QSART and Other Autonomic Tests: Evaluation of Cardiac and Sudomotor Function

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Common Tests of Parasympathetic Function

- Sinus Arrhythmia/E:I ratio/Deep breathing
- Valsalva Ratio
Common Tests of Sympathetic Function

- Continuous blood pressure analysis of Valsalva maneuver
- Fall in blood pressure upon standing or head up tilt (60 to 75 degrees)
- Sustained hand grip
- Cold Pressor
- Plasma catecholamines
- QSART (cholinergic fibers only)
Deep Breathing
Valsalva Maneuver
Sustained Handgrip

- Not used everywhere as normal values not as robust
- Maintain at least 30% maximum handgrip for at least 3 minutes
- Sympathetically mediated increase in blood pressure and heart rate
Not used routinely as quite painful. Robustness of normal values. Cold stimulus typically ice water in contralateral hand. Mediated by spinothalamic fibers, hypothalamus, adrenergic fibers. Typically see increased blood pressure and heart rate.
Orthostatic Vital Signs

- Most simple way to test sympathetic system
- Ideally have patient lay supine for at least five minutes before obtaining blood pressure, heart rate
- Have patient stand at least five minutes if tolerated
- Obtain blood pressures and heart rates at 1, 3, and 5 minutes. Some patients will not have an immediate drop in BP, but if symptomatic most likely will occur within 5 minutes of standing
- Normal heart rate should not increase greater than 30 beats per minute.
- Systolic should not fall greater than 20 mm Hg, diastolic 10 mm Hg
Tilt Table
Tilt Table Testing

- Most experts agree on an angle of 60-75°.
- Length of tilt testing hotly contested.
  - Some neurologists argue 10 minute tilt sufficient.
  - Cardiologists argue for 30-60 minutes of tilting.
  - Depends on indication. To reproduce syncopal symptoms, a longer tilt may be necessary. For orthostatic hypotension/baroreflex evaluation, a shorter tilt is probably sufficient (or not needed).
- False positives: ~20-30% of normal volunteers will have syncope or feel pre-syncopal with prolonged tilting.
Thermoregulation

Nonthermal Influences

Thermoregulatory Center
Preoptic Anterior hypothalamus

Autonomic regulation
- Heat production
- Heat dissipation

Behavioral regulation
- Posture
- Voluntary Movements
- Selection of Environment

Thermoreceptors
Core temperature
Skin temperature

Body Shell
Body Core

Adapted from diagram in Low 1997, Clinical Autonomic Disorders
Innervation of sweat glands

- Sudomotor nerves are unique
  - Sympathetic postganglionic neurons
  - Use acetyl choline (Ach) as neurotransmitter
  - Other peptides are present but role is uncertain (VIP, CGRP, substance P)
- Mental/Emotional stresses induce sweat response (especially palms and soles)
- Apocrine secretion is not blocked by sympathectomy
Central Disorders affecting Sudomotor Function

- Multiple system atrophy
- Chronic multiple sclerosis (affecting brainstem/spinal cord)
- Stroke (affecting basilar artery territory)
- Fatal familial insomnia
- Spinal cord lesions
Peripheral Disorders Affecting Sudomotor Function

- Diabetic autonomic neuropathy
- Reflex sympathetic dystrophy
- Small fiber neuropathy associated with HIV
- Amyloidosis
- Chronic idiopathic anhidrosis
- Paraneoplastic autonomic neuropathy
- Acute Pandysautonomia
- Hereditary sensory autonomic neuropathy (Riley-Day Syndrome)
- Pure Autonomic Failure
Evaluation of Sudomotor Function

- Thermoregulatory sweat test
- Silastic Imprint
- Sympathetic skin response
- Quantitative sudomotor axon reflex test
Thermoregulatory Sweat Test (TST)

- Useful for assessing central and peripheral sympathetic sudomotor dysfunction
- Can be used to screen the whole body for focal areas of sweat loss or hyperhidrosis
- Is not quantitative
TST continued

- Ideally ambient air temperature and humidity needs to be controlled.
- Need to measure core and skin temperature.
- Temperature should be increased to 45-50° C, to achieve skin temperature between 38.5 and 39.5° C, oral temperature up to 38° C.
- Apply indicator powder before heating
  - Can use alizarin red, iodineated corn starch, iodine solution
- Evaluate pattern of sweating
TST abnormalities

From Low, Clinical Autonomic Disorders, 2nd ed., Lippincott
Silastic Skin Imprint

- Sweat stimulated with pilocarpine or acetylcholine
- Silastic material is placed over skin
- Sweat beads indent silastic material and can be quantified
- Measures sweat output from denervated gland
- Not routinely used in most autonomic laboratories
Sympathetic skin response (SSR)

- Commonly performed in EMG laboratory
- Noninvasive, quick, easy to perform
- Apply recording electrode to palm, plantar surface of foot with reference on dorsal surface.
- Record long enough to develop stable baseline, then use arousal stimuli such as loud noise, inspiratory gasp, etc. to increase the amplitude of the response.
- Typically 1-2 mV in amplitude.
Quantitative Sudomotor Axon Reflex Test (QSART)

- Sensitive measure of postganglionic sudomotor axon integrity
- Able to quantify amount of sweat produced
- Reproducible
- Noninvasive, easy to perform
QSART-Methodology

Adapted from Low P.A. Clinical Autonomic Disorders (1997) Lippincott
Caution: Medications affecting Autonomic Testing

- Anticholinergics
- Most antidepressants, especially tricyclics.
- Beta blockers
- Antihistamines
- Stimulants
Conclusions

- Autonomic testing is a helpful adjunct in some neurologic disorders
- The best test is the simplest!