Value of Cortical Scintigraphy in Urinary Tract Diseases

Elma Kucukalic-Selimovic, Amela Begic, A.Skopljak-Beganovic
Institute of Nuclear Medicine, Clinical Centre University of Sarajevo

SUMMARY
Urinary tract diseases are common problem that, if untreated may lead to progressive renal damage. It can be diagnosed by radionuclide techniques or by radiological techniques. Static (cortical) renal scintigraphy with 99mTc-DMsA is a sensitive method for evaluation of any reduction of cortical mass function. Static renal scintigraphy is simple, non-invasive examination.

1. INTRODUCTION
Urinary tract diseases are common problem that, if untreated may lead to progressive renal damage (1).

It can be diagnosed by radionuclide techniques or by radiological techniques. Static (cortical) renal scintigraphy with 99mTc-DMsA is a sensitive method for evaluation of any reduction of cortical mass function. Static renal scintigraphy is simple, non-invasive examination. It enables the evaluation of the shape, size, and location of the kidneys, functional status of the renal parenchyma and determination of cortical uptake and separated renal function (2, 3, 4).

The examination is based on imaging of the uptake of specific radiopharmaceutical-Tc-99m DMsA in the functional renal parenchyma. The accumulation of the radiopharmaceutical depends on the functional activity of the cells.

2. RADIOFARMACEUTICAL FOR STATIC RENAL SCINTIGRAPHY

The most common radiopharmaceutical for static renal scintigraphy is Tc-99m DMSA (Dimercaptosuccinic acid). This tracer was introduced in 1974, but it is only since the late 1980s that numerous publications have appeared, related to the methodology, the robustness of the technique and the field of clinical applications. The tracer is taken up by the proximal tubular cells, directly from the peritubular vessels, and is therefore located in the outer layer of the kidney with minimal activity in the medulla and the calyces. As a consequence, the posterior view of the DMSA scintigraphy will usually not appear homogeneous, the inner part of the kidney showing less uptake than the outer part. Minimal activity was found in distal tubules and in the Henle loop (5). DMSA concentrates in higher quantities in the renal cortex with peak concentrations achieved 3 to 6 hours after application when approximately 50% of activity is present in the kidneys. After 24 hours, only 30 to 40% is excreted in the urine. Separated function can be determined by quantifying the uptake of DMSA in the renal parenchyma. Radiation dose to the patient is low. The effective Tc-99m DMSA dose is estimated to approximately 1mSv examination (5), regardless of the age of the child and using the dose schedule put forward by the European Pediatric Task Group (6).

3. TECHNIQUES
The most common used technique in general nuclear medicine is planar...
imaging.

Improvements in the nuclear medicine have led to the widespread use of SPECT-single photon emission tomography.

Patient usually examined in the supine position using single or dual headed gamma camera, equipped with low energy high resolution collimators. After 2 to 3 hours of application of radiopharmaceutical planar scintigraphy is performed. Usually is performed anterior, posterior and oblique projection- matrix size 256x256, 500.00 counts per one projection. Acquisition should be supplemented by single photon emission tomography (7).

Tc-99m DMSA is administered i.v. usually 1-2MBq per kg of patients body weight. The usual activity in adults is 74-185MBq.

4. CLINICAL APPLICATIONS OF STATIC RENAL SCINTIGRAPHY

How well is the technique of DMSA scintigraphy validated?

We estimated 50 pediatric patients who referred at our Department with diagnosis of urinary infection. 10 patients (20%) referred as suspected of abnormal kidneys, 40 (80%) of patients have no abnormalities. 3 patients with severe kidney abnormalities have been sent to further clinical investigation.

Kidney contours are distinctly demarcated with a good contrast between the active outer part and less active inner part (8).

Medulla have lower uptake. This is usually appearance in normal kidney.

Acute pyelonephritis results in the formation of one or more foci of reduced accumulation of radiopharmaceutical without loss of volume or change of separated function (4).

This is images of 10-year old boy with history of urinary tract infection and fever (figure 1).

Planar images acquired using high-resolution collimator. There is reduced uptake of radiopharmaceutical (focal cortical defect) in the superior pole of the left kidney.

The scars is characterized as wedge-shaped defects with thinning of the cortex. A pathophysiological mechanism leading to the damage is caused by several factors. Early treatment can improve changes. The development of fibrotic changes usually occurs on the basis of longer inflammation. Late scintigraphy (3 to 6 months) is important for the evaluation of effective of therapy. Multiple bilateral renal scars suggest significant and advanced damage to kidneys, which can be led to hypertension. Tc-99m DMSA scintigraphy is also very useful method for detection of anomaly kidney. Using static renal scintigraphy is possible differentiate horseshoe-shaped kidney, agenesis of kidney, ectopic kidney. Also, high occurrence of parenchymal changes is referred for children with duplicated collecting system which is considered an obstructive uropathy (9,10). Scintigraphy has limited role in diagnosis of renal tumors.

5. CONCLUSION

Nuclear medicine provides useful methods for management of renal disease.

We can say that DMSA is still gold standard for analysis of renal parenchymal lesions.
REFERENCES


Corresponding author: prof Elma Kucukalic-Selimovic. MD, PhD. Institute for Nuclear medicine, Clinical center University of Sarajevo, Bolnicka 25. Tel.: 00 387 33 297 000.