

A Case of Pulseless Ventricular Tachycardia Induced by Iatrogenic Adrenaline Overdose

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Abstract

Case: The patient was a 19-year-old male. The patient presented anaphylaxis after the administration of phosphomycin. Adrenaline (1 mg) was intravenously administered to treat his anaphylaxis. Immediately after the injection of adrenaline, the patient lost pulse and the monitor showed ventricular tachycardia (VT). Spontaneous circulation returned 21 minutes after the onset of VF.

Outcome: We did not observe arrhythmia on the patient's monitor during the course of his hospitalization. The cause of this pulseless VT was determined to be an iatrogenic overdose of adrenaline. After 13 days, he was discharged without hypoxic encephalopathy.

Conclusion: Safety measures to prevent the incorrect administration of adrenaline are required as soon as possible. First, medical practitioners need to attend study meetings to address their lack of knowledge in relation to the usage of adrenaline. Second, most emergency carts have adrenaline products (1 mg/ml) for CPA, not for anaphylaxis. An epinephrine autoinjector (EpiPen®) for anaphylaxis should be put into emergency carts.

Keywords: Adrenaline; Cardiopulmonary arrest; Iatrogenic; Overdose; Pulseless ventricular tachycardia

Introduction

Adrenaline is often used in cases of cardiopulmonary arrest (CPA) and anaphylaxis; however, the safe dosage range is narrow. Cases in which an adrenaline overdoses have caused critical complications have been reported [1-7]. We report a case of pulseless ventricular tachycardia (VT) due to an iatrogenic overdose of adrenaline.

Case Presentation

The patient was a 19-year-old male who had shown no electrocardiogram abnormalities during school medical screening and who had no relevant family medical history. Approximately one year prior to his presentation, he underwent the insertion of an intramedullary nail in the treatment of a left tibial fracture. At the time, a rash appeared after the administration of cefazolin. An allergy to cephem antibiotics was therefore suspected. At his current presentation, when phosphomycin was administered before the removal of the nail, a rash and dyspnea appeared. He was diagnosed with anaphylaxis, and the phosphomycin treatment was stopped and hydrocortisone sodium succinate (300 mg) and adrenaline (1mg) were intravenously administered. Immediately after the injection of adrenaline, the patient noticed chest pain, lost pulse and the monitor showed VT (Figure 1). Emergency medical service was called, cardiopulmonary resuscitation was performed, adrenaline (1 mg) was administered every 3 minutes and automated external defibrillation was performed three times; however, pulseless VT continued. Spontaneous circulation returned 21 minutes after the onset of CPA. The patient was transferred to our center after intubation. His Glasgow Coma Scale score was 9T (E3, V1T, M5). His vital signs were as follows: blood pressure 92/64 mmHg, heart rate 132 beats per minute, respiratory rate 24/min breaths per minute and body temperature 36.8°C. A blood gas analysis performed on admission revealed the following: pH 7.246, PaO₂ 146.0 mmHg, PaCO₂ 45.9 mmHg, HCO₃⁻ 19.3 mmol/L, bicarbonate 19 mmol/L and lactate 88 mg/dL. PaO₂/FiO₂ (P/F) ratio was 244. The serum CK level was 93 IU/L, CK-MB was 1.4 ng/mL and troponin T was 0.044 ng/mL. Chest radiography and chest CT showed the presence of bilateral pulmonary infiltrates (Figure 2). The electrocardiogram documented sinus tachycardia and ST-segment depression in leads

V2-V5 (Figure 3). The echocardiogram showed an ejection fraction of 72% with normal wall motion. The patient was transferred to our ICU. Mechanical ventilation and therapeutic normothermia (36°C, 24 hours) were performed, and noradrenaline (0.2 µg/kg/min) was administered. On the next day of admission, the patient recovered clear consciousness, his vital signs were stable without vasopressor, and his P/F ratio increased to 422. He was therefore extubated. No remarkable changes were observed on head magnetic resonance images or in his neurophysiological function. It was determined that he did not have hypoxic encephalopathy. Arrhythmia was not observed on the patient's monitor during hospitalization or on his Holter electrocardiogram. The cause of pulseless VT was determined to be an iatrogenic overdose of adrenaline. He was discharged from hospital 13 days after admission.

Discussion

Adrenaline is important drug in emergency situation, including CPA and anaphylaxis. An intramuscular injection of adrenaline (0.3-0.5 mg) is recommended for the treatment of anaphylaxis, whereas the intravenous injection of adrenaline (1.0 mg) is recommended for the treatment of CPA [8]. The administration of adrenaline is complicated in cases of CPA and anaphylaxis, because of the different doses and routes of administration. Most situations where the administration of adrenaline is required are medical emergencies, thus there is not enough time to check how it should be administered. Adrenaline is commonly used by emergency physicians; however, doctors who are not involved in emergency cases have almost no opportunities to use adrenaline. Reports detailing the evaluation of radiologists' knowledge

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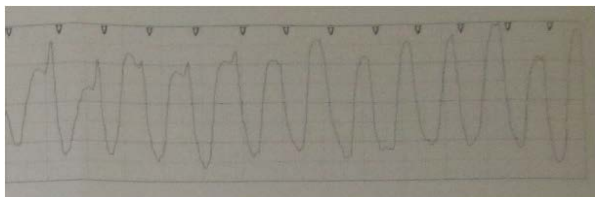


Figure 1: Monitor showing ventricular tachycardia.

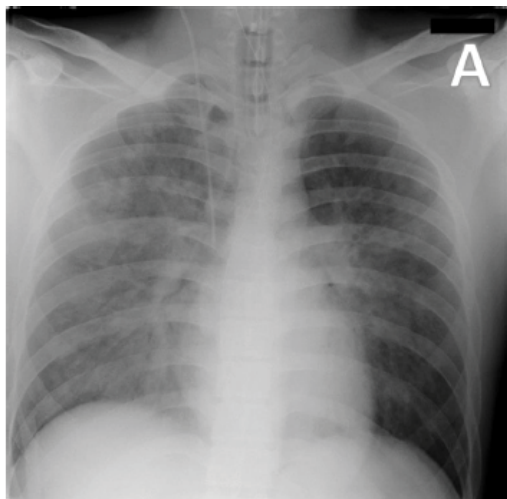


Figure 2a: Chest radiography showing butterfly shadow.

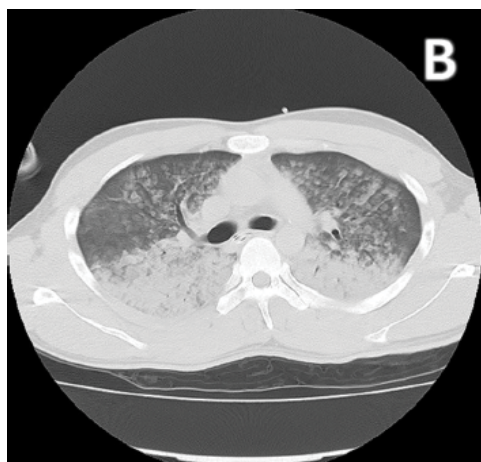


Figure 2b: A computed tomography (CT) scan showing the presence of bilateral pulmonary infiltrates.

of anaphylaxis indicated that the possibility of an adrenaline overdose was 8-17% [9,10]. The knowledge of other doctors were insufficient. In fact, the frequency of adrenaline overdose-related complications in patients with anaphylaxis has been reported to be 2.4% (4/166) [11]. As a result, adrenaline overdoses are not a rare event. In addition, the safety margin for the administration of adrenaline is narrow. There are reports of cases in which iatrogenic overdoses of adrenaline have caused critical complications, including: 1) pulmonary edema, 2) heart failure, 3) coronary artery spasm, 4) myocardial ischemia, 5) Takotsubo

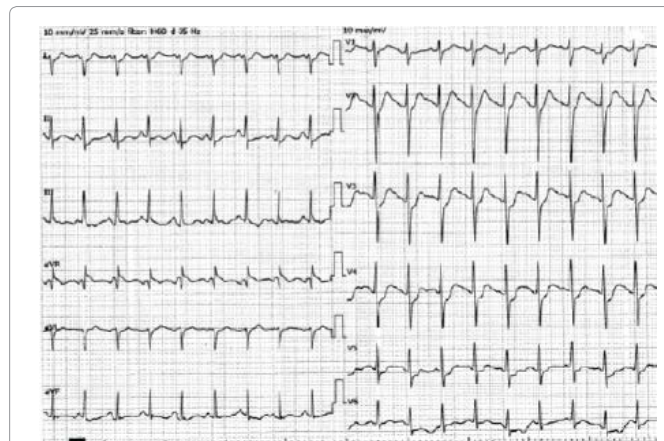


Figure 3: An electrocardiogram showing sinus tachycardia, right axis deviation and ST-segment depression in leads

cardiomyopathy, 6) coronary artery dissection and 7) cardiac shock. To the authors' knowledge, the present case represents the first report of an iatrogenic overdose of adrenaline inducing pulseless VT. Adrenaline overdoses occur with relatively high frequency and are associated with critical complications (the most critical being CPA). Thus, safety measures for preventing the misadministration of adrenaline should be established as soon as possible. First, medical practitioners should attend study meetings to address their lack of knowledge about adrenaline. They should confirm the correct protocols for the administration of adrenaline. Second, most emergency carts have adrenaline products (1 mg/ml) for CPA, but not anaphylaxis. An epinephrine autoinjector (EpiPen®) for anaphylaxis should be put into emergency carts. It is better if physicians have the choice between an adrenaline product for patients with CPA and an epinephrine autoinjector for patients with anaphylaxis.

Conclusion

We experienced a case in which an iatrogenic overdose of adrenaline caused pulseless VT. Safety measures for preventing the misadministration of adrenaline are required as soon as possible.

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