

A 3D-based scoring system for diagnosing bronchiectasis in children

Abstract

Bronchiectasis involves the abnormal bronchial dilation and destruction of the bronchial walls due to recurrent (>3) episodes of chronic (>4 weeks) wet/productive cough or inflammation. This condition needs immediate attention because, without early diagnosis and proper treatment, it can cause permanent lung damage, significantly worsen quality of life, and increase the risk of severe respiratory complications. It is confirmed radiographically using chest C.T. scan. The key diagnostic feature is an abnormally increased broncho-arterial ratio (BAR) exceeding 0.8mm. Additional supporting findings may include bronchial wall thickening, lack of bronchial tapering, and mucus plugging. Developing imaging methods (2D and 3D) facilitate quicker studies and detailed evaluations for healthcare professionals according to the lobes and segments. Challenges such as inclined nature, oblique orientation, and partial volume effect can make it difficult to obtain accurate measurements of structures in the upper and middle lobe from a single high resolution computer tomography (HRCT) slice. This research has two main goals: 1. To develop a system using various imaging methods, especially 3D, to reconstruct important lung structures; and 2. To evaluate and score the bronchial arteries for abnormalities according to lung lobes and segments. We applied modified Reiff scores to 20 full length HRCT scans to grade bronchiectasis severity, yielding promising results with our proposed methods. Further studies are required to compare and validate the performance of our methods with human readers.