

NASA 10-minute Lean Test* instructions:

Orthostatic intolerance (OI) is an umbrella term used to describe the development of symptoms while in upright posture that are relieved by reclining. Orthostatic hypotension (OH), neurally mediated hypotension (NMH) [or neurogenic orthostatic hypotension/NOH] and postural orthostatic tachycardia syndrome (PoTS) are terms used to describe variants of this response. The 2015 IOM/NAM clinical diagnostic criteria for ME/CFS establish that orthostatic intolerance is a common and often overlooked feature of illness that is objectively measurable. OI may contribute to dizziness, fatigue, headache, cognitive dysfunction, chest (palpitations, shortness of breath) or abdominal discomfort (nausea), tremor or anxiety and various pain manifestations. We recommend that all ME/CFS and FMS patients undergo a NASA 10-minute Lean Test to assess for orthostatic intolerance.

A baseline test will be most revealing if measures that reduce orthostatic intolerance are withheld before testing. For example: limit extra fluid and sodium intake, do not wear compression socks, and alter the intake of medications that might influence the test (see examples below). These treatments can be resumed after the test. Tools needed: Blood Pressure cuff and finger pulse oximeter. Two observers—one to obtain BP values and one to scribe and instruct.

Ask the patient to remove shoes and socks and lie down comfortably on a bed or exam table in quiet supine position for 15-20 minutes to reach circulatory equilibrium¹. After the 15-20 minutes, record the patient's blood pressure (BP) and heart rate (HR). Repeat a minute later. If repeat vital signs are not similar, retake until two consecutive readings are relatively consistent. The goal is to determine the average resting supine BP and HR.

Next, ask the patient to arise and stand up straight leaning against a wall; only shoulder blades should contact the wall, and heels should be approximately 6" from the wall. Coach patient to relax as much as possible. Once the patient is leaning against the wall, start the timer and record the first standing BP and HR. Repeat BP and HR measurements every minute for the next 10 minutes. Instruct patient not to talk and chat, except to report symptoms, and to resist moving feet or shifting weight. Observe patient for lightheadedness or signs of pre-syncope and stop the test if the patient is about to faint. Observe skin and extremities for swelling or changes in color and temperature. Assess cognition. Document any comments/patient symptoms as applicable. A template that can be used to record blood pressure and pulse follows on page 2.

General baseline test preparation instructions, directed by provider, as appropriate for each patient.

- Ideally, withhold medications, supplements, or substances that might affect blood pressure or heart rate, with timing based on the drug half-life and patient safety.
- Examples: midodrine, fludrocortisone, beta blockers (e.g. propranolol, metoprolol or atenolol), stimulants (e.g. dexadrine or caffeine), tricyclic antidepressants (e.g. amitriptyline, doxepin or cyclobenzaprine), Serotonin Norepinephrine Reuptake Inhibitors (SNRI) e.g. duloxetine

The 10 min NASA Lean test can also be repeated while on OI treatments to assess efficacy and determine next steps of treatment.





Orthostatic Vital Signs/The NASA 10-minute Lean Test

	Blood Pressure (BP)		Heart Rate bpm	Comments/Symptoms
	Systolic	Diastolic		
Supine 1 minute				
Supine 2 minute				
Standing 0 minute				
Standing 1 minute				
Standing 2 minute				
Standing 3 minute				
Standing 4 minute				
Standing 5 minute				
Standing 6 minute				
Standing 7 minute				
Standing 8 minute				
Standing 9 minute				
Standing 10 minute				



*The NASA 10-minute Lean Test is a variant of a test used decades ago by NASA researchers to test for orthostatic intolerance²; it reduces muscular influences on venous return, a major cause of variability in orthostatic testing. Passive stand testing has been validated as an equivalent or superior measure of orthostatic intolerance as compared to Head-Up Tilt Table tests^{3,4}.

[1] Stewart, JM. (2013). Common Syndromes of Orthostatic Intolerance. *Pediatrics*. 2013 May;131(5):968-80. doi: 10.1542/peds.2012-2610. Epub 2013 Apr 8. Review. PMID: 23569093 Free PMC Article

[2] Bungo, M. W., Charles, J. B., & Johnson Jr, P. C. (1985). Cardiovascular deconditioning during space flight and the use of saline as a countermeasure to orthostatic intolerance. *Aviation, space, and environmental medicine*, 56(10), 985-990.

[3] Shvartz, E., Meroz, A., Magazanik, A., Shoenfeld, Y., & Shapiro, Y. (1977). Exercise and heat orthostatism and the effect of heat acclimation and physical fitness. *Aviation, Space, and Environmental Medicine*, 48(9), 836-842.

[4] Hyatt, K. H., Jacobson, L. B., & Schneider, V. S. (1975). Comparison of 70 degrees tilt, LBNP, and passive standing as measures of orthostatic tolerance. *Aviation, Space, and Environmental Medicine*, 46(6), 801-808.

