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ORIGINAL RESEARCH

A OBSERVATIONAL STUDY ON SERUM ZINC LEVELS IN CHILDREN HOSPITALISED WITH PNEUMONIA

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ABSTRACT:

Background: Pneumonia is a global health problem and important causes of deaths under five years of age accounting for 17% worldwide. Zinc is an important micronutrient in humans and stimulates immune responses and prevents infections. There is a higher pneumonia risk in a population with zinc deficiency with high rates of infections such as diarrhea, skin, and respiratory infections. The aim of our study is to compare the level of serum zinc in children with pneumonia with age, sex, and nutritional matched healthy controls.Objectives: To studySerum zinc levels in children hospitalised with pneumonia, Correlation between serum zinc levels and severity of pneumonia and its complications.

Materials and Methods: This cross sectional study included 90 subjects (90 with pneumonia and 90 without pneumonia) aged between 3 months to 5 years diagnosed with various levels of pneumonia and 90 age and sex matched controls. 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-120.21µg/dl, severe pneumonia- 59.57µg/dl, very severe pneumonia- 36.19µg/dl). Mean serum zinc levels in complicated pneumonia and death cases was very low 35.28µg/dl compared to those with no complications 109.27µg/dl and who were discharged 141.1µg/dl. Low serum zinc levels were associated with prolonged hospital stay in children.

Conclusion: The final conclusion of the present study indicates there is an inverse relation was established between serum zinc level in children and various degrees of pneumonial respiratory distress than in matched healthy controls. There could be an improvement with zinc supplementation in hospitalized children with ALRI**.**

Keywords: Serum zinc; Pneumonia; ALRI.

INTRODUCTION:

Pneumonia is an acute form of respiratory infection that impacts the lungs. It is defined as an inflammation of the lung tissue due to an infectious agent. The commonly used clinical WHO operational definition is based only on clinical symptoms (cough or difficulties in breathing and tachypnea). In the developing world, the term lower respiratory tract infection is widely used instead of pneumonia, because of poor access to radiography and difficulties in radiological confirmation of diagnosis.[1,2]Most of the ARI 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.[3] The annual estimated global incidence of pneumonia is 158 million new cases per year, ofwhich 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.[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 crucial for cellular metabolism, physical growth, immunocompetence, reproductive functions, integrity of intestinal mucosa, and neurobehavioral development.[6] Zinc deficiency is associated with decreased immunocompetence, and high rates of 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 T-lymphocytes cannot exhibit sufficient effectiveness.[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:

Study was a cross sectional study conducted at Department of Pediatrics, Govt Medical College & Hospital, Nalgonda. All children between 3 months and 5 years of age admitted to Pediatric wards ofGovt General Hospital, located in Nalgonda, Telangana 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 3 months and 5 year of age admitted to Govt Medical College & hospital with a diagnosis of pneumonia (of any severity) according to WHO criteria.

Exclusion criteria

1. Children diagnosed as Protein energy malnutrition according to Indian academy of Pediatrics classification or as severe acute malnutrition according to WHO criteria.

2. Children with associated diarrhoea.
3. Children who are on Zinc supplements or who have received Zinc supplements in the past 6 months.

A written informed consent was taken from the parents/guardian of all children after fully explaining the study procedure. 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.

RESULTS:

The present study was conducted from November 2019 to April 2022. A total of 90 cases of pediatric pneumonia cases fulfilling the inclusion criteria were selected. ninety age and sex matched healthy subjects were selected as controls. The study was conducted atDepartment of Pediatrics, Govt General hospital, Nalgonda, Telangana. Study included 90 cases with pneumonia. Among them, 55 were males (61.11%) and 35 were females (38.88%). 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 100.6 □g/dl and in controls mean serum zinc levels was 165.82 µg/dl. The difference in mean serum zinc between controls and cases was 65.22 µg/dl which was statistically significant (p value 0.001). Same is depicted in table1. Out of 90 cases, 55 were males (61.11%) and 35 were females (38.88%) The mean serum zinc levels among males and females were 115.2µg/dl and 69.23µg/dl respectively. There is statistically significant difference of 46.21µg/dl in terms of gender (p value 0.001) as compared with controls. Same is depicted in table1. Mean serum zinc values among various grades of pneumonia cases was 120.21µg/dl, 59.57µg/dl and 36.19µg/dl among cases with pneumonia, severe pneumonia and very severe pneumonia respectively. Thus there was inverse 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 out of 90 cases, 60 were hypoxic at the time of admission with serum zinc levels among hypoxic children was found to be very low 49.82µg/dl in comparison with high O2 saturation >94% with 121.4µg/dl. There is statistically significant difference between serum zinc levels and SpO2 at the time of admission among pneumonia cases. Out of 90 majorities 59 shown the features o f suggestive shock had very low serum zinc concentration 42.71µg/dl whereas in 31 cases without shock was shown serum zinc levels among those112.21µg/dl. There is statistically significant difference between serum zinc levels and shock at the time of admission among pneumonia cases table 1. Fifty-three out of 90 cases were found to be anemic with mean serum zinc was 64.12µg/dl in comparison with mean serum zinc in nonanemic group of 37 cases was 123.1µg/dl. There is statistically significant difference between serum zinc levels and haemoglobin values among pneumonia cases. Fourty one out of 90 cases with pneumonia had

leucocytosis which is probably due to bacterial infection and mean serum zinc in them was found to be 101.4µg/dl. Followed by 69µg/dl in leucopenia While mean serum zinc in those cases with normal leucocyte count was 121.2µg/dl. There is statistically significant difference between serum zinc levels and total leucocyte count among study group. Fifty-nine cases out of 90 had features of bilateral interstitial infiltrate on chest X-ray with mean serum zinc in this group was 78.5µg/dl followed by 22 cases had features of peribronchial cuffing w i t h 100.91µg/dl of mean serum zinc level and 9 cases had consolidation on chest X-ray with 252.3µg/dl of mean serum zinc level. There is statistically significant difference between serum zinc levels and X-ray finding among cases. Cases with bilateral interstitial infiltrate had low serum zinc levels which is statistically significant. Among 90 cases, 33 cases with pneumonia expired were with mean serum was found to be very low 35.28µg/dl and 57 cases were discharged with 141.1µg/dl. As the mean serum zinc levels was very much low in death cases, statistically significant difference was seen between mean serum zinc levels and outcome among cases and controls. Among 90 cases, 6 3 cases developed empyema as complication w i t h mean serum zinc of 81 µg/dl. Whereas mean serum zinc in those without empyema was 109.2 µg/dl. There is statistically significant difference between mean serum zinc levels and complications among cases.

DISCUSSION:

Recent studies have shown conflicting evidence on the role of zinc against pneumonia. In our study, the mean serum zinc levels in pneumonia cases were significantly lower compared to healthy age- and sex-matched controls (p=0.001), and lower serum zinc was associated with increasing severity of pneumonia. This is consistent with earlier studies by Kumar et al., Pushpa et al., Devrajani et al., and Kumar et al. 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 decreasedimmunity making them more prone to infections. Our results were consistent with previous works as shown in [Table 2].

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 months P value 0.005	<6	10	145.07µg/dl	81.07µg/dl
	7-12	35	138.15µg/dl	87.15µg/dl
	13-18	32	141.85µg/dl	80.5µg/dl
	19-24	5	124.2µg/dl	76.8µg/dl
	>24	8	101.27µg/dl	90.1µg/dl
Gender P value 0.005	Males	55	145.28µg/dl	115.25µg/dl
	Females	35	141.85µg/dl	69.23µg/dl
Severity of pneumonia P value < 0.001	Pneumonia	51	148.28µg/dl	120.21µg/dl
	severe pneumonia	22	139µg/dl	59.57µg/dl

	Very Severe pneumonia	17	124.69µg/dl	36.19µg/dl
SpO2 in room air P value < 0.001	≤94%	60	137.21µg/dl	49.82µg/dl
	>94%	30	156.87µg/dl	121.4µg/dl
Shock P value 0.005	Present	59	139.87µg/dl	42.71µg/dl
	Absent	31	158.28µg/dl	112.21µg/dl
Haemoglobin P value 0.005	Anemia ≤11	53	136.27µg/dl	64.12µg/dl
	Normal >11	37	168.89µg/dl	123.1µg/dl
Total count P value 0.005	Normal	38	170.24µg/dl	121.2µg/dl
	Leukocytosis	41	156.27µg/dl	101.4µg/dl
	Leucopenia	11	126.29µg/dl	69µg/dl
Chest X-ray P value 0.001	Consolidation	9	267.3µg/dl	252.3µg/dl
	Bilateral interstitial infiltrate	59	151.98µg/dl	80.47µg/dl
	Peribronchial cuffing	22	143.69µg/dl	100.91µg/dl
Complications P value 0.001	None	27	189.94µg/dl	109.27µg/dl
	Empyema	63	152.46µg/dl	81µg/dl
Outcome P value 0.001	Discharge	57	197.67µg/dl	141.1µg/dl
	Death	33	172.12µg/dl	35.28µg/dl

Table 2: Comparison of Present Study with Previous Literature

Author	**Year**	**Sample case size**	**Conclusion**
Madhura Shivalingaiah,[13]	2019	60	Zinclevel islowinchildrenwithpneumoniaandlowerserumzincisassociatedwithincreasedseverityof pneumonia.
HanaaI.Rady,[14]	2013	40	Weconcludedthatthelowertheserumzinclevel, the higher the grade of respiratorydistressamongchildrenwithpneumonia.
AmiraM.M.Hamed,[15]	2020	90	Children with pneumonia has a ignificantlylowerserumzinclevelsthanmatchedhealthycontrols.

Rasheedat MobolajiIbraheem,[16]	2014	120	Low serum zinc levels are significantlyassociated with ALRI. There is a need todetermine whether hospitalized childrenmanagedforALRImight benefitfrompostdischargezincsupplementation.
JayashreeRajasekaran,[17]	2020	50	Serumzinclevelsweresignificantlylowerinchildrenwithpneumonia whencomparedtotheirage-,sex-,andnutrition-matchedcontrols.
ReghupathyPanneerselam,[18]	2016	50	Serumzinclevelsaresignificantlylowinchildrenwithseverepneumoniacomparedwithage,sex,andnutritionallymatchedcontrols
Pushpaetal,[19]	2009	50	Children suff-ering from severe pneumoniahavedecreasedlevelofserumzincascomparedtohealthy controls.
Present study	2022	90	There is an inverse relation was establishedbetween serum zinc level in children andvariousdegreesofpneumonialrespiratorydistressthaninmatchedhealthycontrols

CONCLUSION:

The final conclusion of the present study indicates there is an inverse relation was established between serum zinc level in children and various degrees of pneumonial respiratory distress than in matched healthy controls. There could be an improvement with zinc supplementation in hospitalized children with ALRI.

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