

Case 13

Flash CT Pulmonary Angiography in a Freely Breathing Patient

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HISTORY

A 58-year-old female patient with dyspnea, deep vein thrombosis and signs of right heart strain in echocardiography, was referred to CT pulmonary angiography (CTPA) with suspected pulmonary embolism (PE). CTPA was conducted in Dual Source high-pitch mode without the use of a breathing command and with only 40 ml of contrast medium.

DIAGNOSIS

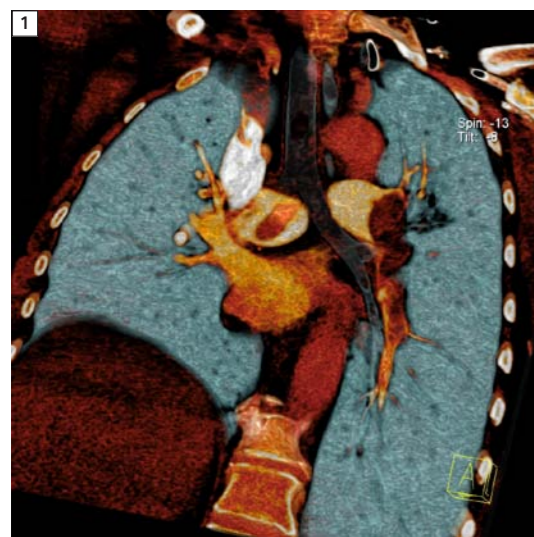
The CT pulmonary angiography showed a partially occlusive massive bilateral pulmonary embolism and signs of right heart strain. Consolidations in the upper left lobe, as indicative for an infarct pneumonia, were present. The high-pitch mode enabled motion-free imaging of

the pulmonary structures, even while the patient was breathing. No double-contours of the diaphragm or pulmonary vessels were seen. The pulmonary arteries showed excellent enhancement to the periphery, at 100 kV with an effective dose of as low as 1.96 mSv.

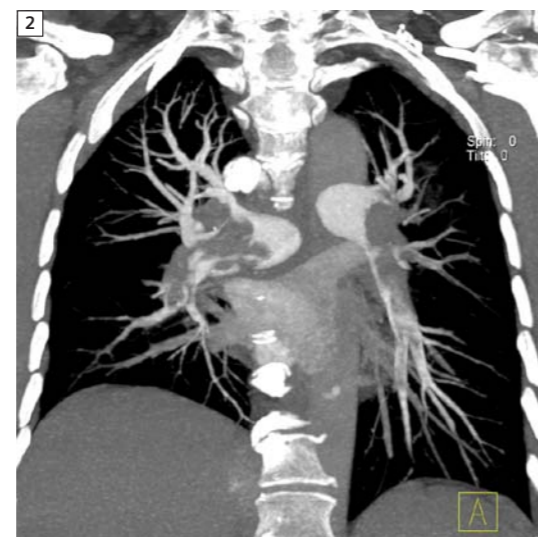
COMMENTS

During CTPA, regular Single Source CT scanners require at least a short period of breath-hold to ensure motion-free imaging of the pulmonary anatomy. However, breath-hold is associated with changes in hemodynamics of the intrathoracic venous system induced by Valsalva's maneuver. Despite adequate bolus timing, this may lead to a loss of contrast enhancement

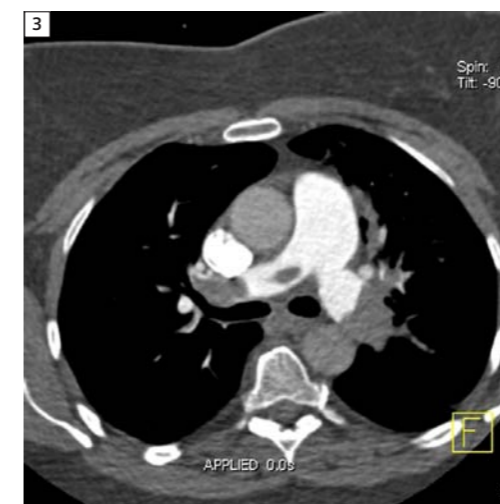
within the pulmonary arteries even though the aorta is perfectly enhanced and contrast medium is still flowing in through the superior vena cava. As shown in the present case, with a pitch of 3.0, patient motion can be virtually frozen. This allows CTPA to be performed in a freely breathing patient and, avoids breath-hold induced interruptions of the contrast column. Further, this technique allows the use of significantly lower amounts of contrast medium. Where usually 80–120 ml are necessary for CTPAs, for this scan, excellent PA enhancement with only 40 ml was achieved. This is possible due to the fact that a snapshot of the pulmonary arteries is virtually made at the moment of maximum enhancement using the FLASH mode.



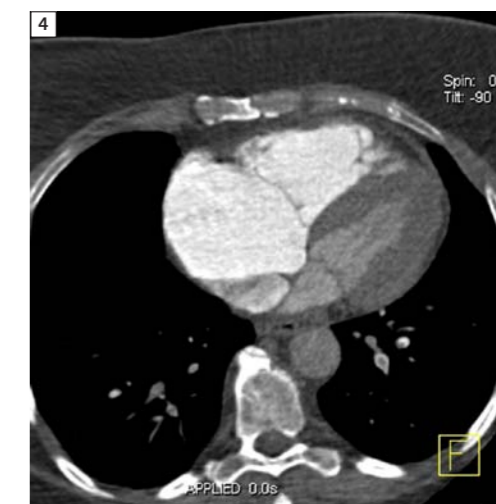
1 Bilateral severe emboli can be shown in para-coronal VRT.



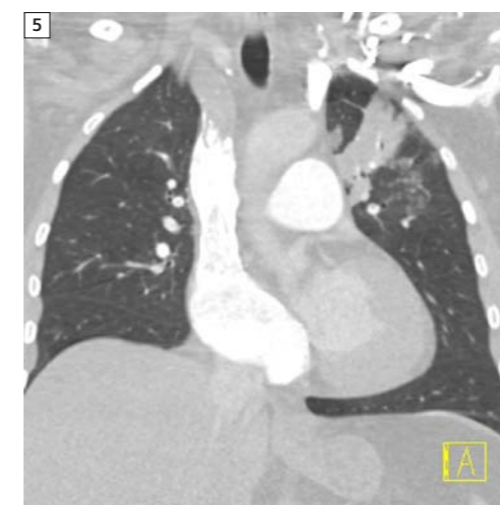
2 Bilateral severe emboli can be shown in coronal MIP as well.



3 With optimal bolus timing, excellent contrast enhancement can be shown in the pulmonary arteries: note almost contrast-free aorta.



4 An enlarged right ventricle and atrium with clearly definable AV valves can be revealed (RV/LV ratio of 1.2).



5 Coronal reformation of CTPA in lung window: note motion-free delineation of the diaphragm, pulmonary vessels and infarction in the left upper lobe, although the patient was breathing.



6 Coronal reformation at the same level as in Fig. 5 but in venous phase in inspiratory breath hold: Note comparable image quality.

EXAMINATION PROTOCOL

Scanner	SOMATOM Definition Flash		
Scan area	Thorax	Pitch	3.0
Scan length	273 mm	Slice collimation	128 x 0.6 mm
Scan direction	Cranio-caudal	Slice width	1.0 mm
Scan time	0.68 s	Reconstruction increment	0.5 mm
Tube voltage	100 kV	Reconstruction kernel	B26f
Tube current	180 reference mAs	Contrast	
Dose modulation	CARE Dose 4D	Volume	40 ml
CTDI _{vol}	4.06 mGy	Flow rate	4 ml/s
DLP	140 mGy cm	Start delay	bolus tracking
Rotation time	0.28 s		