SmartVent Acquisition Procedure

Aim

 (V/Q) imaging allows assessment of both the Ventilation (V) and Perfusion (Q) of the lungs. Its main purpose is for the diagnoses of pulmonary emboli (PE). If a PE is present the lung perfusion will demonstrate a wedge shaped defect where the emboli is disrupting the blood supply to the affected area of the lung, which should be unmatched on the ventilation images i.e. the ventilation image should appear normal. These images along with chest x-ray, blood tests and clinical judgement help the medical team decide on the likelihood of PE.

V/Q SPECT is the optimal method of acquisition as it provides a greater sensitivity and specificity and is of particular use with effect along the medial aspects of the lungs. If a patient cannot lie down or keep still for the duration of SPECT images planar may be acquired with the patient sitting upright.

V and Q scans are acquired back to back with the ventilation scan performed first and the perfusion scan performed immediately afterwards. **As both scans use a ^{99m}Tc agent it is important that the ventilation agent is swamped out by the perfusion agent. A ratio of 4 to 1 is optimum.**

Patient Preparation

Ventilation - Prior to ventilation imaging the patient should be positioned supine on the camera couch and moved under the camera head(s) with their head and apices of lung just out of the field of view. SmartVent ventilation agent should be administered following the guidelines in the SmartVent Instructions for Use document. When the count rate per head reaches 1.5K cps administration of SmartVent may be stopped. This count rate is approximate to 30 MBq of DTPA, however, at 1.5Kcps larger patients may have received an administered dose higher than 30 MBq due to greater tissue attenuation. The patient may be moved into the camera so the whole of the lungs are in the field of view and imaging commenced**.**

Perfusion – When ventilation imaging is complete the patient should be injected whilst still lying supine with MAA. The syringe should be gently swirled immediately prior to injection to re-suspend the particles. Upon injection blood must not be drawn back into the syringe. The patient must breathe deeply during injection

There are no specific contraindications to injection of MAA although special care should be taken if patients have a history of intra-ventricular shunts or pulmonary hypertension. In these cases MAA should be given by slow IV injection and the number of particles reduced by 50%.

The patient should be moved into position under the camera and the count rate noted. **If there is less than a 4 to 1 ratio seek advice from the chief technologist, physicist or radiologist.**

Pregnant Patients and breastfeeding mothers up to 7 days post-partum referred

for V/Q scanning should receive half the normal administered activity of radiopharmaceutical. Breast-feeding mothers up to 7 days post-partum on half the normal administered activity should have a 24 hour breast feeding interruption time.

Ventilation Administered Dose Assessment

The amount of the SmartVent ventilation agent administered may be calculated easily. First, note the anterior count rate immediately after administration of the Smartvent. Then note the combined anterior count rate of both the ventilation and perfusion agents together. Subtract the ventilation count rate from the perfusion count rate which will give the perfusion only count rate. Divide administered perfusion dose in MBq by the perfusion count rate. This will give the amount of MBq in a 1 Kcps count rate. Multiply the result by the ventilation count rate. This figure is the administered dose of DTPA in MBq.

This is summarized below:

$$TCc - Vc = Pc$$

TCc = Total combined count rate
Vc = Ventilation count rate
Pc = Perfusion count rate
APd = Administered perfusion dose
AVd = Administered ventilation dose
kC = MBq per Kilo Counts

$$\frac{APd}{Pc} = Kc$$

$$Kc \times Vc = AVd$$

Camera Parameters

Factor	Settings
Collimator	LEGP
Matrix Size	Planar = 128*128 SPECT = 64*64
Zoom	1
Detectors	Select both or the appropriate one for imaging
Detector configuration	Ant and post planar and SPECT-180 degrees RPO & LPO – 90 degrees
Camera Motion	Continuous

View	Detector 1 name	Detector 2 name	Orientation	Stop conditions
Anterior & Posterior Ventilation	Ant	Post	Head out	300 kcounts or 5 minutes
LPO & RPO Ventilation	LPO	RPO	Head out	300 kcounts or 5 minutes
Anterior & Posterior Perfusion	Ant	Post	Head out	300 kcounts or 5 minutes
LPO & RPO Perfusion	LPO	RPO	Head out	300 kcounts or 5 minutes
Ventilation SPECT	Detector 1	Detector 2	Head out	64 Steps per head – 10 seconds per step
Perfusion SPECT	Detector 1	Detector 2	Head out	64 Steps per head – 5 seconds per step

Acquisition

SPECT -
- Ensure patient is comfortable with a pillow under their knees if required.
- Place a pillow under the patient's head. Ensure this is lengthways so that the camera does not contour around the pillow.
- The patient should go into the camera feet first.
- If patient is able get them to raise their arms above their head. If they are unable to keep their arms up for long enough they may keep them by their sides. Use of the arm rest may help with patient compliance. **It is important to ensure that the patient is in the same position for both the ventilation and the perfusion scan.**

Planar –
- Ensure patient is comfortable with a pillow under their knees if required.
- Place a pillow under the patient's head.
- The patient should go into the camera feet first.
- The patient may keep their arms by their sides for the anterior and posterior images. For the posterior oblique images the patient should place their hands together onto their lap so that the upper arms do not cause attenuation artefact.