

Sinus Node Sparing Hybrid Thoracoscopic Ablation Outcomes in Patients with Inappropriate Sinus Tachycardia (SUSRUTA-IST) Registry

Lakkireddy, D. et. al. (2022). Heart Rhythm, 19(1):30-8

Introduction

A novel sinus node (SN) sparing hybrid ablation procedure was recently evaluated by D. Lakkireddy and colleagues (Kansas City Heart Rhythm Institute, Overland Park, Kansas) in the Sinus Node Sparing Hybrid Thoracoscopic Ablation Outcomes in Patients with Inappropriate Sinus Tachycardia (SUSRUTA-IST) Registry.¹

Methods

A total of 100 patients (50 per arm) were deemed IST-eligible only after ruling out other causes of sinus tachycardia and failing maximum tolerated doses of pharmacological therapy (beta blockers, calcium channel blockers or ivabradine). One arm underwent a SN hybrid ablation with surgical thoracoscopic video-assisted epicardial ablation and endocardial 3D mapping and ablation and the other arm had conventional endocardial catheter radiofrequency (RF) ablation with SN modification. Restoration of sinus rhythm through 12 months was the primary endpoint.

In brief, the SN sparing approach involves use of an endocardial mapping catheter to identify location of the sino-atrial node. Then, an epicardial lesion set is created along the superior vena cava, inferior vena cava and crista terminalis (CT). Endocardial RF lesions are then delivered to complete the gaps along the CT ablation line.

Results

Baseline characteristics were similar between the two groups with the following exceptions for the hybrid ablation cohort: an overall lower mean resting heart rate (111.3 ± 1.29 vs 114.84 ± 1.22 bpm, $p < 0.0001$), lower left ventricular ejection fraction (55.6 vs 58.08, $p < 0.0001$) and fewer with dyspnea (23 vs 50, $p < 0.0001$) as compared to the conventional RF SN ablation cohort. In addition, more patients in the hybrid arm compared to RF-SN ablation arm had a prior electrophysiology (EP) study to treat typical atrial flutter or atrio-ventricular reentrant tachycardia (40% vs 24% RF SN ablation). Also, antiarrhythmic drugs and beta-blockers were stopped at least 5 half-lives prior to ablation.

After SN modification, sinus rates were significantly reduced in the hybrid arm compared with the RF-SN group (61 ± 9.32 vs 82.28 ± 2.38 bpm, $p < 0.001$, Table). Overall, normal sinus rhythm was effectively restored in all patients who underwent hybrid compared to 84% in the RF-SN group, $P = 0.006$). Furthermore, significant improvements in mean daily heart rate (HR) and HR response to the 6-minute walk test were observed in the hybrid arm as compared to those in the RF-SN ablation cohort at 3, 6 and 12 months. Regarding hospital length of stay, ICU stays were longer in the hybrid arm (1.12 ± 0.22 vs 0.2 ± 0.12 , $p < 0.0001$) while non-ICU stays were longer in the RF-SN ablation arm (4.2 ± 1.5 vs 2.92 ± 0.31 , $p < 0.0001$).

Complication rates differed between cohorts with acute pericarditis being the most common ($n = 70$) and occurring more often in the hybrid group (92%, $n = 46$ vs 48%, $n = 24$; $p < 0.0001$). In addition, pleural effusion (6%, $n = 3$) only occurred in the hybrid cohort while phrenic nerve injury only occurred in the RF-SN arm (14%, $n = 7$). There was also higher prevalence for pacemaker implantation in the RF-SN group compared to hybrid (50% vs 2%, $p < 0.0001$).

During follow-up, only 8% of hybrid vs 100% of RF-SN ablation patients underwent repeat ablation. Among redo procedures, 36% of RF-SN patients had 3 procedures and 8% had 4 procedures for symptomatic re-entrant tachycardias primarily due to gaps in the CT lesion set.

A total of 78% (n=22) of hybrid patients discontinued their rate controlling medications after the first procedure while 100% of patients in the RF-SN group (n=50) remained on medication. Although 6% of hybrid patients reported palpitations, none required redo ablation.

Quality of life (QoL) assessments (SF-36, Self-rating Anxiety Score and depression–Zung Self-rating Depression Score) conducted pre- and post-intervention demonstrated greater improvements in QoL among hybrid recipients as compared to conventional RF-SN ablation.

Clinical Outcomes for Sinus Node (SN) Hybrid and SN Endocardial Ablation Alone			
Parameter	SN Hybrid Ablation	SN RF endocardial Ablation alone	P-value
Mean heart rate (bpm)	61 ± 9.32	82.28 ± 2.38	<0.0001
Normal sinus rhythm restoration (%)	100	84	0.006
ICU Length of Stay	1.12 ± 0.22	0.2 ± 0.12	<0.0001
Non-ICU Length of Stay	4.2 ± 1.5	2.92 ± 0.31	<0.0001
Repeat Ablation (2 total procedures)	8%	100%	<0.0001
Repeat Ablation (3 total procedures)	0%	36%	<0.0001

Key Takeaways

- The SN sparing hybrid ablation approach to treat drug refractory or intolerant IST patients appears to be safe and efficacious yielding significant reductions in mean daily HR through 12 months compared to conventional RF endocardial ablation with SN modification alone.
- 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 and mitigates 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, multi-center, 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 ≤ 90bpm or at least a 15% reduction in mean heart rate) will be evaluated at 12 months compared to baseline in the absence of new or higher dosage of previously failed medications.²

Reference:

1. Lakkireddy, D. et al. (2022). *Heart Rhythm*, 19(1):30-8.
2. HEAL IST Trial, [ClinicalTrials.gov Identifier: NCT05280093](https://clinicaltrials.gov/ct2/show/study/NCT05280093).

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