Diagnosis and treatment of sick sinus syndrome

Sick sinus syndrome is a generalized abnormality of cardiac impulse formation that may be caused by an intrinsic disease of the sinus node that makes it unable to perform its pacemaking function, or by extrinsic causes. (1) Abnormalities encompassed in this syndrome include sinus bradycardia, sinus arrest or exit block, combinations of sinoatrial and atrioventricular nodal conduction disturbances, and atrial tachyarrhythmias. Sick sinus syndrome is not a disease with a single etiology and pathogenesis but, rather, a collection of conditions in which the electrocardiogram (ECG) indicates sinus node dysfunction. (2) Sick sinus syndrome is characterized by sinus node dysfunction with an atrial rate inappropriate for physiologic requirements. Although the condition is most common in the elderly, it can occur in persons of all ages, including neonates. (3) The mean age of patients with this condition is 68 years, and both sexes are affected approximately equally. (4) The syndrome occurs in one of every 600 cardiac patients older than 65 years and may account for 50 percent or more of permanent pacemaker placements in the United States. (5)

Etiology

Most cases of sick sinus syndrome are idiopathic, and the cause can be multifactorial (Table 1). (3) Degenerative fibrosis of nodal tissue is the most common cause of intrinsic changes in the sinoatrial node that lead to sick sinus syndrome. Certain conditions can cause these intrinsic changes. (3,5,6) There are also extrinsic causes of sinus node dysfunction and conditions that can cause this problem in children (Table 1). (3)

Coronary artery disease may coexist with sick sinus syndrome in a significant number of patients, although it is not considered a major cause of the syndrome. It is unclear whether inflammation, sinus node ischemia, or local autonomic neural effects lead to the development of sick sinus syndrome in patients with myocardial infarction. Sinus node dysfunction usually is temporary when it follows an acute myocardial infarction. Uncommonly, chronic ischemia may cause fibrosis and lead to symptomatic sick sinus syndrome for months to years after myocardial infarction. (5)

Clinical Manifestations

Patients with sick sinus syndrome often are asymptomatic or have symptoms that are mild and nonspecific (7) (Table 2). (3) Symptoms are related to the decreased cardiac output that occurs with the bradyarrhythmias or tachyarrhythmias. (3) Most of the symptoms are caused by decreased cerebral perfusion, and 50 percent of patients have syncope or pre-syncope. (5)

Symptoms, which may be present for months or years, can include syncope, palpitations, and dizziness, as well as symptoms caused by the worsening of conditions such as congestive heart failure, angina pectoris, and cerebral vascular accident. (8) Peripheral thromboembolism and stroke, which can occur in the presence of bradyarrhythmia-tachycardia syndrome (alternating bradyarrhythmias and tachyarrhythmias), may be related to dysrhythmia-induced emboli. (3) A slow heart rate in the presence of fever, left ventricular failure, or pulmonary edema may be suggestive of sick sinus syndrome. (2,3) Associated tachycardia may cause flushing of the face, pounding of the heart, and retrosternal pressure. (10) Other symptoms include irritability, nocturnal wakefulness, memory loss, errors in judgment, lethargy, lightheadedness, and fatigue (2,11) (Table 2). (3) More subtle symptoms include mild digestive disturbances, periodic oliguria or edema, and mild intermittent dyspnea. (2)

ECG Manifestations

Sick sinus syndrome can produce a variety of ECG manifestations consisting of atrial bradyarrhythmias, atrial tachyarrhythmias, and alternating bradyarrhythmias and tachyarrhythmias (Table 3). (3) Supraventricular bradyarrhythmias may include sinus bradycardia, sinus arrest with or without junctional escape, sinoatrial exit block, ectopic atrial bradycardia, and atrial fibrillation with slow ventricular response. The sinus bradycardia that occurs in patients with sick sinus syndrome is inappropriate and not caused by medications. (2,5) The sinoatrial exit block that occurs in patients with sick sinus syndrome may demonstrate a Mobitz type I block (Wenckebach block) and a Mobitz type II block. (2) The ECG may reveal a long pause following cardioversion of atrial tachyarrhythmias, and a greater-than three-second pause following carotid massage. (5) Sixty percent of patients have tachyarrhythmias. (8)

Supraventricular tachyarrhythmias that occur in patients with sick sinus syndrome include paroxysmal supraventricular tachycardia, atrial flutter, atrial fibrillation, and atrial tachycardia. (2,3) Atrial fibrillation is the most common tachydysrhythmia in these patients. (12) Rarely, a ventricular escape tachycardia may be seen on ECG. (8) Sinus node re-entrant rhythm is another ECG manifestation. (5) Bradycardia-tachycardia syndrome may be seen on ECG or cardiac rhythm strip (Figure 1); this syndrome is more common in older patients with advanced sick sinus syndrome. (3)

Diagnosis

The diagnosis of sick sinus syndrome may be difficult because of the slow and erratic course of the syndrome. The condition often goes undetected in the early stages because only sinus bradycardia may be present at its origin. (9) Some symptoms of patients with sick sinus syndrome (e.g., fatigue, irritability, memory loss, lightheadedness, palpitations, cognitive defects) are present in several other disorders that occur in elderly patients and may be misdiagnosed as those of senile dementia. (5)

Symptoms of sick sinus syndrome may be variable, intermittent, and difficult to associate with ECG changes. (2) If the patient is asymptomatic when ECG or ambulatory monitoring is performed, the dysrhythmias of the syndrome are often not present. (5) Furthermore, there is no definitive way to distinguish patients with atrial fibrillation associated with sick sinus syndrome from patients with atrial fibrillation and normal sinus function; this distinction is clinically important because treating atrial fibrillation with cardioversion or medications can have catastrophic consequences if the sinus node is inadequate.

One manifestation of serious sinus node dysfunction in patients with atrial fibrillation is a slow ventricular rate in the absence of medications such as propranolol (Inderal) or digoxin. (2) Bradycardia may be misattributed to digoxin treatment in a patient with congestive heart failure. Cardioactive drugs, such as digoxin, quinidine (Quinaglute), and procainamide (Pronestyl), as well as hyperkalemia, can cause periodic sinus arrest or sinoatrial exit block.

Functional sinus bradycardia, enhanced vagal drive, gastrointestinal and neurologic conditions, and other causes of syncope can produce symptoms similar to those of sick sinus syndrome and must be included in the differential diagnosis of the syndrome. Sinus node dysfunction can occur perioperatively because of increased vagal tone caused by anesthesia or surgical intervention. (13) All of these possibilities must be
The diagnosis requires not only documentation of sinus node dysfunction but also correlation with the associated symptoms of sick sinus syndrome. The most common method of diagnosis is Holter monitoring. During monitoring, patients must keep a precise diary of their activities and symptoms, so that these factors can be correlated with the ECG changes. (3)

If two 24-hour periods of Holter monitoring fail to reveal the dysrhythmias of sick sinus syndrome, but the symptoms are severe and intermittent, it is likely that the sinus node dysfunction is severe but intermittent. In these cases, patients can carry a pocket-sized device for transmitting ECG readings via telephone when they are having symptoms. For this procedure to be successful, the arrhythmia must last for at least one minute. Another approach is to have patients activate a recording device to monitor the events of cardiac dysrhythmias when they are having symptoms. (2)

There are several other methods of diagnosing sick sinus syndrome. Isometric handgrip exercises or Valsalva's maneuvers normally increase the heart rate, but this effect may be minimal or absent in patients with this syndrome. If carotid massage produces abrupt sinus arrest within three seconds' duration, sinus node dysfunction may be suspected. (8) These measures and monitoring cardiac response to such agents as atropine and isoproterenol (Isuprel) should only be attempted while a patient is undergoing careful ECG monitoring. (3)

**REFERENCES**


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Treatment for sick sinus syndrome focuses on eliminating or reducing unpleasant symptoms. If you aren’t bothered by symptoms, you may only need regular checkups to monitor your condition. For people who are bothered by symptoms, the treatment of choice is usually an implanted electronic pacemaker. Medication changes. Your doctor will likely check your current medications to see if any could be interfering with the function of your sinus node.