Seasonality and solar radiation variation level in benign paroxysmal positional vertigo

Francisco Carlos Zuma e Maia, Rayane Brum de Fraga, Bernardo Faria Ramos, Renato Valério Cal & Pedro Luiz Mangabeira Albernaz

To cite this article: Francisco Carlos Zuma e Maia, Rayane Brum de Fraga, Bernardo Faria Ramos, Renato Valério Cal & Pedro Luiz Mangabeira Albernaz (2019): Seasonality and solar radiation variation level in benign paroxysmal positional vertigo, Acta Oto-Laryngologica, DOI: 10.1080/00016489.2019.1590636

To link to this article: https://doi.org/10.1080/00016489.2019.1590636

Published online: 07 Apr 2019.
Seasonality and solar radiation variation level in benign paroxysmal positional vertigo

Francisco Carlos Zuma e Maia\textsuperscript{a}, Rayane Brum de Fraga\textsuperscript{a}, Bernardo Faria Ramos\textsuperscript{b}, Renato Valério Cal\textsuperscript{c} and Pedro Luiz Mangabeira Albernaz\textsuperscript{d}

\textsuperscript{a}Neurotology, Clínica Maia, Canoas, Brazil; \textsuperscript{b}Otolaryngology, Universidade Federal do Espírito Santo Centro de Ciências da Saúde, Vitória, Brazil; \textsuperscript{c}Otolaryngology, Universidade Federal do Pará, Belém, Brazil; \textsuperscript{d}Otolaryngology, Hospital Israelita Albert Einstein, São Paulo, Brazil

ABSTRACT

**Background:** Several studies have shown that the incidence of benign paroxysmal positional vertigo (BPPV) presents seasonal variations and there is evidence that the variation in time is dependent on the patient’s amount of vitamin D.

**Objectives:** This is a retrospective study to verify if there is a correlation between the incidence of BPPV and the level of solar radiation, essential for the synthesis of vitamin D in the skin.

**Material and methods:** This study comprised 214 patients with BPPV seen from 2012 to 2017, in a city Latitude: $-30.0277$, Longitude: $-51.2287$ 30° 1’ 40” South, 51° 13’ 43” West. The amounts of monthly solar radiation were analyzed in relation to the dates of their first consultations. Statistical tests were employed to verify the existence of a correlation between solar radiation and the incidence of the disease.

**Results:** The statistical analysis revealed a significant difference between the incidence of BPPV and the amount of radiation during the month of the diagnosis of the disease. There was also a significant statistical correlation with the climatic variation.

**Conclusion:** More patients with benign paroxysmal positional vertigo (BPPV) are seen in consultation in the months with low solar radiation and in the autumn and winter seasons, in this geographic city.

**Introduction**

Benign paroxysmal positional vertigo (BPPV) – otolith disease – is the most common cause of vertigo. The labyrinthine mechanical disorder which causes BPPV is probably due to the presence of otoconial debris detached from the utricular macula and floating freely inside the one or more semicircular canals (canalolithiasis), or attached to the ampullary cupula (cupulolithiasis). Otoconia are composites of protein and calcium carbonate and are subject to damage by drugs such as streptomycin \cite{1}, inflammation, trauma, and most importantly age-induced decalcification, (although there is controversy discussion about that \cite{2}). Progressive demineralization with advancing age leads to degradation and fragmentation of otoconia, resulting in balance disorder \cite{2}.

Previous studies have shown a link between seasonality variation, serum level of vitamin D and BPPV \cite{2, 3, 4}. A seasonal variation of patients presenting with BPPV has been observed in the United States and Iraq. In Boston, the number of BPPV clinic visits was greatest during March to May, months where serum vitamin D levels are at their lowest \cite{5, 6}. Populations living in sunny, neighboring regions of the Equator, have high serum vitamin D levels due to higher radiation incidence from the sun with fairly short wavelengths, ultraviolet B (UVB).

The otoconia are composed of calcium carbonate and depends of a homeostasis of calcium metabolism. This is probably the reason why the prevalence of osteopenia/osteoporosis is higher in patients with idiopathic BPPV \cite{7}. The utricular otolith is generated by dynamic Ca\textsuperscript{2+} absorption, which is related to Ca\textsuperscript{2+} binding proteins that are up-regulated by vitamin D \cite{8}. Some authors advocate that vitamin D may improve the pathologic biomineralization of otoconia similar to that of bone and teeth \cite{5}. Besides being ingested, vitamin D is synthesized in the skin when exposed to adequate levels of sunlight containing ultraviolet B (UVB) radiation. Regarding the amount of vitamin D production in human skin, it depends on the several variables, including environmental factors such as geographic latitude, season, time of the day, weather conditions (cloudiness), amount of air pollution and surface reflection, which can all interfere with the amount of UVB radiation reaching the skin \cite{9, 10}.

The dates of the clinic visits of our patients with BPPV led us to conduct this retrospective study to determine if in our geographic locality, Porto Alegre – latitude 30 degrees south –, there was a correlation between the various levels of seasonal solar radiations and this disease.
Material and method

This study was conducted by analyzing the examinations of 214 patients that, in their first consultation, were diagnosed as having idiopathic BPPV of the semicircular canal. They were seen at the neurotology department of a private clinic, at Porto Alegre city – Rio Grande do Sul (Latitude: −30.0277, Longitude: −51.2287 30° 1’ 40” South, 51° 13’ 43” West during the years 2012 to 2017. This study was conducted below the tropic of Capricorn (South of Brazil Bordering Argentina and Uruguay) and therefore distant from the Equator, with a lower production of vitamin D from solar exposition.

All of the patients were submitted to a neurotological evaluation, performed with video-Frenzel recordings, using an Interacoustics Video Frenzel system. There were 65 male patients and 149 females.

The diagnosis was obtained by means of Dix-Hallpike maneuvers, processed according to the literature [7,8]. Patients with BPPV associated with other disorders, such as Menière’s disease, vestibular neuritis and cranial trauma, were excluded.

The month, day and year of the BPPV diagnosis were associated with the season and solar radiation level at midday (Considering that from March 20th. to 21th September are the month of autumn and winter in Porto Alegre). The meteorological data, which mean, the level of solar radiation in that day of consultation and BPPV diagnosis (measured in kJ/m² at 12:00 noon) were obtained from the VIII District of Meteorology of Porto Alegre, a branch of the Brazilian National Institute of Meteorology.

A statistical analysis was performed to determine whether there was a significant correlation between season, solar radiation level and BPPV.

Results

The gender distribution of the patients showed that BPPV was found to be more frequent in female patients – 149 (69.6%) against 65 (30.4%) males. The patients’ ages varied from 24 to 91 years, with a mean age of 57 years. The posterior semicircular canal on the right side was involved in 44.4%; left posterior 28%; left lateral geotropic 9.3%; right lateral geotropic 7%; left lateral apogeotropic 2.3%; right lateral apogeotropic 3.3% and anterior 5.6% of the cases.

Statistical tests were performed to evaluate the patients with BPPV diagnosis in relation to the corresponding radiation level. A negative correlation coefficient (Spearman’s) of −0.70 (p = 0.012) was found between the number of patients and the intensity of the radiation; in other words, the lower amount of radiation corresponds to the larger number of patients (Figure 1).

The proportion of patients among the four seasons of the year does not differ statistically (p = 0.0785), although the p value can be considered very close to the significance. A significant difference (p = 0.014) was observed between the proportions of patients when autumn and winter were compared spring and summer. The results indicate that there is a greater proportion of patients (58.4%) in consultations in the autumn and winter seasons (Figure 2).
Discussion

The results of the present study are in agreement with those reported in the literature regarding the genders, semicircular canal and affected sides [7,8].

In a study conducted by Rhim [5], vitamin D is assumed to affect BPPV as a recurrence factor independent of age, gender, follow-up period, and type of BPPV. Patients with BPPV whose low Vitamin D levels have been corrected have shown an improvement in symptoms and decreased recurrence of their BPPV [3].

The most well-known source of vitamins D is via synthesis in the skin by sun exposure, hence its level depends on the amount of radiations. Webb et al. [11] studied the influence of season and latitude on the cutaneous synthesis of vitamin D during the winter sunlight in Boston (42.2 degrees north) and Edmonton (52 degrees north) and found in their results a dramatic influence of changes in solar UVB radiation on cutaneous vitamin D3 synthesis. They also indicated the latitudinal increase in the length of "vitamin D winter," during which dietary supplementation of the vitamin may be advisable. It was observed in the present study that the relation of patients with BPPV diagnosis to the corresponding radiation level is statistically significant, demonstrating that the lower amount of radiation relates to the largest number of patients. These results are similar to those obtained by other authors [2,11], who noted that the cutaneous synthesis of vitamin D depends on the season, being definitely influenced by the exposure of the skin to ultraviolet B radiation, time of day, latitude, altitude, cloud cover, air pollution, clothing, and sun screen use.

Similar studies [2,4,5] that investigated seasonality of BPPV in different geographical sites (Boston, Norwich and Iraq), also resulted in similar findings, stating that the number of patients with BPPV was larger during the early spring months.

Populations living in sunny, neighboring regions of the Equator, have high serum vitamin D levels due to higher radiation incidence from the sun with fairly short wave-lengths, ultraviolet B (UVB). In our study conducted below the tropic of Capricorn, the proportion of patients among the four seasons of the year did not show statistical differences, but it must be noted that the p value may be considered very close to the significance. When winter and autumn together were compared to spring and summer together, there was a significant difference. These results are also similar to those obtained in a study that evaluated the vitamin D levels in individuals over 40 years of age, either using vitamin D supplementation or not, in different seasons, in the same geographic locality (Latitude: ~30.0277, Longitude: ~51.2287 30° 1’ 40” South, 51° 13’ 43” West) [12]. They concluded that the levels were lower during the winter, probably due to the lack of sun exposure.

The limitations of this study are that it is a retrospective review with a relatively small sample and the delay between symptoms and BPPV diagnosis. Furthermore, blood levels of vitamin D, as well as other parameters of bone density, were not assessed in this study. It may be assumed, however, that the higher incidence of BPPV in winter and autumn months can be explained by the fact that shorter daytime and lower exposure to sun light may result in a vitamin D deficiency.

Conclusion

There are more patients with BPPV in consultation in the months from March 20th to 21th September (Autumn and winter) with low solar radiation in our geographic city (Porto Alegre city – Rio Grande do Sul (Latitude: ~30.0277, Longitude: ~51.2287 30° 1’ 40” South, 51° 13’ 43” West) during the years 2012 to 2017.

Disclosure statement

No potential conflict of interest was reported by the authors.

References