

# Swallowing-induced Supraventricular Tachyarrhythmia

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Swallowing-induced supraventricular tachyarrhythmia is an extremely rare entity with unclear pathophysiology. A 55-year-old man presented with a 2-year history of worsening presyncopal symptoms triggered only by drinking liquids of any temperature. Results of a physical examination were unremarkable except for reproducible atrial tachycardias to 180 to 210 beats/minute documented on rhythm strips when the patient was given water to drink. He underwent radiofrequency ablation with complete resolution of symptoms. We reviewed all 43 published cases of swallowing-induced supraventricular tachyarrhythmia in the English-language medical literature. We found only one other reported case induced only by drinking liquids. Radiofrequency ablation appears to be the treatment of choice.

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## KEY WORDS

Arrhythmias • Cardiac • Modulation • Catheter ablation

Swallowing-induced dysrhythmias can broadly be classified into tachyarrhythmias and bradyarrhythmias, with the latter being more common.<sup>1</sup> They typically manifest as transient

atrioventricular block in the presence of either an esophageal abnormality or known coronary artery disease.<sup>2</sup> Swallowing-induced supraventricular tachyarrhythmias (SISVTs) are less frequent, and

usually not associated with cardiac or esophageal abnormalities.<sup>3</sup> Tada and colleagues<sup>4</sup> reviewed 544 patients undergoing electrophysiologic study with symptomatic supraventricular tachyarrhythmia, and found only three (0.6%) patients to have SISVT. There are fewer than 50 reported cases of SISVT in the English-language medical literature, most of which describe tachyarrhythmias precipitated with solids or both solids and liquids. Herein we report a unique case of SISVT triggered only by drinking liquids. We also reviewed published cases of SISVT in English-language medical literature in an attempt to understand the pathophysiology, characteristics, and management of these patients.

### Presentation

A 55-year-old man presented with a 2-year history of progressively worsening symptoms of dizziness and lightheadedness. Interestingly, this was precipitated only by drinking liquids, with each episode lasting a few seconds. Occasionally, it was associated with tunnel vision, palpitations, and tinnitus. He was asymptomatic between these episodes. All types of liquids consistently produced the patient's symptoms, including hot coffee, room-temperature water, and carbonated cold drinks, which indicated that this phenomenon was not temperature dependent. It was not brought on by ingestion of solids or with head movement while drinking.

He denied having syncope, chest pain, shortness of breath, gastrointestinal symptoms, muscle weakness, skin numbness, and urinary or bowel incontinence. His past history included obstructive sleep apnea, gastrointestinal reflux disease, and carpal tunnel syndrome. His family history was

unremarkable. He used to drink three cups of coffee per day and two beers per week, but denied cigarette smoking and illicit drug use. His only outpatient medication was omeprazole, 40 mg/d.

Results of a complete physical examination, including orthostatic vital signs and detailed neurologic examination, were unremarkable. However, on drinking water, his heart rate increased

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from 65 to 190 beats/min, with symptoms of lightheadedness. In fewer than 10 seconds, his heart rate returned to normal; his blood pressure remained stable during this time. Results of a routine laboratory panel, including complete blood count, comprehensive metabolic panel, and cardiac enzymes, were within normal lim-

*Following RF ablation, tachycardia could no longer be induced.*

its. Investigations including transthoracic echocardiogram, carotid Doppler, and magnetic resonance imaging of the brain and thoracolumbar spine showed no abnormalities. Electromyography was significant only for a past history of carpal tunnel syndrome. Autonomic evaluation including cardiac response to deep breathing, Valsalva maneuver, sudomotor reflexes, and tilt table testing results were completely normal.

The patient's resting electrocardiogram showed normal sinus

*The pathophysiology of SISVT is still speculative...*

rhythm with no evidence of pre-excitation. On drinking water, a run of atrial tachycardia was seen, with an average rate of 180 to 210 beats/min.

The patient was started on oral propranolol and asked to return in 1 month. As symptoms persisted, he was referred to the electrophysiology service for further examination. The electrophysiology study included three-dimensional mapping with multielectrode array and catheter activation mapping. Tachycardia could not be induced via an atrial pacing maneuver or isoproterenol infusion. Only drinking

20 to 30 mL of water reliably and reproducibly induced atrial tachycardia to allow mapping (Figure 1). After mapping, the right atrium and the noncoronary cusp failed to show early atrial activation. A transeptal puncture was made and the left atrium was mapped. During atrial tachycardia, the earliest atrial electrogram was found to originate

from the posterior interatrial septum. Radiofrequency (RF) catheter ablation with an 8-mm catheter was used to ablate the atrial focus. Following RF ablation, tachycardia could no longer be induced. The patient was followed over the next 2 years, and did not have a recurrence of symptoms.

### Discussion

Under the name of "schlucktachycardie," SISVT was first described by Sakai and Mori in 1926.<sup>5</sup> The

pathophysiology of SISVT is still speculative, although three different mechanisms have been proposed in the past. The first explanation refers

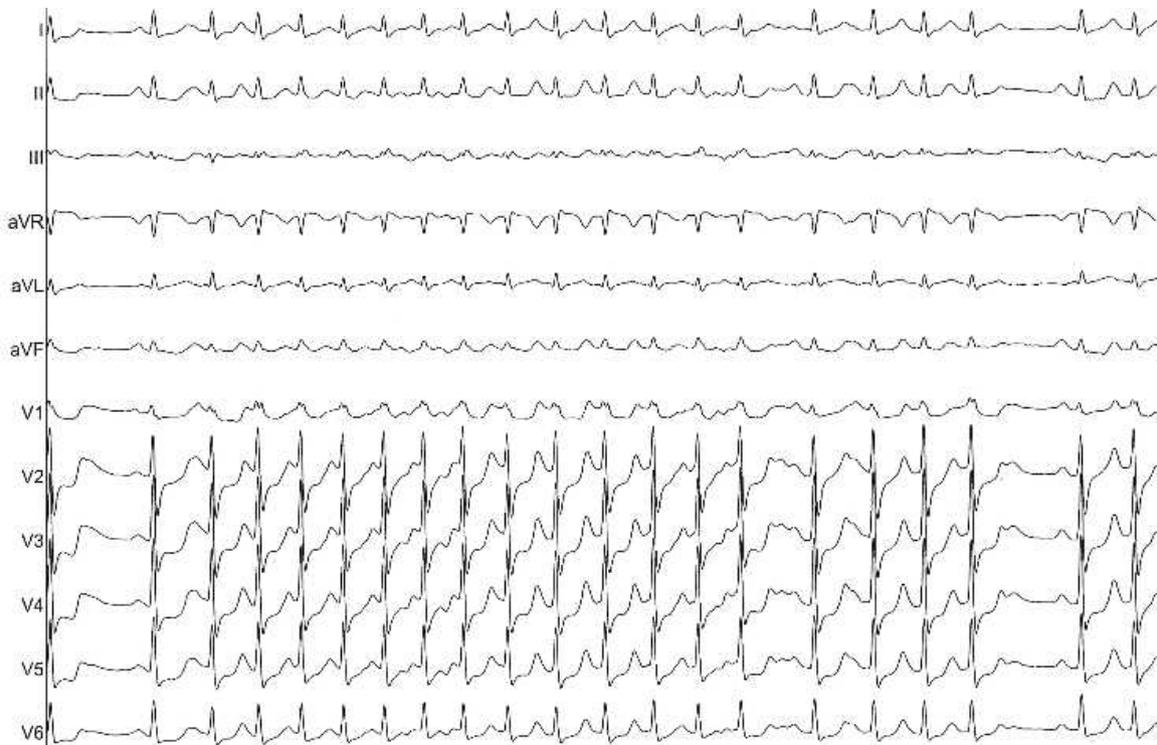


Figure 1. Catheter activation mapping showing repeated episodes of swallowing-induced atrial tachycardia on drinking water.

to the mechanical stimulation of left atrium by distension of the esophagus.<sup>6-11</sup> Cohen and colleagues<sup>9</sup> first reported atrial fibrillation triggered by balloon dilatation of the esophagus at the level of left atrium. This has been shown later by other authors as well, including Bajaj and associates<sup>10</sup> and Kalloor and associates.<sup>11</sup> However, this theory did not explain cases in which the focus of tachyarrhythmia was not the left atrium, such as pulmonary veins and right atrium. Moreover, there have been cases in which the tachyarrhythmia was noted inconsistently with esophageal stimulation.<sup>12,13</sup> The second proposed mechanism, first explained by Lindsay,<sup>14</sup> directs on vasovagal reflexes in the pathogenesis of SISVT.<sup>12,15</sup> The increased intra-esophageal pressure associated with swallowing activated the afferent and efferent branches of the vagus nerve. Atrial ectopy may result from preferential vagal discharge to the atrial myocardium,

which, in turn, may produce atrial tachyarrhythmias.<sup>15-17</sup> However, this hypothesis does not explain the poor effectiveness of vagolytic medications such as atropine in these patients. In addition, adrenergic reflexes originating in the esophageal wall have been thought to play a role in SISVT.<sup>18,19</sup> Suffice it to say

The mean age was  $50.8 \pm 10.73$  years. Men were more likely to be involved compared with women, in a ratio of 6:1. In all, 10 (28.6%) cases reported SISVT with solids ingestion only, 1 reported with liquids only, and 24 (68.6%) reported SISVT with both solids and liquids. Atrial tachycardia (and/or parox-

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that an intricate model linking the nervous system with mechanical factors could explain the occurrence of SISVT, as well as the variability in response to several pharmacologic agents.

In order to understand the basic characteristics and treatment strategies in these patients, we reviewed all reported cases of SISVT in the English-language medical literature. A total of 43 published cases were found and are listed in Table 1.

ysmal atrial contractions) was the most commonly reported response, with 25 (58.14%) cases, followed by atrial fibrillation in 12 (27.90%), and supraventricular tachycardia in 11 (25.60%) patients. Further classification into atrioventricular nodal re-entrant tachycardia or atrioventricular re-entrant tachycardia is not described in all the cases that reported supraventricular tachycardia. Clinically, the palpitations described by patients occurred only

**TABLE 1****Description of Cases of Swallowing-induced Supraventricular Tachycardia**

Study	Age	Sex	Solids/ Liquids/Both	Arrhythmia	Treatments Attempted (Successful Treatment Highlighted in Gray)
Bajaj SC et al <sup>10</sup>	45	M	Both	AT	Propranolol, atropine, quinidine, procainamide
Lindsey AE <sup>14</sup>	45	M	Both	AT	Digoxin, propranolol, quinidine
Engel TR et al <sup>6</sup>	52	M	Both	AT	Digoxin, procainamide, quinidine, propranolol
Kalloor GJ et al <sup>11</sup>	46	M	Both	AFib, AT, VT	Propranolol, quinidine, circular esophageal myotomy
Mirvis DM et al <sup>13</sup>	55	M	Both	SVT	Digoxin, propranolol, quinidine, verapamil
Schreoder DP et al <sup>21</sup>	73	M	Both	SVT	Quinidine, propranolol, procainamide
Abinader and Cooper <sup>15</sup>	62	M	Solids	SVT	Quinidine, verapamil
Landmark and Storstein <sup>22</sup>	U	U	Both	AT	Verapamil
Goldberger and Johnson <sup>23</sup>	26	M	Both	SVT	Discontinuation of coffee
Suarez LD et al <sup>12</sup>	55	M	Both	AT	Quinidine, digoxin, amiodarone, reserpine, disopyramide, atropine
Bexton RS et al <sup>8</sup>	52	M	Both	AT	Quinidine, propranolol, disopyramide
Burton JR et al <sup>24</sup>	48	M	Both	AT	Digoxin, propranolol, intrapleural esophageal repositioning
Keidar S et al <sup>25</sup>	56	M	U	AT, AFib	Amiodarone
Yeh SJ et al <sup>26</sup>	64	M	Both	AF, SVT, AF	Verapamil, quinidine, propranolol, RF ablation
Morady F et al <sup>17</sup>	64	M	Both	AT	Lidocaine, verapamil, quinidine, procainamide
Terasaka R et al <sup>2</sup>	54	M	Both	SVT	Verapamil, quinidine, propranolol
Greenspon and Levy <sup>27</sup>	38	M	Both	SVT	Verapamil, atenolol, quinidine, digoxin
Matsubara K et al <sup>28</sup>	35	M	Both	AT	Propranolol
Ransbottom and Mirro <sup>29</sup>	51	F	U	AT	Digoxin, propranolol, quinidine, verapamil, disopyramide, procainamide, amiodarone
Shirayama T et al <sup>1</sup>	57	M	Both	AT	Digoxin, disopyramide, verapamil
Shirayama T et al <sup>1</sup>	35	M	U	AT	Propranolol
Shirayama T et al <sup>1</sup>	28	M	U	AT	Propranolol + atropine, disopyramide
Wander GS et al <sup>30</sup>	45	M	Both	SVT	Verapamil
Jánoskúti L et al <sup>31</sup>	57	M	U	AT	Cimetidine
Wilmschurst PT <sup>32</sup>	61	M	Solids	AT, AF	Propafenone

Study	Age	Sex	Solids/ Liquids/Both	Arrhythmia	Treatments Attempted (Successful Treatment Highlighted in Gray)
Wilmshurst PT <sup>32</sup>	55	M	Liquids	AF	Avoidance of cold liquids
Chock and Gill <sup>19</sup>	54	M	Solids	SVT	Propafenone
Gordon J et al <sup>33</sup>	26	F	Both	AF	Diet control and proton-pump inhibitor
Baman NS et al <sup>34</sup>	53	M	Solids	AF	Atenolol, verapamil
Gillinov and Rice <sup>35</sup>	62	M	Solids	AF	Surgical repair of slipped Nissen fundoplication
Malik A et al <sup>20</sup>	38	F	Solids	AF	Glycopyrrolate, disopyramide, verapamil
Satish OS et al <sup>36</sup>	48	F	Solids	SVT (AVNRT)	RF ablation
Satish OS et al <sup>36</sup>	49	M	Solids	SVT (AVNRT)	RF ablation
Yamauchi Y et al <sup>16</sup>	49	M	U	AT	β-blockers, RF ablation
Undavia M et al <sup>37</sup>	47	M	Both	AT	Calcium channel blockers, flecainide, RF ablation
Kanjwal Y et al <sup>38</sup>	46	F	Solids	AT, AF	Propafenone
Tada H et al <sup>4</sup>	67	M	Both	AT, AF	RF ablation
Tada H et al <sup>4</sup>	60	M	Both	AT	Verapamil, propranolol, RF ablation
Tada H et al <sup>4</sup>	51	M	Both	AT	β-blockers, RF ablation
Tandeter H et al <sup>39</sup>	49	M	Solids	AT	Discontinuation of salbutamol, atenolol
Ho KL et al <sup>40</sup>	56	M	U	AF	Amiodarone, metoprolol, fluticasone
Ip JE et al <sup>41</sup>	56	M	Both	AT	β-blockers, flecainide, RF ablation
Yokoshiki H et al <sup>18</sup>	64	F	U	MAT	β-blockers, RF ablation
Current case	55	M	Liquids	AT	Propranolol, RF ablation

AFib, atrial fibrillation; AF, atrial flutter; AT, atrial tachycardia; AVNRT, atrioventricular nodal reentry tachycardia; MAT, multifocal atrial tachycardia; RF, radiofrequency; sVT, supraventricular tachycardia; U, unreported; VT, ventricular tachycardia.

when swallowing in most patients, whereas some patients described them during other times, as well.<sup>4</sup>

Management of SISVT can be difficult. β-blockers were the most commonly used medication (in 22 patients); however, they were also one of the least likely medications to be effective, as only four (18.2%) patients showed any improvement. Other commonly used medications included quinidine, verapamil, digoxin, procainamide, and propafenone, with limited success. In patients in whom an anti-arrhythmic agent was successful, it was possible to wean several of them off the

medication without any recurrence.<sup>20</sup> RF ablation was attempted in 10 patients and was successful in all. Hence, RF ablation is an excellent treatment option for patients, with good inducibility, as it can offer a permanent cure (as seen in our patient). The patient was followed over the next 2 years, and did not have a recurrence of symptoms. ■

*Dr. Shaibani conceived the idea and helped draft the manuscript with Dr. Khalid. Dr. Khalid drafted and finalized the manuscript, and added the figure and tables. Dr. Massumi added the section on electrophysiology, and helped draft the case history. All authors have read and approved the final manuscript.*

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### MAIN POINTS

- Swallowing-induced dysrhythmias can broadly be classified into tachyarrhythmias and bradyarrhythmias. They typically manifest as transient atrioventricular block in the presence of either an esophageal abnormality or known coronary artery disease. Swallowing-induced supraventricular tachyarrhythmias (SISVTs) are less frequent, and usually not associated with cardiac or esophageal abnormalities.
- An intricate model linking the nervous system with mechanical factors could explain the occurrence of SISVT, as well as the variability in response to several pharmacologic agents.
- Management of SISVT can be difficult. Radiofrequency ablation is an excellent treatment option for patients as it can offer a permanent cure.