A Practical Guide to Dizziness and Disequilibrium
April 5, 2019

DISCLOSURES

• Nothing to disclose (no financial or pharmaceutical affiliations)
• All discussed pharmacologic treatments are off-label

POTS
POSTURAL ORTHOSTATIC TACHYCARDIA SYNDROME
**POTS**

- First case reported in 1982
- Disable postural tachycardia without postural hypotension
- Nosology is confusing due to several terms used in the past
  - Postural tachycardia syndrome
  - Hyperadrenergic orthostatic tachycardia
  - Shiopath orthostatic tachycardia
  - Neurocirculatory asthenia
  - Vasomotor asthenia
  - Hypodynamic beta-adrenergic state
  - Irritable heart
- Debilitating disorder that is not fully understood

**EPIDEMIOLOGY**

- Estimates
  - Prevalence: > 170 per 100,000
  - Over 500,000 Americans, primarily young woman (1999)
- Women (5:1)
- Childbearing age (15-50 years)
- Most patients have undergone a cardiac evaluation before neurology referral

**MORBIDITY**

- Growing source of impairment and disability in working age people
- Debilitating with a functional impairment similar to CHF and COPD resulting in poor quality of life
- Sources of disability
  - Dizziness during even simple activities (eating, showering, and low-intensity exercise) reduces standing time and activity level
  - Severe fatigue and attentional problems may limit ability to work, attend school and to exercise
  - Comorbidities
    - Disability correlates with psychological variables
    - Misdiagnosis with panic attacks
NORMAL RESPONSE TO STANDING

- Reduction in central blood volume
  - 0.5 to 1.1 L of blood pools in lower body
- Sympathetic activation increases
  - PVR
  - Venous return
  - Heart rate (10-25 bpm)
    - 3 seconds: rapid increase (innervation of vagal tone - exercise reflex)
    - 10-15 seconds: gradual increase (a baroreceptor reflex)
  - Central command - an excitatory signal from brain center to brainstem

PATHOPHYSIOLOGY OF POTS

- Circulating norepinephrine
- Auto-antibodies
- Alpha 1 adrenergic receptor
- Beta adrenergic receptor
- Peripheral vascular innervation
- Vasodilation
- Renal sympathetic innervation
- Renin and aldosterone
- Angiotensin II
- Total blood volume
- Central blood volume
- Red cell volume
- Venous capacitance
- Capillary permeability
- Venous return
- Stroke volume
- Left ventricle size
- Exercise max O₂ uptake

ONSET

- Triggers
  - Concussion
  - Post-viral
  - Surgery
- Gradual
  - Increased venous wall elasticity?
  - Prolonged bedrest
HYPOVOLEMIA AND VENOUS POOLING


CARDIAC ATROPHY

- Cardiac MRI performed on a group of patients with POTS
  - 16% reduction in cardiac mass compared to age-matched controls
  - 20% reduction in blood and plasma volume
- It was hypothesized that the marked tachycardia during orthostasis was compensatory to the smaller stroke volume resulting from a small heart coupled with reduced blood volume.

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KEY MECHANISMS

- Cardiovascular mechanisms of POTS
  - Small heart
  - Reduced blood volume
  - Venous pooling
CLINICAL PRESENTATION OF POTS

CRITERIA FOR POTS

1. Heart rate increase ≥30 beats per minute from supine to standing within 10 min
2. Symptoms get worse with standing and better with recumbence.
3. Symptoms last ≥6 months
4. Absence of orthostatic hypotension
5. Absence of other overt cause of orthostatic symptoms or sinus tachycardia (e.g. anemia, dehydration, hyperthyroidism, pheochromocytoma or cardioactive drugs such sympathomimetics or anticholinergics)

COMMON CLINICAL FEATURES

- Orthostatic intolerance
  - Brain hypoperfusion
    - Dizziness, lightheadedness, weakness, blurred vision, fatigue upon standing
    - Near-syncope and syncope
  - Sympathetic activation
    - Palpitations, tremulousness, anxiety
- Chronic symptoms
  - Fatigue
  - Brain fog
  - Heat intolerance
  - Gastrointestinal symptoms
  - Chest pain
PHYSICAL EXAM

- Orthostatic vitals
- Dependent acrocyanosis
- Small-fiber sensory exam
- Beighton score

AUTONOMIC EVALUATION

- Autonomic Evaluation (Tilt table test)
- ECG
- Anemia or electrolyte abnormalities
- Additional testing depends on additional symptoms
CONDITIONS ASSOCIATED WITH POTS

- GI (IBS, eosinophilic esophagitis)
- Joint hypermobility/Ehler’s Danlos type III
- Fibromyalgia
- Chronic fatigue syndrome
- Vasovagal syncope
- Migraine
- Mast cell activation disorder
- Interstitial cystitis

DIFFERENTIAL DIAGNOSIS

- Structural cardiac disease
- Inappropriate sinus tachycardia
- Neurocardiogenic syncope
- Pheochromocytoma (paroxysms of hyperadrenergic symptoms)
- Other causes of orthostatic symptoms or tachycardia (anemia, acute dehydration, medications, adrenal insufficiency)
- GI illness with hypovolemia
- Panic and anxiety

MANAGEMENT OF POTS
BACKGROUND

- No FDA-approved treatments for POTS
- No long-term randomized blinded placebo-controlled trials
- Optimal management is multidisciplinary
- First-line treatment is non-pharmacological

APPROACH TO TREATMENT

- Education
- Optimization of circulation
  - Tanking up (hypovolemia)
  - Squeezing up (venous pooling)
  - Exercise (deconditioning)
- Adaptation to limitations

HYPOVOLEMIA

- Non-pharmacologic
  - Fluids: > 64 oz/day
    - Rapid ingestion of 500 cc of tap water
    - Up to 12 grams NaCl daily
    - Take salt
    - Salt tablets
- Pharmacologic
  - Fludrocortisone (0.05 mg qod - 0.1 mg/d)
  - Side effects:
    - Edema
    - Hypokalemia
    - Headache

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TREATMENT OF VENOUS POOLING

- Non-pharmacologic:
  - Compression stockings (30-40 mmHg, knee high)
  - Abdominal binder
  - Physical countermaneuvers
- Pharmacologic:
  - Pyridostigmine 30-60 mg tid
  - Midodrine 2.5-10 mg tid
  - Droxidopa 100-600 mg tid

DECONDITIONING

- Cardiovascular Exercise in POTS
  - Rowing, semi-recumbent bicycle, swimming
  - Short-term (i.e., 3 months) exercise training
    - Increases cardiac size and mass
    - Increased blood volume
    - Even cured POTS in several patients
- Referral
  - PT prescription for graded aquatherapy with transition to land
  - Cardiovascular rehabilitation

HYPERADRENERGIC STATE

- Troubled adrenergic symptoms (palpitations)
  - Beta-blockade
    - Propranolol 20 mg daily
  - Sinus node ablation
    - Not effective
  - Ivabradine
    - Inhibits f-channels within the SA node
  - Central sympatholytic agents (clonidine)
    - Equivocal data in POTS
PROGNOSIS

- Limited longitudinal data
- Most patients have a favorable prognosis
- Relapsing-remitting course

TAKE HOME POINTS

- Multidisciplinary team approach
  - Autonomic Neurology:
    - Testing: Clinical Neurophysiology, Lab (414) 805-4169
  - Comorbidities
    - Migraines: Headache specialist
    - Eczematoid: Allergy
    - GI symptoms: Gastroenterology
    - Interstitial cystitis: Urogynecology
  - Joint hypermobility
    - Orthopedics Services (dislocations)
    - Pain Clinic (pain management)