



SINUS NODAL DYSFUNCTION (SND)

Introduction

The term **sick sinus syndrome** first appeared in the literature in 1967 to describe a rapid atrial rhythm interspersed with varying periods of bradycardia that followed cardioversion.

Today, the term is applied to a broad range of electrophysiological abnormalities, including inappropriate sinus bradycardia, sinus arrest, sinus node exit block, chronic atrial fibrillation with slow ventricular response and bradycardia-tachycardia syndrome.

Although the term sick sinus syndrome remains popular, a more appropriate title is sinus nodal dysfunction (SND).

The disease commonly is observed in older patients with underlying heart disease.

Its natural history is incompletely defined, but it frequently runs an erratic and progressively malignant course. For this reason, cardiac pacing has become the cornerstone of therapy for symptomatic patients.

Pathophysiology

Causes:

1. Primary cardiac disease:
 - Most cases are attributable to coronary artery disease or intrinsic idiopathic degenerative disease.
2. Secondary causes include:
 - **Medications, usually beta-blockers or calcium channel blockers**
 - Hypothermia
 - Electrolyte disturbances
 - Hypothyroidism.

Manifestations:

SND may show the following ECG manifestations:

1. Inappropriate sinus bradycardia:

- Refractory sinus bradycardia, defined as bradycardia that does not increase with exertion, usually is the earliest manifestation of SND.
- The diagnosis should be considered strongly in any elderly patient with unexplained chronic bradycardia.

2. Sinus arrest/sinus pause:

A sinus arrest will occur whenever the sinus node becomes so diseased that it ceases to fire impulses appropriately.

- A pause greater than **3 seconds without atrial activity** is strongly suggestive for SND.
- A well-trained athlete occasionally can produce a pause greater than 2 seconds, but a 3-second pause is very unusual in a healthy individual.

3. Sinoatrial exit block:

- Sinoatrial exit block occurs whenever a conduction barrier within the sinoatrial node blocks exiting impulses directed to the atria.
- A way to distinguish sinoatrial block from sinus arrest is to examine the period of asystole. The pause that occurs in sinoatrial block typically is an exact multiple of the preceding **P-P** (not P-R) interval, whereas the pause observed in sinus arrest usually is not.
- Further in sinoatrial block, there may be a progressive shortening of the **P-P** (not P-R) intervals, before the asystolic period.

4. Chronic atrial fibrillation with **slow ventricular response**:

- This often implies underlying SND.
- Attempts at cardioversion typically produce a long sinus pause, followed by a slow unstable rhythm.

5. Tachycardia-bradycardia syndrome:

- This syndrome affects about 50% of the patients with SND.
- The term refers to alternating periods of atrial bradyarrhythmias and atrial tachyarrhythmias (atrial ectopic, junctional, re-entrant SVT, AF and atrial flutter).

- A long pause often follows spontaneous termination of the tachycardia.
- During this pause, patients frequently experience light-headedness or syncope.

Natural History:

- SND is almost always progressive, and patients usually become increasingly symptomatic if left untreated.
- The most important prognostic indicators are age, the type of arrhythmia, and the severity of concomitant heart disease.
- Patients whose SND manifests as sinus bradycardia have a better prognosis than those with tachycardia-bradycardia syndromes.
- Thromboembolic complications are a significant cause of morbidity and mortality. Tachycardia-bradycardia syndromes are the variants with the most significant stroke risk.
- Sudden cardiac death is possible at any point during the disease course.

Clinical Features

SND tends to be a disease of elderly people, with a peak incidence in the sixth and seventh decades of life. It may, however, be seen in younger age groups.

Because SND is a heterogeneous condition, its clinical manifestations may vary widely.

Important Points of History:

Presenting symptoms may include:

1. Asymptomatic:
 - In the early stages of SND, most patients are asymptomatic, and the condition may only be picked up on 12 ECG or ECG monitoring.
2. Syncopal episodes:
 - As the disease advances, however, patients will often seek medical attention for bradycardia-related symptoms, such as syncopal or near syncopal episodes.
 - Syncope and near-syncope (or dizziness) are the most frequently reported complaints

3. Palpitations:
 - Following syncope and near syncope palpitations are the next most frequent presenting complaint.
4. Stroke:
 - Stroke due to embolic phenomena may be the presenting feature.
5. Sudden death:
 - Sudden cardiac death is associated with this condition.

Important Points of Examination:

- 1 Physical examination alone never is never diagnostic.
2. Persistent bradycardia:
 - The most persistent finding is prolonged periods of bradycardia, appearing in as many as 75% of patients.
2. Response to the Valsalva manoeuvre:
 - In a healthy individual, the Valsalva manoeuvre will normally increase heart rate.
 - In patients with SND, however, the heart rate usually does not respond appropriately (ie the heart rate will not change).
3. Response to exercise:
 - The heart rate does not increase appropriately with exercise.
4. Response to carotid sinus massage:
 - If carotid sinus massage provokes a sinus pause of longer than 3 seconds, SND should be considered.

Investigations

Any elderly person with unexplained, marked persistent bradycardia will require further workup.

Blood tests:

- FBE

- U&Es / glucose
- Cardiac enzymes (if an ACS is being considered)
- TFTs.

CXR

- As a baseline routine check

ECG:

- The best diagnostic test for SND is electrocardiographic documentation during a symptomatic episode.
- See above for electrocardiographic manifestations of SND.

ECG Monitoring:

- A 24 to 48 hour ECG Holter monitor.
- **Admission** for a period monitoring is more appropriate for those with malignant symptoms such as syncope.

Electrophysiological studies:

- These may be required to further define underlying pathology.

Management

1. Medication review:

- Patient's medications must be carefully reviewed.

Any medication that may depress the sinus node or cardiac conduction in general should be discontinued in these patients.

2. Cardiologist referral:

- If a diagnosis of SND is suspected, patients should be referred to a specialist electrophysiology cardiologist for further assessment and consideration of the placement of a pacemaker.

3. Asymptomatic SND:

- Asymptomatic SND may not require specific treatment *in the first instance*, but should nonetheless be closely monitored.
4. Pacemaker:
- Patients who get significant symptoms usually do so from sustained bradyarrhythmias.
 - The best treatment in these cases is a **permanent pacemaker**, in combination with medication to control any significant tachyarrhythmias.
 - The urgency on this will depend on the *severity* of the symptoms, as well as the overall risk profile of the patient.
5. Immediate management:
- Significant (symptomatic) sustained bradyarrhythmias are treated along conventional lines.
 - Significant tachyarrhythmias are generally short lived and better tolerated.

Extreme caution should be exercised in treating tachyarrhythmia cases with either cardioversion or medication because of the risk of severe subsequent bradyarrhythmias or asystole in patients who do not have a pacemaker.

Disposition:

Symptomatic patients suspected of having SND should be admitted for a period of ECG monitoring followed by a cardiac consultation.

Patients with significant symptoms such as syncope should never be discharged home for an outpatient Holter monitor.

Patients with no symptoms or minor symptoms of palpitations or non-compromising dizziness may be considered for an outpatient Holter monitor.

References:

1. Sinus Nodal Dysfunction in Understanding Electrocardiography: Conover 7th Ed 1996, p.73.

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