

# Micturition Cystourethrography using Scintigraphy

RAM Kengen, Laurentius Ziekenhuis Roermond

## 1. Introduction

The detection of vesico-uretero-renal reflux (VUR) during bladder filling, with full bladder and during bladder voiding is possible using two different methods: one indirect and one direct. The indirect method is no longer recommended due to its low sensitivity. For the direct method, retrograde filling of the bladder is performed via a catheter.

*Advantages:*

- a. No interfering residual activity in the kidneys
- b. A cystometric examination can easily be performed at the same time
- c. Relatively short duration

*Disadvantages:*

- a. Catheterisation of the bladder; moderately invasive and with risk of iatrogenic infection
- b. Influence of intravesical pressure due to catheterisation and relatively fast filling of the bladder

## 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 VUR in patients with recurrent urinary tract infections, renal abnormalities (such as hydronephrosis, hydroureter, duplex kidney) and neurological disorders (meningomyelocele, spinal cord injury, etc.)
- b. Follow-up of patients with VUR who are treated conservatively or following surgical correction

## 4. Relation to other diagnostic procedures

There is no truly reliable standard in the diagnosis of VUR as VUR is an intermittent phenomenon. Historically, the micturating cystogram (MCG) with contrast enhancement has been considered by many to be the best parameter. Some even see it as the gold standard. Yet, MCG also has the disadvantages of catheterisation and relatively rapid filling of the bladder which can lead to false positive findings.

When comparing the results obtained using MCG with scintigraphy, the experiences of the authors are highly variable. This can be explained by the intermittent occurrence of reflux. However, grade 1 VURs can only be observed by MCG. Radionuclide micturition cystography has a place in the follow-up of reflux.

A more recent development is the use of ultrasound with contrast. This method has a high operator dependent variability.

**5. Medical information necessary for planning**

- a. Presence of urinary tract infection
- b. Recent/ ongoing antibiotic therapy
- c. Continence
- d. Bladder capacity
- e. Results of previous investigations e.g. ultrasound, intravenous urogram and micturating cystogram
- f. Abnormalities of the urinary tract

**6. Radiopharmaceutical**

Tracer:  $^{99m}\text{Tc}$  DTPA or  $^{99m}\text{Tc}$  colloid  
 Nuclide: Technetium-99m  
 Activity: 30 MBq  
 Administration: Intravesically via bladder catheter or suprapubic bladder puncture

**7. Radiation safety**

Pregnancy is a contraindication for this procedure. Lactation is not a contraindication as the radiopharmaceutical is not absorbed. The radiation exposure is low; 0,06 mSv for a 30 MBq dose.

**8. Patient preparation/essentials for procedure**

- a. Insert urinary catheter or have it inserted.
- b. Connect bottle or bag of 500 ml of sterile 0,9% saline to catheter.
- c. Set the liquid level in the dropper of the infusion system at a height of 70 cm above the pubic symphysis.

**9. Acquisition and processing**

- a. Set up the gamma camera and computer  
 Energy:  $^{99m}\text{Tc}$ -setting, 140 keV  
 Window: 15-20%  
 Collimator: LEAP
- b. Insert balloon catheter or have it inserted.
- c. Position the patient (make ample use of incontinence pads) and connect the infusion system.
- d. Administer the radiopharmaceutical through the connector between the catheter and infusion system as a bolus. Then open the infusion system.
- e. Start the acquisition immediately after the intravesical administration of the radiopharmaceutical. Make a series of recordings of 1-10 sec prior to micturation and during 30 sec of forceful micturation. Allow micturition to be completed, and immediately after, make a series of post micturation images.
- f. Stop the infusion when maximum bladder capacity has been reached. This can be recognised though:
  - An infusion which has already stopped due to high pressure.
  - An infused volume that exceeds the expected maximum bladder capacity.
  - Strong urinary urgency.
  - Leakage along the catheter.

- g. Remove the catheter after emptying the balloon.
- h. Set the gamma camera and computer for recording micturition.
- i. Reposition the patient in a sitting or standing position.
- j. Accurately measure and record the infused volume of saline as well as the amount of urine produced. The following rule can be used as a guidance for the maximally infused volume (in ml):  $\text{age (in years)} \times 30 + 30 \text{ ml} = (\text{age (in years)} + 1) \times 30 \text{ ml}$ .
- k. Position: Babies and small children in supine position above the gamma camera. Older children and adults, preferably sitting or standing in front of the gamma camera during voiding.
- l. The timing of micturition recordings depends on the time when maximum bladder capacity is indicated. Start micturition recordings when the command to urinate is given.
- m. Processing of data: Before micturition, during and after micturition: 5-10 sec frames with a matrix of 128x128. Add up the dynamic urinary recordings to three static images: before, during and after micturition. If accumulation of activity is visible in the ureter and/or renal area this can be captured in the curve with the help of ROIs on both kidneys, both ureters and bladder.

## 10. Interpretation

- a. Reflux is an intermittent phenomenon. Therefore, false negative findings occur frequently. Reflux is sometimes observed during a urinary tract infection only.
- b. The severity of reflux (grading) cannot always be indicated precisely.
- c. Grade 1 reflux often fails to be recognised because of 'outshining' by the bladder.
- d. False positives can be caused by the change in intravesical pressure due to catheterisation or relatively fast filling of the bladder.
- e. Contamination through urine leaking alongside the catheter can cause problems in interpretation.

## 11. Report

- a. Indicate whether there is reflux. If reflux is observed, describe the frequency and time(s) of occurrence.
- b. Give an approximation of the severity of the reflux as well as the height it reaches. Also indicate the rate at which this urine once again leaves the kidney.
- c. Indicate the bladder volume (if possible) and the infused volume of saline.

## 12. Literature

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