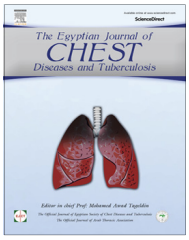
Egyptian Journal of Chest Diseases and Tuberculosis (2015) **64**, 477–482

HOSTED BY

The Egyptian Society of Chest Diseases and Tuberculosis

Egyptian Journal of Chest Diseases and Tuberculosis

www.elsevier.com/locate/ejcdt
www.sciencedirect.com



ORIGINAL ARTICLE

Role of a diagnostic triad in bronchiectasis

Wafaa Ali Hassan [a,*], **Ibraheem shalan** [a], **Hytham Abd Allah** [a], **Mona Soliman** [b]

[a] *Chest Department, Assiut and Al-Azhar University Hospital, Egypt*
[b] *Internal medicine Department, Assiut University Hospital, Egypt*

Received 22 January 2015; accepted 2 March 2015
Available online 29 March 2015

KEYWORDS

Bronchiectasis;
HRCT;
PFTs;
Echocardiography

Abstract *Objective:* To differentiate cystic and cylindrical bronchiectasis utilizing a diagnostic triad of HRCT score, PFTs, and echocardiography.

Design: A prospective observational cross sectional study.

Setting: All bronchiectasis patients admitted to the chest department of Assiut and Al-Azhar Universities from May 2012 to June 2014 were enrolled in this study.

Main outcome measures: HRCT score, pulmonary function tests parameters (FEV1, FEV1/FVC, FVC, PaO_2, $PaCO_2$ and DLCO) and complete echocardiographic assessment were done for all patients.

Results: Obstructive pulmonary defect was observed in a majority of patients (56%). FVC%, FEV1 and FEV1/FVC were lower in patients with cylindrical as compared to cystic bronchiectasis. RV diameter was significantly greater in cystic bronchiectasis, and was positively correlated with pulmonary hypertension and negatively correlated with PaO_2. PH was significantly greater in patients with cystic bronchiectasis and was positively correlated with $PaCO_2$, and inversely correlated with PaO_2, and FEV1. Global HRCT scores for cystic bronchiectasis were significantly correlated with the values of FEV1% and with SPAP.

Conclusions: Cystic bronchiectasis is associated with more severe lung function impairment and worse HRCT scores as compared with cylindrical bronchiectasis. In cystic bronchiectasis, HRCT scores correlated with FEV1% and SPAP and could be a predictor of future PH. HRCT depicts these pathological changes, moreover, high HRCT score not only reflects lung damage in those patients, but it can also be correlated with PH. PH; therefore can be a marker of lung damage in bronchiectatic patients.

Introduction

High-resolution CT (HRCT) of the chest has become the imaging technique of choice, in the diagnosis of bronchiectasis. It helps to detect findings that are not seen on plain chest radiographs, as well as classify different pathological types and determine the extent of bronchiectasis [1,2]. The

* Corresponding author.

Peer review under responsibility of The Egyptian Society of Chest Diseases and Tuberculosis.

http://dx.doi.org/10.1016/j.ejcdt.2015.03.012

combination of the clinical features of severe lung disease and echocardiographic evidence of pulmonary hypertension or right ventricular dysfunction is associated with a poor prognosis. Several different echocardiographic techniques have been used to assess right ventricular function and pulmonary artery pressure in bronchiectasis. Doppler echocardiography estimates of pulmonary artery pressure using the peak velocity of tricuspid regurgitant jet are a reliable non-invasive way of measuring pulmonary artery pressure [3]. Pulmonary function studies may be normal in localized and mild bronchiectasis. With more severe and diffuse disease, pulmonary function tests may show obstructive or combined obstructive and restrictive abnormalities. Evidence of hyperinflation and reduced carbon monoxide diffusing capacity, may also be seen. In addition, between 30% and 69% of patients with bronchiectasis, have evidence of airway hyper responsiveness, as evident by histamine or methacholine challenge test [4].

Aim of the work

This study aims to differentiate cystic from cylindrical bronchiectasis utilizing a diagnostic triad of HRCT score, PFTs, and echocardiography.

Patients and methods

We included 100 patients who had been admitted for cough, chronic sputum production and radiological changes consistent with bronchiectasis including HRCT.

HRCT interpretation

HRCT scans were obtained on 16 rows HRCT (GE medical systems) scanner. Images were obtained at 1 mm collimation at 1-mm intervals from the apices to the lung bases, 0.5-s gantry rotation time, 120 kVp, and 130 mAs during maximum inspiration with the patient supine and extending from lung apex to diaphragm. All images were displayed at a window level of −700 Hounsfield units (HU) and at window width of 1500 HU, as appropriate for lung parenchyma. Two radiologists who were blinded to the clinical and laboratory data, used according to recommendations of the Nomenclature Committee of the Fleischner Society [5]. The CT scan was interpreted for the presence of bronchiectasis severity, pattern, distribution, and associated disease processes such as emphysema and small airway disease. Bronchiectasis was defined as a bronchus with an internal diameter larger than its accompanying pulmonary artery, lack of tapering of the bronchial lumen for longer than 2 cm, and visualization of a bronchus within 1 cm of the costal pleura. Peribronchial thickening was characterized by a bronchial wall thicker than 1 mm. Cylindrical bronchiectasis was diagnosed based on dilatation and thickening of the bronchial wall arterial wall ratio >1 [5] and cystic bronchiectasis was diagnosed by noticing thin-walled cystic spaces that may contain fluid and these were seen in subsequent axial cuts either in a conglomerate fashion or in branching order [6]. The HRCT scoring system used in the present study was a modified Bhalla CT scoring system. Six CT scan criteria were assessed: (1) bronchial dilatation, (2) peribronchial wall thickening, (3) number of bronchiectasis segments, (4) number of bullae, (5) number of emphysema segments, and (6) criteria of associated small airway disease. Each of the above parameters were scored from 0 in absence of a lesion through 3 according to severity of disease, with the small airway disease scored as 0 if it was absent or 1 if it was present. A global score for each patient was calculated from these measures that reflected the radiological overall severity of the disease process and its associations, with a maximum possible score of 16 [7].

Pulmonary function tests

Forced spirometry and the single-breath Carbon monoxide diffusing capacity of the lung (DLco) were obtained with pulmonary function units (Spirolab MIR, Italy). The Forced vital capacity (FVC) and DLCO were expressed as a percentage of predicted value based on height, age, gender and ethnic origin. Measurement of forced vital capacity (FVC) and forced expiratory volume in the first second (FEV1; best results of 3 successful attempts) was done in all patients. Total lung capacity (TLC) and residual volume were measured by plethysmography to diagnose cases with mixed obstructive and restrictive defects. Data were expressed as percentage of predicted value using the standard protocol of the American Thoracic Society [8]. Arterial blood gases were measured while patients were breathing room air. Hypoxemia and hypercarbia were defined as PaO_2 <60 mmHg and $PaCO_2$ >45 mmHg respectively.

Echocardiography

Two-dimensional transthoracic cardiographs with color flow imaging were performed in all patients (Philips model 5500). The ECHO study was read by a cardiologist without information about patient status. Pulmonary hypertension (PH) was defined in this study as SPAP $\geqslant 40$ mmHg based on criteria established by the World Health Organization Symposium on Primary Pulmonary Hypertension [9]. SPAP was calculated based on the modified Bernoulli equation, and right atrial pressure was estimated as 5, 10, 15, or 20 mmHg on the basis of size and respiratory changes of the inferior vena cava using previously described techniques [10]. Assessment of LV systolic function by calculating ejection fraction (EF) using M-mode method: normally $>55\%$. Assessment of LV diastolic function by detecting transmitral early velocity wave (E wave) and transmitral late velocity wave (A wave). (Normally E/A ratio >0.8). Assessment of RV systolic function by calculating fractional area Change (FAC) (Normally; 35–60%) and tricuspid annular peak systolic excursion (TAPSE) (Normal value >16 cm). Assessment of RV diastolic function by detecting tricuspid early velocity wave (E wave) and tricuspid late velocity wave (A wave). (Normally E/A ratio >0.8), and by measuring deceleration time (DT). (Normally <220 ms) [11,12].

Statistical analysis

SPSS (SPSS for Windows, SPSS Inc., Chicago, IL, USA) statistical package were used for statistical analyses. Descriptive statistics were shown as mean ± S.D. Univariate analysis was performed using chi-square test for proportion of sex differences in the study and variable groups. To compare