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A STUDY OF NUTRITIONAL RISK FACTORS AND PLASMA ZINC LEVELS IN CHILDREN WITH ACUTE LOWER RESPIRATORY INFECTIONS

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ABSTRACT

Background: *Paediatric respiratory disease remains an important cause of morbidity in both the developing and the developed world. It has become the most common reason parents cite for taking their children to see the general practitioner, and nutritional factors are a major reasons for ALRI.* ***Objective:*** *Acute respiratory infection is a leading cause of morbidity and mortality in under five children worldwide especially in developing countries. Hence, the present study was undertaken to identify various nutritional risk factors and serum zinc level for acute lower respiratory tract infections (ALRI) in children aged 6 months to 5 yr.* ***Methods:*** *65 cases fulfilling WHO criteria for pneumonia, in the age group 6 months to 5 yr were interrogated for potential nutritional risk factors as per a predesigned proforma and serum zinc level was measured. 65 healthy control children in the same age group were also interrogated and zinc level measured.* ***Results:*** *Significant nutritional risk factors identified were malnutrition, anaemia and low serum zinc level (p value <0.05 in all). Socio demographic factors like low socio economic status and partial immunized status were not found to be significant.* ***Conclusion:*** *The present study has identified various nutritional risk factors for ALRI which has to be tackled by effective education of the community and appropriate initiatives taken by the government.*

KEY WORDS

Paediatric respiratory disease, ALRI, serum zinc level.

INTRODUCTION

Paediatric respiratory disease remains an important cause of morbidity in both the developing and the developed world. It has become the most common reason parents cite for taking their children to see the general practitioner, and for attendance to the emergency department with a paediatric medical problem.

Pneumonia or ALRI cause over 2 million deaths annually among children younger than 5 years of age. Responsible for about 19% of all child deaths, pneumonia is the leading cause of child mortality. The two-thirds reduction in child mortality needed to achieve the MDG4 is not likely to be achieved without effective interventions to reduce mortality from pneumonia. About 150 million cases of pneumonia are estimated to occur every year in the developing world and 11-20 million of these cases are severe enough to require hospitalization, creating a huge burden on hospital services.

Despite ALRI being a condition commonly encountered by clinicians, uncertainty remains over the diagnosis, investigation, and treatment of the condition. The BTS and WHO have published clinical guidelines which provide evidence base for the management of ALRI[4]. The guidelines recognize, however, that there are still some recommendations based on consensus opinion due to the lack of available evidence.

Improvements in nutrition are a keystone of current global efforts to reduce the burden of mortality and morbidity due to ALRIs among children living in developing countries[5]. Zinc deficiency is widely prevalent in the developing areas of the world, which

also have a high incidence of ALRI[6]. Zinc deficiency has been a particular focus of attention because of its high frequency in developing countries and its debilitating effects on immune function. Observational studies and randomized controlled trials have revealed a range of functional outcomes associated with zinc status during childhood, including linear growth, motor development and susceptibility to infectious diseases[8].

METHODOLOGY

The study is conducted as a cross-sectional study at Vijayanagar Institute of Medical Sciences, which are a teaching hospital and a referral centre. Children in the age group 6 months to 5 years of age admitted in the hospital with acute lower respiratory tract infection during the study period were enrolled in the study as cases as per the inclusion and exclusion criteria. Controls included in the study are healthy children between 6 months and 5 years of age who are normal siblings of admitted children and children of same age group admitted for non-respiratory complaints during the study period.

This study protocol was reviewed and approved by the ethical review committee of Vijayanagara Institute of Medical sciences, Bellary.

Written informed consent of the child's parent or legally accepted representative was obtained in both cases and controls. A detailed history and physical examination was done according to a predesigned proforma to elicit various Potential risk factors. Age of the child was recorded in completed months. A detailed history of relevant symptoms like fever, cough, rapid breathing, chest retraction, refusal of feeds, lethargy, wheezing was taken. Past history of similar complaints also taken. History of immunization was elicited from parents and verified by checking all available documents. Dietary intake of child prior to the illness was calculated by 24 hour dietary recall method. History of upper respiratory tract infection in family preceding 2 weeks was recorded.

A detailed examination of each child was done. Respiratory rate and heart rate was measured for one minute, when the child is quiet. A detailed anthropometry was done and malnutrition was graded according to Indian Academy of paediatrics classification. Severity of respiratory distress was assessed in each child. Anaemia and signs of vitamin A deficiencies and rickets was recorded. A detailed systemic examination was done in both cases. Routine haematological and urine investigations, chest x- ray was done in all cases. Within 24 hour of admission 3 ml of venous blood was collected via venipuncture using zinc free plastic tubes. The blood samples were transported to lab where serum zinc concentrations were measured using colorimetric method. A Certified trace element control serum was used daily to ensure accuracy and precision.

RESULTS

Serum Zinc levels Out of the 65 patients in the cases group, 53 patients (81.5%) had serum zinc level below the normal range, 11 patients (16.9%) had normal zinc values and 1 patient (1.5%) had zinc value above normal level. Whereas in control group, 6 patients (9.2%) had zinc values less than normal, 56 patients (86.2%) had zinc values in the normal range and 3 patients (4.6%) had zinc values above normal range. Serum zinc level was significantly associated with cases with a P value < 0.001**

SERUM ZINC	CASES		CONTROLS	
	NO	%	NO	%
<60	53	81.5	6	9.2
60-120	11	16.9	56	86.2
>120	1	1.5	3	4.6

Comparison studies of variables on comparing the variables total protein, serum albumin and zinc level between the study group and the control group, following are the inferences:

1. Mean total protein in cases group is 7.23± 0.63 and 7.17+0.42 in control group. it is not a statistically relevant analysis since the p value is 0.528
2. Mean serum albumin is 4.33+0.46 and 4.15+ 0.26 in cases and control group respectively with p value 0.008 which implies statistically strongly significant with the cases.
3. Mean serum zinc level is 49.90+ 20.65 in study group and 87.86± 19.0 in control group with p value 0.001 implying it is statistically strongly significant with the cases.

	CASES	CONTROL	P VALUE
TOTAL PROTEIN	7.23±0.63	7.17±0.42	0.528
SERUM ALBUMIN	4.33±0.46	4.15±0.26	0.008
SERUM ZINC	49.90±20.65	87.86±19.00	<0.001

DISCUSSION

Childhood pneumonia clearly represents one of the most common infective illnesses in developing countries and is of great importance as a cause of preventable mortality in children. To attack this global problem, WHO shaped strategy for early diagnosis and effective case management that had remarkable impact on mortality due to childhood pneumonia in developing countries. Even after these measures the burden caused by childhood pneumonia in terms of both mortality and morbidity is very high. It is necessary to identify other causes which contribute to the severity of pneumonia. Influence of demographic, socioeconomic and nutritional factors has been a matter of debate for quite few years. Among the nutritional factors, vitamin A deficiency, anaemia, rickets, and zinc level is considered important. Role of zinc in immunity is known to everyone. But an exact influence of zinc has not been outlined yet. The present study has been done with keeping this view in mind. The objective of the study was to determine the nutritional factors especially zinc level in serum contributing to lower respiratory infections.

The present study has taken into consideration nutritional factors like malnutrition, anaemia, serum zinc level, vitamin A deficiency and rickets clinically. We have also taken into consideration socio-demographic factors like partially immunized status and socio economic status into the study. The age and sex distributions were comparable between case and controls.

Among the socio demographic variables studied, low socio economic status was not significantly associated with ALRI unlike reports by earlier reporters. Previously Cunha AL et al138 reported that children with low SES experienced a higher prevalence of ALR1 than children with high SES even after adjusting for other nutritional risk factors and overcrowding. Even though low SES leads to less access to social, human and material resources leading to more of infections, our study didn't find any significant association between ALRI and SES.

Previous studies by BroorS et a1125 have reported that partially immunized children were more prone for ALRI as compared to upto date immunized children. But in our study we didn't find any significant association between partially immunized state and ALRI. Most probable reason for that would be because of the low incidence of partially immunized children (12.3%) in our study and we have taken WHO immunization schedule as the standard. Mostly a study with more number of cases and IAP immunization schedule as the standard would have given a different result.

Among the nutritional variables, malnutrition, anaemia and serum zinc level was found to be significantly associated with ALRI with a P value of 0.015, 0.001 and < 0.001 respectively whereas vitamin A deficiency and serum albumin level was not found to be significant. And rickets was excluded because of very less number of cases.

Presence of malnutrition was significantly associated with ALRI in the present study with P 0.015, similar to other studies. A study in Philippines included age stratified risks in children less than 23 months of age and reported highest risk of of death from ALRI due to malnutrition among those aged 12-22 months.

A study in New Delhi revealed severe malnutrition as the predictor of mortality in ALRI in 2wk to 5yrs old children140. Overall malnutrition is associated with a

2-3 fold increase in mortality from ALRI. It is well known that malnourished children will have defective cell mediated immunity secondary to thymolymphatic depletion leading to severe gram negative infections and sepsis. They may also have qualitatively abnormal immunoglobulin's and impairment of key enzymes involved in bactericidal action of leucocytes.

Anaemia was a significant factor for ALRI in the present study. Not many studies have stressed on the role of anaemia in ALRI. The role of anaemia in infection is debated extensively. The proposed pathophysiologic basis for increased risk of infections are - neutrophils have a decreased capacity to kill bacteria due to reduced myeloperoxidase activity. Both the proportion and absolute number of circulating T cells are reduced and also they have defective DNA synthesis due to decreased ribonucleotide reductase activity.

In the present study vitamin A deficiency was not significantly associated with ALRI (P= 0.545). Although vitamin A supplements reduce childhood mortality in areas where deficiency is present, no reduction in ALRI morbidity or mortality has been shown'.

In this present study, low serum zinc level was found to have significant association with ALRI (P<0.001). It implies that, in the present study, children with ALRI had significantly low serum zinc values which can be a predisposing factor for the infection. Even though there is a strongly significant association between low serum zinc values and ALRI according to the present study, it doesn't imply that all the children having ALRI will have low serum zinc values. It can be taken as one among the many causes predisposing for ALRI. In this study, 9 cases (13.8%) having ALRI had normal zinc values. Moreover, children with ALRI and low serum zinc level had other nutritional risk factors like malnutrition and anaemia. On analysis, malnutrition and low serum zinc level showed suggestive significance with a P value of 0.060. This implies low serum zinc level can be considered as a modifiable nutritional risk factor predisposing to ALRI.

Previous research studies were mainly concentrated on the effect of zinc supplementation on the course of treatment of ALRI. As discussed earlier few studies have reported the beneficial effect of zinc on treatment course of ALRI. Whereas few other studies concluded that zinc supplementation has no effect on the incidence, course and outcome of ALRI. Extensive studies and debates are still going on regarding this topic. Anyway the effect of zinc on immunity and leading to infections is well understood and accepted. In short, zinc is an important trace element and its level in the body is significant.

CONCLUSION

The present study identified many nutritional risk factors for ALRI. The significant nutritional risk factors were malnutrition, anaemia and low serum zinc level. Socio demographic factors like partial immunization status and SES which were taken into study didn't have any significant association with ALRI. The interesting fact is nutritional factors which were found to be significant in this study are actually either preventable or curable. The above risk factors should be tackled with effective health education of the community and appropriate initiatives should be taken by the government which can lead to a healthy community and a healthy nation as a whole.

Limitations of the study should be considered while interpreting the results. The total number of cases taken for the study, ie which satisfied the WHO criteria for ALRI is less compared to the incidence of ALRI. Moreover zinc values were estimated only at the time of admission. A follow up estimation of zinc level at the time of discharge or after 2 weeks of infection would have given more detailed results. A randomized controlled trial study with zinc supplementation would have been an ideal study method. Vitamin A deficiency was estimated only clinically which was very subjective. A biochemical test for vitamin A level would have been ideal, which is very costly. A study with more number of patients with more detailed assessment of demographic, socioeconomic and nutritional factors should be performed.

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