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The Role Of MRI Lymphangiography In The Assessment Of Non-Vascular Causes Of Lower Limbs Edema

Mohamed Ahmed Abdelbaset Mahmoud , Marwa Elsayed Abdelrahman Ibrahim , Safa Kamal Mohamed, Remon Zaher Elia

Radiology Department, Faculty of Medicine, Ain Shams University, Cairo, Egypt.
[*]Corresponding author:
Mohamed Ahmed Abdelbaset Mahmoud.
Cairo, Egypt. Email address: dr.elsherif11@gmail.com

Abstract

Background: MRI lymphangiography may give a diagnostic clue adding much informative data concerning the anatomy and pathology of lymphatic vessels. To evaluate the role of MRI lymphangiography in assessing the possible causes of lower limb oedema of non-vascular origin, aiding in the selection of the treatment strategy for each patient.

Results: Dilated lymphatic vessels in the lower limb were detected in 19 patients (70.4%), while not detected in 8 patients (29.6%). In most patients, the level of dilatation was below the knee. Regarding the pattern of dilated lymphatic, pattern (I) was the most commonly seen pattern in all affected extremities. Regarding post-procedure complications, at the time of gadolinium application, bilateral pain was described in 14 patients and unilateral pain in 13 cases while being described as mild pain by 18 patients (66.7%) and as moderate by 9 patients (33.3%). Minor swelling was observed in 15 patients (55.6%). All patients were capable of walking well and without discomfort after the examination.

Conclusions: MRL is a good morphological and functional minimally invasive imaging modality used for mapping the lymphatic system and staging of primary and secondary lymphedema. Thus, it can help guiding the management and optimizing the surgical plan in patients with non vascular lymphedema.

Background

Lower limb oedema is a challenging diagnostic problem. Irrespective of the underlying pathological process, lymphatic system function is usually undervalued. Although diagnosis of lymphedema is based on the clinical data, introduction of imaging procedures are essentially required to confirm the diagnosis and preoperative planning of surgical intervention. Currently, lymphoscintigraphy is used to identify and stage lymphedema by surgeons prior to and during using certain types of treatment and is also used for staging and follow-up after surgery [(1) &(2)].

Lymphoscintigraphy, however, has disadvantages like low spatial resolution, injection of radiotracer with subsequent possible allergic reaction in high-risk patients as well as risk of radiation exposure; hence MR lymphography (MRL) with or without contrast injection has been introduced a change in the assessment and management of lymphatic pathologies and can be a promising method providing a way for visualization of lymphatic system and its pathologies. It has the advantages of being minimally invasive procedure and lacking ionizing radiation but availability, and interpretation expertise is lacking [(3,4&5)].

MRL has been demonstrated in previous research to be more sensitive and accurate in comparison to lymphoscintigraphy in identifying various anatomical abnormalities in the lymphatic system in individuals presented with extremity lymphedema [(6)].

The purpose of this study was to evaluate the potential role of direct post contrast MR lymphangiography in assessment of the non vascular lower limb oedema "lymphedema".

By comprehending the structural anatomy and function of the lymphatics, a more effective treatment strategy for lymphedema patients may be provided. The MR lymphangiography is a very useful technique for elucidating the pathophysiology of these individuals and determining the best course of treatment [(7)].

3D MRL images can provide many perspectives and help detect lymphatic channels based on their unique beaded configuration however the related venous structures appear straight with focal contour bulges at the valves. Moreover, the enhanced veins show significant contrast washout than lymphatic vessels which retain the dye for a longer time because of increased venous flow[(8&9)].

Differnet lymphatic drainage pattern are identified in which pattern (I) shows good lymphatic drainage and needs only consverative treatment while lymphedema (Pattern II) there is an abundance of fluid in the tissues, which is clinically shown as pitting edema. With the lack of randomized controlled trials comparing outcomes of lymphovenous anastomosis (LVA) versus vascularized lymph node transfer (VLNT), the decision between VLNT versus LVA depends largely on patient factors, with most patients preferring LVA due to better cosmesis which was performed in most of our patient1. Indeed, in some patients who have undergone lymphadenectomy in the past and have functioning lymphatics may benefit from both surgeries, LVA and VLNT, in order to get the best possible outcomes [(10)].

If the lymphatic system is not working properly in advanced lymphedema (pattern III), the superficial lymphatics will not pick up dye, and the progress in lymphatic drainage utilizing physiological approaches will be restricted. Although harmonious benefits from combining LVA and VLNT have been achieved for more advanced lymphedema treatment, most studies agree that patients with more advanced lymphedema will benefit most from reductive techniques, like direct excision procedures, to remove fibro-fatty tissue that has been built up over time because of chronic lymphatic fluid stagnation.[(11)]. Similarly, A functional lymphatic system is less likely to be observed in patients with significant fatty deposition and no pitting edema on their physical examination. [(7)].

Methods

This study was a cross-sectional study conducted at Ain Shams University Hospitals and private centres during the period from January 2020 to January 2021. The study included 27 patients who presented with lower limb oedema of non-vascular causes and were referred to MRI units to verify the diagnosis and assess the extent of the situation.

Inclusion criteria: patients clinically diagnosed as lymphedema of one or both lower extremities whether primay or secondary. No age or sex predliction.

Exclusion criteria: patients with abnormal venous or arterial duplex and patients with MRI contraindication such as cochlear implants, cardiac defibrillators ,pacemakers, and claustrophobic patients as well as pregnant females.

The study MRL examination technique:

The mean duration of various studies is about 80-100 minutes. MRI was performed with a 1.5 T superconductive system (Optima 450, GE Health care, United States) with high-

performance gradients. We divided the examined extremity into 3 regional area of interest: the foot region which includes the foot with distal leg; the calf region that includes the proximal leg, knee and lower thigh; with the last one which comprises thigh and pelvic region that includes the proximal aspect of thigh and pelvic region. For imaging of all those regions , we used only machine body coil for large field of vision.

Contrast material injection:

Contrast material: After local skin disinfection with Betadine, a subcutaneous injection mixture of 1 ml of meglumine gadopentetate with 0.5 ml of 2% lignocaine in each interdigital webspace as well as between the first and second metatarsals heads.

Post-injection precautions: The injection sites in each foot were massaged for approximately 1–2 min and the patients were closely monitored to deal with any emerging complications such as swelling or redness.

The used MRL sequences were:

1. Heavy T2 weighted 3D TSE with spectral fat suppression (SPIR) with the following parameters (TR/TE, 2500/700; flip angle, 90; matrix, 384× 384; bandwidth, 192.7; field of view, 380 mm; slices, 48; voxel size, 1.7 x 1.7 x 3.0 mm; acquisition time, 3 min 47 s) to outline the degree and extension of lymphedema.
2. Dynamic fat-suppressed T1weighted 3D SPGR (single echo 3D T1w GRE with spectral fat suppression or dual-echo 3D T1w GRE with Dixon reconstruction) pre & post intradermal injection of the MRI contrast material with the following parameters used: (TR/TE, 5/2.1; flip angle, 10; matrix, 448 × 384; bandwidth, 327.9; field of view, 405 mm; slices, 170; voxel size, 1.7 × 1.72 × 1.7 mm; acquisition time 3 min, 54s). For assessment and evaluation of lymphatic vascular channel enhancement.
3. Seven dynamic phase acquisitions at 5-10 minute intervals (0-5–15–25–35–45–55 min). For the lower extremity MRL examination using a single station coil we scanned the distal-most station for the first five time points and then moved the coil up into the upper leg for the final two time points. After that, the images are reviewed and additional phases may be obtained based on fulfilment of lymphatic enhancement progression.
4. To prevent external tissue beyond the extremity of interest during 3D processing, 3D scans of unilateral lower extremities were performed in sagittal orientation
5. To allow imaging of both lower limbs in the same field of view we performed the 3D scans of the bilateral lower extremities in the coronal orientation.

MRL images' interpretation:

A) **Lymphedema:** presence, degree (extent and thickening) as well as localization.
B) **Lymphatic vessels:** The number, calibre and course as well as and distance from overlying skin to both diseased lymphatic channel & nearest veins.
C) **Pattern of lymphatic drainage**: which was classified into 3 types as in table 1 [(12)].
D) **The drainage delay:** was assessed and scored from 0 to 3 as in table 2[(12)].
E) **Lymph nodes**: existence and localization.
F) **Venous contamination:** (present or not present) and whether it compromises the diagnosis and the presence of lymphangiectasia (yes or no) should be also reported.

The limitations of this work are that MRL examinations were not performed during the course of lymphedema treatment, and therefore, we are unable to evaluate the sensitivity and specificity of MRL. Lastly, there were only a

small number of cases that were available during the period of study.

Statistical analysis: Data were collected, coded, revised and entered into the Statistical Package for Social Science (R studio) version 2.3.2. The data were presented as numbers and percentages for the qualitative data, mean, standard deviations, and ranges for the quantitative data with parametric distribution and median with inter quartile range (IQR) for the non-parametric distribution. **Shapiro test** was used to verify the normality of distribution.

Results

The patients' ages range from 7 to 77 years old, with a typical age of 33 years. The majority of the patients (40.7 percent) were between the ages of 20 and 40, with males outnumbering females (55.6 percent vs 44.4 percent , respectively). In terms of prior history, 17 patients (62.9%) came with primary lower limb edema without underlying reasons, while 10 patients (37.1%) presented with secondary lower limb edema related to surgery in 7 patients (25.9%), and trauma in 3 patients (1.1%). Bilateral oedema was more common than unilateral oedema (66.7 percent) (33.3 percent). Oedema below the knee (40.7 percent) was the most common kind of oedema.

In terms of post-procedure consequences, pain was recorded as bilateral in 14 patients and unilateral in 13 patients at the moment of gadolinium administration, whereas mild discomfort was described by 18 patients (66.7 %) and intense pain by 9 individuals (33.3%). After the evaluation, all of the patients were able to walk normally and without pain. Minor edema was seen in 15 individuals (55.6%) (the region of the interdigital web following gadolinium administration disappeared in all 15 patients after 24 hours), and there was essentially no swelling in 12 patients (44.4%). After the examination, no issues were discovered.

Regarding the pattern of a dilated lymphatic; pattern (I) was observed in 11.11% of all afflicted limbs (Figure 1), pattern (II) was seen in 59.25% of all affected limbs (Figure 2&3) and pattern (III) was found in 29.6% of all affected limbs (Figure 4).

Regarding the drainage delay scoring criteria ; score (0) was seen in 7.4% of all affected extremities, score (1) was seen in 3.7% of all affected extremities, score (2) was seen in 59.25% of all affected extremities and score (3) was seen in 29.6% of all affected extremities.

In term of microsurgical planning of lymphedema , the distance between the diseased lymphatic and the neartest vein was a range between 3-6 mm.

Conservative treatments such as compression therapy and physiotherapy in combination were the cornerstone of early lymphedema treatment which had been performed in 8 patients in our study which are noted and marked as pattern III drainage.

Surgical treatment in the present study was performed in 19 patients of which 16 patients underwent LVA ± VLNT which was manifested on MRL as pattern II drainage and 3 patients underwent reductive technique (Excision) who show pattern I drainage.

Discussion

We proposed in this study to assess the role of MRL in obtaining a detailed anatomic delineation of the lymphatic drainage system in the targeted lower limb to aid in the selection of the treatment strategy for each patient.

In the present study, all patients presented with edema of non vascular origin whether primary or secondary lower limb edema while the former without underlying causes were more than patients presented with secondary lower limb edema which were mostly surgery followed by trauma. This was in accordance with Lohrmann et al. who conducted their study to estimate the

potentiality of using high-resolution MRL in order to visualize the lymphatic channels in patients with primary and secondary lymphedema. There were 8 patients with primary lower limb oedema and 2 patients with secondary lower limb oedema after malignant lymph node extirpation and radiation in the pelvic and inguinal regions [13]. On the contrary, in Mazzei et al. study on 30 patients with upper and lower limbs lymphedema; all of them underwent interventional surgeries within 3 days after MRL examination; 17 out of 30 were affected by lower limb lymphedema with 6 cases of primary lymphedema; the others 11 cases were secondary to cancer treatment [12].

In our study, patients who were presented with bilateral lower limb oedema were more than that unilateral oedema. Regarding the oedema level, the majority of patients presented with dilatation below the knee. In comparison, Lu et al. carried out an observational study for lower extremity lymphedema on 40 female patients with past history of gynecological carcinoma treatment who underwent MRL. For those individuals with early-stage disease, the most common initial symptom is oedema on the distal part of the extremity. With disease progression, oedema spreads proximally, and lymphatic vessels in the thigh become involved [14].

In the present study of MRL lymphangiography , we described the approach of using dye injection into four interdigital webs and between first and second metatarsal heads while the starting point was on the the first interdigial space in order to provide a high quality imaginary map for proper diagnosis in cases of non-vascular lower limb lymphedema. Each lymphatic vessel has their single origin in the foot so those lymphatics often branches and converges throughout its course, but it is seldom to have inter-connections which form a local newtowk with adjacent lymphatics. These features could permit to classify the lymphatic pathways of the lower limb into groups which can not be clealy obtained by using a single local injection. This was in accordance with Shinaoka et al., who conduced a research about the usefulness of multiple injection over single one on fresh human cadavers using computed tomography lymphangiohraphy[15] .

In the current investigation, the two MRL problems that occurred during the study were pain and transitory interdigital web edema. After the evaluation, all of the patients were capable of walking smoothly and without experiencing pain. This was in accordance with Baz et al., who said that all patients experienced minimal, bearable discomfort following contrast delivery, and that all patients were able to walk quickly after the assessment. Swelling at the location of contrast injection was rarely observed, although it disappeared within 12–36 hours of the test. In none of our cases, a hypersensitive response was seen. There were no major issues during or after the test. [8]. More serious adverse effects had been documented such as significant necrosis, haemorrhage, and oedema [9,13]. Furthermore, as established in a Notohamiprodjo et al study, improper application of contrast media might result in severe venous contamination, [16].

In our proposed study, in review of MRL findings, dilated lymphatic vessels in the lower limb were clearly visualized in 19 patients (70.4%) as follow; bilateral in 6 patients (22.2%), and unilateral in 13 patients (48.1%), while no appreciable dilatation was depicted in 8 patients (29.6%). This was consistant with Baz et al., who found on MRL that lymphedema was unilateral in 14 cases (70% of cases), and there was bilateral affection in 6 cases (30% of cases) with right sided predominance [8]. Also, Notohamiprodjo et al. [16], and Liu et al. [17] described that the unilateral affliction of the examined extremities was the dominating feature in the patients.

In the current study, we had been evaluating the maximal lymphatic vessels' calibres (3.68 mm) as well as the lymph nodes groups that will suggest variable underlying pathological mechanisms and will aid for preoperative surgical planning of the lymphatic

vessels. In addition, the best time of detecting dilated lymphatic vessels and lymph nodes in case of non-vascular lymphedema ranged from 35-45 min with a median of 35 min and ranged from 45-55 min with a median of 45 min respectively. In the same line with our results, Lohrmann et al. study which was done on 10 individuals with lower extremities lymphedema to evaluate the effectiveness of MRL. In all patients, There was definite detection of lymphatic channels showing their characteristic beaded appearance after 15 mintues from injection on the web spaces. The best detection timing of the affected lower leg lymphatic channels was after 35-45 minutes. In eight patients, visualization of upper leg lymphatics leg could be detected , showing the strongest enhancement at 45-55 minutes after dye injection. In all patients, reliable depiction of the inguinal lymph nodes with external iliac lymphatic pathways at 35 minutes, with the highest signal intensity at 45 minutes after gadodiamide application. The maximum lymphatic vessel diameter dilatation was 5 mm [(13)]. A comparative study between heavily T2-weighted image and MRL was conducted by Lu et al. on 40 lower extremities in 31 cases (9 bilateral and 22 unilateral) who presented with primary lymphedema. They described that the useage of MRL showed the recognition of the beadable configuration of the affected lymphatics on 40 lower extremities while the greatest diameter of it was 3.41 ± 1.05 mm. They concluded that although the higher sensitive detection of heavily T2-weighted imaging, the MRL has greater legibility for demonstrating any modified lymphatic vessels pathology as well as associated complications by using non invasive procedure [(18)]. In another comparitve study by Lu et al. for morphological appearance of lymphatic vessel in normal and affected limbs using MRL. An interrupted, low signal intensity line on MRL was seen on the healthy lymphatics, while in the affected individuals were visualized as beaded, dilated, high signal intensity channels on MRL. The average lymphatic vessels transverse diameter for the diseased calf was 3.41±1.4 mm and 2.11±1.25 mm for the diseased thigh, respectively [(14)].

In the current study, lymph nodes in the lower limb (pelvic group) were detected in the the majority of cases (88.9%) on MRL. On the contrary, Notohamiprodjo et al. reported that lymph nodes detection were achieved in more than 50% of cases during the use of MRL and thus lower specificity. They attributed this to the nature of the imaging techniques as the cross-sectional MRL depicts many other anatomic structures, which might mask lymph nodes, particularly when enhancement lymph node is weak. Moreover, There is fat-saturation heterogeneity , considered as a MR specific limitation, which may be the cause of failure in lymph node visualization and detection of contrast agent uptake [(19)]. On other hand the high temporal resolution of MRL would be of value in better visualization for dynamic imaging of lymph node enhancement, as described by Liu et al. [(17)].

Other characteristics, which are frequently associated with lymphatics, include dermal backflow (a regional area of progressive interstitial accumulation of contrast material in soft tissue because of lymphatic drainage insufficiency with nearby occlusion) and collateral transfer pathways (honeycombing); these features are visible after a mean of 15–20 minutes from dye injection and their intensity propgated over time[(12)].

In the present study, out of 27 patients, 19 patients (70.3%) showed collateral vessels. Also, 19 patients (70.4%) out of 27 showed dermal backflow which was similar to Lohrmann et al., who found that in lymphedema cases, the collateral vessels with dermal backflow were detected in 70% of cases [(13)]. In Lu et al study, the backflow was seen in 25 (52.1%) of the 48 afflicted limbs. The dermal back-flow pattern is described as an irregular, patchy shaped, high signal intensity area on MRL [(14)].On MRL, besides lacunar dilatation of lymph vessels (lymphangiectasia), Notohamiprodjo et al. found entrapment of the

contrast medium in 4 out of 30 cases with lymphedema donating obstruction [19]. Similarly, 3 patients (11.1%) in the current study showed obstruction in the lower limb.

In the present study, the delay in drainage score of all affected extremities in which the 0 score indicates no drainage while score 3 indicates no delay of drainage, in the current study, the majority of cases (59.25%) were score 2 indicating slight delay of drainage. In the same line, delayed lymphatic drainage was showed in 27 out of 33 extremities using MR lymphangiography in Notohamiprodjo et al. study[19] , Moreover Liu and Wang found that using MRL on breast cancer-related lymphedema (BCRL) cases that the effect of damage on the lymphatic circulation could be of variable extent and severity ranging from lymph stagnation, ectasis, stretching, and up to disruption ([20]).

Overall, our results emphasize MRL's great spatial resolution and detailed anatomic information. The isotropic resolution of the cross-sectional MRL approach enables assessment of the structures of interest in any orientation and angle by using three-dimensional reconstruction, which is particularly advantageous for planning microsurgical treatment. Using MRL imaging to observe the morphology of lymphatic channels and lymph nodes enabled the categorization of anatomical lymphatic abnormalities in primary lymphedema. It is possible that MRL aid in the selection of the most appropriate surgical or non-surgical treatment for secondary lymphedema, and that it could also be used as a monitor for the patient's progress after treatment has been completed.

Conclusions

MRL is good morphological and functional minimally invasive imaging modality used for mapping the lymphatic system and staging of primary and secondary lymphedema. Thus, it can help guiding the management and optimizing the surgical plan in patients with non vascular lymphedema.

List of abbreviations

MRI
Magnetic resonance imaging.

MRL
Magnetic resonance lymphangiography.

LVA
Lymphovenous anastomosis.

VLNT
Vascularized lymph node transfer.

IQR
Inter quartile range.

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Table

Table (1): Types of lymphatic drainage.

Pattern	Description
Pattern (I)	Defective lymphatic drainage or diffuse interstitial enhancement which also known as dermal backflow.
Pattern (II)	Partially diffuse enhancement or interstitial and vascular enhancement, if some lymphatic vessels are depicted in the area of the dermal backflow (honeycombing).
Pattern (III)	Direct lymphatic enhancement with no dermal backflow.

Table 2: Lymphatic drainage scoring system.

Score	Description
Score (0)	No drainage.
Score (1)	Significant/considerable delay [pelvic level >60 minutes or not shown up till the end of the study.
Score (2)	Slight delay [pelvic level >20 minutes].
Score (3)	No delay [The first series of images will show enhancement of lymphatics or appeared at pelvic level <20minutes].

Table 3: MRI findings

Dilated lymphatic vessels: (n=27)		
	Non-detected	8 (29.6%)
	Detected	19 (70.4%)
Laterality of Lymphatic Affection (dilatation): (n=19)		
	Bilateral	6 (22.2%)
	Unilateral	13 (48.1%)
Level of dilatation: (n=19)		
	Below knee	14 (51.9%)
	Up to scrotum	2 (7.4%)
	At the ankle	1 (3.7%)
	Mid thigh	1 (3.7%)
	Upper thigh	1 (3..7)
Pattern of lymphatic drainage (n=27):		

	Pattern I	3 (11.11%)
	Pattern II	16 (59.25%)
	Pattern III	8 (29.6%)
Delay drainage scoring (n=27)		
	Score (0)	2 (7.4%)
	Score (1)	1 (3.7%)
	Score (2)	16 (59.25%)
	Score (3)	8 (29.6%)
Time of detecting dilated lymphatic vessels: (n=19)		
	Min.-Max.	15 -25 minutes
	Median (IQR)	15 (15-15)
Best time of detecting dilated lymphatic vessels: (n=19)		
	Min. – Max.	35 – 45 minutes
	Media (IQR)	35 (35-35)
Maximum Diameter of Lymphatic vessels: (mm)		
	Min. Max.	2 – 5 mm
	Mean ± SD	3.68 ± 0
	Median (IQR)	3.0 (3.0- 5.0)
Detected Pelvic Lymph Node:		
	Non-detected	3 (11.11%)
	Detected	24 (88.88%)
Interstitial enhancement:		
	Present	19 (70.3%)
	Not present	8 (29.6%)
Obstruction:		
	Present	3 (11.1%)
	Not present	24 (88.9%)
Collateral Vessels:		
	Yes	19 (70.3%)
	No	8 (29.6%)
Dermal back flow:		
	Yes	16 (59.25%)
	No	11 (40.74%)
Treatment Plan		
Consverative therapy		8 (29.6%)
Physiological techniques (LVA ± VLNT)		16 (59.25%)
Reductive technique (Excision)		3 (11.1%)

Figures

Figure (1)

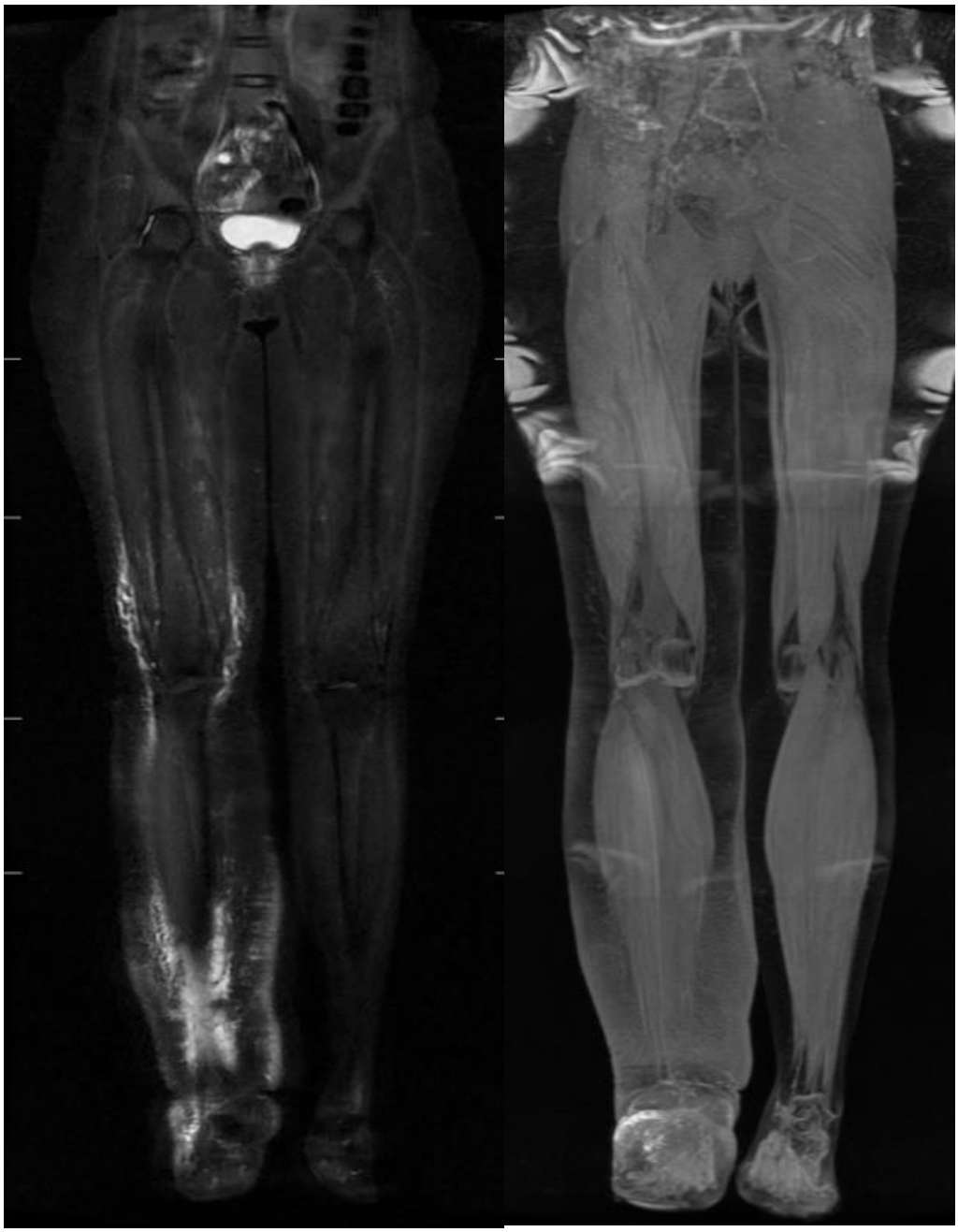

Fig.1(a). **Fig.1(b).**

Figure 1: A 23-year-old female presented with chronic right sided lower limb edema of more than 10 years duration. Patient had Nano colloid scintigraphy study shows absent or rudimentary right sided lymphatic with normal left one. The obtained Coronal STIR image (a). revealed right sided lower edema of the leg and distal thigh. The obtained coronal post contrast T1 fat sat images delayed images after 1 hour from injection (b). revealed no lymphatic uptake (same finding as scintigraphy). **(Type I drainage) score(0)**

Figure 2

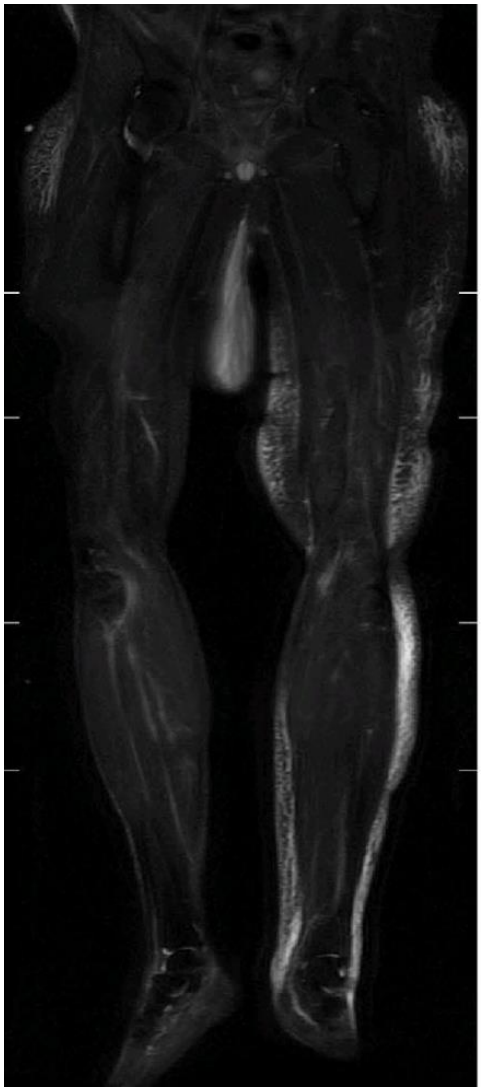

Fig.2(a).

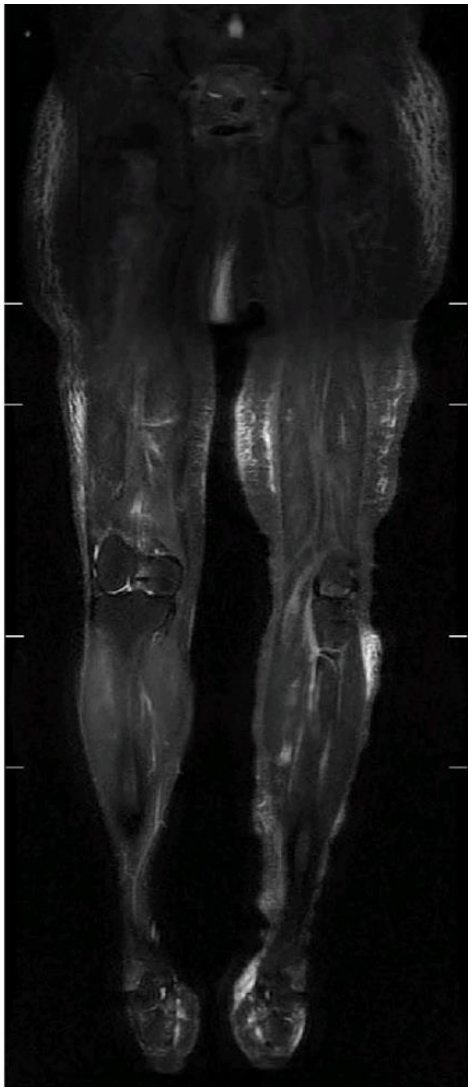

Fig.2(b).

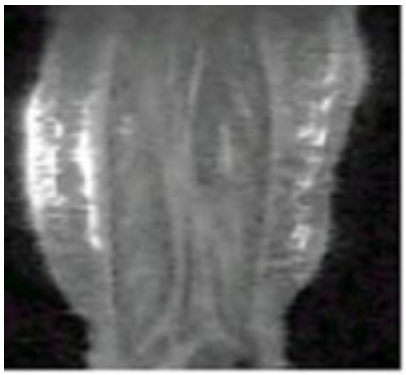

Fig.2(c)

Figure 2: A 44-year-old male presented with bilateral lower limb edema extending above knee reaching scrotum. The obtained coronal STIR image (a) revealed left lower leg diffuse subcutaneous edema extending from the proximal thigh down to the level of the ankle joint and dorsal aspect of the foot. The obtained dynamic T1 fat suppression (MRI lymphangiography) (b) revealed dilated lymphatics at left side appear extending at anteromedial aspect of distal leg and thigh **(Type II lymphatic drainage).** The

obtained zoomed dynamic T1 fat suppression (c) showed significant dermal backflow/interstitial edema extending above the knee joint and mid-thigh. while the scoring system for this case was score (2).

Figure (3)

Fig.3 (a)

Fig.3 (b)

Figure 3: A 42-year-old male presented with bilateral lower limb edema extending above knee reaching the upper thighs. (a) Coronal T2WIs shows asymmetrical bilateral subcutaneous edema is noted extending from the dorsal aspect of the foot and ankle joint up to pelvic and inguinal region as well as lower abdomen more on the right side. (b) The obtained dynamic coronal T1 fat suppression (MRI lymphangiography) revealed gradual progressive filling of dilated lymphatic channels at the level of right leg. These lymphatics appear located anteriorly at the middle third of right leg assuming linear branching beaded appearance midline and paramidline. **(Type II lymphatic drainage) Score (2).**

Figure (4)

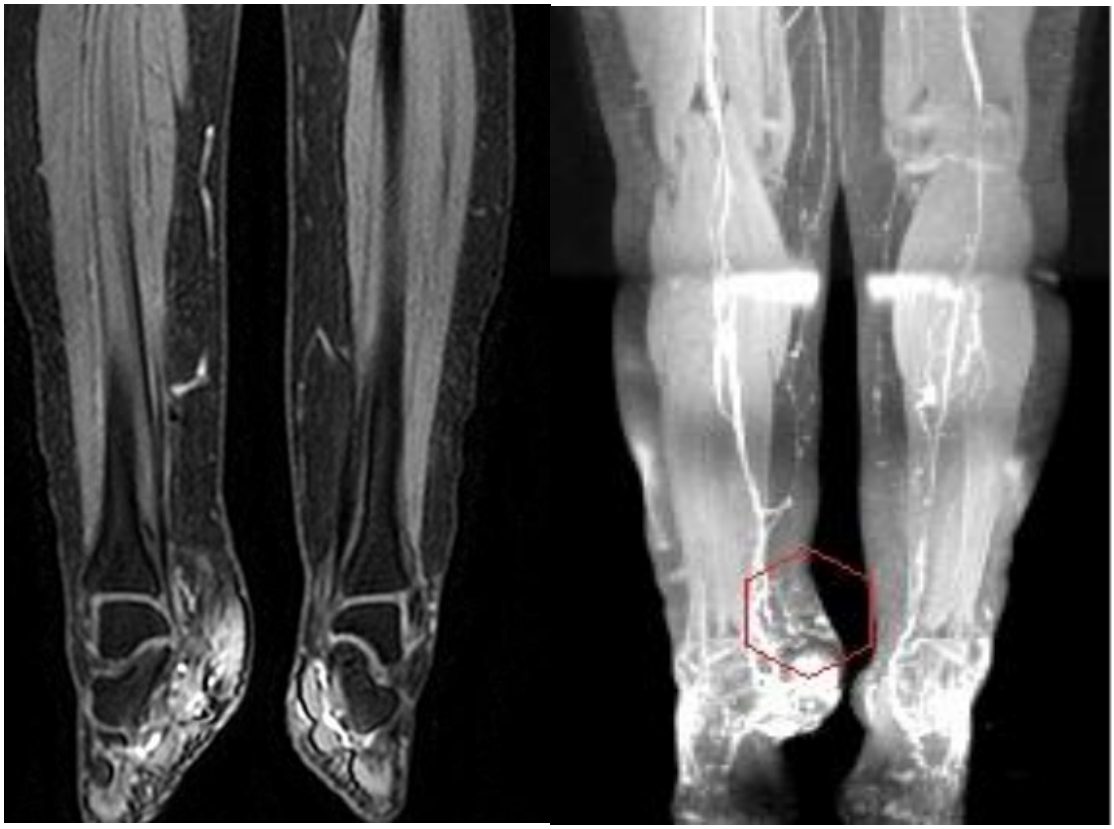

Fig.4(a). **Fig.4(b).**

Figure 4: A 34-year-old female patient complaining of bilateral lower limb edema of more than 6 months duration with no significant past history. The obtained 3D coronal heavy T2WIs (a) revealed mild bilateral ankle edema. The obtained dynamic coronal T1 fat suppression (MRI lymphangiography) (b) revealed mild progressive filling of the lymphatics. Irregular radiating lymphatic are seen at medial aspect of the ankle with irregular beaded pattern **(type III drainage) score(3)**.