ELECTROCARDIOGRAPHIC ABNORMALITIES IN ACUTE PULMONARY EMBOLISM

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Aim: We study the electrocardiographic abnormalities at time of diagnosis of acute PE in our series of consecutive patients of the last years. We conclude that the electrocardiogram may have diagnostic and prognostic value in patients with acute PE.

Methods: We retrospectively reviewed the records of 154 consecutive patients with acute PE.Diagnosis of PE was established by a high-probability ventilation/perfusion lung scan (121 patients), pulmonary angiography or spiral computed tomography (19 patients), or the combination of a suggestive clinical picture with a deep vein thrombosis (DVT) demonstrated by phlebography or echo-doppler (14 patients).

Results: Electrocardiogram at time of diagnosis showed abnormalities consistent with acute PE in 107 patients (69.5%). These electrocardiographic abnormalities were: sinus tachycardia in 85 patients (55.2%), S1Q3T3 pattern in 41 patients (26.6%), right bundle branch block in 23 patients (14.9%), T-wave inversion in precordial leads in 22 patients (14.3%), supraventricular tachycardias in 11 patients (7.1%), ST segment depression in 4 patients (2.6%) and P pulmonale in 1 patient (0.6%). Supraventricular tachycardias were: presumed new-onset atrial fibrilation in 8 patients, atrial flutter in 2 patients and paroxysmal supraventricular tachycardia in 1 patient.

Conclusion: We might conclude that sinus tachycardia and S1Q3T3 pattern are the principal determinants of severity between the electrocardiographic abnormalities at time of diagnosis in patients with acute PE.

Key words: Electrocardiogram, pulmonary embolism, pulmonary thromboembolism.

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INTRODUCTION

Sinus tachycardia, supraventricular tachycardias, T-wave inversion in precordial leads, S1Q3T3 pattern, right bundle branch block and P pulmonale are considered electrocardiographic abnormalities consistent with acute pulmonary embolism (PE) (1). Some models of probability of acute PE using these electrocardiographic abnormalities are useful in the diagnostic investigation of patients suspected of having acute PE (2). Therefore, we think that the electrocardiogram still must be considered in the diagnosis of acute PE. We study the diagnostic and prognostic value of electrocardiographic abnormalities at time of diagnosis of acute PE in our series of consecutive patients of the last years.

MATERIAL AND METHODS

We retrospectively reviewed the records of 154 consecutive patients with acute PE admitted to an Internal Medicine service in a tertiary hospital between January 1993 and December 2001. Diagnosis of PE was established by a high-probability ventilation/perfusion lung scan (121 patients), pulmonary angiography or spiral computed tomography (19 patients), or the combination of a suggestive clinical picture with a deep vein thrombosis (DVT) demonstrated by phlebography or echo-doppler (14 patients). We considered electrocardiographic abnormalities consistent wit acute PE : sinus tachycardia, supraventricular tachycardias, T-wave inversion in precordial leads, S1Q3T3 pattern, right bundle branch block and P pulmonale.

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Table 1. Comparison between patients with an without electrocardiographic abnormalities

	ECG abnormalities (+)	ECG abnormalities (-)	p value
n	107	47	
Age, years	69.3±13.2	67.9±12.2	ns
Female	72	24	ns
Dyspnea	86	29	0.02
Hemoptysis	10	10	0.04
Pleuritic pain	38	25	0.04
Dyspnea isolated syndrome	63	17	0.04
Pulmonary infarction syndrome	28	28	0.02
Respiratory failure	51	10	0.003
Systolic blood pressure <100 mmHg	13	0	0.01
Hospital mortality	5	5	ns

Plus-minus values are means ± standard deviations. The data in brackets are percentages. ECG: electrocardiography. ns: non significance (p > 0.05).

Sinus tachycardia was defined as a heart rate higher than 100 beats per minute. S1Q3T3 pattern was defined as the presence of S wave in lead I and Q wave and inverted T wave in lead III. Prior cardiopulmonary disease was defined as a prior diagnosis or evidence of chronic cardiac or pulmonary diseases. Dyspnea isolated syndrome was defined as dyspnea in the absence of pleuritic pain and hemoptysis. Pulmonary infarction syndrome was defined as pleuritic pain and/or hemoptysis. We used the chi-square test or Fisher's exact test to compare the categorical variables and the t-tests to compare the continuous variables.

RESULTS

Electrocardiogram at time of diagnosis showed abnormalities consistent with acute PE in 107 patients (69.5%). These electrocardiographic abnormalities were: sinus tachycardia in 85 patients (55.2%), S1Q3T3 pattern in 41 patients (26.6%), right bundle branch block in 23 patients (14.9%), T-wave inversion in precordial leads in 22 patients (14.3%), supraventricular tachycardias in 11 patients (7.1%), ST segment depression in 4 patients (2.6%) and P pulmonale in 1 patient (0.6%). Supraventricular tachycardias were: presumed new-onset atrial fibrilation in 8 patients, atrial flutter in 2 patients and paroxysmal supraventricular tachycardia in 1 patient. We compared the characteristics of our patients with an without electrocardiographic abnormalities (table 1). Respiratory failure was more frequent in patients with sinus tachycardia (50.6% vs 26.1%, p: 0.003). Hypotension was more frequent in patients with sinus tachycardia (12.9% vs 2.9%, p: 0.02) and in patients with S1Q3T3 pattern (17.1% vs 5.6%, p: 0.02).

DISCUSSION

Electrocardiographic abnormalities consistent with PE have been described with a variable frequency in patients with acute PE (1-6). Acute right cardiac chambers dilatation and hypoxemia are proposed mechanisms to explain these abnormalities (3). Like in our study, about 70% of patients with acute PE of the PIOPED study presented electrocardiographic abnormalities consistent with acute PE (6). The most frequent abnormalities in our patients were sinus tachycardia, S1Q3T3 pattern, right bundle branch block and T-wave inversion in precordial leads, similar to other studies (1-6). Our study also confirms that supraventricular tachycardias (especially atrial fibrillation) may be present in a minority of patients at time of diagnosis of acute PE. We point out that these electrocardiographic abnormalities were not more frequent in our patients with prior cardiopulmonary disease. In the PIOPED study, a normal electrocardiogram was more frequent in patients with the pulmonary infarction syndrome (7), observation consistent with our results. Dyspnea was more frequent in our patients with electrocardiographic abnormalities and hemoptysis and pleuritic pain were more frequent in our patients without electrocardiograhic abnormalities.

Respiratory failure and hypotension may be considered indicators of severity in acute PE and were more frequent in our patients with electrocardiographic abnormalities. Therefore, the presence of these electrocardiographic abnormalities at time of diagnosis might be a predictor of severity in acute PE. Further studies must be confirm or rule out this conclusion. The explanation for this observation may be that

electrocardiographic abnormalities are more frequent in patients with severe pulmonary vascular obstruction and pulmonary hypertension which are indicators of severity in acute PE (4,5) However, we did not find significant difference in the hospital mortality between our patients with and without electrocardiographic abnormalities although there were few events. Respiratory failure was more frequent in our patients with sinus tachycardia, and hypotension was more frequent in our patients with sinus tachycardia and S1Q3T3 pattern.

We might conclude that sinus tachycardia and S1Q3T3 pattern are the principal determinants of severity between the electrocardiographic abnormalities at time of diagnosis in patients with acute PE.

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