Original Article

Level of Vitamin D in COVID-19 Positive Patients on Admission and Their Outcome in Tertiary Hospital

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Abstract:

Background: : Vitamin D is one of the important immunomodulator which enhance immune system of the body. The level of vitamin D directly influences the outcome of COVID-19 patients. Our study was carried out to explore the relationship between the level of vitamin D and COVID-19 positive patients and their outcome. **Methods:** We conducted a cross-sectional study of Covid positive patients from 1st June to 30 August 2020 whom got admitted at the Combined Military Hospital (CMH), Dhaka to assess vitamin D levels in COVID-19 patients. Diagnosis of COVID-19 was confirmed via viral Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) from nasal or nasopharyngeal swab or supporting radiological investigations. This study includes assessed demographic laboratory analysis, including vitamin D measurement. Data were collected from medical records and recorded in a questionnaire for analysis. **Results:** The 71 individuals included in this study had test results for Covid-19 in 2020 and vitamin D levels in pandemic period. Among 71 patients 34(48%) of patients were male and 37(52%) of patients were female, 28(39%) COVID-19 positive patients had insufficient vitamin D, 37(52%) of patients had deficient vitamin D and 6(9%) of patients had adequate level of vitamin D. The duration of hospital stay was more (>14 days) among vitamin D deficient patients than patients with insufficient and adequate vitamin D level. The aged group (59-68years) suffered more in vitamin D deficiency than other age groups. Female patients were found more (54%) vitamin D deficient compared to male (46%). **Conclusion:** Vitamin D deficiency increases the chance of disease severity after COVID -19 infections. Vitamin D plays a protective role against Covid-19 infection.

Keywords: 25-hydroxyvitamin D, RT-PCR, SARS cov-2.

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Introduction:

Covid-19 is caused by SARS-CoV-2, an RNA virus transmitted through respiratory droplets, the spike protein present on the surface of SARS-CoV-2 binds to the ACE2 (angiotensin converting enzyme) receptor on the host cells of the nose and respiratory tract. Vitamin D plays a significant role in the modulation of the innate and adaptive immunity. Vitamin D has been noted to inhibit the pro-inflammatory cytokines secretion and manipulate the ACE2 receptors through which the virus manifestation spreads apart from being an immunomodulator that affects both innate and adaptive immune responses. Vitamin D active form also induce the production of antimicrobial peptides and support the differentiation of monocytes, with the enhancement of phagocytic and chemotactic capacity[1]. Vitamin D is also involved in the regulation of thrombotic pathways and vitamin D deficiency is associated with an increase in thrombotic episodes[2]. Vitamin D may come from endogenous production after exposure to UVB rays, nutritional sources or exogenous supplementation[3]. The importance of vitamin D in cases of respiratory infection is illustrated by the fact that low levels have been associated with a significantly increased risk of pneumonia and viral upper respiratory tract infections[4]. Vitamin D deficiency

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has also been found to occur more frequently in patients with obesity and diabetes mellitus. These conditions are reported to carry higher mortality in COVID-19. Vitamin D is known to play a key role in the maintenance of bone health and calcium -phosphorus metabolism, yet many other functions of this vitamin have been recently postulated, such as modulation of the immune response in both infectious and autoimmune disease[5]. The global prevalence of vitamin D deficiency (<20 ng/ml), several studies have reported data on the prevalence of low vitamin D levels in Europe (up to 40%) and United states of America, Canada and India (>20%) of the general population being deficient[6]. Several reports have suggested a possible association between vitamin D deficiency 25 (OH)D levels <20 ng/ml) and COVID-19 susceptibility.[7,8] Our review reveals that a strong relationship of vitamin D status on COVID-19 health related outcomes.

Methods:

This was a cross-sectional study conducted at Combined Military Hospital Dhaka from 1st June to 30 August 2020. The study population were purposively selected who were RT-PCR positive COVID-19 patients with age group 28-75 years who admitted in COVID-19 care center of CMH Dhaka during the study span of three months. Their vitamin D level was assessed before and during hospital admission. Patients who were taking bisphosphonates, steroids, anti-convulsant, calcium or vitamin D supplements before admission were excluded from this study. All patients took adequate sun exposure at least 10-30 min/day. The cut-off ranges of vitamin D in deficient, insufficient and sufficient (adequate) groups shown <50 nmol/l, 5075 nmol/l and > 75 nmol/l respectively and in severe deficient cases <25 nmol/l[7]. Data were collected from medical record and interview of patient. All data recorded in a semi-structured questionnaire. After processing of data analysis was done by SPSS-20.

Results:

Among 71 patients 52% were suffering from vitamin D deficiency, 39% had insufficient vitamin D. Between 59-68 age group patients were suffering more in vitamin D deficiency (14%) (Table-I). Female patients (54%) were suffering more vitamin D deficiency in comparison to male patients (46%). In this study, patients had various symptoms such as fatigue (71%), fever (48%), dry cough (46%) and asymptomatic were (17%) (Table- II).

Patients had different types of chronic diseases such as hypertension (HTN) were 34(48%), Diabetes (DM) were 27(38%), Chronic Obstructive Pulmonary Disease (COPD) 24(33%) and others 13(18%) (Figure-I). Among 71 patients about 56 patients suffered from at least one chronic disease. According to Figure-2 among 37 vitamin D deficiency patients, the duration of hospital stay or recovery time were <7 days in 9(24%) patients, 7-14 days in 11(28%) patients, and >14 days in 13(35%) patients. In 28 vitamin D insufficient patients, the duration of hospital stay or recovery time were <7 days in 7(25%) patients, 7-14 days in 8(29%) patients and >14 days in 12(32%) patients. Among adequate level of vitamin D group 4 patients <7 days and 2 patients recovered within 714 days. Four vitamin D deficiency and one insufficient vitamin D patients were required intensive care unit (ICU) support with noninvasive ventilation.

Table I: Vitamin D status in different age and sex group of the respondents (n=71)

Variables	n(%)	Vit-D deficient	Vit-D insufficient	Vit-D adequate
COVID-19 positive patient	71	37 (52)	28 (39)	6 (9)
Sex				
Male	34 (48)	17 (24)	14 (20)	3 (4)
Female	37 (52)	20 (28)	14 (20)	3 (4)
Age (years)				
28-38	7 (10)	2 (3)	2 (3)	3 (4)
39-48	9 (13)	4 (6)	4 (6)	1 (1)
49-58	12 (17)	6 (9)	5 (7)	0 (0)
59-68	26 (37)	14 (20)	11 (15)	1 (1)
69-78	17 (24)	11 (15)	6 (9)	1 (1)

Table II: Clinical presentation of COVID-19 associated with vitamin D deficiency among respondents (n= 71)

Serial	Symptoms	n =71	Percentage
1	Fatigue	51	71%
2	Fever	34	48%
3	Dry cough	33	46%
4	Non-specific Headache	7	9%
5	Diarrhea	13	18%
6	Asymptomatic	12	17%

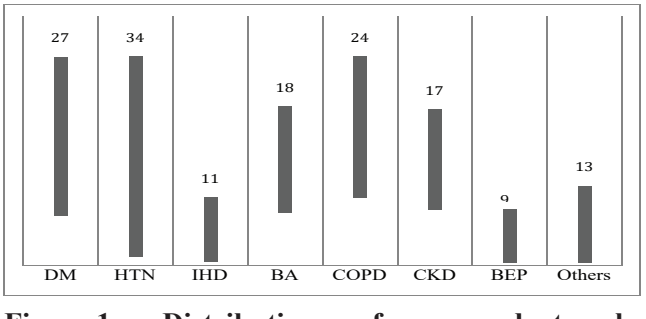

Figure-1: Distribution of respondents by co-morbidities (n = 71)

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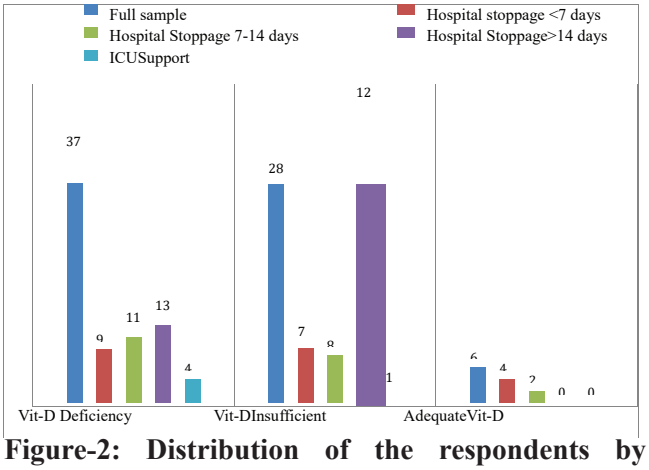

Figure-2: Distribution of the respondents by outcome of the disease (n=71).

Discussion:

Vitamin D is essential for health specially in immune response as in COVID-19 where overall immunity is affected. So, Vitamin D may help in rapid recovery of individual by enhancing the immune response. Research has focused poorer clinical outcome from COVID-19 infection in patients with vitamin D deficiency, namely hospitalization and mortality. Our observational study shows that patients with a severe form of COVID-19 had significantly lower serum 25(OH)D which is consistent with the findings of previous meta-analysis[9] that revealed a causal role for vitamin D deficiency in COVID-19 severity. Vitamin D deficiency was strongly associated with mortality related to COVID -19 infection. Lower concentration of vitamin D level corresponded to a significant increase in mortality in hospitalized patients for COVID-19 infection, consistent with few studies[10,11]. Lower vitamin D levels were associated with an increased risk of more symptoms and longer hospital staying. Nimer et al[12] study shows vitamin D sufficiency may reduce the COVID -19 mortality.

In our study, we evaluated vitamin D status in 71 patients with COVID -19. Among 71 patients, we found that 52% (37 patients) had vitamin D deficiency and 38% (28 patients) had vitamin D insufficiency. About 90% of COVID-19 patients have not adequate level of vitamin D. Our statistics revealed that among all reported cases, vitamin D deficiency was found among all ages. From our study, severe vitamin D deficient patients were more likely to have hypertension and diabetes, similar to the studies from New York City found that hypertension and obesity were the most common co-morbidities in COVID-19 patient[13]. Alhazzani et al conducted a study from 12 different countries, reported that among 1099 patients admitted for COVID-19,173 had severe infection with secondary co-morbidities. Out of comorbidities,16.2% and 23.7% suffered from diabetes and hypertension respectively[14]. Vitamin D plays a role in strengthening the body's immunity by inducing monocyte differentiation and inhibiting lymphocyte proliferation. According to the most recent research, COVID-19 is a potentially endothelial disease with a pathophysiological concept of cytokine storm that may worsen initial pneumonitis, leading to destructive alveolitis and acute respiratory distress syndrome.[15] Vitamin D deficiency has been found to contribute to acute respiratory distress syndrome (ARDS), a major cause of death associated with COVID-19. In our study, we did not get any ARDS cases as all patients returned from ICU without any invasive ventilatory support and there was no fatal case associated with vitamin D deficiency.

In our study duration of hospital stay or recovery was <7 days were 9 patients (24%), 7-14 days were 11 patients (28%) and >14 days were 13 patients (35%). In vitamin D insufficient 28 patients, <7 days were 7 (25%) patients, 7-14 days were 8 patients (29%) and >14 days were 12 patients (32%). However, consistency of vitamin D deficiency has been observed in patients with severe form of COVID-19. 25-hydroxy vitamin D (25OHD) has beneficial effects on the immune system, play a significant role in controlling the homeostasis of the human body thus providing enough support to hypothesize Vitamin D insufficiency may lead to adverse outcomes especially in the COVID-19 patient. For example, vitamin D will increase the production of various peptides by the innate immune system, which has anti-viral, anti-fungal, and anti-microbial activity[16]. Vitamin D deficiency, defined as 25(OH)D <20ng/ml.[17] Current evidence suggests that taking a Vitamin D supplement at doses recommended by the Endocrine Society to maintain a serum concentration of 25(OH)D of at least 30ng/ml. [17]

Conclusion:

Considering some limitations our findings suggest that lower vitamin D, 25(OH)D concentrations have significant relationship and adverse clinical outcomes in patient with COVID-19 infection. The COVID-19 positive individuals with sufficient vitamin D levels had significantly lower the symptoms and shorter hospital stays.

Study limitation:

The study has some limitations, including a small number of enrolled participants, single-centered retrospective study and potential confounders such as age and co-morbidities.

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