

## Case 7

# Dual Energy Perfusion Maps Reveal the Extent of Perfusion Deficits from Multiple Peripheral Pulmonary Emboli

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## History

A 58-year-old female patient presented to the emergency department complaining of shortness of breath and acute chest pain. History revealed an extended immobility due to long-distance travel and further risk factors such as smoking and female gender. Risk of pulmonary embolism according to the Wells' score was elevated, as was the D-dimer level, while the arterial O<sub>2</sub>-saturation level was low during monitoring. CT imaging was ordered to rule out pulmonary embolism. A pulmonary CT angiography (CTA) was performed in dual energy mode.

## Diagnosis

CTA images revealed a multitude of bilateral segmental and subsegmental

pulmonary emboli. Branching filling defects caused by thrombus formation were seen in both upper lobes. The central pulmonary arteries were free of embolic formation and there was no total occlusion at the segmental level. Enlargement of the right atrium and ventricle, along with arching of the interventricular septum towards the left ventricle, were observed.

Pulmonary perfusion maps revealed an extended bilateral decrease in pulmonary blood volume. Perfusion defects were dominant on the right side affecting the apical and lateral right-upper lobe, the lateral middle lobe, the peripheral regions of the right-lower lobe, the apicolateral left-upper lobe and the ventral left-lower lobe with several smaller peripheral defects. There was a typical wedge shape to these perfusion defects.

None of the pulmonary segments showed a complete perfusion defect.

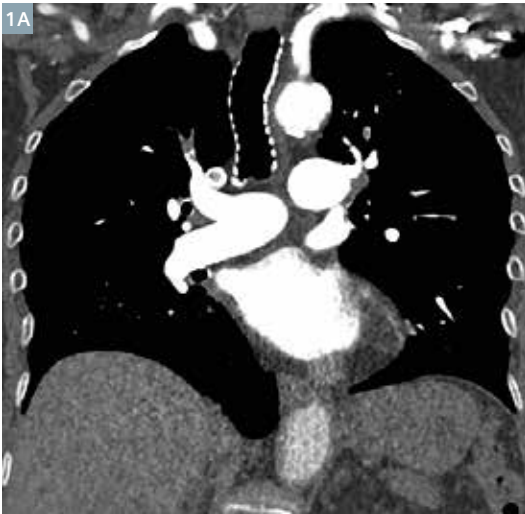
## Comments

Diagnostic information on the presence of pulmonary emboli and the accompanying perfusion impairment can be simultaneously obtained using dual energy pulmonary CTA. Pulmonary blood-volume maps, utilizing iodine quantification, add valuable information on pulmonary perfusion deficits from total or subtotal occlusions of the subsegmental pulmonary arteries. These emboli are very small and can be potentially missed if relying on single energy pulmonary CTA alone. In case of multiple peripheral emboli, perfused blood volume imaging allows a visual correlate for severe pulmonary perfusion deficit. ■

## Examination Protocol

Scanner	SOMATOM Force		
Scan area	Thorax	Rotation time	0.25 s
Scan length	252 mm	Pitch	0.55
Scan direction	Caudo-cranial	Slice collimation	192 × 0.6 mm
Scan time	1.9 s	Slice width	1.0 mm
Tube voltage	90 / Sn150 kV	Reconstruction increment	0.5 mm
Tube current	43 / 32 mAs	Reconstruction kernel	Qr40, ADMIRE 3
Dose modulation	CARE Dose4D	<b>Contrast</b>	400 mg/mL
CTDI <sub>vol</sub>	2.19 mGy	Volume	50 mL
DLP	63.3 mGy cm	Flow rate	4 mL/s
Effective dose	0.89 mSv	Start delay	Bolus triggering, 140 HU in the pulmonary trunk

The outcomes by Siemens' customers described herein are based on results that were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption) there can be no guarantee that other customers will achieve the same results.



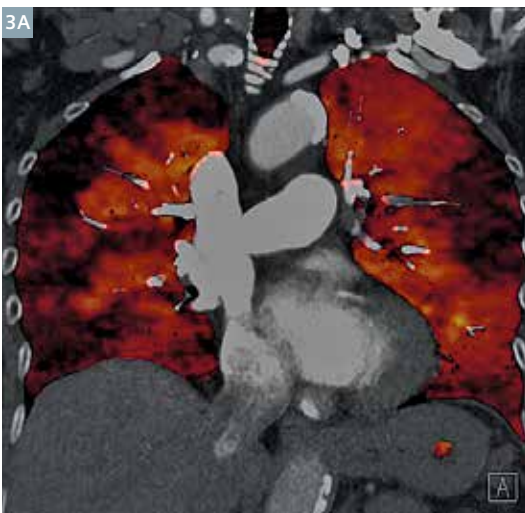
1

A coronal MPR (Fig. 1A, 5 mm) and a pulmonary perfusion map fused with a coronal MIP image (Fig. 1B, 10 mm) demonstrate filling defects in the right pulmonary artery A1 with subsegmental occlusion. Perfusion defects are visible bilaterally in the apicolateral upper lobes, as well as the basal lower lobes.



2

A pulmonary perfusion map fused with an axial MIP image (10 mm) reveals typical wedge shaped apical perfusion defects tapering towards the pulmonary hili (Fig. 2A), branching filling defects in the segmental pulmonary artery A3 with consequent subsegmental perfusion defect (Fig. 2B) and a subsegmental perfusion defect of the left apical lower lobe, corresponding to the distally occluded pulmonary artery branch.



3

A pulmonary perfusion map fused with a coronal MIP image (Fig. 3A, 10 mm) shows filling defect in the left A3 artery with peripheral contrast filling suggesting a subtotal occlusion. The corresponding subsegmental perfusion defect is seen distally to this artery. A pulmonary perfusion map fused with an axial MIP image (Fig. 3B, 10 mm) shows a central filling defect in the right-lower lobe artery with corresponding perfusion deficits in the right anterobasal lower lobe.