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## Nonpharmacological treatment of reflex syncope

■ **Abstract** Reflex syncope is a common medical problem. Vasovagal reflex syncope is the most frequent form. Although the progno-

sis of the disorder is excellent, it may impose substantial changes in life style and cause profound psychological distress. Thus, management of this disorder is an important issue. This chapter, based on a review of the literature and the authors' clinical experience, encompasses the non-pharmacological measures used in the management of reflex syncope.

The cornerstone of the non-pharmacological management of patients with reflex syncope is education and reassurance regarding the benign nature of the condition. Patients should be instructed to avoid potential triggers. A tilt table test can be employed to teach the patient to recognize early premonitory symptoms. There are several physical maneuvers (e. g., leg crossing, muscle tensing and squatting) that are effective in combating or-

thostatic intolerance. For the majority of patients this approach is adequate.

Patients with frequent attacks of reflex syncope are advised to increase their dietary salt intake. Exercise training also increases orthostatic tolerance. In highly motivated patients with recurrent syncope, raising the head of the bed to permit gravitational exposure during sleep and prolonged periods of enforced maintenance of the upright posture (tilt-training) can be considered. Preliminary data suggest that water drinking may improve orthostatic tolerance. Abdominal belts may also be effective in highly symptomatic subjects with reflex syncope.

■ **Key words** hemodynamics · syncope · therapeutics · vasovagal syncope

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### Introduction

Reflex syncope refers to a heterogeneous group of disorders that are characterized by intermittent, reflex vasodilatation and bradycardia that results in transient failure of blood pressure control and diminished cerebral perfusion. The episodes are self-limited and are usually provoked by stimuli or "triggers" such as intense emotions and prolonged standing [19, 30, 65]. Reflex syncope is a common medical problem. Vasovagal reflex syncope is by far the most frequent form (Chapter by Colman, Nahm et al. in this supplement) (Table 1) [19, 30].

Although the long-term prognosis of reflex syncopal disorders is excellent, they may impose substantial changes in life style and cause profound psychological distress [39, 52]. Thus, management of this common disorder is an important issue. This chapter, which is based on a review of the literature and the authors' clinical experience, encompasses the non-pharmacological measures used in the management of reflex syncope. Since reflex syncope is frequently posture related, we will emphasize orthostatic blood pressure control. The approach to other types of reflex mediated syncope will be covered where appropriate.

**Table 1** Reflex mediated syncope: classification based on pathophysiology

Vasovagal syncope
– emotionally induced (central type)
– orthostatic induced (peripheral type)
Carotid sinus syncope
Ocular syncope
Gastro-intestinal
– swallow syncope
– defecation syncope
– glossopharyngeal neuralgia
– gastrointestinal tract instrumentation (esophageal stimulation, rectal examination)
Urogenital
– (post)-micturition syncope
– urogenital tract instrumentation (e. g., prostate massage)
Pulmonary
– airway instrumentation
Increased intra-thoracic pressure
– cough and sneeze syncope
– wind instrument player's syncope
– weight lifter's syncope
– mess trick and fainting lark
– stretch syncope
Special situations
– high altitude
– exercise induced
– diving
– exposure to G-forces

**Table 2** General principles of non pharmacological treatment

<i>Initial approach</i>
1. Counseling and reassurance
– explanation
– avoidance of triggering events:
standing still for prolonged periods
high environmental temperature (including hot showers and baths)
sudden head-up postural change (especially on waking)
straining during micturition and defecation
hyperventilation
fasting
excessive alcohol intake
drugs with vasodepressor properties
– normal salt/water intake
2. Physical counter-maneuvers (see Table 3)
– leg crossing and muscle tensing
– squatting
3. Psychological deconditioning
<i>To be considered in recurrent syncope</i>
4. Increase in dietary salt intake
– daily salt intake of at least 10 grams (180 mmol) a day
– weight gain of about 1–2 kg
5. Water drinking
– 2–2.5 liter fluid/day
– avoidance of dark urine
6. Physical exercise
7. Head-up sleeping
8. Tilt training
9. Abdominal binders and elastic stockings

## Non-pharmacological approach

### ■ Counseling and reassurance

The cornerstone of the non-pharmacological management of patients with vasovagal reflex syncope is education and reassurance regarding the benign nature of the condition (Table 2) [70]. Patients, partners and family members will benefit from clear and simple descriptions of the physiological mechanisms that underlie the hypotensive and bradycardic response, and its effect on cerebral perfusion. Such explanations help clarify the rationale for the self-protective measures that include the assumption of the supine position and other measures to increase cerebral blood flow if syncope becomes imminent. Initial advice should also include early recognition of warning symptoms and avoidance of triggering events such as prolonged standing and/or warm, confining environments. Patients should be informed that there is minimal risk of sudden death in the absence of structural heart disease [5, 19, 30, 58, 64, 65]. Vasodilating and diuretic medications should be modified or discontinued if medically appropriate. Patients should be instructed to increase dietary salt and fluid intake. A low salt diet should be avoided [54]. The tilt table test provides a safe setting for teaching patients to recognize early premonitory symptoms. The frequency of synco-

pal events decreases substantially after tilt-table testing [60]. It is possible that the clinical encounter, education and counseling that accompany this diagnostic test serve as a positive therapeutic intervention [19, 21, 59, 60, 66].

If trigger avoidance is not possible, general treatment strategies may be advocated. These strategies include adopting a protective posture (e. g., sitting rather than standing) or slower changes of posture (e. g. sitting on the edge of the bed before arising, waiting before arising after a bowel movement). Patients and family members also should be advised on appropriate behavior if syncope is inevitable. Resumption of the supine position is usually sufficient to restore cerebral perfusion. Elevation of the legs may be performed in order to increase venous return to the heart [26, 50].

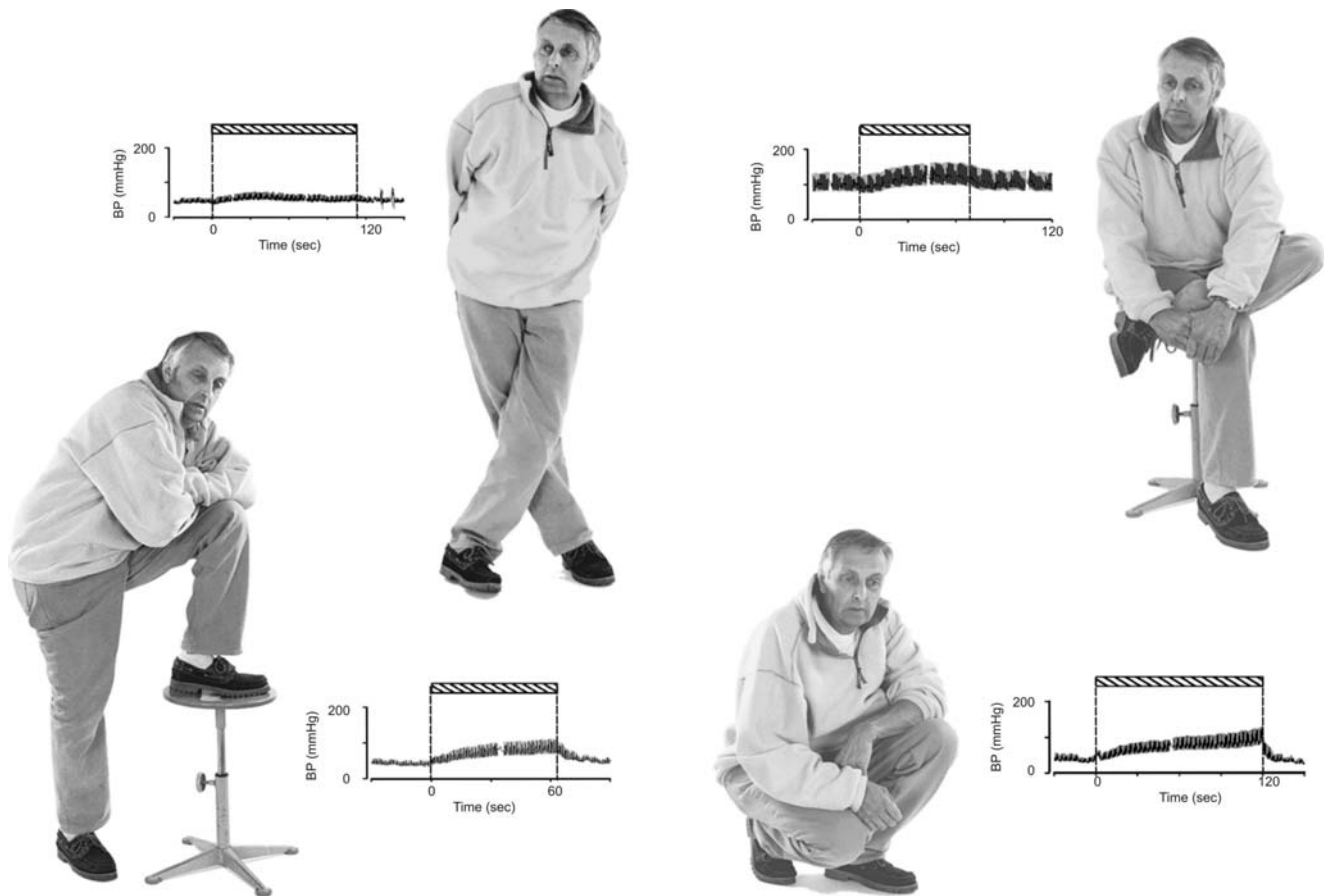
### ■ Physical counter-maneuvers

Traditionally, sitting with the head lowered between the knees has been advocated for acute management of vasovagal syncope [13, 34]. However, there is a wide variety of other physical maneuvers that are both easy to apply and effective in combating orthostatic intolerance. Patients with autonomic failure have discovered several such maneuvers [72]. The beneficial effects of leg

crossing, squatting, and placing one foot on a chair have been the subject of several recent reports (Fig. 1, Table 3) [4, 23, 36, 63, 72].

In the past decade, patients with vasovagal syncope and postural tachycardia have successfully implemented the physical counter-maneuvers first used in patients

with primary autonomic failure. The effectiveness of leg crossing and leg muscle tensing was first described in case reports and then proven effective in an acute controlled trial [9, 12, 32, 35, 53]. In a subsequent trial the effectiveness of two isometric arm counter-pressure maneuvers was described, i. e., hand-gripping at maxi-



**Fig. 1** Physical counter-maneuvers using isometric contractions of the lower limbs and abdominal compression. The effects of leg crossing in standing and sitting position, placing a foot on a chair and squatting on finger arterial blood pressure (FINAP) in a 54-year old male patient with pure autonomic failure and incapacitating orthostatic hypotension. The patient was standing (sitting) quietly prior to the maneuvers. Bars indicate the duration of the maneuvers. Note the increase in blood pressure and pulse pressure during the maneuvers (Harms and Wieling unpublished, with written permission of the patient)

**Table 3** Physical counter-maneuvers

Maneuver	Instruction
Leg crossing	Cross one leg over the other at thigh level while standing or sitting.
Limb and/or abdominal contraction	Contract leg musculature and/or abdomen while standing. This can be done also while leg crossing.
Isometric arm counterpressure maneuvers	Maximal voluntary contraction of a rubber ball taken in the dominant hand or maximum tolerated isometric contraction of both arms achieved by gripping one hand with the other and abducting both arms at the same time.
Bending forward	Lowering the head to heart level while standing or sitting.
Squatting	Sit on the heels. A variant is to kneel down, pretending to lace a shoe or standing on one foot while placing the other on an elevated surface with bending of the trunk (foot on chair maneuver) .
Toe raising	Rise onto the front of the feet, maintain calf contraction and return to flat-stance position.
Knee flexion	March on the spot.

mal voluntary force using a rubber ball and arm-tensing (gripping one hand with the other and abducting both the arms at the same time) [6]. Both arm tensing maneuvers induce whole body muscle tensing [13]. The data strongly suggest that leg crossing and whole body muscle tensing are useful in daily life [6, 9, 12, 35, 53]. Leg muscle pumping can also be applied to increase orthostatic tolerance in patients with posture related reflex syncope, but patients find this maneuver more cumbersome to perform [18].

A major advantage of physical counter-maneuvers is that they may be applied at the start of hypotensive symptoms, increasing central blood volume and blood pressure, thereby giving the patient the opportunity to regain self-confidence in provocative situations [6, 9, 12, 35]. Leg crossing has the advantage that it can be performed as a preventive measure without much effort and without drawing much attention to the patient's problem. Leg crossing can also be used for the prevention of hypotensive light-headedness in the sitting position in patients with reflex syncope (Wieling and Krediet unpublished observations).

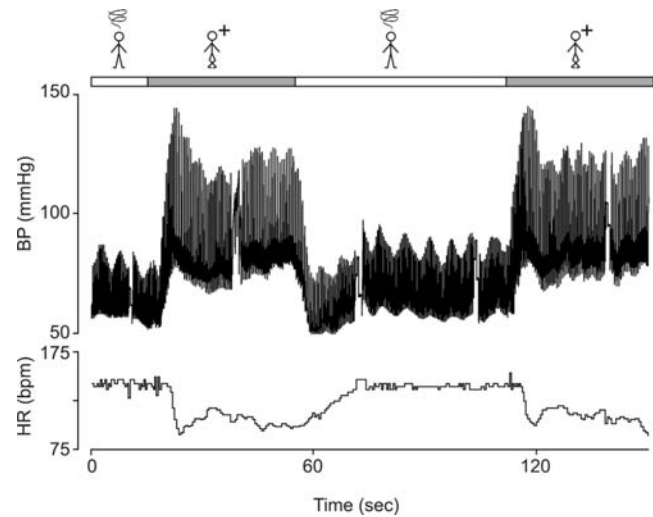
Physical counter-maneuvers may be impractical for patients with motor disabilities or compromised balance, such as the elderly. However, a recent publication documented the beneficial effect of lower body muscle tensing in an older adult [53]. In our experience the pressor effect of muscle tensing in fit elderly subjects under laboratory conditions is at least as great as in young subjects.

Squatting is an effective emergency mechanism to prevent a syncopal episode when pre-syncopal symptoms develop rapidly [13, 34]. Bending over, as if to tie one's shoe laces, has similar results. Elderly patients may find this maneuver simpler to perform [72]. When arising again from the squatted position, immediate leg crossing and/or lower body muscle tensing should be advised in order to prevent hypotension [33].

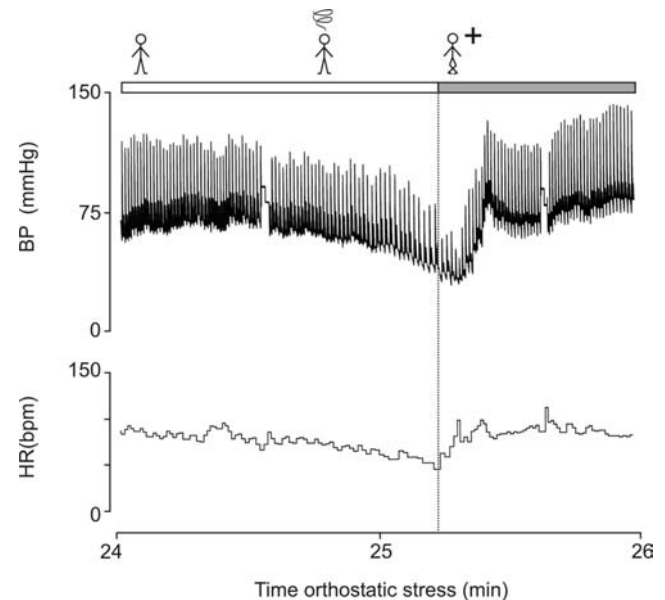
Patients with intermittent, posture related, reflex syncope have found leg crossing with muscle tensing, isometric arm counter-pressure and squatting to be the simplest maneuvers to apply. They should be instructed in these physical counter-maneuvers as part of the therapeutic program.

Patients are advised:

- To apply leg crossing as a preventive measure to improve orthostatic tolerance during prolonged upright standing ("cocktail party posture") (Fig. 2)
- To combine leg crossing with tensing of leg, abdominal and buttock muscles to abort an impending vasovagal reaction (Fig. 3). An alternative is to perform the isometric arm counter-pressure maneuvers.
- To apply squatting as an emergency measure to prevent loss of consciousness when pre-syncopal symptoms develop rapidly (Fig. 4).

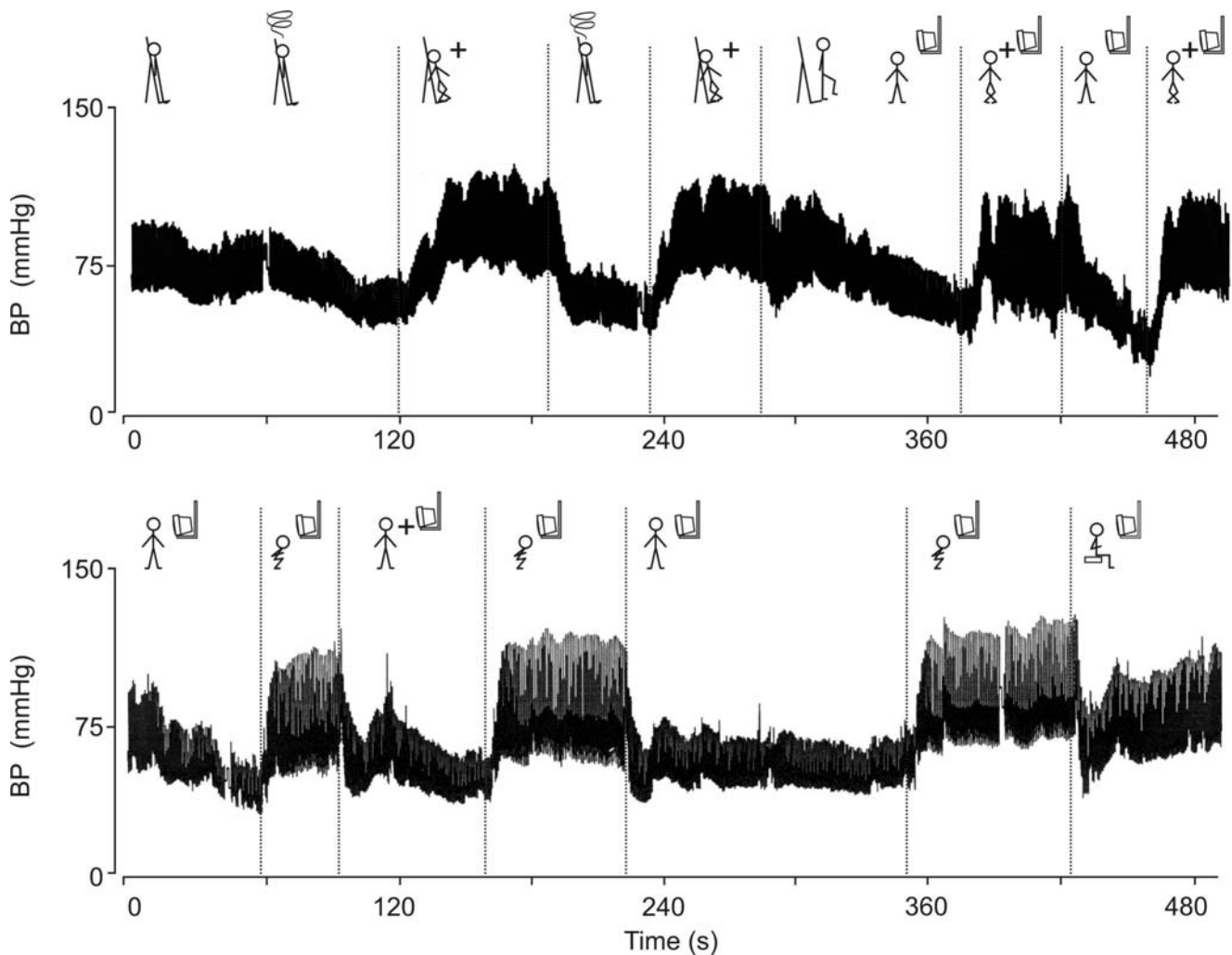


**Fig. 2** Leg crossing and muscle tensing to increase long-term orthostatic blood pressure. After a negative 20 minute, 70 degree tilt test and subsequent addition of nitroglycerin this 19-year old healthy female subject with daily episodes of light-headedness and palpitations and occasional posture-induced fainting developed hypotension and postural tachycardia. Leg crossing and muscle tensing (+) induced a remarkable increase in pulse pressure and decrease in heart rate. After 40 seconds she uncrossed her legs and relaxed her muscles and a low blood pressure and postural tachycardia reoccurred. The physical counter-maneuver was effective once more (Krediet and Wieling unpublished)



**Fig. 3** Aborting a vasovagal faint by the combination of leg crossing and muscle tensing. Typical vasovagal syncope in a 24 year-old male subject with recurrent syncope during orthostatic stress testing on a tilt table. Note progressive fall in finger arterial pressure and heart rate. After crossing of the legs and tensing of leg- and abdominal muscles (+) blood pressure and heart rate recover quickly. Bar indicates onset of leg crossing and muscle tensing (Krediet and Wieling unpublished)

Patients with recurrent syncope may benefit from practising leg muscle tensing and muscle tensing while standing motionless each morning as part of their daily



**Fig. 4** Patient education of physical counter-maneuvers using continuous on-screen blood pressure tracing. A 49-year old male with a history of clinically vasovagal syncope underwent tilt table testing. The provoked vasovagal reaction was aborted by leg crossing and tensing of leg, abdominal and buttock muscles (+) while on the tilt table. Then he was asked to step off the tilt table. Standing next to it he was educated on the application of physical counter-maneuvers (leg crossing and muscle tensing (+); squatting; isolated leg muscle tensing (+); sitting down with legs crossed) to combat his ongoing vasovagal hypotension, watching his continuous blood pressure tracing on a video screen (Krediet and Wieling unpublished)

routine. The effects of physical counter-maneuvers on a low standing blood pressure are difficult to monitor by sphygmomanometric readings only, but a continuous blood pressure measuring device (e. g., Finapres) can be used to quantify their benefits [27]. The changes in blood pressure can immediately be demonstrated to a patient by showing the continuous blood pressure tracing on a video screen. This technique can be used to train patients to apply the maneuvers effectively (Fig. 4) [4].

The increase in mean arterial pressure and pulse pressure induced by leg crossing can be attributed to compression of the muscles in the upper legs and abdomen with mechanical squeezing of venous vessels resulting in an increase in central blood volume and thereby in cardiac filling pressures, cardiac output and

cerebral perfusion. Simultaneous tensing of leg and abdominal muscles can produce an additional increase in mean arterial blood pressure (Fig. 2). This effect is most likely a consequence of the combination of a further increase in venous return and the increase in systemic vascular resistance due to the mechanical consequences of skeletal muscle tensing on the arterial circulation to the legs [13, 37]. Reflex effects of muscle tensing are likely to be involved as well in the rise of systemic blood pressure [13, 35].

#### ■ Psychological counseling

Psychological deconditioning is the first choice of therapy for patients with vasovagal reflex syncope due to in-



capacitating blood phobia [14, 31]. In one to five sessions, depending on the seriousness of the phobia, patients are exposed to phobic stimuli and taught to apply body tension consisting of contraction of the arm, chest and leg muscles to attain a feeling of facial warmth [49]. Prognosis after psychological counseling seems to be very good. Öst reported, in two one-year follow-up studies, improvement in 84–90% of treated patients after one to five sessions of therapist-directed exposure and improvement in 50–70% of treated patients after one to five sessions of applied tension treatment [24, 48]. Repeated self-exposure to the phobic stimulus by donating blood regularly may help maintain the treatment effect [24].

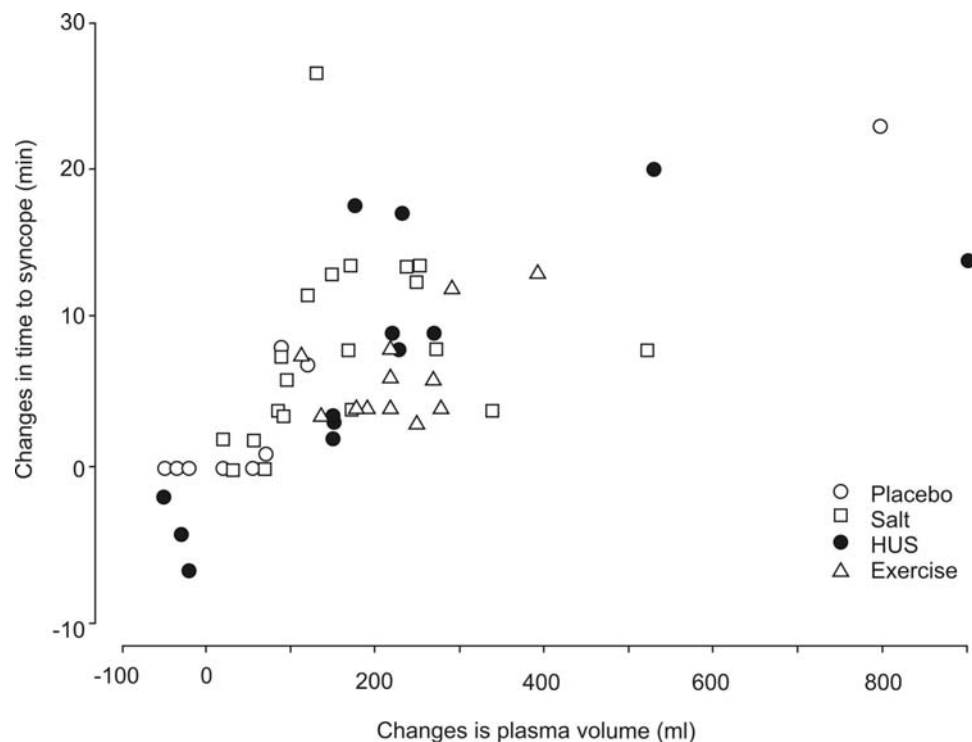
A small retrospective observational study described the use of cognitive behavioral therapy (CBT) in 9 patients with therapy resistant vasovagal syncope [46]. The psychological intervention involved redirecting the somatic attention and fears to regain self-assurance in situations that provoke syncope. In addition strategies of applied tension were taught to cope with syncope. All patients subjectively improved after CBT. Larger prospective studies are needed to prove the effectiveness of CBT in vasovagal patients.

For the vast majority of patients, the non-pharmacological approach to therapy discussed above is sufficient. This approach can be individualized and intensified in patients who remain symptomatic.

### ■ Increase in dietary salt intake

Patients with frequent attacks of reflex syncope should be advised to increase their dietary salt intake if there are no contraindications. The rationale for this advice is that sodium content determines the volume of the extra-cellular fluid volume, including the plasma volume. Plasma volume expansion thus improves orthostatic tolerance (Fig. 5) [16, 17, 61, 71]. Patients should have a daily dietary intake of at least 10 grams (180 mmol) of sodium. This can be accomplished by the liberal addition of salt to their meals or the use of salt tablets [17, 61, 71]. The daily twenty-four hour urinary sodium excretion is monitored and one or more 1-gram salt tablets are added three times a day if needed. Some patients report that buffered salt tablets have less gastrointestinal side-effects. The increase in dietary sodium should be accompanied by an increase in fluid intake up to 2–2.5 liters (in adults) per day. Some patients benefit from specific practical advice for fluid ingestion such as to ingest enough water to produce colorless urine at a frequency of twice in the morning and twice in the afternoon. Urinary sodium output of about 10 grams (185 mmol) of sodium should be present after 1 week. An early morning body weight gain of about 1–2 kg usually implies adequate extra-cellular fluid volume expansion. Beneficial effects are reported in the majority of subjects within one week, particularly in subjects with low dietary salt intake [43].

**Fig. 5** Summary of effects of various interventions on plasma volume (Evans blue dilution) and orthostatic tolerance (time to presyncope in test of head-up tilt and lower body suction). Changes shown in response to following interventions: salt loading, placebo, exercise training and head-up sleeping (From Wieling et al. (2002) *Clin Auton Res* 12:242–249)



## ■ Exercise training

Exercise training also increases total body water and thereby increases orthostatic tolerance (Fig. 5) [71]. Exercise training should be considered if salt loading is not effective or contraindicated, particularly in patients with high blood pressure. A 3-month program consisting of combined endurance and strength training has been documented to increase plasma volume and improve orthostatic tolerance [44, 45]. Exercise training should be encouraged especially when fitness is low. In patients with high physical fitness levels additional training actually may decrease orthostatic tolerance [71]. Another potential mechanism by which exercise may improve orthostatic tolerance is via increased muscle mass particularly in the dependent limbs and thus improving circulatory control by enhancing the effectiveness of the skeletal muscle pump [42]. Sewall suggested, as early as 1916, that a rowing machine was particularly appropriate for strengthening abdominal muscles and thereby increasing orthostatic tolerance [56]. In a controlled study of identical twins, who were discovered to be tilt board fainters, in 1945 Allen et al. reported the beneficial effects of a training program consisting of graduated abdominal and trunk exercises [2].

## ■ Head-up sleeping and tilt training

In highly motivated patients with recurrent reflex syncope, raising the head of the bed on blocks to permit gravitational exposure during sleep can be considered. This technique is highly effective in patients with autonomic failure [71]. Preliminary results suggest that this may also be beneficial in subjects with reflex syncope (Fig. 5) [22]. The postulated effects of head-up sleeping are expansion of plasma volume and a more favorable distribution of body fluids [47]. Another procedure applied to limit the shift of fluid from the legs into the cardio-thoracic region is the use of veno-constrictive thigh cuffs. The procedure has been adopted by Russian cosmonauts, but so far has not been assessed in syncope patients [3, 8, 38, 41, 69].

The prescription of progressively prolonged periods of enforced maintenance of the upright posture in the hospital (until 45 minutes upright are tolerated) followed by daily training at home (2 sessions of 30 min upright standing against a vertical wall) have also been advocated. Three groups of investigators have reported promising effects of this so-called tilt-training [1, 11, 15, 51]. An obvious drawback of this approach is the inconvenience and associated poor compliance [20]. The mechanism underlying the effectiveness of tilt-training

remains to be elucidated. A possible mechanism is that the patients learn to apply muscle tensing as described above.

## ■ Pressor response to water drinking

Rapid water ingestion may prevent vasovagal syncope. This intervention is reported to be effective in combating orthostatic intolerance and post-prandial hypotension in patients with autonomic failure [7, 28, 29, 57].

Preliminary data suggest that water drinking can also be applied to improve orthostatic tolerance in healthy subjects, and in patients with a postural tachycardia syndrome [40, 55, 57]. One case study suggests its effectiveness in exercise-related syncope [68]. The rapid onset of the effects of water drinking and its sustained effect could support the use of this intervention as a preventive measure during situations that patients prone to vasovagal syncope are known to be symptomatic (e.g., long airplane flights) although the effect is of relatively short duration. However, conclusive data on the effectiveness of water drinking in patients with vasovagal syncope are to be awaited.

## ■ Abdominal binders

Applying external pressure to the lower half of the body substantially reduces venous pooling when upright, and consequently, arterial pressure and cerebral perfusion are better maintained. Recent work has shown that the abdomen is the most important single site for compression [10, 62]. Abdominal belts are effective in highly symptomatic young and elderly subjects with reflex syncope [25, 67]. When an abdominal binder alone is ineffective, elastic stockings or elastic body garments can be considered. Donning of elastic garments is difficult and they are uncomfortable to wear, especially in warm weather.

## Conclusion

The mainstay of management of a patient with reflex syncope consists of advice and education on the various factors that influence systemic blood pressure. Counseling should be supplemented with education on the physical counter-maneuvers to increase blood pressure and increase in fluid and salt intake to expand intravascular volume. In appropriate subjects, these interventions may be supplemented by physical exercise programs, tilt-table training, and abdominal binders.

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