VERTIGO AND OSTEOPOROSIS: THE CORRELATION BETWEEN NUTRITIONAL INTAKE OF VITAMIN D AND INCIDENCE OF RECURRING BENIGN PAROXYSMAL POSITIONAL VERTIGO IN SUBJECTS WITH HYPOVITAMINOSIS D

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ABSTRACT

Introduction: *Benign paroxysmal positional vertigo (BPPV) is the most common peripheral cause of vertigo. It can be defined as transient vertigo induced by rapid changes in head position associated with a characteristic paroxysmal positional nystagmus. The aim of this study is to evaluate the association between the serum calcium and vitamin D levels in osteoporotic patients affected by recurrent BPPV.*

Materials and Methods: *Calcium and 25-hydroxy-vitamin D levels were evaluated in peripheral venous serum samples of 40 BPPV patients.*

Results: *The reduction of serum vitamin D levels is present in 16 of BPPV patients with recurrence. After nutritional intake of vitamin D there was a decline of the vertiginous crisis recurrence.*

Conclusion: *Our findings suggested that the administration of vitamin D dietary supplements can improve, reduce and even eliminate the BPPV vertiginous crisis.*

Keywords: *Benign paroxysmal positional vertigo, vitamin D, hypovitaminosis D.*

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Introduction

The benign paroxysmal positional vertigo (BPPV), the most common cause of recurring vertigo, is a positioning vertigo. It is generally accepted as the mechanism which causes the pathological dislocation of the otoliths (calcium carbonate crystals CaCO3) on the sensory epithelium of the dome of a semicircular canal (cupololithiasis)[1]. The benign character of the BPPV is attributed to the fact that it disappears either spontaneously or following a liberating maneuver that corresponds to the injured semicircular canal.

The etiology of this disease remains indeterminate in the 50-70% of cases, although there are several factors which can lead to a detachment of the otoliths with the subsequent appearance of BPPV[2, 3]. The suggested predisposing factors are: age, sex, head trauma, viral labyrinthitis, hormonal factors and dysmetabolic diseases.

The BPPV can occur at any age, even if a major incidence has been documented in adult patients[2]: in fact, the prevalence of BPPV is roughly seven times higher in subjects aged over 60 years than in subjects aged between 18 and 39 years[4]. Moreover, it is quite common in subjects aged over 70 years and in the geriatric population and it is associated with a considerable comorbidity and an increased risk of falls[5]. Probably, this increased incidence in the elderly population is connected to the age-related degeneration

of the vestibular system of the inner ear[6], a degeneration which is partially accelerated by the coexistence of metabolic diseases such as the osteoporosis.

Several studies have suggested the existence of a likely relationship between the BPPV and the altered calcium homeostasis in the endolymph. Osteoporosis, a disease which is characterized by a reduction of the bone mass and by an increase of the bone turnover with subsequent deterioration of the microarchitecture of bone tissue, which leads to an increased bone fragility and risk of fracture[7], seems to occur more frequently in women suffering from idiopathic and recurrent BPPV[8, 9]. Serum Vitamin D deficiency would be associated with recurrent episodes of BPPV and the subsequent intake of vitamin D, for therapeutic purposes, could reduce the risk of this recurrence[10, 11].

A pilot study demonstrated how some serum biochemical markers related to the bone turnover, such as N-terminal propeptide of type 1 collagen (P1NP), have increased in osteoporotic patients affected by BPPV and this would probably represent the local effect in the vestibular peripheral system[12].

All these studies show how the alteration of balance between bone formation and bone resorption can lead to an alteration of calcium homeostasis in the inner ear, resulting in an increase of prevalence and risk of recurring BPPV in elderly patients. The dysfunction of calcium metabolism could influence the otolithic organs in two ways: the deficiency of calcium integration in the inner structure of the otoliths and their maintenance on the utricular macula could generate a repeated detachment; the increase of free calcium in the endolymph may slow or even inhibit the dissolution of the detached otoliths[13].

Recent studies have underlined the potentially useful role of the dosage of bone turnover markers for the early identification of patients with a high risk of developing osteoporosis, in order to adopt therapeutic strategies and monitor the outcome of the treatment. Since maintaining the calcification of the otoliths requires a specific interaction between the otoconial membrane and the surrounding microenvironment, the analysis of calcium metabolism in patients affected by BPPV could represent the first step to develop some strategies that aspire to reduce the incidence of recurrence of BPPV or, alternatively, to predict the risk for these patients to develop a BPPV.

With this study we evaluated the association between the serum calcium and vitamin D levels in osteoporotic patients with recurring BPPV and how the administration of vitamin D dietary supplements, together with the medical therapies already carried out, has lead to an improvement in terms of reduction and even disappearance of BPPV vertiginous crisis.

Materials and methods

Our study has been conducted in a private clinic of Otorhinolaryngologists during a twelve-month time frame, involving 40 patients who reported positional vertigo.

The patients we have recruited have been subsequently divided into two groups: the first one included patients who had already been diagnosed with canalolithiasis or cupololithiasis of the semicircular canals in the absence of a positive clinical history for vestibular pathologies, head trauma, chronic metabolic diseases, hormonal disorders and previous fractures; the second group included patients with a history of vertigo and/or dizziness and an established diagnosis of osteoporosis conducted by densitometric investigation, a gold diagnostic standard for this disease.

All the patients have been evaluated in this way: careful anamnesis; ENT examination with otomicroscopy; audio impedancemetric exam; vestibular examination with nystagmus evaluation in videonistagmoscopy making the patient wear the Frenzel glasses in order to inhibit the fixation. Diagnostic maneuvers were then carried out and have been followed, when necessary, by the corresponding liberating maneuvers: for the lateral semicircular channel the diagnostic maneuver of Pagnini-McClure and the liberating maneuver of Gufoni; for the semicircular rear channel the diagnostic maneuver of Semont and the liberating maneuvers of Semont and the maneuver of Epley.

Control visits have been scheduled for all of the patients with a different lapse of time based on the frequency of the recurrent positional vertigo associated with the presence of nystagmus. Moreover, the patients have been sent to their General Practitioner, suggesting first level (blood count, calcium test, fractional proteinuria, phosphoremia, erytrocyte sedimentation rate, alkaline phosphatase, creatinine) and second level (25-hydroxy-vitamin D serum levels) blood chemistry tests: patients with a significant reduction in serum vitamin D levels have been advised, from the very first visit, to take oral dietary supplements containing vitamin D.

Statistical analysis

Statisticals was performed using GraphPad Software. The Chi-Square Calculator was used to test significant difference between the two groups. Results were considered to be statistically significant when $p<0.05$.

Results

The average age of the total 40 patients was 57 years-old with a range between 45 and 70 years-old. The average age of female patients was 57 years-old (range from 45 to 70 years-old); the average age of male patients was 59 years-old (range from 55 to 70 years-old). Therefore, there were no significant distinctions between the two groups in terms of age. However, significant differences were recorded by evaluating the sex of our patients. In fact, the sample of patients we studied included 25 females and 15 male subjects.

Among the female patients, 10 of them had been diagnosed with osteoporosis (T-score < -3) with reduction of serum vitamin D levels and 5 presented an isolated hypovitaminosis D. Among the male patients, none of them had a diagnosis of disease and only 5 patients had hypovitaminosis D.

Thus, the reduction of serum vitamin D levels was higher in those patients who had been diagnosed with osteoporosis but still present in about half of the examined patients.

We have not recorded any significative differences in terms of presence of various risk factors, such as hyperlipidemia, diabetes, arterial hypertension, history of cigarette smoking and alcohol abuse. So, among the 40 patients included in the study, only 21 of them presented recurrent BPPV according to the following distribution.

Among the 20 patients without either osteoporosis or hypovitaminosis D, the following ones had recurrence: 2 of them after 15 days and then a month; 1 patient after a month; another one after 15 days and 1 patient after 6 months. They have been treated with vestibular maneuvers and the pharmacological assumption of betahistine.

Among the 10 patients having an isolated reduction of serum vitamin D levels and who had been treated, since the very first visit, with vestibular maneuvers and vitamin D dietary supplements: 6 of them had recurrence after 15 days and were completely asymptomatic in the following outpatient controls.

Eventually, all of the 10 patients who had been diagnosed with osteoporosis had recurrence after 15 days, probably because their clinical conditions made vestibular maneuvers difficult to perform, while just 2 of them had recurrence even after one month.

Discussions

We found that 20 of our patients with idiopathic BPPV had low average vitamin D serum levels or osteoporosis: we have been treated them with vitamin D dietary supplements (Group A). The remaining 20 patients without either osteoporosis or hypovitaminonis D have been treated with bethistine (Group B).

In the Group A we identified 16 patients who had been having recurrent episodes of BVVP after 15 days and 2 patients who had been having recurrent episodes of BVVP after 30 days.

In the Group B we found 3 patients with recurrence after 15 days, 2 of them had recurrence after 30 days and 1 patient had been having recurrent episodes of BVVP after 180 days.

After having been supplemented with vitamin D, Group A patients have not encountered relapses in the follow-up period at 6 month; hovewer, this was not statistically significant (the chi-square statistic is 4.6883; the p-value is 0.095929; the results are not significant at $p<0.05$).

These preliminary results show that a hypothesis linking vitamin D and BPPV may be valid. Although we cannot rule out coincidence at the present, given the multiple benefits of vitamin D and the extremely low number of recruited patients, we recommend supplementation in BPPV case.

Conclusions

Therefore, the main features of our study are the following: the analysis made to evaluate the connection between BPPV and osteopenia has shown how effectively the osteoporosis can represent a risk factor for the BPPV; if looked for, the reduction of serum vitamin D levels is present in about half of the patients affected by BPPV; the administration of vitamin D dietary supplements contributed to reduce the recurrence of vertigo episodes in the patients affected by BPPV.

It goes without saying that this study has some shortcomings, which are mainly related to the little number of recruited patients and to the short time

frame they have been examined for but one more time it underlines how the management of the patients who are affected by recurring vertigo episodes requires a multidisciplinary approach.

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