

# Renal Cortical Scintigraphy

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## 1. Introduction

After intravenous administration of the tracer, it is accumulated in the renal tubules with a half-time of 1 h. The maximum is reached within 3 h. Space-occupying processes or abnormalities with loss of renal parenchyma show up as 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. Detection of scars in patients with reflux or stones. This investigation may be used to trace the course of the diseased parenchyma. In so doing, it is important also to determine the left-to-right ratio.
- b. Only when it is clinically important to diagnose or exclude acute pyelonephritis.
- c. Six months after an acute urinary tract infection in children.
- d. Diagnosis of renal infarction and space-occupying processes in the kidney.
- e. To determine whether the isthmus of a horseshoe kidney consists of connective tissue or renal parenchyma.
- f. Visualisation of an ectopic kidney. Because of over projection of the pelvic skeleton, a pelvic kidney may sometimes not be recognised on an intravenous pyelogram (IVP).

## 4. Relation to other diagnostic procedures

Renal scintigraphy is considered the most sensitive method to demonstrate foci of acute pyelonephritis and scarring after pyelonephritis. For the diagnosis of space-occupying processes, renal scintigraphy is only complementary to other non-invasive techniques, such as ultrasound and CT scan.

## 5. Medical information necessary for planning

For every kidney investigation, it is important to report any abnormalities of the urinary tract and to clearly formulate the clinical queries, in view of the fact that an adaptation of the protocol is often desirable. Furthermore, in order to carry out an optimal investigation, it is important to ascertain the serum creatinine level, which gives an overall estimate of the renal function. The date of the last urinary tract infection is important.

## 6. Radiopharmaceutical

Tracer:	$^{99m}\text{Tc}$ -DMSA
Nuclide:	Technetium-99m
Activity:	80-110 MBq
Administration:	intravenous

## 7. Radiation safety

Pregnancy is a contraindication. Radiation exposure is about 0,88 mSv for an adult with normal renal function who receives 100 MBq dose. 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 hours.

## 8. Patient preparation/essentials for procedure

- a. Allow the patient to drink enough so that no activity is retained in the renal pelvicalyceal system, 10 ml of water per kg of body weight is sufficient.
- b. Dependent on renal function, the recordings are made 2-6 h after injection. In patients with urinary tract obstruction, it is sometimes necessary to wait longer.

## 9. Acquisition and processing

- a. Camera and computer:
  - Energy:  $^{99m}\text{Tc}$ -setting, 140 keV
  - Window: 15-20%
  - Collimator: Preferably LEHR (alternatively pinhole collimator with 3 mm aperture)
  - Time: 400.000 counts, with parallel hole collimator
  - Computer: Static images; matrix: 256x256; zoom  
SPECT (single-headed system): matrix: 128x128; 360°; 64 steps; 25 sec per step (zoom in when using a camera with a large field of view).
- b. The recordings are made no earlier than 2 h after injection. Transplanted kidneys, pelvic kidneys and horseshoe kidneys, should be imaged with the patient in supine position with the gamma camera anteriorly.
- c. Otherwise, the patient should be supine with the gamma camera posteriorly (below the table). For the posterior oblique images, place the patient obliquely with sufficient support so that he/she can lie still. The gamma camera remains horizontal under the table.
- d. If the recording is made with the patient in supine position and the gamma camera posteriorly, the left-to-right ratio can be readily calculated. In most patients, the difference in distance between the left and right kidney in relation to the gamma camera is very slight in this position and may be regarded as negligible for the overall calculation or subsequent check-ups.
- e. For an accurate calculation, both an anterior and a posterior measurement must be made. After correction for background activity, the geometric mean of activity in the kidneys is calculated, from which the left-to-right ratio can be derived.
- f. It is not possible to obtain an accurate determination of the left-to-right ratio when using a pinhole collimator.
- g. A SPECT investigation is more sensitive for cortical defects and is particularly desirable for indications 3a-3c; there is as yet no consensus about this.

## 10. Interpretation

- a. Abnormalities, such as foci of acute pyelonephritis, scarring from pyelonephritis, renal infarction, cyst and other space-occupying processes show up as activity defects. After adequate treatment, foci of acute pyelonephritis may disappear. However, scars will not disappear.

- b. For normal variants obtained with the aid of planar images, see Piepsz (1999). For normal SPECT images, see Sadeleer (1996).
- c. A dilated pyelocaliceal system can present as a cold spot. In infants, the stomach can also appear as a cold spot above the left kidney. Deviations of the upper pole can be seen in an occult ectopic ureter.
- d. Recognition of an ectopic kidney, which is located low in the pelvis may be hampered by a full bladder. An image made after micturition can clarify this.
- e. The uptake of DMSA is a reflection of the functional kidney mass. However, a low DMSA accumulation where there is complete obstruction does not mean that the kidney is irreversibly damaged. The accumulation of DMSA in the kidneys is also lower in various diseases of the proximal tubules such as renal tubular acidosis.

### 11. Report

- a. Describe the overall size, shape and location of the kidneys.
- b. Describe the distribution of radioactivity in the kidneys and whether defects are visible in the cortex.

### 12. Literature

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