Sinus Node Dysfunction

이화의대
반지은
• Conflict of interest: non declared
Brady arrhythmia

- **Sinus node dysfunction** * sick sinus syndrome
  - Sinus bradycardia
  - Sino-atrial block (SA block)
  - Sinus pause, Sinus arrest
  - Tachycardia bradycardia syndrome

- **Atrio-Ventricular block (AV block)**
  - 1\textsuperscript{st} degree AV block
  - 2\textsuperscript{nd} degree AV block (Mobitz type I, II)
  - 3\textsuperscript{rd} degree AV block (complete AV block)
Disordered automaticity or impaired conduction of the impulse from the sinus node into the surrounding atrial tissue

1. **Extrinsic SND**
   - drugs, ANS influences that suppress automaticity and/or compromise conduction

2. **Intrinsic SND**
   - degenerative SA node, fibrous replacement of the SA node or its connection to the atrium
# Sinus bradycardia

![ECG waveform](image)

<table>
<thead>
<tr>
<th>Heart Rate</th>
<th>Rhythm</th>
<th>P Wave</th>
<th>PR interval (s)</th>
<th>QRS (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;60 bpm</td>
<td>Regular</td>
<td>Present before each QRS, identical</td>
<td>Normal, consistent (0.12 to 0.20)</td>
<td>Normal (&lt; 0.12)</td>
</tr>
</tbody>
</table>
Sinus bradycardia

• Causes
  1. vagal stimulation
  2. medicines (e.g. beta blocker, Ca-channel blocker, digoxin)
  3. hypothyroidism
  4. hypothermia

* Normally in some well-conditioned athletes
Inappropriate sinus bradycardia
Chronotropic Incompetence

• HR < 60 that doesn’t increase appropriately with exercise
• Usually defined as failure to attain 80% of maximal age predicted HR (MAHR) on exercise testing
• MAHR = 220-Age
Sino-atrial block (Sinus exit block, SA block)

• The sinus impulse is blocked within the SA junction (between SA node and atrial myocardium)

• 3 types of SA block
  1. First-degree
  2. Second-degree : type I, type II
  3. Third-degree
2\textsuperscript{nd} degree Sinoatrial block, type I

- PP cycle becomes progressively shorter
- No P waves & QRS complexes
- Pause is less than twice the preceding PP cycle

gradual lengthening of conduction time from the SA node to the atria
2\textsuperscript{nd} degree Sinoatrial block, type I
2nd degree Sinoatrial block, type II

- PP cycle is constant
- No P waves & QRS complexes
- Pause is twice the preceding PP cycle

Normal or slow regular rhythm is followed by a pause that is a multiple of the P-P interval usually (2-4)
2\textsuperscript{nd} degree Sinoatrial block, type II
✓ Multiple of the PP interval

SA block 3 times the normal PP interval

SA block 4 times the normal PP interval
SA block with escape junctional beat
3rd degree Sinoatrial block

- very similar to a sinus arrest

- third degree SA block: a failure to conduct impulses
- sinus arrest: a failure to form impulses
Sinus pause, arrest

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<tr>
<td>N/A</td>
<td>irregular</td>
<td>Each QRS identical. New rhythm begins after a pause.</td>
<td>Normal (0.12 to 0.20)</td>
<td>Normal (&lt; 0.12)</td>
</tr>
</tbody>
</table>

- The P-P interval during the pause is **not a multiple** of the P-P interval of the underlying rhythm.
Sinus pause, arrest

Sinus pause is not a multiple of the PP interval

Sinus arrest is longer than a sinus pause and is not a multiple of the PP interval
Sinus pause

Long sinus pause
/sinus arrest
Sinus arrest with junctional escape beat
**Junctional Rhythm**

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<tbody>
<tr>
<td>40-60 bpm</td>
<td>regular</td>
<td>Variable (none, antegrade, or retrograde)</td>
<td>None, short or retrograde (&lt;0.12)</td>
<td>Normal (&lt; 0.12)</td>
</tr>
</tbody>
</table>
Tachycardia-Bradycardia syndrome

- a variant of sick sinus syndrome
- the arrhythmia alternates between slow and fast heart rates

- Usually, symptomatic long pause after termination of atrial fibrillation, atrial flutter, or atrial tachycardia
Tachycardia-bradycardia syndrome

Atrial fibrillation

Sinus pause 3528ms
Molecular and electrophysiological mechanisms underlying TBS
Diagnosis Algorithm of SND

Symptomatic SA node dysfunction → Surface ECG → Ambulatory ECG recording → Exercise testing → Drug test (atropine, isoproterenol) → EPS
EPS

• Indication

✓ The symptomatic pts who has no ECG findings suggestive SND
✓ The symptomatic pts whom ECG fail to correlate with Sx
✓ The pts who develops SND on usual doses of drugs

Sinoatrial conduction time (SACT)
Sinus node recovery time (SNRT)
Sinoatrial conduction time (SACT)

- SACT(=A): 50-125 ms (normal)
- Prolonged SACT- suggest SA block
Sinus node recovery time (SNRT)

Symptomatic Sinus bradycadgia, TBS
# Recommendations for Permanent Pacing in Sinus Node Dysfunction 2012

<table>
<thead>
<tr>
<th>Class I</th>
<th>Class IIa</th>
<th>Class IIb</th>
<th>Class III</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. SND with documented <strong>symptomatic bradycardia</strong>, including frequent sinus pauses that produce symptoms. (C) 2. <strong>symptomatic chronotropic incompetence</strong>. (C) 3. <strong>symptomatic sinus bradycardia</strong> that results from required drug therapy for medical conditions. (C)</td>
<td>1. <strong>SND with HR&lt;40 bpm</strong> when a clear association between significant Sx consistent with bradycardia and the actual presence of bradycardia has not been documented. (C) 2. <strong>unexplained origin</strong> when clinically significant abnormalities of sinus node function are discovered or provoked in EPS studies. (C)</td>
<td>1. minimally symptomatic patients with chronic HR &lt; 40 bpm while awake. (C)</td>
<td>1. <strong>SND in asymptomatic patients</strong>. (C) 2. <strong>SND in patients for whom the symptoms suggestive of bradycardia have been clearly documented to occur in the absence of bradycardia</strong>. (C) 3. <strong>SND with symptomatic bradycardia due to nonessential drug therapy</strong>. (C)</td>
</tr>
</tbody>
</table>
Thank you for attention!