

Vagus nerve injury after posterior atrial radiofrequency ablation

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Introduction

Radiofrequency ablation of the posterior left atrium is required for the treatment of various arrhythmias.¹ For atrial fibrillation (AF) therapy, extensive posterior atrial ablation is performed, particularly when targeting complex fractionated electrograms or for the transmural ablation of autonomic ganglia.^{2–4} Thermal injury resulting in atrial–esophageal fistula has been reported from collateral injury with such ablation.^{5–7}

The vagus nerve also courses posterior to the left atrium, which also makes it vulnerable to injury (Figure 1). Vagal branches form a single cord that then runs posterior to the esophagus, enters the abdomen, and contributes to the celiac and lineal plexus, stomach, lesser omentum, and liver.^{8,9} The physiology of vagus nerve injury depends on the level at which nerve damage develops and the downstream organs are innervated. For example, vagus nerve–mediated parasympathetic stimulation of the sinoatrial node, atrioventricular node, pulmonary veins, and myocardium results in slowing of the sinus and ventricular rates and can increase atrial fibrillation inducibility.² Ablation of vagus nerve fibers above or at the regions at which they enter the heart will increase the heart rate and reduce AF inducibility.^{2,3} In the gastrointestinal tract, vagus nerve fibers control peristalsis, pyloric sphincter relaxation, and gastric antrum motility.¹⁰ Injury to the vagus nerve above these organs can result in gastroparesis and pyloric spasm manifested as abdominal bloating, pain, nausea, early or easy satiety, and weight loss and has been described.^{11–13}

We report a series of patients with postablation vagus nerve injury and discuss the utility of systematic clinical and laboratory evaluation to document and understand the level of vagus injury.

Case series

Patient 1

A 47-year-old woman with highly symptomatic AF refractory to flecainide and sotalol presented for left atrial catheter ablation. Radiofrequency (RF) energy at an outside institution was delivered with a 3.5-mm irrigated catheter (NaviStar

ThermoCool, Biosense Webster, Diamond Bar, CA) with irrigation flow rate (17 to 30 ml/min; OIC-2) and a power setting up to 35 W. All 4 pulmonary veins were isolated using lasso and intracardiac echocardiogram (ICE) guidance with additional ablation in the coronary sinus, along the mitral annulus, and along the high right atrium–superior vena cava junction. There was no report of an impedance pop, difficult anatomy, or periprocedural complication. There was no report of significant pain while ablating along the posterior left atrium. However, after resuming her diet, the patient complained of abdominal bloating and distention. She also reported band-like abdominal pain and satiety.

Her symptoms persisted, and a computed tomography scan showed marked gastric dilatation (Figure 2A). A Gastrografin (Bracco Diagnostics, Inc, Princeton, NJ) study showed marked dilatation of the stomach but no apparent obstruction (Figure 2B). She also noted that her heart rate was persistently high (average of 90 beats/min up from 70 beats/min). She was treated with metoclopramide, erythromycin, and domperidone. Over time, her symptoms began to improve; she was able to eat small, low-fat meals and restored most of her 10- to 20-pound weight loss. Approximately 1 year after the procedure, she had persistent mild abdominal pain and bloating when she stopped her prokinetic therapy. Vagus nerve integrity was assessed with a pancreatic polypeptide response to sham feeding that showed a baseline plasma polypeptide level of 44 pg/ml that peaked at 20 min at 55 pg/ml and then decreased to undetectable levels (<35) over the next 10 min (Figure 3). The abnormal kinetic and peak response of the pancreatic polypeptide suggested continued vagus nerve dysfunction. A gastric accommodation study was diminished with an average ratio of 2.46 (normal ≥ 3). These studies were consistent with mild, permanent vagus nerve injury. A 24-h ambulatory electrocardiogram confirmed her baseline heart rate had returned to the preablation status with an average rate of 74 beats/min.

Patient 2

A 16-year-old male patient underwent an ablative procedure at

