

Concomitant usage of thrombolytic therapy and therapeutic hypothermia in a case of sudden cardiac arrest due to massive pulmonary embolism

Masif pulmoner emboli sonucu gelişen ani kalp durmasında trombolitik tedavi ve terapötik hipoterminin birlikte kullanımı

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Summary– Massive pulmonary embolism is a well-known cause of sudden cardiac arrest in the adult population. Systemic fibrinolysis can be a life-saving option. Therapeutic hypothermia is highly recommended for nontraumatic sudden cardiac arrest victims to minimize neurological complications. However, there are limited data about the use of therapeutic hypothermia for sudden cardiac arrest victims also treated with systemic fibrinolysis. Concerns about hypothermia-related coagulopathy and a possible tendency to bleeding have limited the use of cooling therapy in such cases. Presently described is a case of sudden cardiac arrest due to a massive pulmonary embolism that was successfully treated with the concomitant usage of systemic fibrinolysis and therapeutic hypothermia.

Massive pulmonary embolism is the third ranking cause of cardiac arrest in cases of cardiovascular disease, after myocardial infarction and a cerebrovascular event. Clinical outcomes are worse for these patients without clot-specific treatment. Bedside fibrinolytic administration is a good choice and can be life-saving in emergency departments for sudden cardiac arrest due to a massive pulmonary embolism.^[1]

Targeted body temperature management and therapeutic hypothermia are recommended to minimize the possibility of poor neurological function in all sudden

Özet– Masif pulmoner embolizm erişkin popülasyonda tanımlanmış ani kalp durması nedenlerinden biridir. Sistemik fibrinolitik hayat kurtarıcı bir seçenektir. Travmatik olmayan ani kalp durmasında nörolojik komplikasyonların sınırlandırılması amacıyla terapötik hipotermi uygulanması şiddetle önerilmektedir. Buna karşılık, sistemik fibrinolitik ile tedavi edilen masif pulmoner emboli durumunda gelişen ani kalp durmasında terapötik hipotermi kullanımı ile ilgili veriler kısıtlıdır. Hipotermi ilişkili koagülopati ve olası kanama eğilimi hakkındaki endişeler soğutma tedavisinin sistemik fibrinolitik uygulanmış kardiyak arrest hastalarındaki kullanımını sınırlandırmaktadır. Bu yazıda, masif pulmoner embolizme bağlı ani kalp durması gelişen, sistemik fibrinolitik ve terapötik hipoterminin birlikte kullanımı ile başarılı şekilde tedavi edilen hasta sunuldu.

cardiac arrest victims. However, there are some concerns about the safety of cooling therapy for sudden cardiac arrest victims treated with systemic fibrinolysis.^[2] This report is a description of a case of sudden cardiac arrest due to a massive pulmonary embolism that was successfully managed with systemic fibrinolytic administration and therapeutic hypothermia.

Abbreviations:

AHA	American Heart Association
ECG	Electrocardiography
ESC	European Society of Cardiology
GCS	Glasgow Coma Scale
ROSC	Recovery of spontaneous circulation
tPA	Tissue plasminogen activator

Received: October 08, 2018 Accepted: November 09, 2018

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CASE REPORT

A 53-year-old male patient was admitted to the emergency service with complaints of chest pain and severe dyspnea. Atrial fibrillation with a high heart rate (190 beats per minute) and a right bundle branch block was observed on a 12-lead electrocardiography (ECG). The surface ECG did not reveal any ST segment elevation consistent with acute myocardial infarction. Immediately after the ECG recording, cardiac arrest developed and bedside echocardiography was performed during cardiopulmonary resuscitation to perform a differential diagnosis. The echocardiography documented excess dilatation of the right heart chambers. During resuscitation, the patient's relatives provided information about a history of lower extremity venous thrombosis. Thrombolytic therapy was initiated for a suspected massive pulmonary embolism. An accelerated infusion of 50 mg recombinant tissue plasminogen activator (tPA; Alteplase) was administered in 15 minutes as well as 70 IU/kg unfractionated heparin via intravenous access. Recovery of spontaneous circulation (ROSC) was achieved at the 20th minute following the fibrinolytic administration. A 12-lead ECG examination revealed restoration of sinus rhythm and resolution of the right bundle branch block. Following ROSC and hemodynamic stabilization, thoracic computerized tomography with contrast injection was performed to confirm the diagnosis of pulmonary embolism, and thoracic computerized tomography revealed blood clots in both pulmonary arteries (Fig. 1). Arterial monitoring indicated a blood pressure of systolic 120 mm Hg and diastolic 70 mm Hg. Although the arterial blood pressure was stable, the patient remained comatose, with a Glasgow Coma Scale (GCS) score of 5 and a modified Rankin Scale score of 5.

Therapeutic hypothermia treatment was initiated within an hour after ROSC to minimize possible neurological damage related to prolonged cardiac arrest and the body temperature was cooled to 32°C over the following 4 hours. Therapeutic hypothermia was performed via chest and extremity pads using an Arctic Sun 5000 Temperature Management System (Bard, New Providence, NJ, USA) (Fig. 2). Therapeutic hypothermia was administered for 24 hours and the patient was rewarmed 0.25°C per hour over the following 20 hours. Sedation was provided dur-

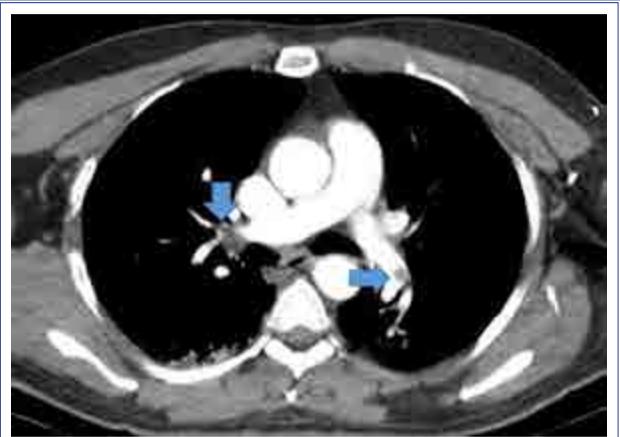


Figure 1. Computerized tomography revealed blood clots in both pulmonary arteries (blue arrows). After the administration of systemic fibrinolysis, the thrombus was probably fragmented and embolized distally. The fragmented blood clots were likely the remnants of a saddle-back thrombus in the main pulmonary trunk, which could have been the cause of the sudden cardiac arrest.

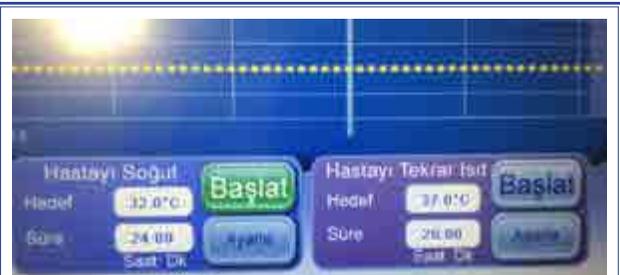


Figure 2. Main screen of the external cooling device, the Arctic Sun 5000 Temperature Management System (Bard, New Providence, NJ, USA).

ing the cooling and rewarming periods as well as a sodium pentothal infusion of 2 mg/kg/hour. None of the possible complications, such as hypotension or arrhythmia episodes, were observed during cooling and rewarming. A control echocardiography revealed that the right heart chambers had returned to normal size and the systolic pulmonary arterial pressure was under 25 mm Hg. Full neurological recovery was achieved on the fourth day after weaning from therapeutic hypothermia and sedation. In all, the patient was hospitalized for 12 days and then discharged without any neurological disability.

DISCUSSION

A differential diagnosis to clarify the underlying cause of hemodynamic collapse is essential during cardiopulmonary resuscitation in sudden cardiac arrest

victims. The prognosis is much poorer without a precise treatment option for the original etiological factor. A pulmonary embolism can lead to hemodynamic collapse and cardiac arrest. A massive pulmonary embolism in a hemodynamically unstable patient has poor prognosis without specifically targeted treatment and the overall mortality can be as high as 70%.^[3] Even with successful ROSC, survival is low in these cases. The current clinical guidelines suggest systemic fibrinolytics, catheter-directed embolectomy, or surgical embolectomy for the management of patients with cardiac arrest due to a massive pulmonary embolism.^[4] Systemic fibrinolysis is a common choice for prompt management of these patients in an emergency setting and can be life-saving treatment. Unfortunately, a pulmonary embolism generally presents with non-specific or subtle clues and the differential diagnosis depends on high clinical suspicion. A patient's personal history of thromboembolism, ECG findings, and a bedside echocardiographic evaluation are the initial tools used to perform an exact differential diagnosis. The most recent European Society of Cardiology (ESC) guidelines for the management of pulmonary embolism include systemic fibrinolytic treatment when there is evidence of echocardiographic findings supporting pulmonary embolism in hemodynamically unstable patients.^[4] This guideline also recommends a bolus dosage of recombinant tPA in very high-risk patients, according to the view of the clinician after a complete bedside evaluation. Although, we do not have an exact recommendation for the management of cardiac arrest due to a massive pulmonary embolism in the current ESC or American Heart Association (AHA) clinical guidelines,^[4,5] there are some case reports about successful treatment of these patients with systemic fibrinolytic administration even during ongoing cardiopulmonary resuscitation. In an emergency setting, systemic fibrinolysis may be the only chance for these patients and a clot-specific fibrinolytic agent is highly recommended to restore hemodynamic stability.

Therapeutic hypothermia is a well-defined treatment option to minimize poor neurological outcomes for cardiac arrest victims in the post-cardiac arrest care period following ROSC. In the latest AHA guidelines about post-cardiac arrest care, published in 2015, cooling therapy in the next 24 hours is recommended for all cardiac arrest victims.^[6] Our patient was an in-hospital cardiac arrest victim and

cardiopulmonary resuscitation was initiated without delay, but following ROSC and hemodynamic stabilization, given the comatose state and low GCS score, we decided to perform cooling therapy to limit any neurological complications. A targeted body temperature approach is recommended, with an optimal body temperature of between 32°C and 36°C. There are some brief reports about the availability of therapeutic hypothermia or a targeted body temperature approach in patients who have received systemic fibrinolytics.^[7] However, there are conflicting data and some concerns that therapeutic hypothermia may trigger coagulopathy disorders. Some authors have advised that the decrease in body temperature not be too aggressive, especially in patients who are prone to develop excessive bleeding.^[8,9] In an evaluation of an artificial coagulopathy model, Shenkman et al.^[10] found that the effects of fibrinolysis and hypothermia may influence one another. In a large scale meta-analysis, therapeutic hypothermia was not found to be related to increased risk of hemorrhage, despite increased thrombocytopenia and transfusion requirements.^[11] We do not have any clinical trial data evaluating the optimal management of body temperature and the efficacy and safety of cooling therapy in cardiac arrest victims who are given systemic fibrinolysis to treat the underlying cause of circulatory collapse. There are only a few case reports about successful management of these patients with therapeutic hypothermia after ROSC and the effects of systemic fibrinolysis.^[3,7,12] These case reports have little data and they do not provide a common or comprehensive definition of the cooling method to be applied.

In conclusion, a prompt differential diagnosis for the underlying cause of sudden cardiac arrest is of critical importance. In the event of sudden cardiac arrest due to massive pulmonary embolism, fibrinolytic therapy and therapeutic hypothermia following ROSC may be a good option to limit poor neurological outcomes in selected cases when there is no additional underlying risk of excessive bleeding.

Peer-review: Externally peer-reviewed.

Conflict-of-interest: None.

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

Authorship contributions: Concept: A.Ç.; Design: A.Ç.; Supervision: A.Ç.; Materials: A.Ç., T.B.; Data collection: A.Ç., T.B.; Literature search: A.Ç., T.B.; Writing: A.Ç.

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Keywords: Cardiac arrest; embolism; fibrinolysis; hypothermia; massive; pulmonary; systemic; therapeutic.

Anahtar sözcükler: Kalp durması; emboli; fibrinoliz; hipotermi; masif; pulmoner; sistemik; terapötik.