Imaging of Asthma

John Caleb Richards, MD*, David Lynch, MD,
Tilman Koelsch, MD, Debra Dyer, MD

KEYWORDS

• Asthma • Radiography • High-resolution computed tomography • Bronchiectasis
• Allergic-bronchopulmonary aspergillosis

KEY POINTS

- Bronchial thickening and hyperinflation are the most common radiographic findings in asthma, although they are nonspecific.
- High-resolution computed tomography (HRCT) findings of asthma include bronchial thickening, air trapping, and bronchial dilation.
- An important role of HRCT performed in the asthmatic patient is to evaluate for complications or mimics.

INTRODUCTION

Asthma is one of the most common diseases of the lung. Asthma manifests with common, although often subjective and nonspecific, imaging features at radiography and HRCT. Perhaps of utmost importance in imaging asthma is identifying complications or mimics. This article reviews the imaging features of asthma as well as common complications and mimics.

CHEST RADIOGRAPHY

Chest radiographic findings in asthmatic patients are not entirely specific but, when present, include bronchial wall thickening and lung hyperinflation. Bronchial wall thickening is most common, identified in 48% and 71% of patients in 2 separate studies, respectively.[1,2] This degree of variability between the 2 studies emphasizes the subjectivity of the finding. The radiographic appearance of bronchial wall thickening manifests as a ring shadows when viewed in profile and tram track shadows when viewed en face (**Fig. 1**A). Other conditions, such as acute bronchitis and chronic bronchitis, may also cause bronchial wall thickening.

Lung hyperinflation is the second most common radiographic abnormality,[3] albeit less reliable. Suggestive imaging features include flattening of the hemidiaphragms, rib splaying, and increased retrosternal clear space (**Fig. 1**B). Although radiographs

Department of Radiology, National Jewish Health, 1400 Jackson Street, Room K012f, Denver, CO 80206-2761, USA
* Corresponding author.
E-mail address: richardsj@njhealth.org

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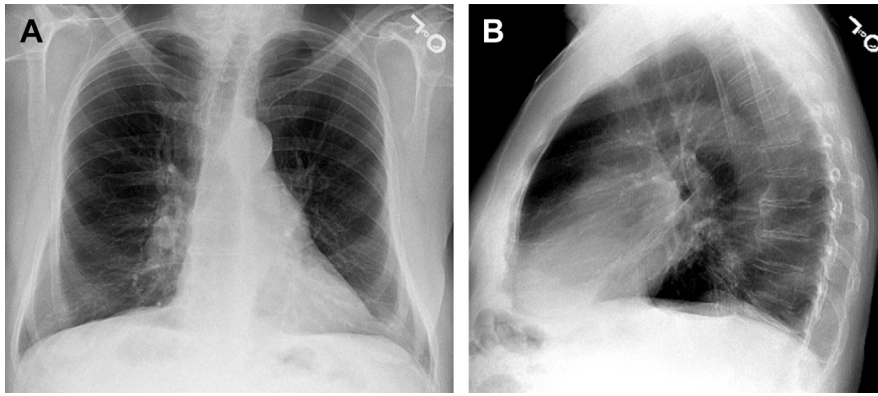

Fig. 1. (*A*) Posteroanterior radiograph in an asthmatic patient showing subtle central airway thickening. (*B*) Lateral radiograph in the same patient showing increased lucency in the retrosternal clear space and flattening of the hemidiaphragms, indicative of hyperinflation.

in asthmatic patients may show lung hyperinflation, with one study identifying this abnormality in 24%,[2] it is rare to see marked hyperinflation in an asthmatic patient who does not also have emphysema. Many patients with asthma have normal or reduced lung volumes even during an acute exacerbation of their condition.[4]

The utility of routine chest radiography in a patient admitted for severe asthma, particularly as it pertains to alteration in management, is an interesting topic. White and colleagues[5] evaluated the impact of admission chest radiography in 54 adult patients with acute asthma, who were refractory in intensive bronchodilator therapy in the emergency ward. They found that major radiographic abnormalities (focal parenchymal opacities, increased interstitial markings, enlarged cardiac silhouette, pulmonary vascular congestion, new pulmonary nodule, and/or pneumothorax) were present in 34% of patients. Instituting antibiotic therapy was more common in patients with focal parenchymal opacities or increased interstitial markings than when these findings were absent. Because of this immediate change in management, the investigators concluded that admission chest radiography is appropriate in asthmatic patients refractory to emergency room therapy.

Tsai and colleagues[6] have suggested guidelines for the selected performance of chest radiographs in patients admitted with acute exacerbations of obstructive airway disease, proposing that patients who are otherwise uncomplicated do not benefit from routine admission chest radiography. According to this proposition, patients with one or more of the following criteria are classified as "complicated" and should receive an admission chest radiograph: a clinical diagnosis of chronic obstructive pulmonary disease (as defined by the American Thoracic Society); a history of fever or temperature more than 37.8°C; clinical or ECG evidence of heart disease; history of intravenous drug abuse; seizures; immunosuppression; evidence of other lung disease; or prior thoracic surgery.[6] In a prospective study, the investigators showed that management was more likely to be changed on the basis of chest radiography in patients who met these criteria.[6] An important potential implication from this study is the reduction in unnecessary admission chest radiographs in uncomplicated patients, which in turn decreases ionizing radiation and health care costs.

Thus, although bronchial wall thickening and lung hyperinflation are the most common radiographic findings in asthmatic patients, they are ultimately nonspecific. Although admission radiographs may alter management in complicated asthma,