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Serum Vitamin D Concentration in Pandemic 2009 H1N1 Influenza Infected Patients

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Abstract

Background: Recently, immunomodulatory effect of vitamin D was documented. It was proposed that serum level of vitamin D in some populations including patients with asthma, cystic fibrosis, chronic obstructive pulmonary disease (COPD), tuberculosis and respiratory infections is lower than normal. We have evaluated serum vitamin D concentration in H1N1 infected patients.
Methods: Fifty-two patients with documented H1N1 influenza were enrolled the study during pandemic 2009 flu. Patients' demographic data was recorded and one venous blood sample (3 ml) was collected from each patient at same time a day (at morning). Serum 25 (OH) D concentrations was measured by Chemiluminescence method.
Results: Median (interquartiles 25-75) serum 25 (OH) D concentrations in the studied population was 26.62 (13.85-45.86) nmol/l. In men and women enrolled in the study, medians (interquartiles 25-75) of serum 25(OH) D were 28.95 (21.10-44.55) and 16.72 (10.48-98.34), respectively. Serum vitamin D concentration was higher in women than men, but it was not statistically significant.
Conclusion: Based on vitamin D deficiency definition [serum 25(OH) D levels less than 35 nmol/l], 60.8% of the Iranian H1N1 infected patients had vitamin D deficiency.

Keywords: Vitamin D, Pandemic 2009 flu, H1N1 influenza

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Introduction

Vitamin D is a lipid soluble vitamin provided to the human body by some foods such as oily fish, egg yolk, fish liver oil and some fortified food like milk or orange juice (1). Biologically active form of vitamin D is 1, 25 dihydroxy vitamin D3 [1, 25 (OH) D3] that can be produced from precursors like 7-Dehydrocholestrol (7-DHC) by a photosynthetic mechanism in skin (2). Several studies documented the various important roles of this vitamin such as regulation of calcium and phosphorous homeostasis (3), immunomodulatory effect on cancers (4) and cardiovascular diseases (5,6). Recently, immunomodulatory effects of vitamin D was documented (6-8). It seems that vitamin D serum levels in some populations including patients with asthma, cystic fibrosis, chronic obstructive pulmonary disease(COPD), tuberculosis and respiratory infections are lower than normal population (9) and there is emphasis on vitamin D role in innate immunity including T cells, B cells, NK cells, and monocytes (10). For many decades, vitamin C has been used for prevention and treatment of upper respiratory tract infections (URTI) despite the lack of convincing evidence of benefit in community populations (11). But it was shown that vitamin D status is inversely associated with recent URTI, common cold and influenza (9). Pandemic 2009 flu caused by H1N1 virus, and its spread throughout the world lead to important burden on healthcare system, and causing morbidity and mortality to millions of people worldwide (12, 13). It was hypothesized that that epidemic influenza occurs in seasonal pattern and peaks during winter, when vitamin D deficiency is common (14).

Vitamin D deficiency is common in Iran and many other countries (15, 16). This study focused on H1N1 infected population and their 25(OH) D serum level to determine prevalence of vitamin D deficiency in this patients.

Methods

Fifty-two patients with documented H1N1 influenza (based on RT-PCR reports) were enrolled the study during pandemic 2009 flu in Imam-Khomeini hospital, Tehran, Iran. Patients' demographic data was recorded and one venous blood sample (3 ml) was collected from each patient at same time a day (at morning). Serum 25 (OH) D concentrations was measured by Chemiluminescence method. Based on national data (15-18), serum 25(OH) D levels lower than 35 nmol/L are considered as vitamin D deficiency. Data analyses have been performed using SPSS version 13.

Results

Fifty-two patients including 29 males (aged 39±14 years) and 23 females (aged 37 ±13 years) participated in this study. The most frequent clinical features and chief complaints of patients were cough (71.5%), fever (69.6%), myalgia (65.1%), shaking chills (63.1%), and headache (60.1%). Based on severity of infection, location of care was determined for (49 %) of patients as to be remained in the community, (43%) were admitted to the general ward in the hospital, and (8%) were admitted to an ICU. The length of staying for hospitalized patients had a median of 3 days and the mean duration of symptoms was 5 days. The outcome of patients based on their location of care, was as following: from those remained in the community 70.2% recovered without any complications. From hospitalized patients in general wards 40.3% discharged without any complication. Complications of H1N1 infection that recorded in the patients were as following: respiratory complications, central nervous system disorders, gastrointestinal, cardiovascular, renal, and hepatic complications.

Median (Interquartiles 25-75) serum 25 (OH) D concentrations in the studied population was 26.62 (13.85-45.86) nmol/l. In men and women enrolled in the study, medians (interquartiles 25-75) of serum 25(OH) D were 28.95 (21.10-44.55) and 16.72 (10.48-98.34), respectively (Figure 1). Serum vitamin D concentration was higher in women than men, but it was not statistically significant (P=0.3). Based on vitamin D deficiency definition (serum 25(OH) D level less than 35 nmol/l), 60.8% of the studied patients had vitamin D deficiency. In comparison with healthy population, serum vitamin D concentration was not significantly different. There was no correlation between serum 25(OH) D and age (R=0.25 and P=0.07) and patients' outcome (R=0.41, P=0.1).

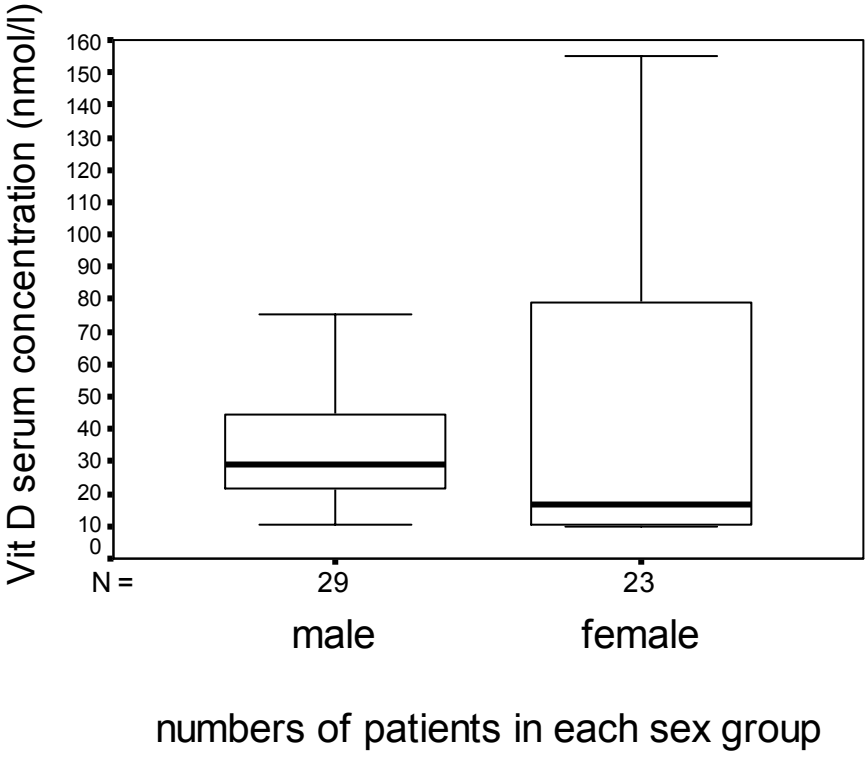

Figure 1- Median, 5 and 95 percentile of serum vitamin D in males and females

Discussion

This is the first report that has evaluated vitamin D serum concentration in Iranian H1N1 infected patients. We found that 60.8% of this population was vitamin D deficient, as defined serum 25(OH) D lower than 35 nmol/L. According to previous studies, vitamin D deficiency is common in Iranian population. The highest level was reported by Hashemipour *et al.* which found vitamin D deficiency in 81.3% of healthy population of Tehran (16). The differences between vitamin D deficiency prevalence may be related to seasons that the studies were done. The mentioned study was done at the beginning of 2001 and present study was done in October and November 2009. Serum 25(OH) D concentrations have monthly variation and the nadir were seen in December and February but in October the values was highest (17).

There are several explanation for vitamin D deficiency such as insufficient sun exposure, clothing habits, darker skin pigmentation, skin coverage, air pollutions and insufficient vitamin D intake (9, 16). Vitamin D deficiency suffers both males and females. Our findings are consistent with some other studies showing difference between mean serum 25(OH) D levels in males and females (15, 18). However this difference was not significant. In accordance with Sedrani *et al.* (19) findings serum 25(OH) D level was lower in the H1N1 infected males than females.

Epidemiological studies indicate an inverse association between serum 25(OH) D level and respiratory tract infections (2, 9). Possible mechanisms may due to vitamin D effects on innate immunity. Immune cells including B and T lymphocytes, neutrophils, and antigen presenting cells such as macrophages have receptors for vitamin D (20). Recent researches showed that vitamin D stimulates genetic expression of anti-microbial peptide (AMP) in human monocytes, neutrophils, and other human cell lines. Defensins and Cathelicidins are some of these endogenous antibiotics and display broad spectrum antimicrobial and anti viral activity (14). Influenza is one of respiratory viral pathogens that show a distinct wintertime excess. In 1981 Hope-Simpson proposed that "seasonal stimulus" associated with solar radiation and seasonality of epidemic influenza. He found vitamin D is responsible for this event. Since vitamin D formation dependent on solar

radiation and it improves innate immunity around the summer and impairs it in the winter (21). We have not found direct correlation between 25 (OH) D deficiencies and severity, duration and outcome of influenza infection. It is compatible with LI-NG *et al.* findings (22). Because the main production source of vitamin D in human is exposure to sunlight, and so many factors affect it, some authors recommend vitamin D supplement in the winter in order to reduce the risk of respiratory infections including influenza (14), but some studies have not proposed it (22).

More evidences from randomized controlled trials are warranted to establish effectiveness of vitamin D supplementation in preventing respiratory viral infections.

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