

# The Head-Up Tilt Test in Patients with Unexplained Syncope or Presyncope

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## Abstract

### Background:

Syncope is a relatively frequent medical event and its assessment is deemed an important aspect of medical practice in general medicine and cardiology. The present study had two main purposes: first, to assess the clinical history and characteristics of patients referred to our cardiology department with syncope or presyncope symptoms and second, to analyze the results of the head-up tilt test (HUTT) and its relations with other study parameters.

### Methods:

The present cross-sectional study was performed on 210 consecutive patients with unexplained syncope or presyncope referred to our cardiology department between 2002 and 2011. After history taking and physical examination, including age, sex, presenting symptoms, underlying disorders, history of drug taking, and orthostatic blood pressure measurements, holter monitoring, electrophysiological study, and neurological evaluation were performed in the patients with structural cardiovascular or cerebrovascular disease. The HUTT was performed using an electrically controlled tilt table with a footboard for weight bearing.

### Results:

Among the study participants, 193 (92.38%) patients had a positive result and among them, vasodepressor and mixed type were the common types. Study variables had no significant differences between the patients with positive or negative HUTT results.

### Conclusion:

Although the HUTT is suitable in syncope management, our study variables had no significant impacts on the results of this test and could not predict its results. (*Iranian Heart Journal 2012; 13(3):16-21*).

**Keywords:** Syncope ■ Presyncope ■ Head-up tilt test

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## Introduction

**S**yncope is a common disorder with an annual incidence rate between 1.3 and 2.7 episodes per thousand of population (1). Syncope is a relatively frequent medical event and its assessment is regarded as an important aspect of medical practice in general medicine and cardiology (2). Previous studies have shown that syncope occurs in nearly 3% of the emergency room visits and accounts for 6% of the general hospital admissions in the United States (3-4). In most patients with syncope, only counseling and reassurance are sufficient for patients; patients with frequent syncope can be severed with disability (5).

Currently, there is a global consensus that the head-up tilt test (HUTT) is useful for direct diagnosis of patients with syncope and presyncope symptoms.

The present study had two main purposes: first, to assess the clinical history and characteristics of patients referred to our cardiology department with syncope or presyncope symptoms and second, to analyze the results of the HUTT and its relations with other study parameters.

## Material and methods

### Study Population

The present cross-sectional study was performed on 210 consecutive patients with unexplained syncope or presyncope referred to our cardiology department between 2002 and 2011. We categorized the patients with a history of both syncope and presyncope as the syncope group. The study was performed by researchers who were members of a cardiac team with an interest in syncope. Our hospitals were tertiary centers with an active emergency room, from which most of the population were admitted or referred to the cardiology outpatient clinic.

We performed history taking and physical examination, including age, sex, presenting symptoms, underlying disorders (valvular heart diseases: mild mitral and tricuspid regurgitation; no significant coronary artery

diseases), history of drug taking, and orthostatic blood pressure measurements in all the patients. Holter monitoring, electrophysiological study, and neurological evaluation were performed in the patients with structural cardiovascular or cerebrovascular disease (6). The predominant baseline rhythm was determined according to the outpatient records. Written informed consents were obtained from all the patients, and the study was approved by our local Ethics Committee.

### Head-Up Tilt Testing

The HUTT was performed using an electrically controlled tilt table with a footboard for weight bearing. Heart rate was continuously monitored with twelve-lead surface ECG. Instantaneous blood pressure was recorded using sphygmomanometer blood pressure recording. We did not use any invasive instrument during stress. The patients had fasting overnight and all the medication (i.e., diuretics, vasodilators, and  $\beta$ -blockers) which might have impact on the HUTT results were withheld at least for two days before the study. The HUTT study was performed between 8:00 am and 21:00 pm in a quiet and standard room for temperature (21–25°C) with the lights dimmed.

The HUTT was conducted after an initial observation, with the patient in the supine position for 20 minutes. The test consisted of two consecutive stages. In the first or “passive” stage, the patients were tilted at 70° for up to 45 minutes without medication. If syncope did not develop, the patients entered the “active” stage. They received 400 $\mu$ g sublingual glyceryl trinitrate and continued to be tilted for another 15-20 minutes (6).

If syncope occurred during the test, the tilt table was rapidly adjusted to return the patient to the supine position, and the study was terminated. A cardiologist and a technician were present throughout the procedure. The patients were observed for 45 minutes after the test. The sensitivity and specificity of our protocol for the test were

70% and 94%, respectively. All the positive tests were classified according to the modified vasodepressor Syncope International Study (VASIS) classification (7). An “exaggerated response” to glyceryl trinitrate (GTN) was considered a negative response. This response is thought to be specifically due to the pharmacologic effects of nitrates, and is defined by Raviele et al. (8) as “the gradual development of symptoms of presyncope resulting from a progressive and slow (occurring in >5 minutes) decrease in systolic blood pressure with concomitant compensatory tachycardia or with only slight bradycardia occurring after a very prolonged period of marked hypotension (systolic blood pressure <60 mm Hg).”

### Statistical Analysis

The variables are expressed as mean  $\pm$  SD and percentages. Differences in the frequency of the characteristics were assessed via the independent sample Student *t*-test for the continuous variable (age). The chi-squared test (or the Fisher exact test if applicable) was used for the discrete variables (gender, underlying heart disease, presenting symptom, and type of positivity). The logistic regression model was employed for the assessment of the predictive value of the HUTT. A two-tailed *p* value <0.05 was considered statistically significant. We used SPSS\_ 13.0 (SPSS Inc. Chicago, IL, USA) for data storage and analysis.

## Results

### Baseline Patient Characteristics

Between 2002 and 2011, a total of 210 patients with unexplained syncope or presyncope underwent the HUTT at our center. There were 160 (76.2%) males and 50 (23.8%) females at a mean age of  $36.70 \pm 15.80$  years old (range =20-81years). The study population was comprised of 193 patients with a positive tilt test and 16 patients with negative results.

Among the patients, 56 (26.67%) patients had structural heart disease. Coronary artery diseases (35 cases, 62.5%) and valvular

heart diseases (15 cases, 26.78%) were common structural heart disease. Hypertensive heart disease and congenital heart disease were detected in 8.93% and 1.79%, respectively. The presenting symptoms were syncope in 72.38% (152 cases) and presyncope in 22.86% (48 cases) of the patients. Baseline rhythm was sinus in all of the patients. The baseline characteristics of the included patients are presented in Table 1.

Table 1- Characteristics of the study participants based on HUTT response

Type of positive responses		Negative response	Positive response	P value
Age		36.70 $\pm$ 15.65	35.68 $\pm$ 18.08	0.81
Sex	Male	148 (76.7%)	11 (68.8%)	0.54
	Female	45 (23.3%)	5 (31.2%)	
Underlying heart disorders	No	27 (15.8%)	5 (35.7%)	0.13
	Yes	144 (84.2%)	9 (64.3%)	
Drug consumption	Yes	56 (36.1%)	10 (62.5%)	0.04
	No	99 (63.9%)	6 (37.5%)	
Presenting symptoms	Syncope	142 (74.7%)	14 (87.5%)	0.25
	Presyncope	48 (25.3%)	2 (12.5%)	

### Result of HUTT

One hundred ninety-three (92.38%) patients had a positive result. Among the patients with positive HUTT results, vasodepressor (72.17%, 139 cases) and mixed (27.83%, 54 cases) were common types. In the comparison of the study participants with respect to the two types of positive responses, mean of age and frequency of sex, underlying heart disorders, drug consumption, and presenting symptoms had no significant differences between the two groups.

Table 2- Characteristics of the patients with positive tests based on the type of response

Type of positive responses		Vasodepressor type	Mixed type	P value
Age		36.87 $\pm$ 16.22	36.28 $\pm$ 14.21	0.81
Sex	Male	109 (78.4%)	39 (72.2%)	0.48
	Female	30 (21.6%)	15 (17.8%)	
Underlying Heart disorders	No	19 (15.1%)	8 (17.8%)	0.41
	Yes	107 (84.9%)	37 (82.2%)	
Drug consumption	Yes	43 (38.7%)	12 (27.9%)	0.14
	No	68 (61.3%)	31 (72.1%)	
Presenting symptoms	Syncope	103 (75.2%)	41 (77.4%)	0.75
	Presyncope	34 (24.8%)	12 (22.6%)	

### Predictors of Positive Response to HUTT

Using logistic regression, we did not find any predictor of a positive HUTT result. In our model, age (p value = 0.07), gender (p value = 0.83), presence of underlying heart disease (p value = 0.06), heart-related drug consumption (p value = 0.09), and presenting symptom before the test (p value = 0.33) failed to predict the result of the HUTT.

### Predictors of the Vasodepressor Type of Response

Using logistic regression among the patients with a positive response, gender (p value = 0.59), age (p value = 0.95), presenting symptom (p value = 0.83), underlying heart diseases (p value = 0.92), and heart-related drug consumption (p value = 0.47) were not predictors of the type of response to the HUTT.

### Discussion

The present study was performed to assess the responses of the study participants to the HUTT and determine the predictors of a positive response. Among our study participants, 193 (92.38%) patients had a positive result and among them, vasodepressor and mixed type were common types. The study variables had no significant differences between the patients with positive or negative HUTT results. In our logistic regression, none of the study variable had power of prediction of the HUTT results. To identify differences between the patients with positive responses and those with negative responses, several clinical factors and hemodynamic values during the HUTT were evaluated. There are controversial findings for the impact of age on the results of the HUTT.

Kochiadakis et al. (9) in a recent study reported that age could predict a different type of syncope response to the HUTT. Ebert et al. (10) presented a possible mechanism for an age-dependent clinical response to the tilt test, arguing that a lower body pressure in the elderly subjects caused less movement of the thoracic blood into the

lower extremities, which exerts a similar negative pressure in younger subjects. Lipsitz et al. (11) and Simpson and Wicks (12) found that elderly people had a low frequency of heart rate variability in response to orthostatic stress. Giese et al. (13) believed that elderly patients had higher blood pressure and maintained their blood better in comparison with young patients.

In the present study, the mean of age in the patients with vasodepressor type was slightly higher than that of the patients with the mixed type. We think that the aging heart and/or autonomic nervous system were unable to produce the suitable compensatory heart rate changes for the stress induced by the HUTT (14-18). Kochiadakis et al. (9) showed that sympathetic withdrawal in response to the HUTT was larger in elderly patients.

The positive pattern of the study participants in our study was related to vasodepressor and mixed type. Brignole et al. (19) reported that among patients with a positive response, the mixed type accounted for 53.5%. Perez-Paredes et al. (20) found that 50% of the patients with a positive response had the mixed type. Guzman et al. (20) reported a rate of 33.3% for the mixed type. In the present study, the mixed type was reported as 27.83% and was similar with the rates in the above studies. Our results had some limitations, first and foremost among which is that we performed the study only in two tertiary referral centers. Furthermore, the retrospective character of this study is another shortcoming.

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