



Case Report

Minimal pneumothorax with dynamic changes in ST segment similar to myocardial infarction



Seok-Ran Yeom, MD, PhD^a, Sung-Wook Park, MD^a, Young-Dae Kim, MD, PhD^b, Byung-Jae Ahn, MD^c, Jin-Hee Ahn, MD^d, Il-Jae Wang, MD^{a,*}

^a Pusan National University Hospital, Department of Emergency Medicine, 179, Gudeok-ro, Seo-gu, Busan 602-739, South Korea

^b Pusan National University Hospital, Department of Thoracic and Cardiovascular Surgery, Pusan National University of College of Medicine, 179, Gudeok-ro, Seo-gu, Busan 602-739, South Korea

^c Pusan National University Hospital, Department of Internal Medicine, 179, Gudeok-ro, Seo-gu, Busan 602-739, South Korea

^d Pusan National University Hospital, Department of Cardiology, 179, Gudeok-ro, Seo-gu, Busan 602-739, South Korea

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ABSTRACT

Pneumothorax can cause a variety of electrocardiographic changes. ST segment elevation, which is mainly observed in myocardial infarction, can also be induced by pneumothorax. The mechanism is presumed to be a decrease in cardiac output, due to increased intra-thoracic pressure. We encountered a patient with ST segment elevation with minimal pneumothorax. Coronary angiography with ergonovine provocation test and echocardiogram had normal findings. The ST segment elevation was normalized by decreasing the amount of pneumothorax. We reviewed the literature and present possible mechanisms for this condition.

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1. Introduction

ST segment elevation in patients with chest pain is an emergency situation in the emergency department (ED) because a majority of these cases have myocardial infarction. However, besides a myocardial infarction, there are various causes of ST segment elevation [1,2]. Pneumothorax is a rare disease, which can cause ST segment elevation. There are a few reports related to pneumothorax and ST segment elevation. We report the case of a 35-year-old man who did not have any history of other diseases, presenting with minimal spontaneous pneumothorax and ST segment elevation.

2. Case presentation

A 35-year-old man presented to the emergency department with chest pain. The pain started the day before the visit. The pain was of

sharp nature, specifically, in the left chest area. It turned into pressing pain around the substernal area when the patient visited the ED. He was a healthy young man with no previous medical history. Recently, the patient had consumed alcohol four or five times a week, and had not taken any medication. On presentation, the blood pressure was 110/60 mm Hg, pulse rate was 106 beats/min, respiratory rate was 18 times/min, and body temperature was 36.1 °C. Oxygen saturation was 97% in room air, as measured by a pulse oximeter. There were no specific findings upon a physical examination. Electrocardiography showed ST segment elevation in leads II, III, and aVF and ST segment depression in aVR. T wave inversion was also observed in leads V1 and aVL (Fig. 1). We checked the routine chest X-ray. There was a minimal pneumothorax in the left lung, but we missed it (Fig. 2). We consulted the cardiologist and an emergency coronary angiography was performed. The patient had no stenosis, and the ergonovine provocation test result was negative. Subsequently, chest computed tomography (CT) was performed to identify pericarditis. We found 4.9-cm bullae in the apex of the left lung and a small amount of pneumothorax along the chest wall (Fig. 3). We checked the previous chest radiograph, and found a small left pneumothorax. All cardiac marker levels were in the normal range. We administered oxygen using nasal cannula. Chest pain dramatically improved and the patient was admitted to thoracic surgery department. An electrocardiography performed 2 h later revealed a

* Corresponding author at: Pusan National University Hospital Department of Emergency Medicine, Biomedical Research Institute, Pusan National University Hospital, 179, Gudeok-ro, Seo-gu, Busan 602-739, South Korea.

E-mail addresses: domini@pusan.ac.kr (Y.-D. Kim), jrmr9933@pusan.ac.kr (I.-J. Wang).

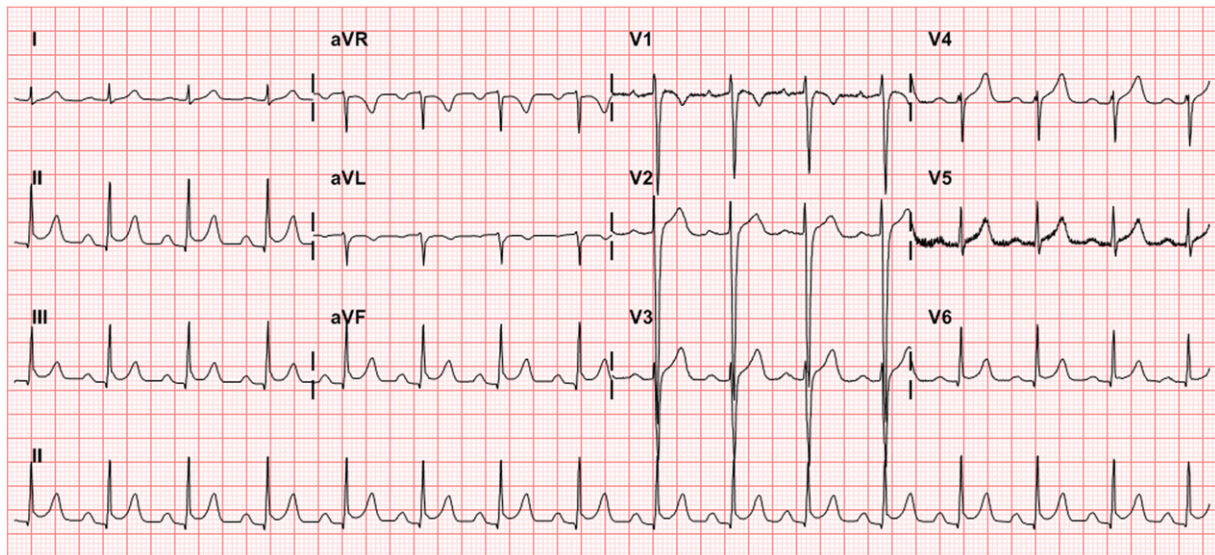


Fig. 1. On presentation, there is ST segment elevation in II, III, aVF leads and ST segment depression in aVR lead. T-wave inversion is observed in I, aVL leads.

new T wave inversion in V2 and deep inverted T wave in V1 (Fig. 4). Two days later, the ECG revealed a normal T wave in V2 and aVL.

Seven days later, ST elevation in II, III, and aVF, ST depression in aVR, and T wave inversion in V2 were normalized. T wave inversion in V1

also diminished (Fig. 5). Pneumothorax was not observed in the simple chest radiograph acquired on the same day.

3. Discussion

Electrocardiographic changes in patients with pneumothorax have been reported since about one hundred years [3]. Krenke et al. [4] reviewed the ECGs of 40 patients with spontaneous pneumothorax. They reported that abnormal axis deviation is more common in the patient with left pneumothorax while QRS and T wave changes are seen more often in the patient with right pneumothorax. Other reported changes include QRS voltage variation, QS pattern, PR segment elevation, and S1Q3T3 pattern [5-7].

The assumed mechanism for changes in ECG findings is cardiac rotation around its long axis, right ventricular dilatation due to increased pulmonary artery pressure, and cardiac displacement [8-10]. Another mechanism is the presence of air in the thoracic cavity that acts as an insulator [11,12].

ST elevation induced by pneumothorax has rarely been reported. A total of six cases were reported. Both tension pneumothorax [13-15] and simple pneumothorax [16-18] cases have been reported. An anterior lead ST elevation is usually found; however, ST elevation of the inferior lead has also been reported [16]. Although controversial, the cause of ST segment elevation is presumed to be the reduction of venous return due to increased intra-thoracic pressure and decreased stroke volume. A reduction in stroke volume leads to a decrease in cardiac output. Compensatory tachycardia occurs and the oxygen demand of the myocardium further increases, leading to ischemia [16]. In our patient, this mechanism does not apply. Additional studies were warranted to evaluate our findings.

The cause of ST segment elevation in our patient could have been early repolarization. However, since our patient presented with continuous electrocardiographic changes, it is highly likely that the change was not due to early repolarization. The dynamic T segment changes observed in other leads are also not compatible with early polarization [19].

In conclusion, ST elevation has a variety of causes. Pneumothorax can be one example. The presented case shows that a very small amount of pneumothorax can cause ST segment elevation. Emergency physicians should know that patients with ST segment elevation, accompanied by chest pain, do not always have a myocardial infarction.



Fig. 2. Chest X-ray showed left minimal pneumothorax.

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