Case Report

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An application to Keep in Mind in Cases of Pulmonary Thromboembolism: Positive Airway Pressure System

Oğulcan Kınık[1], Kadir Yenal[1], Ahmet Emre Ay[2], Ahmet Burak Erdem[1], Safa Dönmez[1], Faruk Büyük[2]

[1]Ministry of Health Ankara City Hospital, Emergency Department, Ankara, Turkey.

[2]Ankara Yıldırım Beyazıt University and Ministry of Health Ankara City Hospital, Emergency Department, Ankara, Turkey.

Abstract

Massive pulmonary embolism is a vital emergency pulmonary pathology. Early diagnosis and treatment approach reduce mortality. Thrombolytic applications play an important role in the treatment. However, complications of thrombolytic therapy put a serious strain on physicians. In this case series, we aimed to present the management of carbon dioxide retention with the EzPAP® device in two young massive embolism patients who were given thrombolytic therapy. Our 26 and 36-year-old male patients applied to our emergency department with complaints of flank pain and syncope, respectively. Massive PTE was detected in PCTAs taken due to hypoxia and tachycardia in our patients. When carbon dioxide retention developed in patients who were decided to be given thrombolytic therapy, barotrauma, which could be caused by non-invasive mechanical ventilation, was withdrawn. And it was decided to apply EzPAP® to these patients. In both patients, hypoxia and carbon dioxide retention were treated in a short time without complications. Etiological investigations of the patients are continuing and they were discharged with convalescence. While thrombolytic therapy provides rapid and positive results, it also includes serious life-threatening side effects such as bleeding. EzPAP® can be used as an alternative treatment method for thrombolytic-related bleeding that may develop in the face and respiratory tract due to barotrauma of non-invasive mechanical ventilation.

Keywords:PEzPAP®, carbon dioxide retention, massive pulmonary thromboembolism, thrombolytic therapy

Introduction

Pulmonary thromboembolism (PTE) is an important preventable clinical problem with high mortality and morbidity. Symptoms such as shortness of breath, chest pain, and hemoptysis are not specific to the disease and can be seen in many cardiopulmonary diseases. Since shock and cardiopulmonary arrest may be clinical in massive cases, it is important to go for diagnosis and treatment quickly. PTE develops when pieces of deep vein thrombosis (DVT) in the leg occlude the pulmonary artery and/or its branches. When advanced diagnostic methods are used, deep vein thrombus is detected in 79% of PTE patients. PTE and DVT are also called venous thromboembolism (VTE). Pulmonary thromboembolism is the third most common acute cardiovascular disease after myocardial infarction and stroke. Pulmonary thromboembolism is a frequent complication of hospitalizations and one of the leading causes of preventable hospital deaths[1,2]. VTE is seen in 23-269 per hundred thousand per year. 30-day mortality due to PTE is 1.8%. Prior surgery, immobility, cancer, major trauma and obesity are important risk factors. In low-risk patients, low molecular weight heparin or standard heparin is started and added to oral anticoagulant therapy[3]. Thrombolytic methods are used effectively in the treatment of massive PTE. It is necessary to avoid unnecessary procedures that may cause complications such as invasive, traumatic and barotrauma to patients during thrombolytic therapy[4]. EzPAP® (a noninvasive positive airway pressure device) is a simple, manual device that can be used in cases of acute atelectasis. It creates a continuous positive airway pressure (CPAP) effect. Thus, it aims to prevent good oxygenation and carbon dioxide (CO_2) retention in patients[5-6].

In this case series, we aimed to present the management of carbon dioxide retention with the EzPAP® device in two young massive embolism patients who were given thrombolytic therapy.

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Case-1

A 26-year-old male patient applied to the emergency department with the complaint of left flank pain for 3-4 hours. After, the patient had syncope. Glasgow coma score (GCS): 15, general condition was good, conscious,

Corresponding Author: Ahmet Burak Erdem
e-mail: drabe0182@gmail.com
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cooperative, oriented. In his vitals, the patient had arterial blood pressure: 93/63 mm/Hg, pulse: 115/minute, fever: 36.2 C°, oxygen saturation 90% at room air, and had no additional complaints. Electrocardiography (ECG) was sinus tachycardia. The patient had a known diagnosis of autism. There was no significant change in the blood of the patient, whose physical examination did not reveal any active pathology, except for the white blood cell count of 11,000, high sensitive troponin I was 660 ng/L and C-reactive protein (CRP): 140 mg/L. Unfortunately, the d-Dimer level could not be measured even though it was repeated due to sample error. In the pulmonary computed tomography angiography (PCTA) report taken in the emergency room, the diameter of the pulmonary trunk increased and thrombus material was observed that caused the filling defect extending from the pulmonary trunk bifurcation to the right and left main pulmonary arteries, and a hampton hump secondary to pulmonary embolism was observed in the left lung lingula and lower lobe posterobasal. In the ECHO cardiogram of the patient, the left ventricular ejection fraction was interpreted as 50%, global mild hypokinesia, minimal mitral insufficiency, 1-2 tricuspid insufficiency, right heart chambers wide, spab: 35 mmHg. The patient was started on alteplase in the form of an intravenous (iv.) infusion in 2 hours. During the administration of thrombolytic therapy, carbon dioxide (CO_2) retention was observed in the patient. We decided to start EzPAP® because the patient was afraid of the barotrauma effect of the thrombolytic due to hypoxia and CO_2 retention. Our initial blood gas values were as follows. pH was 7.24, oxygen saturation 83.8%, pO_2 count was 45, pCO_2 count was 58 and HCO3 was 19. After two hours, pH was 7.40, oxygen saturation 93%, pO_2 count was 47.4, pCO_2 count was 38 and HCO3 was 23.4.The patient, who was stabilized clinically, was transferred to the intensive care unite for treatment and follow-up by pulmonologist. Systemic lupus erythematosus was determined as the etiological cause. The lupus anticoagulant scan came in 75.75 seconds. But the patient, whose etiological investigation continued, was discharged with convalescence.

Case-2

A 36-year-old male patient applied to the emergency department after dispnea and syncope in the bathroom for 5 minutes. GCS: 15, general condition was good, conscious, cooperative, oriented. His vitals were arterial blood pressure: 91/55 mm/Hg, pulse: 127/minute, fever: 36.2°C, oxygen saturation at room air was 78%, and the patient had no additional complaints. ECG was sinus tachycardia. Physical examination did not reveal any active pathology. Glucose value was 452 mg/dL, high sensitive troponin I was 168 ng/L, d-Dimer was 21.27 mg/L and CRP was 112 mg/L. In the PCTA taken in the emergency department, there were filling defects consistent with diffuse PTE in the bilateral main pulmonary artery and its branches. Right heart chambers were enlarged, and there was significant diameter reduction in the descending aorta and abdominal aorta. The patient, who was compatible with massive pulmonary embolism, was started on iv. alteplase infusion in 2 hours as thrombilytic therapy. After the treatment was finished, CO_2 retention was observed in the patient. in venous blood gas, pH was 7.06, pCO_2 was 66.2, HCO_3 was 18.3 and oxygen saturation %88. It was decided to apply EzPAP®, as the patient developed carbon dioxide retention and the application of non-invasive mechanical ventilation simultaneously with after thrombolytic therapy could cause complications. 2 hours after the start of EzPAP®, the venous blood gas values became pH was 7.11, pCO_2 was 57, HCO_3 was 17.9 and oxygen saturation was %95. The patient who benefited from the EzPAP® application was admitted to the intensive care unite for treatment and follow up by pulmonologist. The patient, whose etiological investigation continued, was discharged with convalescence.

Discussion

Pulmonary embolism is one of the life-threatening thoracic emergencies that the emergency physician should consider in patients presenting to the emergency department with symptoms such as chest pain, dyspnea, tachypnea and hemoptysis. In patients diagnosed with massive embolism, close vital hemodynamic monitoring should be performed, necessary treatments should be started in terms of hemodynamic stability, and invasive procedures should be completed before treatment if there is an indication for thrombolytic initiation. In the treatment of PTE, emergency physicians should keep in mind the application of EzPAP® in addition to other oxygen treatments such as nasal cannula, balloon mask and noninvasive mechanical ventilation (NIMV)[7]. The NIMV provides respiratory support with positive pressure continuously or separately during expiration and inspiration. It is especially used in cardiogenic pulmonary edema and chronic obstructive pulmonary disease. Treatment success is demonstrated by the improvement of oxygenation and a decrease in pCO_2 in the first 2 hours. During treatment, it may cause facial erythema due to pressure and mask, nasal congestion, and ulceration and irritation on the mucosal surfaces[8]. Atelectasis developing in the postoperative period leads to hypoxia. Treatment with positive end-expiratory pressure (PEEP) can often be used in this period. Although different devices can be used for this, the EzPAP® system is an alternative method. With 5-8/L oxygen flow, this device provides 35-42% fractionated oxygen. It does this by increasing the oxygen flow fourfold. An increase in lung volume provides positive expiratory pressure during expiration. With less effort, atelectasis lung tissue begins to oxygenate. The superiority of the devices used in the treatment of

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this hypoxemia due to atelectasis is not fully evident[9,10]. Both of our patients had massive pulmonary embolism syncope and deep hypoxia before coming to the emergency department. We started oxygen support with nasal cannula for our patients. However, CO_2 retention accompanying hypoxia also developed in the patients. In the meantime, our patients after thrombolytic therapy needed respiratory support with NIMV. We decided to apply EzPAP® because of the risk of barotrauma complications. This device has shown successful results in post-operative hypoxia and CO_2 retention. Saturation, increase in oxygen and decrease in CO_2 values were easily achieved. Patient compliance and ease of application also provide an important advantage[10,11].

In our case series, attention was drawn to the convenience provided by EzPAP® in clinical follow-up after thrombolytic therapy. Respiratory support was provided in two of our cases in EzPAP® treatment, and improvement in blood gas values 2 hours later and clinical improvement were observed. This treatment method gave us an advantage to avoid the complication of barotrauma (especially subcutaneous or mucosal bleeding, airway obstruction due to hematoma) after thrombolytic treatment. Anxiety in hypoxia patients may cause compliance problems at the point of application of NIMV. These 2 patients, to whom we applied EzPAP®, adapted easily to the device.

Conclusion

Considering that such patients may need NIMV; Simpler device applications such as EzPAP® that provide positive expiratory pressure and can be used to reduce carbon dioxide retention can be used. In this way, the patient is not affected by the complication of NIMV application, which may cause barotrauma during thrombolytic therapy.

Declaration of competing interest: *The authors have no outside support information, conflicts or financial interest to disclose. Informed consent from the patient has been obtained.*

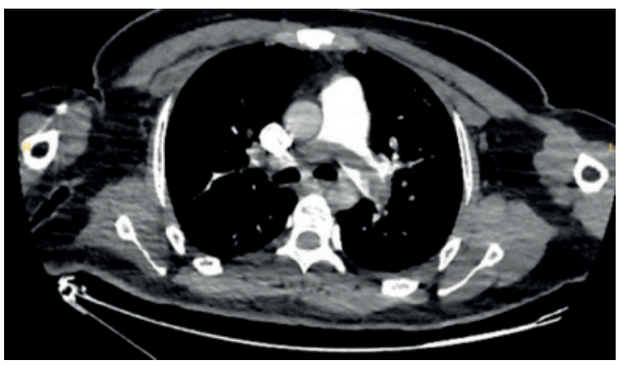

Figure 1. Presence of thrombus in the bilateral main pulmonary artery of Case 1

Figure 2. Filling defect in bilateral main pulmonary artery and branches of Case 2.

Figure 3. Positive Airway Pressure System; EzPAP®.

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