Therapeutic Effect of the Correction of Vitamin D Deficiency in Patients with Benign Paroxysmal Positional Vertigo – A Randomized Clinical Trial

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Abstract

Introduction  Benign paroxysmal positional vertigo (BPPV) appears during the same age group in which vitamin D and calcium deficiencies are evident. Vitamin D deficiency could predispose to BPPV, since these two entities share a demineralization process.

Objective  To establish the otological impact of vitamin D supplementation in patients with its deficiency who suffer from BPPV.

Methods  This was a randomized clinical trial. A total of 35 patients with vitamin D deficiency (< 30 ng/ml) and BPPV were divided into 2 groups: Group 1 (control group): treatment with repositioning maneuvers; and Group 2: treatment with repositioning maneuvers and vitamin D supplementation.

Results  A follow-up of between 6 and 13 months and a log rank test revealed that the probability of recurrence between the experimental groups was significantly different, with group 2 having a decreased recurrence of vertigo (p = 0.17). Scores in the Dizziness Handicap inventory (DHI) in patients treated with vitamin D supplementation were smaller (10 ± 9) when compared with a score of 36 ± 9 in the control group.

Conclusion  Plasmatic values of 25-hydroxyvitamin D have an impact in patients with BPPV, who present an improvement in their quality of life when their vitamin D levels are replaced with supplementation. Benign paroxysmal positional vertigo could stop being perceived as a purely otologic disease.

Keywords

► benign paroxysmal positional vertigo
► deficiency
► vitamin D

Introduction

Benign paroxysmal positional vertigo (BPPV) is the most common cause of peripheral vertigo, affecting 2.4% of the population worldwide.¹,² Benign paroxysmal positional vertigo appears during the same age group as vitamin D and calcium deficiencies (between the 5th and the 7th decades of life). Vitamin D deficiency is quite common; it is present in up to 60% of the general population, and could predispose for BPPV, since these 2 entities share a demineralization process.³

The conventional treatment for BPPV is based in canalicular repositioning maneuvers, which have variable results and recurrence rates as high as 50% during the next 5 years.
The group of nonrecurrent BPPV (cantly lower in patients with recurrent BPPV compared with
may generate an increase in the concentration of Ca²⁺ within their inorganic perimeter.

The function of the semicircular canals and otoliths reduces with time. With aging, there is a degeneration of the type I and II sensitivity ciliary cells. A degeneration of otoliths is also observed as part of a demineralization process related to age. These structures suffer from fractures of their bodies as part of a demineralization process, since they are structures with a high level of Ca²⁺ within their inorganic perimeter. This natural process may be accelerated in patients with vitamin D deficiency, therefore making otoliths unstable.

The pathophysiology of BPPV is based on the migration of otoliths out of their conventional site in the utricular macula and into the semicircular canals. Furthermore, we must observe this disease as part of a whole in the physiologic disequilibrium in a molecular level. Calcium and vitamin D participate in the homeostasis of the otoliths; therefore, it is expected that their deficiency will relate with the appearance of this type of peripheral vertigo. Structural modifications such as decreased density and size were observed with electronic microscopy of otoliths extracted from adult female rats with induced osteopenia and osteoporosis due to ovariectomy. Moreover, Zuca et al. proved that an increase in Ca²⁺ resorption due to vitamin D deficiency may generate an increase in the concentration of Ca²⁺ in the endolymph and reduce the dissolution capability of the dislocated otoliths.

Various studies have demonstrated the relationship between decreased bone density and BPPV: a systematic revision by Yu et al. containing 7 studies, the study by Vibert et al., in which 75% of women between 50 and 85 years old with diagnosis of BPPV had osteopenia or osteoporosis; a revision of 101 patients with BPPV who had a positive relation with postmenopausal women, and the study by Jang et al., who reported that patients with low column and hip bone density had a higher vertigo recurrence rate and required more repositioning maneuvers.1–11

In addition, a study by Talaat et al. proved that, by increasing plasmatic levels of 25-hydroxyvitamin D > 10 ng/ml, 82% of the patients had a statistically significant decrease in the number of recurrent vertigo episodes compared with patients with levels < 10 ng/ml.12 Talaat also concluded that levels of 25-hydroxyvitamin D were significantly lower in patients with recurrent BPPV compared with the group of nonrecurrent BPPV (p < 0.05).13 Jeong et al. demonstrated that in patients with values between 10 and 20 ng/ml, the risk of having BPPV increased 3.8 times, while in patients with levels < 10 ng/ml, the risk was 23 times higher.14

Sheikhzadeh et al. did an experimental study that became a role model for ours, in which they divided patients into two groups; the first was composed of patients with BPPV treated with both vitamin D supplements and repositioning maneuvers and the second was a control group treated with the conventional maneuvers. The intensity of the disease was aggravated in the control group patients, compared with a state of stability without vertigo episodes during 6 months in the supplemented group (p = 0.001).15

The present study seeks to establish the impact of vitamin D replacement in patients with deficiency of this element in our center, the National Institute of Rehabilitation Luis Guillermo Ibarra Ibarra, who, in addition, suffer from BPPV, as an extra to the conventional treatment with repositioning maneuvers. A better comprehension of the relationship between BPPV and other metabolic diseases will help to find innovative treatment strategies that decrease recurrences, generating a positive impact in the well-being of our patients by decreasing falls, fractures, hospitalizations, and expenses generated by work absenteeism.16

**Patients and Methods**

Thirty-four patients from both the otoneurology and otorhinolaryngology departments the National Institute of Rehabilitation Luis Guillermo Ibarra Ibarra, in Mexico City with clinical diagnosis of BPPV using Dix-Hallpike or McClure maneuvers, were randomly chosen using Microsoft Excel (Microsoft Inc., Redmond, WA, USA) software. As inclusion criteria, patients had to have 25-hydroxyvitamin D deficiency (< 30 ng/ml) corroborated by laboratory blood tests. Sixty patients were recruited during 2 years, of which 2 had normal Vitamin D values, 9 were lost to follow-up, 5 were excluded for being diagnosed with osteoporosis and, therefore, were already under Ca²⁺ and vitamin D supplementation, 5 were excluded because of an abnormal videonystagmography (VNG), 2 with Meniere diagnosis and 1 with a cerebral vascular event diagnosis. Other exclusion criteria included paresis or preponderance of 25% in VNG, all diseases that cause vertigo other than BPPV, and patients with kidney diseases.

The patients were asked to fill in the Dizziness Handicap Inventory (DHI) during the time of diagnosis and again between 6 and 12 months after treatment. All patients signed the informed consent form and received the conventional repositioning maneuvers after diagnosis. After having their laboratory tests done for 25-hydroxyvitamin D and Ca²⁺ to identify any state of hypercalcemia which would exclude them, the patients were randomly separated into 2 groups: Group 1 was treated with a vitamin D supplement (Colecalciferol 1,600 U) with personalized dosage depending on their serum levels (→ Appendix A), and group 2 was only treated with repositioning maneuvers.

All patients were informed of which foods are rich in vitamin D with a list recommended by a nutritionist, and received information on the importance of moderate sun exposure. Patients were asked to attend the emergency consultation if they presented a vertigo attack to have strict control of these episodes. In addition, all patients received monthly calls to track the number of episodes they had.
before treatment was very similar in both groups, to a mean of 10 patients to a toxic state, gives us a security range to establish an adequate supplementation, without leading to a mean of 26.2 ng/ml with a SD of 4.9. This confirmed most of them, to suf

A Kaplan-Meier graph was used to display the follow-up through time (in days) of both groups, with a minimum of 180 days (6 months) and a maximum of 400 days (13 months) as well as the probability of the patients of presenting a recurrence in the form of vertigo episodes. A log rank test was used in which the probability of recurrence between groups significantly differed ($p = 0.017$). (Fig. 1)

A difference from the aforementioned studies was that most of our patients had a follow-up $>6$ months, which could give more opportunity for recurrences to appear, due to the natural history of the disease, in which the possibility of new episodes duplicates each year. Additionally, patients perceived a sense of improvement demonstrated with the lower scores in the DHI, with a mean decrease of 47 points, which could be attributed to an indirect effect of vitamin D on muscular tone and balance derived from an improvement in the muscular skeletal system. Whichever is the targeted physiological and anatomical site of vitamin D (physiognomy of the otolith and/or muscular skeletal system), we observed the existence of a beneficial effect perceived by patients with BPPV after the elevation of this liposoluble vitamin. A weakness in our study was the difference in vestibular rehabilitation that was given by the different practitioners who saw our patients. All doctors work in the same hospital; however, each has different training and points of view in the rehabilitation treatment for BPPV.
Conclusion

Plasmatic values of 25-hydroxyvitamin D have an impact in patients suffering from recurrent BPPV, who present an improved quality of life when their levels are improved with supplements of this vitamin. Benign paroxysmal positional vertigo is a disease that must not be considered as purely otorrheic. The reposition of vitamin D together with repositioning maneuvers should be given as a treatment in this type of vertigo. Moreover, more studies are needed to study this relationship in the long term (>2 years) to find a more proactive management for the prevention of recurrent episodes of vertigo, considering the equilibrium of disorders of bone replacement.

Conflict of Interests

The authors have no conflict of interests to declare.

References

### Appendix A Vitamin D Reposition

<table>
<thead>
<tr>
<th>Patient serum 25/hidroxyvitamin D levels</th>
<th>Dosage of vitamin D</th>
<th>Duration of treatment</th>
<th>Maintenance</th>
<th>Dosage per day Valmetrol pills 1600 UI</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 10 ng/ml</td>
<td>180,000 UI</td>
<td>1 month</td>
<td>16,000 UI once a week</td>
<td>4 pills for 1 month 1.5 pills during 6 months</td>
</tr>
<tr>
<td>10-19 ng/mill</td>
<td>16,000 UI</td>
<td>Once a week during 8-10 weeks</td>
<td>16,000 UI once a week</td>
<td>1.5 a day during 8-10 weeks 1.5 pill daily.</td>
</tr>
<tr>
<td>20-29 ng/ml</td>
<td>16,000 UI</td>
<td>Once a week during 5 weeks.</td>
<td>16,000 every 15 days during 5 weeks.</td>
<td>1.5 pills every day during 5 weeks. 1.5 pills every 15 days.</td>
</tr>
</tbody>
</table>