
Resolve to move forward
A technologist's guide to DaTSCAN imaging
DaTSCAN™
IOFLUPANE (123I)
Guiding by insight

Contents

A technologist's guide to DaTSCAN imaging

Introduction[1]

DaTSCAN contains a dopamine transporter radioligand and is used to assess the pre-synaptic striatal uptake in the basal ganglia of the brain.

The patterns of uptake can differentiate between:

- Parkinsonian syndromes (PS) with striatal presynaptic degeneration and essential tremor (ET)
- Probable dementia with Lewy bodies (DLB) and Alzheimer's disease

DaTSCAN is supplied in a single dose vial.
An injection of 185MBq ^{123}I DaTSCAN is given and the patient imaged the same day.

Patient preparation

Some drugs may need to be stopped prior to the study.
Please refer to the SPC for detailed information.[1]

The patient should be asked to contact your department when forwarded an appointment so that any necessary changes can be made.

Thyroid blocking is required 1 hour before injection only.

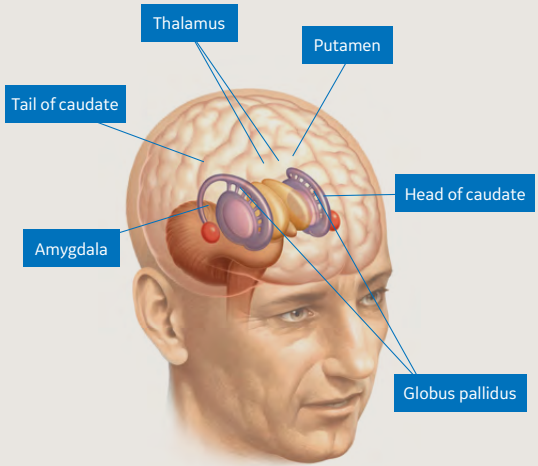
Explain the procedure fully to the patient, emphasising the need to remain still during the scan.

It may be useful to show the camera to your patient to check if there are any issues, i.e. claustrophobia, beforehand.

DaTSCAN is supplied ready to use in single dose vials.
Inject slowly via a venflon (not less than 15-20 seconds).
Image 3-6 hours later.

No other restrictions are necessary.

DaTSCAN is contraindicated in pregnancy and in patients with hypersensitivity to the active substance or to any of the excipients.[1]



Adapted by GE Healthcare
Image on file GE Healthcare

Patient positioning

A headrest must be used to ensure high quality images.
A head restraint should also be used to minimise movement.

For maximum patient comfort, place a support under the knees and support the arms.

This exam is hard to correct for motion, so a good quality acquisition is important.

The radius of rotation defines the resolution of the study and should be set up as close to the patient's head as possible.

This will vary dependent upon the system used but 12–15cm radius of rotation is ideal.

The structures being imaged are positioned above ear level and, unlike cerebral blood flow studies, the cerebellum does not need to be included.

The patient may therefore be moved further out of the camera heads to avoid the shoulders and obtain a smaller radius.

Record radius of rotation on the patient's request form for the reporter's information.

If the patient is unable to tolerate this exam, you may consider 180 degree acquisition.[2]

Adapted by GE Healthcare. Image on file GE Healthcare.

SPECT imaging parameters

Camera set up:

High Resolution or fan beam collimator.

^{123}I 159 KeV photopeak +/- 10% window.
Radius as tight as possible (typically 12–14 cm).

Contouring is not recommended. A circular orbit is preferred.

Matrix size: 128 x 128.

Pixel size: ideal size is 3.5 mm – 4.5 mm.

A zoom may need to be applied to achieve this pixel size.

Number of projections over 360 degrees:

Dual head 120 (60 per head) 30 seconds per view.

Triple headed camera 120 (40 per head). 20 seconds per view.

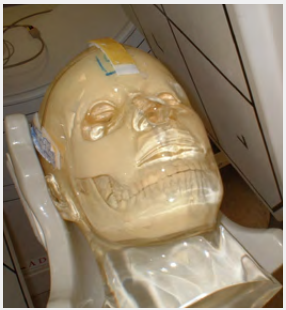
Maximum recommended imaging time is 45 minutes.

EANM Guidelines recommend 3000k counts for optimal quality study.
A minimum of 1000k is acceptable in difficult patients unable to tolerate the longer imaging time.[3]

High quality images are essential for accurate reporting.

All cameras should be calibrated with a striatal phantom to optimise imaging parameters. Please contact your GE Healthcare Account Manager or Applications Specialist for details.

Striatal phantom



Images on file GE Healthcare (not actual patient)

Image reconstruction

Display raw data as a cine loop to check for movement.

Repeat acquisition if necessary.

Position reconstruction limits to exclude hot salivary glands if visible.

Reconstruct with Filter Back Projection (FBP) or iterative reconstruction.

A butterworth/low pass filter is the recommended choice for FBP or post iterative with an order between 6–10 and a “sharp” cut off.

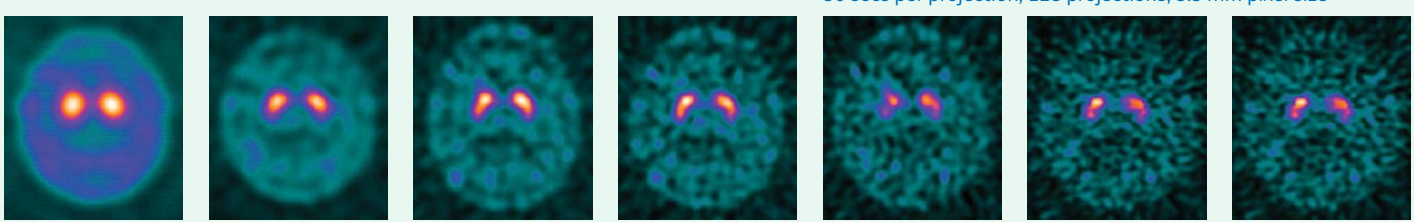
Images should not be over smoothed, see Figure 1.

These parameters should have been established with a phantom study and remain consistent for every patient.

Images need to be re-orientated to correct for patient tilt.

Figure 1

Butterworth Filter – Order 8, variable cut-off (cycles/pixel).
Dual-headed High Resolution Parallel collimator,
30 secs per projection, 128 projections, 3.5 mm pixel size



0.2 0.3 0.4 0.5* 0.6 0.8 1.0

Images courtesy of Birmingham City Hospital, UK

** Image of choice*

Image display

Reconstructed transverse images should be checked for asymmetry. If there is asymmetry visible, images may need correction for tilt. Images should ideally be displayed in a consistent colour scale as displayed in Figure 2.

No background subtraction is necessary. The displayed images may be zoomed to 1.5–2.0.

Image interpretation is recommended from a set of transverse sections.

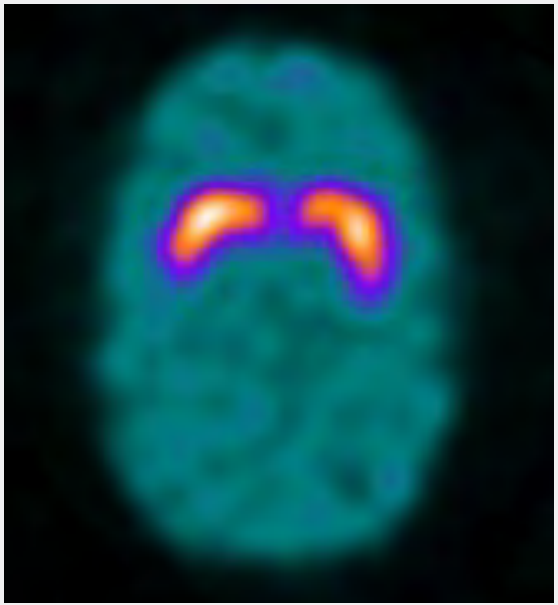
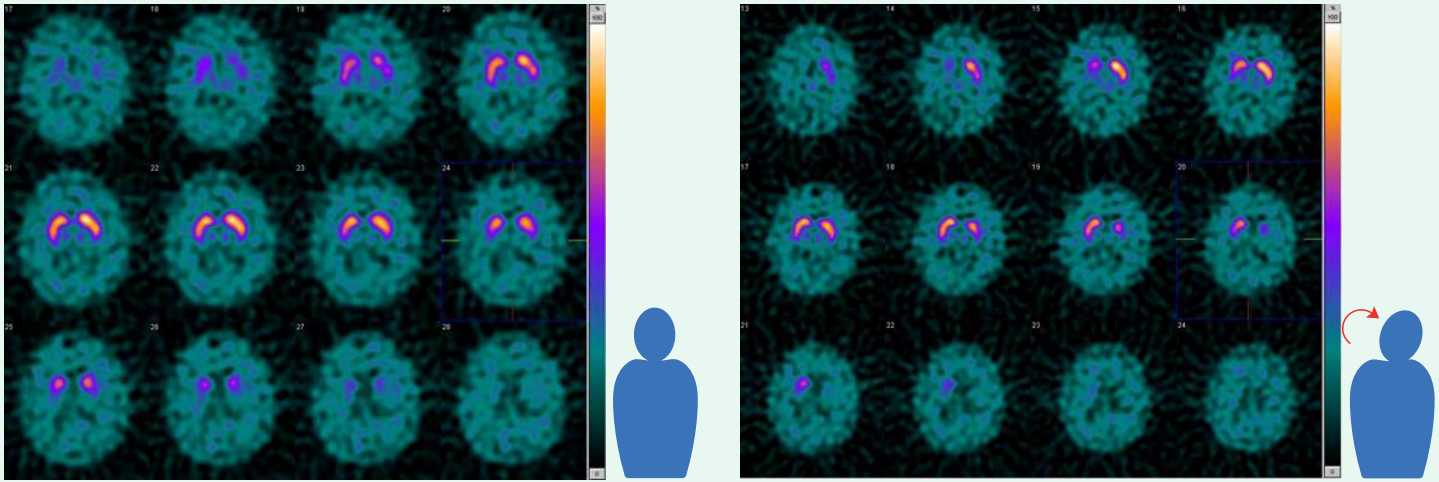


Image on file GE Healthcare

DaTSCAN preferred colour scales

Figure 2
Example phantom study
Siemens Systems: Warm Metal
GE Systems: GE Colour Philips/
ADAC systems: COOL Hermes
Colour Table 8

Re-orientation of images

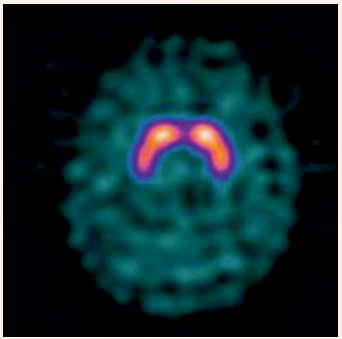


Re-orientation images courtesy of Russells Hall Hospital, Dudley, UK

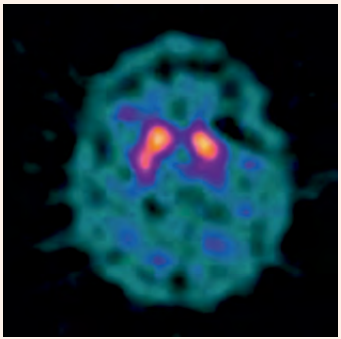
All 3 planes need to be corrected for any tilt using reorientation software.
In particular, it is the lateral tilt that can cause assymetry on the scan. See above.

Visual assessment

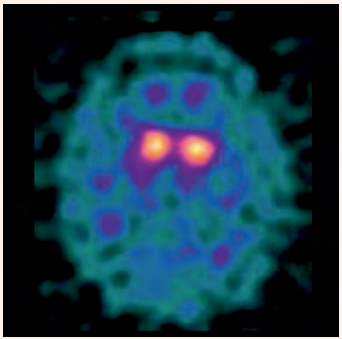
Normal



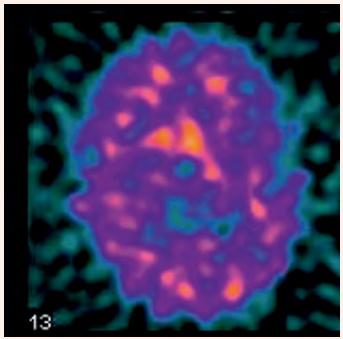
Early PS/probable DLB



PS/probable DLB



Advance PS/probable DLB



Images courtesy of Birmingham City Hospital, UK

The differentiation between a normal and abnormal distribution is primarily based on shape. A transverse slice through the striatum shows a crescent or comma shaped structure in a normal patient.

A circular full-stop shaped caudate lies anteriorly and the putamen forms the tail of the comma. Uptake in the caudate is initially preserved in PS/probable DLB leading to a circular image, the full stop shape, rather than the normal comma shape.

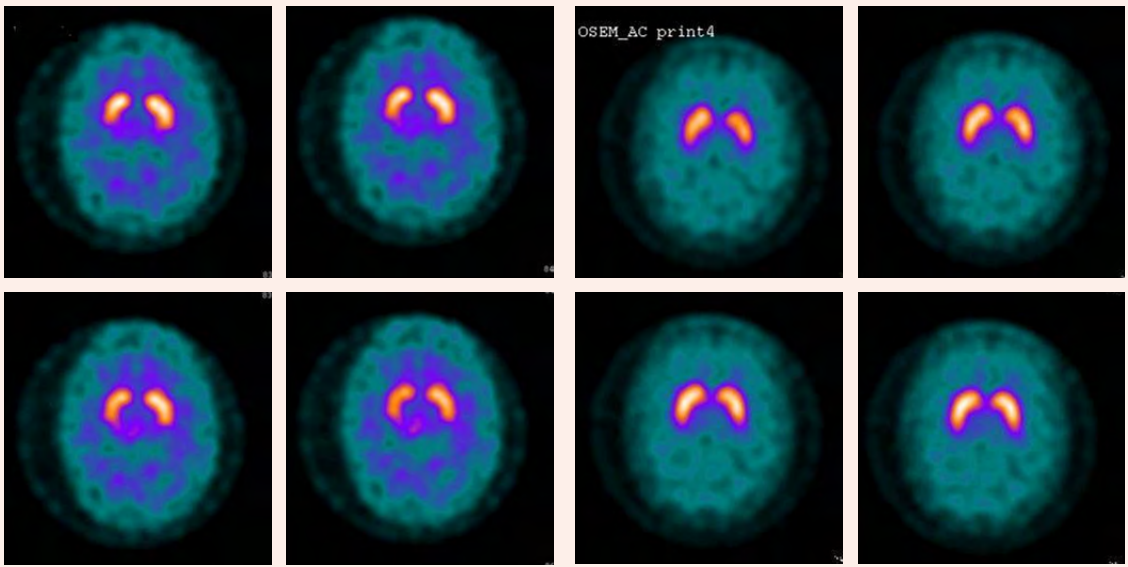
In an abnormal study, the images will appear more noisy with increased background. The chosen settings should be used consistently for all patient studies.

Visual assessment

Check background levels when assessing visual image as in some instances there is an overall reduction in striatal uptake or a balanced loss.[4] See Example 1 to the right.

Example 1

Balanced loss **Normal**



Images courtesy of Southampton Hospital, UK

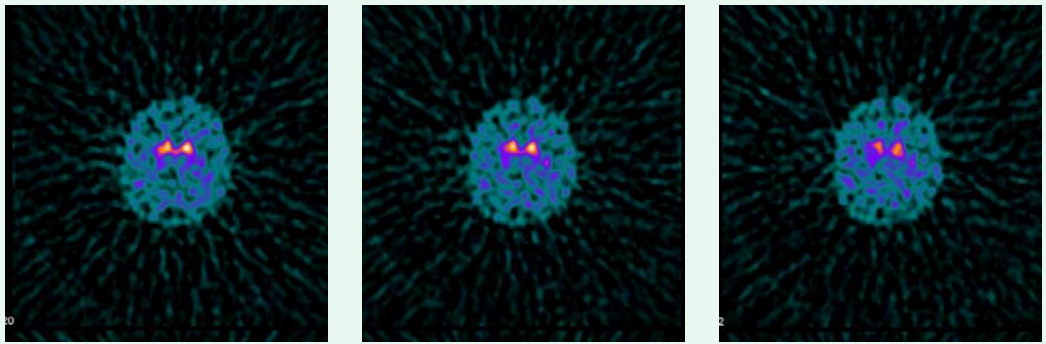
Patient movement

DaTSCAN is very difficult to motion-correct, so raw data should be checked for any evidence of movement before the patient leaves the department. This can be done by viewing the cine or quickly processing the data.

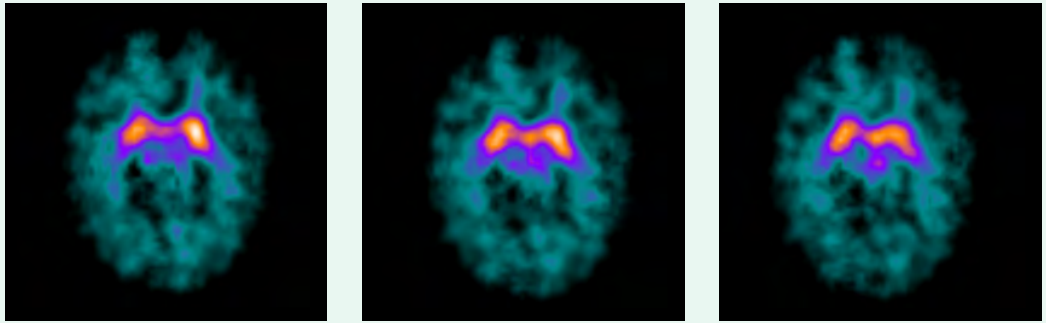
Motion correction software does not usually give satisfactory images so a repeat acquisition will be required.

Movement can be identified by the caudates joining together on the transverse slices; “kissing caudates” (Please refer to Movement 1).

Movement 1



Movement 2

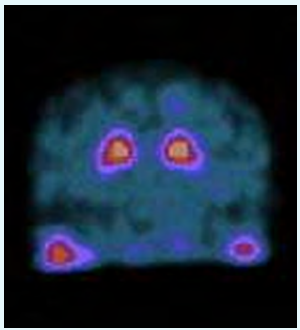


Images on file GE Healthcare

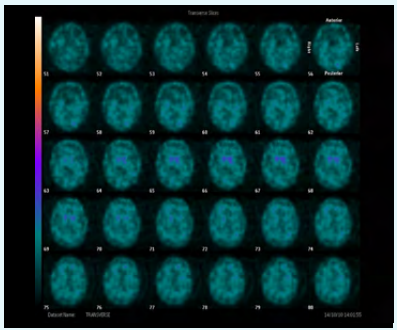
Incorrect scaling

The study will be scaled from the hottest pixel in the data set. If the patient had “hot” salivary glands and these were included in the reconstruction limits, the scaling of the whole study will be affected resulting in poorly resolved striata.

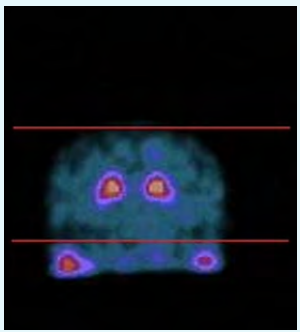
Salivary glands open



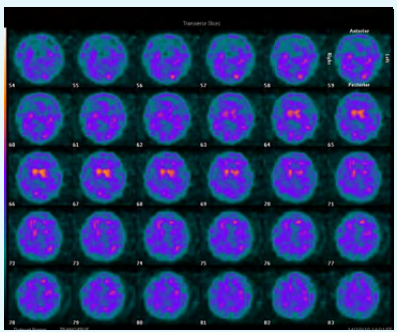
Salivary glands poor scaling



Salivary glands corrected



Salivary glands correct scaling



Images on file GE Healthcare

Quantification

Visual assessment is the primary form of reporting.

Quantification may be an important adjunct in helping interpret more difficult scans and is recommended in the EANM guidelines.[3] Various software quantification packages are available which may assist with this.

As with visualisation, consistency of image acquisition, protocol and assessment of patient's medication should be ensured.

A range of ratio's are produced including striata uptake to background and caudate to putamen regions.

DaTSCAN checklist

- 1 dose / 1 vial crucial to maintain image quality
- Thyroid blocking pre-injection only
- Difficult patients require adapted techniques – 180 degree
- Be aware of movement and scaling artefacts
- Process using consistent established parameters
- Check for raised background levels
- Consider quantification in difficult cases[3]
- Always check for asymmetry resulting from patient tilt

Image on file GE Healthcare
(permission sought)

Notes

Notes

Your DaTSCAN sales representative:

Name:

Contact information:

References:

1. DaTSCAN Summary of Product Characteristics (EN), GE Healthcare, December 2018.
2. Notghi A *et al.* Nucl Med Comm 2010; 31: 217–26.
3. Darcourt J *et al.* Eur J Nucl Med Mol Imaging 2010; 37: 443–50.
4. Shepherd B *et al.* Eur J Nucl Med Mol Imaging 2011; 38 (Suppl 2): S260–S441.

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02-2019 JB7997/JB61099GB(1)/PRT/OS UK

PRESCRIBING INFORMATION

DaTSCAN™ ioflupane (^{123}I) 74 MBq/ml solution for injection

Please refer to full Summary of Product Characteristics (SPC) before prescribing. Further information available on request.

PRESENTATION Single dose vials containing 185 MBq or 370 MBq ioflupane (^{123}I) at reference time.

INDICATIONS Detecting loss of functional dopaminergic neuron terminals in the striatum. **i)** in adult patients with clinically uncertain Parkinsonian Syndromes, for example those with early symptoms in order to help differentiate Essential Tremor from Parkinsonian Syndromes related to idiopathic Parkinson's Disease (PD), Multiple System Atrophy (MSA) and Progressive Supranuclear Palsy (PSP). DaTSCAN is unable to discriminate between PD, MSA and PSP. **ii)** in adult patients to help differentiate probable dementia with Lewy bodies (DLB) from Alzheimer's disease. DaTSCAN is unable to discriminate between DLB and Parkinson's Disease dementia.

DOSAGE AND METHOD OF ADMINISTRATION Prior to administration appropriate resuscitation equipment should be available. For use in patients referred by physicians experienced in the management of movement disorders/dementia. Clinical efficiency has been demonstrated across the range of 111-185 MBq; do not use outside this range. Appropriate thyroid blocking treatment must be given prior to injection of DaTSCAN. The safety and efficacy of DaTSCAN in children 0 to 18 years has not been established. No data are available in patients with significant renal or hepatic impairment. DaTSCAN should be used without dilution. Slow intravenous injection (15-20 seconds) via an arm vein is recommended. SPECT imaging should take place 3-6 hours after injection of DaTSCAN.

CONTRAINDICATIONS Pregnancy and hypersensitivity to the active substance or any of the excipients.

WARNINGS AND PRECAUTIONS If hypersensitivity reactions occur, the administration of the medicinal product must be discontinued immediately and, if necessary, intravenous treatment initiated. Resuscitative medicinal products and equipment (e.g. endotracheal tube and ventilator) have to be readily available. This radiopharmaceutical may be received, used and administered only by authorised persons in designated clinical settings. Its receipt, storage, use, transfer and disposal are subject to the regulations and the appropriate licences of the local competent official organisations. For each patient, exposure to ionising radiation must be justifiable on the basis of likely benefit. The activity administered must be such that the resulting dose is as low as reasonably achievable bearing in mind the need to obtain the intended diagnostic result. DaTSCAN is not recommended in cases of moderate to severe renal or hepatic impairment. Contains 39.5 g/l (5% volume) ethanol, up to 197mg per dose, harmful for those suffering from alcoholism. To be taken into account in high-risk groups such as patients with liver disease or epilepsy.

INTERACTIONS Consider current medication. Medicines that bind to the dopamine transporter with high affinity may interfere with diagnosis; these include amfetamine, benzatropine, buproprion, cocaine, mazindol, methylphenidate, phentermine and sertraline. Medicines shown during clinical trials not to interfere with DaTSCAN imaging include amantadine, trihexyphenidyl, budipine, levodopa, metoprolol, primidone, propranolol and selegiline. Dopamine agonists and antagonists acting on the postsynaptic dopamine receptors are not expected to interfere with DaTSCAN imaging and can therefore be continued if desired. In animal studies pergolide does not interfere with DaTSCAN imaging.

PREGNANCY AND LACTATION Contraindicated in pregnancy. Information should be sought about pregnancy from women of child bearing potential. A woman who has missed her period should be assumed to be pregnant. If uncertain, radiation exposure should be the minimum needed for satisfactory imaging. Consider alternative techniques. If administration to a breast feeding woman is necessary, substitute formula feeding for breast feeding for 3 days.

UNDESIRABLE EFFECTS The following undesirable effects are recognised for DaTSCAN: Common side effects include headache. Uncommon side effects include vertigo, increased appetite, formication, dizziness, dysgeusia, nausea and dry mouth. Intense pain or burning sensation on injection has been reported uncommonly following administration into small veins. Hypersensitivity occurs with unknown frequency, as well as erythema, pruritus, rash, urticaria, hyperhidrosis, dyspnea, vomiting, decreased blood pressure and feeling hot. Exposure to ionising radiation is linked with cancer induction and a potential for hereditary defects. Because of the low radiation dose incurred these adverse events are expected to occur with a low probability.

DOSIMETRY Effective dose from 185 MBq is 4.63 mSv.

OVERDOSE Encourage frequent micturition and defecation.

MARKETING AUTHORISATION HOLDER GE Healthcare B.V., De Rondom 8, 5612 AP, Eindhoven, The Netherlands.

CLASSIFICATION FOR SUPPLY Subject to medical prescription.

MARKETING AUTHORISATION NUMBERS EU/1/00/135/001 (2.5ml) and EU/1/00/135/002 (5.0ml).

DATE OF REVISION OF TEXT 16 January 2019

UK PRICE £525.00/185MBq.

Adverse events should be reported.
Reporting forms and information can be found at https://yellowcard.mhra.gov.uk/.
Adverse events should also be reported to GE Healthcare at gpv.drugsafety@ge.com.