

Delayed Takotsubo Cardiomyopathy After Electrical Cardioversion Requiring Veno-Arterial Extracorporeal Membrane Oxygenation



INTRODUCTION

Electrical cardioversion (ECV) is a common treatment for atrial fibrillation and the best way to reestablish sinus rhythm. Common side effects include transient hypotension or bradycardia while severe complications such as ventricular arrhythmias are quite rare (1).

Takotsubo cardiomyopathy (takotsubo syndrome) is a condition of acute left ventricular dysfunction typically triggered by emotional or physical stress. Typical physical triggers include acute respiratory failure, post-surgery, fractures and severe neurological injury (2). Rarely, however, takotsubo cardiomyopathy may be triggered by ECV. The first reported case was published in 2008 (3) and since then, no more than a few dozen cases have been reported. A systematic review estimates the incidence to 2.7 events per 10,000 procedures (4). Cardiogenic shock caused by this syndrome was estimated to be present in 10% of all takotsubo cases, regardless of the degree of left ventricular dysfunction (5).

OBJECTIVES

- To describe a case of delayed cardiogenic shock post-ECV due to a takotsubo cardiomyopathy necessitating extracorporeal membrane oxygenation (ECMO). This is to our knowledge the first case of its kind published in the literature.

METHOD

A 64-year-old female known for mild aortic stenosis with a normal LV function, presented to the emergency department with recent onset atrial fibrillation (AF). Her main complaint was a progressive shortness of breath with a New York Heart Association class III/IV. She has been on metoprolol and apixaban for two weeks. Given her symptoms, a decision was made to attempt rhythm control with ECV. Two ECV at 200 joules were attempted. Sinus rhythm failed to be maintained and the patient was added on flecainide.

The following day, ECV was successful in bringing the patient back into sinus rhythm. A transient episode of hypotension followed. She was discharged home the same day with on flecainide, metoprolol and apixaban.

Two days later, emergency services were called to the patient's home as she had awoken in acute respiratory distress. On arrival to the emergency department, her blood pressure was 117/57 mmHg with a heart rate of 107 bpm and an oxygen saturation of 67% despite 100% oxygen. A provisional diagnosis of acute pulmonary edema was made, and the patient was swiftly intubated. Cardiogenic shock was suspected and milrinone and epinephrine infusions were started. Despite optimizing respiratory parameters, the patient's saturation stagnated at 80%. A transthoracic echocardiogram showed a left ventricular ejection fraction (LVEF) of 25% with typical findings suggestive of takotsubo cardiomyopathy. Coronary angiography was performed showing no significant coronary disease; ventriculography confirmed typical takotsubo appearance.

RESULTS

Despite up-titration of milrinone and epinephrine, an intra-aortic balloon pump was installed to support her hemodynamic status. Multi-organ system failure with acute kidney injury ensued, necessitating renal replacement therapy. Less than 10 hours after her admission, the decision was made to begin veno-arterial ECMO (VA-ECMO). The cannulation was complicated by a Stanford B aortic dissection that started in the aortic arch through to the left iliac artery.

Three days after her admission, TEE demonstrated marked improvement in her LVEF with an increase to 38%. The patient was successfully weaned off the VA-ECMO after 3 days; the arterial lesions were surgically repaired. Of note, the hospitalization was also complicated by a *Pseudomonas veronii* ventilator-associated pneumonia, recurrent AF refractory to ECV and amiodarone, and ICU acquired weakness. The patient was discharged home 19 days after her admission, in AF with adequate rate control, with complete recuperation of her LVEF on a control TTE.

CONCLUSION

Takotsubo syndrome is a rare complication after an ECV with shock caused by this etiology being even rarer. To our knowledge this case is the first of its kind reported in scientific literature of severe refractory cardiogenic shock requiring VA-ECMO. Physicians should be aware that ECV may trigger cardiogenic shock secondary to a stress cardiomyopathy. Although this condition is typically transient and reversible with time, hemodynamic and respiratory support may be needed as demonstrated here. This case report also outlines the role of advanced mechanical support in the treatment of Takotsubo syndrome.

AUTHORS

Marcoux, Nathan¹; Courchesne, Karl²; D'Aragon, Frédéric³; Daneault, Benoit²

¹ Department of internal medicine, Université de Sherbrooke, Sherbrooke, Canada

² Department of cardiology, Université de Sherbrooke, Sherbrooke, Canada

³ Department of Anesthesia, Université de Sherbrooke, Sherbrooke, Canada

CONTACT INFORMATION

Karl Courchesne, Karl.Courchesne@USherbrooke.ca
Nathan Marcoux, Nathan.Marcoux@USherbrooke.ca
Frédéric D'Aragon, FredericD'Aragon@USherbrooke.ca
Benoit Daneault, Benoit.Daneault@USherbrooke.ca

REFERENCES

1. Brandes A, Crijns HJGM, Rienstra M, et al. Cardioversion of atrial fibrillation and atrial flutter revisited: current evidence and practical guidance for a common procedure. *Europace*. 2020; 22(8):1145-1161. doi:10.1093/europace/eaab057
2. Tempin C, Ghazi JR, Diekmann J, et al. Clinical Features and Outcomes of Takotsubo (Stress) Cardiomyopathy. *N Engl J Med*. 2015; 373(10):929-938. doi:10.1056/NEJMoa1406761
3. Eggleston S, Mathur G, Lambros J. An unusual precipitant of tako-tsubo cardiomyopathy. *Heart Lung Circ*. 2008; 17(6):512-514. doi:10.1016/j.hlc.2007.08.005
4. Thangjai S, Henthorn T, Angkaweja T, Ratanasri Y, Muhammad F, Jain K, and Lertnirapong N. "Electrical Cardioversion-Associated Takotsubo Cardiomyopathy: A National Readmission Database 2018 Analysis and Systematic Review." *Australian Journal of Cardiology* 27, no. 2 (February 1, 2023): 62-69. <https://doi.org/10.14744/AnalsJCardiol.2022.2238>.
5. Singh T, Khan H, Ganibé, D, Scully, C, Newby, D, and Dawson, D. Takotsubo Syndrome: Pathophysiology, Emerging Concepts, and Clinical Implications. *Circulation*, 2022, 145(13):1002-1019. doi:10.1161/CIRCULATIONAHA.121.055854

INTRODUCTION

Electrical cardioversion (ECV) is a common treatment for atrial fibrillation and the best way to reestablish sinus rhythm. Common side effects include transient hypotension or bradycardia while severe complications such as ventricular arrhythmias are quite rare (1).

Takotsubo cardiomyopathy (takotsubo syndrome) is a condition of acute left ventricular dysfunction typically triggered by emotional or physical stress. Typical physical triggers include acute respiratory failure, post-surgery, fractures and severe neurological injury (2). Rarely, however, takotsubo cardiomyopathy may be triggered by ECV. The first reported case was published in 2008 (3) and since then, no more than a few dozen cases have been reported. A systematic review estimates the incidence to 2.7 events per 10,000 procedures (4). Cardiogenic shock caused by this syndrome was estimated to be present in 10% of all takotsubo cases, regardless of the degree of left ventricular dysfunction (5).

OBJECTIVES

- To describe a case of delayed cardiogenic shock post-ECV due to a takotsubo cardiomyopathy necessitating extracorporeal membrane oxygenation (ECMO). This is to our knowledge the first case of its kind published in the literature.

METHOD

A 64-year-old female known for mild aortic stenosis with a normal LV function, presented to the emergency department with recent onset atrial fibrillation (AF). Her main complaint was a progressive shortness of breath with a New York Heart Association class III/IV. She has been on metoprolol and apixaban for two weeks. Given her symptoms, a decision was made to attempt rhythm control with ECV. Two ECV at 200 joules were attempted. Sinus rhythm failed to be maintained and the patient was added on flecainide.

The following day, ECV was successful in bringing the patient back into sinus rhythm. A transient episode of hypotension followed. She was discharged home the same day with on flecainide, metoprolol and apixaban.

Two days later, emergency services were called to the patient's home as she had awoken in acute respiratory distress. On arrival to the emergency department, her blood pressure was 117/57 mmHg with a heart rate of 107 bpm and an oxygen saturation of 67% despite 100% oxygen. A provisional diagnosis of acute pulmonary edema was made, and the patient was swiftly intubated. Cardiogenic shock was suspected and milrinone and epinephrine infusions were started.

Despite optimizing respiratory parameters, the patient's saturation stagnated at 80%. A transthoracic echocardiogram showed a left ventricular ejection fraction (LVEF) of 25% with typical findings suggestive of takotsubo cardiomyopathy. Coronary angiography was performed showing no significant coronary disease; ventriculography confirmed typical takotsubo appearance.

RESULTS

Despite up-titration of milrinone and epinephrine, an intra-aortic balloon pump was installed to support her hemodynamic status. Multi-organ system failure with acute kidney injury ensued, necessitating renal replacement therapy. Less than 10 hours after her admission, the decision was made to begin veno-arterial ECMO (VA-ECMO). The cannulation was complicated by a Stanford B aortic dissection that started in the aortic arch through to the left iliac artery.

Three days after her admission, TEE demonstrated marked improvement in her LVEF with an increase to 38%. The patient was successfully weaned off the VA-ECMO after 3 days ; the arterial lesions were surgically repaired. Of note, the hospitalization was also complicated by a *Pseudomonas veronii* ventilator-associated pneumonia, recurrent AF refractory to ECV and amiodarone, and ICU acquired weakness. The patient was discharged home 19 days after her admission, in AF with adequate rate control, with complete recuperation of her LVEF on a control TTE.

CONCLUSION

Takotsubo syndrome is a rare complication after an ECV with shock caused by this etiology being even rarer. To our knowledge this case is the first of its kind reported in scientific literature of severe refractory cardiogenic shock requiring VA-ECMO. Physicians should be aware that ECV may trigger cardiogenic shock secondary to a stress cardiomyopathy. Although this condition is typically transient and reversible with time, hemodynamic and respiratory support may be needed as demonstrated here. This case report also outlines the role of advanced mechanical support in the treatment of Takotsubo syndrome.

REFERENCES

1. Brandes A, Crijns HJGM, Rienstra M, et al. Cardioversion of atrial fibrillation and atrial flutter revisited: current evidence and practical guidance for a common procedure. *Europace*. 2020; 22(8):1149-1161. doi:10.1093/europace/euaa057
2. Templin C, Ghadri JR, Diekmann J, et al. Clinical Features and Outcomes of Takotsubo (Stress) Cardiomyopathy. *N Engl J Med*. 2015; 373 (10):929–938. doi:10.1056/NEJMoa1406761
3. Eggleton S, Mathur G, Lambros J. An unusual precipitant of tako-tsubo cardiomyopathy. *Heart Lung Circ*. 2008; 17(6):512–514. doi:10.1016/j.hlc.2007.08.005
4. Thangjui, S, Harshith T, Angkawipa T, Ratdanai Y, Muhammad F, Jakrin K, and Leenhapong N. “Electrical Cardioversion-Associated Takotsubo Cardiomyopathy: A National Readmission Database 2018 Analysis and Systematic Review.” *Anatolian Journal of Cardiology* 27, no. 2 (February 1, 2023): 62–68. <https://doi.org/10.14744/AnatolJCardiol.2022.2236>.
5. Singh, T, Khan, H, Gamble, D, Scally, C, Newby, D, and Dawson, D. Takotsubo Syndrome: Pathophysiology, Emerging Concepts, and Clinical Implications. *Circulation*, 2022, 145 (13):1002–1019. doi:10.1161/CIRCULATIONAHA.121.055854

CONTACT INFORMATION

Karl Courchesne; Karl.Courchesne@USherbrooke.ca

Nathan Marcoux; Nathan.Marcoux@USherbrooke.ca

Frédéric D'Aragon; Frederick.DAragon@USherbrooke.ca

Benoit Daneault; Benoit.Daneault@USherbrooke.ca