



Tilt Table Testing

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Introduction

Tilt table testing (TTT) was introduced decades ago for the evaluation of patients with unexplained syncope. Initially, it was welcomed enthusiastically through different medical specialties, but its use has decreased due to the recognition of several limitations when inappropriately employed. Nonetheless, the generalized consensus still stands that TTT remains an important diagnostic tool in the correct patient population.

Indications

TTT has been used for the evaluation of postural tachycardia syndrome, inappropriate sinus tachycardia, and vasovagal syncope. It is especially useful in the evaluation of recurrent episodes of syncope in the absence of organic heart disease, or in patients with prior cardiomyopathy diagnosis in whom other syncope etiologies have been excluded. Furthermore, TTT is also a practical option to discriminate between convulsive syncope and epilepsy, to establish a diagnosis of pseudosyncope, and lastly to evaluate patients with hypotension that are less likely to respond to

permanent cardiac pacing. Additionally the diagnosis of delayed orthostatic hypotension syndrome can be successfully made through TTT after all other diagnostic studies are negative. Nonetheless, it should not be used when the vasovagal syncope diagnosis is certain; or to guide therapy, its response, or lack thereof [1].

Contraindications

Though a high volume of TTT are performed on a yearly basis, the ordering clinician should be aware of its contraindications. While considered a safe test, complications still may arise from decreased perfusion to the heart, brain, or other organs. Some of the most important contraindications include a history of severe tachyarrhythmias, electrolyte imbalance, end-stage renal disease, left ventricular outflow tract obstruction, severe cerebral or coronary artery disease, hypotensive shock, recent stroke, and lower extremity fracture.

Equipment

The test is performed generally in the electrophysiology laboratory. A tilt table is required, and should be as comfortable as possible (Fig. 21.1). A blood pressure monitor, ECG machine, and oxygen saturation monitor are also needed. Since

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Fig. 21.1 The patient is secured on a padded table with may be placed in a variety of positions, as opposed to position



one of the possible complications is the development of dangerous tachyarrhythmias, a crash cart with defibrillator should be available. During the testing phase, the room should remain quiet comfortable by minimizing disruptive noises, or uncomfortable extreme range of temperatures.

Technique

Multiple protocols have been developed varying the angle tilt, its duration, and the concomitant use of pharmacologic agents. The patient is placed supine and vital signs are closely monitored to obtain a personal baseline. It is recommended that if venous cannulation had been performed prior to the test, the monitoring period should be longer. Another important consideration is to avoid invasive intra-arterial blood pressure monitoring during TTT because catheterization may induce in some individuals a vasovagal reaction.

The patient is positioned in a head-up position. The recommendation is that the tilt angle be between 60° and 70°; however, steeper angles have been described. Heart rate and blood pressures are recorded every 3–5 min and a symptom diary is maintained. Pharmacologic agents can

induce symptoms in patients that have remained asymptomatic. Isoproterenol, a non-specific beta agonist, used as an infusion is commonly employed. The infusion is titrated from 1–3 mcg/min to increase the heart rate up to 25% above the recorded baseline, and then the head-up tilt phase of the study begins. Another important consideration is that isoproterenol is contraindicated in patients with ischemic heart disease. Nitrates have also been showed to have some use in tilt table testing, as intravenous or sublingual formulations. Nitrates work by inducing venodilation, and, thus, reducing cardiac preload, stroke volume, and output. Yet, it does not hamper increases in heart rate or arterial constriction. Like isoproterenol, nitrates decrease the exam duration but are better-tolerated and easier to use [2].

Data Interpretation

Test interpretation depends on the clinical setting for indication in the first place. In patients without structural heart disease, TTT is determined to be diagnostic for different outcomes. First, for the evaluation of reflex hypotension or bradycardia that may, or not, be accompanied of spontaneous syncope. Secondly, when the patient develops

progressive orthostatic hypotension even if there are no associated symptoms. In selected patients being assessed for POTS, TTT may play a diagnostic role, but it is still discretionary to the ordering physician. In patients with structural heart disease, arrhythmias should be excluded before considering a test to be diagnostic. Reproduction of a syncopal event even in the absence of hypotension or bradycardia is in turn suggestive of psychogenic pseudosyncope. The rate of false positives and negatives depends on the patient population; however, these are difficult to estimate given that there is no gold standard testing for comparison.

If the patient has remained asymptomatic during TTT, and there is suspicion for false negative results, it is recommended that the test be repeated using isoproterenol. Though relatively safe for most patients, isoproterenol should be avoided in patients with angina and history of arrhythmia. While most make no discriminations regarding test results when isoproterenol is used, some cardiologists make the distinction that a test is positive only if there is loss of consciousness or postural tone. Nonetheless, the most current guidelines do not include separate diagnostic criteria for TTT with concomitant isoproterenol [2]. Nitrates, like isoproterenol, may also increase the rate of false positives. Trials comparing nitroglycerin to isoproterenol have been conducted, thus, showing similar results; however, sublingual nitroglycerine was simpler to administer, much better tolerated, and safer than low-dose isoproterenol [3, 4].

Complications

As previously stated, TTT is rather safe, and severe complications are rare; however, as with any other medical procedure, there are still some intrinsic risks that both patient and practitioner should be aware. Potential complications include, prolonged hypotension, tachyarrhythmias, syncope, and rarely asystole. Most of these complications resolve when the table is turned back to the horizontal position. Nonetheless, precautionary measures should be taken and readily avail-

able including cardiopulmonary resuscitation equipment.

Clinical Vignettes

Case 1 *Mrs. Jones is a 40 year- old lady that comes to the office for evaluation of syncope. She has a history of hypertension, hypothyroidism, dyslipidemia, and obesity. She takes synthroid 125 mcg daily, and her primary care physician discontinued hydrochlorothiazide over a year ago as her blood pressure seemed better controlled. She experienced her first syncopal event about 3 months ago while getting up from a chair, and then another one last week after standing for some time. She recalled that the same thing used to happen in her “ earlier years.” Before both events, she felt her vision darkened and the room spin for some seconds. Both events were witnessed, and the loss of consciousness was transitory and resolved by itself. There was no tongue biting or sphincter incontinence. She had no post- ictal period. However, per her son, there was some lower extremity jerking movements. She has undergone extensive diagnostic studies including brain images; thus far, no clear etiology given. She undergoes TTT with hypotension and reproduction of symptoms.*

Mrs. Jones has had two syncopal episodes that have prompted a medical evaluation. After extensive and thorough evaluation, there is no clear etiology. However, no pertinent positive findings have been noted. While it can be argued, that given the history, this is very likely consistent with vasovagal syncope, there is the confounding factor of lower extremity jerking, which can also be seen in syncope of cardiac nature. The TTT is considered to be positive given her vital signs response and reproduction of symptoms. Mrs. Jones should be advised regarding hydration, prolonged standing, or sudden changes in position. The patient should also be educated on abortive procedures if she experiences an aura.

Case 2 *A 28 year old woman is referred for the evaluation of recurrent fainting episodes. These*

started about 2 years ago, and have consistently recurred. She has no medical history, other than generalized anxiety disorder, and takes no medications or over the counter supplies. The episodes occur without an aura, or clear precipitating event. These last between 5 and 20 min, and the patient just experiences some residual weakness and left lower extremity weakness. She has undergone extensive neurologic evaluation (including MRI and EEG) without a definitive diagnosis. Furthermore, EKG and echocardiography do not show any abnormalities. At the primary care physician's office her blood pressure was borderline low, but otherwise her vitals were normal. She undergoes TTT, and her vitals remain unchanged but the patient experiences another episode. A psychiatry consultation is placed, and the diagnosis is changed to psychogenic seizures and possibly conversion disorder. With the patient and her family understanding the diagnosis, psychotherapy was started and follow up appointments were provided.

This patient comes with complaints of recurrent syncope without a clear explanation. There is always concern for seizures or syncope of neuro-cardiogenic nature. These seem to have been ruled out. The possibility of vasovagal syncope has to be considered. Her blood pressure was marginally low; however, this is a non-specific finding especially in young healthy indi-

viduals. TTTs that reproduce the loss of consciousness without changes in vital signs are suspicious for a psychogenic etiology. The patient and family should be engaged in the therapy, which should remain empathic and consistent throughout. It is crucial to recognize that most of these events are involuntary, legitimate, and disabling to the patient. She should enroll in behavioral and group psychotherapy, and considered for antidepressant or antipsychotic pharmacotherapy.

References

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