Tree-in-bud

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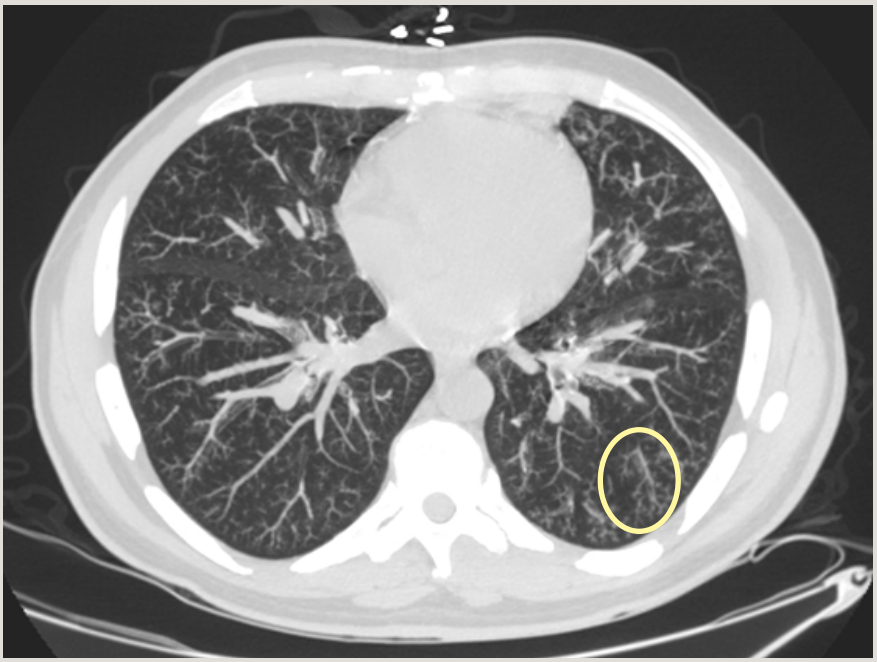

Figure 1: *CT scan with tree-in-bud pattern*

Figure 2: *Drawing rendition of tree-in-bud*

General

Bronchioles refer to the terminal passageways for gas exchange in the lungs. They are not normally seen on computed tomography scans due to their small size (less than or equal to 1 mm). However, in the presence of disease processes which involve the bronchioles (i.e., infectious or inflammatory conditions), they can easily be identified. Among the many patterns used to describe diseased bronchioles, the most recognized is the tree-in-bud pattern. It was initially used by JG Im to describe the endobronchial spread of *Mycobacterium tuberculosis*.[1] However, since its first use in 1993 the tree-in-bud pattern has been associated with multiple etiologies.

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Histopathology

The tree-in-bud pattern seen on CT represents radiologic sequelae of an infectious or inflammatory process. Generally, these often result in bronchial wall thickening with replacement of the normally air-filled lumen with mucous or pus. As a result, involved bronchioles are more conspicuous on computed to-

mography imaging. The tree-in-bud pattern has been likened to finger-in-glove appearance and children's toy jacks. Figure 1 is a CT scan of a patient with tree-in-bud pattern, with a representation circled. Figure 2 is a drawing rendition of tree-in-bud.

Differential Diagnosis

The differential diagnosis for the tree-in-bud pattern is extensive and includes infections, congenital conditions, neoplasms, and idiopathic causes (Table).

Table: Differential diagnoses of tree-in-bud

Infections
Bacterial
Viral
Fungal
Aspiration
Congenital disorders
Cystic fibrosis
Kartagener's syndrome
Idiopathic conditions
Obliterative bronchiolitis
Diffuse panbronchiolitis
Immunologic
Allergic bronchopulmonary aspergillosis
Connective tissue disorders
Sjogren's syndrome
Rheumatoid arthritis
Neoplasms

Respiratory infections cause about 72% of cases with 39% due to Mycobacterial cases, 27% due to other bacteria, and 3% due to viruses. *Mycobacterium avium complex* is the most common cause in most series.[2] However, the classic cause of tree-in-bud is *Mycobacterium tuberculosis*, especially when it is active and contagious and associated with cavitary lesions.[3] Aspiration is also a common cause of the tree-in-bud formation.[1] It is important for clinicians to remember that this pattern has an extensive differential when evaluating patients.

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