

# The Head Up Tilt Test to Diagnose Orthostatic Intolerance

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## Background

- Orthostatic intolerance (OI) affects approximately 500,000 Americans including:
  - Older adults
  - Women
  - Highly trained endurance athletes
- OI refers to the inability to maintain an upright posture without syncope. It is defined as:
  - A reduction of at least 20 mmHg systolic blood pressure (SBP) or 10 mmHg diastolic blood pressure (DBP) within 3 minutes of standing
- The consequences of OI are:
  - Decreased activities of daily living
  - Increased exercise intolerance
  - Increased cerebral, myocardial and lung ischemia
- The standard for diagnosing OI is the head up tilt (HUT) test

## Methods

- The HUT test should be performed in the morning in a temperature (20°C to 24°C) controlled, dimly lit room
  - ≥ 2 hour fast
- Participants are prepared for an electrocardiogram (ECG) and blood pressure (BP) assessment
  - Manual sphygmomanometer
- Supine rest is performed for 10 to 15 minutes on a tilt table
- Breathing rate controlled at 12 breaths/minute
  - Followed by supine assessment of:
    - ECG → Heart rate (HR)
    - SBP and DBP
- Participant is then strapped across the chest and at level of iliac crest
  - Tilt table is angled to 60 degrees (Figure 1)
- HR and BP are assessed immediately after the tilt and every minute of the test
- The HUT test is performed for 45 minutes
- A positive test is defined as syncope or severe presyncope (Table 1)
  - State of light-headedness
  - Decreased vision
  - Slow response to verbal stimuli
  - Nausea
  - Hypotension
    - SBP <80 mm Hg or HR <40 bpm, or both
- HUT test is followed by supine recovery and assessment of HR and BP every minute until near resting levels are reached

## Interventions

- Exercise training can improve OI
  - According to Fu et al. (2015) aerobic exercise performed in the semi-recumbent position 2-4 times per week supplemented with seated, machine weight resistance exercise can improve or abolish OI in individuals with postural orthostatic tachycardia syndrome (POTS)
- Exercise adaptations improve OI:
  - Cardiac remodeling → increased heart size and mass
  - Increased plasma volume → greater stroke volume and Frank Starling Mechanism
- Other non-pharmacological interventions to improve OI include:
  - Increases in water and dietary salt intake
  - Elevating the head during sleeping at night
  - Use of compression garments
- With the adaptations developed from exercise training and supplementation of aforementioned non-drug therapies, the individual may last longer on the HUT and experience fewer episodes of OI



Figure 1. Head Up Tilt Test

## Mechanisms

Table 1. Positive response mechanisms during HUT

Type of Positive Response	Haemodynamic characteristics accompanying syncope
Neurocardiogenic	Acute hypotension with or without bradycardia
Autonomic Dysfunction	Progressive and parallel fall in systolic and diastolic blood pressure
Orthostatic Postural Tachycardia Syndrome	Increased heart rate: 1. Increased heart rate ≥ 30 bpm in the first 10 minutes of tilting. 2. Heart rate ≥120 bpm in the first 10 minutes of tilting. 3. Increased heart rate ≥ 30 bpm when isoprenaline is infused at a rate of 1 µg/min.

Note: Adapted from "Tilt Table Test: State of the Art" by Gonzalo Baron-Esquivias and Antoni Martinez-Rubio. Indian Pacing Electrophysiol J. 2003 Oct-Dec; 3(4): 239-252. Published online 2003 Oct 1.

## Conclusions

The HUT test is an important tool used to diagnose OI. Following diagnosis, appropriate interventions can be made to improve quality of life and exercise tolerance.

## References

1. Barón-Esquivias, G., & Martínez-Rubio, A. (2003). Tilt table test: state of the art. *Indian pacing and electrophysiology journal*, 3(4), 239–252.
2. Fu, Q., & Levine, B. D. (2015). Exercise in the postural orthostatic tachycardia syndrome. *Autonomic Neuroscience*, 188, 86–89. <https://doi.org/10.1016/j.autneu.2014.11.008>
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