Volume 5 | Issue 6 | 2025

ISSN | 2771-019X

Journal of
Clinical & Medical Images
Case Reports

Open Access | Case Report

Intracardiac shunt on V/Q scan: A hidden stroke risk in patients with atrial thrombus

***Corresponding Author:** Sohrab Singh*

Email: fnu.sohrabsingh@mountsiani.org

Kishan Reddy[1]; Sohrab Singh[2]*; Dhairya Nanavaty[2]; Pradeep Kumar Devarakonda[2]; Pedro Moreno[2]

[1]Department of Health Sciences, St. John's University, New York City, USA.

[2]Department of Cardiology, Icahn School of Medicine at the Mount Sinai Hospital, New York City, New York, USA.

Received: Nov 11, 2025

Accepted: Dec 05, 2025

Published Online: Dec 12, 2025

Cite this article: Reddy K, Singh S, Nanavaty D, Devarakonda PK, Moreno P. Intracardiac shunt on V/Q scan: A hidden stroke risk in patients with atrial thrombus. J Clin Med Images Case Rep. 2025; 5(6): 1816.

Introduction

Stroke is a leading cause of short and long-term disability, significantly impacting physical and cognitive ability. According to the American Heart Association/American Stroke Association (AHA/ASA), approximately 800,000 adults in the US experience a new stroke each year, with mortality approaching 10% within 30 days. By 90 days post-stroke, 10% of younger adults and 30% of adults over 65 develop moderate to severe disability [1,2].

Approximately one-third of cases of stroke are classified as cryptogenic. The prevalence of a Patent Foramen Ovale (PFO) is estimated at 30% in the general adult population and 40% in patients with cryptogenic stroke [3]. Technetium-99 combined with Macroaggregated Albumin (Tc-99m MAA) is a tracer agent commonly used in nuclear medicine ventilation-perfusion (V/Q) scans to detect pulmonary embolism. However, visualization of Tc-99m MAA radioactivity in the brain, indicating an intracardiac shunt, is uncommon [4-6]. We describe a case in which an incidental intracardiac shunt was detected via a V/Q scan, in a patient with right atrial thrombus, who was later readmitted with a stroke.

Case description

A 63-year-old male with a history of hypertension, dyslipidemia, and stage IV cecal adenocarcinoma (undergoing chemotherapy with 5-fluorouracil and bevacizumab) presented to the emergency department with shortness of breath and chest pain. The physical examination revealed a frail, alert and oriented male. Review of symptoms was positive for tachypnea. Vital signs were significant for hypoxia (SpO_2: 89% on room air). Cardiovascular exam showed normal heart sounds without murmurs. Pulmonary exam revealed normal breath sounds. Labs were significant for acute kidney injury with creatinine elevated to 1.7. Given the hypoxia and history of malignancy, a ventilation-perfusion nuclear medicine (V/Q) scan was ordered which revealed a large perfusion defect in the right lower lobe with stripe sign, suggestive of non-embolic parenchymal abnormalities rather than true pulmonary embolism. Incidentally, extrapulmonary radioactivity was noted, including brain and kidneys; highly consistent with right to left shunt (Figure 1). An ultrasound venous doppler of lower extremities was negative for superficial or venous thrombosis. Transthoracic Echocardiography (TTE) revealed normal left and right ventricular sys-

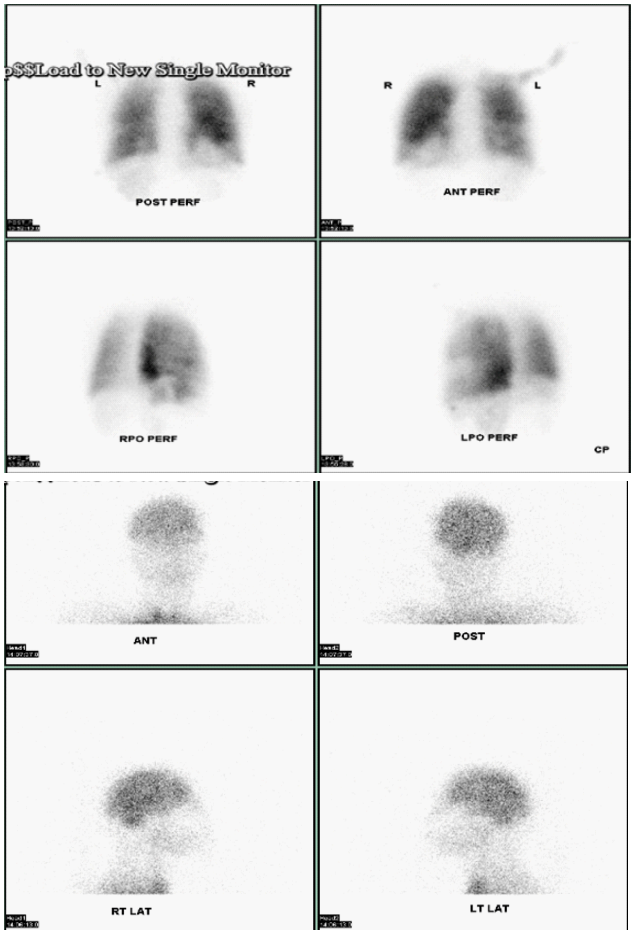

Figure 1: Clinical image.

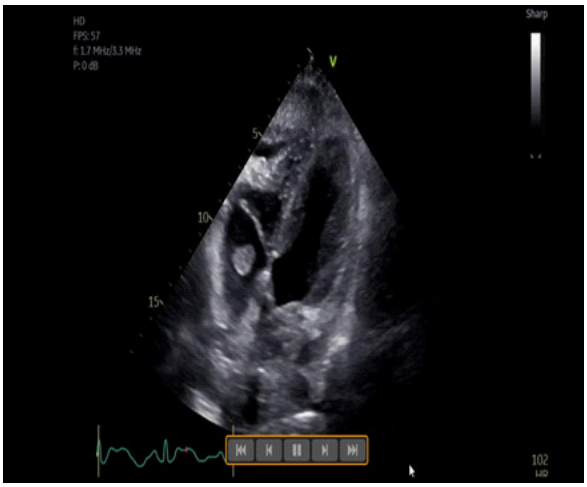

Figure 2: Clinical image.

tolic function but demonstrated a right-to-left shunt, evidenced by a "shower" of microbubbles from the right atrium to the left ventricle, suggestive of a PFO. The patient's shortness of breath was attributed to community-acquired pneumonia, and he was discharged on antibiotics. The patient was readmitted 25 days later for acute onset shortness of breath and Right Lower Extremity (RLE) discoloration raising concern for Acute Limb Ischemia (ALI). Physical exam revealed tachypnea with RLE showing discoloration and poorly palpable pulses compared to the left lower extremity. An ultrasound venous doppler was negative for thrombosis. Laboratory was significant for elevated High Sensitivity (HS) troponin to 336 ng/L and Brain Natriuretic Peptide (BNP) to 137 pg/ml. Computed Tomography of the chest with Angiography (CTA) revealed extensive bilateral pulmonary emboli in the main and subsegmental pulmonary arteries, with associated right heart strain. Given the preference for anticoagulation over surgical interventions, including mechanical thrombectomy, intravenous heparin was initiated. The patient reported subjective improvement in shortness of breath and was discharged on apixaban.

Two months later, the patient was readmitted with changes in mental status, dysarthria, and inability to move his right arm. The National Institutes of Health Stroke Scale (NIHSS) score was 21. A CT head scan revealed a left frontal hypodensity and a left Middle Cerebral Artery (MCA) thrombus. Contrast-enhanced CT of the head and neck showed complete occlusion of the left Internal Carotid Artery (ICA) and left MCA, as well as occlusion of the proximal A1 segment of the left Anterior Cerebral Artery (ACA), consistent with left MCA distribution infarction. The patient was transferred to a tertiary center for possible neurosurgical intervention, where it was decided not to pursue mechanical thrombectomy. TTE revealed normal Ejection Fraction (EF) of 60%, grade 1 diastolic dysfunction, hyperkinetic right ventricular wall motion, and a mobile heterogeneous mass in the RA, measuring 3.0 cm × 1.4 cm, likely originating from the interatrial septum (Figure 2). Patient's compliance with apixaban was reconfirmed. Due to the high risk for hemorrhagic conversion following the recent Cerebrovascular Accident (CVA), anticoagulation was withheld. The patient ultimately succumbed to acute hypoxic respiratory failure.

Discussion

This case report emphasizes the detection of an intracardiac shunt through a nuclear medicine ventilation/perfusion (v/q) scan, which was subsequently confirmed by a Transthoracic Echocardiogram (TTE) using agitated contrast saline. To our knowledge this is the first case report depicting a case of incidental intracardiac shunt detected on a v/q scan wherein the patient was also later found to have a right atrial thrombus and stroke. In this context, the presence of a right atrial thrombus, not previously found during earlier admissions, was also observed (Figure 2). Free pertechnetate (Tc-99m), an aerosolized liquid with particle sizes ranging from 0.1 to 5 microns, typically traverses the pulmonary capillaries. However, when combined with macroaggregated albumin, the resulting Tc-99m-MAA particles size increases to 10-15 microns, which can lead to microemboli depositing in the pulmonary capillaries, detected by a gamma camera.

Under normal circumstances, this intravenous aerosol, consisting of Tc-99m-MAA, should not localize in the brain, as these particles are expected to lodge in the first capillary bed encountered, typically the pulmonary circulation. Conversely, detection of radioactivity outside the lungs, such as in the brain, suggests the presence of a right-to-left shunt, which by passes the pulmonary circulation If there is no uptake in the brain, it can be inferred that no significant right-to-left shunt is present, since Tc-99m-MAA particles are larger than red blood cells (10–30 µm) [7-9]. After intravenous injection, the counts from separate scintigrams (images produced by the gamma camera) are summed to derive a total body count. The proportion of Tc-99m-MAA that bypasses or shunts from the pulmonary to systemic circulation is calculated using the formula: [total body count – total lung count] / total body count × 100 = % Right to Left Shunt [10,5]. In our case, 12.2% of venous blood was calculated as going to total circulation, including the kidneys, by-passing pulmonary circulation without gas exchange. Dedicated images of the brain were obtained to verify that renal de-

position resulted from right-to-left shunting, rather than from free technetium, which can also deposit in the thyroid gland, salivary glands, and stomach [9,11].

The implications of brain uptake in v/q scan as a predictor of future Cerebrovascular Accidents (CVAs) remain unclear. Prior studies have indicated a higher prevalence of PFO in younger patients with cryptogenic strokes; however, more recent research suggests that PFOs may contribute to cryptogenic strokes across all age groups [12,13]. Moderate to large PFOs are estimated to be prevalent in 35% of patients aged >65.12 The size of the right-to-left shunt, often evidenced by the TTE-guided agitated saline "shower" or "curtain" phenomenon, may serve as a predictor of an initial stroke episode; however, its utility in predicting recurrent strokes is uncertain [14]. While our case report depicted an initial stroke episode, prior episodes were not reported. We postulate that the presence of a V/Q scan-detected intracardiac shunt, in combination with the TTE "shower or curtain" phenomenon, may serve as a risk predictor for the size of shunt and therefore future CVAs [15], and that anticoagulation could be considered for primary prevention. Recent literature concludes that anticoagulating patients with a Patent Foramen Ovale (PFO) and cryptogenic stroke depends on individual risk factors and the presence of Deep Vein Thrombosis (DVT) [16,17]. Current guidelines suggest the use of a TTE as the next step for detection of shunt in a cryptogenic stroke [18] however studies comparing the sensitivity of V/Q scan to those of TTE, Transesophageal Echocardiography (TEE) and Transcranial Dopplers (TCD) have not been performed. Further research including randomized control trials (RCTs) are warranted to determine if patients with incidentally detected intracardiac shunt on a v/q scan must be anticoagulated.

Conclusion

The detection of intracardiac shunts on V/Q scans may be used to predict cerebrovascular events. Our case highlights the need for further research on determination of shunt size and decision on anticoagulation once an intracardiac shunt is identified. The use of diagnostic modalities such as TCD may also be used to detect intracardiac shunts with higher sensitivity and reliability for detection of intracardiac shunts. The use of a multidisciplinary team involving cardiologists, including adult congenital heart disease specialists, neurologist and radiologists may help expedite management to prevent further debility, especially in the frail population, and help guide decision on anticoagulation if indicated.

References

1. Kernan WN, Viera AJ, Billinger SA, et al. Primary Care of Adult Patients After Stroke: A Scientific Statement From the American Heart Association/American Stroke Association. Stroke. 2021; 52: 558-571.
2. Gallucci L, Sperber C, Guggisberg AG, et al. Post-stroke cognitive impairment remains highly prevalent and disabling despite state-of-the-art stroke treatment. Int J Stroke. 2024; 19: 888-897.
3. American Heart Association. Understanding diagnosis and treatment of cryptogenic stroke.
4. Konstam MA, Levine BW, Strauss HW, McKusick KA. Left superior vena cava to left atrial communication diagnosed with radionuclide angiocardiography and with differential right to left shunting. Am J Cardiol. 1979; 43: 149-153.
5. Gates GF, Orme HW, Dore EK. Surgery of congenital heart disease assessed by radionuclide scintigraphy. J Thorac Cardiovasc Surg. 1975; 69: 767-775.
6. Treves S, Collins-Nakai RL. Radioactive tracers in congenital heart disease. American Journal of Cardiology. 1976; 38: 711-721.
7. Macrosalb Tc 99m. 2024.
8. Keyeux AJ, Ochrymowicz-Bemelmans DA, Charlier AA. Technetium-99m-Pertechnetate as a Whole Blood Marker for Brain Perfusion Studies. Journal of Nuclear Medicine. 1994; 35: 479-483.
9. Derenoncourt PR, Felder GJ, Royal HD, et al. Ventilation-Perfusion Scan: A Primer for Practicing Radiologists. RadioGraphics. 2021; 41: 2047-2070.
10. Gates GF, Orme HW, Dore EK. Measurement of Cardiac Shunting with Technetium-Labeled Albumin Aggregates. Journal of Nuclear Medicine. 1971; 12: 746-749.
11. Qutbi M. An Easily Overlooked Cause of High Level of Free Pertechnetate in Lung Perfusion Scintigraphy with 99mTc-MAA Resulting From Improper Kit Reconstitution. Indian Journal of Nuclear Medicine. 2020; 35: 91.
12. Dominic JL, Sebastian SA, Paul H, Thomas Mathew J, Dhulipala VR. Patent foramen ovale in patients ≥60 with cryptogenic stroke—not a bystander: why diagnosis and closure matter? European Journal of Preventive Cardiology. 2024; 16: 402.
13. Serena J, Segura T, Perez-Ayuso MJ, Bassaganyas J, Molins A, Dávalos A. The Need to Quantify Right-to-Left Shunt in Acute Ischemic Stroke. Stroke. 1998; 29: 1322-1328.
14. Serena J, Marti-Fàbregas J, Santamarina E, et al. Recurrent Stroke and Massive Right-to-Left Shunt. Stroke. 2008; 39: 3131-3136.
15. Velthuis S, Buscarini E, Gent MWF van, et al. Grade of Pulmonary Right-to-Left Shunt on Contrast Echocardiography and Cerebral Complications: A Striking Association. CHEST. 2013; 144: 542-548.
16. Kasner SE, Swaminathan B, Lavados P, et al. Rivaroxaban or aspirin for patent foramen ovale and embolic stroke of undetermined source: a prespecified subgroup analysis from the NAVIGATE ESUS trial. The Lancet Neurology. 2018; 17: 1053-1060.
17. Messé SR, Gronseth GS, Kent DM, et al. Practice advisory update summary: Patent foramen ovale and secondary stroke prevention: Report of the Guideline Subcommittee of the American Academy of Neurology. Neurology. 2020; 94: 876.
18. Silvestry FE, Cohen MS, Armsby LB, et al. Guidelines for the Echocardiographic Assessment of Atrial Septal Defect and Patent Foramen Ovale: From the American Society of Echocardiography and Society for Cardiac Angiography and Interventions. J Am Soc Echocardiogr. 2015; 28: 910-958.