Original Article

Zinc supplementation for the treatment of severe pneumonia in hospitalized children: A randomized controlled trial

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ABSTRACT

The objectives of this randomized controlled trial (RCT) were to compare the mean duration of hospital stay and mean time to relieve severe pneumonia signs and symptoms with or without zinc supplementation in hospitalized young children. This RCT was conducted from Oct 2011 to Mar 2012. in the paediatric department, PGM/Lahore General Hospital. Three hundred children (150 in each group) were randomly allocated to two groups: group A received zinc syrup (20 mg/day q 12 hourly) till discharge and group B received placebo syrup. This in addition to the antibiotic treatment. Data for severe pneumonia signs and symptoms i.e. oxygen saturation, respiratory rate, temperature and chest indrawing were recorded. The mean age of participants was 16.65+4.23 months in Group-A and15.96+5.11 months in Group-B. We found that the mean duration to relieve severe pneumonia signs and symptoms was 44.62+2.56 hours in Group-A and 48.73+3.124 hours in Group-B (p-value 0.023).Duration of hospital stay was 128.31+3.71 hours in Group-A and 137.67+2.56 in Group-B (p-value 0.001). We conclude that zinc supplementation for the treatment of children with pneumonia is an effective therapy along with standard treatment.

Keywords:

Pneumonia; Children; Zinc supplementation; Relief of symptoms

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INTRODUCTION

Worldwide, pneumonia is a major cause of childhood mortality and morbidity [1]. Pneumonia accounts for an estimated 1.9 million annual deaths among children under 5 years of age [2]. Approximately 95% of the pneumonia-related deaths occur in the developing countries and children less than 2 years of age have the highest risk of death [3]. Zinc plays a critical role in maintaining the integrity of immune system [3]. Pneumonia and diarrhea can be prevented by regular supplementation of zinc in children [4]. Studies showed that zinc supplementation for treatment of severe pneumonia led to not only decrease the time took to relieve severe pneumonia signs and symptoms but also decreased total hospital stay [1,5,6]. So, different studies were conducted to evaluate the effects of zinc in the treatment of severe pneumonia, but the results were inconsistent [7-10].

Therefore, we decided to study the role of zinc supplementation in the treatment of pneumonia in young children.

MATERIALS AND METHODS

This randomized controlled trial (RCT) was conducted in the paediatric department, PGM/Lahore General Hospital, a tertiary care hospital. The duration of the study was 6 months (from 01-10-2011 to 31-03-2012).

Inclusion Criteria:

1. Children between 2 and 23 months of age.
2. Children who presented with difficult breathing or cough with:

a) Respiratory rate more than 50 breaths/min in those aged less than one year and more than 40 breaths/min in children more than one year of age.

b) Temperature more than 37-degree centigrade and anyone of the following signs and symptoms:

i. Flaring of the alae nasi
ii. Central cyanosis
iii. Visible chest indrawing
iv. Inability to feed
v. Lethargy
vi. Crepitation on auscultation

(All the signs were assessed clinically by the attending paediatrician.)

3. Chest X-ray abnormalities consistent with pneumonia.
4. Parents given informed consent.

Exclusion Criteria:

Children known to have active tuberculosis, measles, diarrhoea, severe malnutrition, congenital heart diseases, meningitis, renal failure, sepsis and hemodynamic instability (confirmed by available record).

1. Children who had more than 3 day's history of difficulty in breathing.
2. Children who were previously taking zinc supplementation.
3. Known allergy or intolerance to zinc or zinc containing products.

A sample size of 300 cases (150 in each group) was calculated with 95% confidence level, 80% power of test and taking mean + S.D of mean time to relieve severe pneumonia signs and symptoms in both groups. Non–probability purposive sampling was used [11].

Data collection procedure:

After approval of the study by the ethical review committee at our hospital, children with severe pneumonia (as per inclusion criteria) were admitted after taking informed consent from the parents. Time of enrollment was taken as 0 hours, and all findings were noted on chart. Children were randomly allocated to two groups: group A received zinc syrup (20 mg/day q 12 hourly) till discharge and group B received placebo syrup. Antibiotics in

form of intravenous ampicillin (200-400) mg/kg/day 8 hourly) and intravenous Amikacin (7.5 mg/kg/dose 12 hourly) were given to both groups as per protocol. When the signs and symptoms of severe pneumonia (as per inclusion criteria) were absent for 24 consecutive hours, then patients were given oral antibiotics (Amoxicillin 40 mg/kg/day). Data for severe pneumonia signs and symptoms i.e. oxygen saturation, respiratory rate, temperature, and chest indrawing were recorded by study nurse at the start of every nursing shift. All children were assessed by the attending pediatrician. Children were discharged when they were taking oral feed, had oxygen saturation more than 95%, respiratory rate less than 50 breaths/min and when temperature was 37 degree centigrade for 24 consecutive hours with no reoccurrence of signs and symptoms of severe pneumonia. The total duration of hospital stay and all the information was noted.

Data analysis:

All the collected data had been entered in the SPSS version 10. Quantitative variables like age, duration of hospital stay and time taken for the cessation of severe pneumonia signs and symptoms were presented in the form of mean and standard deviation. Qualitative variables were presented in the form of frequency and percentages. A t-test was used to compare the mean duration of hospital stay and mean time taken for the cessation of severe pneumonia signs and symptoms in both groups. P-value < 0.05 was considered statistically significant.

RESULTS

The mean age of participants was 16.65+4.23 months in Group A and15.96+5.11 months in Group-B. Gender distribution showed 56 %(n=84) in Group-A and 62 % (n=93) in Group-B were males. There was no statistical difference of the age and sex in the two groups. Comparison of duration of relieve of severe pneumonia signs and symptoms showed 44.6 2+2.56 hours in Group-A and 48.73+3.124 in Group-B with p value of 0.023 (Table 1) . Duration of hospital stay was 128.31+3.71 hours in Group-A and 137.67+2.56 in Group B (p <0.001) (Table 2).

Table 1 - Comparison of duration of symptoms and signs relief in 300 patients with severe pneumonia

	Group-A (n=150)	Group-B (n=150)
Time duration (in hours)	44.62+2.56	48.73+3.12
p-value	0.023	

Table 2 - Comparison of duration of hospital stay in 300 patients with severe pneumonia

	GROUP-A (n=150)	GROUP-B (n=150)
Time duration (in hours)	128.31+3.71	137.67+2.56
p-value	0.001	

DISCUSSION

In this RCT we investigated the effects of zinc supplementation in relief of symptoms and signs of severe pneumonia in young children and its effects on duration of hospital addmission. We found that the group of patients received zinc supplementation relived their symptoms and signs of severe pneumonia quicker than the other group who did not receive zinc. Also, zinc supplementation significantly decreased the duration of hospital addmission.

Our findings agreed with the report published by Williams et al [11] who performed a similar RCT investigating the role of zinc in severe pneumonia. They found that the time taken for all the symptoms to resolve in the zinc-supplemented group was significantly lesser than that in the placebo group (42.26[6.66] vs. 47.52[7.15] hours p-value (0.001). Another RCT reported by Brooks, et al [12] showed shorter durations of chest indrawing, respiratory rate >50/min and hypoxia, leading to shorter overall duration of pneumonia and length of hospital stay. This resulted in a mean difference of four (4.2-4.9) versus five (4.5-5.5) days of severe pneumonia, and five (4.8-5.5) versus six (5.1-6.1) days of hospitalization for the zinc and placebo groups, respectively.

On the other hand, Bose et al [13] found that there was no significant difference in the time of recovery from severe pneumonia between the zinc and placebo groups. Likewise, the median length of hospital stay did not differ significantly between the two groups in their study.

Mahalanabis, et al [14] described a significant recovery of boys who received zinc in comparison to those who did not. We were unable to analyse the effects of gender in our study population as we did not stratify the study group according to their gender.

Adequate zinc intake is critical in maintaining cellular growth, cellular differentiation, and metabolism of higher plants and animals. The importance of zinc for human nutrition and health was not recognized until the second half of the 20th century [15]. It was only 30 years ago, when clinicians first noted that human zinc deficiency, secondary to acrodermatitis enteropathica—an inborn error of metabolism that causes reduced intestinal absorption of zinc—is associated with impaired growth, increased susceptibility to infections, and other functional abnormalities [16]. Since then, a number of trials have been undertaken in different countries to assess the effect of zinc supplementation on child health.

Zinc plays a role in the maintenance of epithelial and tissue integrity by promoting cell growth and suppressing apoptosis. Moreover, its antioxidant properties protect one against free radical damage during inflammatory responses. Thus, in cases of diarrhea, the varied functions of zinc help maintain the integrity of the gut mucosa to reduce or prevent fluid loss. Notably, these responses can occur within 48 hours, which are much more rapid than the direct effects of zinc on cellular development [17].

In conclusion, our findings confirmed that zinc supplementation has role in the early cure of pneumonia and it also decreased the total hospital stay in the children severe pneumonia.

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