LUNG AEROSOL STUDY
(Tc-99m-DTPA Aerosol)

Overview

- The Lung Aerosol Study demonstrates the distribution of ventilation within the lungs in multiple projections. The quality of the study can be degraded if some of the aerosol deposits on the bronchi and does not reach the alveoli.

Indications

- Diagnosis of pulmonary embolism, particularly when helical CT is contraindicated because of renal insufficiency or a history of a bona fide contrast reaction (1-4).

- Evaluation of ventilation (5).

Examination Time

- 45 minutes.

Patient Preparation

- The aerosol ventilation study is usually performed after the perfusion study (3). This allows the aerosol study to be omitted when the perfusion study is normal. (However, the aerosol study may be performed before the perfusion study.)

- Rehearse the breathing procedure to assure optimal patient cooperation; instruct the patient to breathe by mouth.

- Pretreatment of asthmatic patients with a bronchodilator may improve the quality of the study (6).

Equipment & Energy Windows

- Gamma camera: Large field of view, preferably a dual head camera.

- Collimator: Low energy, high resolution, parallel hole.

- Energy window: 20% window centered at 140 keV.

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical: Tc-99m-DTPA aerosol (1-3,7,8):

θ Technegas (actually a fine aerosol) is preferred if available (9-11).

- Dose: Approximately 10 to 15% of the dose in the nebulizer goes to the patient (5).

- Technique of administration: Via a positive pressure nebulizer (5,7,12):
  1. Use a relatively small baffle to minimize bronchial deposition of the aerosol.
  2. Drive the nebulizer with compressed air or oxygen at a flow rate of 10 or greater L/min.
  3. Fit the patient with a tightly fitting mask or a mouth piece and nose clamp.
  4. Slowly introduce 35 mCi (1,295 MBq) Tc-99m-DTPA in 3-5 mL into the nebulizer if DTPA is being done first (5). However, if the aerosol procedure is done second (following MAA) then administer 75 mCi (2775 MBq).
  5. (If aerosol is being done first) Instruct the patient to breathe at a normal rate for 5 minutes or when the posterior count rate reaches 3k/second. If aerosol is be done post MAA then administer for 10-12 minutes (13).
  6. Turn off the gas flow to the nebulizer.
  7. Wipe any aerosol from the patient's face and have the patient expel any saliva which may result in activity in the stomach.

Patient Position & Imaging Field

- Patient position: Sitting (supine if the patient is unable to sit).

- Imaging field: Entire lungs.

Acquisition Protocol

- Measure the count rate from the perfusion image in the POST projection.

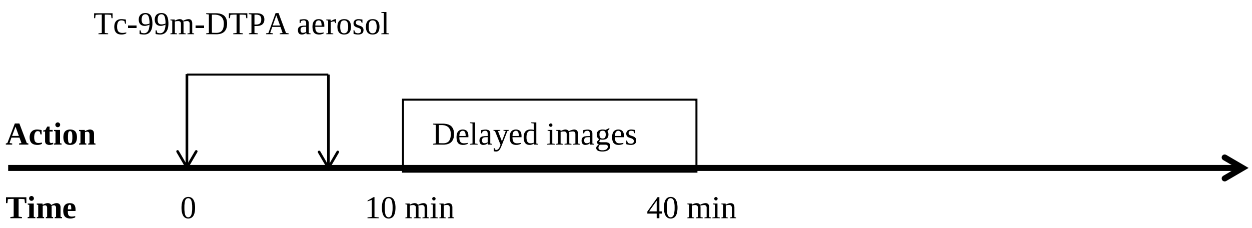
- Then monitor the count rate as the patient inhales the aerosol and continue until the count rate equals 3-4 times the base count rate (5).

- Acquire the aerosol ventilation images for the same times as the corresponding perfusion images.

- Image acquisition:
  > Acquire perfusion images in the POST, LPO, L LAT, ANT, R LAT, and RPO projections. (If a dual head camera is used, acquire RAO and LAO projections as well.) However, the minimal amount of images that should be taken are: POST, RPO, LPO, and ANT.

  θ SPECT images of perfusion and ventilation may be substituted for planar imaging (4,14).

Protocol Summary Diagram



Data Processing

- None.

Optional Maneuvers

- Planar images from SPECT images: Planar images can be reconstructed from SPECT images (4).

- Quantitation of homogeneity of ventilation: The homogeneity of bronchopulmonary distribution may be quantitated (4).

- Functional perfusion/ventilation images: Functional or parametric images of

- Quantitation of clearance: Clearance of Tc-DTPA aerosol from the lungs can be quantitatively evaluated (4,16,17).

Principle Radiation Emission Data - Tc-99m (18)

- Physical half-life = 6.01 hours.

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

Dosimetry - Tc-99m-DTPA Aerosol (19)

Organ	rads/6 mCi	mGy/222 MBq
Bladder wall	0.60	6.0
Lungs	0.30	3.0
Kidneys	0.12	1.2
Total body	0.12	1.2

References

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Normal Findings

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