

Case 1

Multiple, Enlarged and Tortuous Pulmonary Vessels – a Straightforward Diagnosis?

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History

A 31-year-old female patient with a history of Crohn's disease presented herself with an abnormal finding on a plain film due to a recent pneumonia. CT of the chest was required for further evaluation.

Diagnosis

Adaptive 4D Spiral CTA images revealed atresia of several segmental pulmonary veins in both lower lobes with consecutive pulmonary varices, i.e. large venous collaterals that allowed venous drainage through adjacent segmental pulmonary veins.

The primary exam, a standard computed tomography pulmonary angiography (CTPA) showed multiple, tortuous and enlarged vessels in the periphery of both lower lobes. Even though the segmental atresia of several veins was recognized, the suspicion of coincidental pulmonary arteriovenous malformations (PAVMs) was raised due to similar contrasting of both arteries and veins. In addition, several small segmental arteries were

shown in close vicinity of the enlarged tortuous vessels.

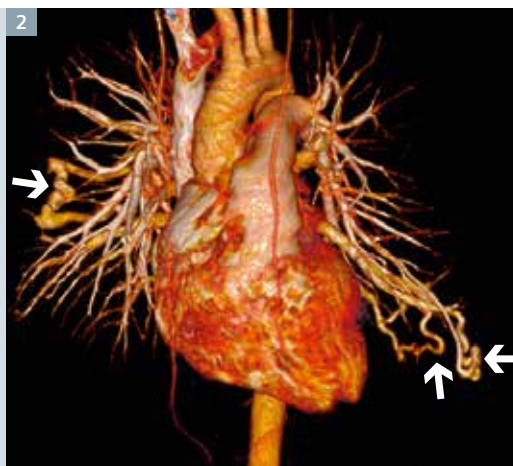
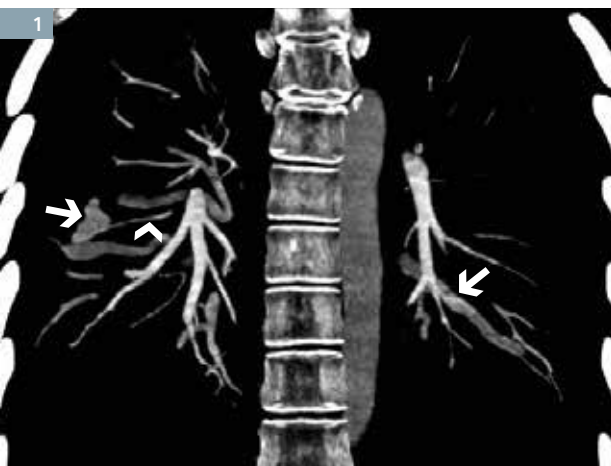
Comments

High-quality imaging is critical for a successful assessment and potential treatment of vascular malformations. Dependent upon their size, PAVMs are treated with embolotherapy to avoid complications, such as paradox embolism, whereas pulmonary varices usually require no treatment. Several imaging methods such as 4D-CTA, MRA and conventional angiography are used to assess the hemodynamic features of vascular lesions. In order to accurately identify the potential feeding arteries and draining veins of the suspected vascular malformation, an Adaptive 4D Spiral CTA mode was performed to generate detailed multiplanar images of the pulmonary vessels, as well as to allow accurate separation of the arterial and venous enhancement.

The scan range was planned to include both hilar and lower lobes. A test bolus

was applied to acquire the time-to-density curve, which helped to determine the number of necessary scans. Informed consent was obtained from the patient prior to the Adaptive 4D Spiral CTA examination. Eight dynamic phases were acquired using 35 mL of contrast agent (Iomeron 400 mg) followed by saline chaser.

CTA images provided sufficient spatial and temporal resolution to completely separate pulmonary arterial and venous enhancement. The resulting images offered two arterial phases, three mixed phases and three venous phases. PAVMs were confidently ruled out since no venous enhancement was seen in the two arterial phases. Homogenous slow diffuse venous contrast filling was visible in the later phases. The high spatial resolution of the SOMATOM Drive allowed easy depiction of the segmental venous atresia and the pathway of venous varices without segmentation. The Adaptive 4D Spiral CTA images contributed to a final distinct diagnosis for the patient at the dose of a standard CTPA of earlier days. ■



1 Coronal thin MIP of a standard CTA of the pulmonary arteries: It shows several large tortuous vessels in the periphery of both lower lobes (arrows) and suspected arterial feeder vessels (arrowhead).

2 Coronal VRT of a standard CTA of the pulmonary arteries: Several tortuous large vessels in the periphery of both lower lobes are depicted (arrows).



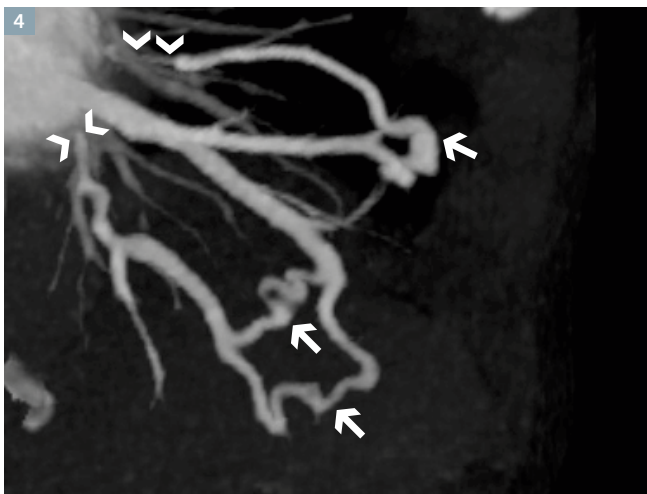
3A Thin MIP image from the first phase of the 8 phases performed with Adaptive 4D CTA mode shows contrast only in the pulmonary arteries of the right lower lobe.



3B Thin MIP image from the second phase shows high contrast in the pulmonary arteries only and a hint of diffuse enhancement in the pulmonary veins (arrow).



3C Thick MIP image from phase 7 shows high contrast in the pulmonary veins only, providing a clear image of the origin (arrowhead) and the extent (arrow) of the enlarged vessels. No segmentation was performed. Visualization is solely based on thin MIPs and a narrow contrast window.



4 Thin MIP of a late venous phase with high contrast in the pulmonary veins of the left lower lobe only, provides a view on the segmental vein atresia (arrow heads) and the varices (arrows) of the left lower lobe. Note that the pulmonary arteries are not visible on this image due to the high temporal resolution of the scan, the saline chaser and the use of a narrow contrast window.

Examination Protocol

Scanner	SOMATOM Drive
Scan area	Thorax, lower lobes
Scan mode	Adaptive 4D Spiral
Scan length	147 mm
Scan direction	Cranio-caudal-cranial
Scan time	10.3 s
Tube voltage	80 kV
Tube current	110 mAs
CTDI _{vol}	22.37 mGy
DLP	346 mGy cm
Effective dose	4.8 mSv
Rotation time	0.28 s
Slice collimation	128 × 0.6 mm
Slice width	1.5 mm
Reconstruction increment	1.5 mm
Reconstruction kernel	B20f
Contrast	400 mg/mL
Volume	35mL
Flow rate	4 mL/s
Start delay	7 s

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.

References

- [1] Anomalous unilateral single pulmonary vein: two cases mimicking arteriovenous malformations and a review of the literature. Hanson JM, Wood AM, Seymour R, Petheram IS. *Australas Radiol.* 2005 Jun;49(3):246-51. Review.
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