Oral Fluid Therapy

A Promising Treatment for Vasodepressor Syncope

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Objectives: To investigate the predictive value of an intravenous fluid bolus during tilt table testing on clinical outcome and to evaluate if oral fluid therapy is an effective treatment for patients with vasodepressor syncope.

Design: Retrospective cohort.

Setting: Regional pediatric cardiology outpatient clinic.

Patients: Patients (N=58) with a positive baseline tilt table testing result who were treated with oral fluid therapy between February 1991 and March 1996.

Interventions and Main Outcome Measures: Patients with a positive tilt table test result were given an intravenous bolus of isotonic saline solution. Responders were identified as having a negative tilt table test result after the bolus. Patients were prescribed a protocol of oral fluid therapy. Data were obtained from the medical record and a mailed survey.

Results: Of the 58 subjects, 90% had no recurrent syncope while receiving oral fluid therapy. During tilt table testing, the mean decrease in mean arterial pressure seen with symptomatic events was lower after the intravenous fluid. The heart rate, which dropped during the initial tests, increased during the tests after the intravenous bolus. In the nonresponders, symptomatic episodes occurred significantly later in the tilt table test when given fluids. The response to intravenous fluid bolus had a positive predictive value of 92% and a negative predictive value of 11% of clinical outcome.

Conclusions: Our data suggest that oral fluid therapy is an effective treatment for vasodepressor syncope in our population. Fluid bolus response during tilt table testing has a high positive but a low negative predictive value of response to oral fluid therapy. We now recommend oral fluid therapy as a primary intervention and reserve tilt table testing for oral fluid therapy failures.


Editor's Note: Any time you can treat something by having the patient drink adequate fluids, I'm all for it. The managed care companies will love this one.

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SYNCOPE is a common complaint, especially among teenagers. The incidence of syncope varies between 1% and 20%, depending on the population studied.¹ The most common cause is vasodepressor syncope, also known as vasovagal syncope or neurally mediated cardiac syncope, accounting for approximately 50% of all syncopal episodes in children. Vasodepressor syncope can be alarming, as it may be associated with periods of asystole or seizures.²

The differential diagnosis of syncope is extensive, including cardiac, metabolic, neurologic, and psychiatric causes. While in general syncope is a benign event, some possibly life-threatening causes include myocardial abnormalities and arrhythmias.³ Multiple studies are frequently ordered to sort out the underlying cause. Calkins et al.,⁴ in 1993, estimated the cost of a workup prior to referral averaged $3763 and, in 1 case, went up to $16606.

The initial form of treatment for vasodepressor syncope is usually pharmacologic. The various agents can be expensive and have adverse effects.⁵ One alternative therapy involves increased oral fluid intake. The objectives of this study are to determine the effectiveness of oral maintenance fluid therapy in patients with vasodepressor syncope and to investigate the predictive value of the response to intravenous fluids with repeated tilt table test-

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PATIENTS AND METHODS

PATIENT POPULATION

Between April 1991 and March 1996, 107 patients underwent tilt table evaluation (Figure). Of those patients, 17 had negative test results and 11 had incomplete data and therefore were excluded from the study. Of the remaining 79 patients, 9 required isoproterenol hydrochloride to induce a positive tilt table test result and they too were excluded. During our early experience, 12 patients were immediately prescribed medication, without a trial of fluid therapy, and therefore they were not included. The remaining 58 patients were included in our study cohort.

TILT TABLE TEST

Our tilt table testing protocol is standardized and concurs with the guidelines suggested by the recent American College of Cardiology Expert Consensus document. The test is performed in the morning after an overnight fast. A peripheral intravenous catheter, a radial artery catheter, and electrocardiogram electrodes are placed for access and monitoring. Patients are placed on the tilt table after being in the supine position for 2 hours prior to the test. A 70° head-upright tilt is continued until positive results are obtained or for a maximum of 20 minutes. A positive result is defined as a syncopal or presyncopal episode associated with a decrease of 50% or greater in the mean arterial pressure or heart rate. Patients with a positive result are then given a 1-L intravenous infusion of isotonic saline solution and the test is repeated in an identical fashion.

ORAL FLUID THERAPY

A specific protocol of fluid therapy is initiated in patients whose history is compatible with vasodepressor syncope and whose tilt table test result is positive. The protocol includes: (1) Beginning in the morning, a minimum of 64 oz (1920 mL) of fluid is consumed each day, which approximates the maintenance fluid requirements for a 40-kg person; (2) only noncaffeinated fluids are permitted to avoid diuresis; (3) the patient is instructed to maintain colorless urine to avoid becoming thirsty; (4) light salting of food is allowed but not emphasized; (5) a note is sent to school allowing the patient to have a water bottle and make extra trips to the bathroom; and (6) patients and their parents are instructed to notify our clinic of any recurrent syncopal episodes.

OUTCOME MEASURES

On review of arterial line tracings from the tilt table tests, the upright baseline heart rate and mean arterial pressure were measured 1 minute after the patients were placed in the upright position. A positive test result was defined as a decrease of 30% or more in the heart rate or mean arterial pressure with syncope or presyncopal symptoms. Patients were designated as either responders or nonresponders based on the lack of a positive tilt table test result after the fluid bolus.

A survey, approved by our institutional review board, was sent to all of the patients in the study asking them specific questions regarding the recurrence of their symptoms and compliance with their prescribed therapy. The patients and their families were also offered the choice of being contacted at home and responding to questions over the telephone. If a mailed survey was not returned, follow-up information was obtained from the patient’s medical record.

STATISTICAL ANALYSIS

Statistical analysis was performed using the Student paired t test to compare tilt table testing results before and after fluid bolus. An α error of .05 or less was considered significant.

RESULTS

The average age of the cohort was 14.7 years, with a range of 8.7 to 27.6 years. Men outnumbered women by a ratio of 1.5:1. Data were available for review of symptoms in 52 of the 58 patients. Documentation of the specific number of syncopal events occurred in 38 patients. The mean number of syncopal events was 2.25, with the number of episodes ranging from 1 to 7 (median, 2). Seven patients were listed as having either multiple, many, frequent, or long-standing episodes of syncope. The remaining 7 patients were listed as having either occasional or several episodes of syncope. Pre–tilt table testing laboratory evaluations were available for 54 of 58 patients. All patients had electrocardiograms. Echocardiograms were performed in 25 patients. Twenty-four-hour ambulatory monitoring was performed in 29 patients. A cardiopulmonary exercise test was performed in 9 patients. Evaluation prior to the tilt table test was dependent on the individual physician and patient. The evaluation was not standardized.

Two patients had previously diagnosed heart disease. One had coarctation of the aorta that was balloon-dilated, with a complicating aneurysm that was surgically repaired. The other patient with Friedreich ataxia had concentric hypertrophy of the left ventricle. In 4 other patients, previously undiscovered cardiac diagnoses were identified during the initial workup (mitral valve prolapse, 2 patients; Wolff-Parkinson-White syndrome, 1 patient; and borderline left ventricular hypertrophy, 1 patient). These diagnoses were not believed to be the cause of the patients’ syncope and therefore the patients were not excluded from the study. The patient with Wolff-Parkinson-White syndrome had a transesophageal electrophysiologic procedure that revealed a long effective refractory period of the accessory connection and no inducible tachycardia at baseline or with isoproterenol stimulation.
The change in mean arterial pressure and heart rate before and after fluid infusion for both the responders and the nonresponders improved significantly (P<.05) (Table). In the nonresponder group, the time for symptoms to appear was significantly prolonged (P<.005). A pause in the pulse ranging from 2 to 20 seconds occurred in 13 patients during the initial tilt, but none occurred after the fluid bolus.

Follow-up information was available for 47 of the 58 subjects. Twenty-five patients returned surveys an average of 2.2 years (range, 0.2-5.1 years) after their tilt table test while the other 22 had clinical follow-up an average of 0.8 years (range, 0.1-4.0 years) after their test. The time between tilt table testing for each patient and the time of this study ranged from 0.2 to 5.2 years, with an average of 2.5 years (median, 2.2 years).

Twenty-two (92%) of the surveyed patients had no further syncopal events when following the prescribed protocol. From the clinical follow-up group, 19 (86%) reported similar success. Some patients were not scheduled for follow-up and were instructed to return to our clinic only if further problems occurred. Overall, 90% of the total cohort had resolution of their symptoms with the prescribed therapy. Eleven patients did not contact our clinic and it was assumed that they had no further syncope. If we assume a worst-case scenario in which all of them are considered to be clinical failures, then the success rate for oral fluid therapy becomes 72%.

The response of the patients to fluids during tilt table testing and their clinical response to oral fluid therapy is shown in the Figure. In this population, the positive predictive value is 92% and the negative predictive value is 11%. The sensitivity is 85% and the specificity is 20%. The overall accuracy of the test is 79%.

Our first objective of this study was to determine the effectiveness of oral fluid therapy in patients with vasodepressor syncope. The body’s hypotensive response to stimulation of cardiac afferents, often termed the “vagal reflex,” was noted by Bezdol in 1867, was further described by Jarisch in 1948, and has come to be known as the Bezdol-Jarisch reflex. Although not fully understood, a similar cardioinhibitory reflex has been proposed as the mechanism underlying vasodepressor syncope. Intervention is based on either preventing the stimuli for the reflex or blocking the reflexive bradycardia or hypotension. Medications that have been found to be effective include mineralocorticoids, β-blockers, and disopyramide. Interestingly, in one of the few prospective placebo-controlled trials of therapy in the adult population, Brignole et al found that their placebo group had just as much success as their medicated group and concluded that the usefulness of pharmacologic therapy guided by tilt table testing was questionable.

Our study shows that a defined protocol of oral fluid intake is an effective therapy in most patients diagnosed with vasodepressor syncope. By drinking more fluid, the patients increase their intravascular volume, which should increase left ventricular preload. Advantages of fluid therapy include its safety and low cost.

The second objective of this study was to investigate the predictive value on clinical outcome of an intravenous infusion of isotonic saline solution during a tilt table test. The tilt table test is the primary laboratory test used to diagnose vasodepressor syncope. The postural change from a supine to an upright position has been shown to elicit the same symptoms experienced by patients during their syncopal and presyncopal episodes. The reproducibility of tilt test results on repeated testing ranges from 63% to 87% in various studies. Mangru et al noted that 84% of their patients had a negative repeated tilt table test result after isotonic saline solution infusion. Our data demonstrate that patients who respond to a fluid bolus on tilt table testing will also benefit from oral fluid therapy. If no improvement is seen after fluid bolus, one cannot say that fluid therapy is not indicated. The positive predictive value of a fluid bolus at the time of tilt table testing might be deceptively high because the prevalence of oral fluid therapy success is so high. Tilt table testing can be expensive, time-consuming, and invasive. This study suggests that in patients with a history and physical examination compatible with vasodepressor syncope, tilt table testing may not significantly influence management.

Limitations of this study include its retrospective design, in which the diagnosis, testing, and treatment of the patients are not strictly uniform. We do not have a comparative control group. Kapoor et al suggested that the use of isoproterenol might not lead to any increase in posi-

| Data From Tilt Table Testing Before and After a 1-L Intravenous Bolus of Isotonic Saline Solution |
|--------------------------------------------------|--------------------------------------------------|
| Responders (n=49) | Nonresponders (n=9) |
| Change in mean arterial pressure, mm Hg | Change in mean arterial pressure, mm Hg |
| Before Bolus | After Bolus | Before Bolus | After Bolus |
| −56 | −10* | −66 | −55* |
| Change in heart rate, beats/min | Before Bolus | After Bolus | Before Bolus | After Bolus |
| −29 | 9* | −54 | 2* |
| Time to event, min | Before Bolus | After Bolus | Before Bolus | After Bolus |
| 8 | No event | 4 | 15* |
| Pulse pause >2 s | Before Bolus | After Bolus | Before Bolus | After Bolus |
| 10 | No event | 3 | 0 |

*P<.05, comparing values before and after receiving intravenous isotonic saline solution.
tive results when compared with similar studies without medications. Exclusion of patients who required isoproterenol to induce a symptomatic event makes our population more uniform, but it does create a potential selection bias. Also, many patients not included in this study were given oral fluid therapy empirically and did not undergo tilt table testing. This may bias our study toward patients with more severe disease.

Adolescent compliance is always difficult to assess. We were not able to find any study that estimated adolescent compliance with treatment of vasodepressor syncope. We have made our protocol as simple as possible to increase compliance. Adolescent patients with persistent syncope are restricted from driving. Patients who comply with therapy and are asymptomatic have their driving privileges restored.

As we continue to gather more information about syncope in the pediatric population, we may find that a diagnostic trial of oral fluid therapy in a patient with a compatible history and normal electrocardiogram result is appropriate. The next logical question becomes: If no advanced cardiac or neurological studies are needed, do so many of these patients need referral to a specialist or can they be managed by the primary care provider? If the latter proves to be true, the work-up and management of these patients potentially becomes much more cost-effective.

In our institution, we prescribe oral fluid therapy if our initial work-up indicates a diagnosis of vasodepressor syncope. The tilt table test is reserved for patients in whom the diagnosis is complicated or in patients who are noncompliant and need proof that more fluid in their body will help them feel better. We speculate that vasodepressor syncope can be managed successfully in most patients with a strict oral fluid protocol. In this new era of health care, we hope this will be prescribed by the primary care physician.

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REFERENCES