Review Article

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Inappropriate Sinus Tachycardia: Brief Review

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Abstract

Inappropriate sinus tachycardia (IST), a form of dysautonomia that is estimated to impact around 1.2% of the population. IST is characterized by unexpectedly fast heart rates at rest, with minimal physical activity, or both. Patients with IST range in presentation from asymptomatic to complaining of extremely debilitating symptoms such as palpitations, weakness, chest pain, shortness of breath fatigue, dizziness, or near syncope. IST is a diagnosis of exclusion. If IST is suspected, a thorough medical history review and physical examination should be performed, in order to rule out secondary causes for the tachycardia . The echocardiogram should reveal a structurally normal heart, and a treadmill exercise test (if used) should document an exaggerated tachycardic response to exercise.

Keywords: Sinus Tachycardia; Inappropriate; Rate.

Definition

Inappropriate sinus tachycardia (IST) was defined as(1) P-wave axis and morphology during tachycardia similar or identical to that during sinus rhythm; (2) resting heart rate of ≥100 beats per minute (bpm) or increase of heart rate ≥100 bpm with minimal exertion (eg, rising out of a chair or slow walking); (3) exclusion of secondary causes of sinus tachycardia; and (4) symptoms of palpitations and/or presyncope clearly documented to be related to resting or easily provoked sinus tachycardia [1,2]. Healthy, normal individuals, at rest, have sinus rates of 50 to 90 beats/min, generally lower than the intrinsic sinus rate (i.e., devoid of autonomic influence), in part because of vagal tone [3,4,5].

Presentation

No specific heart rate best defines IST, yet patients with IST generally have resting daytime sinus rates of more than 100 beats/min and average 24-h heart rates of more than 90 beats/min that are not explained by physiologic demands or conditions known commonly to increase heart rate. Patients with IST often have multiple, incapacitating symptoms including palpitations, dyspnea, dizziness, lightheadedness, and near syncope, but the symptoms may not be dependent on heart rate. Associated emotional and psychiatric problems often are identified, but any relationship to IST is uncertain.

Causes

As expected no single cause can explain the IST, its multifactorial and all the secondary causes of tachycardia need to be excluded**.**

Mechanism

Multifactorial mechanisms have been proposed to explain the IST and the se have been tabulated (Table 2).

Treatment

IST seldom requires treatment unless the symptoms are debilitating or need heart rate to control for other reasons. Controlling the sinus rate in asymptomatic patients with IST is controversial

Table 1: Explainable causes of sinus tachycardia to consider before diagnosing inappropriate sinus tachycardia

Drugs, Substances, Medications, Interventions	Medical Conditions
Anticholinergics	Anemia
Catecholamines	Dehydration
Alcohol	Exercise
Caffeine	Anxiety
Tobacco	Pain
Cocaine	Pulmonary embolus
β-blocked withdrawal	Fever
Supraventricular tachycardia ablation	Pericarditis
	Aortic or mitral regurgitation
	Myocardial Infarction
	Pneumothorax
	Hyperthyroidism
	Hypoglycemia

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Table 2: Mechanism for IST

Intrinsic sinus node Over Activity: Channelopathy
➢ *Autonomic influence*
• Decreased parasympathetic activity
• Hyposensitivityof muscarinic receptors
• Decreased efferent vagal activation
• Increased sympathetic activity
• β-receptor autoantibodies
• Combined
• Baroreceptor activity
➢ *Neurohormonal modulation*
• Vasoactive intestinal polypeptide
• Histamine
• Norepinephrine
• Epinephrine
• Serotonin 1-A receptor activation
• Central GABA-nergic activation

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because the treatment may be worse than the syndrome itself. In IST, no one therapy reduces heart rate and symptoms completely and effectively, likely related to the complexity of the problem and the lack of full understanding of the causes [6]. IST has a benign course and seldom it causes any tachycardia related cardiac problems. Beta-adrenergic blockers, even at high doses, generally are ineffective and tend to be associated with other symptoms. Other treatments (fludrocortisone, volume expansion, pressure stockings, phenobarbital, clonidine, psychiatric evaluation, erythropoietin) have been suggested, but may be harmful and have not been proven [7]. Ivabradine remains the choice treatment in IST. Ivabradine is a promising drug for the treatment of IST. It can slow down a fast heart rate by blocking "funny channel" receptors.

Radiofrequency ablation in attempts to modify the sinus node or eliminate sympathetic inputs, at best, is partially effective, but has been tested only in small populations. It becomes extraordinarily important to distinguish the potential mechanisms responsible for sinus tachycardia, because for patients with POTS, radiofrequency ablation of the sinus node will have devastating effects, exacerbating symptoms or making hemodynamics worse. If POTS was the original problem, incorrectly diagnosed as IST, blunting the acceleration in heart rate during position change by sinus node ablation could prevent the needed sinus response to overcome inappropriate vasodilation or lack of appropriate vasoconstriction. Severe postural hypotension therefore may ensue [6].

Surgical ablation of the sinus node may be ineffective because in patients with IST, escape rhythms, including those from the atrioventricular junction, also may be inappropriately fast [8]. Complete surgical sympathectomy has not been well tested yet. However, innervation may remain via the intrinsiccardiac nervous system [9]. Even complete sympathectomy may not address the primary problem, and therefore may treat IST ineffectively. Further, IST has been observed after heart transplantation even after complete central autonomic denervation [10]. Surgical ablation is not recommended, except for patients who are completely debilitated symptomatically and for whom everything else has failed.

Invasive treatments include forms of catheter ablation such as sinus node modification [11] (selective ablation of the sinus node), complete sinus node ablation (with associated implantation of a permanent artificial pacemaker) and AV node ablation in very resistant cases (creation of iatrogenic complete heart block, necessitating implantation of a permanent artificial pacemaker).

A General Approach [6]

A general approach to patients in whom sinus

tachycardia is present and IST is presumed includes the following:

- Determine if, and when, sinus tachycardia is present and if the problem is reproducible and persistent. Consider if any explainable cause of tachycardia exists and determine if symptoms are postural, because this may be the result of POTS, or exacerbated by physical activity. Consider psychiatric issues, exclude substance abuse, and carefully counsel the patient on the risks and benefits of any interventional therapy. Consider that there is no necessity to move to aggressive ablation interventions if simpler approaches do not work. Ensure the patient is aware that the therapeutic options, including ablation, have limited value and may cause tremendous harm.
- If IST is diagnosed, determine if there is a trigger or an event that precipitated the symptoms because this may help to determine the longevity of the problem. For some, a postviral syndrome can be associated with POTS and this may be short lived. If the patient is otherwise young and healthy, the problem may last 5 years or more before dissipating.
- Patients with IST often have symptoms independent of heart rate. It is critical to determine if the heart rate is associated directly with the symptoms, because in this setting, treatment of the heart rate likely will make a difference. Consider a multidisciplinary approach to rule out psychiatric issues that may be exacerbating the symptoms and may be alleviated by other approaches.
- Treatment begins with modest doses of β-blockers. No specific β-blocker is more effective than another. Exercise training is recommended. Potential stimulants in the diet (such as caffeine or alcohol) should be eliminated.
- Ivabradine at a dose of 5.0 to 7.5 mg twice daily, if available, may be highly effective and should be considered.
- Consider radiofrequency ablation only if sinus rates are extremely fast, the patient clearly has IST with symptoms resulting from sinus tachycardia, and all other therapies have failed.

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