



ISSN:2687-4245

The Use of Ultrasonography to Guide Diagnosis and Treatment in Resuscitation in a Case of Arrest Due to Pulmonary Embolism

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ABSTRACT

Pulmonary embolism is one of the reversible causes of death. Simultaneous diagnostic procedures are beneficial for successfully resuscitating patients brought to the emergency department as an arrest after pulmonary embolism. Ultrasonography is one of the few diagnostic procedures to be performed on an unstable patient during resuscitation and is a direct guide for treatment. We followed the passage of the thrombus from the inferior vena cava to the right atrium in the ultrasonography performed simultaneously with the resuscitation of the 76-year-old male patient who was brought to the hospital with arrest, and we started thrombolytic therapy simultaneously with resuscitation. Thrombus enlargement was observed in the right atrium. The patient who did not respond to resuscitation died. Although the causes of reversible arrest are known, there may be uncertainties in diagnostic procedures and treatment during resuscitation. Classical resuscitation practice may be insufficient to solve reversible problems such as pulmonary embolism. Although there are reservations about the inclusion of point-of-care ultrasound in resuscitation, it can play a life-saving role.

Turk J Int Med 2023;5(1):48-50

DOI: [10.46310/tjim.1069084](https://doi.org/10.46310/tjim.1069084)

Keywords: POCUS, pulmonary embolism, resuscitation, arrest, ultrasonography.



Received: February 08 2022; Accepted: November 18, 2022; Published Online: January 29, 2023

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Introduction

Rapid diagnosis and treatment decisions are vital during cardiopulmonary resuscitation (CPR). Ultrasonography (USG) is highly valued in life-threatening conditions because of its non-invasive and easily accessible properties. Recent studies have shown that USG can contribute to the management of resuscitation.¹ In addition to traditional methods such as pulse control, auscultation or capnography, USG provides accurate real-time information about cardiac/circulatory, airway and ventilation status in patients undergoing CPR.¹ Massive pulmonary embolism is one of the possible reversible noncardiac causes of cardiac arrest and has a poor prognosis. Targeted cardiac-circulatory ultrasonography (POCUS) can guide rapid diagnosis, treatment and advanced diagnostic tests, especially in patients who are too unstable to undergo computed tomography imaging.² Here, we presented a case brought to the emergency department as a cardiac arrest. The passage of a dynamic thrombus from the inferior vena cava to the right atrium was detected in bedside USG.

Case Report

A 76-year-old male patient was brought to the unconscious emergency room by his family. Cardiopulmonary resuscitation was started in the patient whose pulse was not detected on examination and who did not have spontaneous respiration. POCUS was applied at the 5th minute when we received a temporary pulse during the intervention. Since there was no need for cardiopulmonary resuscitation during this application, there was no disruption. Subsequently, the patient recovered, and the intervention was resumed. POCUS was not performed during CPR. During resuscitation, blood gas pH was 7.18, pCO₂ 64 mmHg, pO₂ 55 mmHg, bicarbonate 19.5 mmol/L, lactate 6.33 mmol/L, potassium 4.72 mg/dL, and glucose 121 mg/dL. Reversible arrest etiologies were investigated in the patient. Echocardiography showed enlargement of the right atrium and right ventricle simultaneously with targeted resuscitation. The micro convex (cardiac) probe was used in the POCUS application. In addition, a thrombus was seen in the right ventricle

and right atrium and extending to the inferior vena cava. Tissue plasminogen activator therapy was started during resuscitation. The patient was thought to have developed cardiac arrest due to a massive pulmonary embolism. Despite thrombolytic treatment, thrombus continued to be observed on echocardiography. The patient whose spontaneous circulation could not be achieved despite adequate cardiopulmonary resuscitation for 45 minutes was considered dead.

Discussion

In high-risk pulmonary embolism cases, 90% of cardiac arrests occur within 1-2 hours after the onset of symptoms.³ Therefore, most of these patients will require cardiopulmonary resuscitation long before any attempt to diagnose the cause of cardiac arrest. In most cases, the diagnosis is made at autopsy after failed resuscitation. The mechanism of cardiac arrest due to pulmonary embolism is based on pulmonary main flow obstruction and increased right ventricular afterload due to the release of vasoconstrictive mediators from the thrombus. The right atrial pressure rises when right ventricular failure develops, and cardiogenic shock develops. Overloading of the right ventricle causes the ventricular septum to shift to the left, resulting in decreased left ventricular diastolic filling and end-diastolic volume. Thus, circulatory failure and cardiac arrest occur with a profound decrease in left ventricular preload.⁴ In this case, a massive pulmonary embolism was quickly diagnosed by bedside ultrasonography. However, although thrombolytic therapy was started immediately, the patient died. Treatments such as thrombolysis or surgical embolectomy are assumed to reduce mortality in cardiac arrest due to thrombosis. Both methods can be used alone or in combination therapy for ongoing cardiopulmonary resuscitation. In cases where rapid treatment decision is required, possible causes of cardiac arrest such as pulmonary embolism, myocardial infarction and cardiac tamponade and reversible causes such as hypovolemia can be detected noninvasively and quickly with targeted ultrasonography. Thus, it can provide timely administration of effective treatments such as thrombolytic therapy or mechanical embolectomy, coronary intervention, pericardiocentesis and

fluid resuscitation.¹ The major controversy regarding the use of USG during resuscitation is the concern that it delays chest compressions and prolongs the interval between compressions.⁵ To maintain the quality of chest compressions found beneficial to develop the ultrasound protocol To maintain the quality of chest compressions, it has been found beneficial to develop the ultrasound protocol and to assign an experienced ultrasound person to the resuscitation team only for marking.⁶ An emergency medicine specialist, who has been practising ultrasonography for five years, made the POCUS application. The Turkish Emergency Medicine Association implemented a certified-trainer emergency medicine specialist.

Conclusions

As a result, this case revealed the importance of ultrasound application that guides diagnosis and treatment simultaneously with resuscitation. Simultaneous USG with the examination should be considered in medical applications.

Conflict of Interests

The author declare that there is no conflict of interest about this manuscript.

Funding Sources

The author report no funding to disclose.

Authors' Contribution

Literature Review, Critical Review, and Manuscript preparing held by author.

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