

Sinus Node Sparing Novel Hybrid Approach for Treatment of Inappropriate Sinus Tachycardia/Postural Sinus Tachycardia: Multicenter Experience

de Asmundis, C. et al. (2022). *J Interv Card Electrophysiol*, 63(3):531-544.

Background

A recent multicenter study led by Carlo de Asmundis and colleagues at the University Hospital in Brussels, Belgium evaluated a potentially novel substrate* and sinus node (SN) sparing hybrid thoracoscopic ablation to target this substrate in patients with drug refractory inappropriate sinus tachycardia (IST) or postural orthostatic tachycardia syndrome (POTS).¹

Methods

This multicenter retrospective analysis included 255 consecutive drug refractory patients (n=204, 80% with IST; n=51, 20% with POTS) who underwent a novel SN sparing hybrid thoracoscopic ablation. Patient eligibility was determined after other root causes of sinus tachycardia and mechanisms of supraventricular tachycardia were deemed unrelated. P wave morphology and heart rate variability (HRV) parameters were measured using a 12-lead electrocardiogram and 24-h Holter, respectively. Among patients without an implantable loop recorder (ILR), low and high frequency (LF and HF) HRV were evaluated over 15 minutes while the patient was supine, sitting or walking using a digitized Holter algorithm. An LF/HF ratio was used to determine sympathovagal balance. Pre-procedure, 152 (59%) patients underwent an electrophysiological study without a confirmed diagnosis, 69 (27%) underwent slow pathway ablation for atrio-ventricular nodal reentry tachycardia, 15 (0.5%) for typical right flutter ablation and one (0.3%) for pulmonary vein isolation due to atrial fibrillation.

Sinus Node Sparing Approach

The SN sparing approach involves use of a 3-dimensional radiofrequency (RF) endocardial mapping catheter to identify the location of the SN region and relative position relevance to the superior vena cava (SVC), crista terminalis (CT) and inferior vena cava (IVC) to preserve the SN from the lesion set. Then, epicardial lesion lines are created along the SVC, IVC and CT. Further endocardial RF lesions are then delivered to complete the gaps along the CT ablation line. After ablation, a map of the ablation scar is used to confirm the continuity and transmural of the ablation lines.

Procedural Aspects

At the start of the procedure, all IST patients presented with sinus tachycardia while POTS patients were administered isoprenaline to increase the sinus rhythm to 75% of max HR. In all patients, prophylactic administration of aspirin was introduced on post-operative day one. Aspirin regimens were tapered over time to mitigate occurrence and/or severity of pericarditis. Pericarditis was the most frequent adverse event; 121 (47%) patients developed it in the first three months post-procedure. In 24 (9%), symptoms persisted to six months. Other common post-procedural complications included pleural effusions in six (2%) patients, which were resolved medically; severe pleural effusion requiring surgical drainage in three (3%) patients; pneumothorax in five (1.9%) patients, of which three (1.1%) required surgical drainage; and pacemaker implantation due to sinus arrest > five seconds in five (1.9%); and repeat catheter ablation in 13 (5%) patients due to right atrial tachycardia.

A total of 224 (87%) patients were implanted with an ILR after ablation. Those who did not receive ILRs were evaluated using serial 24-h Holter every three months. Mean overall hospital and ICU length of stay were 4.04 ± 0.37 days and 1.06 ± 0.09 days, respectively.

Hybrid Approach for Treatment of IST/POTS: Multicenter Experience

Rhythm Outcomes

Normal sinus rhythm was restored in all patients post-procedure and all patients in the study discontinued medication during follow-up. Of the 51 POTS patients, none experienced syncopal episodes after ablation.

Mean follow-up was 4.07 ± 1.8 years. After a six-month blanking period, 204 (80%) patients demonstrated a significant reduction in HR compared to pre-ablation. Per a subgroup analysis in 198 (77%) patients, mean normal-to-normal R-to-R (RR) intervals improved from 542.30 ± 28.60 to 1022.60 ± 169.01 milliseconds (ms). Furthermore, the standard deviation of all normal RR intervals also improved from 97.4 ± 14.07 to 142.49 ± 40.65 ms pre- and post-ablation, respectively.

Key Takeaways

- Use of a novel SN sparing hybrid thoracoscopic ablation approach to treat IST/POTS in drug refractory patients seems feasible and after which all patients in the study had complete resolution of symptoms and restoration of normal sinus rhythm.
- The SN sparing hybrid approach may offer a few key advantages over traditional ablation strategies. It is minimally invasive, offers direct tissue visualization of the structures of interest which may mitigate collateral damage to adjacent tissues like the esophagus or phrenic nerve, all while simultaneous endocardial activation mapping is conducted to allow for SN identification and precise epicardial ablation.
- The HEAL-IST Trial, currently underway, is a prospective, multicenter, single-arm, Bayesian adaptive designed trial which will evaluate the safety and effectiveness of a hybrid sinus node sparing ablation in up to 142 symptomatic drug refractory or drug intolerant IST patients. Freedom from IST (mean heart rate of ≤ 90 bpm or at least a 15% reduction in mean heart rate) will be evaluated at 12 months as compared to baseline in the absence of new or higher dosage of previously failed medications.²

¹The targeted substrate is based on embryological development of the heart and region that encompasses the sinus node, superior vena cava, crista terminalis and inferior vena cava where the initial heart structure is a tube and all cardiomyocytes automatically generate impulses.

A Note on Distinguishing Features Between IST and POTS

When distinguishing between IST and POTS, symptom evaluation is critical.³ A key difference between the two syndromes is POTS patients tend to have a more pronounced degree of postural change in heart rate than those with IST such that in a supine position, the heart rate in POTS patients rarely increases above 100 bpm whereas in IST, resting heart rate is often > 100 bpm. Techniques like sitting or standing, tilt table testing and use of continuous monitoring devices like ILRs or event monitors can help delineate sinus tachycardia from POTS and other arrhythmias like supraventricular tachycardia. In addition, echocardiography should be considered to rule out structural heart abnormalities.

References:

1. de Asmundis, C. et al. (2022). *J Interv Card Electrophysiol*, 63(3):531-544.
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3. Ahmed, A. et al. (2022). *J Am Coll Cardiol*, 79(24):2450-2462.

Summary written by: Stacey Neuman, PhD, Scientific Affairs