



Austin Radiological Association

Nuclear Medicine Procedure

RENAL TUBULAR SECRETION STUDY (Tc-99m-MAG3)

Overview

- The Renal Tubular Secretion Study images Tc-99m-MAG3 as it passes through the vascular system, renal tubular cells, tubular lumens, and collecting system. This series of images allows the sequential evaluation of renal perfusion, renal clearance by tubular secretion, renal parenchymal transit time, and passage of urine through the renal collecting system. In addition, the study provides high contrast images for evaluation of renal anatomy.

Indications

- Evaluation of renal perfusion and function.
- Evaluation of renal trauma.
- Diagnosis of renovascular hypertension.
- Detection and evaluation of renal collecting system obstruction.
- Evaluation of renal transplants.

Examination Time

- 60 minutes.

Patient Preparation

- The patient should hydrate by drinking 24oz of water 1 – 2 hours prior to the study.
- The patient should void before beginning the study.
- Pediatric patients unable to void on command will be catheterized.

Equipment & Energy Windows

- Gamma camera: Large field of view.

- Collimator: Low energy, high resolution, parallel hole.
- Energy window: 20% window centered at 140 keV.
- Computer: With renal analysis application

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: Tc-99m-mercaptoacetyltriglycine (Tc-99m-MAG3).
- Dose: 6 mCi (222 MBq), 10 mCi (370MBq) for transplant, NACG for pedi's
- Technique of administration: I.V. bolus injection

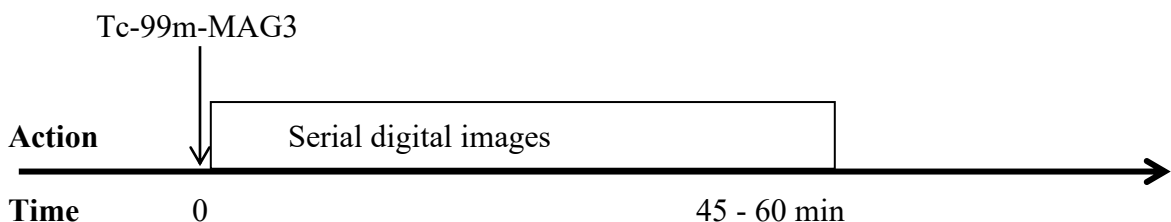
Patient Position & Imaging Field

- Patient position: Supine.
- Imaging field: All of kidneys and bladder, if possible

Acquisition Protocol

- Position the camera under the table for POST images.
- Count pre-injection syringe for 60 seconds / 30 cm from detector.
- Position and Inject patient.
- Phase one flow imaging: 3 seconds per frame for 60 frames (three minutes).
- Phase two function imaging: 10 seconds per frame for 342 frames (57 minutes).
- If diuretic renal scan is ordered inject 0.5 mg/kg adult or 1.0 mg/kg child, I.V. furosemide (max 40 mg) over 2 minutes when calyces show filling. If filling is delayed wait **at least** 15 minutes before injecting. Delay injection until you see filling if schedule allows.
- Image for minimum of 20 minutes post Lasix, 30 minutes is preferred.
- Count post-injection syringe for 60 seconds / 30 cm from detector.
- Have the patient void at the end of the study to significantly reduce the gonadal radiation dose.

Protocol Summary Diagram



Data Processing

- Display serial 3-second images summed 2 frames for 6 seconds / frame for visual evaluation of flow. 30 frames on one screen save, Phase 1 images.
- Display serial 10-second images summed 6 frames for 1 min/frame visual evaluation of renal perfusion. 28 frames on one screen save, Phase 2 images, remaining frames on second screen save.
- Display 5-minute analog images beginning at 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, and 60 minutes for visual evaluation of clearance parenchymal transit, excretion, and anatomy. 8 frames on one screen save page.
- If study was ended early, cut and paste 3-4 frames to end of study, to avoid sudden artificial drop-off of renal curve during processing.
- Place regions of interest over the entire kidney and lateral to / below each kidney for background subtraction, label image "Excretion"
 - Place a region of interest over the adjacent aorta, at level of renal hilum, to generate and display Flow curve (1st minute of exam).
- Generate 40 - 60 minute renal and background curves.
- Adjust T-upslope line to approximately the 1-minute mark, so T-max falls on highest peaks (not initial flow peak prior to 1 minute).
- Repeat process with Excretion, adding the Lasix injection time (if performed) to generate Lasix curves. This calculates the curve from time of Lasix injection, rather than from time of peak.

Optional Maneuvers

- Imaging a transplanted kidney:
 1. The patient is positioned supine.
 2. Images are acquired in the ANT projection.
 3. The field of view includes the transplanted kidney and bladder (usually imaging the entire pelvis will accomplish this).
 4. The acquisition and quantification is otherwise the same as for native kidneys

- Angiotensin converting enzyme (ACE) inhibitor renal study:
 1. Chronic administration of ACE inhibitors and diuretics may decrease the sensitivity of the test:
 - Stop ACE inhibitors and diuretics 3-5 days prior to the study.
 2. Administer the ACE inhibitor:
 - Captopril: 50 mg orally. (Since food in the gastrointestinal tract delays absorption, the patient should fast for 4 hour prior to the study if Captopril will be used.)
 3. Record the patient's blood pressure every 15 minutes for 1 hour.
 4. Timing of radiopharmaceutical injection:
 - Captopril: Inject Tc-99m-MAG3 60 minutes after ingestion of the Captopril.
 4. Additional quantitative measurements beyond those in the routine quantitative renal study may be performed.
 5. If the ACE inhibitor renal study is abnormal, a baseline Tc-99m-MAG3 renal study should be performed later when the patient has been off ACE inhibitors for at least 2 days.

Method for timely correction of Data Analysis and reporting errors and notification of referring parties

- Data Analysis and reporting errors are reported to the interpreting physician and appropriate clinic manager for timely correction and notification of the referring physician via report addendum or STAT call if error is significant.

Principle Radiation Emission Data - Tc-99m

- Physical half-life = 6.01 hours.

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

Dosimetry - Tc-99m-MAG3

Organ	rads/10 mCi	mGy/370 MBq
Bladder wall		
4.8 hour void	4.8	48.0
Ovaries		
4.8 hour void	0.26	2.6
Testes		
4.8 hour void	0.16	1.6
Kidneys	0.14	1.4
Total body	0.07	0.7
Liver	0.04	0.4