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ORIGINAL RESEARCH

COUNTER CORRELATION AMIDST SERUM ZINC AND ALRI AGONY IN HOSPITALIZED PEDIATRIC SUBJECTS: A CROSS SECTIONAL STUDY

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ABSTRACT

Background: One of the prime global health problem in children is pneumonia accounting for 29% of mortality worldwide. One of the important micronutrient in humans which plays vital role in stimulation and proper functioning of immune system and prevents infections is zinc. There is a strong correlation between risk of pneumonia in a population with zinc deficiency with high rates of infections such as diarrhea, skin, and respiratory infections. The prime objective of present study is to provide further experimental support to strengthen above correlation. To study the serum zinc levels in children hospitalised with pneumonia and correlation between serum zinc levels and severity of pneumonia and its complications.

Materials and Methods: This observational cross sectional study included 100 subjects (100 with pneumonia and 100 without pneumonia) aged between <12 months to 5 years of age diagnosed with various levels of pneumonia. A detailed history, clinical examination, chest X-ray findings, arterial oxygen saturation (SpO2), haemoglobin (g/dl), WBC count and serum zinc levels (µg/dl) was noted.

Results: Mean serum zinc levels in cases was significantly low compared to age and sex matched controls (p value-0.001). Low serum zinc levels were associated with increasing severity of pneumonia (Pneumonia-112.21µg/dl, severe pneumonia- 41.18µg/dl, very severe pneumonia- 28.38µg/dl). Mean serum zinc levels in complicated pneumonia and death cases was very low 22.28µg/dl compared to those with no complications 189.94µg/dl and who were discharged 197.67µg/dl. Low serum zinc levels were associated with prolonged hospital stay and prime cause of death in children.

Conclusion: Our study results conclude that there is a contrary relation between serum zinc and different stages of pneumonial agony than in matched healthy controls.

Prognosis could be augmentation of zinc in hospitalized children with acute lower respiratory infection.

Keywords: Serum zinc; Pneumonia; Prognosis.

INTRODUCTION

The annual global incidence of pneumonia is 158 million new cases per year, of which 154 million are occurring in developing countries. It is estimated to cause 3 million deaths or an estimated 29% of all deaths among children younger than 5 years of age, worldwide.[1] In the developing countries, the abbreviation ALRI is widely used instead of pneumonia, because of poor access to radiography and difficulties in radiological confirmation of diagnosis.[2,3] Most of the ALRI result in mild illnesses such as common cold, but in vulnerable children, infections that begin with mild symptoms may sometimes leads to more severe illnesses such as pneumonia.[4] Pneumonia was responsible for about 18% of all under 5-year deaths in India.[5] Zinc is a trace element and an essential mineral which is present in all tissues, fluids, and secretions in the body. It is pivotal for immunocompetence, cellular metabolism, and physical growth, integrity of intestinal mucosa, reproductive functions, and neurobehavioral development.[6] Zinc deficiency is associated with feeble immune response, and susceptible to infections such as diarrhea, skin, and respiratory infections.[7,8] Zinc is routinely supplemented in children with diarrhea for 14 days.[9] Zinc is known to protect children from RTI by its role in immunomodulation, protection of epithelium of respiratory tract from infections, and improvement of T-lymphocytes function.[10] It also acts as an antioxidant and a cytoprotective agent against the toxins and inflammatory mediators which damage the respiratory epithelium.[11] Even a mild- to-moderate zinc deficiency impairs the function of immune system, thus resistance against infection is reduced and loss of T-cell efficacy.[12] The purpose of our study was to compare the serum zinc level in children admitted with pneumonia to the matched controls and assess its relationship to the grade of respiratory distress.

MATERIALS & METHODS

Plainly explained informed written consent was taken from the parents/guardian of all children. A detailed history, demographic data, clinical examination, severity of pneumonia according to WHO criteria, chest X-ray findings consistent with pneumonia, arterial oxygen saturation measured by pulse oximetry (SpO2), haemoglobin (g/dl), total WBC count, serum zinc levels (g/dl) were noted. All the statistical methods (descriptive statistics, contingency table analysis, paired samples t test, repeated measure ANOVA) were carried out through SPSS for windows (version 17). Serum zinc level was expressed as mean, SD. A p-value of <0.05 was considered as statistically significant.

Methodology: The cross sectional observational study supervised over a time period of 34 months dated from 1st January 2021 to 1st January 2022 at District Hospital, Nandyal. All children between <12 months to 5 years of age admitted to Pediatric wards of District Hospital, located in Nandyal, AP with pneumonia, severe pneumonia and very severe

pneumonia graded according to WHO criteria were taken as cases along with matched controls.

Inclusion Criteria: Children between <12 months to 5 year of age admitted to Pediatrcis Department District hospital Nandyal diagnosed with pneumonia (of all stages) according to WHO criteria.

Exclusion Criteria:

- Children who are on Zinc supplements or who have received Zinc supplements in the past 6 months.
- Children with associated diarrhea
- Children diagnosed as Protein energy malnutrition according to Indian academy of Pediatrics classification or as severe acute malnutrition according to WHO criteria.

RESULTS

A total of 100 cases of pediatric ALRI cases fulfilling the inclusion criteria and age and sex matched healthy subjects were selected. The study was conducted at District Hospital, Nandyal. Out of 100 subjects 62 were males and 38 were females. There was no statistically significant difference in sex distribution between cases and controls. Hence, cases and controls were similar in terms of sex distribution. Mean serum zinc levels in pneumonia cases was 112.21µg/dl and in controls mean serum zinc levels was 162.91µg/dl. The difference in mean serum zinc between controls and cases was 50.71µg/dl which was statistically significant (p value 0.001). Same depicted in table1. The mean values of serum zinc among males and females were 111.22µg/dl and 69.23µg/dl respectively. There is statistically significant difference of 42µg/dl in terms of gender (p value 0.001) as compared with controls. Same depicted in table1. Mean serum zinc values were as 112.21µg/dl, 41.18µg/dl and 28.38µg/dl among cases with mild pneumonia, severe pneumonia and very severe pneumonia respectively. Thus there was counter relationship between serum zinc levels and severity of pneumonia. Though mean serum zinc levels were decreasing with the severity of pneumonia, p value fell short of <0.001. Hence statistically significant difference was seen. Same is depicted in [Table 1]. Among 100 cases, 79 were hypoxic at the time of admittance with serum zinc levels among hypoxic children was found to be very low 41.27µg/dl in contrast with high O2 saturation >94% with 100.41µg/dl. There is statistically significant difference between serum zinc levels and SpO2 at the time of admission among pneumonia cases. Out of 100, majorities 86 shown the features of suggestive shock had very low serum zinc concentration 39.79µg/dl whereas in 14 cases without shock was shown serum zinc levels among those112.21µg/dl. There is statistically substantial difference between serum zinc levels and shock at the time of admission among pneumonia cases table 1. 81 out of 100 cases were found to be anemic with mean serum zinc was 64.12µg/dl in comparison with mean serum zinc in nonanemic group of 19 cases was 109.10µg/dl. There is statistically noteworthy difference between serum zinc levels and haemoglobin values amongst pneumonia cases. 68 out of 100 cases with pneumonia had leucocytosis which is perhaps owing to bacterial infection and mean serum zinc in them was established to be 111.41µg/dl, followed by 69µg/dl in leucopenia. While mean serum zinc in those cases with standard

leucocyte count was 121.20µg/dl. There is statistically important difference between serum zinc levels and total leucocyte count among study group. 64 cases out of 100 had attributes of bilateral interstitial infiltrate on chest X-ray with mean serum zinc in this group was 80.47µg/dl followed by 31 cases had features of peribronchial cuffing w i t h 100.91µg/dl of mean serum zinc level and 5 cases had consolidation on chest X-ray with 112.30µg/dl of mean serum zinc level. There is statistically momentous difference between serum zinc levels and X-ray finding among cases. Cases with bilateral interstitial infiltrate had low serum zinc levels which are statistically significant. Among 100 cases, 48 cases with pneumonia died were with mean serum was found to be very low 22.28µg/dl and 52 cases were discharged with 106.15µg/dl. As the mean serum zinc levels was very much low in death cases, statistically weighty difference was seen between mean serum zinc levels and outcome among cases and controls. Among 100 cases, 88 cases were with advanced empyema as complication w i t h mean serum zinc of 81.27µg/dl. Whereas mean serum zinc in those without empyema was 192.46 µg/dl. There is statistically noteworthy difference between mean serum zinc levels and complications among cases [Table 1].

Table 1: Comparison between various parameters and zinc levels in cases and controls

Parameter		**No of individuals**	**Mean serum Zinc in controls**	**Mean serum zinc in cases**
Age in years P value 0.005	< 1	8	151.02µg/dl	79.01µg/dl
	2	39	142.50µg/dl	88.11µg/dl
	3	36	156.72µg/dl	86.62µg/dl
	4	10	142.41µg/dl	92.27µg/dl
	5	7	169.27µg/dl	99.18µg/dl
Gender P value 0.005	Males	62	152.82µg/dl	111.22µg/dl
	Females	38	141.85µg/dl	69.23µg/dl
Severity of pneumonia P value < 0.001	Mild pneumonia	26	162.91µg/dl	112.21µg/dl
	Severe pneumonia	56	149.27µg/dl	41.18µg/dl
	Very Severe pneumonia	18	164.19µg/dl	28.38µg/dl
SpO2 P value < 0.001	≤94%	79	149.22µg/dl	41.27µg/dl
	>94%	21	159.17µg/dl	100.41µg/dl
Shock P value 0.005	Present	86	139.87µg/dl	39.79µg/dl
	Absent	14	158.28µg/dl	112.21µg/dl
Haemoglobin P value 0.005	Anemia ≤11	81	136.27µg/dl	64.12µg/dl
	Normal >11	19	181.89µg/dl	109.10µg/dl
Total count P	Normal	23	169.41µg/dl	121.20µg/dl
value 0.005	Leukocytosis	68	163.27µg/dl	111.41µg/dl
	Leucopenia	9	126.29µg/dl	69µg/dl

Chest X-ray P value 0.001	Consolidation	5	267.3µg/dl	112.30µg/dl
	Bilateral interstitial infiltrate	64	189.98µg/dl	80.47µg/dl
	Peribronchial cuffing	31	193.49µg/dl	100.91µg/dl
Complications P value 0.001	None	12	189.94µg/dl	109.27µg/dl
	Empyema	88	192.46µg/dl	81.27µg/dl
Outcome P value 0.001	Discharge	52	197.67µg/dl	106.15µg/dl
	Death	48	183.11µg/dl	22.28µg/dl

Table 2: Comparison of Present Study with Previous Literature

Author	Year	Sample case size	Conclusion
Seçil Arıca *etal*,[13]	2011	25	It was concluded that infections, particularly pneumonia, which present a serious issue both in our country and developing countries, may be developed more commonly among children with zinc deficiency.
Rasheedat Mobolaji Ibraheem,[14]	2014	120	Low serum zinc levels are significantly associated with ALRI. There is a need to determine whether hospitalized children managedfor ALRI might benefit from post discharge zinc supplementation.
Reghupathy Panneerselam,[15]	2016	50	Serum zinc levels are significantly low in children with severe pneumonia compared with age, sex, and nutritionally matched controls
Madhura Shivalingaiah,[16]	2019	60	zinc level is low in children with pneumonia and lower serum zinc is associated with increasedseverity of pneumonia.
Amira M.M. Hamed,[17]	2019	90	Children with pneumonia has significantly lowerserum zinc levels than matched healthy controls.
Jayashree Rajasekaran,[18]	2020	50	Serum zinc levels were significantly lower inchildren with pneumonia when compared to their age-, sex-, and nutrition-matched controls.
Present study	2022	100	Strong converse correlation was evident between pneumonial respiratory distress and serum zinc level in children than in matched healthy controls

DISCUSSION

Recent studies have shown conflicting evidence on the role of zinc against pneumonia. The current investigation presents the mean serum zinc levels in pneumonia cases were significantly lower compared to healthy age- and sex-matched controls with p=0.001, and lower serum zinc was linked with rising severity of pneumonia. Present research work results were agreeable with earlier studies by Kumar etal, Pushpa etal, Devrajani etal. Most of the cases in the present study were in the age group of 3 –18 months (85.55%) which is in accordance with other studies. Increased susceptibility of this group may be due to decreased immunity making them more prone to infections. Our results were consistent with previous works as shown in [Table 2].

CONCLUSION

Our study results conclude that there is a contrary relation between serum zinc and different stages of pneumonial agony than in matched healthy controls. Prognosis could be augmentation of zinc in hospitalized children with acute lower respiratory infection.

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