Case Report

A case report of stomach perforation during automatic mechanical chest compression following pulseless electrical activity due to cibenzoline intoxication

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Background: The current report describes a case of stomach perforation, a rare but serious complication, that occurred during cardiopulmonary resuscitation following severe cibenzoline intoxication.

Case Presentation: A woman aged in her 30s was brought into our hospital while receiving cardiopulmonary resuscitation for pulseless electrical activity. After starting extracorporeal membrane oxygenation (ECMO), her abdominal X-ray examination revealed free air in her abdomen. She was diagnosed with internal gastric perforation. An emergency operation was carried out while the circulation was maintained using ECMO. As the patient's blood cibenzoline concentration on admission was 3,868 ng/mL, she was diagnosed with cibenzoline intoxication caused by the self-intake of twice the prescribed dose. She was successfully weaned off ECMO and discharged alive with full recovery.

Conclusion: We successfully treated a case of gastric perforation after pulseless electrical activity requiring ECMO support due to cibenzoline intoxication. Abdominal surgery can be carried out even if ECMO support is needed.

Key words: Automatic mechanical chest compression, cibenzoline intoxication, extracorporeal membrane oxygenation, stomach perforation

INTRODUCTION

CIBENZOLINE SUCCINATE IS a group I-a antiarrhythmic drug according to the Vaughan–Williams classification. Its side-effects range from severe pulseless electrical activity (PEA), which requires extracorporeal membrane oxygenation (ECMO), to hypoglycemia. However, robust CPR after PEA might result in damaging complications, such as rib fracture. We report the first case of cibenzoline intoxication that developed PEA, which not only required ECMO but was complicated by gastric perforation resulting from cardiopulmonary resuscitation (CPR).

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CASE

THE PATIENT WAS a woman aged in her 30s who had been receiving treatments for palpitations at a clinic for several years. According to a family member, at 9.00 AM on the day of arrival, the patient complained of ill health. The family member returned home from work and found the patient at 10.45 AM collapsed and unconscious. No CPR was undertaken while the patient was unconscious. The family member then requested emergency services. When the emergency services arrived, her heart rate was 50 b.p.m. She was brought to our emergency center at 11.25 AM undergoing CPR for PEA. On arrival, the electrocardiogram showed a wide QRS complex with a right-bundle branch block (Fig. 1A), and echocardiography showed an ejection fraction of 20% with diffuse left ventricular dysfunction. After arriving, the patient again exhibited PEA. She was maintained on CPR using an automatic CPR system (LUCAS-2; Physio-Control Operations, Scanfil Åtvidaberg, Åtvidaberg, Sweden). She underwent ECMO and mechanical ventilation (Fig. 2). Her coronary angiography revealed

intact arteries, and an intra-aortic balloon pump was inserted. After leaving the catheterization room (Fig. 1B), her abdomen appeared full. Chest and abdominal X-ray examinations showed free air in her abdomen (Fig. 1C). She was diagnosed with a large stomach perforation in the fornix region through emergency upper digestive tract endoscopy (Fig. 1D).

An abdominal surgeon undertook emergency perforation repair and omental implantation repair, while circulation was maintained using ECMO. After the stomach perforation repair operation, improvement from a wide QRS complex to a narrow QRS complex was observed on electrocardiogram (Fig. 1E). Additionally, due to circulatory assist device therapy, her circulation improved, and she was successfully weaned from ECMO, intra-aortic balloon pump, and the respirator, respectively (Fig. S1). Brain damage was not observed after temperature management therapy. The electrocardiogram showed a narrow QRS complex (Fig. 1F), and cardiac function was normalized. As the patient had been taking cibenzoline, the blood concentration was measured due to the possibility of cibenzoline intoxication. It was found to be 3,868 ng/mL (therapeutic range, 70–250 ng/mL) at the time of admission and decreased to 19 ng/mL by day 7. When the patient was interviewed after recovery, we discovered that she had been taking 1,200 mg/day because her palpitations did not improve. Her renal function was normal during the hospital stay. She was diagnosed with cibenzoline intoxication. She was discharged after full recovery and was still healthy and alive several years later.

DISCUSSION

THIS IS THE first reported case of cibenzoline intoxication that was complicated by gastric perforation resulting from CPR in a patient with PEA who required ECMO.

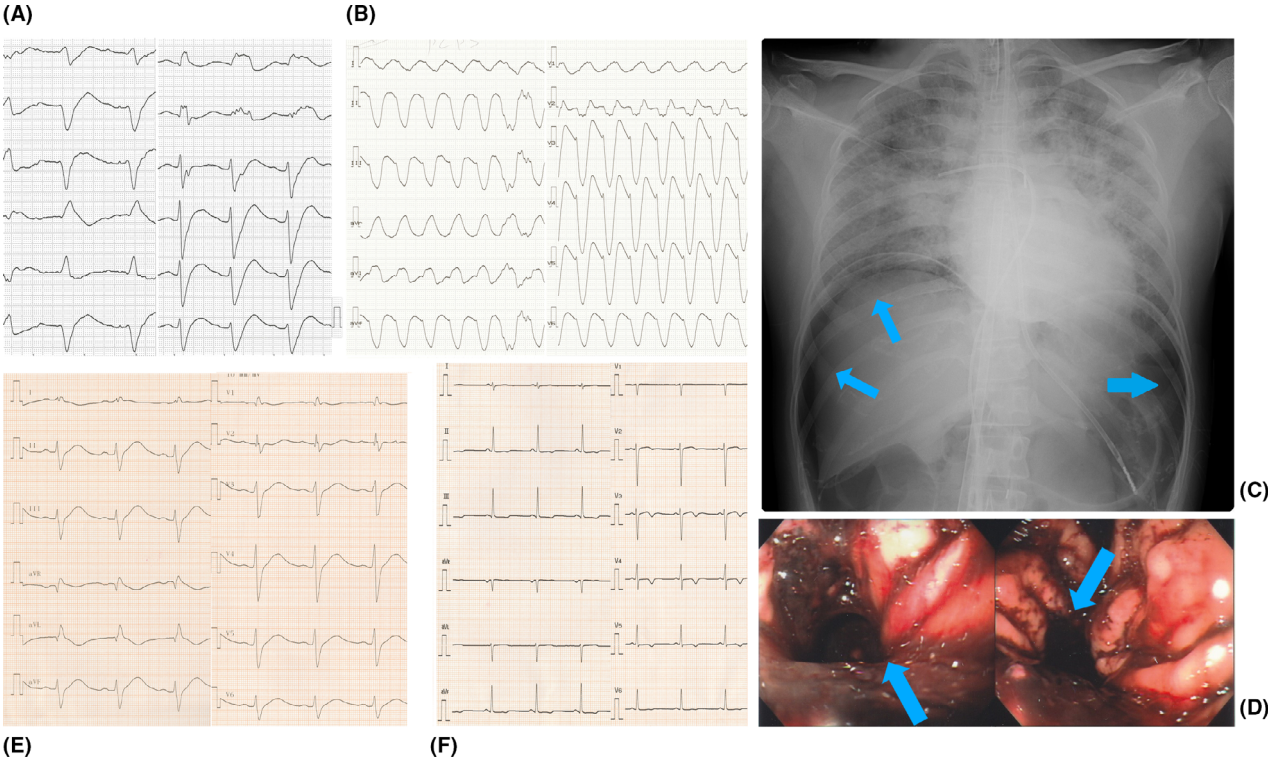

Fig. 1. Series of electrocardiogram and imaging modalities. A, On admission, idioventricular rhythm with right branch bundle block. B, After starting extracorporeal membrane oxygenation (ECMO), wide QRS tachycardia. C, Chest and abdominal X-ray examination after starting ECMO; blue arrows show free air. D, Emergency upper tract fiber examination; blue arrows indicate perforation site. E, Electrocardiogram after abdominal surgery, sinus rhythm with narrow QRS and atrioventricular block (PQ time 0.28 s). F, At discharge, sinus rhythm with narrow QRS (heart rate 68 b.p.m.) and mild ST abnormalities in II, III, aVF, and V3-5. Emergency endoscopy with air insufflation seemed to be riskier than computed tomography for this patient's situation. Our final decision was made to undertake endoscopy because: (i) the risk of transportation to the computed tomography room was high, (ii) endoscopy allowed for less-invasive surgery if the perforation site was identified, (iii) a skilled endoscopist was available.

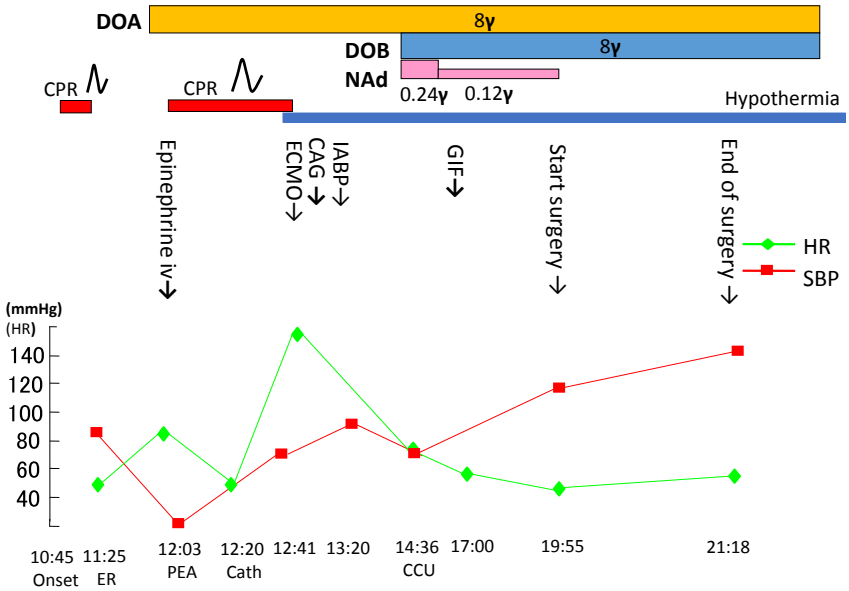

Fig. 2. Clinical time course of the acute phase of the present case of a woman aged in her 30s with stomach perforation that occurred during cardiopulmonary resuscitation following severe cibenzoline intoxication. Her Sequential Organ Failure Assessment score was 12 points on admission. CAG, coronary angiography; Cath, cardiac catheterization room; CCU, cardiac are unit; CPR, cardiopulmonary resuscitation; DOA, dopamine; DOB, dobutamine; ECMO, extracorporeal membrane oxygenation; ER, emergency room; GIF, gastro-interstitial fiber; HR, heart rate; IABP, intra-aortic balloon pumping; NAd, noradrenaline; PEA, pulseless electrical activity; SBP, systolic blood pressure.

This case is extremely rare for three reasons. First, cibenzoline poisoning resulted in PEA and required ECMO. Second, the condition was complicated by gastric perforation due to CPR, and third, emergency laparotomy under ECMO support was carried out.

Cibenzoline succinate has a total molecular weight of 380, protein binding ratio of 50–53%, distribution volume of 4.1–7.3 L/kg, and bioavailability of 83–90%,[1,2] making it well absorbed in the gastrointestinal tract. Approximately 60% of the drug is excreted by the kidneys. Therapeutic drug monitoring is generally recommended for this drug to achieve a trough value of less than 250 ng/mL and a peak concentration of less than 800 ng/mL 2 h after ingestion. As the cibenzoline in the body could hardly be eliminated by apheresis and there are no antagonists, the only treatment available is to wait for the cibenzoline to spontaneously decrease in the blood.

There have been four reported cases of cibenzoline intoxication that required ECMO for resuscitation, and one of the patients died.[3] In a literature review of gastric perforation after cardiopulmonary resuscitation, 14 patients died, and two patients were mechanically resuscitated, one of whom died.[4] Moreover, two subsequent papers reported cases of LUCAS-related gastric perforation, both of which resulted in death.[5] There were no cases of cibenzoline intoxication involving extracorporeal CPR with LUCAS and ECMO. Our present case was therefore considered to be a rare case where the patient was appropriately treated. The patient was saved because, first, the basic life support and advanced cardiovascular life support were properly carried out until the introduction of ECMO. Second, the gastroenterologist and surgeon undertook appropriate and timely diagnosis and intervention. In the case of hollow viscous injury, delay in surgical intervention can affect the prognosis.[6] Surgical treatment was chosen because the size of the injury was also too large to be reliably healed by conservative treatment. Last, it was thought that the patient's young age and lack of underlying diseases contributed to the success of the treatment. In a previous report, in an analysis of 355 ECMO cases, laparotomy was carried out in 3.7% patients and the mortality rate was 69%. The high severity of the disease due to underlying comorbidities, not the surgery itself, is thought to have increased the mortality rate.[7] Finally, it was thought that the patient's young age and lack of underlying diseases contributed to the success of the treatment.

The stomach ruptures with an internal pressure of 73 mmHg or more and a volume of 2,670 mL.[8] In a previous report, it was speculated that closure of the pyloric and gastroesophageal vent, caused by spasm and kinking, resulted in gastric perforation.[9] In our patient, in addition to the above reasons, we presumed that the air inflow into the stomach due to ambulance-assisted ventilation caused a transient increase in intrathoracic pressure in synchronization with the resuscitation rhythm of LUCAS-2 mechanical CPR, which further increased gastric pressure due to esophageal compression, resulting in gastric perforation. We therefore suggest that a nasogastric tube might be inserted to expel any gastrointestinal air at some point in patients during CPR, especially when using the LUCAS-2 system.

We successfully treated a case of gastric perforation after PEA requiring ECMO support due to cibenzoline intoxication. We show that abdominal surgery could be used, even if ECMO support is needed.

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DISCLOSURE

APPROVAL OF THE protocol: N/A.

Informed consent: Written informed consent for publication was obtained from the patient.

Registry and the registration no. of the study/trial: N/A.

Animal studies: N/A.

Data sharing and accessibility: The present case record is available at our institute.

Conflict of interest: None.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

Fig. S1. Clinical time course of the hospital stay of a woman aged in her 30s with stomach perforation that occurred during cardiopulmonary resuscitation following severe cibenzoline intoxication. As her myocardial scintigram was normal, she was considered negative for cardiomyopathy. Her signal-averaged electrocardiogram was also negative.