A pictorial essay of rare presentations of bronchial stenosis in pediatric patients

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Learning objectives

To show rare presentations of isolated bronchial stenosis occurred in pediatric patients, and their clinical and imaging mimics

Background

Pediatric airway anomalies represent a challenging pathology to treat, even for the most skilled Multidisciplinary Units of tertiary care hospitals.

The upper airway is both anatomically and functionally complex and contains multiple vital structures in close proximity. Although the superficial or mucosal extent of lesions that affect the main bronchus can be seen with endoscopy, the sub-mucosal and deeper morphology can be accurately evaluated only with imaging. Diagnostic imaging plays an important role in patient workup because of the ability to both localize and characterize conditions that are often occult on physical examination.

From a clinical perspective, patients may not have any symptoms or may present with nonspecific symptoms such as cough, dyspnea, wheezing, and stridor.

CT is accessible, fast, provides superb detail of the airway and surrounding tissues, and is the mainstay of upper airway imaging. Intravenous contrast is generally recommended unless a clear contraindication exists, and the addition of intravenous contrast further enhances visualization of the vasculature and other soft tissue components.

The complementary use of both 2-D, 3-D CT imaging, including virtual bronchoscopy and virtual endoscopy, can very accurately determine the presence, nature and anatomic level of airway compromise. Airway compromise can be fixed, dynamic (with varying degrees of collapse during the respiratory cycle), or exhibit both components. The location of the abnormality can be classified as extrinsic (located outside but exerting mass effect on the airway) or intrinsic (intramural and # or intraluminal). The etiologies of airway compromise are categorized as: congenital, infectious, inflammatory, traumatic, vascular, or neoplastic.
Findings and procedure details

From January 2013 and October 2015, our multidisciplinary Airway Team requested radiological investigation for 8 pediatric patients with suspected uncommon bronchial stenosis. We encountered: 2 anomalous patent ductus arteriosus, 2 pulmonary sling, 1 isolated bronchomalacia, 2 neoplasia, 1 sacciform dilatation of the accessory bronchus. In every case CT scan determined the site of stenosis and helped to reach the diagnosis of nature of the lesion. Endoscopy, surgery and histological samples represent the reference to compare the diagnostic accuracy of CT results.

Frontal and lateral chest and/or neck radiography constitute the initial investigations of choice in most cases. Options for additional imaging include airway fluoroscopy, contrast esophagography, computed tomography (CT), magnetic resonance (MR) imaging. Advanced imaging techniques such as dynamic airway CT, CT angiography, MR angiography, and cine MR imaging are valuable for providing relevant vascular and functional information, to be considered case by case.

CT Scan:

Volumetric data acquisition protocol involves a post-contrast spiral acquisition of the entire lung volume at end-inspiration. Using a low dose protocol and thin slice (0.6 mm) collimation, images are reconstructed with overlapping or contiguous slices on soft tissue and high spatial resolution (bony) algorithm for optimal mediastinal and lung parenchymal display respectively.

Patients unable to breath-hold are placed in the decubitus position. Good quality contrast enhancement is essential for visualising mediastinal structures in children due to lack of body fat. Contrast enhancement allows better assessment of nodes, vascular structures and branching pattern for differentiating between vessels and nodules. A low osmolar, non-iodinated contrast agent between 280 and 320 mg/l concentration is preferred.

Case report 1:

A ten-years old boy came to our attention for persistent cough. Front chest X-ray showed no definite lesion, normal pleuropulmonary findings. CT scan revealed the presence of a sessile isohypodense lesion developing toward the lumen of the left main bronchus. No mediastinal lymphnodes, no pleuropulmonary lesion. Histological sample obtained during endoscopy confirmed the presence of a mucoepidermoid carcinoma.

Case report 2:
A neonate with stridor and severe dyspnea underwent to imaging investigations. Conventional radiographs showed an absence of unilateral aeration disturbance. CT exam enlightened the presence of anomalous left pulmonary artery which courses over the right mainstem bronchus and then from right to left, posterior to the trachea or carina and anterior to the esophagus, to reach the hilum of the left lung, referred to pulmonary sling. Compression over lower trachea and right mainstem bronchus caused by the sling have produced obstructive emphysema, and atelectasis of the right intermediate lobe.

**Case report 3:**

A 5-month patient with severe dyspnea was addressed to Radiology Dept. Anteroposterior chest X-ray showed mediastinal shift and hyperinflation of the right hemithorax. CT scan revealed the presence of a lesion (5x6 mm) adherent to the wall of the right intermediate bronchus, characterized by disomogeneous contrast enhancement, without signs of mediastinal neither pleuropulmonary involvement. No mediastinal lymphnodes, no pleuropulmonary lesion. Histological sample obtained during endoscopy confirmed the presence of a immature hemangioma.

**Case report 4:**

A 3-month neonate without respiratory symptoms, came to our attention for fever, and high values of markers of inflammation. Chest x-ray depicted a right medio-basal parenchymal opacity. CT scan revealed the presence of a sacciform dilatation of the accessory bronchus, partially filled by secretions, which determined compression and narrowing over the right intermediate and lower bronchus.

**Case report 5:**

A 4-month infant presented with a history of recurrent respiratory tract infections and failure to thrive. Anteroposterior chest X-ray showed mediastinal shift and hyperinflation of the left hemithorax. CT scan revealed the presence of a small (3x9 mm, axial x longitudinal diameter) patent ductus arteriosus which indirectly determined stenosis of the left bronchus, making a tensile strength between aorta and left pulmonary artery.

**Case report 6:**

A 5-month infant with persistent monophonic, harsh wheeze underwent to imaging investigation. CT depicted the presence of a stenosis of the right bronchus, without mediastinal mass, vascular anomalies or definite intra-bronchial lesion. Bronchoscopy
performed during spontaneous breathing without positive end-expiratory pressure, identified a collapse of at least 50% of the left bronchial lumen, consistent with **isolated bronchomalacia**.

**Images for this section:**

![CT reformation on coronal plane. Mucoepidermoid carcinoma of the left bronchus.](https://example.com/ct_reformation)

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**Fig. 2:** CT axial plane. Pulmonary sling: left pulmonary artery encompasses lower trachea and right bronchus, and determines severe stenosis of the airway

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Fig. 3: Anteroposterior chest x-ray. Hyperexpansion of the right pulmonary parenchyma and mediastinal shift suggest the presence of a hyperinflation valve mechanism likely located in right bronchus. CT scan revealed the presence of immature hemangioma.

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**Fig. 4:** CT axial plane. Immature hemangioma of the right bronchus.

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Fig. 5: 3D reconstruction. Sacciform dilatation of the right accessory bronchus

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**Fig. 7:** 3D reconstruction. Isolated bronchomalacia of the right bronchus.

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Fig. 6: CT sagittal reformation. Arrows points the presence of a small patent ductus arteriosus

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Conclusion

Rare presentations of bronchial stenosis should be known and included in differential diagnosis of airway diseases.

CT scan is mandatory to formulate the diagnosis, and guide further imaging or management.

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References


