Int J Clin Exp Med 2019;12(5):6267-6269
www.ijcem.com /ISSN:1940-5901/IJCEM0075261

Case Report

Electrical storm with coronary vasospasm: reversal of the storm with intravenous large doses of diltiazem

Zhi-Ping Zhang, Xi Su, Jiang-You Wang, Cheng-Wei Liu, Dan Song

Department of Cardiology, Wuhan Asia Heart Hospital, Affiliated Asia Heart Hospital of Wuhan University of Science and Technology, Wuhan, Hubei Province, China

Received March 1, 2018; Accepted October 11, 2018; Epub May 15, 2019; Published May 30, 2019

Abstract: The episode of ventricular tachycardia (VT) or ventricular fibrillation (VF) following coronary vasospasm is not an uncommon, but it occurring as a storm in the setting of coronary artery spasm is rare and effective management of the electrical storm still poses a significant challenge. We describe the case of a 58-year-old male who had a recurrent ventricular tachycardia/fibrillation and was defibrillated approximately 30 times unexpectedly often. Emergency coronary angiography revealed the entire right coronary artery systems diffuse spasm. The reason of the electrical storm was ischemia due to coronary artery spasm. Therefore, when electrical storm with episodes of ventricular arrhythmias was happened again, intravenous diltiazem 20 mg was administered as a resort therapy and the refractory electrical storm finally were controlled effectively.

Keywords: Coronary artery spasm, ventricular arrhythmias, electrical storm, diltiazem

Introduction

Electrical storm is an emergency situation with rapidly recurrent ventricular tachycardia or ventricular fibrillation and often need immediately to electrically terminate the hemodynamically destabilizing ventricular arrhythmias. However, refractory ventricular electrical storm is not always be effective under control by defibrillation and often requires antiarrhythmic drugs therapy to facilitate defibrillation. Beta-adrenergic blocking medicines may be helpful to prevent storm recurrence. However, administration of these medicines in electrial storm situations resulting from coronary artery spasm should be avoided because of their potential to exacerbate coronary artery vasospasm through unopposed α-adrenergic vasoconstriction [1]. Here, we report a case with electrical storm secondary to right coronary artery diffuse spasm which did not respond to conservative treatment, but successfully terminated with intravenous large doses of diltiazem.

Case report

A 58-year-old male with no significant past history was brought to our hospital with intermittent chest pain. On arrival in the emergency department, the patient had a sudden loss-of consciousness. Manual chest compression was performed immediately and at that time, his electrography monitoring showed a ventricular fibrillation. Initial cardiac defibrillation successfully terminated the ventricular fibrillation, but shortly thereafter, he developed frequent episodes of ventricular fibrillation, (**Figure 1**) which required repetitive cardiac defibrillations, continuous chest compressions, tracheal intubation and intra-aortic balloon pump support. Intravenous injection of β blocker, lidocaine, amiodarone were administrated and repeated defibrillations were attempted more than 30 times in the following forty minutes, Ultimately, the refractory ventricular electrical storm was finally terminated by electric cardioversion with intravenous administration of amiodarone and a repeated electrocardiogram (ECG) revealed third degree atrioventricular block with inferior ST elevation. We performed an emergency coronary angiography which showed the entire right coronary artery diffuse spasm, while the left coronary artery appear normal. Reversal of the vasospasm was achieved with intracoronary boluses of nitroglycerin. The patient was subsequently started on intravenous administration of nitrates.

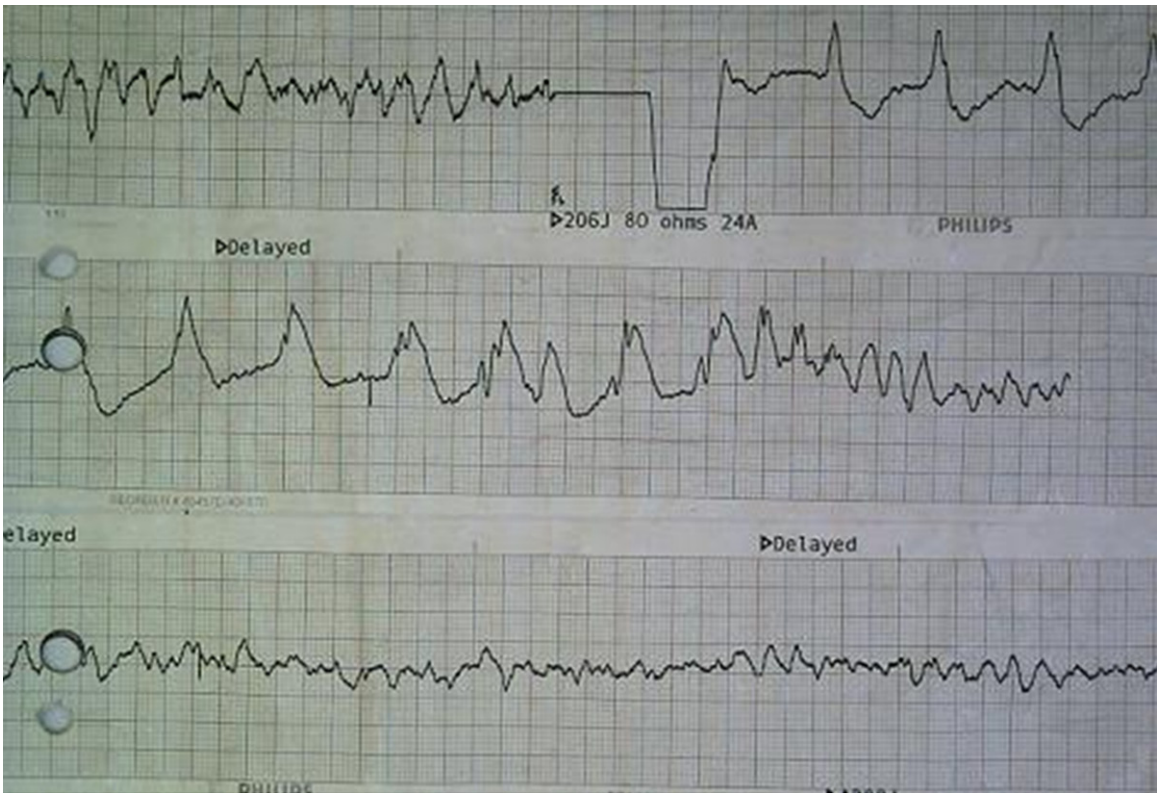

Figure 1. Electrocardiogram revealing ventricular fibrillation and successfully terminated by initial cardiac defibrillation, but subsequently, recurrent incessant ventricular fibrillations requiring continuous chest compressions and repeated cardiac defibrillations.

The next morning at 6 am, the patient experienced recurrent ventricular fibrillation. Diltiazem 20 mg was administrated as a rapid intravenous bolus to reversal of vasospasm and a cardiac defibrillation effectively terminated the ventricular fibrillation. After that he maintained sinus rhythm during the infusion of intravenous diltiazem. On the third day, he was extubated and IABP was also weaned off on the same day. He recovered with no more complications and was managed on oral long-acting diltiazem. The patient finally was discharged on the 7th day. He had no symptoms with close following up for 6 months.

Discussion

Electrical storm is a syndrome characterized by recurrent ventricular tachyarrhythmias and it can cause by ongoing or recent myocardial ischemia, exacerbating heart failure, electrolyte disturbances, and so on. Coronary artery spasm was believed to be due to vasospasm in coronary arteries without significant fixed lesions. It is an important cause of chest pain syndromes with transient ST-segment elevation due to sudden, intense vasoconstriction of an epicardial coronary artery resulting in occlusion or near occlusion of the vessel [2]. Due to it associated with myocardial ischemia, coronary vasospasm can trigger acute myocardial infarction, severe arrhythmias, cardiogenic shock and even cardiac death [3, 4]. Previous studies had demonstrated that diffuse coronary artery spasm was associated with an increased risk of ventricular arrhythmias [5, 6]. Diffuse type coronary vasospasm had an important role in the pathogenesis of spasm induced myocardial infarction, intractable spasm refractory to conventional treatments and cardiac arrest [7].

Management of electrical storm resulting from coronary vasospasm still poses a significant challenge. Especially in the case that we do not know the cause of electrical storm is due to coronary artery spasm in advance. In the setting of electrical storm, it often required repetitive cardiac defibrillations and intravenous administration of antiarrhythmic drugs therapy to terminate the ventricular arrhythmias. Due to

the sympathetic nervous system is thought to play a role in the genesis of ventricular arrhythmias [8]. Beta-adrenergic receptor blockers seem to be the agents of greatest clinical benefit to patients with ventricular electrical storm [9]. However, administration of these medicines in electrical storm situations resulting from coronary artery spasm may exacerbate vasospasm through unopposed α-adrenergic vasoconstriction and should be avoided [1].

In this present case, the electrical storm was difficult to treat with the standard defibrillations and antiarrhythmic drugs. Finally after emergency coronary angiography, we known the ventricular electrical storm was associated with coronary artery spasm. Therefore, when the episodes of ventricular arrhythmias were happened again, administration of intravenous diltiazem as a result the electrical storm terminated. These facts imply the administration of coronary vasodilator, such as intravenous large doses of diltiazem may be an effective therapy for reversal of electrical storm following coronary vasospasm when patients are refractory to the standard cardiopulmonary resuscitation.

Acknowledgements

The study was supported by a grant from the 2015 Training Project of Wuhan Young & Middle aged Medical Backbone.

Disclosure of conflict of interest

None.

Address correspondence to: Xi Su, Department of Cardiology, Wuhan Asia Heart Hospital, No.753 Jinghan Avenue, Hankou 430022, Wuhan Province, China. E-mail: yaxin_suxi@163.com

References

[1] Alexander KM, Veillet-Chowdhury MR, MacIntyre CJ, Loscalzo J, Bhatt DL. A shocking development in a young male athlete with chest pain. Circulation 2016; 133: 756-63.

[2] Miller PE, Czarny MJ, Abraham MR. A rare cause of chest pain and ventricular fibrillation. JAMA Intern Med 2014; 174: 1173-5.

[3] Eifling MI, Razavi M, Massumi A. The evaluation and management of electrical storm. Tex Heart Inst J 2011; 38: 111-21.

[4] Acar G, Fidan S, İzci S. Severe coronary vasospasm complicated with ventricular tachycardia. Arq Bras Cardiol 2014; 103: e81-6.

[5] Takagi Y, Yasuda S, Takahashi J, Tsunoda R, Ogata Y, Seki A, Sumiyoshi T, Matsui M, Goto T, Tanabe Y, Sueda S, Sato T, Ogawa S, Kubo N, Momomura S, Ogawa H, Shimokawa H; Japanese Coronary Spasm Association. Clinical implications of provocation tests for coronary artery spasm: safety, arrhythmic complications, and prognostic impact: multicentre registry study of the Japanese Coronary Spasm Association. Eur Heart J 2013; 34: 258-67.

[6] Lee KH, Park HW, Cho JG, Yoon NS, Kim SS, Rhew SH, Jeong YW, Jang SY, Cho JY, Jeong HC, Park KH, Sim DS, Yoon HJ, Kim KH, Hong YJ, Kim JH, Ahn Y, Jeong MH, Park JC. Predictors of recurrent sudden cardiac death in patients associated with coronary vasospasm. Int J Cardiol 2014; 172: 460-1.

[7] Kim PJ, Seung KB, Kim DB, Her SH, Shin DI, Jang SW, Park CS, Park HJ, Jung HO, Baek SH, Kim JH, Choi KB. Clinical and angiographic characteristics of acute myocardial infarction caused by vasospastic angina without organic coronary heart disease. Circ J 2007; 71: 1383-6.

[8] Ajijola OA, Lellouche N, Bourke T, Tung R, Ahn S, Mahajan A, Shivkumar K. Bilateral cardiac sympathetic denervation for the management of electrical storm. J Am Coll Cardiol 2012; 59: 91-92.

[9] Srivatsa UN, Ebrahimi R, El-Bialy A, Wachsner RY. Electrical storm: case series and review of management. J Cardiovasc Pharmacol Ther 2003; 8: 237-746.