Jewell Kerry (Orcid ID: 0000-0003-1426-0113)
Lee Sze Ting (Orcid ID: 0000-0001-8641-456X)

Ventilation perfusion lung SPECT/CT in pregnancy during COVID-19

Kerry E Jewell[1], Sze Ting Lee[1,2,3], Jason Trubiano[4,5], Eddie Lau[1,6], Andrew M Scott[1,2,3,5]

[1] Department of Molecular Imaging and Therapy, Austin Health, Heidelberg, Australia

[2] Olivia Newton-John Cancer Research Institute, Austin Health, Heidelberg, Australia

[3] School of Cancer Medicine, La Trobe University, Melbourne, Australia

[4] Department of Infectious Disease, Austin Health, Heidelberg, Australia

[5] Department of Medicine, University of Melbourne, Austin Health, Heidelberg, Australia

[6] Department of Radiology, Austin Health, Heidelberg, Australia.

Word count: 530

Corresponding Author

Dr Kerry Jewell, MBBS, BMedSc (Hons)

Department of Molecular Imaging and Therapy, Austin Health

145 Studley Rd, Heidelberg, Victoria, 3084, Australia

kerry.jewell@austin.org.au

T: +613 9496 5007

F: +613 9457 6605

Key Words

COVID-19, pulmonary embolism, pregnancy, ventilation perfusion scintigraphy, D-dimer

Author Manuscript

This is the author manuscript accepted for publication and has undergone full peer review but has not been through the copyediting, typesetting, pagination and proofreading process, which may lead to differences between this version and the Version of Record. Please cite this article as doi: 10.1111/imj.15089

This article is protected by copyright. All rights reserved.

Author Manuscript

A 31-year-old lifelong non-smoker of 24 weeks gestation was referred for ventilation perfusion scintigraphy (VQ scan) after presenting to the emergency department (ED) with dyspnoea, dry cough and fatigue, on a background of a COVID-positive swab seven days prior due to a positive household contact. She was asymptomatic then, and self-isolated with her husband and two children.

Her past history included hypothyroidism on thyroxine, and gravida 5, para 2 status with two previous miscarriages. Her body mass index was 29.7 kg/m^2.

Physical examination revealed increased respiratory effort, fine crackles on auscultation of the right lung field, and tachycardia without hypoxia. There were no symptoms of deep vein thrombosis (DVT).

Electrocardiogram demonstrated sinus tachycardia without other features of pulmonary embolism. A chest x-ray showed minor patchy opacities in the right upper and lower lobes only (Figure 1A). D-dimer was 572 ng/ml [normal <500 ng/ml].

Given her worsening symptoms and pregnant status, a VQ scan was arranged to exclude pulmonary embolism (PE) as a contributor to her symptoms. A 3-dimension VQ scan (SPECT) was performed which demonstrated small volume PE in bilateral lower lobes and right upper lobe posteriorly (Figure 1B). The low dose CT (ldCT) demonstrated bilateral peripheral rounded ground glass opacities – especially extensive in the right lung – with early consolidation involving the right upper and bilateral lower lobes, typical of COVID-19 pneumonia [1]. Matched defects in the right lower lobe corresponded to ground glass opacities on ldCT, consistent with COVID-related changes (Figure 1C).

She was commenced on therapeutic enoxaparin until 6-weeks postpartum. Given her multiple miscarriages, beta-2-glycoprotein and cardiolipin antibodies were ordered to screen for anti-

This article is protected by copyright. All rights reserved.

Author Manuscript

phospholipid syndrome; both were negative. She was discharged two days post-admission without further complication.

Pregnancy is recognised as a hypercoagulable state and is a well-established risk factor for PE, estimated to affect around 1 in 1600 pregnancies [2]. Compression leg ultrasound may be considered as an initial imaging modality for patients with suspected PE if there is clinical evidence of DVT [2]. In the absence of lower limb signs or symptoms, or normal leg ultrasound, the preferred imaging modality for PE in pregnancy is VQ scan, due to lower breast radiation burden and diagnostic capabilities [3-4]. COVID-19 is also associated with a hypercoagulable state, commonly with increased D-dimer and fibrinogen [5]. Elevated D-dimer at presentation appears to be independently associated with thrombotic events, with one case series finding D-dimer levels 418 to 9810ng/L amongst patients hospitalised with both COVID-19 and PE [6]. Although CT screening for the detection of COVID-19 is not currently recommended, guidelines exist for the characterisation of typical, indeterminate, and atypical appearances of COVID-19 pneumonia, with ground-glass opacifications being the most common finding [1]. Therefore, VQ SPECT scan with ldCT is a readily available test to identify the dual pathology of PE and COVID-related lung changes. The radiation exposure from ldCT to the patient is 1.8mSv, compared to 9mSv from a CTPA [7], but most importantly, the absorbed foetal dose from the ldCT is <0.1mGy, which is negligible.

This case highlights an intersection of multiple embolic risk factors. Additionally, D-dimer elevation is common to pregnancy, PE, and COVID-19 [2,5,6], but the presence of one diagnosis does not exclude the presence of others.

References

1. Simpson S, Kay FU, Abbara S, et al. Radiological Society of North America expert consensus statement on reporting chest CT findings related to COVID-19. Radiology: cardiothoracic imaging. Published online 25th March 2020. Accessed 27th July 2020. https://doi.org/10.1148/ryct.2020200152.

This article is protected by copyright. All rights reserved.

2. Marik PE, Plaete LA. Venous thromboembolic disease and pregnancy. N Engl J Med. 2008;359(19):2025-2033.
3. Cahill AG et al. Diagnosing pulmonary embolism in pregnancy using computed-tomographic angiography or ventilation-perfusion. Obstet Gynecol. 2009;114(1):124-129.
4. Ridge CA et al. Pulmonary embolism in pregnancy: comparison of pulmonary CT angiography and lung scintigraphy. AJR Am J Roentgenol. 2009;193(5):1223-1127.
5. Panigada M et al. Hypercoagulability of COVID-19 patients in intensive care unit: a report of thromboelastography findings and other parameters of hemostasis. J Thromb Haemost. 2020;18(7):1738-1742.
6. Bilaloglu S et al. Thrombosis in hospitalized patients with COVID-19 in a New York health system. Published online ahead of print, 2020 July 20. JAMA. 2020;e2013372.
7. Khosh S, U P, Lee ST, Rowe CC. VQ SPECT vs CTPA: The impact of changes of breast tissue weighting factor on radiation exposure and cancer risk. Int Med Journal. 2014;44(S1):1-18.

Author Manuscript

This article is protected by copyright. All rights reserved.

Author Manuscript

Figure Legend:

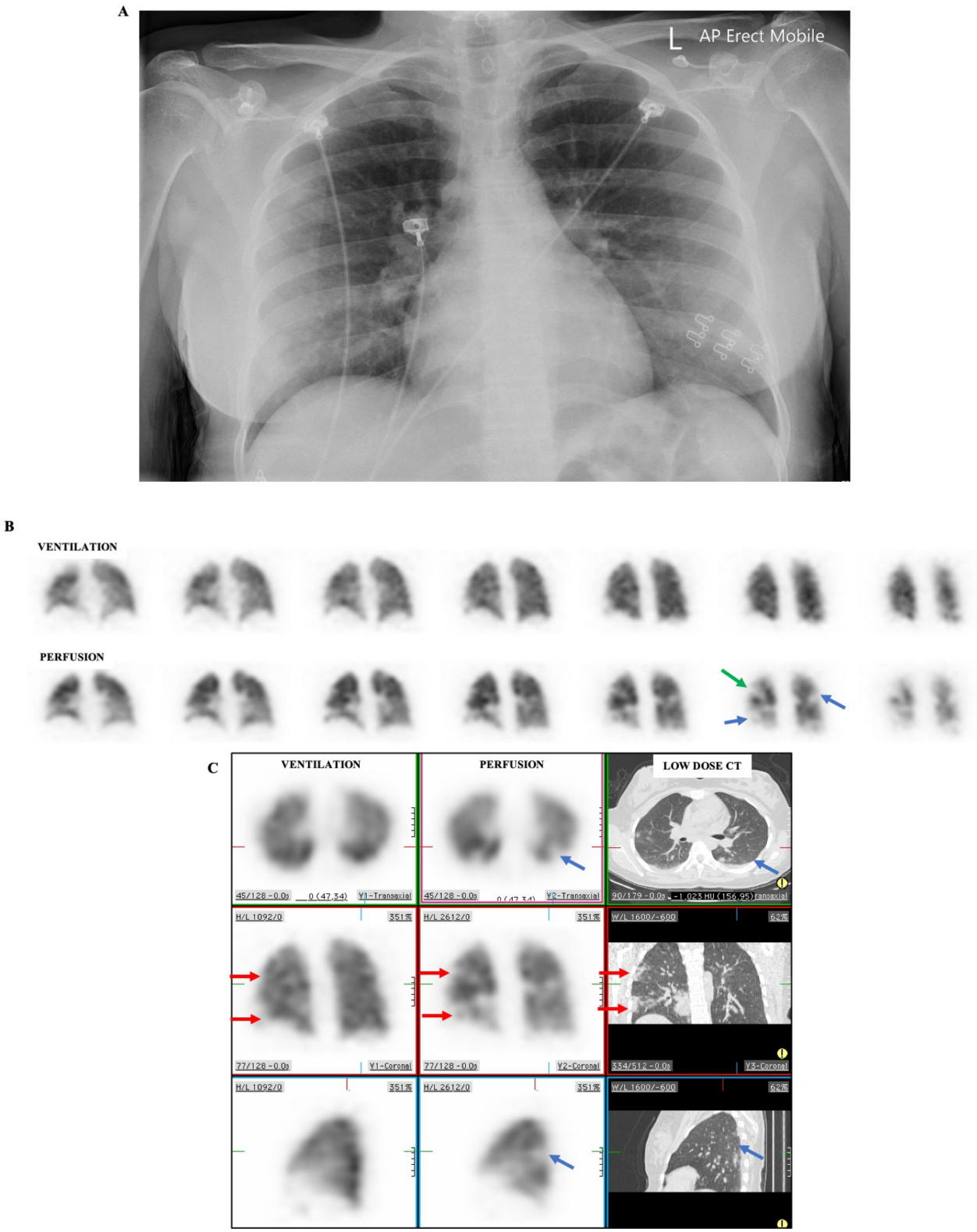
Figure 1A: Mobile Chest X-Ray demonstrating minor patchy opacification in the right upper and lower lobes, with clear left chest.

Figure 1B: Coronal images of ventilation and perfusion SPECT demonstrating perfusion mismatches in bilateral lower lobes (blue arrows) and right upper lobe (green arrow).

Figure 1C: Ventilation perfusion (VQ) SPECT/CT - Top Row-Axial; Middle Row-Coronal; Bottom Row-Left Sagittal – to assist with localisation of the perfusion mismatch in the left lower lobe (blue arrow on axial and sagittal images) and demonstrate some of the ground glass opacities in the right upper and lower lobes (red arrows), but not in the left lung.

This article is protected by copyright. All rights reserved.

Author Manuscript



IMJ_15089_VQ SPECT CT in Pregnancy During Covid - Figure 1 (300dpi).jpg

This article is protected by copyright. All rights reserved.