

## Original Research Article

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# Vitamin D and calcium deficiency in otolaryngological diseases

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## ABSTRACT

**Background:** A prospective study to observe the prevalence of deficiency of vitamin D and calcium in out patients of otolaryngology clinic at R.C.S.M Government medical college, Kolhapur, India. The patients attending outpatient of otolaryngology clinic with various complaints and not responding to conventional treatment were advised for assessment of vitamin D [25 (OH)D] level in blood.

**Methods:** The age, sex, occupation, chief complaints, obesity and provisional diagnosis was noted in all cases. A total of 86 patients were examined, maximum patients were in the age group of 7-15 years. The chief complaints in majority of the patients were sore throat with recurrent upper respiratory tract infection.

**Results:** Only three patient's vitamin D levels were found to be within normal limits. In rest 83 (96.51%) it was either deficient 57 (66.28%) or insufficient 21 (24.42%).

**Conclusions:** The incidence of vitamin D deficiency is extremely common in ear, nose and throat disease (ENT) patients. The results of vitamin supplementation were promising in cases of pharyngitis, upper respiratory tract infection (URTI) with asthma, post operation of chronic suppurative otitis media, empirical supplementation of vitamin D in all ENT patients not responding to conventional treatment is worth trying.

**Keywords:** Vitamin D deficiency, Calcium, URTI, Pharyngitis, Otitis media, Cholesteatoma

## INTRODUCTION

The Purpose of this study is to put some light on the relationship between calcium, vitamin D and ENT disorders. There is huge role of calcium in the maintenance of immunity in the body and it aids to fight off against the microbes from the environment. The role of vitamin D in prevention of Respiratory Tract Infection or aggravating demineralization of bone is gathering evidence and hence this study was conducted to evaluate the same in the outdoor patients of otoryngology clinic.

There is common knowledge about the spread of middle ear diseases and its complications. For example; a bacteria or a virus can cause pharyngitis and a chronic case will lead to its spread via the Eustachian tube towards the middle ear and form acute otitis media. Now

this if untreated complicates into chronic suppurative otitis media which has an association with cholesteatoma.

There are about 200 viruses apart from *Pneumococci*, *meningococci* and *streptococci*, which cause common cold, pharyngitis and acute otitis media. And many of these pathogens are sensitive to antimicrobials, cathelicidin and defensin released by the body under the influence of vitamin D.<sup>1-4</sup>

The epithelium which faces the environment directly like the skin and the respiratory mucosa are protected by innate immunity.<sup>5</sup> Vitamin D has a major role in it as toll like receptor and vitamin D receptor are present on the macrophages governing the innate immunity.<sup>6-8</sup> Vitamin D also regulates the level of the enzyme CYP27B1. All of this in turn leads to secretion of cathelicidin, the major

antimicrobial.<sup>9</sup> Active 1,25 dihydroxy vitamin D also acts as a chemottractant for neutrophils and monocytes.<sup>10,11</sup> Therefore its deficiency definitely causes decreased immunity and increased cases of upper respiratory tract infection.<sup>12</sup>

The respiratory epithelium also converts inactive vitamin D to active 1,25 (OH)D3 to increase the expression of vitamin D regulated genes.<sup>13</sup> It is the key immunomodulator and its deficiency will increase the incidence of URTI leading to otitis media retraction pockets and cholesteatoma.

There is presence of typical compensation in the body related to vitamin D levels. When the body reserves of vitamin D are low, the calcium gets depleted too as vitamin D fails to reabsorb calcium from the kidney and intestine. The decreased calcium activates the osteoclasts and up regulates bone resorption from dense bones first and then other small bones.

An inverse association between maternal intake of vitamin D during pregnancy and incidence of infection, low birth weight and early childhood wheezing has been reported.<sup>14,15</sup> Hence, low serum vitamin D levels in the pregnant women must be considered, which may finally lead to in severe congenital hearing loss in baby.

The calcium and phosphorus content of woven bone of the otic capsule are much higher than other bones and hence may be more affected by deficient vitamin D and Calcium levels. Again deficiency of vitamin D will enhance osteoclastic activity of cholesteatoma.<sup>16</sup>

The role of vitamin D deficiency has been attributed to cochlear deafness representing with trough shaped pure tone audiogram with a dip during 1 and 2 kHz frequencies.<sup>17</sup>

## METHODS

This was an observational study conducted at C.P.R Hospital, Kolhapur city, Maharashtra, India over a period of 5 months from 1st January to 30th May 2016. Post treatment recovery will be observed upon when the decided treatment would be given in placebo control and drug control groups. The procedures followed were in accordance with the ethical standards of experimentation. 86 subjects of both sex age between 1-60+ years with complaints of pharyngitis, chronic suppurative otitis media, cholesteatoma, URTI were included in the study after taking written consent. Exclusion criteria were patients with other associated systemic diseases.

The patients attending outpatient of otolaryngology clinic with various complaints and not responding to conventional treatment were advised for assessment of vitamin D [25 (OH)D] level in blood. The age, sex, occupation, color of skin, chief complaints, obesity, provisional diagnosis, and incidence of sun exposure was

noted in all cases. A quick general history and examination was also undertaken for presence of other medical conditions.

## RESULTS

A total of 86 patients in the period from 1st January to 30th May 2016 were examined. Maximum patients were in the age group of 7-15 years 40 were male 46 female as shown in Table 1. Only in three patients vitamin D level was in normal limits. In rest 83 (96.51%) it was below 25 nmol/mL 10 (11.63%) below 25-50 nmol/mL in 57 (66.28%) and 50-75 nmol/mL 16 (18.61%) cases. As shown in Table 2.

**Table 1: Age and sex distribution.**

Age group	No. of patients	%	Sex	
			Male	Female
<b>1-7 year</b>	18	20.93	10	8
<b>7-15 years</b>	25	29.07	14	11
<b>15-25 years</b>	17	19.77	7	10
<b>25-40 years</b>	19	22.09	8	11
<b>40-60 years</b>	5	5.81	1	4
<b>60 years— onwards</b>	2	2.33	0	2
<b>Total</b>	86	100	40	46

**Table 2: Serum vitamin D levels.**

Serum vitamin D levels	No	%
<b>&lt;10 nmol/mL</b>	5	5.81
<b>10-25</b>	5	5.81
<b>25-50</b>	57	66.28
<b>50-75</b>	16	18.61
<b>&gt;75</b>	3	3.49
<b>&gt;400</b>	0	0
<b>Total</b>	100	100

**Table 3: Chief complaints.**

Complications	No
<b>Sore throat</b>	15
<b>Sore throat with URTI</b>	21
<b>Atelectic ear following cholesteatoma surgery</b>	4
<b>Recurrent ear discharge with central perforation</b>	17
<b>Recurrent ear discharge with cholesteatoma</b>	14
<b>Sensorineural deafness</b>	15

## DISCUSSION

In our study, 96.51% were deficient for vitamin D. Baitlay et al in ENT patients have reported that 2% had the level 17.5 nmol/L or less, 58% below 50 nmol/L and all were below 80 nmol/L while in our study there were 3 patients having more than 80 nmol/L vitamin D level.<sup>18</sup>

Rockell et al has reported only 84% below 80 nmol/L out of which 48% below 50 nmol/L and 3% below 17.5 nmol/L.<sup>19</sup> Ginde et al reported 2% population below 10 ng/ml and 10% below 30 ng/ml and the incidence of URTI was 19% while it was 24.41% in our series.<sup>6</sup>

In this study we could see that significantly lower levels were seen in upper socio economic group. No difference in status of vitamin D level as gender, race, economic status or vitamin use was considered. In this study I could not find out a case of rickets even though it was common once upon a time in India. The association of diabetes with ENT disorder was observed in 9 cases all of them were given weekly sachet of Vitamin D 60,000 units along with all other supportive treatment and reduction in weight the results were promising but it warrants specific long term study to conclude in favor of vitamin D.

There was a case of full term pregnant woman attending ENT outpatient department for chronic distressing cough not responding to all conventional treatment. Her vitamin D level was quite low (5.8 nmol/L) along with low serum calcium level. Patient was developing sign and symptom of preeclampsia. High doses of calcium supplementation are attributed to prevent preeclampsia hence we propose screening for vitamin D level in all pregnant women and suitably supplemented to decrease the incidence of eclampsia.

Low serum levels of vitamin D metabolites may lead to osteoclastic activity (osteoporosis) that is mobilization of calcium from bones may also result in secondary hyper parathyroidism. Radiologically it cannot be detected until more than 35% demineralization of bone has been done. Demineralization of cochlea has also been observed in temporal bone tomography. We can hypothesize that osteoclastic activity will be potentially aggravated in deficiency of vitamin D. Now it is well known that deficiency of vitamin D lowers the immunity and may precipitate the recurrent attacks of upper respiratory tract infection leading to eustachian tube dysfunction which may complicate as cholesteatoma. We have to work out the deficiency of vitamin D and blood level of calcium to prevent this drastic disorder (cholesteatoma).

Replacement of vitamin D and calcium should be done carefully as higher calcium level may lead to extra skeletal calcification but significantly high doses has to be given for months together. Toxicity above 400 nmol/mL has been considered worth alarming. High doses of vitamin A procured from cod-liver oil can be considered as a counter active substitution.

## CONCLUSION

The incidence of vitamin D deficiency is extremely common in ENT patients. The result of vitamin D supplementation is promising in cases of CSOM with

mastoidectomy, cholesteatoma spread and URTI with asthma, since the assay of vitamin D level is costly hence repeated checkup is not cost effective.

Empirical supplementation of vitamin D in all ENT patients is worth trying if patient is not willing for assessment of vitamin D specifically in patients of recurrent attack of acute otitis media or other URTI. We cannot substitute the benefit of sun exposure but certainly to enhance immunity we can supplement vitamin D. At place of sun screen, use of pomegranates and blueberries may be encouraged to prevent sunburn and tanning to prevent deficiency of vitamin D.

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## REFERENCES

1. Muhe L, Lulseged S, Mason KE, Simoes EA. Case-control study of the role of nutritional rickets in the risk of developing pneumonia in Ethiopian children. Lancet. 1997;349:1801-04.
2. Bikle D. Nonclassic actions of vitamin D. J Clin Endocrinol Metab. 2009;94:26-34.
3. Yim S, Dhawan P, Ragunath C, Christakos S, Diamond G. Induction of cathelicidin in normal and CF bronchial epithelial cells by 1, 25-D3. J Cyst Fibros. 2007;6:403-10.
4. Wayse W, Yousafzai A, Mogale K, Filteau S. Association of subclinical dihydroxyvitamin D deficiency with severe acute lower respiratory tract infections in Indian children under 5 years. Eur J Clin Nutr. 2004;58:563-7.
5. Hughes DA, Norton R. Vitamin D and respiratory health. Clin Exp Immunol. 2009;158:20-5.
6. Ginde AA, Mansbach JM, Camargo CA Jr. Association between serum 25-hydroxy vitamin D level and upper respiratory tract infection in the third national health and nutrition examination survey. Arch Intern Med. 2009;169:384-90.
7. Reichel H, Koeffler HP, Bishop JE, Norman AW. 25-Hydroxyvitamin D3 metabolism by lipopolysaccharide-stimulated normal human macrophages. J Clin Endocrinol Metab. 1987;64:1-9.
8. Liu PT, Stenger S, Li H, Wenzel L, Tan BH, Krutzik SR. Toll-like receptor triggering of a vitamin D-mediated human antimicrobial response. Science. 2006;311:1770-3.
9. Webber G, Heilborn JD, Chamorro Jimenez Cl, Hammarsjo A, Torma H, Stahle M. Vitamin D induces the antimicrobial protein hCAP18 in human skin. J Invest Dermatol. 2005;124:1080-2.
10. Gombart AF, Borregaard N, Koeffler HP. Human cathelicidin antimicrobial peptide (CAMP) is a direct target of the vitamin D receptor and is strongly up-regulated in myeloid cells by 1,25-

dihydroxy vitamin D3. *FASEB J.* 2005;19(9):1067-77.

11. Liu PT, Stenger S, Tang DH, Modlin RL. Cutting edge: vitamin D-mediated human antimicrobial activity against *Mycobacterium tuberculosis* is dependent on the induction of cathelicidin. *J Immunol.* 2007;179:2060-3.
12. Holick MF, Chen TC. Vitamin D deficiency: a worldwide problem with health consequences. *Am J Clin Nutr.* 2008;87:1080-6.
13. Hansdottir S, Monick MM, Hinde SL, Lavan N, Look DC, Hunninghake GW. Respiratory epithelial cells convert inactive vitamin D to its active form: potential effects on host defense. *J Immunol.* 2008;181:7090-9.
14. Cammargo CA, Rifas-Shiman SL, Liuonjua AA, Burris HH, Kleinman K, Huh SY. Prospective study of maternal intake of vitamin D during pregnancy and risk of wheezing illness in children at age 2 years. *J Allergy Clin Immunol.* 2006;117:721-2.
15. Devereux G, Litonjua AA, Turner SW, Craig LC, McNeill G, Martindale S. Maternal vitamin D intake during pregnancy and early childhood wheezing. *Am J Clin Nutr.* 2007;85:853-9.
16. Taneja MK, Vivek Taneja. Role of vitamin D in prevention of deafness. *Indian J Otolaryngol.* 2012;18(2):55-7.
17. Brookes GB. Vitamin D deficiency and deafness: 1984 update. *Am J Otolaryngol.* 1985;6(1):102-7.
18. Bartley Jim, Reid David, Morton Randall P. Prevalence of vitamin D deficiency among patients attending a general otolaryngology clinic in south auckland. *Annals Otolaryngology Rhinology Laryngol.* 2009;118(5):326-8.
19. Rockell JEP, Skeaff CM, Williams SM, Green TJ. Serum 25 hydroxyvitamin D concentrations of New Zealanders aged 15 and older. *Osteoporos Int.* 2006;17:1382-9.

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