

# **RENAL STUDY - TUBULAR FUNCTION**

## **(Tc-99m-DMSA)**

### **Overview**

- Tc-99m-DMSA is cleared from blood into the renal tubular cells, but not secreted into the tubular lumen. Thus, the Tubular Function Study depicts tubular function without interference from radioactivity in the collecting system.

### **Indications**

- Diagnosis of acute and chronic pyelonephritis (1-3).
- Differentiation of renal masses from normal variants.
- Quantification of regional renal function (4).

### **Examination Time**

- Initially: 15 minutes for injection of the radiopharmaceutical.
- Delayed images at 3 hours: 1 hour for image acquisition.

### **Patient Preparation**

- None.

### **Equipment & Energy Windows**

- Gamma camera: Dual head, large field of view.
  - Rotating gamma camera.
- Collimator: Low energy, high resolution, parallel hole.
- Energy window: 20% window centered at 140 keV.

### **Radiopharmaceutical, Dose, & Technique of Administration**

- Radiopharmaceutical: Tc-99m-dimercaptosuccinic acid (Tc-99m-DMSA) (5).
- Dose: 5 mCi (185 MBq).
- Technique of administration: Standard intravenous injection.

### **Patient Position & Imaging Field**

- Patient position: Supine and prone.
- Imaging field: Kidneys (upper abdomen).

## Acquisition Protocol

- 3 hours following injection, position the patient supine and acquire digital ANT and POST images for approximately 400 K counts in the POST view.
  - Convert the large field of view electronically to a 10 inch field of view or use a small field of view camera.
  - Then acquire paired RAO/LPO and LAO/RPO images for the same time as the initial POST image.
- ☐ SPECT tomography (4,6-8):
1. Image acquisition parameters:
    - a) degrees of rotation: 360°.
    - b) number of images: 64.
    - c) time per image: 20 seconds.
  2. Data processing:
    - a) reconstruct transverse, sagittal, and coronal image.
    - b) filter selection depends on computer software package.

## Protocol Summary Diagram



## Data Processing

- Using the POST digital image, place regions of interest around both kidneys and below both kidneys for background.
- Calculate the background corrected counts in each kidney and the percent of total counts in each kidney:

$$\text{Percent function right kidney} = \frac{(A-B) R}{(A-B) R + (C-D) L} \times 100\%$$

Where: A = counts per pixel in right kidney region of interest  
B = counts per pixel in right background region of interest  
R = pixels in right kidney region of interest  
C = counts per pixel in left kidney region of interest  
D = counts per pixel in left background region of interest  
L = pixels in left kidney region of interest

## Principle Radiation Emission Data - Tc-99m (9)

- Physical half-life = 6.01 hours.

Radiation	Mean % per disintegration	Mean energy (keV)
Gamma-2	89.07	140.5

### Dosimetry - Tc-99m-DMSA (10-12)

Organ	rads/5 mCi	mGy/185 MBq
Renal cortices	4.25	42.5
Kidneys (total)	3.15	31.5
Bladder wall	0.35	3.5
Liver	0.16	1.6
Total body	0.08	0.8
Bone marrow	0.11	1.1
Ovaries	0.07	0.7
Testes	0.03	0.3
Effective dose	rems/5 mCi	mSv/185MBq
Whole body	0.17	1.7

### References

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### Normal Findings

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