Images in thorax

Systemic-to-pulmonary arterial connections simulating pulmonary emboli in a patient with Tetralogy of Fallot

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Clinical scenario
A middle-aged patient with a history of Tetralogy of Fallot repair (status post modified Blalock-Taussig shunt, right ventricular outlet tract reconstruction and ventricular septal defect repair, with more recent pulmonary artery patch annuloplasty with dilation and stenting, pulmonary valve replacement and aortic valve and root replacement) and symptomatic atrial tachycardia on coumadin therapy presented to an outside institution with dyspnea and recurrent atrial fibrillation. The patient underwent CT pulmonary angiogram (CTPA), which demonstrated multiple unopacified areas in the bilateral segmental pulmonary artery branches; however, international normalised ratio was supratherapeutic at 4.1. The patient was transferred to our facility for suspected pulmonary emboli (PE). On assessment, the patient was noted to be in atrial fibrillation without evidence of hypoxia or respiratory compromise. In the context of adequate anticoagulation and a lack of clinical correlation, a repeat CTPA with pulmonary artery bolus tracking and imaging acquisition at 100 Hounsfield Units was performed which again demonstrated unopacified segments in the bilateral pulmonary artery branches (figure 1A). In addition to this standard CTPA protocol, an additional 28s delayed acquisition targeted at predominantly systemic arterial phase opacification was performed. This additional sequence demonstrated contrast filling the previously unopacified segmental branches (figure 1B), excluding PE and consistent with an alternative diagnosis of systemic-to-pulmonary artery communications. Furthermore, a tangle of systemically opacified vessels was identified above the left atrium with supply from the sinoatrial nodal and bronchial arteries. Multiple connections between this tangle and the bilateral, proximal pulmonary artery circulation resulted in unopacified pulmonary segmental branches in the pulmonary phase imaging. An example of one of these systemic-to-pulmonary arterial branch connections is demonstrated in figure 2.

Discussion
Systemic-to-pulmonary artery communications, or major aortopulmonary collateral arteries (MAPCAs), are systemic arteries that supply the lungs in the setting of an underdeveloped pulmonary circulation (more frequently in the setting of pulmonary atresia) and are identified in up to 13% of patients with Tetralogy of Fallot. The most common sources of these anomalies—the
descending aorta and subclavian arteries—are similar to those of bronchial arteries, supporting the hypothesis that they share a common developmental origin. The MAPCA tangle described above is a rare anomaly with dual coronary and bronchial sources and an opacification pattern consistent with systemic arteries. Using delayed imaging, PE was ruled out and this patient was spared continued workup and treatment; to the authors’ knowledge, this is the first report of misdiagnosed PE due to aberrant aortopulmonary arterial connections. These striking sequences serve as a crucial reminder that interpretation of imaging in congenital heart disease is complex and should be considered carefully. The findings are instructive for all contrast-based imaging modalities in Tetralogy of Fallot and across the spectrum of congenital heart syndromes, where right-sided low-flow states predominate.

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