



Case Report

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Extreme Electrical Storm in Acute Inferior ST-Elevation Myocardial Infarction Successfully Terminated by Dual Sequential Defibrillation: A Case Report

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Running Title Termination of Refractory Ventricular Fibrillation in Acute Myocardial Infarction

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ABSTRACT

Electrical storm and refractory ventricular fibrillation (VF) are rare but catastrophic complications of acute myocardial infarction (AMI) and are associated with high mortality despite adherence to advanced cardiac life support protocols. We report a 48-year-old man with a history of ischemic heart disease, percutaneous coronary intervention, and hypertension who presented with severe exertion-induced chest pain and was diagnosed with acute inferior ST-elevation myocardial infarction. During monitoring, he developed recurrent malignant ventricular arrhythmias progressing to refractory VF despite repeated biphasic defibrillation and antiarrhythmic therapy. Sequential defibrillation with 200-J shocks was performed with procedural sedation and analgesia before each attempt, with a cumulative delivered energy of approximately 4000 J. Intravenous amiodarone, lidocaine, and magnesium sulfate were administered, and thrombolytic therapy with reteplase was initiated. Persistent VF ultimately required dual sequential defibrillation, which successfully restored a stable sinus rhythm. The patient was transferred for urgent coronary angiography and was discharged three days later in stable clinical condition. This case highlights the potential role of dual sequential defibrillation as a rescue strategy in refractory ventricular fibrillation complicating acute myocardial infarction.

Introduction

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alignant ventricular arrhythmias remain a major cause of early mortality in patients with acute myocardial infarction. Ventricular fibrillation and ventricular tachycardia may occur due to acute myocardial ischemia, electrical instability, or reperfusion injury [3,5].

Although rapid defibrillation and pharmacologic

therapy are the cornerstones of management, a subset of patients develop refractory ventricular fibrillation, generally defined as persistent VF after three or more defibrillation attempts with appropriate advanced cardiac life support (ACLS) therapy [5].

Recent attention has focused on alternative defibrillation strategies such as vector-change defibrillation and dual sequential defibrillation (DSD) for the treatment of refractory VF [1,2,4]. These

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techniques aim to enhance myocardial depolarization by altering shock vectors or increasing delivered electrical energy. Emerging evidence suggests that such strategies may improve termination of refractory arrhythmias when conventional defibrillation fails.

Case Presentation

A 48-year-old man with a medical history of ischemic heart disease, percutaneous coronary intervention, and hypertension presented to the emergency department with severe retrosternal chest pain and diaphoresis following approximately two hours of mountain climbing.

At presentation, he was hemodynamically stable and fully conscious with a Glasgow Coma Scale score of 15. Vital signs revealed a blood pressure of 113/85 mm Hg, heart rate of 74 beats per minute, and oxygen saturation of 98% on room air. Electrocardiography demonstrated ST-segment elevation in the inferior

leads, consistent with an acute inferior ST-elevation myocardial infarction (Figure 1).

Standard guideline-directed therapy was initiated, including aspirin, clopidogrel, and high-intensity atorvastatin, and the patient was placed under continuous cardiac monitoring.

During observation, he developed sustained ventricular tachycardia requiring synchronized cardioversion. Shortly thereafter, recurrent ventricular fibrillation occurred. Biphasic defibrillation at 200 J was delivered repeatedly. Because the patient initially maintained consciousness during several arrhythmic episodes, procedural sedation and analgesia were administered prior to defibrillation attempts (Figure 2).

Despite repeated defibrillation, the patient developed recurrent VF and polymorphic ventricular tachycardia (Figure 2). Thrombolytic therapy with

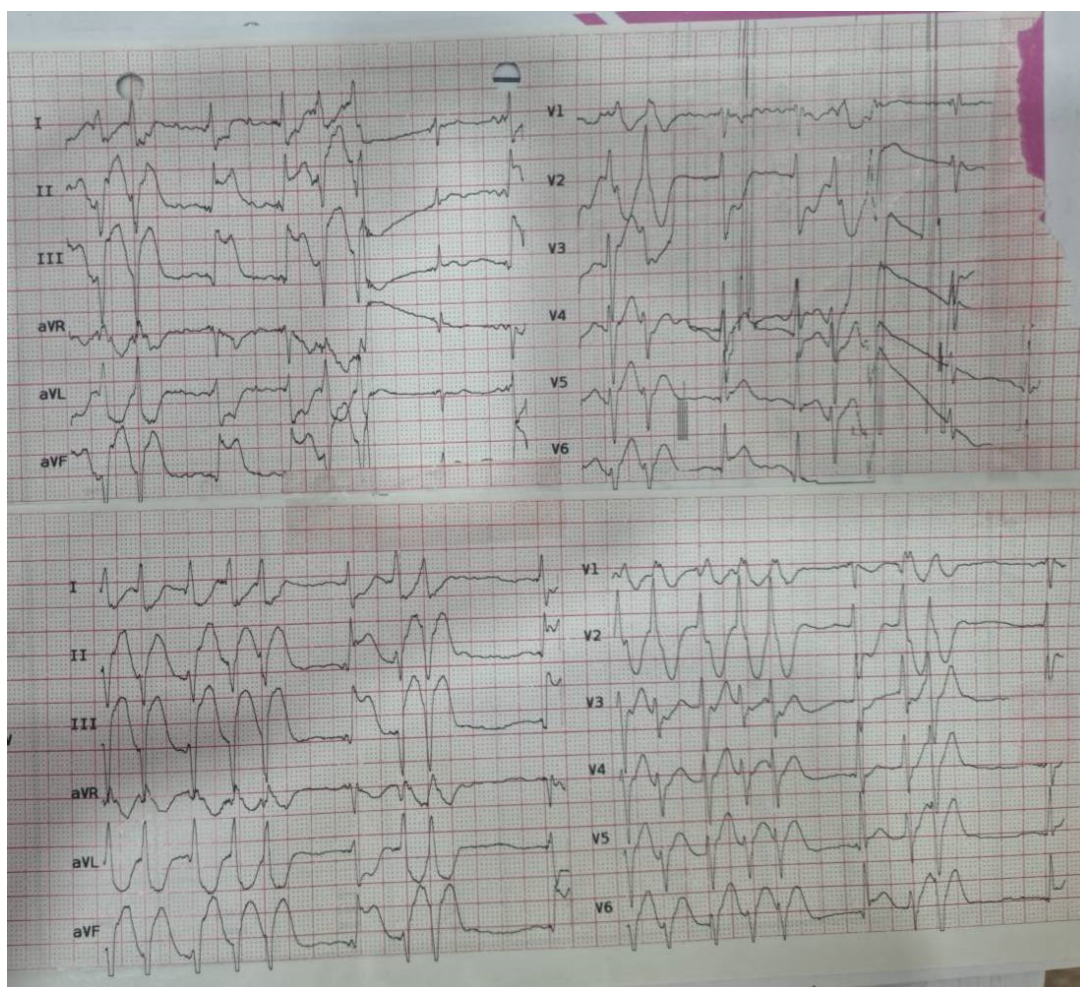


Fig. 1. Electrocardiography demonstrated ST-segment elevation in the inferior leads, with an acute inferior ST-elevation myocardial infarction

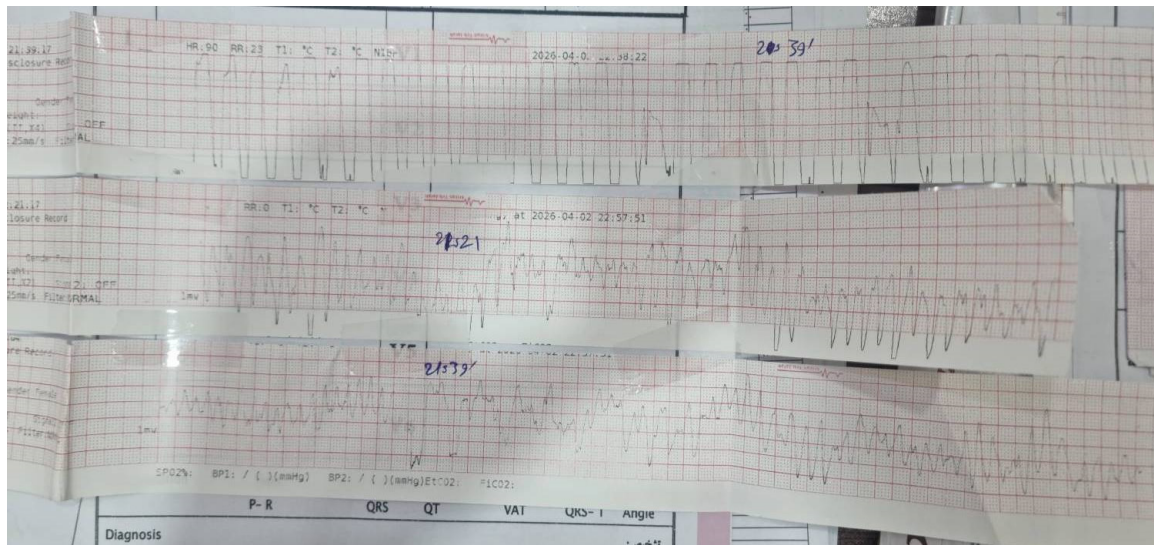


Fig. 2. Sustained ventricular tachycardia

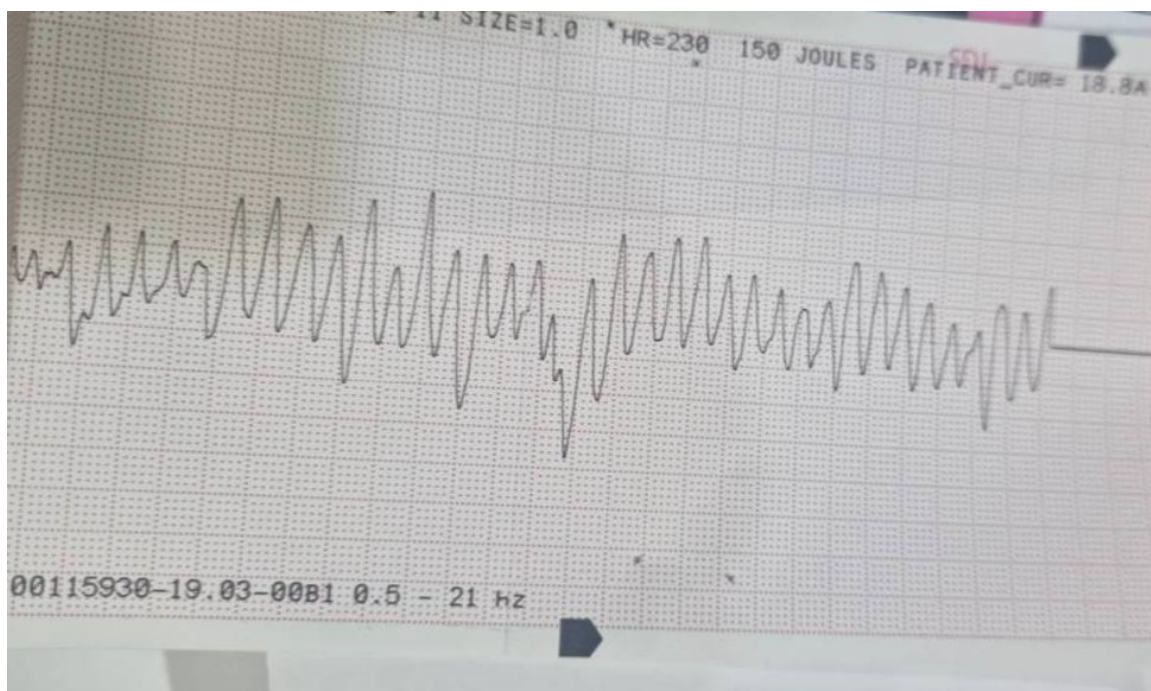


Fig.3. Episodes of torsades de pointes

reteplase was administered for STEMI. Antiarrhythmic therapy consisted of an intravenous amiodarone bolus of 300 mg followed by continuous infusion at 1 mg/min, along with lidocaine infusion. Episodes of torsades de pointes were also observed and treated with intravenous magnesium sulfate (Figure 3).

In total, approximately 20 biphasic defibrillation shocks of 200 J were delivered, corresponding to a cumulative energy of about 4000 J. Because ventricular fibrillation persisted despite these measures, dual sequential defibrillation was attempted using two defibrillators with different electrode vectors.

Following this intervention, a stable sinus rhythm was restored.

The patient was subsequently transferred to a tertiary cardiac center for urgent coronary angiography and further management. His clinical course was uneventful, and he was discharged three days later in good condition without recurrent arrhythmias.

Discussion

Refractory ventricular fibrillation remains a major

therapeutic challenge in emergency cardiovascular care. Persistent myocardial ischemia, electrical instability, autonomic imbalance, and metabolic disturbances may all contribute to recurrent ventricular arrhythmias in the setting of acute myocardial infarction.

The cornerstone of treatment remains early defibrillation combined with high-quality resuscitation and antiarrhythmic therapy. Current guidelines recommend the use of amiodarone or lidocaine for shock-refractory VF [3,5]. However, when repeated shocks fail to terminate VF, alternative defibrillation strategies may be considered.

Dual sequential defibrillation has gained attention as a potential rescue therapy for refractory VF. The technique involves delivering two rapid sequential shocks from separate defibrillators using different electrode vectors [1,2]. Theoretical mechanisms include increased cumulative energy delivery, improved myocardial depolarization, and modification of the electrical propagation pathway across ischemic myocardium.

Recent evidence has begun to clarify the potential benefit of alternative defibrillation strategies. A randomized trial published in the *New England Journal of Medicine* demonstrated that vector-change defibrillation improved survival to hospital discharge compared with continued standard defibrillation in patients with refractory VF [1]. Observational studies and systematic reviews between 2023 and 2025 have also suggested that DSD may increase rates of successful defibrillation and return of spontaneous circulation in selected patients [2,4].

In the present case, recurrent malignant ventricular arrhythmias occurred in the setting of acute inferior STEMI despite repeated 200-J biphasic shocks and aggressive antiarrhythmic therapy. Restoration of sinus rhythm only after dual sequential defibrillation suggests that this technique may be a valuable rescue intervention in extreme electrical storm.

Conclusion

Refractory ventricular fibrillation complicating acute myocardial infarction remains associated with substantial mortality. Dual sequential defibrillation may provide an effective rescue strategy when

conventional defibrillation and antiarrhythmic therapy fail. Further large-scale studies are needed to better define the role of this technique within contemporary resuscitation algorithms.

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this article.

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Conflict of Interests

The authors have no conflict of interest to declare.

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