Critical Considerations on Lymphography

The limitations of morphological diagnosis

B. Tjernberg

Department of Anatomy, University of Uppsala, Sweden, and
Department of Gynaecology, Radiumhemmet, Stockholm, Sweden

Lymphology 2 (1969), 72–77

Although about 15 years have elapsed since the introduction of direct lymphography to clinical practice and the method to-day can be regarded almost as a routine one in diagnostic radiology, much experimental and clinical research must be done before the diagnostic possibilities of lymphography can be fully estimated. This research must be based on a thorough knowledge of the morphology and physiology of the lymphatic system. A short description will be given here of some morphological characteristics of lymph vessels and nodes, the knowledge of which I have found valuable when performing lymphography and when interpreting lymphograms. The account is principally based on combined macro- and microradiographic and histological investigations of the lymphatic system of dogs and rabbits.

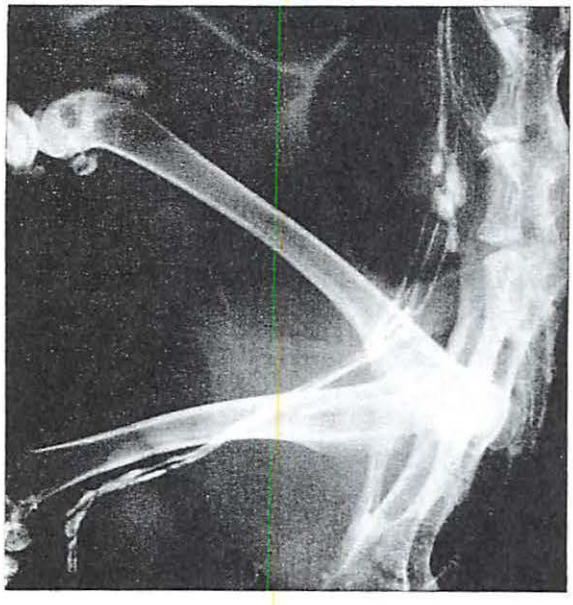
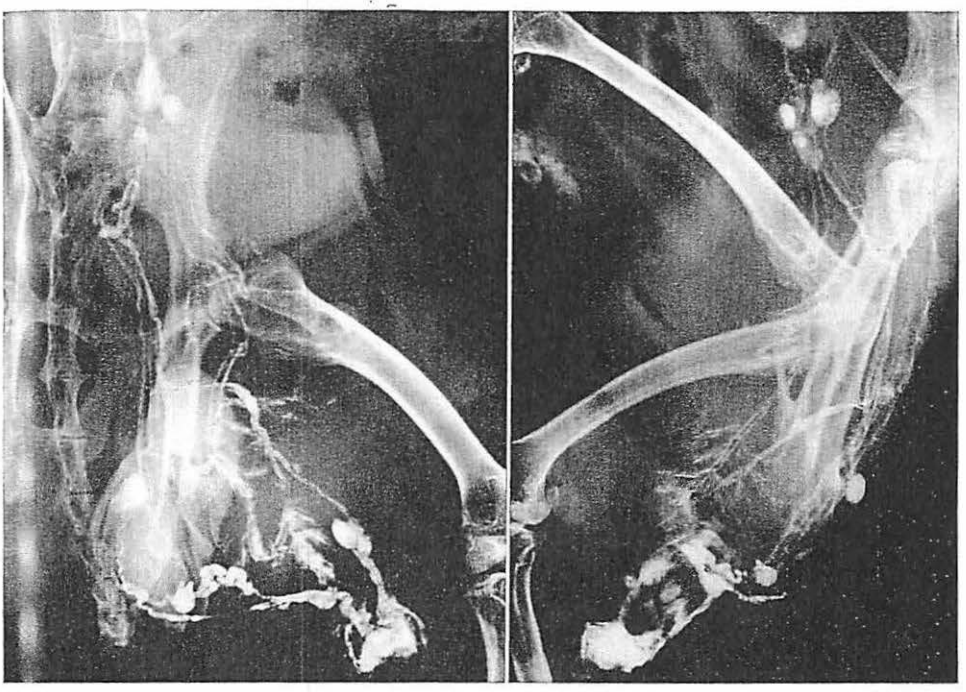


Fig. 1 Normal femoral lymph trunks of rabbit, draining directly to the iliac nodes.

Concerning the *lymph vessels*, it is by now well known that as a result of hypoplasia their calibre may be so fine that cannulation and direct lymphography are impossible, even if the procedure is carried out under magnification. On the other hand, varicose dilatations of the lymphatics may occure in certain forms of oedema. One of the most striking properties of the lymph vessels, however, is the readiness with which collaterals open up when the usual channels are blocked. Fig. 1 shows the normal femoral lymphatics in a rabbit. Fig. 2 shows the pathways taken by contrast medium from the popliteal node 6 months after ligature of the femoral lymph trunks. Some of the medium passes through

lymphatics of the adductor region into the pelvis. Another part passes through lymphatics in the posterior part of the thigh, and thence, via nodes outside the pelvis, by lymphatics accompanying the sciatic vein through the greater sciatic foramen and draining to the iliac nodes. It has been shown by diverse methods in a great number of earlier investigations that in such cases collateral lymph pathways are developed in two ways. Firstly, new lymphatics are formed, and, secondly, already-existing subsidiary channels of ini-



a b

Fig. 2 Collateral lymphatic channels in thigh of rabbit 6 months after ligature of the femoral lymph trunks. Contrast medium passes from the popliteal node into the pelvis through lymphatics in the adductor region and via lymph channels accompanying the sciatic vein in the posterior part of the thigh. Extra-pelvic lymph nodes are filled. (a) Frontal view. (b) Lateral view.

tially very fine calibre become widened to accomodate the lymph flow; as a rule both occur together. It should be noted, however, that it takes some time, several days at least, before new drainage channels become large enough to be demonstrable by macro-radiography. In experiments on dogs and rabbits I have succeeded in showing that after acute blockage of the lymphatic flow, for example by tieing off the ordinary channels, it is impossible to get contrast medium to enter any collateral pathways. Increase in the pressure of injection beyond a certain level only resulted in rupture of the obstructed vessel. The presence of a collateral circulation thus indicates *chronic* obstruction of the lymphatic flow. The reasons for this may be several, and include benign and malignant tumours, inflammation, mechanical damage, etc., and the finding of patent collaterals is therefore of limited diagnostic significance. It should also be noted that for some

reason or other the tendency of collateral lymph channels to develop and the need for new collaterals when the usual channels are blocked varies from one part of the body to another. In rabbit Vx2 carcinoma of the thigh always leads to development of collateral channels owing to occlusion of the usual pathways by carcinoma tissue (Fig. 3). In carcinoma of the lumbar region, on the other hand, collateral vessels are not opened up, although in these cases, too, there is also spread of the carcinoma tissue to the lumen of the passing lymphatics. Displacement of the lumbar lymph trunks and occasionally

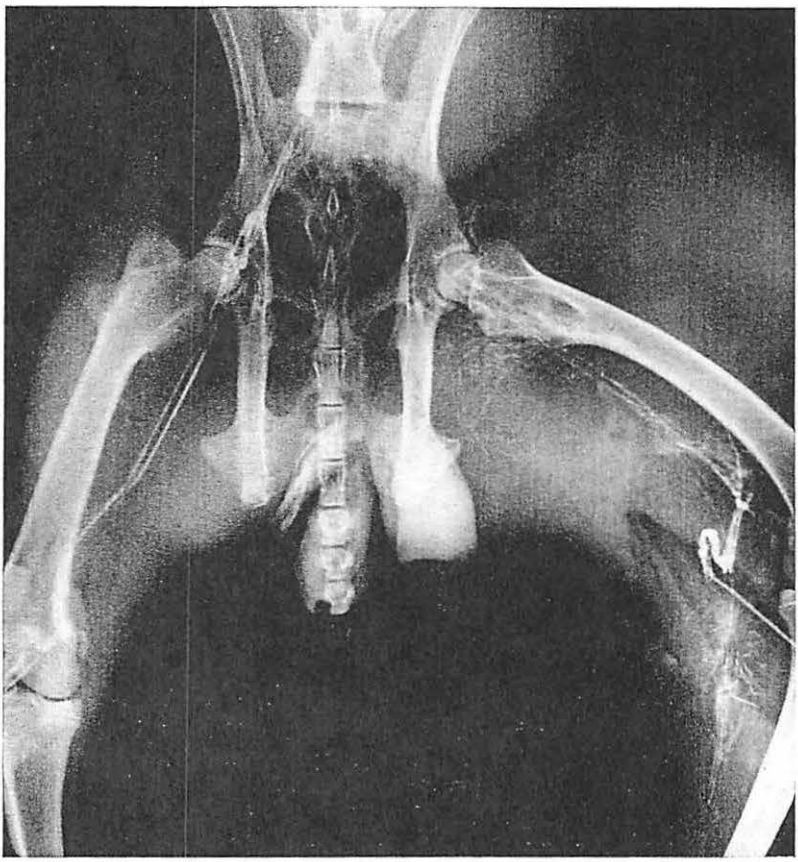
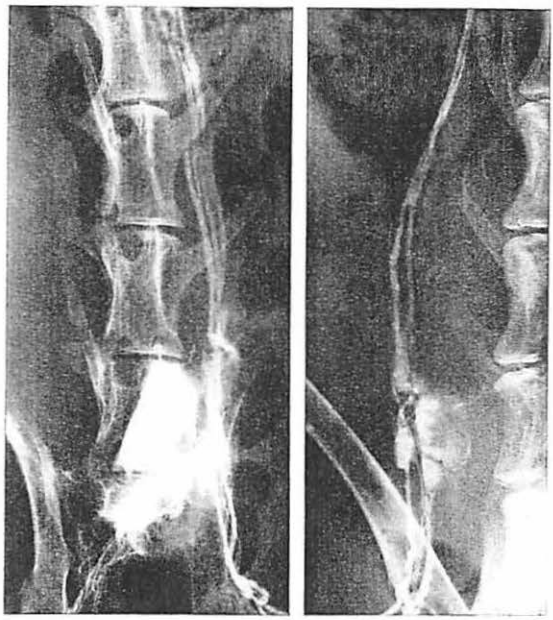


Fig. 3 Collateral lymph pathways in left thigh of rabbit in which the femoral lymph trunks are blocked by Vx2 carcinoma. The femoral lymph vessels of the right thigh are normal.

an irregularity in their lumen are the only changes to be seen (Fig. 4). The absence of collateral lymph channels thus does not exclude the presence of a pathological process that may be causing obstruction of passing lymphatics. It may also be mentioned that obstruction of lymph trunks with resultant opening up of collateral pathways should be differentiated from anomalous absence of a lymph vessel and consequential lymphatic drainage through normal adjacent channels. Such was the case in some rabbits lacking femoral lymph trunks: the efferent popliteal lymphatics drained to the lymph trunks

accompanying the sciatic vein, passing through the greater sciatic foramen to the iliac nodes.

Lymphadenograms are much more difficult to interpret than lymphangiograms, owing to the more complicated morphology of the nodes. Within a lymph node, as can be seen from the microradiogram illustrated in Fig. 5, there is a system of channels – the marginal, the intermediary, and the medullary sinuses – which are on the whole arranged in a three-dimensional network. In the meshes of this network is the specific node



a b

Fig. 4 Rabbit with Vx2 carcinoma of right lumbar region.
a) Frontal view. Irregular peripheral filling defects due to metastases are seen in the enlarged right iliac nodes. The lumbar lymph trunks are displaced by the tumour, and the lumina of some of them vesseli are irregular.
b) Lateral view. Only the left-sided iliac nodes are filled.

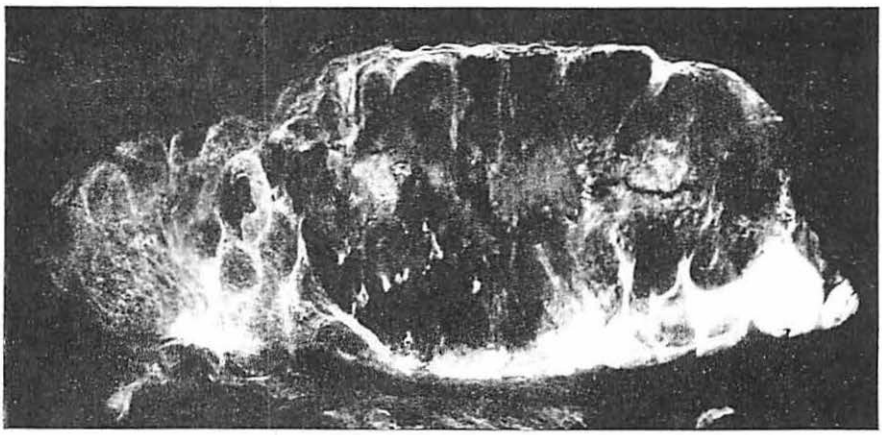
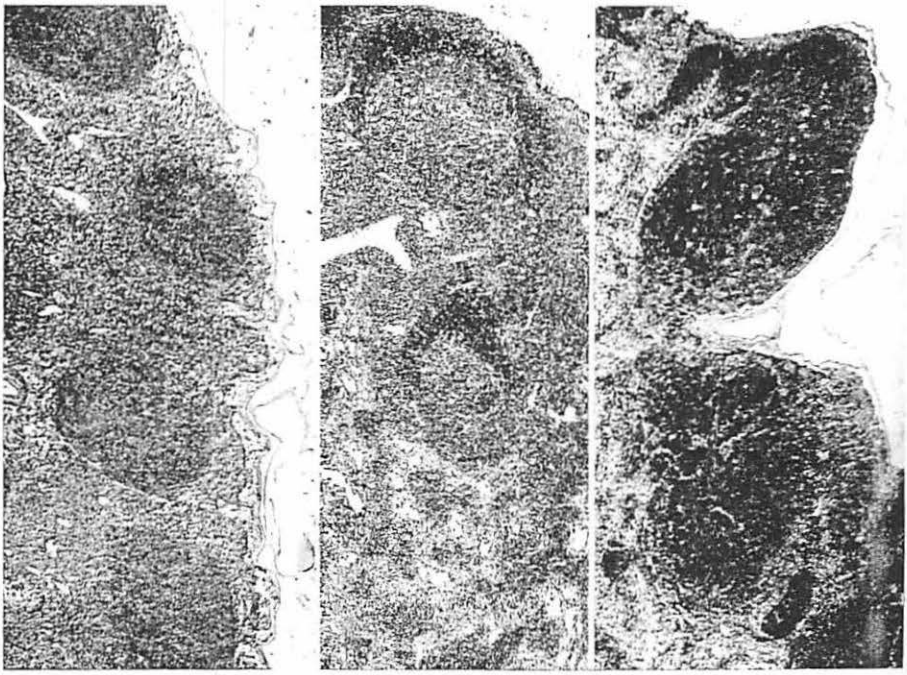


Fig. 5 Micro-lymphadenogram of rabbit, showing contrast-filled marginal, intermediary, and medullary sinuses, and peripheral filling defects due to secondary follicles (x 10).

parenchyma, arranged into a cortex and a medulla and consisting partly of so-called diffuse lymphatic tissue and partly of lymphatic follicles, i.e. dense collections of lymphatic cell elements. The histology of the follicles shows a great range of variation, and the nomenclature on the subject is rather confused. For practical purposes, however, we may distinguish two different types of true follicles, 1) a solid type, the so called *primary follicle* (Fig. 6 a), and 2) a follicle with a pale centre surrounded by a marginal zone of lymphocytes and called a *secondary follicle* (Fig. 6 b). Both the primary and the



a b c

Fig. 6 Histological sections of lymph nodes of rabbit, showing three different types of follicles. (a) Primary follicles, x 45. (b) Secondary follicles, x 55. (c) Pseudo-follicles, x 40.

secondary follicles may measure up to 500 microns in diameter. Larger condensed portion of the cortical lymphatic tissue, measuring up to 3 mm or even more in diameter, are sometimes called tertiary follicles. Opinions differ, however, whether they are true follicles or not. I would therefore propose the term *pseudo-follicle* (Fig. 6 c).

If appropriate lymphographic technique is used, a lymphadenogram of a node with functioning parenchyma shows a characteristic pattern produced by sinuses, follicles, and pseudo-follicles (Fig. 7). The filled marginal and intermediary sinuses appear as opaque streaks and rings. When closely packed, the rings give rise to a reticular pattern. On the other hand, many of the follicles which are not entered by the contrast medium give rise to filling defects (cf. Fig. 5). This is always the case with the primary follicles and also with the pseudo-follicles, but for some reason or other not always with the secondary follicles. In lymphography the most valuable information of the state of a

node is as a rule obtained by studying this roentgenological pattern, although of course estimation of the position, size, and shape of the node are also of great importance. It should be born in mind that the roentgenological structure may be obliterated if the node is overloaded with contrast medium. It is also worth mentioning that a normal lymphadenogram may show a wide degree of variation, since the architecture of the healthy node varies greatly. The fact that normal components of the node, the follicle and the pseudo-follicle, sometimes also the secondary follicles, may produce filling defects, unfortunately confuses the differential diagnosis in all disease states, such as for example metastatic carcinoma, that produce pathological filling defects. Conditions are further complicated by the fact that the follicles increase both in number and size in all conditions that in one way or another bring about irritation of the node parenchyma. Such is the case, for example, in metastatic carcinoma.

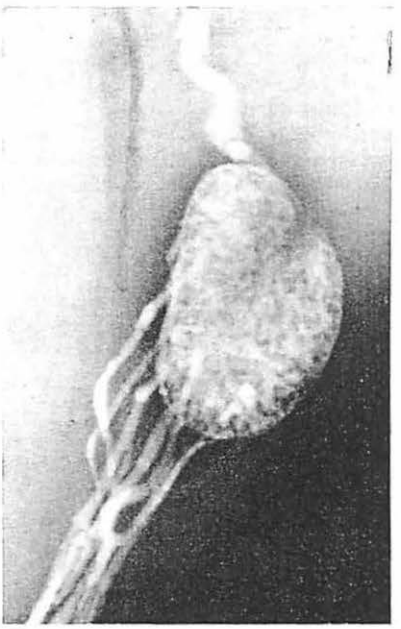


Fig. 7 Macro-lymphadenogram of healthy dog, showing a characteristic pattern produced by filled marginal and intermediary sinuses and follicular filling defects. In places closely packed opaque rings give rise to a reticular structure.

I hope it will have been clear from the above that in interpreting lymphadenograms it is of the utmost importance to identify the follicular filling defects. It is helpful to remember that they are often surrounded by an opaque ring produced by marginal and intermediary sinuses in the immediate vicinity of a follicle, a group of follicles, or a pseudo-follicle and that the diameter of the latter rarely exceeds 3 mm.

Even if the differential diagnosis between different disease states involving the lymphatic system is confused by the morphological characteristics of lymph vessels and nodes, there can be no doubt that in many different circumstances, not least in tumours of pelvic organs, a roentgenological investigation of the regional lymphatic structures will be of great help in making a diagnosis, in determining the extent of the processes, and in planning treatment.

Reference

Tjernberg, B.: Lymphography. An Animal Study on the Diagnose of Vx2 Carcinoma and Inflammation. Acta radiol. (Stockh.) 1962, Suppl. 214

Doz. Dr. Bengt Tjernberg, Lästmarkargatan 8 B, S-75434 Uppsala/Sweden