

Role of zinc supplementation in the recovery of hospitalized children with pneumonia

By

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Abstract:

Background: People who are hospitalized for any reason are also at high risk for pneumonia, Supplemental zinc provides therapeutic benefits in pneumonia. **Objectives:** To evaluate the role of zinc supplementation in the recovery of hospitalized children with pneumonia. **Patients & Methods :** Randomized control study was conducted at Karbala pediatric teaching hospital between March ,2019 – September, 2020. Inpatient children aged 3m-60m who presented with pneumonia were enrolled and divided into 2 groups , zinc group (93 case) who receive zinc, the male was 51 patient and female was 42 patient, and control group (82 case) male was 47 patient and the female was 35 patient. Zinc is given according to WHO guideline, 20mg for children above 6 mo age and 10 mg below 6mo age. for all patient CXR, CBC, oxygen saturation and RR were measured. **Results:** clinically and statistically reduction in recovery time from severe pneumonia and overall hospital stay in children from 3 month to 5 years whom given zinc sulphate with standard antimicrobial therapy. The total days of admission for zinc group was (397 days and mean of 4.2) versus (429 days and the mean of 5.2 days) of control group this indicate that zinc treatment has a direct effect to decrease duration of admission , so children who received zinc supplementation during pneumonia episode who had improvement within 5 days is (89.2%) versus (56 %) improvement of control group with p value of (0.0003), and This result is supported by other 2 trials done one in India (rate of recovery was 2.6 time and P value was 0.004),As well as patient response was more prolong in control group and more severe cases were related to this group compared with zinc group. Also current study show that there is a good response in breast feed zinc group in comparism to breast feed control group, which had improvement of (46.2% versus 34.1%) within 5 days. the difference in response to zinc in bottle feeding infant and the result was 24.7% for zinc group and 19.5 for control group and the small difference in response may be attributed to that the presence of calcium in milk in high concentration is known to decrease zinc absorption from intestine by competition.So , the same response to zinc supplementation between male and female in the first 5 days of treatment and the result was (90.4% and 87.8% respectively). **Conclusion:** The use of zinc sulfate in the management of acute lower respiratory tract infection is effective in decrease both severity and duration of illness.Also Zinc therapy is effective in both male and female.

Keywords: zinc supplementation; recovery; hospitalized children; pneumonia

Introduction:

Streptococcus.pneumoniae is a significant pathogen in school-aged children and adolescents (i.e., five to 18 years of age) with CAP. *M. pneumoniae* and *C. pneumoniae* infections also are more common in these children than in other age groups⁽¹⁾.

In school-aged children, pneumococcal pneumonia usually begins with a high fever and sputum-producing cough. *M. pneumoniae* infection often begins with headache or gastrointestinal symptoms; rhinorrhea is uncommon ⁽²⁾.most children with CAP, identification of the causative organism is not critical⁽³⁾.Patients with severe symptoms, those who are hospitalized, and those who have a complicated clinical course should undergo diagnostic testing to determine the etiology. The cause also should be determined if there appears to be a community outbreak.

Streptococcus.pneumoniae is the most common bacterial cause of CAP after the neonatal period. Less common bacterial etiologies include *Haemophilus influenzae* type B, *Moraxella catarrhalis*, and *Staphylococcus aureus*. *Mycoplasma pneumoniae* and *Chlamydia pneumoniae* frequently are associated with CAP in preschool-aged children and are common causes of CAP in older children and adolescents^(4,5).Pertussis should be considered in all children with CAP, especially if immunizations are not current. Mycobacterium tuberculosis also may cause CAP in children at risk for exposure. Coinfection with two or more microbial agents is more common than previously thought, with a rate of up to 41 percent in hospitalized patients ^(4,6).

Older children and adolescents are more likely to have findings such as rales, dullness to percussion, bronchial breath sounds, tactile fremitus, and a pleural rub. Careful auscultation with an appropriate-sized stethoscope may reveal localized rales and wheezing in younger children. Children with dehydration may have no abnormal auscultatory findings⁽⁷⁾.

Zinc is an essential trace element necessary for normal human functioning. It serves as an enzyme cofactor and protects cell membranes from lysis caused by complement activation and toxin release. Zinc is not stored in the body; therefore, dietary intake is required. Meat and seafood are rich in zinc^(8,9)The role of zinc in human health and functioning has primarily focused on dietary supplementation for the promotion of health and disease prevention. Aside from dietary zinc supplementation, zinc has been studied for therapeutic use in the common cold, atopic eczema, psoriasis, acne vulgaris, degenerative

retinal lesions, age-related macular degeneration, inflammatory bowel disease, and various other disorders^(10,11,12).

Zinc plays an important role in the structure of proteins and cell membranes. A finger-like structure, known as a zinc finger motif, stabilizes the structure of a number of proteins⁽¹³⁾. The structure and function of cell membranes are also affected by zinc. Loss of zinc from biological membranes increases their susceptibility to oxidative damage and impairs their function⁽¹³⁾. Recently, zinc has been found to play a role in apoptosis (gene-directed cell death), a critical cellular regulatory process with implications for growth and development, as well as a number of chronic diseases⁽¹³⁾.

Aim of the study:

The aim of this study is to evaluate the therapeutic response to zinc supplementation in patients with pneumonia.

Patients and methods

A randomized control study was conducted at Karbala pediatric teaching hospital between March, 2019 – September, 2020. In this trial, the inpatient children aged 3m-60m who diagnosed as pneumonia were enrolled. The physician diagnosed pneumonia on the basis of the presence of fever, cough and fast breathing (respiratory rate >50/min for children aged 2-11 mo and >40/min for children aged 12-24 mo and > 30/min for children aged >24 mo) or lower chest indrawing. The severity of pneumonia is depending on the presence of chest indrawing, subcostal retraction, grunting and decrease O₂ saturation.

History of previous admission due to pneumonia and recently receive antibiotics.

Intervention: The cases were divided into 2 group **1.** Zinc group and **2.** control group

Zinc sulfate tablet available in 2 forms, 10mg, 20mg given to the patient (according to WHO guideline) 10mg for less than 6m age and 20mg for more than 6m age for 14 days. If vomiting or regurgitate occur within 1hr after introduced zinc another dose given (by dividing dose regime) and the patient was excluded from the study when did not tolerate the dose or presence of persistent vomiting.

Data analysis: Data analysis was performed using:

Descriptive statistics (frequency and percentage).

Inferential statistics (x²) were $p < 0.05$ considered statistically significant.

Results

A total of 182 children were enrolled in the study. overall, a non-participant number was 7 cases and 175 children were randomized to treatment.

Table (1): The radiological finding in zinc and control group.

Radiological finding	Zinc group		Control group	
	No.	%	No.	%
Nonhomogenous infiltration	30	32.25	28	38.8
Hyperinflation	13	13.97	11	5.97
Hilar shadow	18	19.35	15	20.89
Rt. upper zone consolidation	18	19.35	16	13.4
Rt. middle zone consolidation	11	11.8	9	13.4
Rt. lower zone consolidation	3	3.2	6	7.4
total	93		82	

Duration of admission in zinc group, the total days of hospitalization were 397 day and the mean was 4.2 days, and in control group the total days of admission 429 days with mean of 5.2 days, as shown in figure (1).

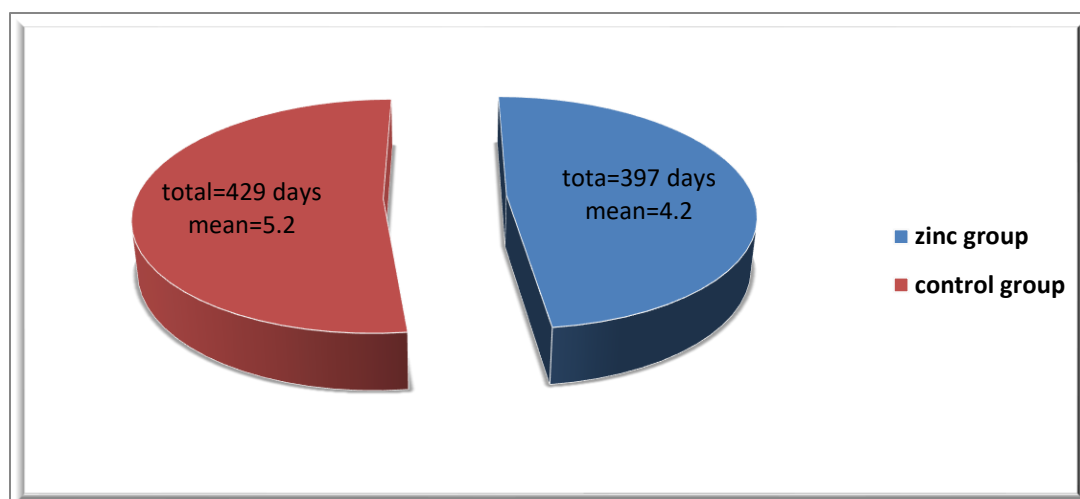


Figure (1): Duration of admission in zinc and control group.

Table (2): the duration of admission in zinc and control group after initiation of zinc.

Days of response	zinc group		Control group		P value
	No.	%	No.	%	
≤5days	83	89.2	46	56	0.0003
>5 days	10	10.8	36	44	

The duration of admission of breast feeding infant in zinc group was 161 day and the mean was 3.7 day, while in control group was 173 day and the mean was 4.6 day, and the duration of admission of bottle feeding infant in zinc group was 87 day and the mean was 3.6 day, while in control group was 108 day and the mean was 4.9 day, as shown in table-3 and 4 respectively.

Table (3): Duration of admission of breast feeding infant in both groups.

days	Zinc group		Control group	
	No.	%	No.	%
2	3	6.98	2	5.4
3	15	34.88	3	8.1
4	15	34.88	9	24.33
5	10	23.26	14	37.85
6			9	24.33
total	43		37	

Table (4): Duration of admission of bottle feeding infant in both groups.

days	Zinc group		Control group	
	No.	%	No.	%
2	0	0	0	0
3	15	62.5	1	4.35
4	4	16.67	6	26
5	4	16.67	11	47.83
6	1	4.16	5	21.73
total	24		23	

Table (5): Response of treatment of male and female in both group.

Sex	Zinc group		Control group	
	No.	%	No.	%
Male	47	90.4	26	55.3
Female	36	87.8	20	57.1
total	83		46	

Discussion

In this study we assess the effect of zinc administration during a severe episode of pneumonia on the course of illness. The study show clinically and statistically reduction in recovery time from severe pneumonia and overall hospital stay in children from 3 month to 5 years whom given zinc sulphate with standard antimicrobial therapy.

The total days of admission for zinc group was (397 days and mean of 4.2) versus (429 days and the mean of 5.2 days) of control group this indicate that zinc treatment has a direct effect to decrease duration of admission as shown in figure (1) which supported by the Meta analysis studies ⁽¹⁴⁾. which show the mean reduction is equivalent to 1 hospital day for both severe pneumonia and time in hospital.

In current study population, children who received zinc supplementation during pneumonia episode who had improvement within 5 days is (89.2%) versus (56 %) improvement of control group with p value of (0.0003) as shown in table (2), and This result is supported by other 2 trials done one in India (rate of recovery was 2.6 time and P value was 0.004) ⁽¹⁵⁾, and the other in Bangladesh ⁽¹⁴⁾.

After 5 days of treatment, the patient who need more time to recovery was (10.8%) zinc group patient versus (44%) of control group. This indicates that the patient response was more prolong in control group and more severe cases were related to this group compared with zinc group.

In the other hand, this study shows that there is a good response in breast feed zinc group in comparism to breast feed control group (table-3) which had improvement of (46.2% versus 34.1%) within 5 days. this probably attributed to the role of breast milk in enhancing the efficacy of zinc absorption from the intestine⁽¹⁶⁾.

Table (4) shows the difference in response to zinc in bottle feeding infant and the result was 24.7% for zinc group and 19.5 for control group and the small difference in response may be attributed to that the presence of calcium in milk in high concentration is known to decrease zinc absorption from intestine by competition⁽¹⁶⁾, therefore those infant response to more zinc added to milk.

Table (5) show the same response to zinc supplementation between male and female in the first 5 days of treatment and the result was (90.4% and 87.8% respectively), and this result not agree with other study done in India (the recovery rate ratio were 1.39 and P value was 0.006)⁽¹⁵⁾, that show the response was more in male than female, this difference may be related to small sample size.

Conclusion:

- 1) The use of zinc sulfate in the management of acute lower respiratory tract infection is effective in decrease both severity and duration of illness.
- 2) Zinc therapy is effective in both male and female.

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