■ ORIGINAL ARTICLE

# Benign Paroxysmal Vertigo of Childhood: Categorization and Comparison With Benign Positional Paroxysmal Vertigo in Adult

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**Introduction**: The differential diagnosis of vertigo in children is extensive. This implies an additional difficulty in diagnosing dizziness in paediatric population.
**Patients and method:** Twenty-three children consecutively examined for paroxysmal attacks of dizziness and/or vertigo attacks entered our study, and were compared to a 15 adults group with benign positional paroxysmal vertigo. Fifteen healthy paediatric subjects and 18 adults were selected as control groups. The clinical characteristics of vertigo, presence of triggering factors, family history of migraine, presence of motion sickness, migraine, and other accompañying symptoms were considered. Neurological, vestibular, and auditory functions were assessed includinf the performance of a posturography in every group of patients.
**Results:** The presence of migraine, physical activity prior to vertigo, and the positional trigger of vertigo were the clinical elements wich differentiated both populations of patients with vertigo. There were significant differences in adult posturography between vertigo and control groups. In paediatric population, there were no differences between vertigo and control group in the posturography study.
**Conclusions:** The benign paroxysmal vertigo of childhood complex is the most frequent aetiology of paediatric dizziness. The duration and triggers of vertigo in children are quite similar to those found in VPPB adults. The instability posterior to vertigo, measured by posturography, were less intense in children than in adult population.

**Key word**s: Childhood vertigo. Migraine. Benign paroxysmal vertigo of childhood.

**Vértigo paroxístico benigno infantil: categorización y comparación con el vértigo posicional paroxístico benigno del adulto**

**Introducción**: Los síntomas vestibulares en la población pediátrica son una queja poco habitual. Esto, unido a la amplia variedad de cuadros clínicos y a las dificultades diagnósticas, hace que el manejo correcto sea más complejo de lo normal.
**Pacientes y método**: Presentamos 23 casos de pacientes pediátricos consecutivos con síntomas de vértigo y/o desequilibrio. Del mismo modo, presentamos otro grupo de 15 pacientes adultos con vértigo posicional paroxístico benigno. Como grupo control se escogieron dos muestras de sujetos sanos, de los que se incluyó a 15 sujetos en edad pediátrica y 18 sujetos adultos. A todos los pacientes se les realizó una anamnesis completa y exploración otoneurológica en el momento de la consulta. Las exploraciones complementarias realizadas fueron audiometría, videonistagmografía y posturografía con estimulación optocinética.
**Resultados:** La migraña, la actividad física previa al vértigo y el desencadenante posicional del vértigo fueron los elementos diferenciadores de las dos poblaciones. Las posturografía realizada en el grupo de adultos con vértigo difería significativamente de la realizada en su grupo control, a diferencia de la población pediátrica, en la que no hubo diferencias entre el estudio de las poblaciones control y patológicas.
**Conclusiones:** El vértigo paroxístico de la infancia es la entidad clínica más frecuentemente hallada en la población pediátrica. La duración y sus desecadenantes son muy similares al vértigo paroxístico benigno. La inestabilidad posterior al vértigo fue menor en la población pediátrica, así como el cortejo vegetativo.

**Palabras clave**: Vértigo infantil. Migraña. Vértigo paroxístico de la infancia.

## INTRODUCTION

Vestibular symptoms as the main symptom in paediatric patients are not very common, or at least that is how the published medical literature has described it up to now.

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Fried[1] described a prevalence of 14 paediatric patients with dizziness symptoms out of 2088 patients over 12 months. Eviatar[2] published numbers of 24 patients in every 5000, and Beddoe included 22 childhood vertigo cases in the series from his otoneurology clinic between 1960 and 1974.

However, the real prevalence is subject to factors that are not so easy to monitor as they depend on the degree of handicap this particular symptom causes in the patient, which goes totally unnoticed a great deal of the time, as well as the characteristics of the health care centre the patients go to, which may lead to a selection bias in the published prevalence. Russell et al,[4] in a paediatric study, described that 15% of children had had at least 1 vertigo episode during the previous year.

Childhood vertigo is not a disorder, per se, because there are several things that may cause it and that fall into either the benign paroxysmal vertigo of childhood (BPV) group, childhood onset of positional vertigo group, Ménière's disease or vestibular neuritis. However, BPV of childhood is the one most described in the medical literature, even though there is no comparable prevalence in our source population.

Benign paroxysmal vertigo of childhood was described by Basser[5] in 1964, and its association with migraines was described by Fenichel[6] in 1967. Parker[7] stated that there was a family history of it in 43% of his patients. It is usually brought on by changes in position, especially in horizontal positions, and last a couple of seconds with variable vegetative symptoms.[8,9] Even though some authors have differentiated these clinical symptoms from childhood onset of positional vertigo, Basser's[5] clinical criteria is fairly non-specific. In both cases migraine is thought to be the likely origin, and it is known that inducement manoeuvres are not always positive in every BPV case. This means that in certain cases the limits between the two symptomatologies are not always clear.

The aims of this study are: *a)* to describe the paediatric population with vertigo symptoms, and *b)* to compare the benign paroxysmal vertigo in the population of children with that of adults.

## PATIENTS AND METHOD

We are reporting here a prospective case-control study conducted between January, 2002, and March, 2006. There were 2 vertigo patient groups based on age: one was a paediatric group and the other was an adult group.

Group A is made up of paediatric patients with recurring vertigo symptoms who were consecutively chosen during the years the study was operational.

Study inclusion criteria for the pathological paediatric population (group A) were: *a)* age between 3 and 14 years; *b)* at least 2 rotational vertigo episodes with peripheral characteristics meeting Basser's criteria; *c)* examinations of the inner ear by otoscopy, impedanciometry, and audiometry within normal limits; and *d)* neuropaediatric examination within normal limits.

Patients were excluded from the study if they presented symptoms or signs indicating centrality, a history of eye, and/or neurological disorder that may be the cause of the patient's symptoms, and an incomplete anamnesis or physical exam.

For the adult population with vertigo (group B), 18 consecutive patients diagnosed as having BPV of the posterior semicircular canal were chosen. The inclusion criteria were: *a)* rotational vertigo with peripheral clinical characteristics; *b)* positional onset; *c)* lasting a few seconds; and d) without any associated hearing symptoms.

A complete medical history was taken for each patient as well as a physical examination including videonystagmoscopy for possible spontaneous, positional, or positioning nystagmus (Dix-Hallpike and McClure manoeuvres). A videonystagmography with caloric stimulation was done on both groups. The vestibular response was obtained by conventional bithermal caloric test and cold-water irrigation if vestibular areflexia was suspected. A videonystagmography system (Ulmer VNG, v. 1.4, Synapsis®, Marseilles, France) was used to evaluate the eye response and the maximum speed was determined for the slow phase of evoked nystagmus after stimulation in each ear, resulting in canalicular paresis and directional preponderance just as Jonkees has described.

All the paediatric patients underwent an examination by a paediatric neurologist to rule out any central pathology.

To be able to compare each group with a control group, 2 samples of healthy individuals were selected, of whom 15 were children between 0 and 14 years old, and 18 were adults. None of them had a history of problems congruent with peripheral or central vestibular disorder, head trauma, or joint problems impeding proper gait.

### Study Conditions

All study patients were given a dynamometric platform postural exam a week following the last vertigo episode reported by the patient. Under the different study conditions, the individuals had to keep their balance standing up, with no shoes, heels together and the tips of their feet forming a 30º angle, and with their arms by their side.[8]

Two 30-second measurements were taken, 1 minute apart, for each study condition, with the following characteristics and order: *a)* eyes opened, focused on a wall 2.5 meters away; *b)* eyes closed; *c)* eyes opened, focused on a wall 2.5 meters away but standing on a foam surface measuring 60×40×13 cm and with a density of 56.7 kg/m$^3$; and *d)* eyes closed, standing on the foam surface.

### Stability Measurements

The Ned/IBV SVE system was used, which was developed by the Biomechanics Institute in Valencia. The centre of gravity variations taken during each of the conditions defined above were measured with a dynamometric platform recording information about the instant position of the centre of pressure (CP) at a 40 Hz sample frequency.

The parameter studied was the average shift in the CP area (A), which is equivalent to the sway area covered. In order to calculate the average area, the application calculates an ellipse encompassing all the points making up the

individual's path from the moment he hits the current target until the transition is completed.

### Statistical Analysis

For each condition, the mean area covered was recorded in square millimetres. For analysis of the A variables, and their comparison with the different conditions within the same group, a parametric univariable analysis (ANOVA) was performed. For the comparative frequency study of the anamnesis variables, a $\chi^2$ test was used.

For the study of the relationship between the mean area covered in each set of conditions within the mean amount of time and their symptoms, a multiple linear regression was conducted.

**Table.** Clinical Characteristics of the Vertigo Mentioned by Group A and B Patients; Absolute Number and Frequencies of Each Variable

| *Clinical Characteristics* | *Group A (Paediatric Population)* | *Group B (Adult Population)* | *P* |
|---|---|---|---|
| Approximate duration of the vertigo | | | |
| Seconds | 19 (82.6%) | 15 (100%) | .09 |
| Minutes | 4 (17.4%) | 0 (0%) | |
| Associated vegetative cortex | | | |
| Yes | 9 (39.1%) | 14 (93.3%) | .001* |
| No | 14 (60.9%) | 1 (6.7%) | |
| Residual instability | | | |
| Yes | 10 (43.5%) | 9 (60%) | .9 |
| No | 13 (56.6%) | 6 (40%) | |
| Associated kinetosis | | | |
| Yes | 15 (63.6%) | 5 (33.3%) | .054 |
| No | 8 (36.4%) | 10 (66.7%) | |
| Physical activity prior to the vertigo | | | |
| Yes | 15 (68.2%) | 1 (6.7%) | .0001* |
| No | 8 (17.4%) | 14 (93.3%) | |
| Positional trigger | | | |
| Yes | 14 (60.9%) | 15 (100%) | .006* |
| No | 9 (39.1%) | 0 (0%) | |
| Triggered in bed | | | |
| Yes | 13 (56.5%) | 14 (93.7%) | .001* |
| No | 10 (43.5%) | 1 (6.7%) | |
| Associated migraine | | | |
| Yes | 16 (68.2%) | 3 (20%) | .03* |
| No | 7 (31.8%) | 12 (80%) | |
| Time relationship with migraine | | | |
| Before | 6 (24%) | 1 (6.7%) | † |
| During | 10 (40%) | 0 (0%) | |
| After | 0 (0%) | 2 (13.3%) | |
| Family history of migraine | | | |
| Yes | 16 (76.1%) | 2 (13.3%) | .001* |
| No | 5 (23.8%) | 13 (86,7%) | |
| Relative with migraine | | | |
| Mother | 12 (48%) | 1 (6.7%) | † |
| Father | 4 (16%) | 1 (6.7%) | |

*Statistically significant difference.
† No statistical analysis was done due to the sample size

## RESULTS

In the study period, 34 children with vertigo symptoms came to our centre. Eleven were excluded: 5 because of incomplete anamnesis, 2 because of vertigo bearing central characteristics, 1 for having childhood Ménière's disease, 1 because of vestibular neuritis and BPV, and another 1 for a non-vertigo related episode.

The group of paediatric patients with vertigo (group A) was made up of 12 girls and 11 boys. The average age of the group was 7.78 years old (4-13); average height was 126.83 cm (100-158) and average weight was 30.24 kg (17-47). The average time the patient had symptoms before seeking medical advice was 4.7 months (1-24).

The group of adult patients with vertigo (group B) was made up of 10 men and 5 women. The average age of the group was 49.87 years old (24-70); average height was 162.47 cm (150-178) and average weight was 68.98 kg (54.5-92.1) The control group of paediatric patients (group C) was made up of 8 girls and 7 boys. The average age of the group was 6.64 years old (4-13); average height was 122.45 cm (95-153) and average weight was 28.78 kg (15-46).

The control group of adult patients (group D) was made up of 10 men and 8 women. The average age of the group was 47.45 years old (26-67); average height was 165.26 cm (150-180) and average weight was 64.24 kg (53-90).

All patients had experienced a rotational vertigo crisis with peripheral characteristics. Table presents the clinical characteristics of vertigo for the patients in groups A and B; the absolute numbers as well as frequencies are given for each variable.

When we compare the frequencies of each variable taken into account in both patient groups, the results were significantly different in the associated vegetative symptom variables, physical activity prior to the vertigo, positional cause for vertigo onset, vertigo while in bed, associated migraine, and a family history of migraine. In the rest of the clinical variables analyzed, the incidence of each alternative is similar in both groups of patients with vertigo.

Caloric stimulation was possible in 14 patients from the childhood vertigo group (group A), without presence of canalicular paresis or directional preponderance beyond the normal limits. Results from group B, for every case, were within normal limits.

While analyzing the parameters obtained from the posturography, we could see that the results of the areas covered under the different conditions analyzed varied significantly ($P<.05$), both in the control group as well as in the pathological group, depending on the average age of

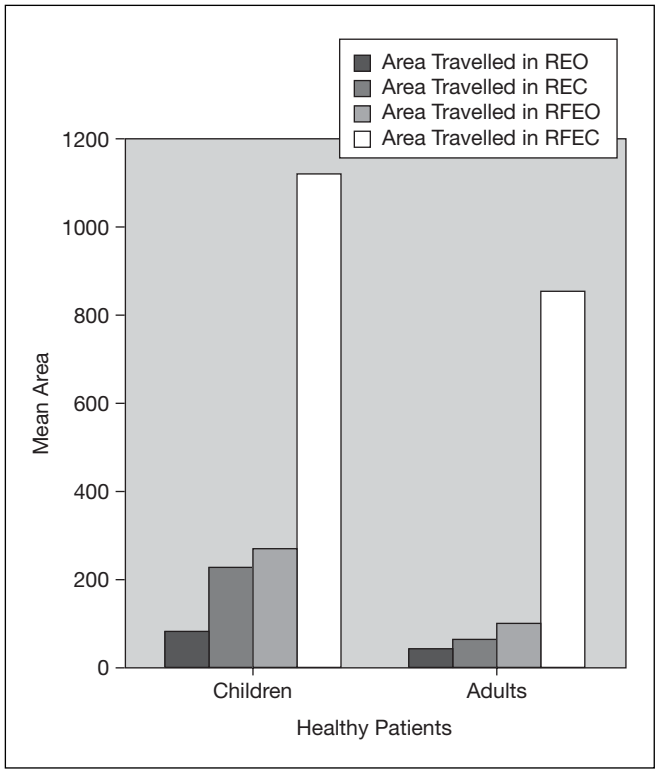


**Figure 1.** Bar graph showing the mean area covered for the different posturography conditions in the paediatric and adult control groups. REO indicates Romberg's test with eyes open; REC, Romberg's test with eyes closed; RFEO, Romberg's test on foam rubber surface and eyes open; RFEC, Romberg's test on foam rubber surface and eyes closed.

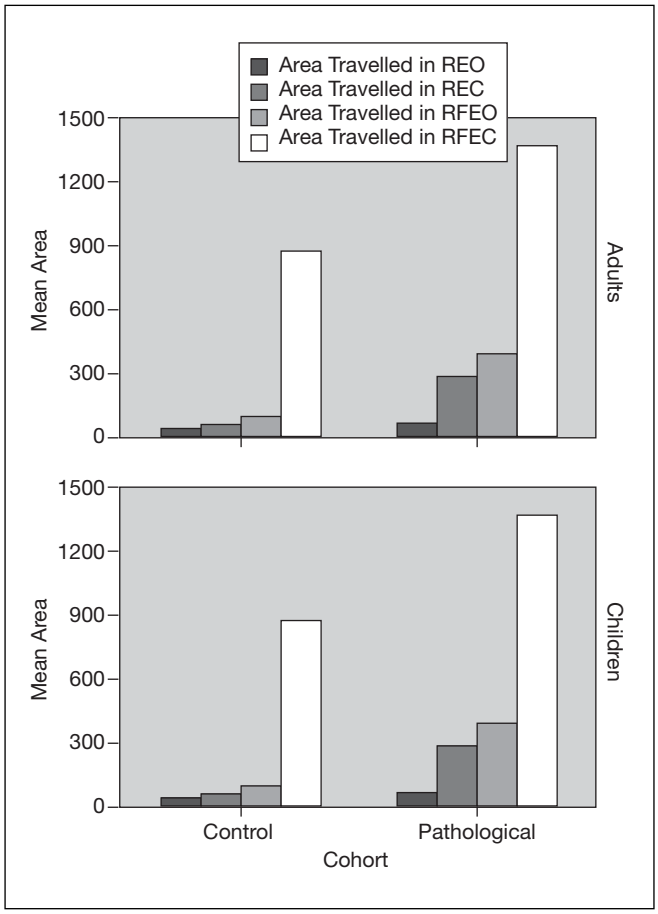


**Figure 2.** Bar graph showing the mean area covered for the different posturography conditions in the paediatric and adult control and pathological groups. REO indicates Romberg's test with eyes open; REC, Romberg's test with eyes closed; RFEO, Romberg's test on foam rubber surface and eyes open; RFEC, Romberg's test on foam rubber surface and eyes closed.

the groups of patients (Figure 1). This means that no direct comparison of both groups is possible due to the fact that the age factor interacts heavily. This is why each patient group (A and B) was compared with its respective control group (C and D).

Comparing the mean areas covered (under the 4 conditions) in the paediatric control and pathological groups, no significant differences were seen ($P>.05$), as shown in Figure 2.

On the contrary, when comparing the mean areas covered (under the 4 conditions) of the posturography in the adult control and pathological groups, significant differences were seen in the 4 conditions analyzed (Figure 2).

A multiple linear regression was done to study the relationship between the mean areas covered in the 4 sets of posturography conditions as well as the mean time the patient had symptoms before going to see a doctor. The regression model proved to be significant ($P=.013$), the predicting variable that was most influenced by time was the mean area covered in the condition with the foam surface and eyes open ($P=.018$), as shown in Figure 3.

## DISCUSSION

Vertigo, as the presenting symptom in a paediatric population, is related to a wide range of clinical symptoms that are, in many cases, difficult to categorize due to the similar ways they present themselves.

However, paroxysmal vertigo of childhood, as Basser[5] indicates, is still the vertigo seen most frequently at ENT clinics and is distinct from other symptoms. In our series of patients, out of 30 paediatric patients with peripheral vertigo during the study timeframe, only 1 patient had Ménière's disease and vestibular neuritis, another had BPV, and the rest fell into the paroxysmal vertigo of childhood category.

Even though benign paroxysmal positional vertigo is currently the most prevalent vertigo, this clinical condition is not seen frequently in the paediatric population.

Some authors[9] differentiate clearly between the 2 populations by alleging that a positional trigger is not frequently seen in childhood-onset positional vertigo. In our study population, even though the positional trigger was seen less frequently than in the adult population (group B), which reached 100%, around 60.9% of paediatric patients (group A) had vertigo triggered by position, and 56.5% of these patients stated that the vertigo came on most of the time while they were in bed. This condition, if present in an adult, makes us lean toward a BPV diagnosis, in most cases.

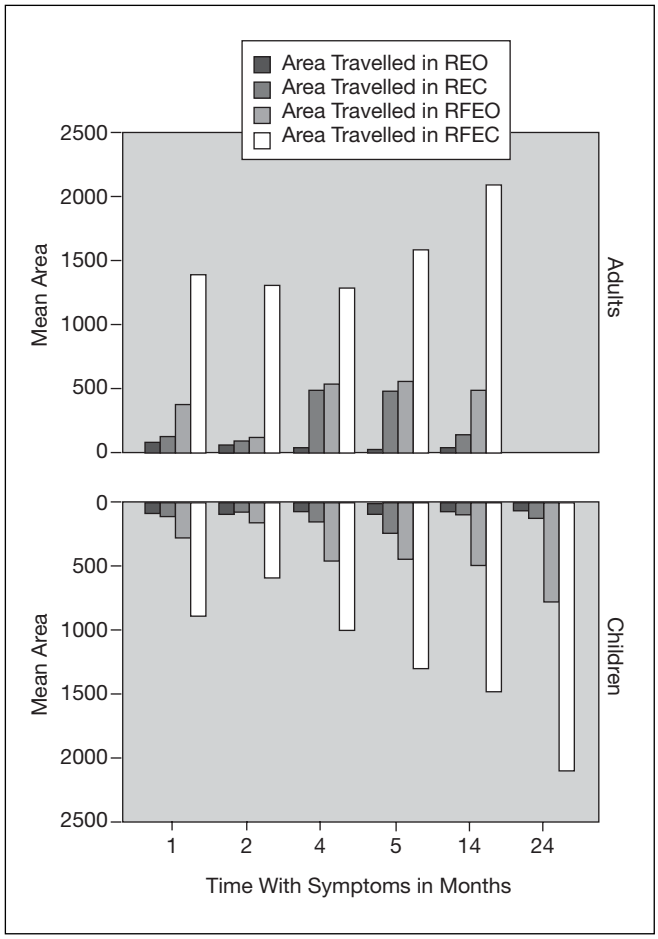


**Figure 3.** Bar graph showing the time during which patients had symptoms before seeking medical advice, for the paediatric and adult groups. REO indicates Romberg's test with eyes open; REC, Romberg's test with eyes closed; RFEO, Romberg's test on foam rubber surface and eyes open; RFEC, Romberg's test on foam rubber surface and eyes closed.

In the same way, when we study the duration of the rotational vertigo, we see that 82.6% of the paediatric group presented a rotational vertigo that lasted a couple of seconds, while that number was 100% of the adult population, without there being any significant differences between the groups. If we look at the results, it is evident that there is practically no clinical information differentiating the symptoms, except for a positive Dix-Hallpike manoeuvre, which was true in 14 of the 15 group B patients. We cannot overlook the fact that on a daily basis we see adult patients with apparent BPV but with negative manoeuvres, known as subjective BPV,[10-12] in which the repositioning manoeuvres were successful in eliminating the vertigo, even though the provoking manoeuvres were always negative.

The most evident clinical difference between the 2 populations is whether or not migraine is present, a family history of migraine, or migraine triggers such as associated kinetosis or intense physical activity prior to the onset of dizziness. With these variables, the presence of these symptoms is significantly higher in the paediatric population, and even though a percentage of adults had associated migraines or a family history, these numbers were no higher than the prevalence of this disorder in the general population.

Feniche[16] established the association between migraine and BPV, and since then a number of authors[3,4,7,9,13] have published their childhood vertigo series with association numbers ranging from 34% to 65%; our patient series has 68.2% for migraine association, coinciding with most authors in the clear relationship of the two that makes us think more of a migraine equivalent than purely vestibular clinical symptoms.

Authors such as Riina et al[14] and Erbes et al[13] state that vertigo in the paediatric population is not as serious as in the adult population. In our study population we can see that, in the childhood vertigo series, the association with vegetative symptoms is less than that found in the adult group. Similarly, the comparison of the posturographic pattern in each pathological group with its control group shows that, for the paediatric group, there are no significant differences with the healthy paediatric group whereas, in the adult group, patients with vertigo have higher area measurements under all of the conditions studied. These findings can be seen regularly at our day-to-day clinics, where children with vertigo return to a normal pace of life much more quickly than adults with BPV.

However, the confirmation of that instability through balance exams in the paediatric population is important since postural problems in this age range may compromise the normal development of the children. Quantification of the symptoms in this patient group is especially difficult because, in many cases, the parents are the only sources of information. This is why posturography is a useful tool for quantitatively evaluating balance in this age range.[15] The development of the postural pattern clearly varies with age, which would render invalid any study that directly compared the posturography patterns between paediatric and adult individuals, whether they have associated vestibular disorder or not. In spite of the fact that the paediatric posturographic pattern is difficult to evaluate, in this study we compared a group of paediatric patients suffering from paroxysmal vertigo with a control group of 15 healthy children. This allowed us to reach valid conclusions when evaluating functional handicaps from vertigo in this population.

For a better understanding of how vertigo affects postural development in the paediatric population, we must take into account another series of factors such as the age of onset, number of recurrences, duration of the vertigo episodes and the amount of time elapsed from the last episode to the balance recording. Thus, a longitudinal study that took all these variables into account would resolve a great many of the questions we are posing.

In conclusion: it is worth mentioning that benign paroxysmal vertigo is the clinical entity most frequently found in the paediatric population suffering from vertigo. There are no clinical characteristics that are clearly distinctive in adult BPV, regarding duration, and vertigo triggers.

Due to the high prevalence of migraine association as well as a family history of vertigo, our results agree with those of other authors regarding the possibility that it is a migraine equivalent. Migraine presence is the clinical characteristic that most differentiates the 2 patient groups.

Imbalance following vertigo was seen less in our study's paediatric population than in the adult BPV group, as were the vegetative symptoms associated with vertigo.

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