

Survival of an Electrical Storm Secondary to Dofetilide Therapy - A Case Report

Antoine Egbe ¹, Aubin Sandio ^{2*}, Agyingi Chris ³, Smart Asare ², Hussein Gaith ¹, Cecile Koumou ⁵, Lariab Imtiaz ⁴, Mohammed Hafeez ¹, Donald Tynes ², Qaiser Shafiq ^{1,4}

¹ Corewell Health Dearborn, Beaumont Hospital, Michigan.

² Wayne State University School of Medicine, Michigan.

³ Woodhull Medical Center, Brooklyn New York.

⁴ Downriver Heart and Vascular Institute.

⁵ Yaoundé Central Hospital, Cameroon.

***Corresponding Author:** Aubin Sandio, MD, MPH, Wayne State University School of Medicine, Michigan.

Received Date: June 08, 2023; **Accepted Date:** August 11, 2023; **Published Date:** August 18, 2023

Citation: Antoine Egbe, Aubin Sandio, Agyingi Chris, Smart Asare, Hussein Gaith, et al (2023), Survival of an Electrical Storm Secondary to Dofetilide Therapy - A Case Report. *J. Clinical Cardiology and Cardiovascular Interventions*, 6(6); DOI:10.31579/2641-0419/329

Copyright: © 2023, Aubin Sandio. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

The case of a 74-year-old patient who experienced an electrical storm while being admitted to the intensive unit for acute hypercapnic respiratory failure. The patient had a history of atrial fibrillation and is on dofetilide. The electrical storm was characterized by multiple runs of polymorphic ventricular tachycardia, which was believed to be secondary to the use of dofetilide and later the usage of amiodarone. The patient was treated with lidocaine infusion, ICD reprogramming, and intravenous magnesium sulfate, which resulted in the successful termination of the tachycardia. This case highlights the necessary steps in the management of an electrical storm, the possible pro-arrhythmogenic effects of anti-arrhythmia medications, and the relative frequency of electrical storms in ICD recipients.

Keywords: electrical storm; hypercapnic; biphasic electrical; anti arrhythmic; telemetry report

Introduction

An electrical storm is defined by the occurrence of equal or more than three episodes of sustained ventricular tachycardia, ventricular fibrillation, or appropriate implantable cardioverter defibrillator shocks in a time span of 24 hours [1]. An electrical storm usually signifies a poor outcome in most patients. It is usually associated with hemodynamic compromise, multi-organ dysfunction, and eventually cardiac arrest; thus, it should be treated as a medical emergency [2]. There are a variety of ways to terminate an electrical storm. They include both pharmacologic and non-pharmacologic therapy, in our discussion we go into detail regarding the management of an electrical storm.

Case Presentation

A 74-year-old female with a past medical history of severe chronic obstructive pulmonary disease, rheumatic mitral stenosis, mitral valve replacement, implantable cardioverter defibrillator implantation, atrial fibrillation s/p ablation, incomplete left atrial appendage occlusion device and non-ischemic cardiomyopathy presented to the emergency department because of shortness of breath and altered mental status. Physical examination and vital signs are unremarkable except for BP 99/53 and Body mass index- 34.39 kg/m². The patient was intubated and transferred to the

critical care unit. She was started on steroids, antibiotics, bronchodilators, and her home dosage of furosemide, metoprolol, diltiazem, warfarin, and dofetilide was resumed.

Later during the day, runs of non-sustained ventricular tachycardia were noted on continuous telemetry. Dofetilide was discontinued and amiodarone was started. About 30 minutes later, she started having full-blown episodes of wide complex tachycardias, and she was given a lidocaine bolus of 1.5mg/kg and started on lidocaine drip at a rate of 1.5mg/minute, magnesium, and potassium infusion. Despite all these interventions, she continued to have multiple ICD shocks. The telemetry report electrocardiogram waveform was consistent with a torsade de pointe. The rate in the atrium was increased to 90 beats per minute and all anti-tachycardia pacing that had worsened the arrhythmia was turned off. The IV lidocaine drip was increased to 2 mg/minute and magnesium was given. Furthermore, a magnet was also placed on her cardiac contractility modulation device, discontinued pantoprazole, and amiodarone. The electrical storm lasted about 2-3 hours and the patient was shocked about 25 times during this entire emergency. After the interventions, the torsade de pointes resolved, and the patient was not shocked by the ICD throughout the night.

Discussion

Torsade de pointes (TdP) is a life-threatening arrhythmia that can occur in patients with predisposing factors such as long QT syndrome, electrolyte abnormalities, and drug-induced QT prolongation. TdP is characterized by a polymorphic ventricular tachycardia with a characteristic twisting pattern on the electrocardiogram (ECG). An electrical storm is defined as three or more

episodes of sustained ventricular tachycardia or fibrillation within a 24-hour period. Electrical storms are associated with significant morbidity and mortality and require urgent management. Electrical storms are associated with an increased risk of hospitalization for heart failure, death and heart transplantation [2]. Electrical storms, which carry a poor prognosis are quite common in ICD recipients, 1 in every 5 ICD recipients experiences electrical storms [3].

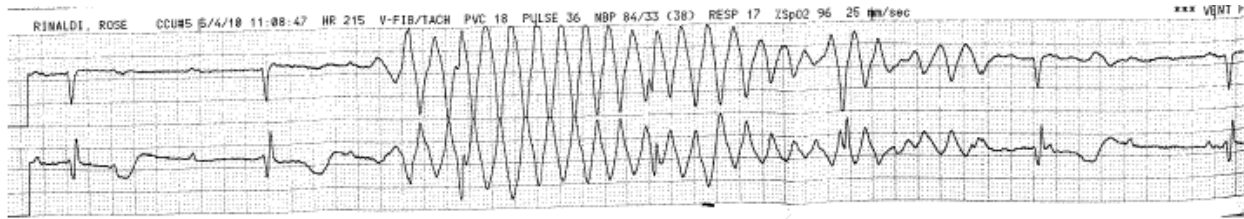


Figure: Imaging of polymorphic ventricular tachycardia

Determining the mechanism of an electrical shock is crucial to treating the underlying substrate at the root cause of the disorder. Electrical storms can be classified under 3 categories: monomorphic ventricular tachycardias (VT), polymorphic VT or ventricular fibrillation. Electrolyte imbalances like hypokalemia and hypomagnesemia, hypothyroidism, and medications which prolong QT intervals like methadone, erythromycin, amiodarone, and proton pump inhibitors should also be monitored [14]. In this case, a 74-year-old female experiencing an electrical storm believed to be secondary to TdP. She was managed with a magnet placed on the cardiac contractility modulation device. The cardiac contractility modulation (CCM) device is a new technology that delivers non-excitatory high-frequency biphasic electrical signals to the heart during the absolute refractory period with the goal of improving its contractility. [7,8]. However, there are only a few studies/ case reports regarding CCM devices and ICDs interaction. The devices at risk of interaction with CCM devices are external cardioverter defibrillators and subcutaneous-ICDs [9]. The patient was initially on dofetilide, later switched to amiodarone when ventricular tachycardia (VT) runs were noted on telemetry. Amiodarone an antiarrhythmic drug, despite its efficacy, is associated with several adverse effects, including QT prolongation, which can lead to TdP. In patients with drug induced TdP, amiodarone was discontinued according to the current guidelines [4,5,6]. PPIs have also been associated with an increased risk of QT prolongation and TdP(10,11)and hypo magnesemia [12,13] which might have contributed to the worsening of the polymorphic ventricular tachycardia. Discontinuing the PPI was one of the actions which led to the termination of the electrical storm.

Conclusion

The management of an electrical storm involves identifying the precipitating factors like drugs that prolong QT intervals, a stat electrophysiology consult, ICD reprogramming, pharmacologic therapy depending on the mechanism of the ventricular tachycardia, as well as the management of underlying electrolyte abnormalities. The use of a magnet to deactivate the cardiac contractility modulating device may be a useful adjunct in the management of TdP, also identifying and discontinuing the medications that precipitate the electrical storm is crucial.

References

1. Al-Khatib SM, Stevenson WG, Ackerman MJ, et al. 2017 AHA/ACC/HRS Guideline for Management of Patients with Ventricular Arrhythmias and the Prevention of Sudden Cardiac Death: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society. *Circulation*. 2018;138(13):e272-e391. doi:10.1161/CIR.0000000000000549.
2. Federico Guerra, Matilda Shkova, Lorena Scappini, Marco Flori, Alessandro Capucci Role of the electrical storm as a mortality and morbidity risk factor and its clinical predictors: a meta-analysis.
3. Stefan H. Hohnloser and others, on behalf of the SHock Inhibition Evaluation with Azimide (SHIELD) Investigators, Electrical storm in patients with an implantable defibrillator: incidence, features, and preventive therapy: insights from a randomized trial, *European Heart Journal*, Volume 27, Issue 24, December 2006, Pages 3027–3032, <https://doi.org/10.1093/eurheartj/ehl276>
4. Kannankeril PJ, Roden DM, Darbar D. Drug-Induced Long QT Syndrome. *Pharmacol Rev*. 2010;62(4):760-781. doi:10.1124/pr.110.003723
5. Kowey PR, Levine JH, Herre JM, et al. Randomized, double-blind comparison of intravenous amiodarone and bretylium in the treatment of patients with recurrent, hemodynamically destabilizing ventricular tachycardia or fibrillation. The Xylocaine-Versus-Amiodarone (XVA) Investigators. *Circulation*. 1995;92(12):3255-3263. doi:10.1161/01.cir.92.12.3255
6. Thomsen MB, Volders PG, Beekman JD, Matz J. Electrocardiographic variability and heterogeneity in drug-induced torsades de pointes: underlying mechanisms and implications. *Clin Pharmacol Ther*. 2010;88(6):799-807. doi:10.1038/clpt.2010.220
7. Susanne Röger, Boris Rudic, Ibrahim Akin, Tetyana Shchetynska-Marinova, Fabian Fastenrath, Erol Tülümen, Volker Liebe, Ibrahim El-Battrawy, Stefan Baumann, Jürgen Kuschyk, Martin Borggreffe - Long-term results of combined cardiac contractility modulation and subcutaneous defibrillator therapy in patients with heart failure and reduced ejection fraction
8. William T Abraham 1, JoAnn Lindenfeld 2, Vivek Y Reddy 3, Gerd Hasenfuss 4, Karl-Heinz Kuck 5, John Boscardin 6, Robert Gibbons 7, Daniel Burkhoff 8; FIX-HF-5C Investigators and Coordinators: A randomized controlled trial to evaluate the safety and efficacy of cardiac contractility modulation in patients with moderately reduced left ventricular ejection fraction and a narrow QRS duration: study rationale and design
9. Victoria Johnson 1 2, Christian W Hamm 3, Jörn Schmitt 3 - Device- Device Interaction <https://doi.org/10.1007/s00399-019-0617-z>
10. Wang J, Liu J, Liang Y, et al. Proton pump inhibitors and the risk of arrhythmias: A systematic review and meta-analysis. *Int J Cardiol*. 2017;238:123-130. doi:10.1016/j.ijcard.2017.02.105

11. Weiguo Fan, Hualong Liu, Yang Shen & Kui Hong - The Association of Proton Pump Inhibitors and QT Interval Prolongation in Critically Ill Patients
12. Pietro E Lazzerini 1, Iacopo Bertolozzi 2, Francesco Finizola 1, Maurizio Acampa 3, Mariarita Natale 1, Francesca Vanni 1, Rosella Fulceri 4, Alessandra Gamberucci 4, Marco Rossi 1 5, Beatrice Giabbani 1, Michele Caselli 1, Ilaria Lamberti 1, Gabriele Cevenini 6, Franco Laghi-Pasini 1, Pier L Capecchi 1 - Proton Pump Inhibitors and Serum Magnesium Levels in Patients With Torsades de Pointes
13. Thawin Srinutta 1, Api Chewcharat 1, Kullaya Takkavatakarn 1, Kearkiat Praditpornsilpa 1, Somchai Eiam-Ong 1, Bertrand L Jaber 2 3, Paweena Susantitaphong 1 4 - Proton pump inhibitors and hypomagnesemia: A meta-analysis of observational studies
14. Michael Eiffling, MD Mehdi Razavi, MD Ali Massumi, MD. The Evaluation and Management of Electrical Storm



This work is licensed under Creative Commons Attribution 4.0 License

To Submit Your Article Click Here:

[Submit Manuscript](#)

DOI: [10.31579/2641-0419/329](https://doi.org/10.31579/2641-0419/329)

Ready to submit your research? Choose Auctores and benefit from:

- fast, convenient online submission
- rigorous peer review by experienced research in your field
- rapid publication on acceptance
- authors retain copyrights
- unique DOI for all articles
- immediate, unrestricted online access

At Auctores, research is always in progress.

Learn more <https://auctoresonline.org/journals/clinical-cardiology-and-cardiovascular-interventions>