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Electrocardiographic characteristics in young male patients with left primary spontaneous pneumothorax estimated by the collins equation

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ABSTRACT

Objective: To investigate the 12-lead surface electrocardiographic (ECG) findings in young male patients with left primary spontaneous pneumothorax (PSP) estimated by the Collins equation.
Methods: From 2003 through 2008, 60 young male patients who had left PSP and 61 age-matched unaffected males were included for 12-lead ECG analyses. The PSP size was estimated by the Collins equation. Those with left PSP were divided into two groups: 1) large PSP ≥30% (n = 37), and 2) small PSP <30% (n = 23). The ECG in the unaffected was used as the normal control. Baseline demographic, anthropometric, and electrocardiographic findings including heart rate, P-QRS-T axes, wave intervals, and RS voltages were compared among three groups.
Results: As compared to the unaffected, patients with left PSP had faster heart rate, longer QTc interval, greater QRS and T axes. With regard to RS amplitudes, greater R in lead aVR and V1, and deeper S in lead II indicating predominant rightward forces, and smaller R in lead I and V3-V6 indicating inferior leftward forces were present in patients with left PSP. Of these ECG findings, heart rate, S voltage in lead II and R voltage in V1 in the large PSP but not in the small PSP had greater values than that in the unaffected group.
Conclusion: Among young male patients with left PSP estimated by the Collins method, the ECG showed faster heart beat and predominant rightward forces especially for those with large PSP.

1. Introduction

Primary spontaneous pneumothorax (PSP) occurs in persons who have no clinically apparent lung disease, and is not caused by trauma or any obvious precipitating factor. It is typically seen in tall, thin young males, and occurs rarely over the age of 40.[1,2] The management of PSP is usually dependent on the clinical situation despite the current management guidelines recommended by the British Thoracic Society and by the American College of Chest Physicians.[2–4] In general, experts suggest that patients who had pneumothorax size ≥30% or ≥3 cm apex-to-cupola distance or were symptomatic should receive air evacuation by simple manual aspiration or chest tube drainage.[2]

In clinical practice, 12-lead body surface electrocardiography (ECG) additionally to chest X radiography (CXR) provides essential information in patients with sudden onset chest pain such as ST-segment elevation myocardial infarction. Several typical ECG characteristics in left PSP have been described, including phasic R wave variations, right ward shift of the frontal QRS axis, diminution of the QRS complex, T-wave inversion, and loss of R waves in the precordial leads.[5–8] ECG findings may provide a clue to the presence of left PSP.

Moreover, our previous report found that S voltage in V2 and V3 in ECG might predict large pneumothorax size (>20%) by the Light index in young male patients with left PSP.[9] However, there are no published data on the ECG findings of left PSP estimated by the Collins method.[10,11] An understanding of ECG changes in pneumothorax is important for suspecting the condition and ordering CXR

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for these patients. In this study, we investigated the ECG characteristics in male patients with left PSP estimated by the Collins method.

2. Methods

This retrospective case-control study was conducted in an 1800-bed tertiary medical center in Taiwan. We took a thorough history and performed full physical examination of all patients who visited our emergency department with suspected pneumothorax. CXR was obtained and 12-lead surface ECG was performed as indicated. From January 2003 to February 2008, we reviewed only male patients with left PSP (n = 101) as the effect of breast in female patients may vitiate the ECG findings.[12] Sixty-six patients with available ECG (65.3%) were enrolled. After excluding those with hydro- pneumothorax, history of acquired cardiac and pulmonary diseases, isolated diaphragmatic elevation, chest wall deformity and previous lung volume reduction surgery, there was a final sample of 60 patients with left PSP for analysis. Echocardiography was not routinely performed for these patients since their young ages. The following data were reviewed and analyzed from the ED medical records and online picture; patients' demographic data including age, sex, height, weight, and body mass index, radiological appearance in pneumothorax size and 12-lead surface ECG characteristics. The Tri-Service General Hospital Institutional Review Board approved the study and waived the requirement for informed consent for this retrospective review of medical records (TSGHIRB09705103).

All patients had posteroanterior CXR in the upright position taken at the same time of admission in the ED, which were reviewed by two physicians. If discrepancy existed in the classification of PSP size by the Collins method, another radiologist blinded to the results further reviewed the CXR and determined the PSP size greater or less than 30%. The Collins method, a function of the interpleural distance (ID), was used for measuring the sizes of pneumothorax and the calculated formula was listed below.[10,11]

$$\%\text{Collins} = 4.2 + 4.7\ (A + B + C)$$

–A = maximal apical ID.

–B = ID at the midpoint of the upper half of the lung.

–C = ID at the midpoint of the lower half of the lung.

To compare the estimate of left PSP size between the Light index and the Collins method, we plotted the scatter diagram of pneumothorax sizes by two methods in our patients. Large PSP was defined as ≥30% by the Collins method (group 3, n = 37); and the small PSP was defined as <30% (group 2, n = 23).[13] The ECGs from 61 age-matched healthy males were as the normal control (group 1). ECG in all patients was taken in supine position. The R wave was measured from the initial positive deflection of ventricular despoliation. The S wave was measured from the first negative deflection of ventricular depolarization that follows the first R wave. The ECGs were performed by experienced technicians in our ED during the study period. Two cardiologists reviewed the results of the 12-lead ECG. If discrepancy (the measurement difference over 10%) existed, another cardiologist blinded to the results would review it again and an average of the two closest results was used as the final value.

2.1. Statistical analysis

Data were demonstrated either as percentage of the group (categorical variables) or as mean ± standard deviation (continuous variables). P-values were derived from Tukey's pairwise multiple comparison procedure. The statistical package SAS (SAS Institute Inc., Cary, NC, USA), was used for all analyses. All *p*-values were 2-sided; $p < 0.05$ was considered significant.

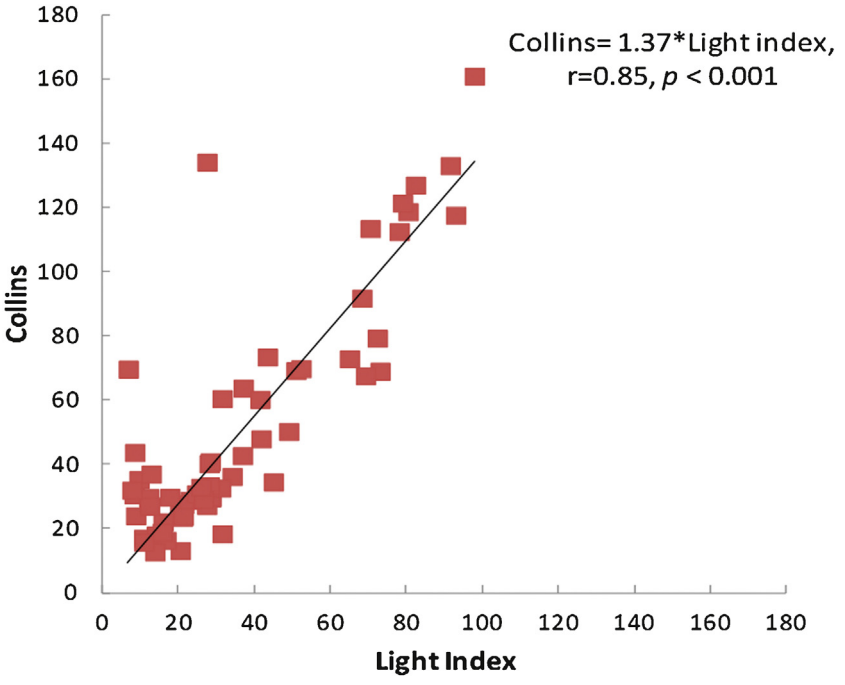

Fig. 1. The scatter diagram of pneumothorax sizes estimated by the Light index and the Collins' Method.

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