

Original Article

Assessment of radiographic findings among asthma patients

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ABSTRACT:

Background: The difference in rib slope between asthma patients and non-asthmatics is a fresh and intriguing finding. The purpose of this study was to determine whether an asthma patient's decreased horizontal rib curve on a chest radiograph represents a distinctive characteristic. **Materials and Methods:** A retrospective review of the chest radiographs of 57 cases of asthma who were admitted between January 2011 and February 2011, and 57 non-asthma patients was performed. Chest radiographs were examined and lines drawn horizontally through the middle point of the sixth rib, and to where the sixth rib reaches the thoracic cage. The angle between these two lines was defined as the angle of rib curve (ARC). The ARCs were then compared between groups using the Student's t-test. **Results:** The asthma group consisted of 46 males and 54 females with a mean age of 49.3 years. The non-asthma group consisted of 56 males and 44 females with a mean age of 37.5 years. The ARC was smaller in asthma patients than in non-asthma patients. In the asthma group, the mean male ARC was smaller than the mean female ARC; however, there was no statistical difference in gender in the non-asthma group ($P = 0.405$). **Conclusions:** The current photographic trait may be helpful in daily practice for suspecting a diagnosis of bronchial asthma. **Key words:** Asthma, gender, ribs, thoracic cage

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INTRODUCTION

Recurrent episodes of acute shortness of breath, typically occurring at night or in the early morning hours, are the cardinal manifestation of bronchial asthma. Further symptoms include cough, wheezing, and a feeling of tightness in the chest. Asthmatic symptoms can often arise after physical exercise. Depending on the severity of bronchial asthma in the individual patient, there may be phases of partial or total freedom from symptoms, alternating with periods of variably severe illness.¹⁻³ This fact has been integrated into the definition of bronchial asthma, which is now defined as a chronic inflammatory disease of the airways characterized by bronchial hyperactivity and a variable degree of airway obstruction. Asthma is a common emergency department problem. The clinical aspects of asthma are paroxysmal respiratory distress, recurrent cough, wheezing, and chest tightness. However, the radiographic traits of asthma have seldom been reported and found. Park reported that acute asthma reversibly increases lung compliance and total lung capacity (TLC).⁴⁻⁶ The authors confirm anecdotal evidence of a smaller horizontal curve of the ribs as a characteristic finding on chest radiographs of asthma patients. We compared the radiographic features of asthma and non-asthma patients.

MATERIAL AND METHODS

100 subjects of asthma as well as 100 non-asthma patients were enrolled in the study. The diagnosis of

the 100 non-asthma patients included gastroenteritis (n=10), trauma (n=16), urinary tract infection (n=8), depression (n=7), drug overdose (n=12), rhinitis/pharyngitis/tonsillitis (n=12), intracranial hemorrhage (n=13), headache/dizziness (n=13), abdominal pain (n=12), myalgia/neuralgia (n=11), upper gastrointestinal bleeding (n=11) and infectious diarrhea, pneumonia, constipation, pelvic inflammatory disease, stroke, appendicitis, hyponatremia, convulsions, pancreatitis, hypertension and urolithiasis in one case each. Chest radiographs were examined and lines drawn horizontally through the middle point of the sixth rib, and to where the sixth rib reaches the thoracic cage. The angle between these two lines was defined as the angle of rib curve (ARC). The ARCs were then compared between groups using the student's t-test. The data was analyzed using the SPSS statistical software.

RESULTS

The asthma group consisted of 46 males and 54 females with a mean age of 49.3 years. The non-asthma group consisted of 56 males and 44 females with a mean age of 37.5 years. The ARC was smaller in asthma patients than in non-asthma patients. In the asthma group, the mean male ARC was smaller than the mean female ARC; however, there was no statistical difference in gender in the non-asthma group ($P = 0.405$).

Table 1: Distribution of patients

Variable		Asthma group	Non-Asthma group
Number		100	100
Mean age (years)		49.3	37.5
Gender	Males	46	56
	Females	54	44

Table 2: Comparison of ARC

ARC	Asthma group	Non-Asthma group
Mean	11.3	14.2
SD	3.8	4.1
p-value	0.00 (Significant)	

DISCUSSION

Chest radiography is the initial imaging evaluation in most individuals with symptoms of asthma. The value of chest radiography is in revealing complications or alternative causes of wheezing in the diagnosis of asthma and its exacerbations. It usually is more useful in the initial diagnosis of bronchial asthma than in the detection of exacerbations, although it is valuable in excluding complications such as pneumonia and asthma mimics, even during exacerbations.^{5,6} The radiographic features of asthma are not specific. In the absence of other concurrent illness the chest radiograph is almost always normal in patients with asthma. Possible findings are bronchial wall thickening and hyperinflation (although marked hyperinflation is uncommon in patients who do not also have emphysema).⁵⁻⁸

In this study, the asthma group consisted of 46 males and 54 females with a mean age of 49.3 years. The non-asthma group consisted of 56 males and 44 females with a mean age of 37.5 years. The ARC was smaller in asthma patients than in non-asthma patients. In the asthma group, the mean male ARC was smaller than the mean female ARC; however, there was no statistical difference in gender in the non-asthma group ($P = 0.405$). In asthmatic patients, inspiratory with continuous outward motion of the upper anterior rib cage produced a horizontal aligned ribs in chest radiography.⁹ In non-asthmatics expiration, the respiratory muscles are completely relaxed, but this is not the case in patients with asthma. Therefore, a smaller ARC may be the anatomic consequence of asthma rather than the cause. This characteristic finding has never been previously described.

In gender, female asthmatic patients have significantly lower strength of inspiratory and expiratory muscle than male, this related to this study's finding of smaller ARC in male asthmatic patients than females.¹⁰ Lesser the hyperinflation associated with bronchoconstriction, lesser is the end-expiratory volume in the rib cage leading to larger ARC.¹¹ The prevalence of bronchial thickening on high-resolution CT in patients with asthma reported by various authors ranges from 44% to 92%. The wide variability in prevalence is presumably related to the subjective nature of the assessment and different patient populations. Park et al. identified bronchial wall thickening in 17 (44%) of

39 asthmatic patients compared with only 4% of healthy control subjects. Bronchial wall thickening was more prevalent among patients with severe air-flow obstruction (83% of patients with forced expiratory volume in 1 sec [FEV1] that was < 60% of predicted volume) than in patients with mild obstruction (35% of patients with FEV1 \geq 60%). Park et al. assessed the degree of bronchial narrowing by objectively measuring the ratio between the short-axis internal bronchial diameter and the short-axis diameter of the accompanying pulmonary artery. Asthmatic patients with an FEV1 of less than 60% of predicted volume had a lower broncho-arterial diameter ratio (mean \pm SD, 0.48 ± 0.11) than patients with mild airway obstruction (0.60 ± 0.18) or healthy subjects (0.65 ± 0.16) ($p < 0.01$). In patients with asthma, most of the bronchi have normal or decreased internal diameters; however, in approximately 30–40% of adult patients with uncomplicated asthma, one or more bronchi are dilated. The presence of bronchiectasis does not correlate with the severity of airflow obstruction in these patients. The bronchiectasis seen in patients with uncomplicated asthma typically is cylindrical, and the bronchoarterial-diameter ratio is less than 1.5.¹²⁻¹⁶

CONCLUSION

The photographic trait may be helpful in daily practice for suspecting a diagnosis of bronchial asthma.

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