

Using Zinc Sulfate to Improve Pneumonia Symptoms in Children Under 5 Years Old

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Received: 08-06-2021 / Revised: 14-07-2021 / Accepted: 22-08-2021

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Conflict of interest: Nil

Background: Pneumonia is a form of acute respiratory infection that affects the lungs. Pneumonia is one of the most common implications of lower respiratory tract involvement. The World Health Organization estimates that of approximately 4 million annual deaths due to pneumonia, half of the cases occur in children less than 1 year of age. This study aimed to investigate the effect of prescribing zinc sulphate on improving the clinical symptoms of pneumonia in 2-59 months old children. **Materials and Methods:** This case control study was performed on 240 children with age of 2-59 months complaining of fever, coughs, and tachypnea in Department of Pediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India. The patients were randomly assigned into control (n=120), and intervention (n=120) using double blinding method. In the control group placebo was prescribed, while the intervention group received oral zinc sulphate 10 mg (1 ml/ kg in children younger than 12 months, and 20 mg/kg every 12 hours for children of 13-59 months). During hospitalization, every 12 hours the clinical symptoms of both groups including tachypnea, duration of fever, coughs, intercostal retraction, hypoxia, crackles-wheezing, and duration of hospitalization were recorded. At the beginning and end of the treatment, two blood samples were taken for determining the serum level of zinc. **Results:** The normal range of serum zinc levels is in the range of 60-150 ug/dl. The mean value of serum zinc levels for the cases was 55.47 ug/dl compared to 57.94 ug/dl for the control group during admission. During discharge, mean value for the case group was raised upto 91.45 ug/dl while it was approximately same (60.37 ug/dl) for the control group. During admission, 85 (71.67%) and 88 (78.33%) patients from case and control groups respectively had complain of tachypnea but after 48 hours of admission, 15 (11.67%) and 23 (20.00%) patients had complained of tachypnea. **Conclusion:** Based on this study, it is suggested that prescription of oral zinc sulphate supplement be considered for pediatric patients to the standard and conventional pharmacotherapy of pneumonia. These effects can do major absolute reductions in childhood morbidity and mortality rates in the numbers of children who die from acute lower respiratory tract infections every year.

Keywords: Pneumonia, Zinc sulphate, Lower respiratory tract infections, Tachypnea.

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Introduction

Pneumonia is a lung infection. It is usually caused by a virus or bacteria. These germs make the air sacs in the lungs fill with fluid (phlegm or mucous). This makes it hard to breathe and causes your child to cough.

Pneumonia is one of the most common implications of lower respiratory tract involvement. The World Health Organization estimates that of approximately 4 million annual deaths due to pneumonia, half of the cases occur in children less than 1 year of age. On the other hand, malnutrition plays a significant role in the increased prevalence, severity, and prognosis of pneumonia, especially among children [1].

Pneumonia is a form of acute respiratory infection that affects the lungs. Pneumonia is caused by a number of infectious agents, including viruses, bacteria and fungi. The most common are *Streptococcus pneumoniae*, *Haemophilus influenzae* type B. In infants infected with HIV, *Pneumocystis jiroveci* is one of the most common causes of pneumonia, responsible for at least one quarter of all pneumonia deaths in HIV-infected infants. When an individual has pneumonia, the alveoli are filled with pus and fluid, which makes breathing painful and limits oxygen intake. Pneumonia is the single largest infectious cause of death in children worldwide. Pneumonia killed 808,694 children under the age of 5 in 2017, accounting for 15% of all deaths of children fewer than five years old [2]. According to WHO, annually 4.1 million deaths occur worldwide due to acute respiratory infections (ARIs), with 90% being due to acute pneumonia. Specifically, 1.9 million of them are children younger than five years old [3], mostly related to developing countries because of malnutrition [4].

According to WHO, clinically, pneumonia involves acute cough attacks with or without fever associated with respiratory problems or tachypnea [5]. Zinc is an essential trace element required for

maintaining intestinal cells, bone growth, and immune function. Children who are living in low-income settings are often undernourished and zinc deficient [6]. Deficiencies may arise from the insufficient intake of foods containing zinc or insufficient absorption. Most foods high in zinc are of animal origin, such as meats, fish and dairy products. These foods may be more difficult to access for low-income populations. Zinc deficient children are at increased risk of restricted growth and developing diarrheal diseases, as well as respiratory tract infections such as acute lower respiratory tract infections [7, 8]. Under-nutrition is considered the underlying cause of approximately half of these fatal acute lower respiratory tract infections [8].

Materials and Methods:

This case control study was performed on 240 children with age of 2-59 months and complaining of fever, coughs, and tachypnea in Department of Pediatrics, Nalanda Medical College and Hospital, Patna, Bihar, India for 1 year. The patients were randomly assigned into control (n=120), and cases (n=120). The control group received placebo (similar to the zinc sulphate syrup in terms of color and taste). The case group received oral zinc sulphate 10 mg (1 ml/ kg in children younger than one year, and 20 mg/kg for children above one year every 12 hours. During hospitalization, every 12 hours the clinical symptoms of both groups including tachypnea, duration of fever, coughs, hypoxia, wheezing and duration of hospitalization were recorded. At the beginning and end of the treatment, two blood samples were taken for determining the serum level of zinc. The rest of the standard and conventional treatments of pneumonia were performed according to the protocol and daily routine.

The detailed demographic information, history, clinical findings and details of clinical course of cases and controls

included in the study were entered in pre-designed and validated proforma. Detailed General examination was carried out in the patients along with Respiratory system and other systemic examination and a clinical diagnosis was made and entered into the proforma. The details of blood investigations and imaging for confirmation of clinical diagnosis were also noted during the stay of the patient in the hospital. The serum zinc estimation was done by using colorimetric test. The data

obtained from the cases and controls was compiled and analyzed.

Results:

120 patients were assigned to the control group and other 120 to the case group. 81(68.33%) of cases being male and 39(31.67%) being female in the case group as compared to 75(63.33%) of controls being male and 45(36.67%) being female. There was no significant difference between the two groups in terms of age and gender.

Table 1: Demographic profile of the children

Parameter	Cases	Controls
1. Sex		
Male	81 (68.33%)	38 (63.33%)
Female	39 (31.67%)	22 (36.67%)
2. Age		
Mean age of Hospitalized Patients	13.47±1.253	13.51±0.742

Table 2: Comparison of zinc levels in cases and controls

Group	Zinc level during Admission (Mean values± Std deviation)	Zinc levels during Discharge (Mean values± std deviation)	p-value
Case	55.47±11.68	91.45±12.78	
Control	57.94±10.35	60.37±12.02	

Table 3: Comparison of patients with complain of tachypnea in cases and controls

Group	Tachypnea during Admission [No. of cases (%)]	Tachypnea after 48 hours of admission [No. of cases (%)]	p-value
Case	85 (71.67%)	15 (11.67%)	
Control	88 (78.33%)	23 (20.00%)	

The normal range of serum zinc levels is in the range of 60-150 ug/dl. The mean value of serum zinc levels for the cases was 55.47 ug/dl compared to 57.94 ug/dl for the control group during admission. During discharge, mean value for the case group was raised upto 91.45 ug/dl while it was approximately same (60.37 ug/dl) for the control group.

During admission, 85 (71.67%) and 88 (78.33%) patients from case and control groups respectively had complain of tachypnea but after 48 hours of admission, 15 (11.67%) and 23 (20.00%) patients had complain of tachypnea.

Discussion:

Pneumonia is spread by infected people who carry the germs in fluid droplets in their throats, noses or mouths. The infected person coughs the germs into the air. Your child breathes in the germs or comes in direct contact with the infected person's saliva or mucous by touching something.

The difference in mean serum zinc levels of cases according to WHO IMNCI grading was statistically significant (p value = 0.0001) with cases belonging to Severe Pneumonia group (Mean=42.35± 6.38 ug/dl) having significantly lower value than that of Pneumonia group (Mean=64.47±7.11 ug/dl) and similar

findings were seen in study by Rady et al., Hussain et al. and Brooks et.al [17, 18, 19].

In our study, a significant decrease was found in the duration of hospitalization and recovery from pneumonia symptoms in zinc-receiving children compared to the comparison group. This indicates the effect of zinc therapy and a change in the clinical course of pneumonia among the children under investigation. This finding is consistent with the results of most studies in this field [10, 11], In another similar study in India that was conducted on 153 children aged 2–24 months, who were hospitalized due to acute lower respiratory infection and divided into two groups (one taking 10 mg of zinc plus vitamin A daily, and the other taking placebo plus vitamin A), it was shown that the recovery time was significantly faster in the treatment group than in the control group. Overall, zinc therapy can reduce the duration of symptoms and acute clinical condition [11].

However, evidence to the contrary was found in studies by Bose et al. and Valentiner - Branth et al [13, 14]. Argument has been put by the above studies that as zinc is required to mount a better immune response by the host against infection, there will be increased damage to the respiratory epithelium due to the increased immune response and thus leading to worsening of symptoms [14].

A number of authors have confirmed that routine zinc supplementation for more than three months does have a positive effect on reducing the duration of acute lower respiratory tract infections among children in developing countries [15, 16]

Conclusion:

Oral prescription of zinc sulphate in children referring with pneumonia symptoms had a useful effect on reducing the duration of fever and improving the respiratory status (tachypnea) in 2 to 59-month-old children.[17] Based on this study, it is suggested that prescription of oral zinc sulphate supplement be

considered for pediatric patients to the standard and conventional pharmacotherapy of pneumonia.[18] These effects can do major absolute reductions in childhood morbidity and mortality rates in the numbers of children who die from acute lower respiratory tract infections every year.

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