

Vitamin D Deficiency in E.N.T. Patients

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Abstract A prospective study to observe the prevalence of deficiency of vitamin D in out patients of otolaryngology clinic at Indian Institute of ear diseases, Muzaffarnagar. 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, colour of skin, chief complaints, obesity, provisional diagnosis, and incidence of sun exposure 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. Only in three patient's vitamin D level was found to be within normal limits. In rest 83 (96.51 %) it was either deficient 57 (66.28 %) or insufficient 21 (24.42 %). The incidence of vitamin D deficiency is extremely common in Ear Nose Throat disease (E.N.T.) patients. The results of vitamin supplementation were promising in cases of benign paroxysmal positional vertigo with cervical spondylosis and URTI with asthma, empirical supplementation of vitamin D in all E.N.T. patients not responding to conventional treatment is worth trying. At place of sun screen, use of pomegranates and blueberries may be encouraged to prevent sunburn and eliminate Vitamin D deficiency.

Keywords Vitamin D deficiency · URTI · Bronchial asthma · B.P.P.V. · Cervical spondylosis · E.N.T

Introduction

The role of vitamin D in prevention of respiratory tract infection, cochlear deafness or demineralization of bone is gathering evidence hence this study was conducted to evaluate the incidence of Vitamin D deficiency in out door patients of otoryngology clinic with various symptoms and signs of E.N.T and related diseases.

Neils Finsen was awarded nobel Prize for using high intensity light by arc lamp in skin tuberculosis. Since then various researches are going on to treat and cure infection by sun rays. The upper respiratory tract mucosa is the initial site of contamination and infection hence nature has provided several protective mechanisms out of which is the ciliary movement of the respiratory mucosa and its mucous a gel like structure which removes the inhaled invading microbes. On invasion to body microbes are taken care by the locally available antimicrobial peptides.

There are about 200 viruses apart from *pneumococci*, *meningocci*, and *streptococci*, which can cause common cold and acute otitis media. Most of these pathogens are sensitive to anti-microbials, cathelicidin and defensin released by the body defense mechanism under the influence of vitamin D [1–4]. The Upper respiratory tract infection (URTI) results in acute neutrophilic infiltration in respiratory epithelium and production of mucous. With increased amount of mucous, patient is more prone to infections and decrease in pancreatic secretion, which may result in mal-absorption of fat, consequently decreased absorption of vitamin D [5].

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The prophylactic role of vitamin C has been embarked and been used for decades in the prevention of recurrent URTI. The ergocalciferol and cholecalciferol are less commonly used as vitamin supplement and rarely used as immunomodulator. Though some foods also contain these pro-vitamins, due to inadequate sunlight exposure or dark skin, active vitamin D (25 hydroxy vitamin D and 25 (OH)D) level varies in the body, which may result in reduced innate immunity. Winter time vitamin D insufficiency may explain seasonal variation and more frequent URTI. Apart from darker pigmentation, use of sun screens, wearing of clothing, clouds, environmental pollution limits the penetration of ultraviolet light B. Aging is also associated with decrease concentration of 7 dehydro cholesterol in skin; a common reason may be attributed for vitamin D insufficiency and old age deafness.

Vitamin D deficiency is now associated with increased risk of certain cancer, autoimmune and infectious diseases [6]. Vitamin D regulates more than 200 genes including genes for cellular proliferation and apoptosis [5]. Vitamin D regulated gene expression through binding with Vitamin D Receptor (VDR), which modulates the expression of genes.

Pathogenic antigens interact with toll-like receptors on macrophages to up regulate the expression of gene that codes for the vitamin D receptor and for the 1 α hydroxylase enzyme that convert 25 (OH) D [7–9] to the biologically active 1, 25 dihydroxy vitamin D and it enhances the production of cathelicidin hCAP-18 (LL-37) [10], which enhances microbial killing in phagocytic vacuoles, acts as a chemottractant for neutrophils and monocytes [11, 12]. Vitamin D is very important for muscle function and it reduces the risk of falls in old persons. If a person is suffering from insomnia or depression the cause may be vitamin D deficiency.

The respiratory epithelium can also convert inactive vitamin D to active 1, 25 (OH)D 3 to increase the expression of vitamin D regulated genes, which provide definite innate immunity at the site [13]. Thus, vitamin D is a key, immunomodulator and its deficiency will increase the incidence of URTI leading to otitis media retraction pocket and cholesteatoma, again deficiency of vitamin D will lead to low bone density and osteoporosis, hence osteoclastic activity of cholesteatoma will be enhanced [14].

An inverse association between maternal intake of vitamin D during pregnancy and incidence of infection, low birth weight, premature birth has been reported [15, 16]. 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 role of vitamin D deficiency has been attributed to cochlear deafness, Meniere's disease and otosclerosis

including cochlear otosclerosis representing with trough shaped pure tone audiogram with a dip during 1 and 2 kHz frequencies [17].

The calcium and phosphorus content of the woven bone of the otic capsule are much higher than other bones hence may be more affected by deficient vitamin D levels.

Again demineralization of otic capsule, may lead to degenerative changes in the spiral ligament, stria vascularis and cochlear hair cells [18]. A significant reduction in the brainstem amplitude has been observed in vitamin D depleted diet in albino rats by Brooks and Morrison [19].

Materials and Methods

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, colour 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 May to 30th September 2012 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.

The chief complaints in majority of the patients were sore throat with recurrent upper respiratory tract infection, details of complaints are shown in Table 3.

Table 1 Age and sex distribution

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

Table 2 Serum vitamin D level

Serum vitamin D levels	No	%
<10 nmol/mL	5	5.81
10–25	5	5.81
25–50	57	66.28
50–75	16	18.61
>75	3	3.49
>400	0	0.00
Total	86	100

Table 3 Presenting complaints

Chief complaints	No.	%
Sore throat	18	20.93
Sore throat with URTI	21	24.42
Tinnitus sinusitis	12	13.95
Recurrent URTI with bronchial asthma	5	5.81
Atelectic ear following cholesteatoma surgery	1	1.16
Recurrent ear discharge with central perforation	7	8.15
Recurrent ear discharge with cholesteatoma	4	4.65
Sensorineural deafness	5	5.81
Sensorineural deafness with tinnitus	5	5.81
Vertigo with tinnitus	2	2.33
Vertigo with sensori deafness	2	2.33
Vertigo with cervical spondylosis	3	3.49
Cheilosis	1	1.16
Total	86	100

Table 4 Skin color type and Vitamin D levels

Colour of skin	No.	%	Vitamin D level		
			Avg	Min	Max
Very fair	0	0	0	0	0
Fair	39	45.35	44.50	7.0	139.0
Wheatish	20	23.26	41.80	11.8	64.4
Brownish	19	22.09	45.56	5.8	116
Dark brown	8	9.30	32.15	16.67	49.2
Dark	0	0	0	0	0
Total	86	100	31.73	5.8	139.0

The color of skin type and vitamin D level was matched as of fitz patriek skin type divided in six categories result shown in Table 4.

The incidence of dental caries was quite high in our group and it was closely associated in cases of cholesteatoma hence the cases of recurrent URTI with dental caries should be investigated for vitamin D and serum calcium level to prevent complication in terms of cholesteatoma.

None of the patient gave a specific history of deliberate sun exposure/sun bath for health reason.

Discussion

In our study, 96.51 % were deficient for vitamin D. Baitlay et al. in E N T 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 [20] while in our study there were 3 patients having more than 80 nmol/L vitamin D level, 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 [21]. Ginde et al. [7] reported 2 % population below 10 ng/ml and 10 % below 30 ng/ml and the incidence of URTI was 19 % while it was 24.42 % in our series.

In our study we could see that significantly lower levels were seen in upper socio economic group while Linday et al. has also derived that no difference in status of vitamin D level as gender, race, economic status or vitamin use was considered. Bantley et al. [22] has also observed deficiency in all ranges & similar proportion. In our study we can 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 favour of vitamin D.

There was a case of full term pregnant woman attending E.N.T out patient 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 & 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 can not 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. The ability of vitamin D to decrease the risk of distal colorectal adenoma in woman can be attenuated by high intakes of preformed vitamin A.

Apart from inadequate sunlight exposure and dietary intake, impaired intestinal absorption, poor liver function or disease, chronic renal disease and anticonvulsant drug may also lead to lower vitamin D levels. The incidence is more in asians, may be due to poor absorption of ultra violet rays due to melanin and/or dietary or genetic factors. Ultraviolet (UV) B radiation with wave length of 290–320 nano meters converts cutaneous dehydrocholesterol to pre-vitamin D₃. The bright scorchy sunlight may itself destroy the vitamin D produced in the skin. It has been observed that vitamin D produced in limbs may be more readily available than from the abdomen. Its suits our culture hence even limited body exposure is sufficient average 15 min sun exposure to face and both limbs on alternate days between 10:00 A.M. to 3:00 P.M. is sufficient.

Conclusion

The incidence of vitamin D deficiency is extremely common in E.N.T patients. The result of vitamin D supplementation is promising in cases of benign paroxysmal positional vertigo with cervical spondylosis 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 E.N.T 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 adenotonsillitis.

We can not 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, 200 IUs up to 50 years, 400 IUs up to 60 years and 600 IUs above it may go up to 2,000 IUs in winters supplementation is advised.

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