Inappropriate sinus tachycardia
Diagnosis and management

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SVT Case #1
Ablation of inappropriate sinus tachycardia

• At age 23 she underwent EP study at outside hospital: diagnosed with SVT
  – Dual AV node physiology “demonstrated”
  – Slow pathway ablation performed
• Symptoms worsen after the procedure
• At age 24, she undergoes a second EP study: no new SVT diagnosis found, patient shown to have “spontaneous runs of atrial fibrillation”.

SVT Case #1
Ablation of inappropriate sinus tachycardia

• At age 25, a 25 year-old woman with “SVT”
• At age 16 she had sustained a humerus fracture during cheer leader practice in high school
  – Complicated with Reflex sympathetic dystrophy
  – Persistent pain
  – Treated with periodic sympathetic nerve blockade
• Palpitations with minimal physical activity
• Patient worked as a paramedic in an ambulance service.

SVT Case #1
Ablation of inappropriate sinus tachycardia

• At age 23, she undergoes cryoablation of AF; complicated by a “moderate” pericardial effusion, which is not drained.
  – Effusion remains stable and hemodynamically stable
  – Discharged 1 week later
• Symptoms of palpitations remain unchanged
• Six weeks after discharge, she develops low-grade fever and severe chest pain.
• Pain and fever resolve with anti-inflammatory treatments
• Palpitations unchanged

Inappropriate sinus tachycardia
Olshansky B et al JACC Vol. 61, No. 8, 2013

• Subjective component: symptomatic ST at rest or with disproportionate physical activity
  – Gradual (but rapid) onset and offset (not so rapid)
  – Resting daytime sinus rates of more than 100 beats/min and average 24-h heart rates of more than 90
  – Normal slowing during sleep
• Typically normal hearts
• Female:male ratio 10:1
• Common precipitating event: flu-like syndrome
• Multiple associated symptoms and coexisting conditions
• Exclude true SVT

SVT Case #1
Ablation of inappropriate sinus tachycardia

• MRI showed evidence of pericarditis
• Patient underwent 6 month treatment with steroids
• Open pericardiectomy and hybrid mapping and ablation
• Intermittent junctional rhythm followed.
• Pacemaker implanted
Inappropriate sinus tachycardia
Common associated conditions

- Irritable bowel syndrome
- Mitral valve prolapse
- Neurocardiogenic syncope/POTS
- Hyper/hypotension
- Migraine
- Pseudo-seizures
- Skin rashes
- Joint pain
- Fibromyalgia
- Cholestasis
- Asthma
- Unexplained/unreproducible neurological symptoms

Inappropriate sinus tachycardia
Pathogenesis

- Anti-β-receptor immunoglobulin G antibodies
- After adenosine, reflex increase in the sinus rate was greater in controls than in IST patients (21.2% vs. 8.5%, p<0.001), supporting the tenet that an accelerated intrinsic sinus rate is key.
- Initial event may be a trigger, such as a viral infection or toxin exposure

Inappropriate sinus tachycardia
Diagnostic workup

- Event monitor:
  - Heart rate temporal trend
  - P-wave identical to sinus
  - Exclude true SVT
  - Not tachycardic during sleep
- Exclude:
  - Hyperthyroidism
  - Carcinoid
  - Pheochromocytoma
  - Multiple sclerosis

Inappropriate sinus tachycardia
Treatment

- Behavioral measures:
  - Exercise: may trigger symptoms, but increases tolerance
  - Maintain hydration
  - Orthostatic maneuvers
  - Learn to "live with it"
- Pharmacological:
  - Beta-blockers: usually poorly tolerated
  - Ca-blockers: ineffective
  - Ivrabidine: worth trying

Ablation: Sinus node modification

- Last resort
- Risk of phrenic nerve damage
- Risk of SVC occlusion
- Risk of sinus arrest or unreliable sinus function
- Isoproterenol if no IST upon sedation
- Sequential ablation:
  - Dominant pacemaker site highest in SVC-RA junction
  - Subsidiary sites appear upon ablation
  - Usually 3-4 sites require ablation
  - Common incidental RA tachycardias
  - Endpoint: low RA rhythm at >20 bpm reduction
    - Junctional rhythm
Ablation: Phrenic nerve protection

Strategies for phrenic nerve protection

SVT Case #2
Ablation of inappropriate sinus tachycardia

- A 31 year-old female presented for a second opinion after multiple procedures performed at an outside institution.
- Initial presentation: palpitations after a slow recovery from a flu-like syndrome. SVT diagnosed on event monitor.
- June 2013: EP study: slow pathway ablation: symptom recurrence
- Event monitor: SVT of gradual onset and offset, occurring multiple times a day, rates up to 180 bpm

SVT Case #2
Ablation of inappropriate sinus tachycardia

- Treated with metoprolol, verapamil, diltiazem –alone and in combination. No response
- October 2014: sinus node modification.
- Syncopal episode 2 weeks later: sinus pauses of 6 seconds on subsequent monitor.
- December 2014: sinus node modification with epicardial balloon protection:
  - Despite this: continuing palpitations, recurrent pericarditis, and dyspnea attributed to phrenic nerve damage

SVT Case #2
Ablation of inappropriate sinus tachycardia

- After 6 ablations, two pacemakers, she presents to me for consultation. Pacemaker interrogation shows multiple episodes of atrial tachycardia at 460 ms cycle-length, correlated with pacemaker Wenckebach episodes and symptoms.
- Other conditions include: mastocytosis, asthma

SVT Case #2
Ablation of inappropriate sinus tachycardia

- After 3 ablations and a pacemaker, and now symptoms of palpitations (original complaint) plus pericarditis, plus phrenic nerve damage, she sees another electrophysiologist –in the same outside institution.
- March, 2015: second epicardial ablation (#4): better tolerated, but symptoms persist.
- Over 6 months failed flecainide, propafenone, dronedarone, sotalol, ivrabidine.
- September 2015: a 3rd electrophysiologist performs AV node ablation (#5) and upgrade to biventricular pacer
- March 2016: ablation of atrial tachycardia #6. symptoms persist

SVT Case #2
Ablation of inappropriate sinus tachycardia

- Harlequin syndrome
Ablation of IST outcomes: Acute

- Acute success rates were consistently high in all studies (88.9%)
  - Cranial to caudal migration of their activation sites with an eventual abrupt change in P-wave morphology
  - Caudal shift at an average of 23 ± 11 mm subsequent to ablation
  - Junctional rhythm was achieved in (41.6%), in all, an RA rhythm followed.

Conclusions
Ablation of inappropriate sinus tachycardia

- Recurrence in 19.6%
- One third remained on AAD: symptoms despite IST ablation success
- Repeat procedures in 15%
- Non-IST tachyarhythmias (27%) were a more common cause of symptom recurrence than persistent, drug-refractory IST (18%)
  - Atrial tachycardias
- Pacemaker implant required (9.8%)

Ablation of IST outcomes: Chronic

- Inappropriate sinus tachycardia syndrome – commonly more than just sinus tachycardia
  - Frequent extracardiac symptoms of dysautonomia
  - Frequent multiple other forms of atrial tachycardia
    - Some but not all represent alternative sites of sinus node exit
- Sinus node modification may lead to sinus pauses
- Multiple atrial tachycardias may arise
- Uncertain outcomes benefit.
- Avoid AV node ablation – a permanent problem without a solution