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Percutaneous Stellate Ganglion Block Suppressing VT and VF in a Patient Refractory to VT Ablation

JUSTIN HAYASE, M.D.[*,†], **JIGAR PATEL, D.O.**[*,†], **SANJIV M. NARAYAN, M.D., Ph.D., F.A.C.C., F.H.R.S.**[*,†], and **DAVID E. KRUMMEN, M.D., F.A.C.C., F.H.R.S.**[*,†]

[*]University of California San Diego, San Diego, California, USA

[†]Veterans Affairs San Diego Healthcare System, San Diego, California, USA

Abstract

Introduction—Electrical storm is a condition characterized by multiple episodes of ventricular tachycardia (VT) or ventricular fibrillation (VF) in a short period of time.

Case Presentation—An 80-year-old male with a history of ischemic cardiomyopathy presented with multiple ICD shocks. As a last resort, he underwent percutaneous left, followed by right, stellate ganglion block under fluoroscopic guidance. Since his discharge, he has been managed with alternating, biweekly left and right stellate ganglion blocks, and he has received no ICD shocks.

Discussion—This case illustrates the potential of ongoing, temporary percutaneous stellate ganglion blockade in suppressing ventricular arrhythmogenesis.

Keywords

autonomic nervous system; *implantable cardioverter defibrillator*; *stellate ganglion block*; *ventricular tachycardia*; *VT storm*

Introduction

Electrical storm is a clinical condition characterized by multiple episodes of ventricular tachycardia (VT) or ventricular fibrillation (VF) in a short period of time. In patients with ICD devices, this is often manifested by 3 or more ATP or ICD shocks delivered within a 24-hour period. The incidence is estimated to be between 10% and 25% of patients with ICDs per year.[1] Surgical interruption of the autonomic nervous system has been shown to decrease subsequent ventricular arrhythmias.[2,3] We report here the first case of ongoing, temporary, percutaneous stellate ganglion blockade as an effective therapy for an adult patient with drug-refractory VT and VF in whom surgical stellate ganglion blockade was not feasible.

Case Report

An 80-year-old male with ischemic cardiomyopathy with an ejection fraction of 30% presented to the emergency department with a chief complaint of multiple ICD shocks. He had a history of coronary artery disease with a prior CABG procedure in 1995 and severe

Address for correspondence: David E. Krummen, M.D., 3350 La Jolla Village Drive, Cardiology Section 111A, San Diego, CA 92161, USA. Fax: +858-552-7490; dkrummen@ucsd.edu.

Other authors: No disclosures.

ischemic cardiomyopathy with a large anterior LV aneurysm. He had had a bi-ventricular defibrillator implanted in 2004, with symptomatic improvement. Device interrogation upon presentation demonstrated 84 episodes of ventricular tachycardia and ventricular fibrillation treated with 65 episodes of ATP and 10 ICD shocks. His medications included sotalol, mexiletine, and carvedilol. He had tried amiodarone 3 months previously, but he was unable to tolerate it due to side effects. He was admitted to the hospital and continued on his antiarrhythmic medications.

The patient had a history of highly proarrhythmic ventricular substrate; during routine device interrogations, testing of the right ventricular lead typically induced nonsustained ventricular tachycardia (Fig. 1A). To circumvent this, his left ventricular lead was programmed to pace 80 milliseconds before the RV lead to reduce the amount of left ventricle paced from the RV (presenting ECG is shown in Fig. 1B). The patient had also previously undergone several VT ablation procedures: a first endocardial ablation 11 months previously, followed by a repeat endocardial with epicardial ablations 8 months previously. Each procedure had located a distinct macroreentrant circuit (Fig. 1C) with subsequent noninducibility of VT. However, VF (Fig. 1D) was still easily induced during EPS, with a cycle length of 220 milliseconds.

Due to VT and VF refractory to ablation, cardiothoracic surgery was consulted to attempt video-assisted thoracoscopic sympathectomy, but the procedure was aborted secondary to dense pleural adhesions. The procedure was complicated postoperatively by hemothorax requiring chest tube placement.

Percutaneous Stellate Ganglion Blockade

The patient underwent a percutaneous left stellate ganglion nerve block. After obtaining appropriate informed consent prior to the procedure, the patient was placed in a supine position on the fluoroscopy table. After sterile skin preparation, the junction between the T1 vertebral body and the transverse process was localized under fluoroscopy and the overlying skin was marked. Local lidocaine was infused, and a 25-gauge spinal needle was advanced under fluoroscopic control to the level of the proximal transverse process. Digital subtraction angiography was performed with a gentle injection of contrast to assure appropriate superior to inferior contrast opacification (Fig. 2) of the prevertebral space without evidence of vascular opacifications. Aspiration was negative before injection of 5 cc of bupivicaine 0.5% for the left-sided stellate ganglion block. The patient remained neurologically and hemodynamically stable throughout the procedure and postprocedure.

He improved but continued to have episodes of symptomatic nonsustained ventricular tachycardia. Two weeks after the initial sympathetic block, he underwent percutaneous right stellate ganglion nerve blockade. He then had a generator exchange procedure and was discharged 1 week later with sotalol, carvedilol, and mexiletine.

Subsequent Clinical Course

He had a recurrence with a single episode of ICD firing for VT 1 week after discharge, and he was readmitted. A left stellate ganglion block was performed, and the patient was discharged thereafter. Since that time, he has been managed with bi-weekly alternating left and right stellate ganglion blocks. Alternating sides reduces the probability of bilateral vocal cord paralysis, which may have a delayed onset from the procedure. Such an event may have serious clinical consequences, particularly in a patient with ischemic cardiomyopathy, congestive heart failure, and refractory ventricular arrhythmias. Although the bupivacaine wears off within 12–24 hours, the residual effects of percutaneous stellate ganglion block persist for several weeks. For this reason, each side is repeated every 4 weeks.

At 2 weeks postdischarge, he had had 9 episodes of VT successfully terminated by ATP therapy but no ICD shocks. At 1 month postdischarge, he had had 2 episodes of VT successfully terminated by ATP. At 4 months since discharge, he had had no episodes of VT.

Pause in Therapy, Increase in Symptomatic NSVT, and Subsequent Resumption of Block

At 3 months of therapy, the patient missed a scheduled procedure due to brief hospitalization for heart failure. He went 8 weeks without stellate blockade, and toward the end of this period, the patient noted an increase in symptomatic NSVT and had 1 episode of VT treated with ATP. Therapy resumed, and the patient is now 5 months after that event (10 months after the first procedure) with no recent ICD therapies doing well.

Discussion

Autonomic Nervous System and Ventricular Arrhythmias

There has been mounting evidence for the efficacy of interruption of cardiac sympathetic innervation for the treatment of ventricular arrhythmias. The interaction of the autonomic nervous system and ventricular arrhythmias has been understood since the work of Schwartz *et al.*,[4] who showed that cardiac denervation increased ventricular arrhythmia threshold. Recent work in canine models has shown postmyocardial infarction neural remodeling of the stellate ganglia including increased synaptic density that persists at least 2 months after injury.[5] This provides mechanistic insight into the role of the sympathetic nervous system in ventricular arrhythmias in ischemic cardiomyopathy.

The work of Nadamanee *et al.* has clearly shown that the advantages of sympathetic inhibition in suppressing ventricular arrhythmogenesis compared to standard advanced cardiac life support protocols.[3] Further evidence of the beneficial effects of sympathetic inhibition in the form of surgical interruption of the autonomic nervous system has been shown in patients with long-QT syndrome.[6] Recently, thoracic epidural anesthesia has also demonstrated promising results in patients with electrical storm.[7,8] The work of Shivkumar *et al.* has shown the benefit of bilateral surgical cardiac sympathetic denervation in treating electrical storm.[2] Boe and colleagues have shown the usefulness of percutaneous stellate ganglion block in a pediatric setting.[9]

Our case represents a unique instance of ventricular arrhythmias refractory to conventional therapies including antiarrhythmic medications and multiple ablation procedures. Thus, sympathetic denervation was deemed appropriate, but surgical sympathectomy was unsuccessful due to dense pulmonary adhesions. Therefore, as a last resort, percutaneous stellate ganglion blockade was attempted. Bi-weekly block procedures proved effective in suppressing ventricular arrhythmias and reducing further ICD shocks over the following 10 months. Percutaneous left stellate ganglion blockade in the management of electrical storm has been reported elsewhere,[10,11] but we report the first case of ongoing bilateral stellate ganglion blockade for the management of an adult patient with refractory VT and VF.

Conclusion

For patients with ablation-refractory or severe ventricular arrhythmias who may not be candidates for surgical stellate ganglion blockade, percutaneous stellate ganglion blockade can be an effective and potentially life-saving option. In our case, the patient had a tapering then complete cessation of ventricular arrhythmias from percutaneous stellate ganglion blockade, recurrence when therapy was interrupted, and then repeated arrhythmia suppression when therapy was resumed. Further studies are required to determine whether

this method can be effective as a maintenance therapy or a bridging method to more definitive treatment of VT.

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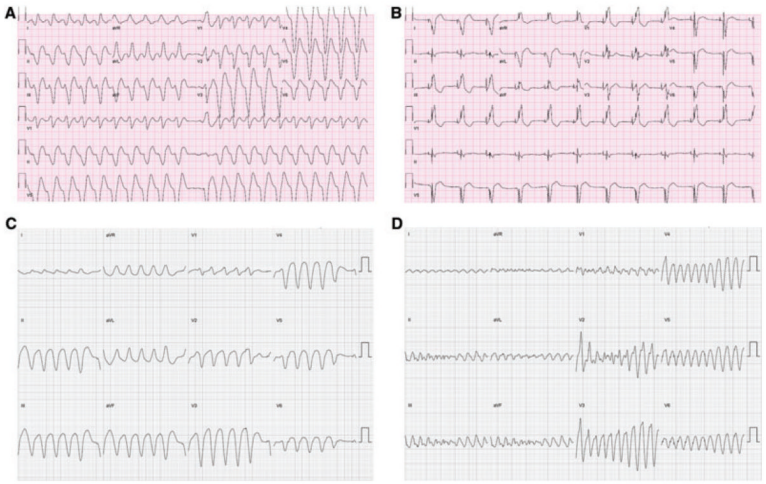

Figure 1.

(A) ECG showing nonsustained VT after pacing with simultaneous LV and RV pacing. (B) Baseline ECG at presentation showing an atrial-sensed, bi-ventricular paced rhythm. The LV lead is programmed 80 milliseconds prior to the RV lead to prevent ventricular arrhythmias in this patient. (C) Induced, nonsustained VT during the electrophysiology study. (D) Induced VF during burst pacing at 210 milliseconds.

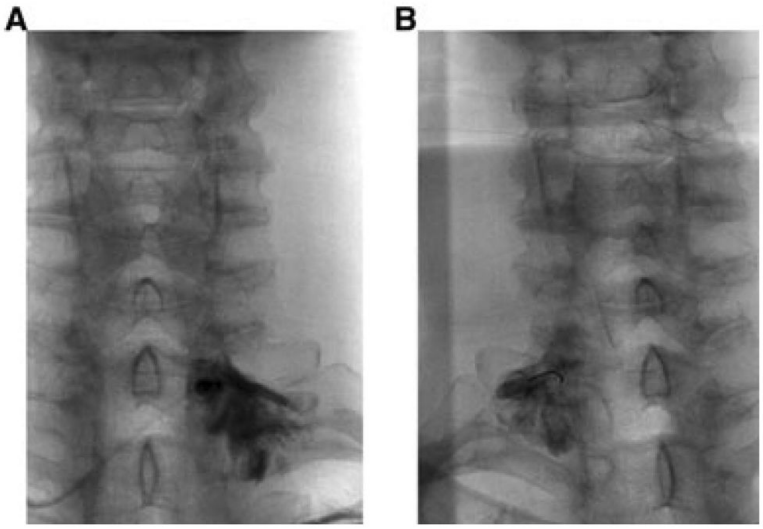

Figure 2.
(A) Contrast fluoroscopy of left (A) and right (B) stellate ganglia during the percutaneous temporary block procedure. No complications have been noted during the 10 alternating injections for this patient over the past 9 months.