Gamma camera imaging of orthopaedic infection using Tc99m-LeukoScan®

Disclaimer

This document is made available for general guidance purposes only. We do not claim that it represents a definitive method, although it is based on over two years’ experience. Some of the detail is equipment-specific, but this should be readily translatable to your own set-up.

Pilgrim Health NHS Trust will accept no liability for damages connected with the adoption of this procedure, howsoever caused.

This procedure describes the use of LeukoScan®, which is a licensed product supplied by Immunomedics Europe.

‘Preparations’

Clinical Indications

Deep infection associated with hip or knee replacements, osteomyelitis, septic arthritis, etc.

Contraindications

Pregnancy.

Particularly during the early stages of pregnancy, LeukoScan imaging should only been performed in exceptional circumstances. That is, where the clinical imperative is to make a diagnosis of bone infection that would outweigh the possible risk to the foetus (estimated dose to the foetus is 4 μGy). Otherwise, the scan should be postponed until after the baby is born, or at least until the third trimester.

Drug interactions

None yet known. Antibiotics should not interfere with efficacy of scan.

Breast feeding

If breast feeding, patient should discard all milk expressed in the 24 hour period following LeukoScan administration, then resume as normal. Patient can be advised to express extra milk prior to injection to cover this 24 hour period.

Patient preparation

No special preparation but, if this is second (follow-up) LeukoScan, check that HAMA (human anti-mouse antibody) levels have been measured and shown to indicate no abnormal elevation (as a result of the previous dose). In patients with elevated HAMA levels there is a slightly higher (but still very small) risk of allergic reaction. With raised HAMA levels, the biodistribution of LeukoScan may be altered, so the “abdominal QC image” (see acquisition procedure) would then be particularly important.
Precautions

At a dose of 0.1-0.25mg, allergic reactions to mouse protein are expected to be rare, but are nonetheless possible. Do not worry the patient with this information (actual risk of adverse reaction is thought to be no greater than some other commonly used radiopharmaceuticals) but the following precautions should be taken as, in theory at least, a severe allergic reaction (e.g. anaphylactic shock) is possible.

There is no need to have medical staff actually in attendance when the injection is given, but make sure you know whereabouts of medical staff in the nearby Cardio-Respiratory Department just in case they are needed. If unavailable, the departmental staff nurse will administer first-aid in the event of an acute reaction and the crash team should be called if necessary.

In any event, detain the patient in the Waiting Room for about 15 minutes after injection to check for side effects. If OK, discharge the patient and remind him/her of the time to return for the actual scan.

Special arrangements for children

Children should be injected on the Children's Ward, where specialised backup facilities (ref: possible allergic reaction) are available. Then administered activity should be reduced (ref: adult dose) according to body weight, as recommended by the EANM Paediatric Task Group Report. Also, for any young children, the ward staff can administer EMLA cream in advance. The child and parents can than remain on the Children's Ward prior to the scan where they can use the Play Room, etc, and be observed by the Ward Staff.

Related NM procedures

The patient will ideally need a bone scan with which to compare the LeukoScan results. Check that the bone scan has either been done or is in hand. The bone scan would normally be arranged 2-3 days before the LeukoScan. The exception would be an urgent in-patient in whom there may only be time to perform one of the procedures (e.g. patient going to theatre), in which case the LeukoScan should be done in preference to the bone scan. If possible (e.g. patient not gone to theatre yet), the bone scan would then be performed 2 days afterwards.

Injection details

Administered activity: 650 MBq (approx) for adults.
Standard dose reduction formula for children.

Mass of antibody: 0.1 mg (minimum) - i.e. maximum of 3 patients per vial.
Injected volume: 0.5ml (approx). The prep vial will contain 1.5ml.

Technique: Intravenous, using green butterfly to check proper venous access. Inject over a period of about 10 seconds and flush butterfly assembly with saline

Delay between injection and scan

4-5 hours
**Instructions / Restrictions regarding the above period**

None

**Camera / computer set up**

**Collimator**

Low energy, high resolution

**Computer**

Run the LEUK STATIC [1] acquisition protocol on ICON1. This protocol is set up to acquire one pair of static images, so will have to be run repeatedly to acquire multiple views.

In summary, the following parameters will be set:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mode</td>
<td>Static</td>
</tr>
<tr>
<td>Isotope pre-set</td>
<td>Tc99m</td>
</tr>
<tr>
<td>Detector 1</td>
<td>ON</td>
</tr>
<tr>
<td>Detector 2</td>
<td>ON</td>
</tr>
<tr>
<td>Stop conditions</td>
<td>300 seconds (designed to give about 200-400k counts per view, depending on projection.)</td>
</tr>
<tr>
<td>Matrix size</td>
<td>256x256</td>
</tr>
<tr>
<td>Zoom factor</td>
<td>1.23</td>
</tr>
</tbody>
</table>

These options can of course be changed each time the program is started. However, the only options that should need to be changed between views are the zoom factor and the ON/OFF status of detector 2.

**Views to be obtained**

In addition to the specific views described below, simultaneous POST/ANT views of the abdomen (centred on kidneys) should be obtained for quality control reasons - to check that the in-vivo distribution of LeukoScan is as expected. This view can be stopped manually (after 2-3 minutes) when 600K cts (from the POST view) have been acquired. This view can be obtained either at the beginning of the study or at the end.

**Patient positioning**

Supine on imaging table.

1. **Total KNEE replacement**

Simultaneous ANT / POST views of both knees (detectors 1 & 2 ON)

Lateral view of left knee (turn one of the detectors OFF; which one will depend on view)

Lateral view of right knee (turn one of the detectors OFF; which one will depend on view)

**Patient positioning**

For simultaneous ANT/POST view - supine on imaging table.

For lateral views - supine or sitting whichever is more comfortable for the patient.
2. Total HIP replacement

Simultaneous ANT / POST views of the pelvis/upper femur (detectors 1 & 2 ON)
Individual ANT view of the prosthetic hip (turn one of the detectors OFF)
Corresponding ANT individual view of the other hip

**Patient positioning**

Supine for all views

3. General osteomyelitis

Check what is written on request card, particularly any comments/instructions added by Consultant Physicist.

Peripheral bones/joints are usually involved (e.g. ankle, wrist, knee, elbow, etc), in which case a single view of both bones/joints (L & R) should be obtained, plus individual ANT zoomed (factor of either 1.45 or 1.78) views of the joints where appropriate. See Physicist for advice on this as it will vary with site of suspected infection.

Simultaneous ANT / POST views of both left and right ankles (say).
Lateral view of left ankle (say) (turn one of the detectors OFF)
Lateral view of right ankle (say) (turn one of the detectors OFF)

Note: lateral views would normally be required for everything except wrists/hands, feet (rather than ankles), and abnormalities associated with the spine.

For feet, perform a simple anterior view (patient supine) and a plantar view. For the latter, position patient semi-recumbent on the imaging couch with feet hanging over the far end. Position detector at just below bed height and angle it towards patient at about 30° to the horizontal. With the knees slightly bent, the soles of the feet can then be placed directly on camera face. Observe normal infection control measures if foot ulcerated, etc.

*If necessary...*

Zoomed view of the abnormal area should be obtained (turn one of the detectors OFF). If this is done, always acquire corresponding zoomed view of the contralateral side

**Patient positioning**

Depends completely on areas to be imaged and patient’s mobility. Supine and/or sitting are acceptable.

**Data acquisition**

Press ENABLE and START to commence each view.

*And Finally ...*

Before discharging the patient, actively enquire about possible side-effects. Patients do not always volunteer this information, or may not associate symptoms. If anything is mentioned that you think might be significant (e.g. rash, headache) complete an Adverse Reaction Report (ARR) and arrange for the patient to be seen by a clinician prior to discharge. Ask the doctor to record brief details of the examination on the ARR and get him/her to sign it. When complete, submit the form to the Consultant Physicist who will forward the details to the National Reporting Scheme for Adverse Reactions.
If given all clear by hospital doctor, advise patient to see their GP if symptoms persist and to notify us should this prove necessary.

**Film output**

On the Siemens ICON processing workstation, read the dynamic images (only) into the GENERAL DISPLAY program.

No predefined protocol has been set-up because the number of static images acquired will vary from study to study. You will therefore need to create the output page manually each time. Use either a 4-position or 6-position format. If more than 6 images are acquired, use 2 films. You can annotate the views (ANT, LLAT, etc) using the Labels | custom facility. Overwrite ‘general display’ with Leukoscan, and enter the acquisition date, if not inserted by default.

Adjust the display levels (Window Level | Change Wtop /| Wbot) before outputting the images to film. When happy with the display, select File | Print. Make sure ‘Drystar’ is the selected (postscript) printer, and click print.

**Selected LeukoScan references**


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