

Electrical Storm

Grand Rounds Summary

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Definitions

The diagnosis of electrical storm (ES) is made when three or more ventricular arrhythmias occur within twenty four hours. Refractory ventricular fibrillation (VF) is a severe form of electrical storm, where rapidly clustering episodes of VF or persistent VF occurs despite multiple defibrillation attempts.

Pathophysiology

In order for the initial ventricular arrhythmia to occur there must be an underlying substrate that is susceptible to arrhythmia and a trigger. Substrate may be active ischemia, scar from prior ischemia, cardiomyopathy, or channelopathy. The trigger could also be active ischemia, worsening heart failure, electrolyte imbalances, anti-arrhythmic drug therapy or sepsis. During ventricular dysarrhythmias endogenous catecholamines are released. This can be exacerbated by external or ICD shocks, or exogenous epinephrine given during an arrest. Catecholamines are proarrhythmic. With each episode of VT/VF, further endogenous and exogenous catecholamines increase sympathetic drive and potentiate further dysrhythmias.

Management

The management of electrical storm involves continuing ACLS, while considering three pillars of treatment: clinical stabilization, electrical stabilization and treatment of underlying cause.

Intubation and deep sedation is thought to improve patient comfort, minimize psychological distress and reduce sympathetic drive that perpetuates continued dysrhythmias. Etomidate is hemodynamically stable, and does not cause myocardial depression or sympathetic surge. Sedating agents such as midazolam and fentanyl are preferred as they do not have negative inotropic effects. Norepinephrine is the agent of choice for shock and tachydysrhythmias. Epinephrine has stronger beta-adrenergic effects than norepinephrine, and has a higher risk of arrhythmias, and should be avoided.

In electrical storm, our firstline antiarrhythmic is amiodarone. Our second line agents are procainamide and lidocaine. Lidocaine is thought to be more effective if ischemia is present. Beta blockers are also a mainstay of treatment for electrical storm. Think about esmolol in patients who have unclear trajectories.

In refractory ventricular fibrillation, esmolol and dual sequence defibrillation have been explored. At this point, there is not adequate evidence to recommend their use.

Lastly, we should reverse the underlying cause. This may be electrolyte correction, treatment of sepsis or diuresis in heart failure. If ischemia is suspected, patients should undergo revascularization. Many patients may benefit from ablation, especially scar-mediated monomorphic VT. If patients are unable to be stabilized to treat reversible etiologies of their electrical storm, VA ECMO should be considered as bridge to definitive therapy.

