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Usefulness of the tilt table test: A "geriatric" point of view

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The tilt table test (TTT) (Figure 1) is an important tool of use for diagnosing neurally mediated syncope (NMS). The ESC guidelines for diagnosis and management of syncope recommend the TTT as an additional test to use when the first line diagnostic tests (i.e., medical history, standing test, and ECG) are inconclusive.[1] The physician's experience in dealing with NMS (i.e., ability to diagnose it without carrying out superfluous tests) and knowledge of what the guidelines indicate are important safeguards to ensure a high sensitivity and specificity of TTT.[2] This is because in some circumstances, TTT-induced hemodynamic stress can evoke syncope even in individuals considered healthy, without a history of syncope. In other words, TTT can have a high sensitivity but unacceptably low specificity in this scenario.[3] Similarly, when the diagnosis of NMS is almost certain or highly likely, no further evaluation is necessary and one can proceed with eventual treatment. Instead, TTT can be useful in patients with recurrent episodes of syncope or when autonomic disturbances are suspected or when a single unwitnessed syncope occurs but the cause is not clear.

Recently Sutton et al. highlighted the potential applications of TTT. In full agreement with their article, we would suggest an additional use of TTT in clinical conditions typically encountered in older people. For instance, TTT can be useful in cases of unexplained falls, or in patients with amnesia to check for prodromal symptoms, or to diagnose classical orthostatic hypotension (OH) when active standing is not applicable in patients with instability or poor compliance due to cognitive impairment. In older patients, as shown in Table 1, TTT represents a multifunctional tool useful not only for the diagnosis and follow-up of OH but also to assess patients with recurrent syncope after pacemaker implantation (in whom a cardioinhibitory or mixed response to TTT can reveal the co-existence of a vasodepressor response). In addition, TTT can be useful as an educational aid to increase older patients' awareness of their condition by helping them recognize the prodromal symptoms.

TTT AS A DIAGNOSTIC TOOL

TTT is widely used for the investigation of syncope and pre-syncope. Nevertheless, in older patients, it may also lead to diagnosis of OH and unexplained falls.

TTT in syncope: Syncope increases with aging and its incidence rises sharply from age 70 onwards. NMS accounts for about 67% of all syncope in older patients.[6] However, some differences have emerged in the diagnosis of NMS between adults and older individuals. In adults, the initial syncope evaluation (medical history, physical examination, ECG, and standing test) is usually sufficient to diagnose NMS without the need of further tests.[1] Instead, in older patients with or without dementia clinical variables such as the presentation of syncope,

See the response from Bennett et al.

FIGURE 1 Tilt table test

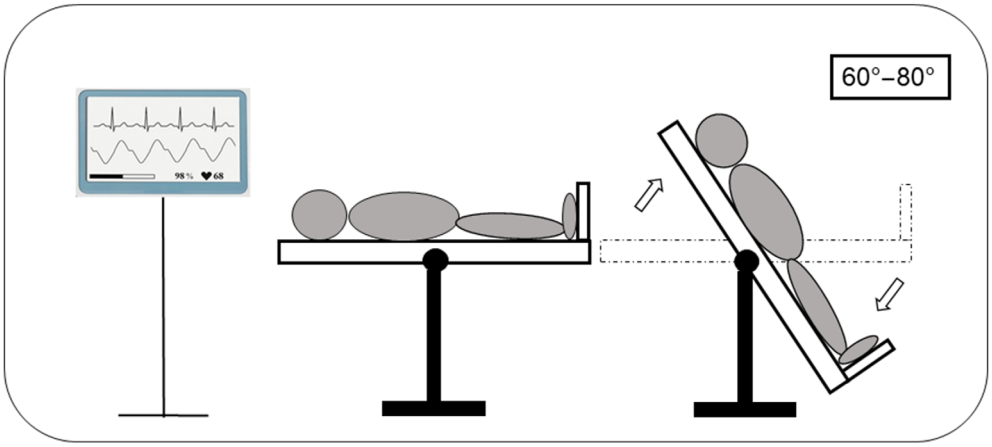

TABLE 1 Useful applications of the tilt table test in older patients

Diagnosis:
- Neurally mediated syncope → *TTT is recommended in NMS if the results of the first line diagnostic approach (medical history, standing test, and ECG) are inconclusive*[1]
- Orthostatic hypotension→ *TTT is useful in diagnosis of various forms of OH (initial, delayed, associated with supine hypertension); it is recommended especially in older patients affected by mobility disturbances, postural imbalance, and recurrent falls*
- Unexplained fall→ *In older patients TTT should be considered in all falls where the cause is not clear*[4]

Follow-up evaluation:
- To evaluate the efficacy of pharmacologic/non-pharmacologic treatment in OH
- To verify if syncope recurs after pacemaker implantation[5]

Educational aid:
- To increase patients' awareness of impending symptoms preceding syncope or OH[1]

Abbreviations: ECG, electrocardiogram; NMS, neurally mediated syncope; OH, orthostatic hypotension; TTT, tilt table test.

cognitive comorbidity and pre- and post-syncope amnesia can confound the medical history.[7] The patient history, which plays a key role in adults' NMS diagnosis, is blurred in older patients who experience an unwitnessed event.[8] Thus, TTT plays an important role in NMS detection in the elderly. A meticulous preliminary selection of patients to refer to TTT is indispensable in order to exclude those with likely cardiac syncope (e.g., with malignant ventricular arrhythmia, or bradyarrhythmia, or if there is a potential obstructive cause). This will improve the accuracy of the TTT response and avoid possible side effects. Also, to reduce a false positive response in older patients with a suspected but unconfirmed episode of syncope, it is important to check beforehand with the patient if they have had any prior prodromal symptoms associated with hemodynamic change during TTT. Older adults frequently do not recall the episode of their presumptive syncope, but during TTT they may identify impending symptoms if previously experienced.[8]

TTT in OH: The use of TTT in diagnosis of OH in older adults represents a further crucial concern. The AHA and ESC guidelines note that TTT plays a role in OH and postural intolerance, but active standing may be a simpler, cheaper, and more specific test. With respect to active standing, TTT reduces the effect of the muscle pump reflex in the lower limbs so increasing venous pooling. However, in older adults even the effort of standing up may cause an increase in transient ischemia and metabolites in the muscles, reducing venous return and so increasing venous pooling. In clinical practice, active standing is widely performed because it gives a reliable result at very low cost.[1] Moreover, active standing can be performed anywhere, patients easily comply with it, and it does not require specific skill on the part of the operator or physician. However, especially in older people, besides the classical OH, there can be a delayed form, which occurs only after 3 min of standing. The test time of active standing is usually too brief to detect delayed OH, and a misdiagnosis could result in a high risk of fall or ischemic attack in this age group. Hence, in these patients, TTT plays a leading role in the diagnosis of OH even compared to active standing. In theory, simply by prolonging the duration of active standing it could be possible to detect a delayed response to postural change, but in practice, many older patients are affected by mobility problems or postural disturbances, such as Parkinson's disease. In these patients prone to risk of falling, TTT is a safer test to diagnose delayed OH. TTT can also be useful in distinguishing OH due to reversible causes (e.g., hypovolemia, blood pressure lowering drugs, dehydration, large varicose veins, and physical deconditioning) from neurogenic OH (nOH). nOH is due to reduced norepinephrine release from postganglionic efferent sympathetic nerves, resulting in defective vasoconstriction

when standing up. When postural blood pressure decreases, the concomitant measurement of heart rate, beat to beat, may detect an exaggerated tachycardia suggesting OH due to dehydration or vasodilators, whereas a slight or absent increase in heart rate response (e.g., <15 beats per minute in the face of significant OH) would suggest nOH.[9] In this regard, however, the bedside screening test for OH represents an effective, low-cost way to detect nOH especially when no TTT facilities are available.[4] However, when balance disturbances occur in older adults, TTT should be considered mandatory.

TTT in unexplained falls: Unexplained falls are a typical condition of aging, and a leading cause of hospital admissions resulting in high healthcare costs. In older people, it is often difficult to establish the exact dynamic of the fall, and the underlying mechanism remains unexplained. The problem is even greater in patients with moderate-to-severe cognitive impairment or with retrograde amnesia if witnesses are absent (as is frequently the case). TTT is a useful diagnostic tool in the evaluation of patients with unexplained falls. Used appropriately, it can yield the presence of syncope in about 40% of older patients with unexplained fall who had no apparent history of syncope.[10] In these cases, the underlying mechanism—after excluding cardiac causes of presumptive syncope—may be OH or NMS. Hence, the usefulness of TTT in unexplained fall specifically applies to older people.

TTT IN FOLLOW-UP

TTT is not indicated for monitoring therapeutic outcome in NMS,[1] but it can be useful in syncope due to OH or in patients with orthostatic intolerance. In fact, the goal of TTT in OH is to assess hemodynamic changes in response to decreased venous return to the heart.[1] Thus, TTT can be useful to detect postural hemodynamic change after therapy especially in patients with no prodromal symptoms of OH.

Pharmacologic/non-pharmacologic treatment: Both pharmacologic and non-pharmacologic treatment especially in the management of OH can be evaluated by repeating TTT after a defined period of therapy. The first line of treatment should be to achieve discontinuation or reduction of reversible causes of orthostatic hypotension through deprescribing drugs such as diuretics, antihypertensive agents, antianginal agents, α-adrenoreceptor antagonists (for the treatment of benign prostatic hyperplasia), antiparkinson agents, and antidepressants. If venous pooling occurs, application of abdominal binders (strongest evidence) and/or lower-limb compression bandages are indicated as a non-pharmacologic measure to prevent OH. In clinical practice, all these measures can improve the quality of life of patients. However, it is sometimes difficult to verify the efficacy of therapy due to the patients' adaptation to hypotension, poor compliance, or amnesia. In these cases, repetition of the TTT can be useful to measure the effect of the intervention, given the high reproducibility (77%–90%) of TTT results.[5]

Pacemaker treatment: Finally, TTT should be considered also in the case of recurrent syncope in older adults after pacemaker (PM) implantation. In these patients, the underlying cause of syncope is likely the coexistence of a vasodepressor response, sometimes underestimated before the implantation. The efficacy of PM treatment is lower in syncope induced by a coexistent vasodepressor response. In these cases, diagnostic procedures such as ECG, Holter monitoring, and PM follow-up are unhelpful to detect the problem. In contrast, TTT can be useful and safe in patients implanted with PM for detecting syncope induced by a vasodepressor response to postural change.[11]

TTT AS AN EDUCATIONAL TOOL

Often older patients fail to correlate early symptoms with a subsequent episode of syncope or fall. Hence, in addition to its diagnostic value (especially in recurrent syncope), TTT can be useful as an educational aid to increase patients' awareness of their condition. By reproducing the prodromal symptoms, it can help the patient recognize impending loss of consciousness and react when they occur.

In conclusion, in older people, TTT has an added clinical value with respect to other age groups. This is because the medical history, which plays a key role in young people and adults, may be more limited in older people due to cognitive comorbidity. More importantly, although NMS is generally a benign form of syncope, it can in older patients lead to serious injury from falls and it can have fatal consequences. In this scenario, TTT represents an important tool for the diagnosis, follow-up and clinical education in older patients with syncope and/or fall.

AUTHOR CONTRIBUTIONS

Gianluigi Galizia and Pasquale Abete were equally involved in the concept and design, preparation, and revision of the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

SPONSOR'S ROLE

None.

FINANCIAL DISCLOSURE

None.

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