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Case Report

Electrical Storm: A case report and review of literature

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Abstract

Most of the sudden cardiac deaths occur due to ventricular tachycardia (VT) and ventricular fibrillation(VF). VT is diagnosed when the ventricular rate is faster than 100 beats per minute with three or more irregular beats occurring in a row arising distal to bundle of His. It may arise from ventricular myocardium, distal conduction system or both. VF is a life-threatening cardiac arrhythmia with high-frequency, disorganized ventricular myocardium excitation, resulting in failure of the heart to pump blood. We present a case report of a 58-year-old man who was admitted with antero-lateral ST segment elevation myocardial infarction (STEMI) and had three episodes of ventricular tachycardia during first 24 hours of hospitalization, each episode lasting for at least 30 seconds (Electric storm).

Keywords: Electrical Storm; Ventricular Tachycardia; Ventricular Fibrillation; Implantable Cardioverter Defibrillator.

Background

Electrical storm is diagnosed as $\geq$ 3 sustained episodes of VT, VF or appropriate implantable cardioverter-defibrillator (ICD) shocks during a 24-hour period [1]. Sustained VT lasts at least for 30 seconds, leading to hemodynamic unstability and warrants urgent termination. It can be present during the acute phase of a myocardial infarction (MI), as its complication, or associated with structural heart disease, an ICD, or an inherited arrhythmic syndrome. Such patient's present with palpitations, dizziness, syncope, fatal arrhythmia or cardiac arrest. Effective management of electrical storm requires knowledge of arrhythmia mechanisms, therapeutic options, ICD programming, and emerging techniques for the treatment of refractory cases.

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Case Report

A 58-year-old man was admitted with classical chest pain radiating to left arm of 1 hour duration. He was a known case of hypertension and hypercholesterolaemia on medication since last two years. Physical examination revealed he was afebrile with pulse 124 bpm , BP 96/65 mm Hg, respiratory rate 25 breaths per minute and SpO2 of 85%. Baseline blood investigation were within normal limits. Baseline serum troponin T level was 1.46 µg/L, cholesterol 6.5 mmol/L and blood glucose 5.2 mmol/L. His baseline ECG showed features of antero-lateral myocardial infarction. He was immediately taken up for thrombolytic therapy after following mandatory checklist for indications of thrombolysis. He was also given aspirin 300 mg loading dose, beta-blocker and ACE-inhibitor. His 8-hour and 24-hour troponin T levels were 1.10 µg/L and 0.95 µg/L respectively. His liver function and kidney function tests were within normal limits and chest X-ray PA view showed 0.55 cardio - thoracic ratio. During the course of treatment , the patient developed ventricular tachycardia thrice in first 24 hours and had to be defibrillated with 200 Joules, 360 Joules and 360 Joules (Figure 1). The patient reverted back to normal

sinus rhythm on all the three occasions. He was put on continuous ECG monitor and immediate bed rest for 48 hours. The patient was subsequently put on warfarin for three months as prophylaxis against systemic embolism. The patient was advised to continue aspirin 81 mg per day, betablocker, ACE inhibitor and simvastatin. Next six days were uneventful in the hospital and patient was mobilized and discharged after seven days. The patient was advised to come for review after 5 weeks. The patient was advised to undergo coronary angiography, electrophysiological study (EPS) and further evaluation at tertiary centre.

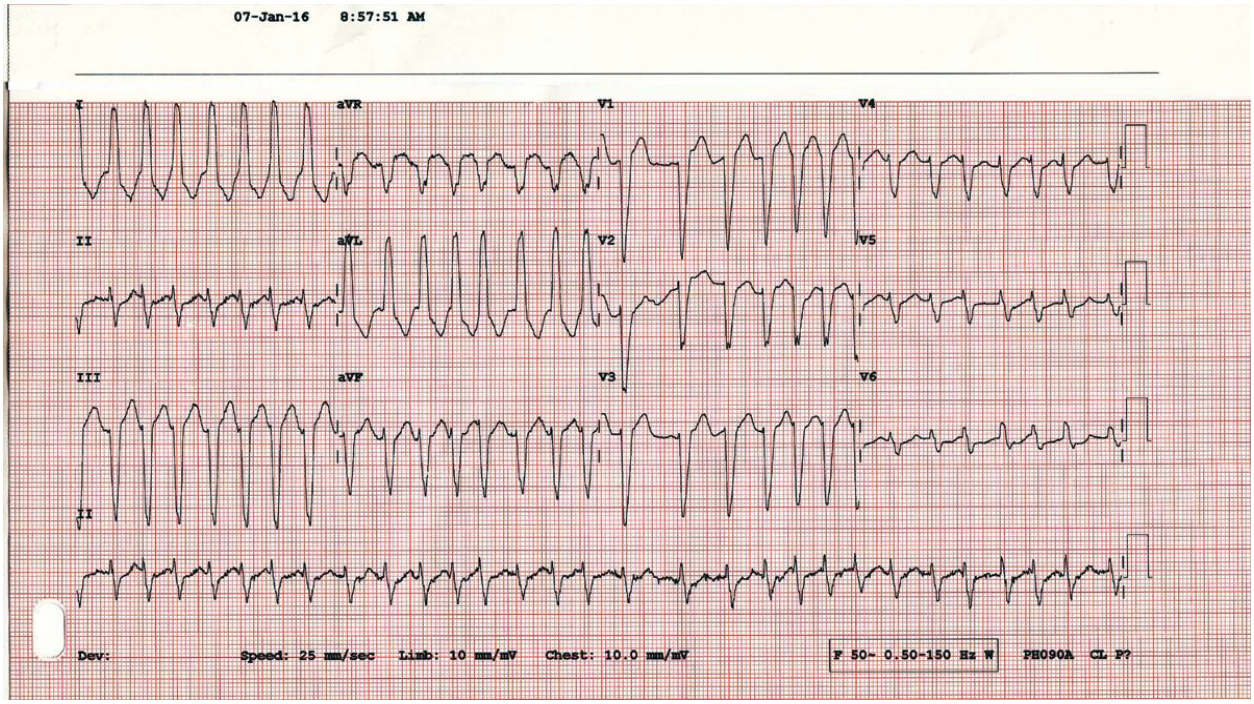

Fig. 1:

Discussion

Electrical storm is a significant independent risk factor for subsequent death, independent of ejection fraction and other prognostic variables, but ventricular tachycardia / ventricular fibrillation unrelated to electrical storm are not significant independent risk factors. The risk of death was greatest within the first 3 months after electrical storm and diminished beyond this time [2]. Gatzoulis et al studied 32 electrical storm patients with implanted ICD for secondary prophylaxis out of which 17 of 32 patients (53%) died during 3 years of follow-up, compared with 19 of the 137 (14%) suggesting that electrical storm was a strong independent predictor of poor outcome in ICD patients [3]. Sesselberg HW et al reported that the hazard ratio for death in the first 3months after the storm was 17.8 compared to VT / VF group. After the first 3 months, the hazard ratio decreased to 3.5 and even in isolated VT / VF cases, there was a hazard ratio of 2.5 in comparison to patients without VT / VF [4]. Literature survey has shown that patients with severely compromised left ventricular function, chronic renal failure, ischemia, infection, function, chronic renal failure, ischemia, infection, hypokalemia or hyperkalemia, and older age might lead to electrical storm [3,4,5].

Electrical storm is a clinical emergency. Antiarrhythmic drugs are useful to stabilize ventricular rhythm in many electrical storm patients. Therapy may be escalated depending upon the severity of illness.

Amiodarone has been widely used for the treatment of electrical storm. A comparative study on patients with ICDs followed up for one year showed that frequent shocks (>10 per year) occurred in 7.4% of patients on beta-blockers compared to 1.4% of patients who were on amiodarone plus beta-blocker [6]. Sotalol has also been shown to significantly decrease the recurrences of ventricular tachycardia / ventricular fibrillation, all-cause ICD shocks, and all-cause death [7].

Dofetilide, drug used in the treatment of atrial fibrillation , was found to be useful in the treatment of frequent ventricular tachycardia / ventricular fibrillation after amiodarone intolerance or failure [8].

Prescription of an antiarrhythmic drug to an

electrical storm patient must be individualized, taking into account the efficacy and increased risks of drug related pro-arrhythmia and side-effects. Amiodarone was associated with side-effects in 82% of patients during 5 years of follow-up, limiting the long-term utility of these medications in a significant number of ICD patients. This, combined with the limited efficacy of antiarrhythmic drugs, has prompted the need for the development of non-pharmacologic treatment strategies [9].

The vast majority of arrhythmic episodes during electrical storm consist of monomorphic ventricular tachycardia (86–97%) consistent with scar- mediated reentry as the main mechanism of electrical storm, which may be a suitable target for catheter ablation [10]. With increasing experience and the rapid advancement of mapping and ablation technologies, catheter ablation of ventricular tachycardia can be performed safely, with a relatively low complication rate [11,12].

Deneke et al evaluated 32 electrical storm patients undergoing catheter ablation with success rate of 94%, and during 15 months follow-up period, electrical storm recurrence or death was observed in 6-9 % patients depending upon whether ablation was done immediately or within 8 hours [13].

Surgical management of electrical storm has a place in the treatment of patients. Bourke et al have reported that patients with ventricular tachycardia episodes, despite maximal medical therapy and catheter ablation procedures can be considered for adjunctive and right cardiac sympathetic denervation [14]. Ajijola et al reported the result of bilateral cardiac sympathetic denervation and complete response was observed in four out of six patients, partial response in one patient and no response in one patient. Treatment of electrical storm by surgical procedure should be reserved to those refractory to drugs and catheter ablation where there is appropriate surgical expertise [15].

Conflict of Interest

None

Financial Disclosure

None

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