Findings in Chest High-Resolution Computed Tomography in Severe Asthma

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About 3%-10% of asthmatic patients have severe asthma (SA), ie, step 5-6 of GEMA [1] and 4-5 of GINA [2].

Chest high-resolution computed tomography (CHRCT) involves the use of thin slices (≤1.5-mm acquired at 10- to 20-mm intervals through the lungs) and a high spatial frequency reconstruction algorithm to detect and characterize diseases that affect the pulmonary parenchyma and small airways. This technique was followed by the development and widespread availability of multidetector CT scanners capable of acquiring near-isotropic data throughout the entire thorax in a single breath-hold, thus enabling acquisition of volumetric single breath-hold data sets and enabling spaced, contiguous, and/or overlapping CHRCT images to be reconstructed [3].

Imaging tests play a crucial role in the study of asthma, especially in SA. Their main indication is to identify possible complications and comorbidities such as bronchiectasis, which should be appropriately assessed in patients with SA [4].

The aim of our study was to describe CHRCT findings in an SA population and assess the relationship between bronchiectasis and patient characteristics.

A descriptive and retrospective study was carried out under conditions of routine clinical practice. We evaluated the lesions found in CHRCT performed on patients studied in the SA unit of the Allergology Department at the General University Hospital of Ciudad Real, Ciudad Real, Spain.

CHRCTs were requested in asthmatic patients with an atypical course to rule out complications and comorbidities. CHRCT images were obtained by the radiologist, who randomly corresponded with the requesting physicians (radiologists did not know the aim of our study).

The demographic and clinical characteristics of patients with bronchiectasis included age, sex, asthma duration (years), atopy (defined as at least 1 positive prick test result), body mass index, smoking status (yes or no), Asthma Control Test score, FeNO, FEV1/FVC, FEF25%-75%, eosinophil cationic protein, peripheral blood eosinophil count (PBEC), gastroesophageal reflux, and asthma exacerbations in the previous year (AEPY).

CHRCT was performed in 121 patients (details available online: Table 1).

The CHRCT image was normal in 58 patients (47.9%) and pathological in 63 (52.1%). The findings were bronchiectasis (19%), atelectasis and/or lamellar fibrosis (18.2%), areas of emphysema (8.3%), ground-glass images (7.4%), centrilobular nodules (5%), bronchial wall thickening (BWT) (5%), hiatal hernia (5%), mucosal impaction and/or tree-in-bud image (4.1%), air trapping (3.3%), increased interstitial tissue (2.5%), pulmonary infiltrate (2.5%), mosaic attenuation pattern (1.6%), pulmonary nodules (1.6%), and pericardial effusion (1.6%). Other findings included (1 patient each) (0.8%) extrapulmonary nodules, pleural thickening, lung abscess, tracheoecele, arterial calcification (possible pulmonary thromboembolism), aygos lobe, and endotracheal goiter. Patients with a normal CHRCT scan had FEV1 above 80%, although the difference was not significant.

Five of the 23 patients (21.7%) who had bronchiectasis met the clinical criteria for allergic bronchopulmonary aspergillosis (ABPA) [5].

Patients with bronchiectasis were older and had higher AEYP, FeNO, and PBEC values. In contrast, bronchiectasis was associated with lower FEV1 values.

The most common findings in asthma are BWT, air trapping, and bronchiectasis [6]. Machado et al [7] found that the most frequent radiological lesion was BWT (69.7%), followed by bronchiectasis (45.9%). Sánchez-Cuellar et al [8] found BWT in 71% and bronchiectasis in 73.8% of cases.

The most frequent finding in the present series was bronchiectasis (19% of patients with SA and 36.6% of those with pathological CHRCT) followed by atelectasis and/or lamellar fibrosis (22 patients [18.2%]). The few cases of BWT found (5%) and the lower frequency of bronchiectasis (19%) are striking, probably because our study was retrospective and performed under conditions of routine clinical practice, whereas other authors conducted their studies prospectively or insisting on the need to report specific patterns. In our series, radiologists were not informed of the need to accurately report each imaging pattern.

The presence of BWT could reflect bronchial and peribronchial inflammation. This pattern does not only appear in symptomatic patients or those with SA. Gupta et al [9] found a prevalence of 62%, which was related to the severity of asthma, as did Machado et al [7], who found BWT in 88.9% of patients with SA, in 78.6% of those with moderate disease, and in 40% of patients with mild disease.

Bronchiectasis is the consequence of infection, inflammation, and airway epithelial repair, which eventually leads to the destruction of the bronchial wall and irreversible dilation. CHRCT is currently the gold standard technique for diagnosis of bronchiectasis, with specificity and sensitivity greater than 90%. Bronchiectasis is not necessarily a synonym of synonymous with ABPA.

In our series, 21.7% of patients with bronchiectasis fulfilled the clinical criteria for ABPA. If we exclude patients with ABPA, the results were similar in asthmatics with or without bronchiectasis, except for PBEC and FeNO values, which were
higher. Our results were not statistically significant, probably because of the small sample size (5 patients).

The frequency of bronchiectasis in asthma is variable. A high frequency of bronchiectasis has been found in patients with SA and impaired lung function. Machado et al [7] found bronchiectasis in 77.7% of severe asthmatics, 42.9% of moderate asthmatics, and 20% of mild asthmatics. Sanchez-Cuellar et al [8] found bronchiectasis in 73.8% of patients with 3 or more AEPY and impaired lung function. Gupta et al [9] found bronchiectasis in 40% of patients with SA and reported that it was associated with more AEPY and impaired lung function. Harmanci et al [10] found that the presence of bronchiectasis was inversely related to FEV1 values. Similar results were observed in the cases we report. Oguzulgen et al [11] found that asthmatics with bronchiectasis had poorer lung function, more severe disease, and more AEPY than asthmatics without bronchiectasis.

Bronchiectasis was more frequent in older patients and was associated with lower FEV1 values, higher FeNO, more AEPY, and greater eosinophilia. Padilla-Galo et al [12] found that almost a third of patients with SA had bronchiectasis and that this was associated with lower FeNO values.

In the present series, the cost-effectiveness of CHRCT requests was high: more than half of the patients had pathological CHRCT images. The most frequently detected alteration was bronchiectasis, followed by atelectasis and/or laminar fibrosis and areas of emphysema. ABPA must be ruled out in cases of bronchiectasis.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

References