Pulmonary Vein Isolation-induced Vagal Nerve Injury and Gastric Motility Disorders

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Atrial fibrillation (AF) is the most prevalent heart rhythm abnormality worldwide. An estimated three to six million people in the United States have AF. It is expected that this number is likely to double by 2050, making AF a significant public health burden. (1) AF is a leading cause of stroke and thromboembolism and is associated with a reduced quality of life. (2) Furthermore, it is linked to an increased mortality in both men and women, with an OR for death of 1.5 in men and 1.9 in women. (3) Medical expenditures for AF are significant, ranging from an annual cost of $1,632 to $21,099, with acute care accounting for the

largest cost component in addition to anticoagulation therapy, which accounted for almost one-third of these costs. (4) The four pillars of AF management include rhythm control, rate control, stroke prevention and risk factor management. (5, 6) While antiarrhythmic drugs are used in some patients for AF rhythm control, AF ablation using pulmonary vein isolation (PVI) is regarded as the major modality for rhythm control. (6)

The vagal nerve provides most of the parasympathetic innervation to the abdominal organs, including the stomach, esophagus, and a significant portion of the intestines. It serves a major role in the regulation of gastric and esophageal motility, in addition to maintaining lower esophageal sphincter tone. (7-9) Due to the relatively close vicinity of the vagal nerve plexus located on the anterior surface of the esophagus and the left atrial posterior wall, the thermal energy utilized during ablation can result in uncommon but potentially fatal complications such as esophageal perforation and atrial-esophageal fistula formation. (10-12) In addition, radiofrequency ablation for AF is associated with non-fatal complications such as an increased risk of gastric motility disorders and acid reflux. (13, 14)

In the current issue of the Journal of Cardiovascular Electrophysiology, Meininghaus et al. recruited 85 patients to assess the incidence of ablation-induced vagal nerve injury (VNI) using both cryoballoon and radiofrequency ablation. Although many cases of VNI induced by PVI have been documented previously, this is one of the first studies to utilize electrophysiologic measurements of gastric motility (EGG) using cutaneous electrodes to record the electrical activity of the stomach two days prior to and two days after the procedure. (15-17) Moreover, the authors have used endoscopy to detect lesions such as erosions, ulcers, and perforations in the esophagus one week prior to and within two days of the procedure.

The findings from this study add to our understanding of one of the complications of PVI in patients with AF (13, 14). One of the key outcomes the researchers observed was the perceived direct link between VNI and preexisting esophageal vulnerability. The authors have found that patients who had preexisting esophagitis had an elevated risk of developing VNI. In addition, the authors identified that in patients in whom EGG showed VNI, the elevated risk of ablation-induced endoscopic pathology was present in the post-procedure endoscopy. Furthermore, another significant finding was the detection of VNI on EGG in approximately one-third of PVI patients, irrespective of energy source, whether high power short duration, or moderate power moderate duration. These findings did not corroborate other studies, which showed that titration of the duration of the ablation energy could prevent VNI in patients undergoing AF ablation. (18)

Overall, the authors should be commended for their tremendous efforts in attempting to understand the intricate pathophysiology and the association of esophageal lesions, atrial-esophageal fistula formation, and vagal nerve injury following PVI using EGG. Certainly, the results of this study have tremendous clinical implications. EGG could have a very important role in the prevention of atrial-esophageal fistula formation in the future. The article had a few limitations, mainly that the results were from a single-center study. Further studies incorporating additional patients from different medical centers should be conducted to better understand the complex pathophysiology of vagal nerve injury and gastric motility disorders following PVI. Advances in esophageal protection technologies will help in decreasing esophageal lesions during PVI. (19-20)

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