizing the non-enhanced MR lymphography technique, with a focus on enhancing image quality, resolution, and acquisition time. This endeavor may involve exploring advanced pulse sequences, coil designs, and post-processing methods to improve the visualization of lymphatic vessels and urinary tract abnormalities. Moreover, conducting comparative studies to assess the diagnostic performance of non-enhanced MR lymphography in comparison with other imaging modalities, particularly gadolinium-enhanced MR lymphangiography, would be valuable. Such studies would help refine the analysis of the clinical usefulness of MR lymphography in evaluating uro-lymphatic fistulae. These research perspectives have the potential to advance our understanding, diagnosis, and management of chyluria, ultimately resulting in enhanced patient outcomes.

Abbreviations

MR	Magnetic Resonance
3D	Three-dimensional
MIP	Maximum Intensity Projection
GLA	Generalized lymphatic anomaly

Author contributions

AS, CK and LA have made substantial contributions to conception and design. All authors were involved in *design*, acquisition of data, analysis, and interpretation of data. All authors were involved in drafting the manuscript or revising it. All authors approved the final version of the manuscript. All authors are accountable for accuracy and integrity of the article.

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Availability of data and materials

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Declarations

Ethics approval and consent to participate

Our Ethics Committee indicated that advice was waived for this pictorial review.

Consent for publication

Consent for publication was waived by our Ethics Committee.

Competing interests

The authors declare that they have no competing interests.

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Homoeopathic treatment of chyluria - a clinical case report

Prof. (Dr) S. Ganguly S, Dr P. Sharma, Dr Tanya Aggarwal

Abstract: In the management of chyluria, most of the patients respond to dietary management, anti-filarial drugs and one or at the most two courses of sclerotherapy. Small number of patients who fail this treatment, chylo-lymphatic disconnection (open or laparoscopic) was a good surgical option with dependable long-term results. This case report supports the evidence that individualised homoeopathic medicine *Thuja occidentalis* may be useful in chyluria cases as it was used in the study done by CCRH (Central Council for Research in Homoeopathy) where *Rhus toxicodendron*, *Apis mellifica*, *Sulphur* and *Thuja occidentalis* were the most useful medicines and there is no need of surgical intervention like chylo-lymphatic disconnection. There is a better scope for the treatment of chyluria since the treatment is based on holistic and individualistic approach though it is grade C level IV evidence (level of evidence according to WHO), this case report encourage to conduct further pilot study or RCT on chyluria.

Keywords: chyluria, individualised homoeopathic medicine, *Thuja occidentalis*.

Abbreviations: World Health Organization (WHO), Central Council of Research in Homoeopathy (CCRH), Wuchereria bancrofti (W. bancrofti), randomised controlled trial (RCT) renal pelvic instillation of sclerosant (RPIS), ultrasonography (USG), kidney, ureter, bladder (KUB), high density lipoprotein (HDL), red blood cells (RBC), high power field (HPF).

Introduction

Chyluria is endemic in South-east Asia, China, India, Japan, Taiwan and parts of Africa, Australia and South America. *W. bancrofti* infestation is responsible for >95% of parasitic chyluria in endemic regions Although this disease is not life threatening, 5-10% of our patients have presented with considerable weight loss and weakness secondary to chronic chyluria. Chyluria is due to the passage of chyle into the urine giving it a typical milky appearance. Filariasis is the commonest cause, which is endemic problem in various Indian states. On chyluria, a study was done by A. Suri and A. Kumar at Department of Urology, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, Uttar Pradesh, India. Over the 18 years, they have managed about 600 cases of chyluria. The patients presented with various complaints like passage of white colour urine, haematuria (haematochyluria), passage of chylous clots in urine and dysuria. Treatment was customised by them according to severity of chyluria. In patients presenting with occasional history of chyluria, they prescribed dietary modifications like high protein low fat diet, promoting medium chain triglyceride intake along with diethylcarbamazine for 3 weeks. Those not responding to the treatment were subjected to renal pelvic instillation of sclerosant (RPIS). In the management of chyluria they said that most of the patients respond to dietary management, antifilarial drugs and one or at the most two courses

of sclerotherapy. Small number of patients who fail this treatment, chylolymphatic disconnection (open or laparoscopic) was a good surgical option with dependable long-term results.

Here is a case of 32 years lady who came with complaint of milky urine. USG of KUB and lower abdomen done on 09.11.2016 was within normal limit. On 14.12.2016, biochemical report of blood plasma revealed normal serum urea, creatinine, cholesterol, triglyceride levels. Serum sodium level was normal though serum potassium level slightly increased 6 mmol/L (normal range-3.5-5.2 mmol/L) and ratio of total cholesterol and HDL level slightly increased 4.67 (normal up to 4.5). Report on haematology shows within normal limits except haemoglobin which was 11.9 gm/dl. These haematology and biochemical report of blood plasma on 14.12.2016 excluded the renal pathology if any. Urine culture and sensitivity isolated bacteria escherichia coli colony count 70,000/r, and by urine routine microscopy, it was revealed that specific gravity was 1.025; pale coloured urine and hazy on physical examination; chemically urine was acidic with reaction; albumin present; blood positive; RBC plenty/HPF which indicates grade III chyluria, i.e. haematochyluria but ruled out other causes of milky white urine like phosphaturia (clears on adding 10% acetic acid), amorphous urates, severe pyuria, lipiduria secondary to fat embolism, and pseudochylous urine. On the basis of homoeopathic principles of prescribing,

the case was prescribed on 17.12.2016 with *Thuja occidentalis* 30/ one dose with *Thuja occidentalis* 200/ one dose on subsequent next day with placebo for 15 days.

Case taking	
Present complaint	Hot, burning urine with cloudy milky offensive. On enquiry, it was revealed that splitting of stream also present. The complaint was since 6 months.
Mental general	Mistakes in writing
Physical general	Desire – cold food
	Aversion – potato
	Thirsty
	Constipation
	Perspiration all over body except scalp
Particular symptom	Urine – hot, burning
	Urine - cloudy
	Urine - strong odour
	Urination - frequent
	Forked stream
Objective symptom	Wart on face

After repertorisation, *Thuja occidentalis*, *Merc sol.*, *Causticum* came out to be the best indicated drugs for prescription *Kent's Repertory* with help of Hompath Eco-tek. After considering the predominant miasm, the best remedy ruled out was *Thuja occidentalis* which covered 10 symptoms among 11 symptoms with highest mark 22.

Remedy	Thuja	Merc	Caust	Merc-c	Nit-ac	Bry	Phos	Rhus-t
Totality	22	17	17	14	14	13	12	12
Symptoms Covered	10	7	6	6	6	5	6	6
[Boenning] [Urine]Cloudy:	3	3	3	0	0	3	0	0
[Boenning] [Urine]Hot, burning:	1	3	0	4	2	2	1	1
[Boenning] [Urine]Odour:Strong:	0	0	0	0	4	0	1	0
[Kent] [Bladder]Urination:Frequent:	2	3	3	3	1	2	1	2
[Kent] [Bladder]Urination:Forked stream:	3	2	2	3	0	0	0	2
[Kent] [Rectum]Constipation (see inactivity):	3	2	3	1	3	3	3	1
[Kent] [Perspiration]Head,general sweat except the:	3	1	0	0	0	0	0	3
[Kent] [Stomach]Desires:Cold :Food:	2	0	0	1	0	0	3	0
[Kent] [Stomach]Aversion:Potatoes:	1	0	0	0	0	0	0	0
[Kent] [Stomach]Thirst:	2	3	3	2	2	3	3	3
[Kent] [Face]Warts:	2	0	3	0	2	0	0	0

	Urine R/E	Follow up
29.12.2016	Urine-blood positive RBC 2-4/ HPF Specific gravity 1.015	31.12.2016- On the basis of current totality again <i>Thuja occidentalis</i> 0/7

	Physical examination- straw colour	14 doses was prescribed at every alternative day along with placebo.
27.01.2017	Blood - nil RBC - nil Specific gravity - 1.020 Physical examination- pale yellow colour	28.01.17- On the basis of current totality again <i>Thuja occidentalis</i> 0/9 14 doses was prescribed at every alternative day along with placebo.
25.02.2017	Blood - nil RBC - nil Specific gravity - 1.015 Physical examination- straw colour	25.02.17- On the basis of current totality, again <i>Thuja occidentalis</i> 0/7 - 14 doses was prescribed at every alternative day along with placebo.
05.04.2017	All within normal limits	10.04.2017- placebo given for 1 month

On further reporting of patient on 31.12.2016, she was better with her urinary complaints and the reports of urine examination done on 29.12.2016 was chemical examination of urine -blood positive and RBC 2-4/ HPF along with specific gravity 1.015 with straw coloured urine on physical examination. On the basis of current totality again *Thuja occidentalis* 0/7-14 doses was prescribed at every alternative day along with placebo. This time fifty millesemal potency was prescribed according to rules of homoeopathic posology and repetition. After one month, the reports of urine examination done on 27.01.2017 reported that blood nil in chemical examination; RBC nil on chemical examination and specific gravity 1.020 with pale yellow colour urine on physical examination. In clinical correlation, patient was also better than before but after one month further reports of urine examination done on 25.02.2017 was blood nil in chemical examination; RBC nil on chemical examination and specific gravity 1.015 with straw coloured urine on physical examination.

CASE STUDY

Modified Naranjo Criteria	+7
Was there an improvement in the main symptom or condition for which the homoeopathic medicine was prescribed?	Yes +2
Did the clinical improvement occur within a plausible timeframe relative to the drug intake?	Yes +1
Was there an initial aggravation of symptoms?	No 0
Did the effect encompass more than the main symptom or condition, (i.e. were other symptoms ultimately improved or changed)?	No 0
Did overall wellbeing improve?	Yes +1
(A). Direction of cure: did some symptoms improve in the opposite order of the development of symptoms of the disease?	No 0
(B). Direction of cure: did at least two of the following aspects apply to the order of improvement of symptoms:	No 0
From organs of more importance to those of less importance	
From deeper to more superficial aspects of the individual	
From the top downwards	
Did "old symptoms" (defined as non-seasonal and non-cyclical symptoms that were previously thought to have resolved) reappear temporarily during the course of improvement?	No 0
Are there alternate causes (other than the medicine) that -with a high probability- could have caused the improvement? (Consider known course of disease, other forms of treatment, and other clinically relevant interventions)	No 0
Was the health improvement confirmed by any objective evidence? (e.g. lab test, clinical observation, etc.)	Yes +2
Did repeat dosing, if conducted, create similar clinical improvement?	Yes +1

Modified naranjo criteria as proposed by the *United States Homoeopathic Pharmacopoeia* clinical data working group: these adapted algorithm enables us to increase certainty that the medicine cause improvement of the patient for establishing a causal relationship between cure and homoeopathic medicine, we have used this algorithm. In the above modified naranjo criteria, the total score is +7, which indicates that there is definitive causal attribution between patient and homoeopathic treatment.

Discussion

This case report supports the evidence that *Thuja occidentalis* may be useful in chyluria cases as it was used in above mentioned study done by CCRH, where *Rhus toxicodendron*, *Apis mellifica*, *Sulphur* and *Thuja occidentalis* were the most useful medicines.

Again there is no need of surgical intervention, chylo-lymphatic disconnection as done in some of patients who fail this medicine treatment at SGPGI study by A Suri et al.

Conclusion

In this case report, it can be concluded that homoeopathic medicines are of importance in managing chyluria and can help the patient to take a new lease on life. There is a better scope for the treatment of chyluria since the treatment is based on holistic and individualistic approach but to establish their proper effects a long-term trials are required on large sample size in future. Though it is grade C level IV evidence, this case report encourage to conduct further pilot study or RCT on chyluria.



Patient's Name :	Age : 32 Yrs	Sex : Female
Adv. By: Dr. Dr. Uttam Lodi, MS, M.Ch. Uro	Reporting Date: 25.11.2016	
Specimen : Urine	Lab Code:- LC- 20161125-52	Collect by: SPR (Lab)

PHYSICAL EXAM.
Chyle or Fat : POSITIVE

Name : _____	Age/Sex : _____	Date : <u>13/11/16</u>
Pt clc, Best excret in urine - cellulitis in scaly - on Heel of - crease \oplus - crease \oplus - 40 days HTN BP 120/80		
① Tab Zandery young ② Tab Zandery young ③ Tab Zandery young ④ Tab Zandery young ⑤ Tab Zandery young ⑥ Tab Zandery young ⑦ Tab mucinase 60g ⑧ Pt ntr to urinate ⑨ To raw c - this prof - no flowing - vaginal - cne		

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NSB Road, Near Punjabi Morris, Rangpur Ph: (03341) 244072/2449930

Patient's Name: Meghna Dubey Age: 32 Sex: F Date: 12/11/16
Address: Mewat

Investigation	ADVICE
1. Blood : Hb, TC, DC, Platelets BT, CT, ESR Blood Group Sugar (F) Sugar (PP) Urea Creatinine PSA Uric acid	<p>so passing white coloured Chine, & hematuria Pain swelling WSH (num) NAD</p> <p>Ray</p> <p>✓ 1. Tab Nitrofur 100mg once after dinner & b/w ✓ 2. Cap UTI of BOXING — Continue. W.H.D.</p> <p>✓ 3. Tab Hebaran 100 TDS x 2 daily</p> <p>Admit on Operation on plain cystoscopy LWT 16/12/16 8:00</p>
2. Urine R/E Urine : C/S Urine for chyluria	
3. E.C.G. Echocardiogram	— positive —
4. USG of KUB	
5. I.V.P. X-ray KUB X-ray Chest PA Retrograde Urethrogram Micturating Urethrogram Uroflowmetry CT Scan -Upper Abdomen Lower Abdomen	

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Our path
ever
skid

Certificate No. M-031

Patient's Name : DR SUBHASISH GANGULY
ID Number : 2534/D-1927
Referred By : DR SUBHASISH GANGULY

Received On : 05/04/2017
Reported On : 05/04/2017
Age/Sex/Wt/Ht: 32Y/FEMALE

REPORT ON EXAMINATION OF URINE

PHYSICAL EXAMINATION

Quantity	: 25 ml (app)	Specific Gravity	: 1.020
Color	: Straw	Sediment	: Nil
Transparency	: Clear	pH	: Not Done

CHEMICAL EXAMINATION

Reaction	: Acidic	Acetone	: Nil
Albumin	: Nil	Bile Salts	: Nil
Glucose	: Nil	Bile Pigment	: Nil
Reducing Substance	: Nil	Blood	: Nil
Phosphate	: Nil	Urobilinogen	: Normal

MICROSCOPICAL EXAMINATION

Pus cells	: 0-2 /HPF.	Casts	: Nil
Epithelial cells	: 1-2 /HPF.	Others	: Normal
R.B.C	: Nil		
Crystal	: Nil		

#: End of Report ::

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