8.2

PULMONARY VENTILATION IMAGING WITH XENON

Clearwater Imaging Associates

INDICATIONS:

- Diagnosis of pulmonary embolism
- Dyspnea
- Chest pain
- Hemoptysis
- Tachycardia, arrhythmia
- Abnormal EKG
- Hypoxia
- Quantitation or preoperative evaluation

SCHEDULING:

1. **Instructions to Patient:**
   
   No specific patient instructions are necessary.

2. **Labs:**
   
   No specific labs are necessary. If available, a recent arterial blood gas result should be entered on the patient data sheet.

3. **Image Correlation:**
   
   Obtain any prior VQ scan. Recent chest X-ray (see Protocol 8.1)(optimally <24 hours).

4. **Comments:**
   
   Ventilation imaging is almost always followed by perfusion imaging. The two tests take approximately 60 minutes to perform.

RADIOPHARMACEUTICAL:

Xenon-133 gas, 10-20 mCi inhaled (see separate protocol for Technetium-99m DTPA aerosol).

PATIENT PREPARATION:

1. Patient cooperation is essential to obtaining a good study. The patient must understand the procedure in detail before proceeding. A "dry run" is always necessary prior to beginning.

2. Because of the low energy range of Xe-133, ventilation imaging should be performed before perfusion imaging with technetium-99m labeled compounds.
EQUIPMENT AND PREPARATION:

1. **Gamma Camera:**
   
a. Use a wide field of view camera for all studies.

b. 20% window centered around 80 keV.

c. High resolution, low energy parallel-hole collimator.

2. Xe-133 ventilation imaging can only be performed in designated rooms. Close the door during the study to enhance clearance within the room, and to prevent entry of xenon into hallway.

PROCEDURE:

1. Image the patient from the posterior projection in either the supine or upright seated position. Mark the position used on the film.

2. The procedure should be explained to the patient before starting the test, and a "dry run" should be made. The patient must be as comfortable as possible with the administration apparatus in order to avoid an inadequate study or the release of Xe-133 into the room.

3. Follow the procedure for using the Pulmonex. Step-by-step protocol can be found in the front cabinet of the Pulmonex.

4. With the mouth piece and nose clip in place, determine if the patient is breathing through the closed dispensing system.

5. To set up study, use Dyn Vent or Preset #3. First breath: Have the patient exhale completely and administer the activity into the input tubing of the dispensing apparatus. The patient takes a deep breath and holds it for 10 seconds.

6. Equilibrium: As the patient breathes normally, obtain two consecutive 60 second images using the same intensity setting as in the first breath image. In the presence of a high count rate, it may be necessary to decrease the intensity setting to avoid overexposure. **A full two-minute rebreathing study is essential if an adequate washout study is to be obtained!**

7. Washout: Adjust the dispensing apparatus for the washout phase. Begin imaging within 30 seconds. Adjust the intensity setting to obtain proper film density. On Elscint systems, 6 sequential one minute washout images are obtained.

8. The imaging rooms are designed to have negative pressure for xenon exhaust when the doors are closed. Leave the door to the imaging room closed throughout the entire ventilation and perfusion lung study so that any free xenon can be discharged via the vent system rather than entering the rest of the Nuclear Medicine Department.
NOTES:

1. Patients with endotracheal or tracheostomy tubes require a special connecting tube, which can be obtained from Respiratory Therapy. Arrange for a respiratory therapist to be present to assist. Omit the initial breath image, since these patients are unable to hold their breath.

2. Occasionally, repeat ventilation imaging after a perfusion scan will be requested by the nuclear medicine physician, usually to assess ventilation from a different projection. After the patient has been positioned, use the following imaging sequence:
   a. Using a 20% window centered around 140 KeV, obtain a 1 minute perfusion image.
   b. Using a 20% window centered around 80 KeV, obtain a 1 minute image, using the same intensity to be employed during the first breath study.
   c. Proceed with first breath, equilibrium, and washout images as per routine. Dyn Vent or Preset #3.

COMPUTER PROCESSING/FILMING:

See discussion under Pulmonary Perfusion Imaging.

REFERENCES:


**Note:** This protocol is in agreement with the Society of Nuclear Medicine Procedure Guidelines Manual, 1999, and ACR Standards 1999-2000.