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CASE REPORT

Case Report: Cardiac arrest due to traumatic coronary artery dissection treated by extracorporeal membrane resuscitation [version 1; peer review: 2 approved with reservations]

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Abstract

Traumatic coronary artery dissection, which is rare in blunt trauma, has high risk of acute myocardial infarction and cardiac arrest. A 44-year-old man who had a traffic accident was transferred to the emergency department with refractory ventricular fibrillation (VF). After conventional cardiopulmonary resuscitation, we introduced extracorporeal cardiopulmonary resuscitation (ECPR) and obtained return of spontaneous circulation with ST-elevation electrocardiogram at V4-6. Subsequent coronary angiography and intravascular ultrasound supported by extracorporeal membrane oxygenation (ECMO) revealed complete occlusions of left anterior descending and left circumflex artery due to dissections. Drug-eluting stents were placed with restorations of TIMI 2 flows. After ICU admission, his left ventricular function gradually recovered; he was successfully weaned from VA-ECMO on day 9. ECPR may be a valuable option to allow time and stable hemodynamic condition to treat the cause of cardiac arrest.

Keywords

cardiac arrest, traumatic coronary artery dissection, refractory ventricular fibrillation, extracorporeal cardiopulmonary resuscitation, hemostasis

Open Peer Review

Approval Status ? ?

	1	2
version 1
04 Oct 2019	view	view
1. Gerald Chi , Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, USA		
2. L Christian Napp , Cardiac Arrest Center, Advanced Heart Failure Unit, Hannover, Germany		
Any reports and responses or comments on the article can be found at the end of the article.		

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Introduction

Traumatic coronary artery dissection is rare but delayed diagnosis of this condition can lead to life-threatening¹. We report a case of cardiac arrest in emergency department (ED) due to traumatic coronary artery dissection, which is treated with extracorporeal membrane oxygenation (ECMO) and extracorporeal cardiopulmonary resuscitation (ECPR).

Case presentation

A 44-year-old man with no previous history of heart disease had a traffic accident, his vehicle ramming into a wall. There were no witness and no information about the speed and mechanism of accident. On arrival of emergency medical service personnel at the scene, he had an open airway, a respiratory rate of 24 breaths/min, a blood pressure of 68/32 mmHg, a pulse rate of 120 beats/min and a Glasgow coma scale of E4V2M4. After 30 minutes, he was transferred to the ED of our hospital. Just before his arrival to the ED, he had a sudden ventricular fibrillation (VF). The VF was refractory to defibrillations, 5 mg epinephrine and 150 mg amiodaron; no abnormal findings was detected in focused assessment with sonography for trauma. After 11 minutes, we initiated to switch conventional CPR to ECPR. Two minutes after introducing ECPR, his electrocardiogram recovered from VF to sinus rhythm with ST-elevation at V4–6. Echocardiography revealed hypokinesis of the basal and anterior septal segment with an ejection fraction of 20% without pericardial effusion. He also had right scapula fracture, left chest wall hematoma, spleen laceration and open left femoral shaft fracture, which needs external fixation (Injury Severity Score38, probability of survival by Trauma Injury Severity Score=3.9%). We prioritized coronary angiography due to a suspicion of acute coronary syndrome. The coronary angiography and intravascular ultrasound (IVUS) supported with ECMO revealed complete occlusions of left anterior descending (LAD) and left circumflex (LCX) artery due to dissections of distal left main coronary artery (LMA) without atheroma; normal right coronary artery was normal (Figure 1, Figure 2). Drug-eluting stents were placed 3 hours after admission: 1 in #6–7 and

Figure 1. Angiography of left main trunk before (left) and after (right) percutaneous coronary intervention.

Figure 2. Maximum intensity projection image of coronary artery made from computed tomography. Arrows indicates the site of coronary artery dissection.

#11–13 with restorations of TIMI 2 flows of LAD and LCX. Subsequently, he was treated for the open femoral fracture with external fixation and then admitted to the intensive care unit (ICU). After ICU admission, his left ventricular function gradually recovered; he was successfully weaned from VA-ECMO on day 9. Despite recovery from traumatic injuries, he had acquired cytomegalovirus and candida infections (diagnosed on day 23 of his hospital stay by bronchoalveolar lavage) in hospital due to his compromised status, he had no infections on admission. Medical therapy with 1.25 mg/kg/day ganciclovir for 19 days and 150 mg/day micafangin for 13 days had been introduced, but he died on day 51 because of advanced multiple organ failure due to resistant virus infection.

Discussion

Acceleration and deceleration forces of blunt trauma potentially causes vascular spasm, intimal tears, dissection or a rupture of an existing plaque within the thrombus formation in coronary arteries, which can result in acute coronary syndrome after trauma^{2,3}. In the present case, intimal tears caused non-atherosclerotic myocardial infarction. In a previous report including 76 cases of traumatic acute myocardial infarction⁴, which included 12 cases with coronary artery dissection, LAD was most frequently affected (LMA, 6.4%; LAD, 71.4%; RCA, 19%; LCX 3.2%); in the present case, the distal LMA were dissected. Spontaneous coronary artery dissection is an increasingly recognized cause of non-atherosclerotic myocardial infarction⁵. However, the right scapula fracture, left chest wall hematoma and spleen laceration, which was located on the same coronary plane may be evidence of traumatic dissection. Since reported incidence of cardiac injury in blunt thoracic trauma was 0.3% in the U.S. National Trauma Data Bank, cardiac injury is relatively rare⁶.

Bleeding is the most common complication during ECMO; the use of ECMO in patients with trauma of bleeding shock is uncommon⁷. The literature search of ECPR in trauma during 1974–2018 identified 67 trauma patients who had cardiac arrest treated with ECPR (bleeding shock=14, severe pulmonary contusion=6, hypothermia=3, hypoxia=1, unknown=24)^{8–17}, but not refractory VF due to AMI or coronary dissection. Recent guidelines from the American Heart Association concerning

cardiac arrest described the following: “ECPR may be considered for select patients for whom the suspected etiology of the cardiac arrest is potentially reversible during a limited period of mechanical cardiorespiratory support”¹⁸. In the present case, percutaneous intervention to the coronary dissection was successfully performed in the hemodynamically stable condition by ECMO.

To conclude, traumatic coronary artery dissection potentially leads to development of refractory VF on ED. ECPR may be

a valuable option to allow time and a stable hemodynamic condition to treat the cause of cardiac arrest.

Data availability

All data underlying the results are available as part of the article and no additional source data are required.

Consent

Written informed consent for publication of clinical details and images was obtained from the patient and his parent.

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Current Peer Review Status: ? ?

Version 1

Reviewer Report 11 August 2020

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L Christian Napp

Department of Cardiology and Angiology, Cardiac Arrest Center, Advanced Heart Failure Unit, Hannover, Germany

The authors submit a case report on a rather young man with cardiac arrest likely due to coronary dissection, which was successfully treated with ECPR. In general the report is well written but left me with some major concerns.

General

- Is this really a case of traumatic dissection, or a car accident due to spontaneous dissection?
- Please discuss the rationale of ECMO vs. ECPella, in a patient with acute myocardial injury.
- Was there some underlying condition, as CMV and candida infection are unusual causes of death in previously healthy people.
- The manuscript might benefit from language revision.

Introduction

- There seems to be a word missing ('life-threatening ...').
- ECMO during resuscitation is the same as ECPR, but in this sentence ('and') it looks like it is two different measures.

Results

- Please provide more details regarding LV function over time.

Figures

- Legends of Figures are mixed up.
- From Figure 2 I am not really sure whether LAD was recanalized, maybe the authors want to submit another angulation after PCI.
- Maybe the authors can submit an ECG from the ED.

Is the background of the case's history and progression described in sufficient detail?

Yes

Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?

Partly

Is sufficient discussion included of the importance of the findings and their relevance to future understanding of disease processes, diagnosis or treatment?

Partly

Is the case presented with sufficient detail to be useful for other practitioners?

Partly

Competing Interests: Lecture fees from Maquet, research funding, lecture/consulting/proctoring honoraria from Abiomed, research funding, lecture/consulting honoraria from Cytosorbents, lecture fees from Orion/Abbott/Zoll

Reviewer Expertise: Interventional Cardiology, Intensive Care Medicine, Heart Failure, Mechanical Circulatory Support

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Reviewer Report 20 November 2019

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Gerald Chi

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Tanaka and colleagues report a case of a 44-year-old man with traumatic coronary artery dissection in the distal left main coronary artery after a traffic accident, which was successfully managed with drug-eluting stent implantation. The background, case presentation, and discussion are well-rounded.

Several comments to be considered:

- Case presentation, Page 2: Imaging from intravascular ultrasound may be supplemented to confirm the absence of underlying atherosclerosis or other coronary artery diseases.

- Discussion, Page 2: "In a previous report including 76 cases of traumatic acute myocardial infarction, which included 12 cases with coronary artery dissection, LAD was most frequently affected (LMA, 6.4%; LAD, 71.4%; RCA, 19%; LCX 3.2%)." Regarding the distribution of coronary arteries affected by traumatic dissection, it is advisable to reference the more recent and comprehensive literature review by Lobay and colleagues (J Emerg Med. 2012 Oct;43(4):e239-43¹).
- Treatment options for traumatic coronary artery dissection include coronary artery bypass grafting, percutaneous coronary intervention with stent placement, and conservative management. The decision rationale for this case may be further discussed.
- The caption for Figure 1 and Figure 2 appears to be in reverse.
- Case presentation, Page 2: "...normal right coronary artery was normal." The sentence should read: "...right coronary artery was normal."
- Typographical errors to be corrected: amiodarone (page 2); micafungin (page 2).

References

1. Lobay KW, MacGougan CK: Traumatic coronary artery dissection: a case report and literature review. *J Emerg Med*. 2012; **43** (4): e239-43 [PubMed Abstract](#) | [Publisher Full Text](#)

Is the background of the case's history and progression described in sufficient detail?

Yes

Are enough details provided of any physical examination and diagnostic tests, treatment given and outcomes?

Partly

Is sufficient discussion included of the importance of the findings and their relevance to future understanding of disease processes, diagnosis or treatment?

Partly

Is the case presented with sufficient detail to be useful for other practitioners?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: cardiology; coronary artery disease; coronary angiography

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

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