

SINUS TACHYCARDIA



American assault troops, about to land on Omaha beach Normandy, June 6 1944.

“...I gazed with awe at the hundreds of ships and boats off Omaha Beach below. All were headed toward the beach landing site and it appeared from our altitude that one could almost step from one vessel to another and walk between England and France...”

Henry Tarcza, B-17 El’s Bells Pilot, 95th Bomber Group, 8th Air Force, June 6 1944.

“...just before landing we could see heavy artillery shells bursting all up and down the beach at the waters edge under well directed fire. As I stood in line waiting to get off the LCI to a smaller craft to go into shore, I was looking toward land and saw a large shell fall right onto a landing craft full of men. I had been praying quite a bit through the night as we approached the French coast, but now I began praying more earnestly than ever. Danger was everywhere; death was not far off...”

Chaplain Burkhalter US Army, June 1944.

“...we were about three hundred yards from touchdown. The Germans opened up on us and as we got in closer, kind of shuddered to a halt as we bucked over a sandbar and the ramp went down. The first man off was on the middle of the ramp and he just went over on it. Oh dammit! The ramp was going up and down, up and down. I guess a wave had caused the landing craft to surge forward and it just smashed and killed him. It was a terrible sight and a terrible shock to everyone to see that man a healthy young man one minute and the next minute smashed to smithereens. You couldn't tell what he was. Everybody went over the sides. From then on it was screams and hollering and people drowning and getting hit and fear. It was bedlam, chaos...”

J.R Slaughter 116th Infantry, 29th Division, June 6th 1944

“...we were about 200 feet from the beach when a shell blew off the front of our landing craft, destroying the ramp. My two best buddies were right in front of me, and they were both killed. When we went over the side of the landing craft, to avoid the machine gun fire, the water was about 12 feet deep. After the shell hit, it was pretty much everyone for themselves...”

R. Alm, US Ranger Battalion, June 6th 1944

“...as the first men jumped, they crumpled and flopped into the water. Then order was lost. It seemed to the men that the only way to get ashore was to dive head first in and swim clear of the fire that was striking the boats. But as they hit the water, their heavy equipment dragged them down and soon they were struggling to keep afloat. Some were hit in the water and wounded. Some drowned then and there...”

Official History Historical Division, 1st Battalion 116th Regiment, June 6th 1944

“...I was in the green sector of Omaha beach. The sea was very rough. When we got there the little hatch opened and bullets showered people near the front of the boat. Then another craft landed next to us and the attention of the bullets turned to them... it was over so quickly, I never knew how lucky I was...”

Tom Bradley, US Rangers, June 6th 1944

“As I look back through those hectic days just gone by, I agree with Ernie Pyle, that it was a pure miracle we even took the beach at all. Yes there were a lot of miracles on the beach that day. God was on the beach D-Day; I know He was, because I was talking with Him...”

Chaplain Burkhalter US Army, June 1944.

There are 3 main groups of causes of a sinus tachycardia including drug induced, normal physiological responses and pathological responses. A great many of the assault troops of the Omaha landings would undergo all 3 responses. Large amounts of cigarettes and alcohol were consumed in the hours leading up to the order to “embark”. The tachycardic response to stress was extreme as the “ramps were let down” on the beachheads. Tragically thousands also suffered the third pathological tachycardic response due to wounds received on that day.

SINUS TACHYCARDIA

Introduction

Sinus tachycardia is the result of an elevation of the rate of the SA node pacemaker.

It does not usually require specific treatment itself; rather treatment is directed at the underlying cause.

Patients with a persistent sinus tachycardia must always be thoroughly evaluated to rule out the possibility of serious underlying pathology.

Physiology

The “normal” heart rate in adults is arbitrarily defined as between **60-100 bpm**.

The mean heart rate is **70 to 75 bpm**.

Hearts rates **greater than 100** are considered to constitute a tachycardia.

Young athletic adults can reach heart rates of up to 200 beats/min during strenuous exercise. This maximal rate declines with age, roughly according to the following formula:

- Maximal heart rate = 220 bpm - age

Pathology

Causes

1. Physiological:
 - Psychogenic:
 - ♥ Anxiety, stress, emotional responses.
 - Pain
 - Exercise
2. Drugs, including in particular:
 - Any sympathomimetic agent
 - Any anti-muscarinic agent.
 - TCA in overdose
 - Alcohol

- Nicotine
- Caffeine
- Early **drug withdrawal** symptoms, in particular alcohol, sedative-hypnotic agents.

3. Pathological:

- **Fever**
 - ♥ Including occult sepsis, *even in the absence of fever.*

- **Hypovolaemia**, from any cause
- Tissue **hypoxia** from any cause:

Low PaO₂

- ♥ Hypoxic hypoxia:

e.g. pneumonia, pulmonary embolism, chronic heart or lung disease of any cause.

Normal PaO₂

- ♥ Anaemic hypoxia (non-functioning Hb, from any cause)
- ♥ Stagnant hypoxia (poor perfusion from any cause)
- ♥ Histotoxic hypoxia (impaired tissue utilization of O₂)
- Hypercarbia (from any cause).
- Cardiac disease:
 - ♥ Myocardial infarction:
 - ♥♥ Sinus tachycardia occurs in one-third or more of patients with myocardial infarction. It occurs secondary to increased sympathetic tone.
 - ♥ Myocarditis:
 - ♥♥ A persistent unexplained tachycardia can be seen. If there is a fever present, then the tachycardia will often be “out of proportion” to this.

- Autonomic dysfunction/ neuropathies
 - ♥ e.g.; Postural orthostatic tachycardia syndrome (**POTS**).
- Endocrine:
 - ♥ Thyrotoxicosis
 - ♥ Pheochromocytoma
- A-V fistulas

Differential diagnosis:

This will primarily be from intrinsic cardiac arrhythmias:

1. SVT
2. Atrial flutter with 2:1 block

Clinical context will be important in assisting to make the distinction from a sinus tachycardia.

Clinical Assessment

Important points of history

1. Anxiety / stress / emotional disturbances
2. Medications
3. Drugs:
 - Alcohol, caffeine, nicotine, illicit drug use.
4. Co-morbidities
5. Associated symptoms:
 - Dyspnoea, pain, dizziness etc.

Important points of examination

1. Assess all vital signs:
 - Fever
 - SaO₂

- If the tachycardia is related to upright posture, in the absence of any significant hypotension, then POTS should be considered.
 - Blood pressure
 - Respiratory rate.
2. Consider the possibility of a GIT bleed.
 3. Consider the possibility of thyrotoxicosis, and look for associated signs.
 4. Look for signs of anaemia.

Investigations

Depending on the clinical setting, no investigation may be necessary.

Each case is investigated according to the index of clinical suspicion for a serious underlying pathology.

The following may need to be considered:

Blood tests:

1. FBE
2. CRP
3. U&Es/ glucose
4. ABGs/ VBGs/ lactate
5. TFTs
6. D-Dimer
7. Metanephrine levels (for phaeochromocytoma).

ECG

1. Rate > 100 (by conventional arbitrary definition).
2. Regular
3. P wave features:
 - P are waves related to each QRS complex with 1:1 A-V conduction.

- P waves are normal in morphology, unless there is pre-existing pathology.
- In very fast rates, P waves may become hidden within the preceding T wave, (sometimes causing a “camel hump” superimposed on it)

Rates approaching and exceeding 150 may be difficult to distinguish from an SVT or atrial flutter with 2:1 block.

Management

Treatment will depend on:

- The degree of tachycardia
- The patient’s clinical state.
- The underlying cause.

Management issues include:

1. Sinus tachycardia does not usually require specific treatment of itself, rather treatment is directed at the underlying cause.
2. For rates of 150 and greater, more so in adults and elderly be suspicious of a tachyarrhythmia such as SVT.

If there is no apparent cause for the tachycardia such as hypovolaemia or hypoxia, CSM or a trial of adenosine may be considered, which will correct an SVT or unmask an atrial flutter.

3. Hypovolaemia and hypoxia must be ruled out in all cases of otherwise unexplained tachycardia.
 - Consider the possibility of hypovolaemia; the blood pressure may be normal
 - Consider the possibility of PE (the patient may not be hypoxic)
4. Drug related:
 - If the cause is drug related (eg amphetamines or TCA overdose) specific treatments may be considered, where these are available.
 - Keep in mind the possibility of an early drug **withdrawal syndrome**.
5. Myocardial infarction:
 - Since **persistent** tachycardia in a patient with acute myocardial ischaemia can result in larger infarcts and a more marked impairment in left ventricular function,

treatment of sinus tachycardia with beta blockers is appropriate in these cases, if there is not significant other contra-indications to these agents.

6. Children:

- Note that children tolerate tachycardias far better than adults do.

Rates of 150 or more are not uncommon in children being treated with ipratropium and salbutamol for asthma and are well tolerated and require no specific treatment.

Disposition

Beware of *sustained unexplained* sinus tachycardias in adults (>110 especially).

- There will almost certainly be an underlying cause.
- If there is no obvious cause, these patients should be kept under observation until one becomes apparent or underlying illness can be ruled out.

References:

1. Chan TC, Brady WJ, Harrigan RA, Ornato JP, Rosen P. ECG in Emergency Medicine and Acute Care. Elsevier Mosby 2005

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