

Tracheobronchomalacia and excessive dynamic airway collapse are underdiagnosed distinct clinical entities. Noninvasive imaging to enable prompt diagnosis and guide proper management.

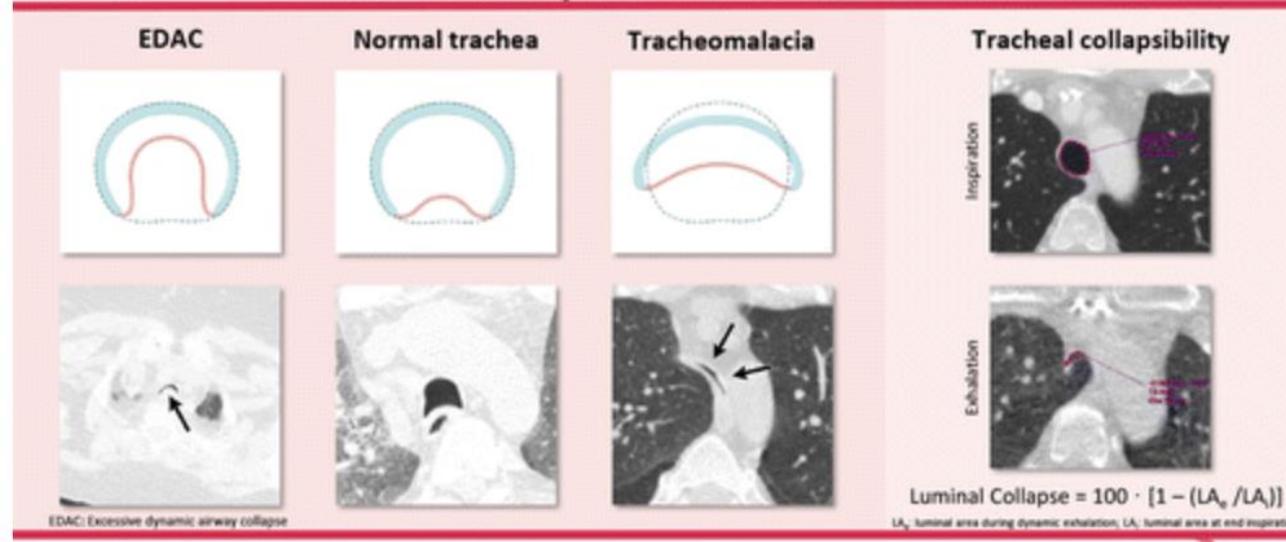
Tracheobronchomalacia (TBM) and excessive dynamic airway collapse (EDAC) are airway abnormalities that cause expiratory narrowing but are distinct pathophysiologic entities. Both entities are collectively referred to as ECAC. The *malacia* or weakness of cartilage that supports the tracheobronchial tree may occur only in the trachea, both the trachea and bronchi (TBM), or only in the bronchi (bronchomalacia). On the other hand, EDAC refers to the posterior membranous wall of the airway collapsing into the lumen with intact cartilage. Clinical diagnosis is often confounded by other diseases such as asthma, chronic obstructive pulmonary disease, obesity, hypoventilation syndrome, and gastroesophageal reflux disease. Diagnostic challenges include the underrecognition of ECAC at imaging; the interchangeable use of the terms *TBM* and *EDAC* that leads to confusion; and the lack of clear guidelines for diagnosis and treatment. The use of CT is growing for the assessment of airway, tracheobronchial collapsibility, and extrinsic disease processes that can narrow the trachea. Magnetic resonance imaging (MRI) is not as widely available and is not used as frequently for this indication as is CT. Together, these tools not only provide a road map to clinicians and surgeons for planning treatment. In addition, CT datasets can be used to plan for medical devices such as stents and splints.

An invited commentary by *Brixey* is available online.

Online supplemental material is available for this article.

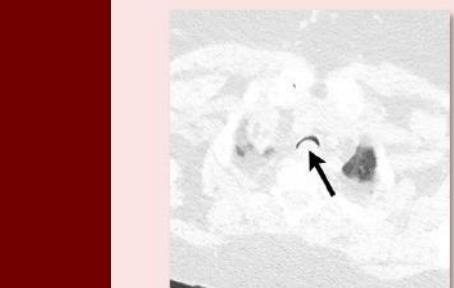
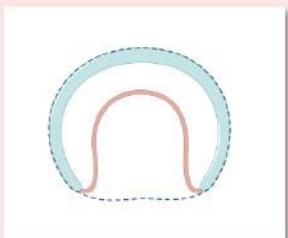
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Tracheobronchomalacia and Excessive Dynamic Airway Collapse: Current Concepts and Future Directions



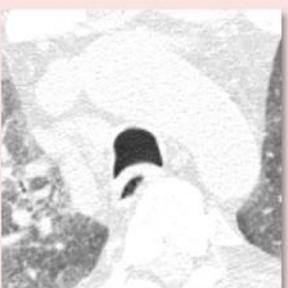
Tracheobronchomalacia and Excessive Dynamic Airway Collapse: Current Concepts and Future Directions

EDAC



EDAC: Excessive dynamic airway collapse

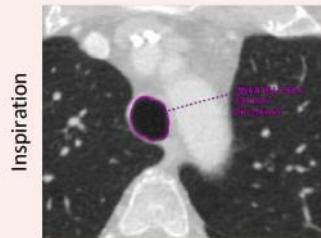
Normal trachea



Tracheomalacia



Tracheal collapsibility



$$\text{Luminal Collapse} = 100 \cdot [1 - (LA_e / LA_i)]$$

LA_e: luminal area during dynamic exhalation; LA_i: luminal area at end inspiration

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RadioGraphics

Discussion

Tracheobronchomalacia (TBM) and excessive dynamic airway collapse (EDAC) often present with nonspecific symptoms of airway obstruction including dyspnea, sputum production, wheezing, cough, exercise intolerance, and difficulty weaning from ventilation. These diseases can go undiagnosed and may be misdiagnosed as asthma or chronic obstructive pulmonary disease. Accurate diagnosis is important for therapeutic and prognostic implications.

During expiration, positive pleural pressure causes the posterior tracheal membrane to move anteriorly into the tracheal lumen. In healthy individuals, luminal narrowing will be less than 50% and is termed dynamic airway collapse. In EDAC, the posterior tracheal membrane moves anteriorly, causing greater than 50% reduction in the cross-sectional area, though the anterior cartilage maintains its normal morphology, resulting in a shape like a frown. On inspiration for both dynamic airway collapse and EDAC, the trachea has a range of appearances and may be circular, oval, or horseshoe-like.

TBM is caused by abnormalities of the cartilage rings of the trachea, causing the anterior and lateral walls to deform on expiration. Three narrowed configurations have been described on axial imaging: saber shape, crescentic, and circumferential, each of which can be focal, segmental, or diffuse. Acquired causes include extrinsic compression from vascular structures or the thyroid, as well as cartilage injury from tracheostomy, long-term ventilation, smoking, chronic obstructive pulmonary disease, polychondritis, infection, or chronic inflammation. Congenital TBM is caused by disorders with impaired cartilage maturation such as Ehlers–Danlos syndrome. It may be associated with certain birth defects such as a tracheoesophageal fistula.

In order to diagnose TBM or EDAC, both inspiratory and expiratory images must be obtained, and the AP luminal diameter and/or cross-sectional area is compared. Some studies have found that dynamic expiratory sequences can better identify collapse because of a higher level of intrathoracic pressure during dynamic expiration compared with end expiration, theoretically causing more central airway collapse. As such, paired static inspiratory–expiratory images may underestimate the amount of tracheal collapse and result in more false-negative results.

Bronchoscopy with provocative techniques remains the gold standard for evaluation but is invasive, operator dependent, and not always readily available. CT evaluation can allow quantification of narrowing by using AP diameter and calculation of the luminal area.