

# Tracheomalacia/ Tracheobronchomalacia and Hyperdynamic Airway Collapse

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## KEYWORDS

- Tracheomalacia • Tracheobronchomalacia • Hyperdynamic airway collapse
- Excessive dynamic airway collapse • Airway stenting • Tracheobronchoplasty

## KEY POINTS

- Tracheomalacia/tracheobronchomalacia (TBM) and hyperdynamic airway collapse (HDAC) are distinct diseases with significant clinical overlap.
- TBM involves loss of structural integrity of cartilaginous structures of the airway wall, whereas HDAC is an exaggeration of normal airway-wall movement with luminal intrusion of the posterior membrane.
- Both TBM and HDAC can mimic asthma and should be suspected in individuals with symptoms disproportional to an initial diagnosis, or in patients who fail to respond to appropriate treatment for this diagnosis.
- Diagnostic evaluation includes chest computed tomography with dynamic expiratory imaging, pulmonary function tests, and the gold standard of bronchoscopy. Treatment includes aggressive medical management of contributing causes (whether inflammatory or mechanical) and comorbid conditions.
- If symptoms persist, trial of airway stenting is indicated to identify individuals who should receive definitive surgical correction with tracheobronchoplasty.

## INTRODUCTION

Tracheomalacia/tracheobronchomalacia (TBM) and hyperdynamic airway collapse (HDAC) can cause respiratory signs and symptoms that result in significant functional impairment and reduced quality of life. TBM and HDAC result in loss of structural

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Disclaimers: None.

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integrity of the airway walls and have similar clinical presentations but distinct areas of affected anatomy. Because of their clinical presentation and diversity of potential causes, it is fairly easy for symptoms to be mistakenly attributed to asthma or other disorders, delaying accurate diagnosis for years.<sup>1</sup>

## DEFINITION

Although they are often not clearly distinguished, TBM and HDAC have different definitions (albeit with significant overlap).<sup>2</sup> In addition, they frequently coexist in the same patient. Strictly speaking, tracheomalacia signifies diffuse or segmental weakness of the trachea. Tracheobronchomalacia refers to tracheomalacia that has extension into one or both mainstem bronchi. The terms tracheomalacia and TBM are often used indiscriminately, and therefore in this article are simply termed TBM unless necessary.<sup>3</sup> In TBM there is loss of structural integrity of the cartilaginous structures of the airway wall. When changes in airway pressure occur (such as with forced expiratory maneuvers or coughing), these hypermobile cartilaginous structures, which are normally curved, flatten.<sup>1,2</sup>

HDAC, also known as excessive dynamic airway collapse, consists of exaggeration of normal airway-wall movement, and involves airway compromise caused by intrusion of the posterior membrane. Normal individuals with structurally uncompromised airways can have up to 35% narrowing of the airway lumen with forced expiratory maneuvers or coughing,<sup>2,4</sup> and this is deemed abnormal when collapse of the airways with forced expiratory maneuvers is greater than 50%.<sup>1,2</sup> TBM and HDAC may coexist in some severe cases, with patients having incompetence of cartilaginous structures as well as posterior membrane invagination.<sup>1,2</sup>

## EPIDEMIOLOGY

The prevalence of TBM and HDAC is unclear; studies have yet to be performed in general populations. In select study populations, prevalence has been highly variable owing to differences in diagnostic definitions and testing modalities.

The incidence of TBM and HDAC was found to range from 4% to 23% in patients with various respiratory symptoms undergoing video-bronchoscopy.<sup>1,2,5,6</sup> In one study looking at 163 patients receiving evaluation for possible pulmonary embolism, 16 (10%) met the criteria for TBM.<sup>7</sup> TBM and HDAC seem to be most common in men older than 40 years, at least in early reports.<sup>6</sup>

## NATURAL HISTORY

TBM and HDAC are typically progressive diseases. Jokenan and colleagues<sup>6</sup> found worsening of airway narrowing in 76% of a case series of 17 TBM patients on repeat bronchoscopy. In a larger study looking at patients with tracheomalacia, TBM, or bronchomalacia, Nuutinen<sup>8</sup> followed 94 patients for 5.2 years. Most patients who received repeat bronchoscopy showed worse disease, and none improved. Among patients with progression, 6 of 9 tracheomalacia patients worsened to TBM, and all 5 subjects with bronchomalacia deteriorated to TBM.<sup>3</sup>

## HISTOPATHOLOGY

There is a dearth of detailed information regarding histopathology in TBM and HDAC, but in general it depends on the underlying etiology. TBM involves incompetence of cartilaginous airway structures, and this is also where the main abnormalities are

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