Sick Sinus Syndrome

Gabriel Gregoratos, MD

Sick sinus syndrome (SSS) is the name given to several conditions in which the sinus node (also known as the sinoatrial or SA node) does not function normally.

What Is the Sinus Node?
The sinus node is the normal pacemaker of the heart and is responsible for the regular, rhythmic heartbeat. It consists of a collection of specialized cells located at the top of the right collecting chamber (right atrium) (Figure). These cells generate regular electric impulses that then spread through the atria and pumping chambers (ventricles) and cause the muscular contractions responsible for the pumping function of the heart. Under normal conditions, the sinus node produces 60 to 100 impulses a minute; this is the normal resting heart rate. The sinus node can increase the heart rate during periods of stress, such as exercise or high fever. Conversely, during quiet sleep, the sinus node may slow down to below 60 impulses, or beats, per minute. Well-conditioned athletes often have a slow heart rate at rest. This is normal and does not indicate the presence of sinus node malfunction.

What Is Sick Sinus Syndrome?
When the sinus node malfunctions several different abnormalities may result:

1. The heartbeat may become too slow for the demands of the body (also known as inappropriate bradycardia).
2. The heartbeat may become too fast even at rest (also known as inappropriate tachycardia).
3. The heart rate may alternate between fast and slow (so-called bradycardia-tachycardia syndrome).
4. There may be sudden pauses in the normal activity of sinus node (sinus pause or sinus arrest) of longer than 2 or 3 seconds’ duration.

SSS affects about 3 out of every 10,000 persons, and it becomes more common with advancing age. Drugs that are used for other cardiac conditions often may worsen or cause the development of SSS. Women and men are affected equally.

Who Is at Risk to Develop SSS?

1. Persons over the age of 65. As we age, the number of pacemaker cells in the sinus node decreases, and the normal wear and tear on the sinus node and the conduction system may result in SSS.
2. Persons who have suffered a heart attack (myocardial infarction) and who may have sustained damage to the sinus node.
3. Persons taking medications for high blood pressure and other cardiac conditions.
4. Persons taking medications for heartbeat that is too fast (tachycardia). Such medications include beta-blockers (for example atenolol), some calcium channel blockers (verapamil or diltiazem), digitalis, and others. These medications may contribute to the development of SSS.
5. Persons with high blood potassium (hyperkalemia) and other disorders of biochemical imbalance in the blood (electrolyte disorders). These abnormalities are usually the result of kidney diseases.
6. Persons with low-level thyroid hormone in the blood (hypothyroidism) and who may have a heart rate that is too slow.
7. Persons with sleep apnea, a condition in which breathing stops and starts repeatedly during sleep.
8. Children who have undergone corrective surgery (especially in the upper chambers) for a congenital heart defect.
9. Persons who have had diphtheria, muscular dystrophy, or amyloidosis. These are rare causes of SSS.
Chest pain (angina). This symptom

Fainting, near-fainting, or dizzi-
ness may develop:

1. Palpitations, or an unusual aware-
ness of one’s heartbeat. The per-
son may be aware of rapid and
forceful heartbeat, or of a sudden
brief cessation of heart activity
followed by an extra forceful beat
or by a rapid heart beat.

2. Fainting, near-fainting, or dizzy-
ness (syncope, pre-syncope, or
light-headedness). This group of
symptoms occurs when the heart is
unable to pump sufficient blood to
the brain because of a too slow or
too fast heart rate.

3. Fatigue and weakness. These
symptoms may indicate that the
heart is not pumping sufficient
blood to meet the needs of the
body. There are many other causes
for these symptoms besides SSS.

4. Confusion. When the blood supply
to the brain is decreased because
of erratic heartbeat, some persons
come confused and may have
difficulty understanding what is
happening around them. Confu-
sion can be especially disturbing
to older persons with SSS.

5. Chest pain (angina). This symptom
develops when the heart is not get-
ing enough blood either because of
blocked arteries or because of erratic
heart beat as in SSS.

6. Disturbed sleep. The erratic heart
rhythm may interfere with sleep and
wake people repeatedly at night.

How Is the Diagnosis of SSS Made?

Often a detailed account of a person’s
symptoms will suggest the diagnosis
of SSS. The diagnosis is confirmed by
a variety of different tests. The elec-

cardoigram (ECG) records the elec-
trical activity of the heart and is the
simplest. However, since the manifes-
tations of SSS come and go, the basic
ECG may not reveal the abnormal
heart rhythm. Therefore, when SSS is
suspected, physicians may order a
monitor that records a person’s heart-
beat continuously for 24 or 48 hours
(Holter monitor). For persons with
very infrequent symptoms, other types
of monitors are used, such as event or
loop recorders. The physician will of-
ten order other tests to make sure that
no other disease is present because the
symptoms described above can result
from other medical conditions as well.

How Is SSS Treated?

There are no medications that reliably
increase the heart rate in persons with
a heartbeat that is too slow. Most
persons with severe SSS symptoms
will therefore need to have an artificial
pacemaker implanted in their body. An
artificial pacemaker is a small elec-
tronic device that is inserted under the
skin of the upper chest, usually below
the collarbone. This device produces
regular electrical impulses whose
strength and rate can be adjusted.
These electrical impulses are then
transmitted to the heart by means of
wires that the physician inserts via one
of the patient’s large veins and guides
and anchors into one or two of the
heart chambers. Currently, SSS is the
most common reason for implanting
an electronic pacemaker. After a pace-
maker has been inserted, its function
must be monitored regularly.

Modern electronic pacemakers are
highly sophisticated devices that are able
to sense the needs of the body and auto-
matically adjust the heart rate accordingly.
In this way, they simulate the functions of
the normal sinus node. The artificial pace-
maker will take care of the heart rate that is
too slow or the prolonged pauses in per-
sons with SSS. For those persons whose
heart rate alternates between being too
slow and too fast (bradycardia-tachycardia
syndrome), medications that slow the
heartbeat may be required in addition to
the pacemaker. Before a decision is made
to implant an electronic pacemaker for
SSS, all non-essential drugs are usually
discontinued to see whether normal sinus
node function returns. Similarly, if a per-
son has other medical conditions which
may be precipitating the SSS, these condi-
tions are treated before an artificial pace-
maker is inserted.

Some persons with SSS who also have
other medical problems (especially rapid
irregular contractions of the heart, also
called atrial fibrillation) may be at a greater
risk of suffering a stroke. For this reason,
such patients may be given an anti-clotting
(anticoagulant) medicine such as warfarin
(sometimes referred to as blood-thinners).

Additional Resources

American Heart Association web site. Available
October 20, 2003.

North American Society of Pacing and Electro-
physiology web site. Available at: http://

WebMD. Available at: http://www.webmd.net.

US National Library of Medicine and National
Institutes of Health. MEDLINEplus health infor-
mation. Available at: http://www.nlm.nih.gov/

Braunwald E, Zipes DP, Libby P. Heart Disease: A
Textbook of Cardiovascular Medicine. 6th ed. Phil-
Sick Sinus Syndrome
Gabriel Gregoratos

Circulation. 2003;108:e143-e144
doi: 10.1161/01.CIR.0000102938.55119.EC
Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 2003 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/108/20/e143

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org/subscriptions/