

Tracheobronchomalacia

Nicholas G. Kujala, MD, and Terrance T. Healey, MD

A 79 YEAR OLD FEMALE SMOKER WITH A past medical history of hypertension presented with gradually worsening shortness of breath, fever, and productive cough. Preliminary chest radiographs showed interstitial abnormalities in the periphery of the lungs, and further evaluation with a high-resolution chest CT was pursued during inspiratory (Figure 1) and expiratory phases (Figure 2). Peripheral subpleural honeycombing was consistent with fibrotic changes related to **usual interstitial pneumonia (UIP)**. On expiratory phase images, there was dramatic near-complete collapse of the trachea lumen, which was crescent-shaped and significantly narrowed. This appearance is diagnostic of tracheomalacia, which was an unsuspected, but contributory finding of shortness of breath for this patient.

The trachea is a vital dynamic airway structure that serves as a conduit from the upper aerodigestive tract to the lungs. It terminates at the carina as it branches into mainstem bronchi, which further divide into bronchioles and eventually alveoli as the airways move further into the lung parenchyma. Approximately 16-22 cartilaginous C-shaped rings, with a posterior membranous muscular wall make up the majority of the trachea. In transverse cross-section, the patent extrathoracic trachea assumes a circular or horseshoe-shaped morphology depending on the respiratory phase. Intrathoracic cross-sectional morphology is variable, but pathologic alteration can be a sign of intrinsic airway or lung disease.¹

Tracheobronchomalacia (TBM) (malakia, Greek for “softness”) is a disease process resulting in structural weakness and excessive collapsibility of the trachea and bronchi. There are many causes of TBM, the most common predisposing factors associated with its development are COPD, asthma, previous prolonged intubation, trauma, respiratory infections, or extrinsic airway compression. The clinical presentation is variable, ranging from coughing, wheezing, shortness of breath, or hemoptysis. It is not uncommon for TBM to be discovered incidentally on CT examinations where

pneumonia or pulmonary embolism was suspected. TBM is diagnosed when the airway lumen is less than 70% of its expected cross-sectional area. This is generally identified on CT examination with airway collapse in an end-expiratory or forced-expiratory phase or if the patient is coughing. The anteroposterior diameter

will be less than the transverse diameter on an axial image (see Figure 2). The previous gold-standard test for diagnosis was cine fluoroscopy of the airway or direct visualization with bronchoscopy. Dynamic CT imaging has proven to be efficacious in identifying TBM if patients are able to cooperate with inspiratory and

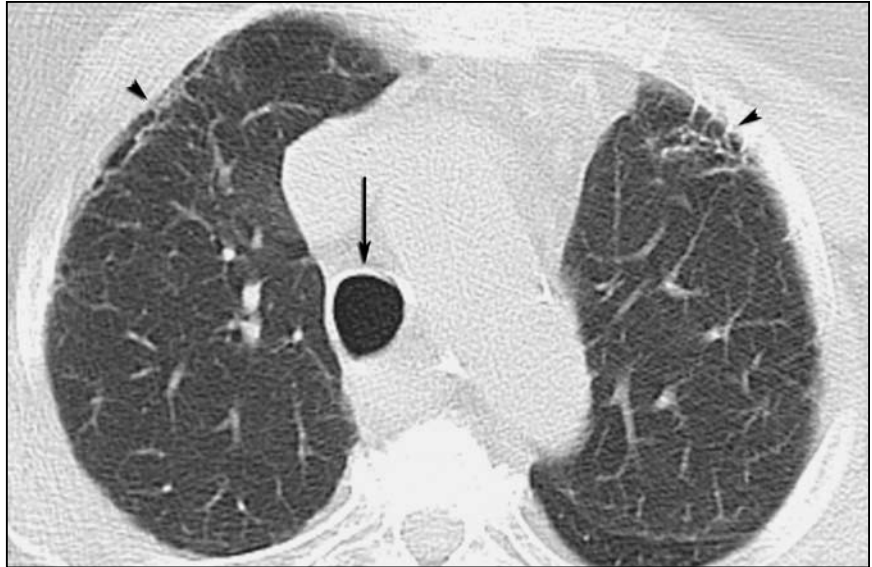


Figure 1. An axial CT image at the level of the aortic arch was obtained during the inspiratory phase. The trachea is widely patent (black arrow). Note peripheral subpleural fibrotic changes (black arrowheads).

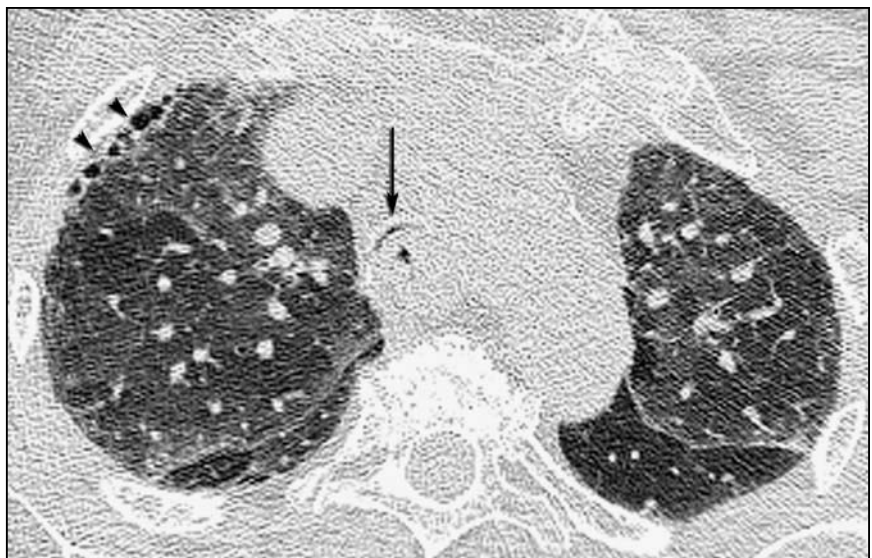


Figure 2. An axial CT slice at the same level was obtained during expiration. There is dramatic near-complete collapse of the trachea lumen, which is now crescent-shaped and significantly narrowed (black arrow). This appearance is diagnostic of tracheomalacia. This patient was also diagnosed with usual interstitial pneumonia (UIP). Note peripheral subpleural honeycombing in the right upper lobe (black arrowheads) and bilateral air-trapping (alveolar areas of decreased attenuation).

forced expiratory examinations (sensitivity >90%).² A study is currently underway at our institution using three additional low-dose CT images through the airway to determine the prevalence of TBM in a patient population clinically suspected of having a pulmonary embolism, as TBM remains an under-diagnosed condition in patients presenting to the emergency department with shortness of breath.

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Disclosure of financial interests

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MRI of Acute Appendicitis in the Pregnant Patient

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A 34 YEAR OLD PREGNANT PATIENT PRESENTED

to the emergency department with a one day history of right-sided abdominal pain, nausea, and vomiting. The patient reported a recent positive urine pregnancy test. At the time of presentation, the patient was afebrile, with heart rate of 90 bpm, and blood pressure of 122/74 mmHg. Physical examination revealed right lower quadrant tenderness superior to the expected location of McBurney's point. Laboratory analysis demonstrated a white blood cell count of $16.8 \times 10^3/\mu\text{L}$ (84% neutrophils), hemoglobin of 12.9 g/dL, and a platelet count of $282 \times 10^3/\mu\text{L}$.

Right upper quadrant and pelvic ultrasound (US) were performed. The right upper quadrant US was normal. Pelvic US demonstrated a six-week four-day live intra-uterine gestation. The appendix could not be visualized. Subsequently, a magnetic resonance imaging (MRI) study of the abdomen and pelvis was performed demonstrating a tubular, fluid filled structure (the appendix) arising from the posterior aspect of the base of the cecum (Figure 1, left). The retrocecal appendix measured up to eight mm in diameter. Fluid signal was also identified within the periappendiceal soft tissues (Figure 1, right).

Emergent laparoscopic appendectomy was performed. Pathology revealed acute appendicitis with mucosal ulceration, transmural inflammation and periappendicitis.

DISCUSSION

The evaluation of abdominal pain in the pregnant population is challenging due to confounding factors present in normal pregnancy including displacement of normal pelvic structures from their usual location, nonspecific nausea and vomiting, difficult abdominal exam, and physiologic leukocytosis.^{1,2} Given that appendicitis is the most common

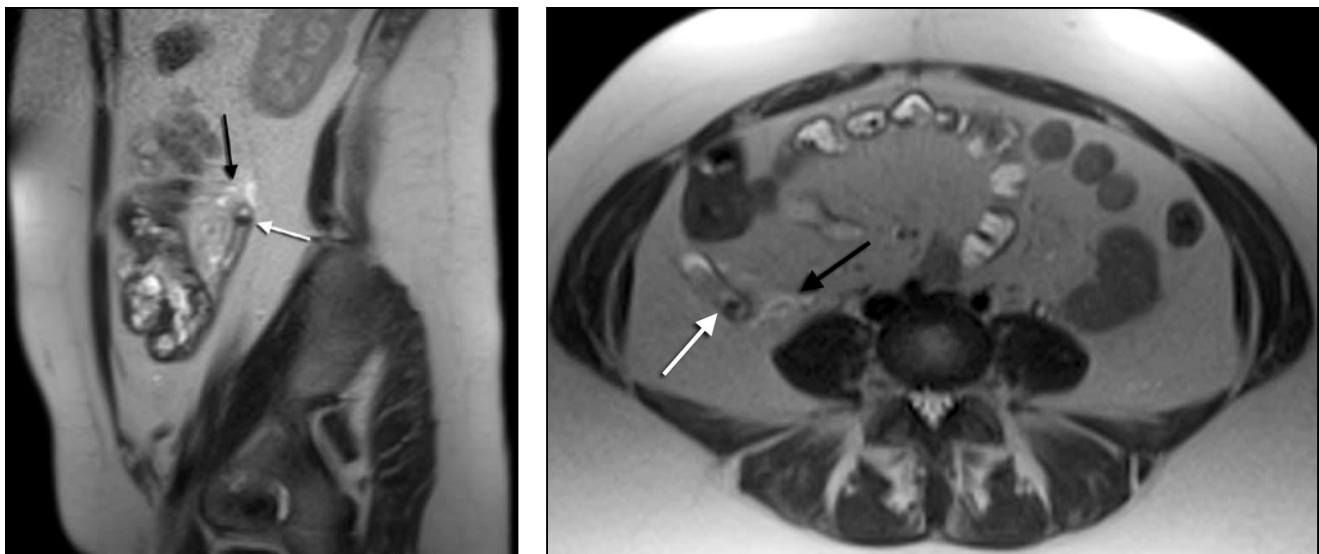


Figure 1. Acute appendicitis in a 34 year old pregnant patient with a six-week four-day gestation. Sagittal T2-weighted single shot fast spin echo (SSFSE) [left] and axial T2-weighted SSFSE [right] MR images demonstrate the retrocecal, dilated fluid filled appendix containing an appendicolith (white arrow) and peri-appendiceal inflammation (black arrow).