Vitamin D and Pneumonia in Children: A Case Control Study

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Abstract

Objectives
To evaluate Vitamin D levels and its correlation with severity and outcome of pneumonia in children.

Design
It is a case-control study.

Setting
The study was conducted at tertiary care centre from Northern India from June 2013 to June 2014.

Participants
Fifty children of 1 month to 12 years of age admitted with pneumonia were enrolled as cases. Fifty age and sex matched children without pneumonia were taken as controls.

Outcome measures
Vitamin D levels were compared between the groups and were correlated with severity and outcome of pneumonia.

Results
The median (IQR) age of cases and controls was 12 (5,39) months and 12 (5,39) months respectively. Overall, 76 (86.4%) children were Vitamin D deficient. The median (IQR) Vitamin D levels [cases 6.8 (2.0, 14.5), controls 7.3 (4.7, 14.6) ng/ml; p=0.362] and proportions of children having Vitamin D deficiency were similar between the groups. Vitamin D levels were not different among children with pneumonia, severe pneumonia, and very severe pneumonia (p=0.985). Odds ratio of children with pneumonia being Vitamin D deficient was 3.7 (95% CI: 0.930, 14.770; p-value 0.066). Vitamin D levels were not correlated with requirement of intensive care management, mechanical ventilation and duration of hospital stay.

Conclusion
Majority (86.4%) of children were Vitamin D deficient. Vitamin D levels were not different in cases and controls and were not related to severity and outcome of pneumonia.

The study is registered with Clinical Trials Registry of India (Reg. No: CTRI/2013/09/004021).

Keywords: Hospital stay; Pneumonia; Vitamin D

Introduction

Pneumonia is one of the most common causes of morbidity and mortality in children worldwide. In world, about 150 million children are affected by pneumonia annually [1]. There are about two million deaths annually due to pneumonia in children five years of age [2]. In India, about one-fifth of under-five mortality is attributed to pneumonia [3].

There are numerous risk factors for pneumonia in children e.g., malnutrition, poverty, ethnicity, incomplete vaccination, smoke exposure, and underlying diseases like bronchopulmonary dysplasia and congenital heart diseases [4,5]. Despite interventions to control some or more of these factors, pneumonia continues to be a major threat to child health. There is growing interest to identify other risk factors that may contribute to incidence and severity of pneumonia.

Vitamin D had many functions other than bone metabolism. Recently, Vitamin D is found to have anti-infective property through modulation of innate immune system [6,7]. Vitamin D enhances the expression of Vitamin D Receptors (VDR) and increases production of cathelicidin and beta-defensin-2 peptides which acts through toll-like receptors to elicit antimicrobial function against infections [8-13]. Vitamin D also regulates phagocytosis dependent and antibody-dependent macrophages which protect from respiratory infections [14]. In Vitamin D deficiency, there is decreased expression of VDR resulting in impaired clearance of microbes and uncontrolled inflammation that leads to more lung damage with impaired oxygenation. Vitamin D levels are correlated with respiratory infections. Low Vitamin D production during winter season may be one of the reasons for increased respiratory infections during winter [15,16]. The hospitalization rate for children with acute respiratory infections was also correlated to skin pigmentation, one of factor determining Vitamin D production in human body [16].

Vitamin D is associated with risk and severity of pneumonia in various studies from world. Higher maternal Vitamin D levels were associated with lower risk of pneumonia in one study [17] but not in other study [18]. In observational studies from Iran [19], Kuwait [20], Egypt [21], Ethiopia [22] and Jordan [23] children with rickets had higher risk of pneumonia compared to children without rickets. In case-control studies, mean Vitamin D levels were significantly lower in children with pneumonia compared to controls [13,24-26]. There are very limited studies from India. We could find only one study from Indapur, India in 2004, where higher Vitamin D levels were associated with lower risk of pneumonia [27]. The study did not assess correlation between Vitamin D levels and outcome of pneumonia [27]. The available studies had mixed results and Vitamin D levels may vary according to regions, therefore, it is worthy to conduct more