

Lymphoscintigraphy

Report
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Report by:

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from Mike Peters)

Purpose

This guideline must be read in conjunction with the BNMS Generic guidelines.

The purpose of this guideline is to assist specialists in Nuclear Medicine and Radionuclide Radiology in recommending, performing interpreting and reporting the results of lymphoscintigraphy. This guideline will assist individual departments to formulate their own local protocols.

Background

Lymphoscintigraphy is a safe, minimally invasive, well established method for assessing lymphatic drainage in the investigation of lymphoedema.

In the limbs, normal superficial lymphatic drainage occurs through lymphatic tracts which run within the superficial venous epifascial planes, then sequentially to the inguinal nodes, iliac nodes and paraaortic nodes. When normal routes are obstructed, lymphatic drainage is diverted either into the skin by dermal backflow or into the deep subfascial planes resulting in popliteal nodal uptake.

Common Indications

Investigation of lymphoedema.

Contraindications

1. Absolute – None
2. Relative – pregnancy and breastfeeding.

The effective dose from lymphoscintigraphy is 0.05mSv and therefore no interruption to breast feeding is required however, as lymphoedema is a non-life threatening condition, consideration should be given to delaying investigation until after breast feeding has ceased. The same principle applies in pregnant patients.

Procedure

1. Patient preparation

Skin preparation prior to injection using iodine or frozen alcohol sterets. Emla cream should **not** be used as it may affect absorption of tracer into the lymphatics.

The patient is warned that the injection may sting.

2. Injection site and technique

A single subcutaneous injection within the first webspace of both feet (or hands) by the same operator.

Volume of injection = 0.2mls. The dermal space is small therefore a small volume with high specific activity is required.

Both limbs should be evaluated for internal comparison and assessment of subclinical disease.

Radiopharmaceutical

1. Technetium-99m Nanocolloid. The optimal particle size for lymphoscintigraphy is 50-70 nm. At least 95% of nanocolloid particles have a diameter <80nm and are cleared rapidly from the injection site. Therefore this is the preferred radiopharmaceutical in the UK.
2. ARSAC diagnostic reference level 20MBq **per limb**.

Image Acquisition

1. Camera - Large field of view, dual head detector system.
2. Collimator - Low Energy High Resolution parallel hole (LEHR)
3. Whole body scanning mode.
4. Matrix size 256 x 256
5. 20% window centred on the 140KeV photopeak of ^{99m}Tc .
6. Patient positioning – the patient is imaged supine.
7. Acquisition :
Both limbs must be imaged simultaneously using a whole body sweep at **8-12cm/minute** from feet (including the injection site) to the upper abdomen including the liver.

Early views of the liver area are important to exclude accidental intravenous injection.
On late images liver activity confirms completion of the lymphatic circuit with activity passing from the thoracic duct into the systemic circulation.

Imaging of the injection site is essential even on late views for evaluation of dermal backflow, which can occur very late.
8. Standard imaging would be expected to take up to 3 hours.
Recommended imaging times are 45 minutes and 3 hours or 30 minutes, 1, 2 and 3 hours.
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9. Cobalt markers can be used to identify anatomical landmarks (ankles, knees, pelvis).

Data Analysis

Quantification can be utilised which is especially helpful in the evaluation of bilateral swelling, with assessment of injection site clearance or inguinal/iliac nodal uptake as a percentage of the injected activity. The method and normal range for this should be established for individual departments.

Interpretation and Reporting

1. Normal features include:

Swift uptake into lymphatic tracts with visualisation of discrete lymphatic channels (usually 3-5 in the calf and 1-2 in the thigh).

Activity is usually apparent within inguinal nodes by around one hour, para-aortic nodes by two hours and the liver (indicating completion of the lymphatic circuit) by around three hours.
2. Findings in lymphoedema include-

Delayed transit of activity relative to the normal side in unilateral oedema
Reduced activity /non visualisation of the lymphatic channels
Poorly visualised / reduced number of lymph nodes.

Diversion of activity through the skin lymphatics, indicated by dermal backflow. 'Stocking sign'.

Visualisation of collateral lymphatic vessels

The presence of abnormal deep collateral flow e.g. visualisation of popliteal nodes

Presence of lymphocoeles / lymphangiectasia.

3. Exercise and even standing, has been shown to enhance lymphatic drainage by extrinsic compression of lymphatic vessels by the skeletal musculature. This can be useful if uptake and transport of tracer is very delayed. Hand gripping exercises can be used when examining the upper limbs.

Mobilisation between the 45minute and 3 hour images can enhance lymphatic flow.

Problems and Pitfalls

1. The rate of lymphatic drainage may be rapid or slow, depending on the individual patient and the subsequent imaging must be adjusted accordingly.
2. Early images alone may lead to false negative results as dermal backflow may occur very late. For this reason it is important to include the injection site in the field of view even on late images.

Controversies

1. Route of injection both intradermal and subcutaneous injection may be used to evaluate the superficial lymphatic system. There are conflicting views in the literature as to which route is better. Intradermal injection provides a larger surface area for tracer uptake resulting in more rapid uptake and clearance from the injection site, but the subcutaneous injection site (as recommended here) is more likely to demonstrate the communication between subcutaneous tissues and the draining lymphatics more completely.
2. Most centres use single site injections per limb and this is our recommendation. If 2 injections are used, caution should be used in the interpretation of the results, as a more laterally placed injection in the dorsum of the foot may cause uptake in the deep lymphatic system, resulting in visualisation of 1-2 popliteal nodes as a normal feature.
3. Quantitative studies assess the speed with which the lymphatics transport the injected molecule and are particularly helpful in assessing bilateral lymphoedema where the signs of slow absolute uptake can be subtle. There are a number of examples within the literature of quantitative methods however, to ensure reproducibility, the same type and volume of radiopharmaceutical must be used along with a standardised method of injection, amount of exercise and mode of acquisition. There are no universally established normal ranges.

4. Lymphoedema has no cure and there is debate on the effectiveness of the available therapies for its treatment. However, the aims of treatment such as manual lymphatic drainage techniques are symptom relief, to prevent progression of disease from oedema to cutaneous fibrosis, prevention of secondary infections and reduction of limb size.

References

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Date for review

Comment	Date	Version	Reviewer
First draft	Aug 2011	1	Vidhiya Vinayakamoorthy, Charlotte Fowler and Mike Peters
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