SNMMI AUC Factsheet for Ventilation-Perfusion Imaging in Pulmonary Embolism

EXECUTIVE SUMMARY

Nuclear medicine imaging studies are essential for the diagnosis and management of many diseases. The ready availability of medical imaging studies in conjunction with concerns about missed diagnoses has, at times, resulted in inappropriate use and overuse of all medical imaging technology, including nuclear imaging. The overuse may have resulted in an unnecessary financial burden on the health-care system and in some cases unnecessary exposure to ionizing radiation. Overuse and inconsistent use of imaging procedures has prompted a push for multi-stakeholder consensus documents outlining the most appropriate and cost-effective use of advanced medical imaging studies.

Perfusion lung imaging for diagnosing pulmonary embolism (PE) was introduced 50 years ago. At that time, it offered a noninvasive alternative to pulmonary angiography in patients with a clinical suspicion of PE. Because there are many causes of diminished regional blood flow in the lungs, particularly redistribution of blood flow away from regions with lung disease, the subsequent introduction of radionuclide ventilation studies added greater specificity to findings on radionuclide perfusion imaging. When appropriately used and interpreted, ventilation–perfusion (V/Q) scintigraphy is an important imaging tool for the evaluation of patients suspected of having regional compromise of lung perfusion and ventilation.

AUC INTRODUCTION

The purpose of this document is to describe the appropriate use criteria (AUC) of ventilation-perfusion (V/Q) imaging in patients suspected of having acute PE. It is hoped that through these recommendations, V/Q scintigraphy will be appropriately applied to benefit patients. This document is presented to assist health-care practitioners considering V/Q scanning in patients suspected of having PE; however, each patient is unique, as is each clinical presentation, and therefore this document cannot replace clinical judgement. V/Q scanning can also be used to assist in the management of patients with conditions other than acute PE; however, conditions other than acute PE are beyond the scope of this document.

Clinical Scenarios for V/Q Imaging in PE

A PE occurs when a blood clot from a deep-vein thrombosis detaches from a vein wall, travels to the lungs and blocks pulmonary arterial flow. PEs affect 300,000 to 600,000 Americans each year, and sudden death is the first symptom in about 25 percent of cases. A V/Q scan measures both breathing and circulation in all areas of the lungs and, used appropriately, is an important tool for diagnosing PE. It can expose patients to less radiation than CT pulmonary angiography (CTPA) and does not include the risks associated with iodinated contrast agents.

Shortness of breath or hypoxemia are behind many of the referrals for patients with suspected PE. Both V/Q scans and CTPA can assist in diagnosing the cause of hypoxemia or shortness of breath. This document is therefore written to assist all medical practitioners in the appropriate use of V/Q scintigraphy in all patients that present with signs or symptoms of PE.

The two basic imaging technologies that may be used to perform nuclear medicine V/Q studies are planar imaging and SPECT. SPECT combined with low-dose, non-contrast CT (SPECT/CT) has gained some popularity as well. Both methods have excellent performance characteristics in the diagnosis of clinically significant PE. Both nuclear imaging and CTPA may demonstrate the presence of small, subsegmental emboli, which, if uncomplicated, may not require treatment.

There is regional variation in the choice of V/Q methodology, with V/Q planar imaging being the more commonly used technology in the United States whereas V/Q SPECT is preferred in Europe, Australia, and some countries in Asia.

Clinical Scenarios for PE in Adults

Scenario #	Description	Appropriateness	Score
1	PE unlikely, d-dimer negative	Rarely Appropriate	1
2	PE likely; negative d-dimer	Appropriate	8
3	PE unlikely, d-dimer positive	Appropriate	8
4	PE likely, male or non-pregnant female, with normal chest radiograph.	Appropriate	9
5	PE likely, male or non-pregnant female, with mild abnormal chest radiograph.	Appropriate	9
6	Suspected PE, male or non-pregnant female, with significant abnormal chest radiograph.	May be Appropriate	4
7	PE likely, patient with abnormal renal function	Appropriate	9
8	PE likely, patient at risk for complications from contrast administration	Appropriate	9
9	PE likely; patient can not cooperate for ventilation imaging, perfusion only	May be Appropriate	5
10	PE likely; CTPA chest inconclusive or discordant with clinical probability	Appropriate	9

11	PE likely; Hemodynamically unstable patient, portable V/Q equipment available	Appropriate	9
12	PE likely; Hemodynamically unstable patient, portable V/Q equipment unavailable	Rarely Appropriate	1
13	PE likely; US lower extremity with thrombus	Appropriate	9
14	PE unlikely; US lower extremity with thrombus	May be Appropriate	5
15	PE likely; Pregnant patient with normal/mild abnormal chest radiograph, low dose perfusion only	Appropriate	9
16	PE likely; Pregnant patient with severe abnormal chest radiograph, perfusion only	Rarely Appropriate	3
17	PE likely; Patient ventilator dependent	May be Appropriate	5
18	Recent/prior documentation of PE; suspected new PE, previous CTPA	Rarely Appropriate	2
19	Recent/prior documentation of PE; suspected new PE, previous V/Q	Appropriate	9
20	Recent CTPA documented PE now on anticoagulation. Imaging to document disease status	Rarely Appropriate	2
21	Recent V/Q documented PE now on anticoagulation. Imaging to document disease status	Appropriate	9

Rating and Scoring

The above clinical scenarios are scored as “appropriate,” “may be appropriate,” or “rarely appropriate” on a scale from 1 to 9. Scores 7–9 indicate that the use of the procedure is appropriate for the specific clinical scenario and is generally considered acceptable. Scores 4–6 indicate that the use of the procedure may be appropriate for the specific clinical scenario. This implies that more research is needed to classify the use of V/Q imaging in the particular clinical scenario definitively, or that some patient sub-populations in the described clinical scenario may benefit more than others. Scores 1–3 indicate that the use of the procedure is rarely appropriate for the specific clinical scenario and generally is not considered acceptable.

Methodology

The process for AUC development was modeled after the RAND/ UCLA Appropriateness Method for AUC development. It includes multi-stakeholder identification of a list of relevant clinical scenarios, a systematic review of evidence in the literature, and a systematic synthesis of available evidence, while adhering to the Institute of Medicine’s standards for developing trustworthy clinical guidance.

This AUC was developed by the Society of Nuclear Medicine and Molecular Imaging with participation from experts affiliated with the following organizations: European Association of Nuclear Medicine; American College of Emergency Physicians; American College of Radiology; American Society of Hematology; Society of Thoracic Surgeons; and American College of Chest Physicians.

For the complete manuscript and listing of references, visit: http://snmmi.files.cms-plus.com/Quality/jnm191437_v7.pdf

JNM Reference

Waxman AD, Bajc M, Brown M, et al. Appropriate use criteria for ventilation – perfusion imaging in pulmonary embolism: summary and excerpts. J Nucl Med. 2017;58(5):13N–15N.