

## Possibilities of Studying the Deep-sub-fascial Lymphatic System of the Lower Limbs

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### Summary

After mentioning the lymphangiographical methods for the study of the lower limb channels, the authors illustrate a new technique which allows, in at least 15% of cases, the simultaneous study of both the superficial and deep lymphatic systems

The study of the lymphatic system has become of interest to investigators only after the vessels have been successfully demonstrated in animals and humans following the injection of vital blue dyes. Significant interest arose after *Kinmonth's* (19) successfully injected these structures with iodinated contrast medium and these were demonstrated by radiograph. In general, the superficial lymphatics have been cannulated.

*Mascagni* was able to cannulate the deep lymphatic vessels of the foot using a technique in which the vessels were isolated below the external malleolus adjacent to the small saphenous vein. In this region, usually two vessels can be cannulated in a fairly standard way as suggested by *Tosatti* (37, 26). These lymphatics have been called the subfascial or deep lymphatics and they follow the vascular nervous bundle on the lateral side of the leg.

We developed a technique for routine evaluation of these lymphatics. The vital blue dye is injected into the subcutaneous tissues of the heel and following incision of the skin, behind the lateral malleolus, the lymphatics can be isolated and cannulated. Contrast medium is then injected and radiographs can be taken.

Our studies have shown that direct connection between the different lymphatic systems of the legs occur. By injecting the "deep" sys-

tem, the popliteal lymph nodes are usually visualized (35, 12, 13).

These anastomoses between two systems have also been shown by *Ginzburg* (17). Usually the flow of contrast medium is from the deep to the superficial system in the lower leg and from the superficial to the deep system in the thigh. *Clodius* (15) reported that when the two systems are examined in the upper extremity, obstruction of the lymph flow in the axilla may result in direction flow from the deep to the superficial channels. However, in obstruction, this flow may be reversed (20, 29, 31).

### Purpose of the Study

The purpose of the study was to visualize these anastomoses. What prompted us to investigate these was the observation in a patient in whom simultaneously the superficial and deep systems were visualized. These anastomoses have been demonstrated using tourniquets placed just below the knee. This simple maneuver permitted us to study simultaneously the deep and superficial systems without a need for two cannulations. We were thus able to study the lymphatic dynamics both in normal and abnormal conditions.

### Material and Methods

This method was used in 50 patients whose ages ranged from 30 to 75 years. Males and females have been examined. In 25 patients the indication for the study was lymphedema, in 8 the examination was done to stage the spread of melanoma. The remaining patients were studied for staging of lymphoma.

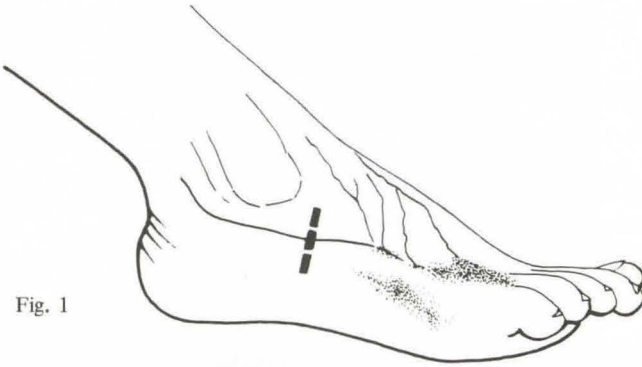


Fig. 1

Fig. 1 The vital colouring injection shows the collector which, in 15 % of patients treated with lymphangiography, may directly connect the superficial and deep system of the lower limbs



Fig. 2a

Fig. 2a and 2b Simultaneous evidence of superficial and deep system by injection of contrast medium into a collector of external pre-malleolar area



Fig. 2b



Fig. 3a and 3b The lymphangiography through contrast medium injected into a collector of the foot fourth metatarsal space may evidence the deep system directly

### Results

In 15% of the patients, we were able to show anastomotic channels with flow into the deep subfascial system. The level of anastomosis was usually proximal to the fourth intermetatarsal space. In several, the flow was towards the lymphatics around lateral malleolus. In 10% of the patients, two lymph nodes were demonstrated in the popliteal region. Anastomoses were also found between the deep and superficial system in the popliteal region, though this type

of anastomosis was less frequent than the more distal ones.

### Conclusion

By applying a tourniquet we were able to show that frequently it is possible to fill the superficial and deep systems simultaneously. These systems anastomose. It is conceivable that by applying extrinsic pressure, lymph flow can be diverted to the deep system and



Fig. 4 Another simultaneous evidence of superficial and deep lymphatic system of lower limb by injection into a sole collector of the foot fourth intermetatarsal space

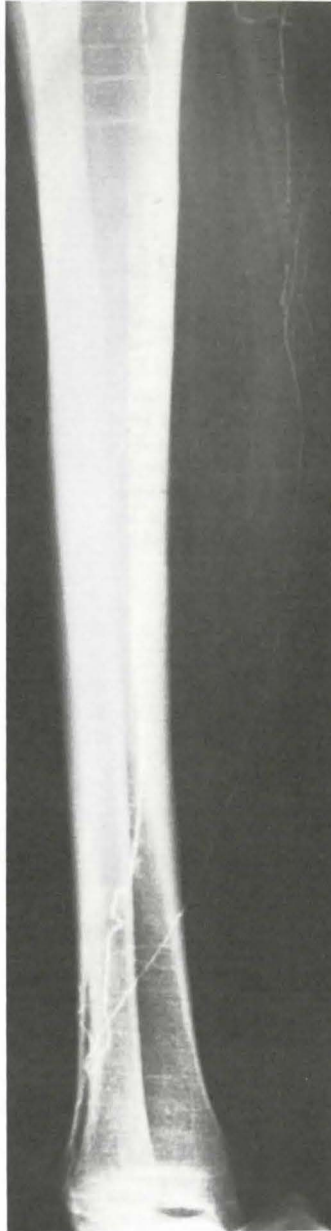


Fig. 5a

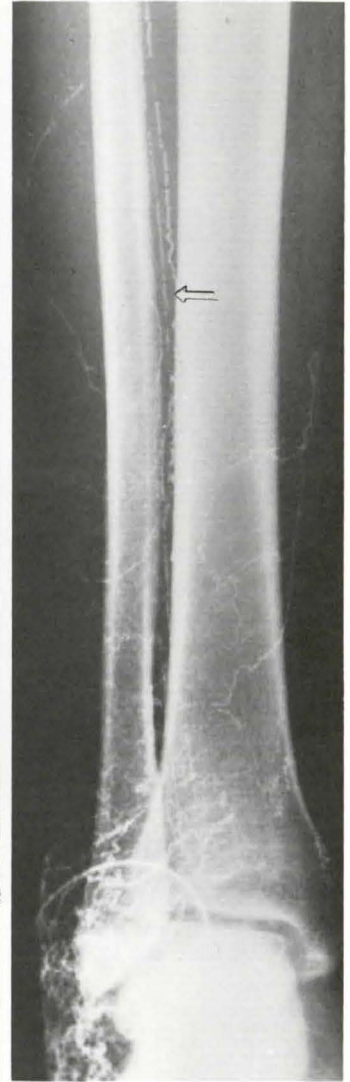


Fig. 5b

Fig. 5a and 5b Lymphatic collector and dermal back flow of lower limb in lymphedema. This lymphography was obtained according to *Cariati* (10, 11, 12, 13) and *Accarpio's* (2) method

this mode of drainage could be possibly used in patients with lymph vessel disease.

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