

RADIOLOGY THROUGH IMAGES

**The role of imaging in the diagnosis of bronchiectasis:
The key is in the distribution** ☆



J. Bueno^{a,*}, L. Flors^b

^a *Imagen Cardiorádica, Departamento de Radiología, Universidad de Chicago, Chicago, IL, United States*

^b *Imagen Cardiorádica, Departamento de Radiología e Imagen Médica, Universidad de Virginia, Charlottesville, VA, United States*

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Abstract Diseases that involve the medium caliber airways (segmental and subsegmental bronchi) are common and present clinically with nonspecific respiratory symptoms such as cough, recurrent respiratory infections and occasionally, hemoptysis. The abnormal and irreversible dilation of bronchi is known as “bronchiectasis”. The diagnosis can be challenging and the analysis of the regional distribution of the bronchiectasis is the most useful diagnostic guide. The objective of this manuscript is to describe the main imaging findings of bronchiectasis and their classification, review the diseases that most commonly present with this abnormality, and provide an approach to the diagnosis based on their imaging appearance and anatomic distribution. Bronchiectasis is a frequent finding that may result from a broad range of disorders. Imaging plays a paramount role in diagnosis, both in the detection and classification, and in the diagnosis of the underlying pathology.

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PALABRAS CLAVE

Bronquiectasia;
Dilatación bronquial;
Fibrosis quística;
Bronquitis;
Bronquitis crónica

Papel de los estudios de imagen en el diagnóstico etiológico de las bronquiectasias: la distribución es la clave

Resumen La patología de las vías respiratorias de medio calibre (bronquios segmentarios y subsegmentarios) es común y se presenta con síntomas respiratorios poco específicos, como tos, infecciones de repetición y en ocasiones hemoptisis. La dilatación permanente del árbol bronquial se conoce como «bronquiectasia» y representa un reto diagnóstico. El análisis de

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* Corresponding author.

E-mail address: julianab@uchicago.edu (J. Bueno).

la distribución regional de las bronquiectasias en los diferentes lóbulos pulmonares es la guía diagnóstica más útil. El objetivo de este trabajo es describir los hallazgos de imagen de las bronquiectasias y sus diferentes tipos, revisar las situaciones más comunes y proponer un algoritmo diagnóstico basado en su distribución anatómica. Las bronquiectasias son un hallazgo frecuente, resultado de un amplio espectro de enfermedades. Los estudios de imagen desempeñan un papel esencial en su detección, clasificación y orientación diagnóstica hacia la patología subyacente. © 2017 SERAM. Publicado por Elsevier España, S.L.U. Todos los derechos reservados.

Introduction

Bronchiectases are a chronic inflammatory disease of the airways that involve dilation and progressive destruction of the bronchial wall. Due to the little specificity of their clinical manifestations, such as chronic cough, recurrent respiratory infections, expectoration or hemoptysis, the imaging modalities play an important role in its diagnostic guide and treatment.

Chest X-ray is the initial study in patients presenting with respiratory symptoms.¹ Recognizing the findings that characterize bronchiectases is essential in their diagnostic algorithm. The computed tomography (CT) scan is the imaging modality of choice in the study of the airways,²⁻⁴ and specifically in the diagnosis of bronchiectases thanks to the anatomic information it provides, both of the airway and the lung parenchyma, and its high spatial resolution so needed if we want to visualize small bronchial structures. In addition, the CT scan can provide the keys to the etiological diagnosis of bronchiectases. CT protocols with low radiation doses allow its use in young patients and among the pediatric population.⁵⁻⁷

The goal of this work is to describe the imaging findings of bronchiectases as well as their different types, to review the most common diseases that present this abnormality and to propose a diagnostic algorithm based on its anatomical distribution.

Definition, classification and imaging findings

The term "bronchiectasis" is reserved to describe permanent localized or diffused dilation of the bronchi.⁸⁻¹⁰ Bronchiectases usually occur due to chronic infectious processes; recurrent inflammation; obstruction of the bronchial lumen; or systemic diseases,^{9,11} resulting in a vicious circle of infection and inflammation that alters the dynamics of the airways and the mucociliary transport, weakening the wall, making it collapse and promoting the retention of secretions.¹² In up to 50 per cent of the cases the cause is not identified.¹¹

The abnormal dilation of the bronchioles is called bronchiolectasis⁸ and it is usually of inflammatory etiology, or secondary to pulmonary fibrosis.

Based on their macroscopic morphology, bronchiectases are categorized into three main groups¹³—cylindrical, varicose and cystic. Although this categorization has an excellent correlation with the bronchiectases morphology seen in the CT scans, its use is of little diagnostic utility,¹⁴

since the different types usually coexist and they can be associated with more than just one disease:

- Cylindrical bronchiectasis consists of the uniform dilation of segmental bronchi (Fig. 1A and B), in most cases spreading to subsegmental branches.
- Varicose bronchiectases are characterized by the tortuosity of the affected bronchi, which, in addition to being dilated, have some sort of diffuse pseudosaccular appearance (Fig. 1A and B).
- In cystic bronchiectasis, the bronchus acquires a rounded morphology forming spaces of cystic appearance that converge with one another in severe cases (Fig. 1A and B) capable of simulating a "honeycomb" pattern.

"Traction bronchiectases" are a subtype of varicose bronchiectases that occur in pulmonary fibrosis.⁹

Any of these types of bronchiectases can be associated with the thickening of the bronchial walls and with mucoid impaction.

Chest X-ray findings are based on the severity and type of bronchiectasis.

We should remember that: The "tram line" visualization of bronchial walls (Fig. 2), and the peripheral tubular opacities branching out, with the "finger-in-glove" sign in cases of severe proximal bronchial dilation (Fig. 3) are signs of bronchiectasis in the chest X-rays.^{9,15}

In the CT scan axial images, the recognition of an abnormal caliber of the bronchi is based on the association between the arterial and bronchial calibers. Both the arteries and the bronchi travel while wrapped up by the same connective tissue (axial interstice) toward the pulmonary periphery, and when they branch out, the proportion between both their calibers remains relatively constant. We should not forget that the lack of progressive bronchial tapering toward the pulmonary periphery, and one bronchioarterial relation >1 in the CT scan axial slices, are useful if we want to determine the presence of bronchiectases in adults.¹⁶ One dilated bronchus adjacent to its arterial branch with a smaller caliber gives the appearance of the characteristic "signet-ring sign"^{2,8,13} (Fig. 3).

In healthy people, bronchi are only visualized on the CT scan up to 2–3 cm of the pleural surface. The only structure of the secondary pulmonary lobule that is normally seen is the centrilobular artery.⁸

We should remember that: visualization of the bronchi in the lung periphery is indicative of bronchiectasis.¹⁷

The thickening of bronchial walls; mucoid impactions; mosaic pattern; and air trapping are usually associated findings.

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