

# Oesophageal Scintigraphy

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## 1. Introduction

Oesophageal motility can be assessed physiologically using a radiopharmaceutical. Under normal circumstances a person will be upright when swallowing. Thus having the patient seated will produce the most functionally accurate picture. However, with the patient in supine position, the passage of a bolus depends exclusively on peristalsis. Therefore this position allows motility defects to be detected sooner. The investigation is indicated in suspected functional motility defects of the oesophagus when obvious anatomical or organic defects have been excluded. Anatomical defects can be detected using non-invasive swallowing studies with the aid of radiopaque contrast. 24 h pH / manometry testing can be used to demonstrate reflux. Oesophageal scintigraphy has a high sensitivity (95%) and specificity (96%) for detecting oesophageal motility defects.

## 2. Methodology

This guideline is based on available scientific literature on the subject, the previous guideline (Aanbevelingen Nucleaire Geneeskunde 2007), international guidelines from EANM and/or SNMMI if available and applicable to the Dutch situation.

## 3. Indications

- a. Primary oesophageal motility defects such as achalasia and oesophageal spasm.
- b. Secondary oesophageal motility defects such as systemic sclerosis, myasthenia gravis and polymyositis.
- c. Gastro-oesophageal reflux (primary or following antireflux treatment).

## 4. Relation to other diagnostic procedures

Oesophageal scintigraphy is a relatively simple, patient-friendly and noninvasive method to gain information about oesophageal motility under physiological conditions. However, this investigation is being superseded by other radiological imaging modalities (dynamic and static imaging of the pharynx, modified barium swallows, biphasic oesopagography), endoscopy and possibly invasive manometry. These non-nuclear techniques, are unable to quantify oesophageal motility. The demonstration of anatomical causes of abnormalities, including the demonstration of transit defects, nevertheless usually provides sufficient information with which to answer the clinical query.

## 5. Medical information necessary for planning

- a. Results of clinical examination.
- b. Results of previous relevant investigations (e.g. x-ray or gastroscopy).

## 6. Radiopharmaceutical

Tracer:  $^{99m}\text{Tc}$  colloid

Nuclide:	Technetium-99m
Activity:	5x10 MBq
Administration:	Oral

## 7. Radiation safety

### a. Pregnancy

The external radiation dose received by a foetus after oral administration of the radiopharmaceutical is approximately 0,8 mGy (0,016 mGy/MBq). The risk to a foetus is therefore low. Nevertheless, the investigation should be postponed till after parturition whenever possible.

### b. Lactation

According to ICRP 106 there is no need to interrupt breastfeeding, but due to possible free  $^{99m}\text{Tc}$  pertechnetate it is advisable to interrupt the feeding for 4 h.

### c. Effective dose (mSv/MBq)

0,11; 0,062; 0,039; 0,025 and 0,019 for respectively a 1-yr-, 5-yr-, 10-yr-, 15-yr old and an adult patient with normal biological functioning.

## 8. Patient preparation/essentials for the procedure

### Patient preparation

- Patients should fast for at least 4 h prior to the investigation, though they are preferably fasted from the night before.
- Prokinetics should be discontinued for 3 days prior to the investigation. Unless the clinical query is oesophageal motility under prokinetic treatment.

### Essentials for the procedure

- One 10 ml syringe filled with water.
- Five syringes each containing 10 MBq  $^{99m}\text{Tc}$  nanocolloid in 10 ml water.

## 9. Acquisition and processing

- The examination should be carried out preferably with the patient lying supine (this is more sensitive as the effect of gravity is greatly reduced). The camera is positioned posterior to the patient. The patient's mouth should be at the top of the field of view. A 10 ml bolus of water is administered into the patient's mouth. The patient is asked not to swallow until the dynamic acquisition has started. The cricoid and xiphoid can be marked on the first image (prior to the labelled bolus administration). After swallowing, the patient remains supine and is told to keep the mouth open and not to swallow for 30 sec. On instruction, the patient then performs a dry swallow every 15 sec during 2 min. This sequence is practiced with unlabeled water, after which five sequences are carried out using labelled water.
- Following acquisition, the dynamic images are evaluated in cine and in series mode. Compressed images are subsequently created. The X-axis frames are compressed to a width of one pixel and the individual frames displayed in sequence to create a diagram showing parametric position set against time.
- The passage of activity through the proximal, mid and distal oesophagus can be evaluated and quantified using ROI analysis.
- Camera settings and processing:

Energy:	$^{99m}\text{Tc}$ setting, 140 keV
Window:	15-20%
Collimator:	Preferably LEAP. LEHR also possible
Time:	0,25 sec images for 30 sec followed by 1 sec frames during 90 sec; five studies in succession
Computer:	64x64 matrix

## 10. Interpretation

- Normal oesophageal motility studies demonstrate rapid passage through the first half of the oesophagus and limited delay in the distal section. Normal oesophageal transit time ranges from 6-15 sec. The residual fraction (i.e. the oesophageal activity as percentage of the total oesophageal activity after the initial bolus swallow) can be calculated after every swallow. The residual fraction after four swallows is usually < 19% (aqueous bolus).
- Oesophageal scintigraphy can be carried out using a solid test meal. A solid bolus poses a greater challenge to the swallowing process and might therefore increase sensitivity. However it is more difficult to interpret due to activity sticking to the oesophageal wall.
- In adult patients, the occurrence of reflux is usually evaluated by ambulatory 24 h pH measurements which can be combined with impedance testing. When this is not possible, intermittent gastro-oesophageal reflux can be detected by oesophageal scintigraphy. Sensitivity can be increased by performance of the Valsalva manoeuvre. Minimal reflux is physiological. At least two reflux peaks should be present for the diagnosis of reflux.
- Infant reflux detection studies are carried out using labelled formula milk. Acquisition is carried out with the child lying down for 60 min (120 frames of 30 sec). A late image (24 h) of the chest may demonstrate aspiration.

## 11. Report

The scintigram and curves are assessed for transit speed, the degree of radionuclide stasis in the oesophageal segments and possible reflux.

## 12. Literature

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