

LYMPHANGIOGRAPHY IN CHILDREN*

BY

MALCOLM H. GOUGH

From the Department of Surgery, St. Thomas's Hospital Medical School, London

Lymphangiography was first introduced by Kinmonth in 1951. Although some years previously lymphatic vessels had been demonstrated it was not until this time that the technique was developed for use in clinical medicine.

Lymphatic vessels may be demonstrated visually—visual lymphangiography—or by radiographs following the use of a contrast medium. It is necessary to introduce such a medium into the lymphatic vessels and therefore visual lymphangiography is a necessary preliminary to x-ray lymphangiography.

Material and Method

The vessel is identified following the subcutaneous injection of a diffusible dye. 'Patent blue violet' has been found to be the most satisfactory for this purpose: it diffuses rapidly (a process aided by local massage), clears rapidly and its use is attended by no ill effects. In limb studies the dye is injected into the web spaces between the fingers or toes. If during a laparotomy, for example in a case of chylous reflux, the bowel or mesenteric lymphatics are to be demonstrated a subserosal or submucosal injection is satisfactory. 'Patent blue violet' is used in 10% aqueous solution, which is isotonic, and about 0.1 ml. is injected into each web space. In a normal limb the coloured lymphatics will be visible through the skin, but this appearance may be masked where there is oedema. In a lymphoedematous limb due to obstructed lymphatics a blue 'blush' will probably appear on some part of the foot or lower leg. This represents 'dermal backflow' of the dye into an abnormally distended dermal lymphatic plexus.

An incision is made on the dorsum of the foot or ankle over a lymphatic vessel which is then carefully dissected from the surrounding subcutaneous tissue. An operation microscope greatly facilitates this procedure, especially in small children or in children with abnormally small lymphatics. With an assistant obstructing the vessel proximally so as to dilate it, it is then possible to introduce a needle into its lumen. The needle is size 30 S.W.G. and is swaged onto flexible translucent vinyl tubing. This tubing has a No. 14 needle swaged to its other end by which it is connected to the syringe. Our present practice

is to prepack these sets and sterilize them by gamma radiation. The x-ray contrast medium to be injected may be either water soluble (e.g. Hypaque) or oily. The advantage of a water soluble medium is that it can be easily and rapidly injected. It gives good pictures of the peripheral lymphatics, but becomes diluted as it passes centrally, and little or no definition of the lymph glands is obtained.

We now always use an oily contrast medium, usually Ultrafluid Lipiodol (Bengue). Other similar preparations are Neo-Hydriol (May and Baker) and Ethiodol (Fougera Inc.). These oily media are more difficult to inject and the injection takes a longer time: for this reason an injection machine is a great advantage and we use one designed in Lund, Sweden (Clementz and Olin, 1961) (Fig. 1). Oily media may be injected at the rate of about 1 ml. every 8 to 10 minutes; a faster rate leads to extravasation through the vessel wall, and dosages should not exceed 0.25 ml. per kilogram of body weight. This amount will provide filling, in lower limb injections, of inguinal, pelvic and para-aortic glands; often the thoracic duct will be seen also. Amounts in excess of this quantity may be dangerous due to pulmonary oil embolism, and should only be exceeded when there is a known adenopathy which will take up larger quantities of medium.

Radiographs are taken at the end of injection to show the peripheral vessels, and 24 hours later to show the glandular pattern. The oil may remain in the glands for periods up to six months. No ill effects have been seen from this prolonged retention, and experimental work in rabbits has not shown any significant reaction in the glands for periods up to four months (Guiney, Gough and Kinmonth, 1963).

Full details of this recent technique of, and equipment required for, lymphangiography have recently been published elsewhere (Gough, Guiney and Kinmonth, 1963).

Clinical Applications

Lymphangiography is being increasingly used to diagnose the underlying pathology in patients with lymphoedema; and also to determine the extent of malignant processes. Examples of limb lymphangiograms are shown in Figs. 2-9. Figs. 10-12 demonstrate abdominal glands.

* A paper read at a meeting of the British Association of Paediatric Surgeons in Sheffield, July 1963.

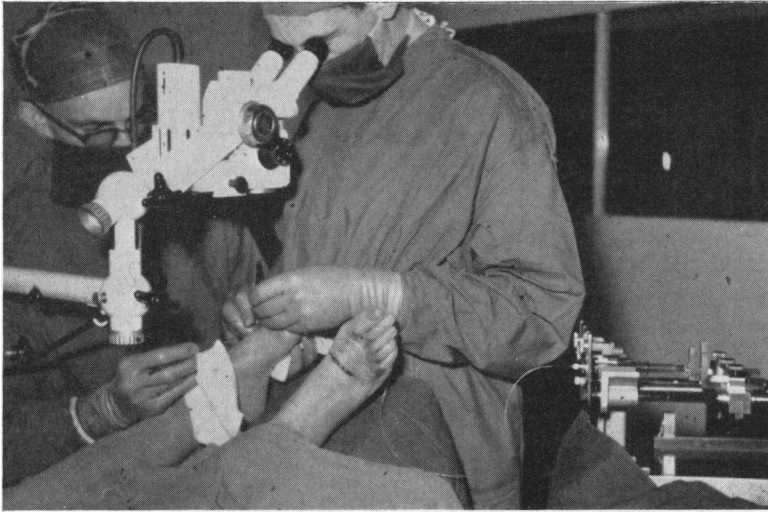


FIG. 1.—View of operating theatre showing Zeiss operation microscope and injection machine.

Kinmonth (1954) has described primary lymphoedema as being caused by aplasia or hypoplasia of the lymphatics or glands, or varicosity of the lymphatic vessels. With a knowledge of the extent of the

lymphatic abnormality, rational therapy can be planned. Gross lymphoedema with widespread aplasia or hypoplasia will require treatment by a reducing operation such as the Charles operation.

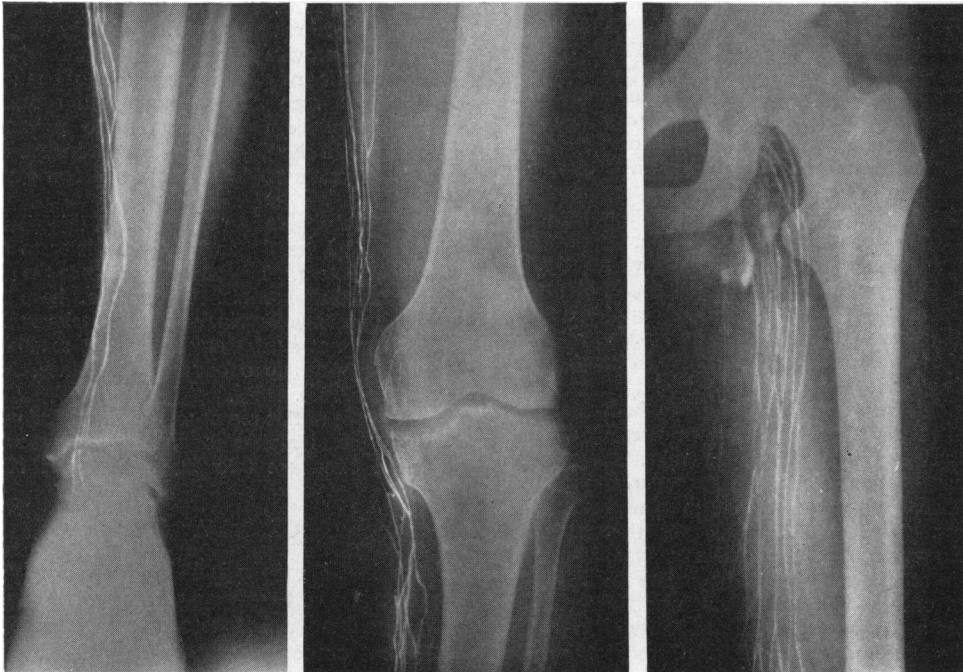


FIG. 2.—A composite picture showing normal superficial lymphatics of the lower limb. The contrast medium is injected into a lymphatic on the dorsum of the foot, and the vessels are seen to increase in number as they pass proximally.

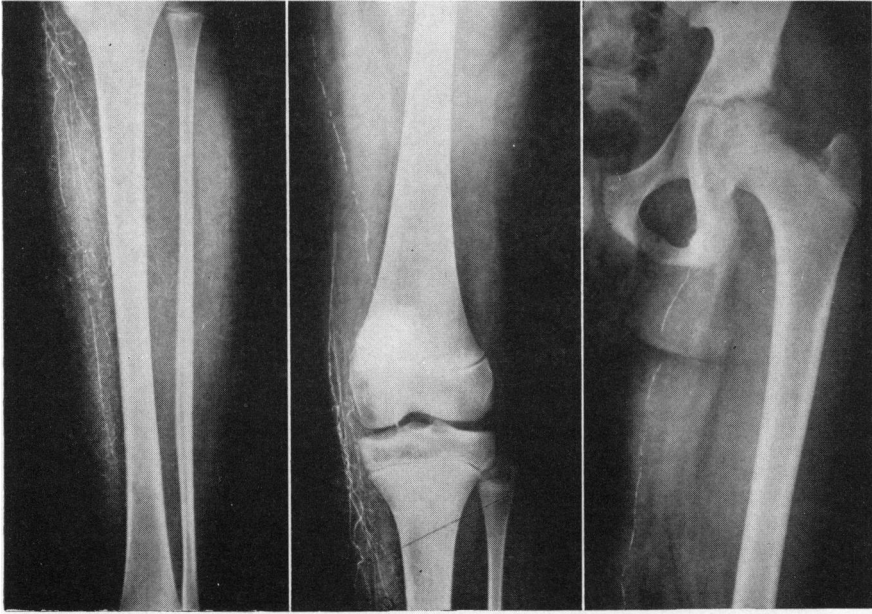


FIG. 3.

FIG. 4.

FIG. 5.

FIGS. 3, 4 and 5.—The lymphangiograms of a 12-year-old girl who had noticed increasing swelling of her leg and thigh for five years. Fig. 3 shows an obstructive picture in the leg with many distended superficial lymphatic vessels. In Fig. 4 this plexus becomes less noticeable at the level of the knee but there is an absence of normal thigh lymphatics. Fig. 5 shows a solitary thigh vessel leading to a solitary superficial inguinal gland. The diagnosis here is one of hypoplasia of the thigh lymphatics and inguinal glands.



FIG. 6.

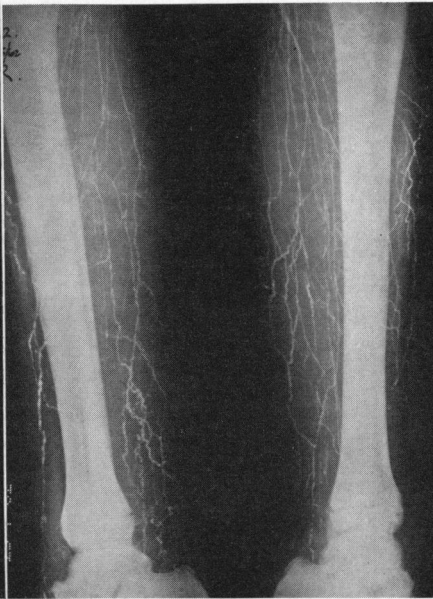


FIG. 7.



FIG. 8.

FIG. 6.—A bilateral lymphangiogram of a 4-month-old infant with swelling of the right lower limb. On the left the superficial vessels and glands appear normal while on the right there is an obstructive pattern over the calf and lower thigh, with arrest of the passage of medium just above the superficial inguinal glands. Diagnosis was right iliac gland aplasia.

FIG. 7.—Varicose lymphatics in a 15-year-old boy with bilateral lymphoedema.

FIG. 8.—Lower limb lymphangiogram in a child of 3 years with peripheral lymphoedema and Turner's syndrome. The vessels here demonstrated are deep lymphatics passing proximally in relation to the femoral vessels. Recently, superficial-deep lymphatic communications have been demonstrated in Turner's syndrome (this will be reported in full elsewhere), and this fact is undoubtedly the reason for the frequent spontaneous improvement of the lymphoedema in such patients.

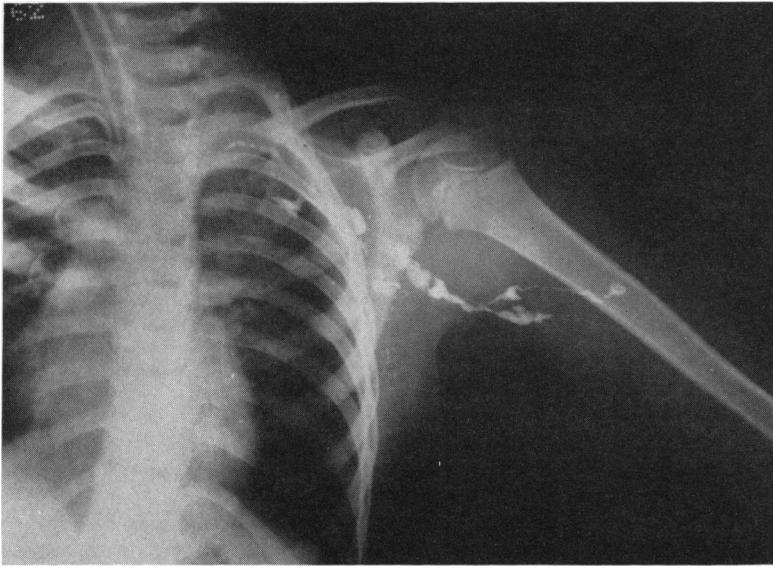


FIG. 9.—An upper limb lymphangiogram in a girl of 6 years with a soft tissue swelling of the lateral chest wall. The medium is seen passing both to the axillary glands and also into irregularly dilated spaces which communicate with the swelling. Diagnosis—diffuse lymphangioma.

However, if obstructed distal vessels with localized inguinal or pelvic glandular aplasia are shown, it may be possible to plan some sort of by-pass operation using, for example, a pedicle graft as described by Gillies and Fraser (1935). The results of operations in

which fine plastic tubes have been inserted from abnormal to normal areas of lymphatic drainage have been disappointing. Further experimental studies are proceeding in an attempt to find a more satisfactory means of by-passing localized obstructions.

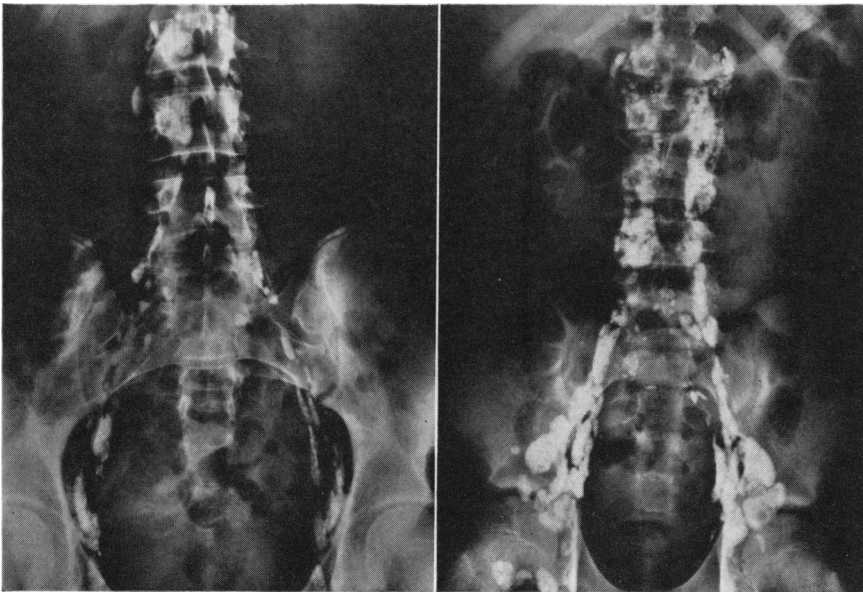


FIG. 10.

FIG. 11.

FIG. 10.—Normal abdominal lymphadenogram. Film taken 24 hours after injection. The oily medium has cleared from the vessels but remains in the glands.

FIG. 11.—Abdominal lymphadenogram in a 15-year-old boy suffering from tuberculous adenitis (proven by biopsy).

Further ways in which lymphangiography has been of assistance are: (1) in the detection of metastatic deposits in lymph nodes in malignant disease; (2) in

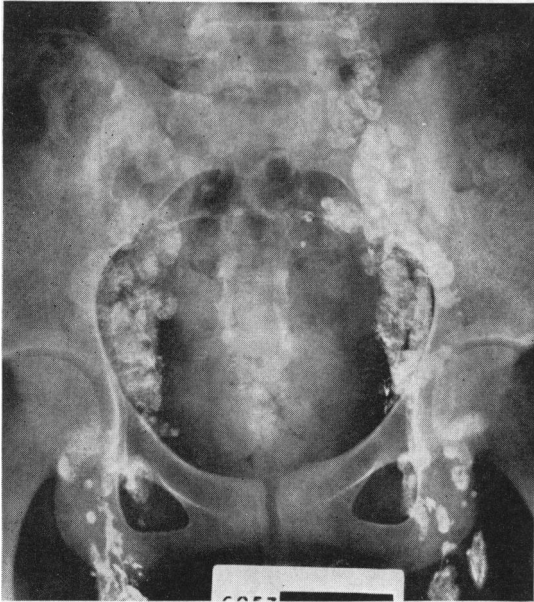


FIG. 12.—Abdominal lymphadenogram in a 17-year-old girl who had been diagnosed as having Hodgkin's disease at the age of 13. She had then been successfully treated by local irradiation to the affected cervical region. Prior to this admission she had been complaining of lassitude and was found to be anaemic. There was no clinical evidence of recurrent Hodgkin's disease. This lymphadenogram shows multiple enlarged iliac and para-aortic glands. Laparotomy was rendered unnecessary and treatment with chlorambucil was commenced.

the investigation of patients with pyrexia of unknown origin, or splenomegaly, when all other tests have proved inconclusive; (3) in adults, endolymphatic therapy with radioactive isotopes (^{98}Au or ^{131}I) has been employed in the treatment of malignant disease; and (4) endolymphatic therapy with cytotoxic agents may, after further experimental studies, prove to be a practical form of therapy in patients with lymphomas.

Summary

Recent improvements in the technique of lymphangiography, including the use of oily contrast media, have been described. The value of the investigation in children with congenital lymphatic abnormalities, and also in those suffering from lymphoma, has been demonstrated.

I gratefully offer my thanks to Professor J. B. Kinmonth for introducing me to this technique and for his encouragement; to Mr. Derek Rutt for technical assistance; and to the Photographic Department of St. Thomas's Hospital for illustrations.

REFERENCES

- Clementz, B. and Olin, T. (1961). Apparatus for controlled infusion of saline in angiography and contrast medium in lymphography. *Acta radiol. (Stockh.)*, 55, 109.
- Gillies, H. and Fraser, F. R. (1935). Treatment of lymphoedema by plastic operation. (A preliminary report). *Brit. med. J.*, 1, 96.
- Gough, M. H., Guiney, E. J. and Kinmonth, J. B. (1963). Lymphangiography: new techniques and uses. *ibid.*, 1, 1181.
- Guiney, E. J., Gough, M. H. and Kinmonth, J. B. (1963). Lymphography with fat-soluble contrast media. Studies of their effect in lepus cuniculus. *J. thorac. cardiovasc. Surg.* In the press.
- Kinmonth, J. B. (1951). Communication to Medical Research Society, London.
- (1954). Lymphangiography in clinical surgery and particularly in the treatment of lymphoedema. *Ann. roy. Coll. Surg. Engl.*, 15, 300.