

The Value of Tilt Testing and Autonomic Nervous System Assessment



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KEYWORDS

• Syncope • Tilt testing • Implantable loop recorder • Autonomic nervous system function tests

KEY POINTS

- Tilt testing has been and remains valuable to study patients with syncope and related conditions, including the making of correct and precise diagnoses.
- Tilt testing has some shortcomings, some of which are overcome by the use of the implantable loop recorder.

HISTORY

Syncope was seldom studied in the 30 years before the advent of tilt testing in 1986.¹ The discovery of tilt testing as a means of precipitating syncope in the laboratory was serendipitous. An investigation was in progress into the hormonal changes of upright posture in carotid sinus syndrome but it proved difficult because most patients lost consciousness on the tilt table. This difficulty prompted the application of the tilt protocol to a group of syncope patients, who, at the end of exhaustive investigations, had no diagnosis. They also lost consciousness. Ultimately, an age-matched control group with no history of syncope was tilt tested when a tiny minority of them lost consciousness. The original *Lancet* paper¹ was written on this experience. At this time, there was a small but growing interest in using the tilt table to simulate upright posture. The Mayo Clinic had published results of using the upright posture during electrophysiological studies² and investigation of hypertensive and hypotensive patients with upright posture was ongoing at the Cleveland Clinic.³ In Denmark a group was using tilt whereby the subject was sitting astride a bicycle saddle supported by the footplate of the tilt table. Thus, the

subject was erect but with legs dangling without support. The research group had close to 100% syncope in their subjects to study hormonal changes before and at syncope so as to try to gain a better understanding of the fainting phenomenon.⁴ If the Cleveland Clinic were not already working on this technique for clinical syncope induction, they quickly presented data on the subject in 1988.⁵

IMPACT OF TILT TESTING

The impact on the nascent electrophysiological community in the late 1980s was profound. Presentations on the subject of tilt-induced syncope were striking and generated considerable interest. The test received enthusiasm and spread in its application. During this time, efforts were made to establish it, define its methodology,⁶ and gain experience in the technique.⁷ Recognition of the value of the test first came with an American College of Cardiology Consensus document on tilt testing for syncope.⁸

The series of European Society of Cardiology Guidelines on the diagnosis and management of syncope followed beginning in 2001 and was updated in 2004 and 2009.^{9–11} These documents

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were broad in concept and contained information on performance and interpretation of tilt tests. It could, however, be claimed that without the advent of tilt there would have been little to discuss. Gradually, in the 20 years since the introduction of the test in 1986, syncope has emerged as a subspecialty of electrophysiology with a considerable following sufficient to demand a minimum of several sessions at all electrophysiology meetings and contribute a substantial body of literature in major cardiology journals.

Tilt testing has been adopted by many neurologists with equal enthusiasm to that of cardiologists. However, the bulk of neurologists are not so involved and they prefer to refer when they deem necessary. The difference in selection of this test between the 2 specialties reflects the different personalities and training among the 2 groups. Most of those interested in this subject think that the fundamental problem is in the brain not in the heart. Cardiologists are doers; neurologists are more speculative. Thus, the former group thought in tilt testing that they had a means of making a diagnosis and having achieved that, therapy could follow. As is so often the case in medicine, the reality is far less clear.

NEGATIVITY TOWARD TILT TESTING

At the same time that tilt testing was becoming established in the early 2000s, evidence began to emerge that the test was certainly fallible. The series of studies now known as ISSUE 1¹²⁻¹⁴ was published in 2001. The first of these was particularly challenging for tilt testing. The investigators' group of patients with syncope but no evidence of heart disease was termed, "Isolated Syncope." Some of these patients experienced recurrent syncope with an implanted electrocardiogram (ECG) loop recorder and a surprising number had asystole or severe bradycardia not shown at tilt testing. Approximately half the Isolated Syncope group had negative tilt tests. Thus, this ISSUE 1 study¹² demonstrated that tilt testing could not always induce syncope in those that would have recurrences and that the rhythm disturbance during syncope was also not well predicted by the tilt test, there being a large number of severe bradycardias not seen on tilt. Until this time, investigators, generally, had been clinging to the idea that a patient's collapse pattern on tilt was reproduced spontaneously, despite there being little evidence to support this concept. This series of studies was followed by ISSUE 2,¹⁵ the findings of which, in this context, were very similar to ISSUE 1, only raising the possibility that asystole on tilt may give a high positive predictive value

for spontaneous recurrence of asystole. Since 2000, publications on the findings of implanted ECG loop recorder have been numerous¹⁶⁻¹⁸ and it was obvious that the diagnostic accuracy of what actually happens during a spontaneous attack was much more precise than tilt testing whereby syncope is forced.

In 2010, the United Kingdom body, the National Institute for Healthcare and Clinical Excellence, suggested that tilt testing should not be performed for the diagnosis of syncope.¹⁹ Their rather radical view stemmed from the evidence presented above. This professional and administrative body paid little attention to the widespread ability to undertake tilt testing, its remaining residual value, and its low cost.

It is true that a specialist in syncope is usually able to make a confident diagnosis of vasovagal syncope from the history of the patient and an observer of an attack, providing physical examination, 12-lead ECG, and orthostatic blood pressure measurements are normal.¹¹ Thus, tilt testing is then unnecessary. However, this ignores the fact that syncope is seen by a plethora of different kinds of physicians, many of whom are not experts in the field and unable to make the confident diagnosis referred to above. Requesting a tilt test is a facility considered valuable by many of these physicians. Moreover, it is a test, which is not costly, brings some expertise to bear on the patient's symptoms, is noninvasive, and often increases the patient's confidence in the diagnosis by precipitating an attack in front of a medical witness.

There are even more potent reasons not to abandon tilt testing now. Other diagnoses can be made by tilt testing than simple reflex or vasovagal syncope (VVS). These conditions can have similar presentations and can be very difficult for most physicians to separate from VVS on clinical grounds alone. The first of these is postural orthostatic tachycardia syndrome (POTS). This condition has an overlap with vasovagal syncope of up to 30%²⁰⁻²² and its management is different from VVS. The second of these is orthostatic hypotension whereby tilt testing shows the immediate (within the first 3 minutes of tilt) blood pressure decrease that does not occur in VVS. Again the management of this condition is different from VVS with neurologic input being mandatory except in those cases where the cause is iatrogenic by excessive hypotensive medication. The third condition for which tilt testing is required is psychogenic pseudosyncope.²³⁻²⁵ These patients appear to collapse on tilt with normal and largely unchanged physiologic parameters, a finding that not only determines the diagnosis

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