

Latest highlight from literature review

Bajc, M et al "Identifying the heterogeneity of COPD by VIP SPECT: a new tool for improving the diagnosis of parenchymal defects and grading the severity of small airways disease", *Int J Chron Obstruct Pulmon Dis* (2017); 12: 1579-1587

COPD, a new indication for using Technegas V/Q SPECT?

Chronic obstructive pulmonary disease (COPD) is a heterogeneous disease caused by inflammation and obstruction resulting in remodeling of small airways and parenchymal destruction¹. Experts prognose that COPD will be the third frequent cause of death worldwide².

Spirometry is used in daily clinical practice to monitor disease progression and severity in patients with COPD³. However, spirometry correlates poorly with small airways diseases and therefore does not reflect physiopathology and heterogeneity of COPD³.

Quantification of ventilation pattern in chronic obstructive lung diseases as COPD could be used as a support to discriminate between phenotypes because of heterogeneous ventilation abnormalities⁴.

Ventilation single photon emission computed tomography (SPECT) imaging could detect early functional airway abnormalities and provide useful information on topographical distribution of ventilation at the (sub)regional level⁴.

Imaging modalities such as ventilation-perfusion (V/Q) SPECT scan could help categorizing patients into different phenotypes, optimizing therapies, following and predicting disease progression and measuring response to therapy⁵.

1. Agusti, et al. *Eur Respir J* 2016; 47(2): 410-419
2. Adeloje, et al. *J Glob Health* 2015; 5(2): 020415
3. Vestbo, et al. *Am J Respir Crit Care Med* 2013; 187(4): 347-365
4. King, et al. *Semin Nucl Med* 2010; 40(6): 467-73
5. Hah, et al. *Am J Respir Crit Care Med* 2010; 182(5): 598-604

Aim of the study

Evaluating V/Q SPECT:

- in the diagnosis of COPD;
- in grading the severity of COPD;
- and in specifying the role of additional pulmonary comorbidities inducing COPD heterogeneity

Design of the study

Enrollment of 94 patients in a multi-centre trial:

- 40 years of older;
- clinical diagnosis of COPD based on GOLD criteria;
- history of smoking or biomass exposure;
- no exacerbation within 6 weeks prior to study entry

Methods to assess lung function:

- Post-bronchodilator spirometry
- V/Q SPECT
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Major findings

V/Q SPECT using Technegas as the ventilation imaging agent could diagnose and grade severity of COPD and estimate preserved lung function.

V/Q SPECT appears to be a unique tool to reveal the heterogeneity of COPD caused by pulmonary comorbidities with vascular and ventilatory defects such as pulmonary embolism, left heart failure, lung tumour and pneumonia.

The characteristics of these comorbidities suggest their significant impact in symptoms, their influence on prognosis and response to treatment.

Clinical value for TECHNEGAS

The small hydrophobic aerosol property of Technegas allows its penetration into the smallest airways enabling detection of airway obstruction earlier than by spirometry which solely cannot describe the complexity of COPD.

Early year literature review

The optimal tracer for ventilation studies is Technegas, an ultra fine dispersion of ^{99m}Techneium-labeled carbon. Despite that Technegas is not approved for use in the United States, it is used in 79% of ventilation imaging studies performed in Canada and is also commonly used in Europe. Its main advantage is greater percentage deposition in the alveolar spaces and less undesirable adherence to the central airways, compared with droplet radioaerosols.

Metter D, et al. Am J Roentgenol (2017); 208: 1-6

Lung Ventilation-Perfusion (V/Q) scan as diagnostic tool for Pulmonary Embolism

Among the traditional imaging modalities for diagnosing PE, the choice has narrowed to V/Q scan and CT pulmonary angiography (CTPA).

However, V/Q scan is preferred over CTPA for follow-up of PE particularly in young women in order to avoid the excessive breast radiation exposure associated with CTPA. *Hess S, et al. Adv Exp Med Biol 2017; 906: 49-65*

CTPA can lead to overdiagnosis and overtreatment of non-occlusive subsegmental PE. *Lu Y. Nucl Med Mol Imaging 2017; 51(1): 97-98*

Indeterminate V/Q scan for pulmonary embolism diagnosis is reduced by 41% with SPECT compared to planar scintigraphy.

Patients with single subsegmental mismatched (SSM) were more commonly identified with SPECT than with planar V/Q studies.

However, SSM patients would not require further imaging studies as pulmonary embolism incidence was extremely low (<5%) in SSM patients that underwent CTPA.

Stubbs M, et al. Nucl Med Commun 2017; 38(2): 135-140

Acute pulmonary embolism patients of female, older age, and higher tricuspid regurgitation jet at baseline seem to have a higher risk of persistent perfusion defects after 6 months of treatment.

The presence of residual perfusion abnormalities at 6 months was not associated with an increased risk for recurrent PE highlighting that quantified perfusion SPECT scans do not have additional value as a stand-alone test after treatment.

Meysman M, et al. Ann Thorac Med 2017; 12(1): 30-35

Lung V/Q scan as screening tool for CTEPH diagnosis

Ventilation-perfusion (V/Q) scan is the imaging modality of choice for screening patients with CTEPH due to its high sensitivity.

Imaging in CTEPH reveals perfusion defects with normal ventilation.

A normal or low-probability V/Q effectively excludes CTEPH with a sensitivity of 90-100% compared to CTPA yielding a sensitivity of 50-98%.

Despite the high sensitivity and experts recommendations, V/Q scan for detecting CTEPH patients is still underutilized.

Efforts should be tailored to increase its use in clinical setup as V/Q do not require iodine contrast and have less radiation exposure compared to CTPA.

Ascha M, et al. Ann Thorac Med 2017; 12: 61-73

Other related topics v

Pulmonary thromboembolism (PTE) is a potentially underdiagnosed cause of early post-lung transplantation (PTX) respiratory failure. Systematic follow-up V/Q SPECT scans for identifying subclinical PTE should be conducted to accurately assess the incidence and prognostic impact of PTX associated with PTE.

Kristensen AW, et al. Clin Transplant 2017; 31(4): e12

4-Dimensional computed tomography (4DCT) is a ventilation lung imaging modality for pre-operative surgical resection having a great potential to translate to the surgical domain. 4DCT-ventilation may reduce the cost and imaging time for patients while providing spatial accuracy and quantitative results for surgeons.

Vinogradskiy Y, et al. Med Phys 2017; 44(1): 200-208