Lung Perfusion Scan for Pulmonary Embolism and Shunt Detection: An Effective Diagnostic Tool

Sana Munir Gill[1], Areej Ijaz[2], Aamna Hassan[3]

[1,3]Department of Nuclear Medicine, [2]Resident Doctor, Shaukat Khanum Memorial Cancer Hospital and Research Centre, Lahore, Pakistan

Correspondence: Aamna Hassan. **Email**: aamnah@skm.org.pk

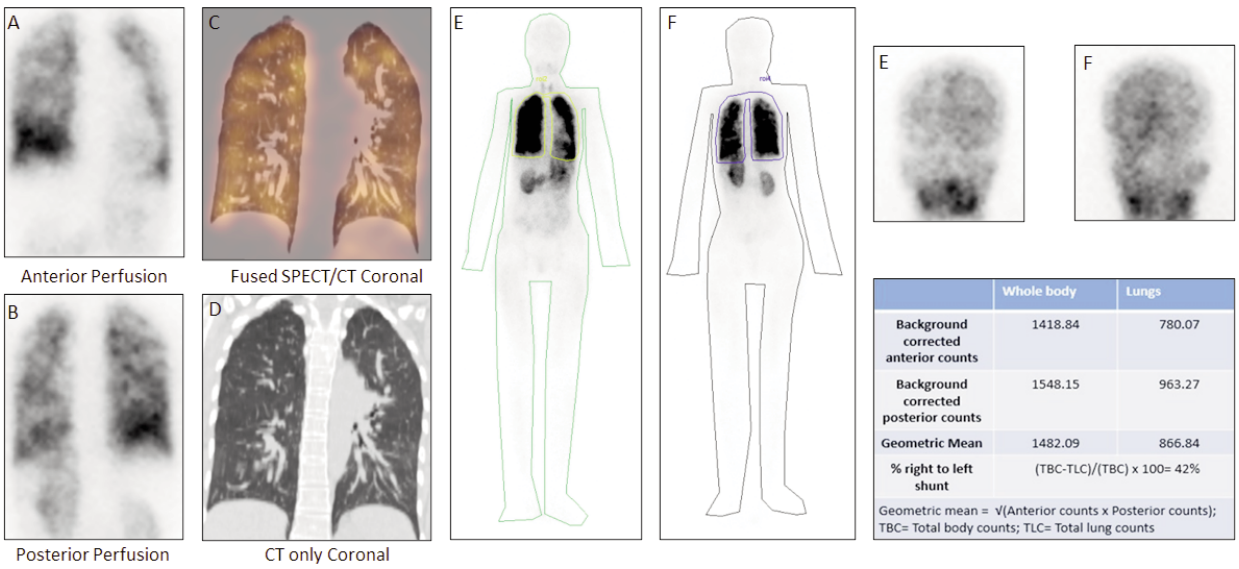
ORCID ID: 0000-0003-0026-0729

Abstract

Pulmonary embolism (PE) can lead to chronic thromboembolic pulmonary hypertension (CTEPH) which can result in right heart failure. Therefore, timely management of this condition can save patients from serious complications. In the department of Nuclear Medicine, ventilation perfusion (V/Q) scan has been used to supplement detection of PE especially in cases where contrast based computed tomography pulmonary angiography (CTPA) cannot be performed. With the advent of single photon emission computed tomography (SPECT/CT), perfusion scan with SPECT/CT is being frequently used. It has also been used for the diagnosis of various other indications such as right to left cardiac shunts in addition to PE. Technetium 99m macroaggregated human serum albumin (99mTc HSA) is commonly used in lung perfusion scans. It can also be taken up by extra pulmonary organs such as brain or kidneys due to presence of shunt. We present an interesting case of simultaneous detection of PE and right to left shunt in a young patient.

Keywords: Pulmonary embolism, ventilation perfusion scan, right to left shunt, brain uptake.

DOI: https://doi.org/10.47391/JPMA.25-15



	Whole body	Lungs
Background corrected anterior counts	1418.84	780.07
Background corrected posterior counts	1548.15	963.27
Geometric Mean	1482.09	866.84
% right to left shunt	(TBC-TLC)/(TBC) x 100= 42%	

Geometric mean = √(Anterior counts x Posterior counts); TBC= Total body counts; TLC= Total lung counts

Figure: Anterior and posterior planar images of [A,B] show heterogenous and patchy perfusion to bilateral lungs with nonsegmental areas of reduced perfusion. Reversal of the anterior posterior perfusion gradient; more pronounced in the left lung which was suggestive of pulmonary venous hypertension. Similar findings are seen on fused coronal SPECT/CT images [C] without any underlying lesion on CT [D]. Whole body and spot views of skull showed abnormal tracer accumulation was seen in the brain and kidneys representing significant systemic right to left shunt [E-F]. Right to left cardiac shunt of 42% was calculated (Normal value: less than 10%).

A 19-year-old girl, with repeated episodes of dyspnoea and recent onset of cyanosis, was referred for ventilation perfusion scan to rule out pulmonary embolism (PE). Transesophageal echocardiography (TEE) showed right ventricular hypertrophy, pulmonary hypertension and gigantic pulmonary artery with severe pulmonary resistance and normal left ventricular function. PE is a highly treatable condition, which if left untreated, can result in significant mortality and morbidity. Nuclear lung scan plays a pivotal role in early diagnosis and effective management of patients who cannot have CT pulmonary angiogram[1]. Addition of single photon emission computed tomography (SPECT/CT) to VQ scans has led to improved sensitivity. There was heterogenous perfusion in both lungs with non-segmental perfusion defects (A, B).

Incidental visualization of kidneys lead us to acquire whole body planar images followed by spot views of brain to rule out right to left shunt (A-D). Increased tracer activity was seen in brain (E, F) and shunt percentage was calculated to be 42%, confirming our suspicion of right to left cardiac shunt in addition to chronic PE.

99mTc MAA has been used in the diagnosis intrapulmonary and extrapulmonary shunts in addition to PE[2,3]. Intrapulmonary and intracardiac shunts can both lead to true right to left shunts.[4] In our case, although operator dependent TEE showed no evidence of anatomic cardiac septal defect, but VQ findings suggested otherwise. So, in cases where supplemental oxygen is unable to rectify hypoxaemia, co-existence of right to left shunting of venous blood either through heart or lungs or even both should be suspected.[5]

References

1. Zantonelli G, Cozzi D, Bindi A, Cavigli E, Moroni C, Luvarà S,et.al Acute Pulmonary Embolism: Prognostic Role of Computed Tomography Pulmonary Angiography (CTPA). Tomography. 2022;8:529-539.
2. Gandhi SJ, Babu S, Subramanyam P, Shanmuga Sundaram P. Tc-99m macro aggregated albumin scintigraphy - indications other than pulmonary embolism: A pictorial essay. Indian J Nucl Med. 2013;28:152-62.
3. Gühne F, Drescher R, Ndum F, Seifert P, Freesmeyer M. Complete Right-to-Left Shunt in Lung Perfusion Scintigraphy. Clin Nucl Med. 2021;46:e162-e164.
4. Elliott CG. Pulmonary physiology during pulmonary embolism. Chest. 1992 ;101(4 Suppl):163S-171S.
5. Goldhaber SZ, Elliott CG. Acute pulmonary embolism: part I: epidemiology, pathophysiology, and diagnosis. Circulation. 2003;108:2726-9.