Tracheobronchomalacia: morfologic evaluation in 64-MDTC.

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Authors: C. A. P. Fontes, A. A. S. M. D. Santos, A. L. Ferreira Neto, E. Marchiori, V. Brady Rodrigues, T. C. R. S. SANTOS; Niterói - Rio de Janeiro, RJ/BR
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Learning objectives

The purpose of this exhibit is:

• Review the prevalence of tracheobronchomalacia.

• Analyze cross-sectional tracheal dimensions and reconstructions on 64-MDCT with inspiratory and expiratory scans.

• Explain the usefulness of the diagnosis of tracheomalacia in patients with emphysema and its complications.
Background

- Tracheobronchomalacia is a central airway disease characterized by weakness of the wall and dynamic decrease in the tracheal lumen and the bronchial diameter, particularly while exhaling.
- Tracheobronchomalacia may be primary (congenital), or secondary, associated with other previous changes (airway infections, radiation, trauma, surgery, emphysema, asthma and others).
- It is more common in children in whom the cartilage is congenitally deficient, and in the middle age and the elderly with previous exposure to cigarettes. The acquired form of tracheobronchomalacia has been increasingly recognized as a relatively common cause of chronic respiratory symptoms in adults.
- Characterized by excessive expiratory collapse of the tracheal walls and/or supporting cartilage that is increasingly recognized as an important cause of chronic cough and other respiratory symptoms.
- It is generally accepted that the diagnosis of tracheomalacia can be established by the identification of a reduction in cross-sectional area of the airway greater than or equal to 50% at expiration or during coughing.
- The diagnosis of tracheobronchomalacia is often delayed, particularly in adults. Symptoms are nonspecific; include cough, wheezing, and dyspnea; and are often misinterpreted as asthma, or secondary to intubation, chronic obstruction airway disease, trauma, recurrent infections or polychondritis.
- Tracheobronchial imaging has undergone a major revolution with 64-MDCT. The improved spatial and temporal resolution has introduced newer techniques such as dynamic expiratory imaging to evaluate for tracheomalacia.
- Multi-slice CT has traditionally been used for the evaluation airway abnormalities because of its inherent high spatial resolution and excellent air-tissue contrast.
- We made a retrospective analysis in patients with emphysema who underwent chest 64-MDCT imaging and comparing the images in the inspiratory and expiratory phases and verify the existence of tracheomalacia in these patients.
Imaging findings OR Procedure details

Imaging findings:

- MDTC is a new tool in the investigation of focal and diffuse diseases of trachea and main-stem bronchi, can demonstrate the location and extension of disease, characterize abnormal tissues and thickness of the tracheal wall.
- The tracheomalacia was considered when there is a reduction in the light of the trachea in 50 percent or less during expiration.
- Measurements of the normal trachea during forced expiration show a mean decrease of 35% (range 11-61%) in the cross sectional area of the trachea between inspiration and expiration (FIG. 1,2).
- MDTC is a noninvasive method for diagnosing tracheomalacia, allowing the study of wall and the external surface of the airway and its relationship to adjacent structures, we analized axial images , wich is ideal for measurements of cross-sectional area changes in different phases of respiration, and sagital reconstructions images along the axis of the trachea are helpful for displaying the craniocaudad extent of excessive tracheal collapse during expiration (FIG.3,4).
- Because of the volumetric nature of scan acquisition, we were able to visualize focal malacic segments that would have potentially been missed if interpreting scans obtained at selected axial levels.
- Excessive collapse may also be seen as an isolated finding in patients during cough and forced expiration. A reduction of airway lumen by 50% or more in the sagittal diameter has been considered abnormal and, when due to invagination of the posterior membrane, should probably be referred to as excessive dynamic airway collapse.
- It is important in assessing patients with respiratory complaints, especially with emphysema, the radiologist be aware in search of a diagnosis of tracheomalacia. Therefore, it is essential that the protocol's Chest computed tomography, especially in TC multidector, involves the execution of acquisitions volume in expiration, with subsequent multiplanar reconstructions (FIG. 5).
- Equally important is the knowledge of anatomical variations that may simulate reduction in the diameter of the trachea, as in the case of vascular compression (FIG.6).
- Although studies have shown that the addition of virtual bronchoscopic images does not significantly alter diagnosis, these images were preferred by many of our clinicians, and in several cases obviated further bronchoscopic evaluation in patients who refused bronchoscopy or whose clinical status precluded fiberoptic bronchoscopy.
- Although further studies need to be performed, we suspect future research will establish an important role for multidetector CT in the evaluation of patients with airway disease.
**Fig. 0:** Tracheomalacia: Schematic figure. Airway lumen during inspiration (A). During expiration there is inward bulging of the posterior membrane. This process is physiological and is called dynamic airway collapse (DAC) (B). The pathologic exaggeration of this process results in a reduction in cross sectional area of 50% or more and is called excessive dynamic airway collapse (EDAC) (C). The pathological collapse of the cartilaginous rings represents tracheobronchomalacia (TBM). The crescent type TBM occurs when the anterior cartilaginous wall is softened and results in excessive narrowing of the sagittal airway diameter (D). The saber-sheath type TBM is due to softening of the lateral walls and excessive narrowing of the transverse airway diameter (E). Circumferential (combined) type TBM is characterized by anterior and lateral airway walls collapse and is usually associated with significant airway wall inflammation (F).

Fig. 0: CT scan obtained at inspiration and in maximal expiration shows typical inward bulging of the posterior tracheal wall. Semilunar aspect of the trachea in forced expiratory (tracheomalacia).

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Fig. 0: Inspiratory and expiratory series, semilunar aspect of the trachea with reduction in anteroposterior diameter, by the flaccidity of the membranous portion during expiration.

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**Fig. 0:** Sagittal reconstructions in insp and expiration demonstrating the marked reduction in the diameter of the trachea.

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Fig. 0: Woman, 70 yo, smoker. Dyspnea for 5 months. There is a significant reduction in the diameter of the trachea and lung parenchyma involvement in expiration. Tracheomalacia in emphysematous patients.

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**Fig. 0:** Differential diagnosis: a normal caliber of the trachea, it has the azygos vascular impression, no impairment occurred at the expiration of the tracheal. Women with persistent cough, chest CT performed in another hospital, was diagnosed reduction in the diameter of the trachea in the images at maximal inspiration and coronal reconstruction, and suggested a diagnosis of tracheomalacia. However by repeating the CT, the images in expiration, did not confirm this diagnosis. The finding corresponds to the azygos vein vascular impression (anatomical variation).

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Conclusion

• MDCT is a non-invasive technique to image the trachea.
• Inspiratory tracheal morphology is almost always normal in patients with tracheomalacia, with a lunate configuration only rarely observed, in contrast to an expiratory study.
• 64-MDCT is advantageous for functional imaging because of its high spatial and temporal resolution combined with its length of coverage. This method is technically feasible for diagnosing tracheomalacia.
Personal Information

Cristina Asvolinsque Pantaleão Fontes. MD.

Corresponding Author. Assistant Professor. Department of Radiology, and Diagnostic Imaging Service of University Hospital Antônio Pedro (HUAP) /UFF (Federal Fluminense University) - Niterói, RJ, Brazil.

Medical radiologist in Image Center-HCN (Hospital Clinicas de Niterói) and PROECHO-Niterói.

Email: cristinasvolinsque@gmail.com

Alair Augusto Sarmet M. D dos Santos. MD, PhD.

Associate Professor, Department of Radiology and Head of the Radiology and Diagnostic Imaging Service of University Hospital Antônio Pedro (HUAP) /UFF (Federal Fluminense University) - Niterói, RJ, Brazil. Coordinator of Image Center-HCN (Hospital Clinicas de Niterói) and PROECHO-Niterói. Rio de Janeiro, Brazil.

Email: alairsarmet@globo.com

e-curriculum: http://lattes.cnpq.br/1215394507629695

Armando Leão Ferreira Neto. MD.

Assistant Professor of Radiology, Medical School, State University of Rio de Janeiro (UERJ).

Medical radiologist and Sub-coordinator in Image Center PROECHO-Niterói.

Email: armando.cdaf@gmail.com

Edson Marchiori MD, PhD.

Full Professor of Radiology, UFF, Associate Professor and Coordinator of the Post-Graduation in Radiology, UFRJ.

edmarchiori@gmail.com

Viviane Brady Rodrigues.

Medical radiologist in Image Center PROECHO-Niterói.
Teresa Cristina de Castro R.S. dos Santos

Medical radiologist in Radiology Services: University Hospital Antônio Pedro/UFF (Federal Fluminense University), HCN (Niteroi Clinical Hospital) and PROECHO-Niterói. Student of Master of Medical Sciences UFF.

Email: teresasarmet@globo.com

Study site

Image Center PROECHO-Niterói and Hospital de Clínicas de Niterói - Rio de Janeiro, RJ, Brazil

Potential Conflict of Interest

No potential conflict of interest relevant.

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References


