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Childhood pneumonia and vitamin A

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ABSTRACT

One of the major causes of mortality in children younger than 5 years old is acute lower respiratory tract infections (ALRI). ALRI clinical features are cough, tachypnea, fever, coryza, chest retraction, crackles and wheeze. Increased white blood cell count with left shift might happen in pneumonia. C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) might rise in children with respiratory tract infections. Vitamin A deficiency is associated with severe childhood infections. The effect of vitamin A supplementation in childhood pneumonia depends on the prevalence and the level of vitamin A deficiency in the population. Some studies confirmed that retinol levels were significantly higher after recovery from acute pneumonia compared to acute phase. But there were no significant association between serum retinol level and the clinical manifestation.

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Introduction

One of the major causes of mortality in children younger than 5 years old is acute lower respiratory tract infections (ALRI) (1). It is estimated that 156 million episodes of pneumonia happen in young children each year and about 4 million lead to death. Various studies in developing and developed countries around the world showed that viruses were the most common pathogens in acute lower respiratory tract infections (2). Bronchiolitis and pneumonia are two clinical manifestations of ALRI (3). Distinguishing between these two clinical conditions might be difficult in young children and infants. Community-acquired pneumonia in children is responsible for 30 to 40% of childhood hospitalizations, which leads to death in 15 to 28% of cases (4). It is estimated that pneumonia is the cause of 20% of deaths happen in childhood, and a greater portion of it occurs in poor countries. Annually, 1.9 million deaths

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happen in children younger than 5 years, and half of them occur in Africa. Although childhood pneumonia is not mortal in high income countries, its economic burden is high due to ALRI morbidity (5).

Bacterial causes of childhood pneumonia include Streptococcus pneumonia, H. influenza type b and Staphylococcus aureus. Pneumonia becomes worse in children with underlying diseases such as malnutrition, HIV positive children, measles and children infected with TB and etc. (6).

About 30 to 40% of acute respiratory infections in hospitalized children have a viral etiology and respiratory syncytial virus (RSV) that can be found in 20 to 25% of these infections. Paramyxovirus and human metapneumovirus (hMPV) are the second most common causes of viral pneumonia in children (7).

ALRI clinical features are cough, tachypnea, fever, coryza, chest retraction, crackles and wheeze. Increased white blood cell count with left shift might happen in pneumonia. C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) might rise in children with respiratory tract infections (8).

Low birth weight, indoor air pollution exposure, lack of exclusive breastfeeding, crowding, incomplete vaccination, undernutrition and HIV infection are some of the known risk factors in childhood ALRI (9). Vitamin D deficiency, passive smoking, sex, preterm delivery, zinc deficiency and anemia are factors associated with severe ALRI. Some studies have proposed several characteristics which might increase susceptibility to ALRI such as day care, birth interval, birth order, pervious ALRI history and vitamin A deficiency (10).

Breastfeeding could reduce the risk of ALRI. Leukocytes, lysozyme, lactoferrin and secretary IgA are immune factors which are transferred into human milk. Some mineral supplementations such as zinc could decrease the risk of respiratory tract infections. Vitamin A supplementation might have the same effect in ALRI. Vitamin A plays a crucial role in immune function and it is necessary for epithelial cell differentiation of respiratory system (11). Although multiple studies conducted to evaluate the impact of high dose vitamin A and zinc in respiratory tract infections, their effect did not prove any effect on childhood acute respiratory tract infection outcome (12).

Vitamin A deficiency is associated with severe childhood infections and it is the major cause of preventable blindness. Retinol is active form of vitamin A which is circulating in blood. Retinol releases from liver in response to tissue demand. Retinol-binding protein carries this element to different tissues. Serum retinol level is suggestive of severe liver storage depletion (lower than 0.07 μmol/g liver). Retinol plays a fundamental role in vision, epithelial tissue and gene expression (13).

Discussion

Various studies have obtained the data about the role of periodic vitamin A supplementation in reducing childhood mortality and morbidity (14). Moreover, it was proposed that high dose vitamin A administration during illness could decrease mortality, disease severity and its duration. These benefits are dominant in malnourished children. Vitamin A supplementation effects in measles and diarrhea had been proved by different clinical trials, but the role of vitamin A in childhood pneumonia is still conflicting (14). Table1 shows the results of different studies about the role of vitamin A in childhood pneumonia.

The effect of vitamin A supplementation in childhood pneumonia depends on the prevalence and the level of vitamin A deficiency in the population (3). Some

Table 1. Results of different studies about the role of vitamin A in childhood pneumonia

Author	Publication year	Age	Vitamin A dose	Result
Mahalanabis (13)	2004	2-24 m*	10000 µg retinol	Vitamin A had no significant beneficial effect in childhood pneumonia
Brown (14)	2004	1m-6 y**	High dose	Vitamin A had no significant effect in childhood pneumonia
Chang (8)	2007	<11y	50000-100000 IU	Vitamin A had no significant effect in childhood pneumonia
da Silva (11)	2005	6 m-5 y	___	Vitamin A level reduced the duration of pneumonia in children
Imdad (12)	2011	6-59 m	___	Vitamin A reduced mortality
Mathew (15)	2010	___	___	Vitamin A had no significant effect in childhood pneumonia
Ni (16)	2005	___	___	Vitamin A had no significant effect in childhood pneumonia mortality

*m: months; **y: year

studies confirmed that retinol levels were significantly higher after recovery from acute pneumonia compared to acute phase. But there were not significant association between serum retinol level and the clinical manifestations (11).

Vitamin A deficiency might happen due to low intake and impaired vitamin A absorption which occur very rare. Serum albumin might decrease during pneumonia due to development of acute phase response (4). Vitamin A supplementation might have protective impact on HIV positive children and pregnant women, and might reduce their morbidity and mortality in addition to positive effect on birth weight. But there are not enough evidence to support the efficacy of administered vitamin A supplementation in pregnant or lactating women in reduction of infant mortality and morbidity (17).

Conclusion

There are credible evidence about the impact of case management and recommendations of WHO in regard to antibiotic administration in childhood infection. Nevertheless, the results of randomized control trials do not reinforce the effect of vitamin A supplementation in childhood pneumonia treatment.

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Conflict of Interest

The authors declare no conflict of interest.

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