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# Stellate Ganglion Block to Treat RVF: Case Report

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## Abstract

### Background

Refractory Ventricular Fibrillation (RVF) is denoted as “ventricular fibrillation that is resistant to at least three defibrillation attempts, 300 mg of amiodarone, and does not exhibit Return of Spontaneous Circulation (ROSC) after > 10 min of Cardiopulmonary Resuscitation (CPR)”

### Objective

The case report describes the successful treatment of RVF with a Stellate Ganglion Block (SGB).

### Case Report

The patient presented in the emergency department in severe respiratory distress leading to intubation. Shortly after being intubated, the patient was found to be in ventricular fibrillation. After CPR, ACLS protocol, and serial defibrillation the patient was in RVF. A beta blocker, metoprolol, was given and the patient received double sequential defibrillation three times but was still in ventricular fibrillation. A stellate ganglion block was then performed by a landmark approach, and after the next double sequential defibrillation, ROSC was obtained. The patient was alert and following commands for 6 hours and was extubated 5 days later. 8 days later, the patient subsequently passed away due to complications of hemodialysis.

### Conclusion

SGB should be considered when treating RVF in the emergency department setting, after the failure of standard treatment methods.

*Why should an ED physician be aware of this?* RVF treatment modalities in the emergency department differ from standard ACLS treatment, and ED physicians should be aware of this.

## Introduction

Ventricular Fibrillation (VF), is a fatal cardiac arrhythmia causing sudden cardiac death and requires emergent treatment, to prevent further organ damage and fatalities. Refractory Ventricular Fibrillation (RVF) is denoted as “ventricular fibrillation that is resistant to at least three defibrillation attempts, 300 mg of amiodarone, and does not exhibit Return of Spontaneous Circulation (ROSC) after > 10 min of Cardiopulmonary Resuscitation (CPR) [1].” Standard of care interventions are typically the use of antiarrhythmic medications and catheter ablation. If these methods are unsuccessful, there are other modalities including thoracic epidural anesthesia, spinal cord stimulator, and Stellate Ganglion Block (SGB) [2]. SGB is a procedure that injects a local anesthetic to the stellate ganglion for sympathetic denervation. A successful outcome of SGB will allow stabilization of the patient’s cardiac arrhythmia and hemodynamic status. Stellate ganglion blocks are most often performed by anesthesiologists and interventional cardiologists, but now emergency physicians have started using this procedure to treat refractory ventricular fibrillation, when standard methods fail. In this paper, we present a case of RVF successfully treated by using SGB in the emergency department and a discussion on how SGB should be considered as an adjunct treatment for RVF.

## Case

A 60 year old female with a history of end-stage renal disease on hemodialysis, congestive heart failure, diabetes mellitus, and hypertension presented in severe respiratory distress, altered mental status, and hypoxemia. Shortly after intubation, the patient’s condition deteriorated, she became pulseless and was found to be in ventricular fibrillation. CPR was initiated immediately with effective chest compressions based on end-tidal CO<sub>2</sub> measurements. She received three doses of epinephrine 1mg IV, amiodarone 300mg IV followed by 150mg, magnesium sulfate 2g IV, three doses of sodium bicarbonate 50 mEq, and two doses of calcium chloride 1g IV. Concurrently, she was defibrillated three times at 200 J. When it was determined the patient was in refractory ventricular fibrillation, she was then administered lidocaine 100mg IV and metoprolol 5mg IV. A second defibrillator was introduced and the patient received double sequential defibrillation three times. Despite these measures, she remained in ventricular fibrillation. However, maintained an elevated end tidal CO<sub>2</sub>. A left sided stellate ganglion block was performed using a landmark approach with the administration of 10 ml of 2% lidocaine without epinephrine. ROSC was achieved after the next double sequential defibrillation. The patient was subsequently admitted to the intensive care unit and treated for acute respiratory distress syndrome due to pneumonia and fluid overload. Within 6 hours of successful resuscitation, the patient was following commands despite being intubated and having decreasing vasopressor and oxygen requirements. She was extubated on day 5 of hospitalization. However, the patient was subsequently on hospital day 8 due to complications during hemodialysis.

## Discussion

Refractory Ventricular Fibrillation as an entity is not commonly discussed for patients arriving to the emergency department as it is rare and most often fatal. The underlying pathophysiology relates to a combination of increased defibrillation threshold, increased electrical impedance, and increased sympathetic stimulation [3,4]. Current management is tailored to correcting these disturbances. Firstly, defibrillation threshold is improved through management of underlying electrolyte, acid/base,



metabolic, toxic, ischemic, and/or environmental insults. Furthermore, antiarrhythmics (amiodarone, lidocaine, magnesium sulfate, etc) are thought to improve the success of electrical defibrillation by lowering the defibrillation threshold [5]. Secondly, patients may have increased electrical impedance due to physical factors such as structural heart disease and large body habitus. A number of case studies have suggested double sequential defibrillation to improve the effective energy delivery of electrical cardioversion [3,4,6]. Lastly, increased catecholamine surge due to physiologic stress and increased epinephrine administration during cardiac arrest is thought to contribute to RVF [6]. A number of case reports have suggested limiting total epinephrine administration and utilizing beta blockers such as esmolol or metoprolol [1,7-10].

Stellate ganglion blockade is proposed to work through this mechanism.

The stellate ganglion is a portion of cervical sympathetic chain that is thought to provide the majority of sympathetic stimulation to the myocardium, with the left ganglion innervating most of the ventricular myocardium [1,11,12]. By administering lidocaine in the vicinity of the ganglion, there is decreased sympathetic outflow to the ventricles. A number of studies have demonstrated the effectiveness of left stellate ganglion blockade in the treatment of ventricular tachydysrhythmias [13-15]. Typically, these are performed under fluoroscopic imaging by interventional cardiologists or anesthesiologists in patients with persistent ventricular tachycardia not amenable to traditional chemical or electrical cardioversion [11,12]. To date, its use in the ED has been limited due to minimal training on the procedure. One case report demonstrates successful resuscitation using this technique under ultrasound guidance [12].

In our case, therapy was guided towards the underlying causes of RVF. Amiodarone, lidocaine, bicarbonate, calcium, and magnesium were all given for their antiarrhythmic activity and to correct any underlying metabolic disturbance. Double sequential defibrillation was used to overcome any increased impedance caused by prior structural heart disease. Metoprolol and SGB were utilized to reduce sympathetic stimulation. It must be noted that the use of beta blockers and SGB has not been proven to be effective yet and it is critical to perform the standard therapy correctly and effectively. As these patients are in extremis and the overall condition is uncommon, no prospective study exists as of yet. Further studies may be warranted to further evaluate the role of stellate ganglion blockade as adjunctive therapy in RVF.

## Conclusion

SGB is a procedure that should be considered when treating RVF in the emergency department setting. Although it should be noted that the standard methods (antiarrhythmics and serial defibrillation) should be used first, as they have proven to be more successful in treating these arrhythmias. SGB should complement these methods if these interventions have been unsuccessful. Emergency physicians should have training on this procedure to allow a higher success rate when performing a stellate ganglion block for RVF.

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