

Animal Experimental Studies of Indirect Lymphography of the Eye, Face and Neck Regions using Iotasul

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Summary

In experiments in the dog, it is possible to demonstrate the lymph drainage system of the conjunctiva and lids as far as the jugular trunk by means of indirect administration of the water-soluble contrast medium Iotasul and application of a pressure bandage. Quicker opacification of the cervical lymph nodes can be achieved by simultaneous indirect lymphography (SIL) which also includes the chin region.

Introduction

Lymphography of the eye, face and neck regions is still in the experimental stage. Although it is possible to demonstrate the network of conjunctival lymph vessels *in vivo* using patent blue, lymph drainage from this region into the jugular trunk via the individual groups of lymph nodes escapes detection. Our concept of the lymph drainage in this region is based on vascular preparations using cadavers (*Mascagni* 1787, *Teichmann* 1861, *Most* 1905), on measurements in animals of the distribution of activity following injection of radioactive tracers (*Grüntzig* et al. 1977a, b; 1978a, b) and on India-ink preparations (*Grüntzig* and *Huth* 1977).

Lymphography with oily contrast media is not used in the region of the eye. Apart from the difficult intralymphangial application techniques in this region, the possible complications of such contrast media, e.g. foreign body reactions, allergic reactions and embolisms, also make it unsuitable for use in the eye. On top of this, visualization of the efferent tract is incomplete.

Inoue et al. (1980) recommended direct lymphography with Lipiodol from the chin for lymphography in the region of the face and neck. However, visualization of the efferent lymphatic tract is again incomplete and the technical difficulties are similar to those encountered in direct lymphography of the posterior auricular region (*Krish* et al. 1972). In 1976, *Stutte* and *Arnaudow* reintroduced indirect lymphography with Lipiodol ultrafluid into the retromolar mucosal fold (mini-pig), but this proved to be just as unsatisfactory.

Iotasul – a new development – is a water-soluble contrast medium which is suitable for direct and indirect lymphography (*Siefert* et al. 1980). The object of the present animal experimental studies with this new substance was to establish the extent of contrast visualization of the lymph drainage system in the region of the eye, face and neck.

Material and Methods

All studies were conducted with Iotasul, a water-soluble dimeric hexaiodinated non-ionic contrast medium. The iodine content in aqueous solution was 275 mg iodine/ml and the viscosity was 19.8 MPas.

The only animals used were dogs anaesthetized with barbiturates (Nembutal® *i.v.*). Ketamin (Vetalar® *i.m.*) was also administered as required to increase the depth of anaesthesia.

To demonstrate the lymph drainage system of the conjunctiva, the conjunctival lymph vessels were first of all visualized by means of Patent-blue (*Grüntzig* 1978). After this,

1–2 lymphography needles were fixed intraconjunctivally in the vicinity of the efferent lymph vessels at the outer angle of the eye (tip of the needle in the direction of flow – temporal and to the outside). About 6 ml Iotasul were infused by means of a perfusor at a rate of 0.1 ml/min. A pressure bandage was applied to the eye to increase the tissue pressure. Corresponding interstitial infusions were made into the epidermis of the lids and chin. The infusions were performed from 4 different injection sites – simultaneously in some cases.

The X-rays were made with a Siemens Siregraph B (12-pulse generator). Spot films were made with the films Curix R P 1 (Agfa-Gevaert) and the foils Cawo SE I (rare earths) under fluoroscopy with the high-resolution X-ray television Videomed H.

Results and Discussion

No side effects attributable to Iotasul were observed in our studies. Local oedema following infusions regressed within 24 hours, and were reduced after pressure bandages. All animals excreted the contrast medium within a few hours via the kidneys: control films taken after 24 hours failed to reveal any radiological contrast medium residues in any of the animals. The eyes (conjunctiva, lids) displayed no inflammatory reactions. The pre-requisites for successful indirect lymphography with Iotasul are administration into suitable catchment regions of the lymph vessels concerned on the one hand and, on the other, a depot-induced increase of tissue pressure which, as it were, presses the contrast medium into the lymph capillaries. These conditions are only partly present in the conjunctiva, since this loose tissue can expand greatly because of the open palpebral fissure. However, we circumvented this drawback by closing the lids and applying a pressure bandage.

Intraconjunctival infusion leads to demonstration of the efferent lymph vessels and the loco-regional lymph nodes (parotid lymph glands) (Fig. 1). This visualization corresponds to the drainage of lymph observed using the extremely difficult method of direct vascular puncture



Fig. 1 Parotid lymph nodes (arrow) with efferent lymph vessels following intraconjunctival infusion (0,1 ml/min) Iotasul

(Grüntzig et al. 1981). If the infusion is made from the lids, the lymph vessels likewise drain into the parotid lymph glands. The infusion technique chosen by us demonstrates within 30–40 minutes not only the submandibular and cranial lymph vessels of the neck, including their faint valvular constrictions, and the network of cervical lymph nodes, but also the flow of contrast material from the jugular trunk into the venous angle (Fig. 2).

Infusion into the mental skin (2 or 4 infusion sites lateral of the median plane) leads to simultaneous visualization of the bilateral lymphangial network and of the submandibular and cervical lymph nodes; drainage communications to the parotid lymph glands can also be demonstrated. If a pressure bandage is not used, it is also possible to visualize superficial cutaneous lymph vessels in the cervical region with drainage into a supra-clavicular lymph node (Fig. 3).



Fig. 2 Parotid lymph node, afferent and efferent lymph vessels, cervical lymph nodes and jugular trunk following indirect Iotasul infusion (0,1 ml/min) into the lids (infusion time: 45 min)

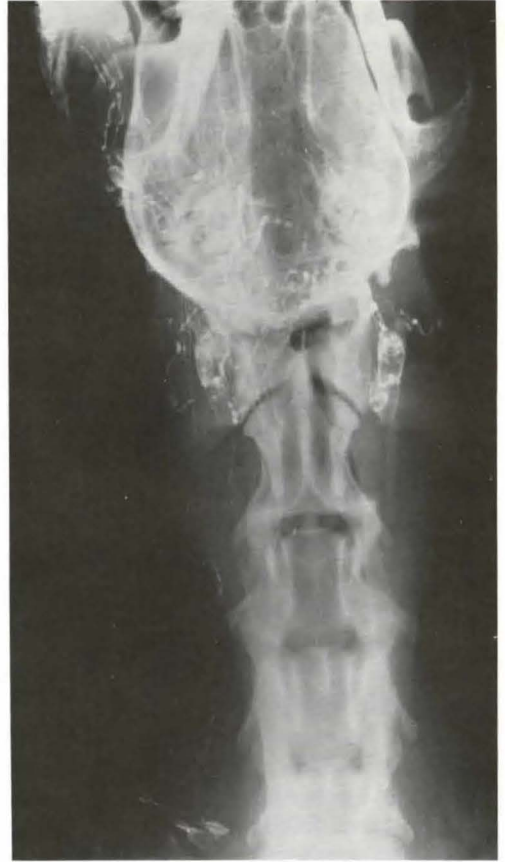


Fig. 3 Cervical lymph nodes, superficial cutaneous lymph vessels and supraclavicular lymph nodes following simultaneous indirect Iotasul infusion into the lids and chin (bilateral)

If the conjunctiva, lid and chin are infused in combination (bilaterally), films are obtained which are reminiscent of the splendid vascular preparations of *Mascagni* (1787) (Fig. 4).

An additional advantage of simultaneous indirect lymphography (SIL) is that the amount of contrast medium infused at the individual infusion sites can be kept low and that quicker opacification of the cervical lymph nodes can be achieved – particularly if a pressure bandage is applied.

The excellent tolerance of Iotasul in direct and indirect lymphography has been demon-

strated in animal experiments (*Wenzel-Hora et al.* 1980). The good radiological effects on intraconjunctival and intrapalpebral administration of Iotasul permit for the first time in vivo visualization of the efferent lymph vessels and nodes of the eye. Infusion from the chin, which is technically very simple, also leads to demonstration of the cervical lymph nodes. Simultaneous indirect lymphography (SIL) considerably simplifies the observation and evaluation of the lymph drainage system in the region of the neck and head. Clinical studies must now be performed to establish whether this examination technique can be

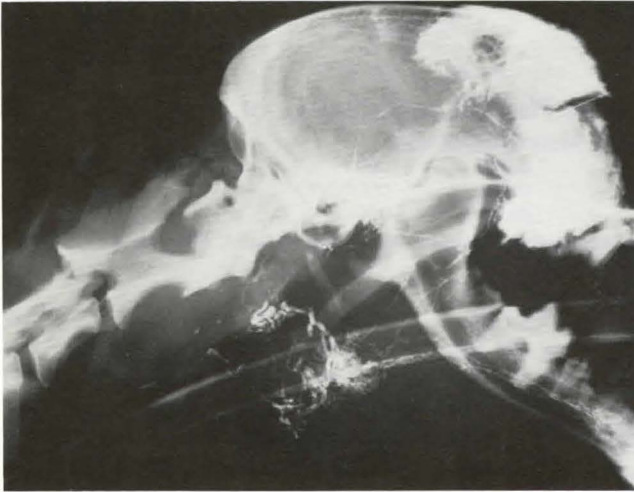


Fig. 4 Demonstration of the lymph vessels and nodes following simul- simultaneous indirect Iotasul infusion into the lids and chin

used routinely for the diagnostic assessment of disturbances of lymph drainage or of meta- static disease in the cervical region.

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