

## ORIGINAL ARTICLE

## SHORT DURATION HEAD-UP TILT TEST: A COMPARISON WITH CONVENTIONAL LONG PROTOCOL IN PATIENTS OF ORTHOSTATIC INTOLERANCE

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**Background:** Orthostatic intolerance is development of symptoms during upright standing relieved by recumbency. An individual's predisposition to orthostatic intolerance (development of symptoms during upright posture) can be identified by Head-up Tilt Test (HUT). The aim of the present study was to compare the diagnostic yield (Percentage of patients tested positive) of short duration with conventional HUT. **Methods:** The study was conducted in Islamic International Medical College, Rawalpindi in collaboration with Armed Forces Institute of Cardiology/National Institute of Heart Diseases. A total number of 100 patients with orthostatic intolerance were studied. The conventional and short duration HUT protocols were compared. Conventional protocol had a passive tilt phase of 30 minutes and drug provocation phase of 20 minutes while the short duration protocol had both phases of 15 minutes, thereby reducing the test duration by 20 minutes. All patients underwent short duration HUT and patients with positive test were considered positive for conventional HUT as well. Patients having negative short duration HUT underwent conventional HUT after one week. Comparison was done using Chi-square statistics and  $p < 0.05$  was considered significant. **Results:** Diagnostic yield of short duration and conventional HUT was 53% and 63% respectively with no statistically significant difference between the two protocols ( $p = 0.15$ ). **Conclusions:** Head-up tilt test (HUT) is an effective investigative tool for orthostatic intolerance with satisfactory diagnostic yield. Short duration HUT may be substituted for conventional HUT to save time and to accommodate more patients.

**Keywords:** Orthostatic intolerance, Head-up tilt test, Nitroglycerine

### INTRODUCTION

Orthostatic intolerance is a broad term used for several conditions characterised by symptoms of light headedness, dizziness and faintness on assuming upright posture.<sup>1,2</sup> The underlying mechanism of orthostatic intolerance is the inability of the autonomic nervous system to maintain adequate haemodynamics of the body during upright posture resulting in cerebral hypoperfusion.<sup>3</sup> Cerebral perfusion pressure is largely dependent on systemic arterial pressure and any factor that decreases either cardiac output or total peripheral vascular resistance diminishes systemic arterial pressure and cerebral perfusion pressure.<sup>4</sup>

Upright posture is the most physiological orthostatic stressor and Head-up tilt test allows simulation of upright posture in carefully monitored and controlled conditions.<sup>5-7</sup> Head-up tilt table testing has emerged as an accepted modality for identifying an individual's predisposition to orthostatic intolerance as it is a safe, useful and cost-effective diagnostic tool greatly improving insight in the management of patients with orthostatic intolerance.<sup>7,8</sup> Pharmacological provocative agents like nitroglycerin or isoprenaline can be employed during Head-up tilt table testing to increase subject's susceptibility to orthostatic intolerance.<sup>9,10</sup>

The sensitivity of Head-up tilt test averages 35% without drug provocation and 57% with drug

provocation. Performed independently, Head-up tilt test has a relatively high specificity averaging 92% which comes down to 81% with drug provocation.<sup>5</sup>

The most commonly used Head-up tilt test protocols all over the world recommend a passive tilt phase of 30–45 minutes and if patient does not develop symptoms it is followed by drug provocation phase of 20 minutes.<sup>8-11</sup> Recently, researchers have shown that Head-up tilt test protocols with shorter duration of passive tilt phase are as effective as the conventional protocols.<sup>12</sup> The centre where this study has been done employed conventional Head-up tilt test protocols that consume minimum of 60 minutes for completion. A short duration (40 min) protocol and hypothesized that a shortened (40 min) Head-up tilt test protocol is as effective as the conventional (60 min) Head-up tilt test protocol. Therefore the diagnostic yield of short duration and conventional protocols were compared.

### SUBJECTS AND METHODS

Study was conducted at the Electrophysiology Department of Armed Forces Institute of Cardiology/National Institute of Heart Diseases (AFIC/NIHD) during one year from May 2006 to May 2007. A total of 100 patients with orthostatic intolerance who fulfilled the inclusion criteria of more than one episode of unexplained syncope, pre-syncope, dizziness, light headedness were included in the study.

Patients were tested from the outpatient department and wards of the Electrophysiology department of AFIC/NIHD, Rawalpindi. The data collecting tool was a structured questionnaire proforma which was filled for every patient with informed consent. Basic evaluation process was done to identify whether orthostatic intolerance was primary or secondary in nature.<sup>8,11</sup>

**Patient preparation:** Drugs disturbing the cardiovascular and autonomic nervous systems and those likely to affect intravascular volume were discontinued for at least twenty four hours before the test: ACE inhibitors, Calcium channel blockers,  $\alpha$ -Receptor blockers, Tricyclic antidepressants, Diuretics, Nitrates, Opiates.

The test was performed after eight hours of fasting to avoid vomiting and inhalation in case of appearance of symptoms or syncope.<sup>12-14</sup> Testing was conducted from 0800 to 1400 hrs, in a quiet environment, and at a constant room temperature. While in the Head-up tilt position, the patients were strapped to tilt table and asked to avoid movement of the lower limb musculature and joints in order to maximize venous pooling.<sup>4</sup> The staff present also ensured their still position before recording the test.

A physician experienced in advanced cardiac life support and advanced resuscitation equipment was immediately available for any type of emergency at all times.

**Head-up tilt test Protocol:** The differences in the protocols are shown in Table-1.

**Stabilization phase:** Lasted for five minutes in which patients were placed and properly strapped in supine position to tilt table and baseline heart rate and blood pressure measurements were obtained.<sup>14</sup>

**Passive tilt phase:** Patients were rapidly (in less than 10 seconds) tilted to 70° for orthostatic stress. The duration of passive tilt phase was 15 minutes in short duration head up tilt test and 30 minutes for conventional head-up tilt test. The test continued in case of no symptom with the drug provocation phase.

**Drug provocation phase:** The patients were administered 400  $\mu$ g of nitroglycerine sublingually.<sup>10,14,15</sup> It lasted for 20 minutes in conventional head up tilt test and for 15 minutes in short duration head up tilt test.<sup>10</sup>

**Post tilt phase:** The patients remained in a supine position for five minutes after drug provocation in supine position.

**Test Interpretation:** The test was considered positive if patient developed syncope, Pre syncope or abnormal heart rate and/or blood pressure response.

## RESULT

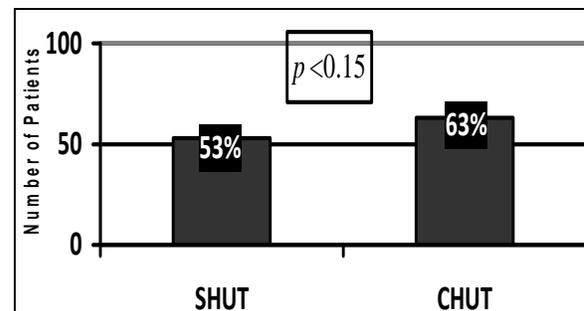
Out of 100 tests performed with short duration protocol, 53 patients had positive test thus the diagnostic yield of

short duration HUT was 53%. Sixty-three patients were positive for HUT including short duration and conventional protocols giving an over all diagnostic yield of HUT of 63%. The difference between the diagnostic yield of short duration HUT and conventional HUT was statistically non-significant (53% vs 63%,  $p=0.15$ ) (Figure-1).

**Table-1: Comparison of SHUT and CHUT protocols**

SHUT	CHUT
1. Pre tilt phase of 5 minutes	1. Pre tilt phase of 5 min
2. Passive tilt phase of 15 minutes	2. Passive tilt phase of 30 min
3. Drug provocation phase of 15 min	3. Drug provocation phase of 20 min
4. Post tilt phase of 5 min	4. Post tilt phase of 5 min
5. Total maximum duration of 40 min	5. Total maximum duration of 60 min

SHUT=Short duration Head up tilt test protocol  
CHUT=Conventional Head up tilt test protocol



**Figure-1: Comparison between short duration and conventional head-up tilt tests**

## DISCUSSION

The study was conducted to formulate a short duration protocol and compare its diagnostic yield with conventional long protocols. The proportions of positive responses in the study are comparable to those reported in the literature.

The tilt test protocols discussed in the study is one of the shortest which have so far have been studied. Nava et al shortened the passive tilt phase to 15 minutes and published their work in 2004.<sup>12</sup> With similar protocol as in the study, they reported 60.9% positive responses in 64 consecutive patients. However, in that study the comparison was between intravenous isoprenaline and shortened nitroglycerine protocol. In the study the comparison was with long and short nitroglycerine protocols. Bartoletti et al recommended 20 minutes of tilting followed by nitroglycerine provocation. This protocol yielded a sensitivity of 62%.<sup>10</sup> Del Rosso et al demonstrated that shorter duration protocols employing 20 minutes of passive tilt phase followed by 15 minutes of drug provocation with sublingual nitroglycerine provide satisfactory positivity rates ( $\approx$  63%) and specificity ( $\approx$ 95%) in younger patients as well as in older patients with recurrent unexplained syncope.<sup>16</sup> They reported positivity rate of 60% in patients under 65 years of age and 66% in

patients over 65 years of age.<sup>16</sup> All these studies compare favorably with our findings.

Studies with even shorter passive duration have been conducted. Bartolletti et al designed a test with passive phase of only 5 minutes.<sup>17</sup> To optimize the test they took a randomized intra-patient comparison of two protocols. They employed a conventional nitroglycerin test (cHUT) and an accelerated nitroglycerin test (aHUT) which consisted of passive upright posture at 60° for 5 min only to rule out orthostatic hypotension followed by sublingual nitroglycerine 0.4 mg spray, with the test continued for 20 min. Eighty four consecutive patients with unexplained syncope underwent both cHUT and aHUT in a randomized sequence with a 24–72 hr interval between them. Additionally, 25 age-matched control subjects underwent aHUT. They concluded that a passive tilt phase of 15–20 minutes is necessary to increase the sensitivity of the test. Their work again endorses that short duration protocol in which the study employs 15 minutes of passive drug free tilt.

Recently, newer studies are coming out which further reduces the duration of passive tilt phase, but more studies are required before these protocols can be adopted. Aerts *et al* in 2005 studied 38 consecutive patients.<sup>18</sup> The subjects were tilted to 70° for a maximum period of 30 minutes, and sublingual nitroglycerin 0.4 mg spray was administered directly after attaining erect posture and concluded that “nitrate stimulated tilt testing, without a preceding passive tilt phase, and limited to test duration of 15 minutes, provides an accurate, sensitive, and specific method to provoke vasovagal reactions in subjects with clinically suspected vasovagal syncope.”

## CONCLUSION

The study confirms that the diagnostic yield of short duration Head up tilt test protocol is similar to the conventional Head up tilt test protocol. On the basis of these findings it is recommended that short duration head up tilt test protocol may be substituted for conventional long duration protocol.

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