

# Sick Sinus Syndrome—Case Reports

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## Introduction

**D**ISORDERS of the Sino atrial node play a major role in the causation and manifestation of cardiac arrhythmias. Sinus tachycardia is the commonest arrhythmia and is often detected both in normal healthy individuals as well as in persons with cardiac or systemic diseases. Sinus bradycardia on the other hand comprises a smaller group and sometimes heralds the appearance of sinus arrhythmia, atrial ectopics and runs of atrial tachycardias. Prolonged sino-atrial arrest with Adams Stokes Syndrome is its most dreaded complication. The hall mark of these arrhythmias is an unstable sino-atrial node with its capricious rhythm which ultimately leads to chronic atrial fibrillation. These chaotic sino atrial disturbances are collectively known as Sick Sinus Syndrome.

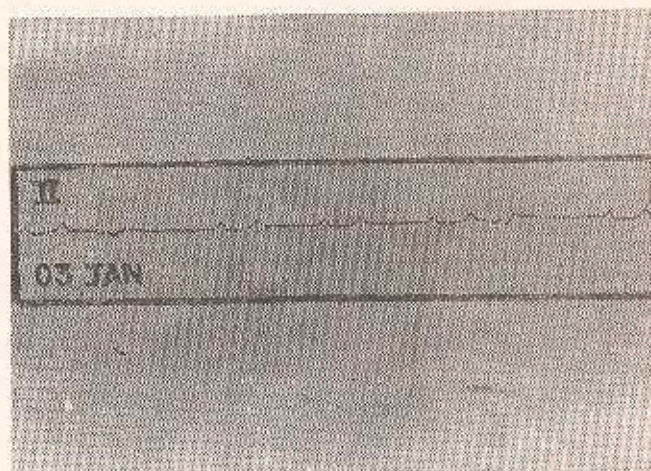
## Case Reports

Three cases of obscure brady-arrhythmia are selected from a large group of patients attending the cardiac clinic of Air Force Hospital, Bangalore. The brady-arrhythmic group consisted of much larger number of patients, majority of whom have been associated with acute myocardial infarction and have been excluded from this review.

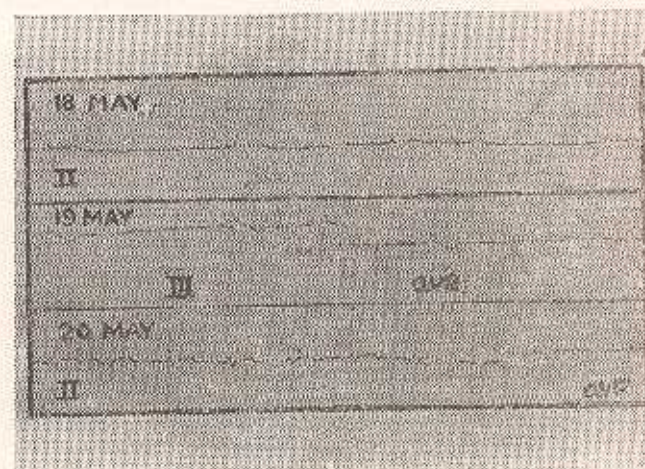
### Case No. 1

VRN, a 52 year old male an old case of Diabetes Mellitus was admitted to the hospital for stabilisation of Diabetic state. While under treatment, he complained of sudden giddiness and fainted for a few seconds. Examination revealed the pulse rate was 25 per minute with occasional irregular rhythm. There was no clinical evidence of congestive cardiac failure. Besides the marked bradycardia, cardiovascular system, lungs, abdomen were essentially normal. There was no evidence of neurological deficit. ECG (Fig. 1) showed rate 25 to 30/mt. He was treated with Atropine Sulphate

0.5 mg, parenterally at 4 hrly. intervals. Subsequent ECGs showed gradual increase in the heart rate ultimately returning to normal (Fig. 2). Investigations (Table I) did not show any other abnormality. On discharge from hospital he was found to have pulse rate of 50-60 per minute, regular, without



(Fig. 1)



(Fig. 2)

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any associated symptoms. The sick sinus syndrome noted in this case was attributed to Ischaemic Heart disease and the patient is under treatment and follow up.

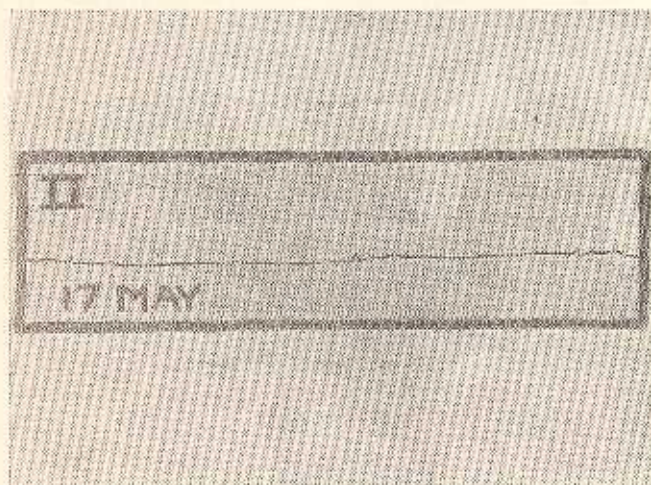
TABLE I

Sl. No.	Investigations	Names of cases		
		†V R N	S A H	P L D
1.	Blood Hb%	14.6%	15.4%	13.6%
	T L C	8600/cmm	7500/cmm	6800/cmm
	D L C	P68 E3 L30 M0	P66 E4 L28M2	P62 E2 L36 M0
2.	Urine RE	NAD	NAD	NAD
3.	Stool RE	NAD	NAD	NAD
4.	Blood Urea	20 mg%	25 mg%	32 mg%
5.	Blood Uric acid	3.5 mg%	2.6 mg%	3.4 mg%
6.	Serum Cholestrol	190 mg%	210 mg%	186 mg%
7.	Liver Function Tests	Normal	Normal	Normal
8.	Glucose Tolerance Test	*Normal (on drugs)	Normal	Normal
9.	X-ray chest	NAD	NAD	NAD
10.	Thyroid studies (I 131 uptake studies and scan)	Normal	Normal	Normal

† An old case of Diabetes mellitus who has achieved grade II control with Rastinon 500 mg tds before principal meals)

#### Case No. 2

SAH, a 25 year old male, aircrew, was referred for slow and occasional irregular pulse rate. He had no complaints. On physical examination besides the slow pulse rate with occasional irregularity there was no other significant abnormality. Pulse rate was 45 to 50/mt. Investigations (Table I) were normal. ECG showed rate 45 to 50/mt, sinus arrhythmia with multiple nodal ectopics (Fig. 3). ECG



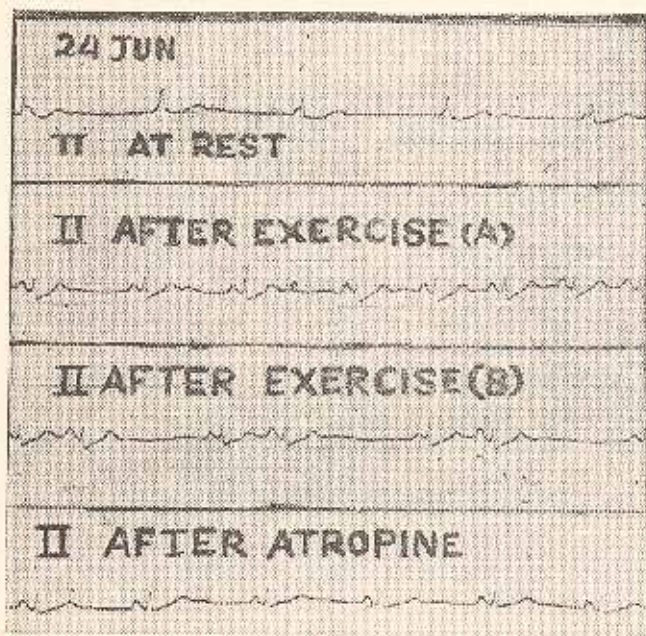
(Fig. 3)

after exercise showed increase in the heart rate (78 /mt) with disappearance of ectopics. There was no evidence of IHD in the post exercise graph. He was initially kept under observation in a lower medical category. Subsequently he has been reviewed repeatedly at Institute of Aviation Medicine and subjected to various physiological stress tests which yielded normal results. Since all the electrocardiograms done during and following the stress testings were normal and did not show any ST-T changes suggestive of Ischaemic heart disease, he has been finally upgraded to full flying category with recommendation for annual review with electrocardiograms. He is completely asymptomatic at present.

#### Case No. 3

PLD, 15 year old daughter of a serving person reported with complaints of retrosternal discomfort and exertional dyspnoea. She had suffered from fever for three weeks and was treated by a private doctor. During the illness she did not have palpitation, swelling of feet or face or shifting joint pains. On examination, the pulse was 45 per minute and regular. Systemic examination did not reveal any abnormality. Investigations as tabulated in

Table I were normal. ECG showed A-V dissociation, ventricular rate being 44/mt. On exercise, sinus arrhythmia (Fig. 4A) and sino-atrial block



(Fig. 4)

alternately—(Fig. 4B). After Atropine sulphate 1.0 mg was given parenterally, the rate improved to 50/mt, regular sinus rhythm. The arrhythmia was considered to be the after effect of an apparent attack of mild viral myocarditis. She has been therefore put on oral steroids and is maintaining regular rhythm (50-55/mt) without any further complaints.

#### Discussion

Sick sinus syndrome was coined by Lown<sup>6</sup> to describe "chaotic and unstable supraventricular rhythm disturbances following DC Cardioversion of chronic Atrial fibrillation." He defined this syndrome as "Chaotic Atrial Activity with continual changes in P wave contour with bradycardia interspersed with multiple and recurring ectopic beats with atrial or nodal tachycardia." Ferrer<sup>3</sup> broadened the definition to include: (1) Persistent, severe and unexpected sinus bradycardia; (2) Sinus arrest—brief or sustained with escape atrial or A-V junctional rhythm; (3) prolonged cardiac arrest with failure of subsidiary pacemaker resulting in total cardiac asystole; (4) Chronic atrial fibrillation with slow ventricular response not due to drug therapy

and (5) inability of the heart to resume sinus rhythm following electroversion for atrial fibrillation." It has also been referred to as Lazy Sinus Rhythm.<sup>8</sup> Persistent Sinus bradycardia is often the early sign of sino atrial diseases. It is difficult to distinguish the sinus bradycardia from the well known innocent physiological bradycardia of athletes. What may be passed as a normal and healthy heart's response in a person who is a long distance runner, or a weight lifter may well be a feature of sick sinus syndrome—only recognisable when complications like sino-atrial block, arrest, nodal rhythm or atrial fibrillation set in and may result in loss of life and aircraft.

Physiologically, the sinoatrial node has the highest rate of impulse formation which makes it the dominant pacemaker. Diseases of the sino-atrial node whether organic as in inflammation or infarction or functional from autonomic imbalance may lead to transient or prolonged failure of the spontaneous rhythmicity. When transient, sino atrial node suppression produces sinoatrial block temporarily. The possible mechanisms of this include (1) Disturbances of impulse formation; (2) abnormal conduction of impulses between the sinus node and atrial muscle—the so called exit block and (3) atrial unresponsiveness due to sub threshold impulse formation in the sinoatrial node<sup>9</sup>.

The rhythm in sick sinus syndrome may be classified into three groups: (1) Bradycardic; (2) Tachycardic and (3) mixed. Mixed rhythms such as alternating bradycardia and tachycardia—Brady-tachycardic syndrome—Short<sup>10</sup> and Bradycardia Tachycardia—Asystole syndrome—Adelman and Wigle<sup>1</sup>, are frequently observed in cardiac diseases and drug toxicities like digitoxicity.

There are various aetiological factors responsible for the Sick Sinus Syndrome. Some of them are mentioned here.

Arteriosclerosis of the artery to the Sino-atrial node results in circulatory insufficiency of the node<sup>11</sup>. Similarly atrial infarction involving the SA node may produce atrial arrhythmias including atrial fibrillation.

Thyrotoxicosis results in sinus tachycardia because of the chronotropic effect of thyroxine. Severe bradycardia is also described in thyrotoxicosis, ultimately ending in atrial fibrillation<sup>11</sup>.

The autonomic influences play a major role in variation of the rate of impulse formation. The sinoatrial node and atrium are richly innervated by both sympathetic and para-sympathetic nerve fibres, the pace maker cells being directly affected by the release of Acetylcholine and catecholamines<sup>4</sup>. Drugs like Isoprenaline, Atropine, Prostigmine have been employed to emphasise the autonomic effect on heart rate and it has been found that those who had underlying atrial pathology did not respond satisfactorily to these drugs, unlike those with normal hearts<sup>2</sup>. The former should literally mean sick sinus syndrome, though differentiation from the latter, the physiological bradycardia, is often difficult. Vagotonia, that is 'supernormal' Vagal reflex and adequate drug response is rare in incidence.

Intracranial injuries, especially subarachnoid haemorrhage<sup>5</sup> produce sinus bradycardia probably because of autonomic influence.

Side effects and toxicities of various drugs like Digoxin and Phenothiazine derivatives produce wide range of ventricular and atrial arrhythmias including the group comprising of sick sinus syndrome.

Myocarditis and cardiomyopathy may involve the sinus node, and in the earlier stages irritative phenomena like paroxysmal and transient episodes of arrhythmia result. Degeneration of the ganglionic plexus supplying the SA node both in Chagas cardiomyopathy and diphtheritic myocarditis produces sick sinus syndrome<sup>2</sup>

Whatever the underlying cause, it may be said that sick sinus syndrome results either from direct structural damage to the SA node whether ischaemic in origin or otherwise or from sympathetic, parasympathetic imbalance as a result of disturbances from the circulatory hormones or drug agents, or Neurovegetative derangement of the ganglionic fibres to the SA node by the disease process.

### Management

The treatment of the sick sinus syndrome is a challenging problem and is difficult because the rhythm is often unpredictable coming in paroxysm, it is often mixed, bradycardia alternating with tachycardia and the underlying pathology in these cases is often not identifiable or treatable. Vagolytic drugs like Atropine, sympathomimetic agents like Isoprenaline and Orciprenaline have been used variously in bradyarrhythmias because

of vagotonic effect. Treatment of the underlying cause has to be given due importance. Atrial pacing in such cases has been the most advocated line of treatment and often life saving<sup>7</sup>.

### Aeromedical implications

Cases of sinus bradycardia are occasionally seen during aircrew medical evaluation. The practitioner of Aviation Medicine should be aware of the significance of this syndrome and its implications in flying.

Such cases may precipitate serious atrial arrhythmia, atrial fibrillation and Adams Stokes syndrome while being subjected to stresses of flying such as hypoxia and positive 'G' forces. Atrial infarction may also result. These cases must be fully investigated to exclude organic diseases. If there is no evidence of any organic disease, they should be kept under observation before being diagnosed as benign physiological bradycardia. Before being cleared for full flying, these cases should be subjected to investigations under physiological stress conditions such as hypoxia, hypothermia and + Gz stress as well as tilt table studies.

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