

## Lymphography of the Edematous Extremities

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### Summary

The mechanism of secondary lymphedema of the extremities is not always simple to understand.

The unsolved mechanism of lymphedema should be further studied from exploring relationship between lymphatic and venous systems each of which has superficial and deep systems respectively.

Lymphatic systems of the extremities are seemingly simple for observing the mechanism of lymphedema by lymphography.

I have experienced, however, many cases that baffles my understanding of the cause of lymphedema of the extremities by lymphography (1).

### Case report

63 year old male complained of skin eruption fever, generalized lymphadenopathy, hepatosplenomegaly, polyclonal hypergammaglobulinemia and hemolytic anemia after applying hair-dye. There were asymmetrically enlarged nodes of inguinal region on the right side comparing with left side (Fig. 1).

It is reasonable to mention that lymph stasis ensued more prominent on the right side than on the left as a natural course of event.

The inguinal node on the right side was verified by biopsy as immunoblastic lymphadenopathy.

Obstructive lymphopathy of the rat could be experimentally caused by extirpating the Lnn. popliteus and ligating corresponding lymphatics just proximal and distal of the nodes, thus ensuing experimental "lymph stasis", which was examined by lymphography.

Lymphography by injecting contrast material into the lymphatics of the hind leg of the rat (2) two days after operation showed the interstitial extravasation with dermal backflow, perivascular opacification and open up of collaterals towards lateral thoracic route with opacification of Ln. subilicus (Fig. 2).

These obstruction mechanism could be more completely and irreversibly observed by implantation of Walker's carcinoma cells to the rat (Fig. 3).

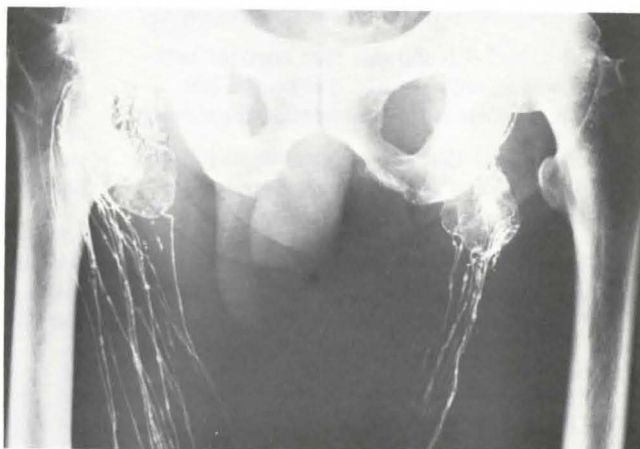


Fig. 1 Mechanical obstruction of the lymph flow at the level of inguinal regions on both sides, more prominent on the right than on the left side

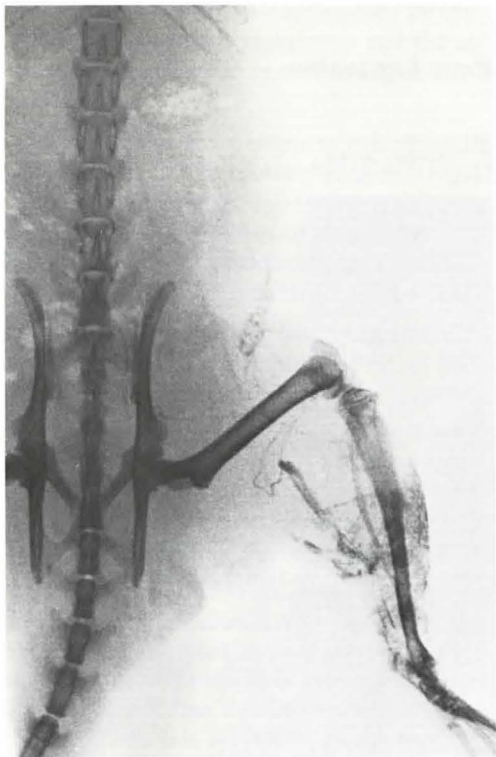


Fig. 2 Rat lymphography (1)  
extirpation of Ln. popliteus and of the corresponding lymphatics

An interesting phenomena of rapid transit of contrast medium on the side of the leg with deep venous thrombosis or edema compared with normal side have been empirically not infrequently observed by lymphography.

Fig. 4 a, and 4 b showed that contrast medium was already washed out on the left side in the case with deep venous thrombosis.

Fig. 5 showed that few subcutaneous lymphatics of the Vena saphena magna group was seen in the case with varicous vein.

This pattern of seemingly poor ramification of the prefascial longitudinal lymphatics is normal variant, Type II by *Kaindl* et al. (3) and did not show the hyperplastic pattern.

This case, suspicious of Stewart-Treves syndrome, proved to be no malignant by biopsy. Brachial angiography (Fig. 6 a) showed tor-



Fig. 3 Rat lymphography (2)  
implantation of Walker's carcinosarcoma cells

tuos A. and V. circumflexa humeri anterior et posterior at the obstruction site. No venous thrombosis was observed. Arm lymphography (Fig. 6 b) showed complete obstruction of the superficial lymphatics with unusually opacified cubital node with enlarged in size and its architecture was coarsened probably due to chronic inflammatory process. Increased number and diameter of the afferent lymphatics with tortuous, persistent collaterals and dermal backflow were seen.

Lymphography showed tubular cuffs of contrast medium following the distribution of major blood vessels, presumably of veins in the late phase of lymphography (Fig. 7).

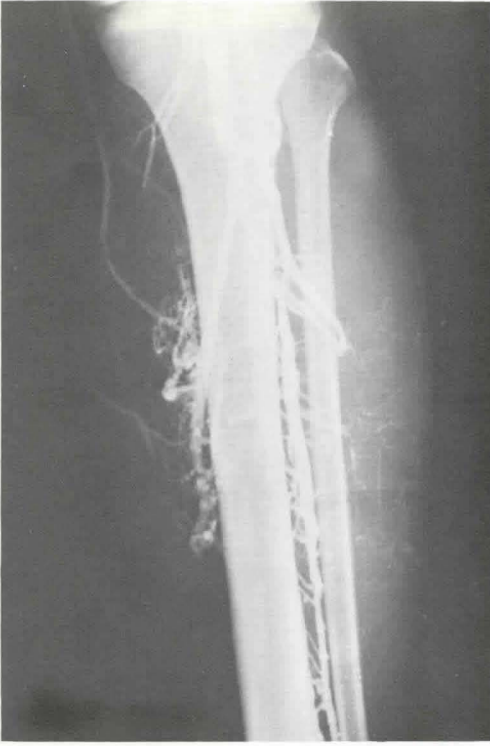


Fig. 4 a

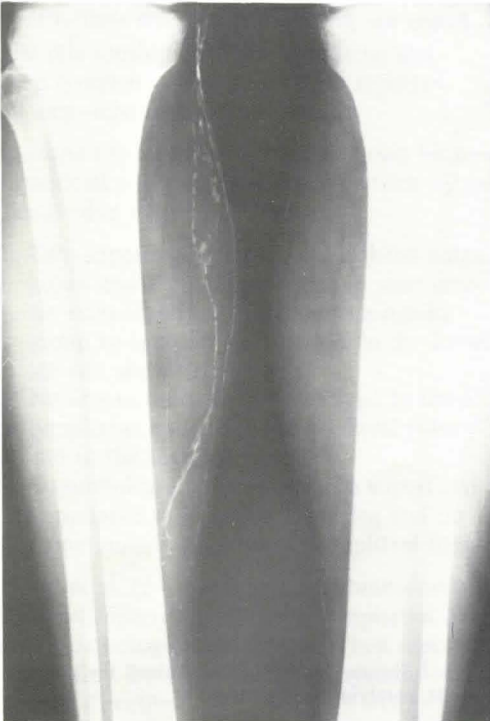


Fig. 4 b

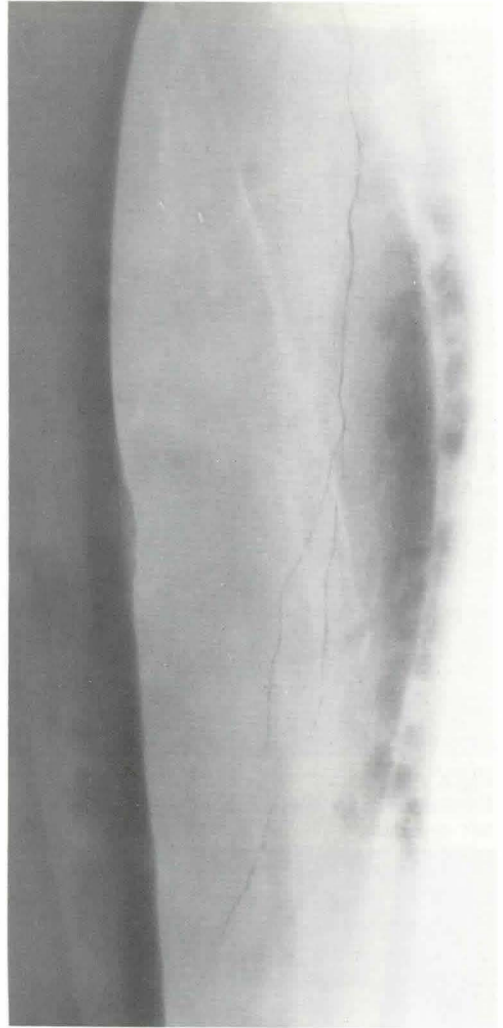


Fig. 5

Fig. 4 a Venography of the deep venous thrombosis of the left lower leg

Fig. 4 b More rapid transit of contrast media from the lymphatics of the left lower leg than on the right

Fig. 5 This case with varicose vein did not show hyperplastic pattern of lymphedema

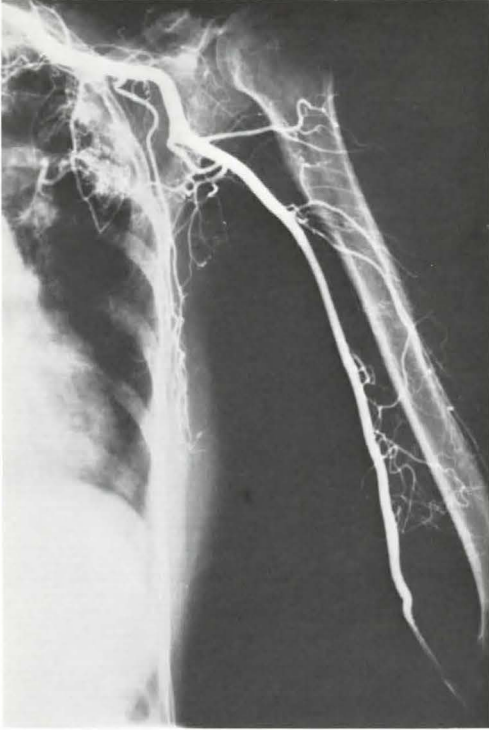


Fig. 6 a

Edematous upper arm, arteriography and lymphography. Biopsy was performed at the lower third of the left upper arm



Fig. 6 b



Fig. 7 Sheath-like opacification along the venous walls; paralympathic system



### Discussion

Lymph stasis is caused by the anatomical and physiological fault in the lymph system which can be examined by lymphography. There are two types of lymphedema, primary and secondary. The cause and degree of the secondary lymphedema can be examined by lymphography.

There are three vascular systems in the extremity; arterial, venous and lymphatic systems, each of them is composed of superficial and deep system respectively.

The unsolved mechanism of lymphedema should be explored from interrelationship between each system above mentioned using lymphography, venography and arteriography.

The deep, subfascial lymphatics of the thigh can be visualized lymphographically by injecting indicator dye below the lateral malleolus of the ankle. But this technique is not usually applied to routine lymphography.

The deep lymphatics of the leg are accompanied along with A. tibialis anterior et posterior and A. fibularis and also closely contacted with deep veins of the leg.

The relationship between superficial and deep lymphatic system has been reported by anatomists and radiologists.

*Kutsuna* (4) reported the anastomoses between superficial and deep lymphatic systems by indicator dye method as follows.

1. Two superficial lymphatics, saphena magna group and saphena parva group anastomoses each together, from saphena magna group to saphena parva group in the lower leg and above it, vice versa.
2. No anastomoses from superficial to deep lymphatics except in the popliteal fossa and in the inguinal region.
3. Communications from deep to superficial lymphatics only in the lower leg and no communications above the popliteal fossa.

*Malek et al.* (5) found direct communications between superficial and deep lymphatics only in the pathological conditions. They reported lymph flow between these two systems travels in both direction.

Dilatation and increase in number of the subcutaneous, superficial lymphatics in the saphena magna group and opening up of new lymphatics on the outer aspect of the leg was observed in case with deep venous thrombosis of the leg.

The high pressure in the deep veins is blown-out into the subcutaneous veins through deep fascia via communicating veins which accompany the communicating lymphatics, thus, intrafascial deep venous hypertension can be transmitted to superficial veins and superficial lymphatics.

The communicating lymphatics was ascertained by injection Patent Blue dye deep into the sole of the foot by *Askar* (6), observing the flow of connecting lymphatics from within outwards. This is the reason why the transit time of the contrast medium in the lymphatics in case with edema is rapid. Increase of the lymphatic space and acceleration of lymph flow in the corresponding lymphatics is confined to the portion of the thrombosed deep vein.

Acute inflammation or even complete obstruction of the prefascial vein; f. e., of V. saphena magna showed reportedly no lymphographical abnormalities.

It is interesting that in case of phlebitis of deep vein, only transient edema is complained, probably due to compensation of deep venous collaterals.

Our experimental obstructive lymphopathy using rat lymphography showed that lymphedema becomes more severe as the obstruction site descends from lumbar to popliteal region, namely decreased capacity of compensation mechanism.

Flow disturbance of lymphatic systems plays an important predisposing factor in opacification of perivascular cuffing.

The cuffing is not extravasation but within the perivascular sheath and this paralympathic system serves as collateral circulation in the lymph flow disturbance (7). The obstructive lymphopathy which can be frequently seen in the clinical field is not always compatible with experimental results using ligation and

extirpation of the lymphatic system of the animals.

In the former, the interval between the cause and onset of edema is longer and clinical features are more complex than in the latter.

The experimental works, however, may contribute to gain some clues of solving complex mechanism.

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