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# Benign paroxysmal positional vertigo and vitamin d deficiency

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**Abstract**
**Objectives:** The aim of this study is to establish a relation between vitamin D deficiency and benign paroxysmal positional vertigo (BPPV) and to investigate the curative effect of 25 (OH) vitamin D on BPPV.
**Methods:** In a small pilot study, 25 patients with clinical diagnosis of posterior canal BPPV were examined, treated and followed up at ENT department of Al salam teaching hospital, Mosul/Iraq. Serum 25(OH) D was measured at 1st visit. During a follow up period the neuro otological assessment was repeated. In patients with insufficient serum level of 25(OH) D, vitamin D supplementation started. Follow up period was 10.5 months after which patients were kept on touch by telephone interview.
**Result:** This study was conducted on 25 patients with BPPV (18 females and 7 males). The average age was 46.5 years with a range of 32-61 years. 16 patients (64%) (group A) had their 1st episode of BPPV. 9 patients (36%) (group B) had been having multiple episodes over several years. Average serum level of 25(OH) D in all patients (both groups) was 11.65 ng/ml 22 (88%) patients had low serum level of 25(OH) D (below 20ng/ml) and only 3patients (12%) were above 20 ng/ml. In patients with recurrent severe BPPV episodes (group B), average levels of serum 25(OH) D were significantly lower than that of group A. Vertigo attacks did not recur after supplementation with vitamin D.
**Conclusion:** We support the hypothesis that patients with benign paroxysmal positional vertigo who have low serum vitamin D levels may benefit from supplement and suggest further epidemiological studies to detect the effect of vitamin D deficiency on the development/ recurrence of vertigo. Many researchers recommend the assessment of S. vitamin D in patients with benign paroxysmal positional vertigo and supplementation if necessary.

**Keywords:** BPPV, vitamin d supplement

## Introduction
Benign paroxysmal positional vertigo (BPPV) is the most common neuro-otological disorder, and its incidence rate in normal population can be up to approximately 10%. The average onset age is close to 60 years [2]. After the age of 60 years, the incidence is increased, and the rate is lower in population aged below 40 years. It is rare in children with woman to man ratio of nearly 2:1 [2]. Now it is accepted, that it is caused by dislodged otoconia (calcium carbonate crystals) with falling from the macula and floating into the semi-circular canals thereby making them sensitive to gravity [5]. Although BPPV may result secondary to head trauma, migraines, prolonged bed rest and otologic surgery vestibular neuritis. etc, 80% of all cases are of unknown etiology (idiopathic) [5]. Canolith repositioning maneuver (CRM) is an effective and rapid procedure for BPPV treatment in which the dislodged crystals are moved to the vestibule where they may be absorbed by the body. Despite the effectiveness of this treatment, BPPV often recurrs. Many scientists have confirmed that vitamin D receptors are founded on calcium channel transport systems of the labyrinth and act to regulate proper calcium balance. This mechanism may helps explain the role of vitamin D in maintaining proper auditory function [5].
BPPV main manifestation is that the transient vertigo can be sustained when the head moves to a specific position, accompanied by nystagmus and autonomic symptoms. BPPV is common in middle-age and elderly patients and other age groups may involved. The disease is self-limited, and the posterior semicircular canal is involved most commonly followed by the horizontal semicircular canal and the superior semicircular canal is the least involved. 1α-Hydroxyvitamin D3 is an active metabolite of vitamin D3, which can regulate the calcium-phosphorus hemostasis in the body and treat osteoporosis during women's menopause. Elderly population may suffer from unrecognized recurrent vertigo. 9% percent of geriatrics in one study were found to have unrecognized BPPV and more likely to have reduced

activities, have a fall in the previous few months, and may be depression.

Recent studies showed common features between bone and otoconia bio-mineralization. Clear cross beneficial therapeutic effects could be detected between BPPV and osteoporosis when treated with bisphosphonates in women [1]. The therapeutic effect of vitamin D on osteoporosis has been confirmed in the literatures. Calcium and vitamin D have an important roles in improving bone mineral density and decreasing the risk of fractures. Connections between vitamin D supplement and improved osteoporosis, and between osteoporosis and BPPV have been suggested in the literatures. There are few publications linking vitamin D and BPPV. As a hypothesis researchers suggest, that there may be a relationship between vitamin D and BPPV. It is also suggested that the beneficial effect of Vitamin D on reduction of falls in BPPV eldely patients may be achieved by decreasing recurrence of chronic BPPV.

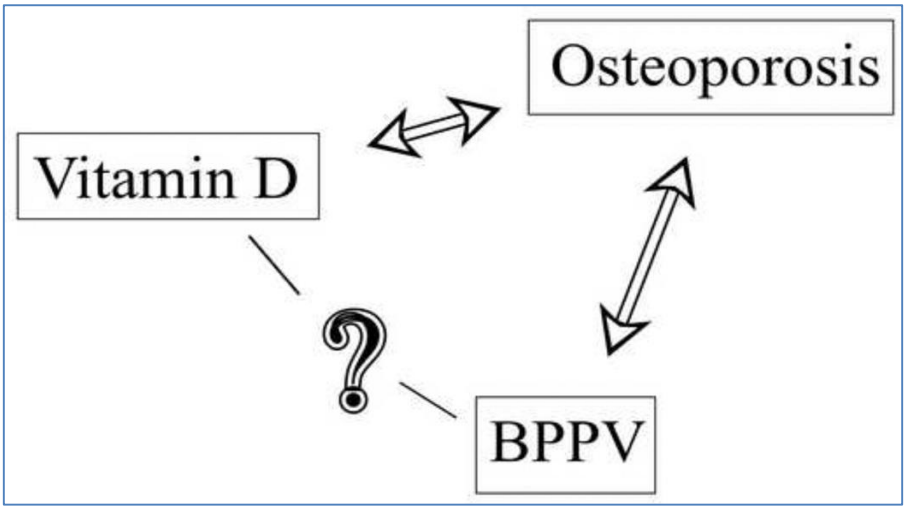


**Fig 1:** The relation between vitamin D and BPPV. The arrows =confirmed relation. The question mark=hypothesis

## Patients & method

Twenty five patients suffering from BPPV were examined in ENT outpatient &emergency departments at alsalam teaching hospital, Mosul city, between June 2017 and Jan 2018. Inclusion criteria were: 1- diagnosis of unilateral idiopathic posterior canal BPPV with no history suggestive of secondary BPPV; 2-availability of serum level of 25(OH)D at first visit; 3-availability of periodic follow-up; 4-negative neurological state; 5-successful repositioning Epleys maneuver was applied to all patients at first presentation; 6-normal symmetric hearing threshold. The group of patients included 18 females and 7 males (average age = 46.5 years (min: 32; max: 61 years). The routine neuro-otological examination was carried out including positional testing. Serum 25(OH) D was measured using (cobas c 411, germany) by an electro chemilumine scence immunoassay. During a follow up period the neuro-otological assessment was repeated and in patients with insufficient serum level of 25(OH) D and no history of nephrolithiasis, vitamin D supplementation started. If the level of 25(OH) D was under 20 ng/mL, then the supplementation consisted of daily 5000 IU cholecalciferol for one month, then 5000 IU cholecalciferol twice weekly for one month, then a weekly dose of 5000 IU was given thereafter. Follow up period was 10.5 months. After this time the patients were kept on touch by the telephone interview, and their state were evaluated.

## Results

At the first presentation in all patients posterior canalolithiasis could be diagnosed. It was possible to perform a successful repositioning Epley-maneuver in every patient. In 16 cases (Group A) the patients had their first episode of BPPV, in average since 10 days. In 9 cases (Group B) the patients had been having multiple episodes over several years. The data of those patients are listed in Table 1

**Table 1:** Data of 9 Patients with Severe Recurrent BPPV

| Patient no. | gender | Age | 25(OH)D (ng/mL) | History |
|---|---|---|---|---|
| 1 | f | 42 | 5.8 | Recurrent episodes since 2 years; each episode for weeks |
| 2 | f | 43 | 7.4 | Recurrent episodes since 4 years, each episode for weeks |
| 4 | m | 68 | 3.1 | Episodes 2 years ago, every second month each episode for days |
| 6 | f | 52 | 9.2 | Since 2 years every third months; (5 episode) each episode for weeks |
| 8 | m | 39 | 4.5 | Recurrent episodes since 2 years (8 episodes) each episode for weeks |
| 10 | f | 55 | 6.5 | Recurrent episodes since 4 years, (10 episodes) each episode for weeks |
| 12 | f | 29 | 9.3 | Episodes 10 years ago, then 5 years ago, since 2 years approx. every second month; each episode for days |
| 19 | m | 58 | 8.2 | Since 2 years every third months; (5 episode) for weeks |
| 24 | f | 43 | 8.3 | Since 2 years every third months; each episode for weeks |

Average 25(OH) D level in all patients (Group A+ Group B) was 11.65 ng/mL (minimum: 3.1; maximum 27). In 15(60%) patients (both groups) the 25(OH)D level was under 10 ng/mL (“deficient” 25(OH)D level and in 7(28%) patients it was 10 -20 ng/ml and only 3 (12%) patients were above 20 ng /ml. Totally 22 out of 25 BPPV patients had abnormally low serum 25(OH) D. After having examined all BPPV patients we divided the group of all patients into two groups. Group A:

first manifestation, Group B: recurrent BPPV. In Group A average serum 25(OH) D level was 14.3 ng/mL (minimum: 7.6; maximum 27). In Group B average serum 25(OH) D level was 6.9ng/mL (minimum: 3.1; maximum 9.3). The difference between the two groups was significant (Mann Whitney test; $p<0.05$): Fig. 2.

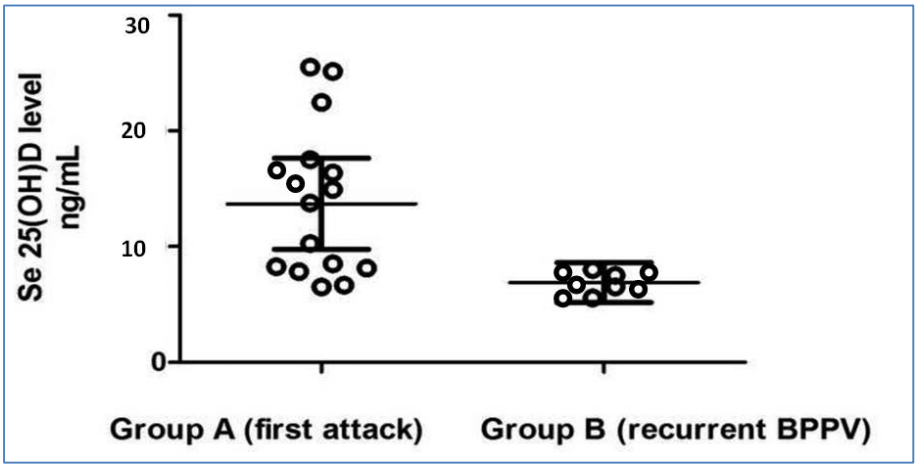


**Fig 2:** Distribution of cases according to serum 25 (OH) D (group A &group B)

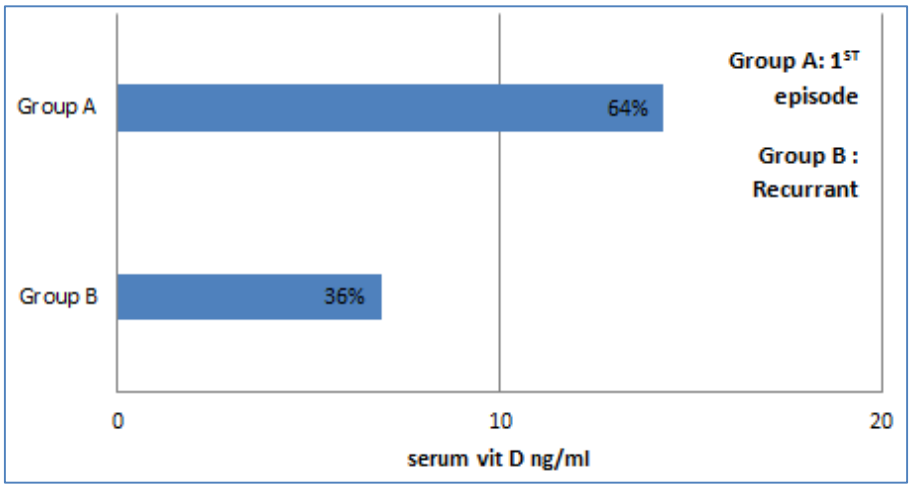


**Fig 3:** Recurrance of BPPV and relation with AVERAGE s. 25 (OH) D Level

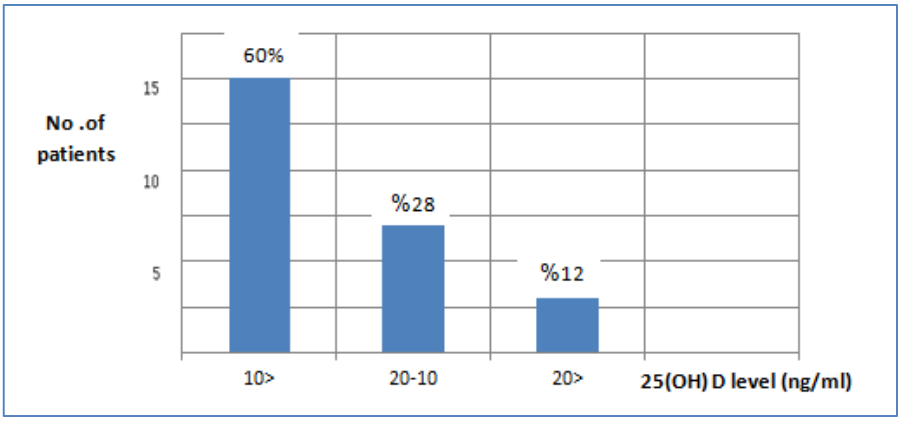


**Fig 4:** Distribution of all patients according to serum Vit. D level

**Follow up evaluation**

At the time of the initial follow up assessment nystagmus due to BPPV was not elicited in any case. Up to the time of the telephone contact there was no recurrence of the BPPV episodes in any case of both groups.

**Discussion**

We found that patients with idiopathic BPPV had low average serum level of vitamin D (11.6 ng/mL). This is similar to that of the general population, which has a high rate of vitamin D hypo vitamin osis. We identified 9 patients, who had recurrent episodes of BPPV for a long time with a frequency of 3–4 relapses/year for several years. These patients had significantly lower average serum level of 25(OH) D than patients in the group A (first episode). After vitamin D supplementation, BPPV patients have not encountered recurrence in the follow up period of at least 10 months. Vibert *et al* in 2003 suggested a relation between BPPV and

osteoporosis and bone metabolism may be connected to BPPV [1]. Although many BPPV cases are mild and self-limited, most cases recur. Recently the recurrence rate of BPPV was 27%, and most patients relapse in the first 6 months. Generally the recurrence rate of BPPV after successful treatment is 40 to 50% at average of 5 years follow-up [1]. Yamnaka *et al*. 2013 found the incidence of osteoporosis in patients with BPPV was 26.2% and in BPPV patients with osteoporosis, the incidence of recurrence was 56.3%, which was significantly higher than that observed in patients with normal bone mineral density (16.1%) [12]. Furthermore, the frequency of BPPV recurrence increased as BMD decreased. He concluded that osteoporosis is a risk factor for BPPV recurrence and the prognosis of BPPV might be clinically predicted by BMD reduction [12]. Jeong *et al*. 2013 reported the levels of 25(OH) D in 100 idiopathic BPPV patients and found that the level in serum of BPPV patients was lower than that in control group [2], and the probability of vitamin D insufficiency (<20 ng/ml) in BPPV patients was significantly higher than that in control group. Moreover, the statistic analysis of the age, sex, body mass index (BMI), hypertension, diabetes mellitus and lower bone mineral density (BMD) proved that both the vitamin D insufficiency (10–20 ng/ml) and deficiency (<10 ng/ml) are associated with BPPV, and suggest that low serum vitamin D is a risk factor of BPPV [2]. The Journal of Neurology published findings in 2013 that reported vitamin D levels in people with BPPV to be 4.5 ng/mL lower than healthy controls. Very low levels have also been associated with the recurrence of BPPV. In our study in 9 cases with recurrent episodes of BPPV and low levels of serum 25 (OH) D, BPPV did not recur after vit. D supplementation. These results show that a hypothesis relating vitamin D and BPPV may be valid in the view of the classical effects of vitamin D on bone density, and muscle performance. Moreover, falling of elderly people was significantly reduced in individuals supplemented with vit D in comparison to those receiving calcium and placebo possibly by lowering the frequency of unrecognized BPPV [1]. The non-classical effects of vitamin D supplementation also have been described (cardiovascular, diabetes mellitus, asthma, allergy, multiple sclerosis, cancer) and a synergistic relationship may be targeted by correcting abnormally low vit D serum level (1). The authors classified vitamin D profile according to measured 25(OH) D concentration: 1- less than 10 ng/mL: deficient; 2-between 11–20: insufficient; 3- higher than 20 ng/ml: sufficient. A range of 30 to 40 ng/mL was recommended. There is an international agreement about the need for vitamin D supplementation in certain groups of patients and the need for assessment of their (25(OH) D) serum levels for optimal clinical outcome. The beneficial effect of vitamin D supplement may be include improving the pathologic bio mineralization of otoconia just like to that of bone and teeth. The lower limit for vitamin D levels should be 30 ng/mL, but keeping S. level above 45 ng/mL, or even 50 mg/mL, may be the most beneficial. Safe sun exposure of 15 to 30 minutes daily may help stabilize serum vitamin D.

## Conclusion

- According to many studies the relation between otolithiasis and vitamin D deficiency is highly possible.
- Due to the high rate of vitamin D deficiency and the availability of measurement of serum 25(OH) D and supplementation, the recommended supplement should be done anyway.
- BPPV is so common and disabling that if the vitamin D supplement inhibits recurrence rate even in a small percentage of patients, this means a significant number of patients with improvement.
- We suggest further investigations to estimate average serum levels of 25(OH) D in patients with BPPV and the benefit of treating vitamin D deficiency on the occurance and recurrence of BPPV. Given the other benefits of vitamin D, the study recommend estimation of 25(OH) D of BPPV patients and supplementation whenever necessary.

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