Austin Radiological Association

LUNG VENTILATION STUDY
(Xe-133 Gas)

Overview

- The Lung Ventilation Study demonstrates the distribution of ventilation, air space, and air trapping within the lungs in the posterior projection, but images in other projections can be acquired concurrently.

Indications

- Diagnosis of pulmonary embolism, particularly when helical CT is contraindicated because of renal insufficiency or a history of a bona fide contrast reaction.
- Evaluation of regional ventilation.

Examination Time

- Initial images: 10 minutes.

Patient Preparation

- Rehearse the patient through the breathing maneuvers required for image acquisition.

Equipment & Energy Windows

- Gamma camera: Large field of view.
- Collimator: Low energy, high resolution, parallel hole.
- Energy window: 20% window centered at 80 keV.
- Gas dispenser with return trap and 3 way valve.

Radiopharmaceutical, Dose, & Technique of Administration

- Radiopharmaceutical (10): Xe-133 gas.
- Dose: 4 - 20 mCi (148 - 740 MBq). Pedi dose by NACG chart.

- Technique of administration: Xenon delivery system with trap:
    1. Fit the patient with a tightly fitting mask or a mouth piece and nose clamp.
    2. Attach the xenon delivery system for injection of Xe-133 gas and collection of exhaled Xe-133 gas.
    3. Set the valves so the patient is breathing from and into the xenon system, i.e. a closed system.

Patient Position & Imaging Field

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

- Imaging field: Entire lungs; the Xe-133 dose may be used as a transmission source to ensure that the lungs are all within the field of view.

Acquisition Protocol

- Be sure a new external filter is in the gas delivery system.

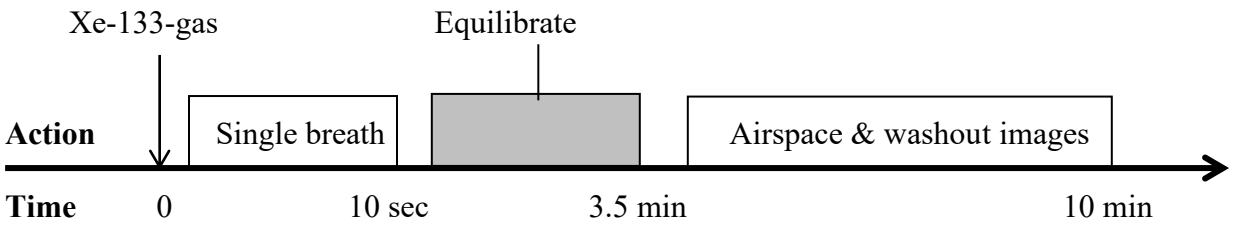
- Acquire an inspiration (single breath) image:
    1. Instruct the patient to exhale completely, take a deep breath as the Xe-133 gas bolus is injected into the delivery system and then hold their breath as long as possible.
    2. Acquire Posterior (and Anterior if dual-head) image for 10 seconds (if possible).

- Acquire equilibrium (rebreathing) images:
    1. Acquire the following images while patient breathes normally, 30 seconds each.
    2. For a seated patient, acquire in this order: RPO, LPO, Posterior
    3. For supine patient, all images should be Posterior (and Anterior if dual-head).
    4. If patient's arms are in the FOV on Oblique images, this should be notated on images and / or technologist comments.

- Acquire a series of washout (airway obstruction) images:
    1. Change the system valve so that the patient breathes room air in and exhales Xe-133 into the system trap.
    2. Beginning immediately, acquire sequential 30 second images until the Xe-133 gas is gone as judged from the persistence scope. Acquire a minimum of 5 Posterior (and Anterior if dual-head) images.

- Close the xenon delivery system and remove the mask from the patient's face.

Protocol Summary Diagram



Data Processing

- None

Principle Radiation Emission Data - Xe-133

- Physical half-life = 5.25 days.

Radiation	Mean % per disintegration	Mean energy (keV)
Beta-2	99.3	100.5
Ce-K-2	52.0	45.0
Ce-L-2	8.5	75.3
Ce-M-2	2.3	79.8
Gamma-2	37.1	81.0
K alpha 2 x-ray	13.3	30.6
K alpha 1 x-ray	24.6	31.0
K beta x-rays	8.8	35.0

Dosimetry - Xe-133 Gas

Organ	rads/20 mCi	mGy/740 MBq
Lungs	0.17	1.7
Whole body	0.002	0.02
Brain	0.001	0.01