

Hyponatremia in Children with Acute Lower Respiratory Tract Infections: An Institutional Based Study

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ABSTRACT

Background: Lower respiratory tract infection (LRTI) is among the serious health problems specifically in less than 5 years of age needing hospitalisation and attributes to 30 % of deaths yearly worldwide especially due to pneumonia as the leading cause. In developing country like India patients with pneumonia and bronchiolitis, the most typical diseases come across in pediatric basic practice, are at particular danger of establishing hyponatremia due to antidiuretic hormonal agent (ADH) over secretion or it might also arise from a salt deficit, or surplus of water, which can contribute the child motility rate.

Objective: The objective of this study is to compare the sodium and CRP level in children with LRTI, and to highlight the more important aspect in this subject.

Materials and Methods: Total of 100 children between the age group of 2 months to 5 years where taken in this study. Out of which 50 children were control and 50 were known cases of lower respiratory tract infection mainly pneumonia. Aseptically, 3 ml of venous blood was drawn from the antecubital vein from each patient and were analysed for serum sodium level and serum CRP level. Statistical analysis of collected data has been done by using SPSS (16.0). P value < 0.05 was considered as statistically significant.

Results: Statistically significant differences were observed in the mean serum sodium level of controls and CRP as compared to children with pneumonia (138 ± 2.63 mmol/L), (129 ± 3.215 mmol/L) ($p = 0.004$) and (6.11 ± 2.79 mg/L). ($p =$

0.02) respectively. While, after applying Pearson's correlation coefficient it was found that there is a negative correlation between serum sodium level and CRP ($r = -0.290$) in cases. Whereas, in control it do not shows any significant relations.

Conclusion: Hyponatremia has clearly been shown to be a common electrolyte abnormality in lower respiratory tract disease mainly in pneumonia. Thus, serum electrolytes should be measured in children hospitalised for pneumonia; the appropriate fluid therapy must be carefully arranged in children with hyponatraemia for appropriate management resulting in better outcome of the patient.

Keywords: Hyponatremia, Pneumonia, ADH, LRTI.


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INTRODUCTION

Lower respiratory tract infection (LRTI) is among the serious health problems specifically in less than 5 years of age needing hospitalisation and attributes to 30 % of deaths yearly worldwide especially due to pneumonia as the leading cause.¹ Lower respiratory tract infection (LRTI) is infection listed below the level of the throat and might be taken to include: Bronchiolitis, Bronchitis, Pneumonia and empyema.² Pneumonia is a common illness affecting children especially in developing countries accounting for approximately 20% of childhood deaths.³ Children admitted with pneumonia are critically ill and often times have complications which include electrolyte abnormalities, the commonest being hyponatremia. The recent advances made in the medical field with newer antibiotics and immunisation has

reduced the incidence of lower respiratory tract infection in the developed world and also help in maintaining the body homeostatic⁽³⁾. But in developing country like India patients with pneumonia and bronchiolitis, the most typical diseases come across in pediatric basic practice, are at particular danger of establishing hyponatremia due to antidiuretic hormonal agent (ADH) over secretion or it might also arise from a salt deficit, or surplus of water.⁴ Primary illness, impaired water excretion, improper release of vasopressin, use of hypotonic fluids, redistribution of sodium and water, ill cell syndrome, and numerous drugs might add to hyponatraemia.⁵ Hyponatremia is defined as serum sodium (Na) concentration of less than 135 mEq/L. Serum sodium concentration and serum osmolarity

normally are maintained under precise control by homeostatic mechanisms involving stimulation of thirst, secretion of antidiuretic hormone (ADH), and renal handling of filtered sodium.⁶ Fluids and electrolytes are the primary pillars in the upkeep of body homeostasis. The most essential among electrolytes is salt which is the abundant cation of the extracellular fluid. Hyponatremia is the most common electrolyte irregularity seen in the intensive care unit (ICU), with an occurrence as high as 30% in some reports.⁷ Hyponatremia typically establishes in severe inflammatory diseases such as meningitis, breathing tract infections, febrile convulsions, and Kawasaki disease in children which can contribute the child motility rate.^{8,9} Thus, on the basis of these considerations the present study was directed towards the evaluation of serum sodium level and serum CRP as an inflammatory indicator in lower respiratory tract infection with pneumonia as compared to age matched normal children.

MATERIALS AND METHODS

The present study was conducted in KD medical college and hospital, Mathura, Uttar Pradesh in department of pediatrics. A total of 100 children between the age group of 2 months to 5 years where taken in this study. Out of which 50 children were control and 50 here known cases of lower respiratory tract infection mainly pneumonia. Patients were identified by the principal investigator at IPD, ICU and wards. Complete history and physical examination were taken to confirm diagnosis. If a child met the inclusion criteria, informed consent was sought from the guardian

or the parent after explaining to him or her about the study. Aseptically, 3 ml of venous blood was drawn from the antecubital vein from each patient. The blood samples were then transported to the central laboratory within an hour of collection for analysis of serum C-reactive protein (CRP) and serum concentrations of sodium (Na).

Children who had normal sodium levels on admission were followed up over 48hours during which their fluid intake both orally and intravenously were recorded. For those who received intravenous fluid, the type of fluid and amount was also documented.

Statistical analysis of collected data has been determined by using SPSS (16.0). The results of laboratory tests of this study have been summarized as mean \pm standard deviation. Mean difference (both participating groups) have be analysed by using student's t-test and chi-square test was used to saw the co-relation. P value < 0.05 was considered as statistically significant.

Inclusion Criteria

1. Children 2 months to 5 years with a diagnosis of pneumonia and age matched normal children were considered as control.
2. Only children for whom consent is obtained from parent(s) or legal guardian(s) to participate in the study have been included.

Exclusion Criteria

The children with Cardiac disease, Kidney disorders, Central nervous system infections, gastroenteritis and children who are on drugs which can cause electrolyte imbalance such as diuretics, anticonvulsants were excluded from the study

Table 1: Comparison of serum Sodium level between controls and children with pneumonia by Student's t-test.

Parameter	Control group (n=50) Mean \pm SD	Children with pneumonia (n=50) Mean \pm SD	p-value
Serum Sodium level (mmol/L)	138 \pm 2.63	129 \pm 3.215	0.004

Table 2: Comparison of CRP level between controls and children suffering from pneumonia by Student's t-test.

Parameter	Control group (n=50) Mean \pm SD	Children suffering from pneumonia (n=50) Mean \pm SD	p-value
Serum CRP (mg/L)	3.17 \pm 1.27	6.11 \pm 2.79	0.02

Table 3: Tabular representation showing Pearson correlation coefficient (r) and p-value.

Parameters	r-value	p-value
Sodium-CRP (in Cases)	- 0.290	0.03
Sodium-CRP (in Control)	0.072	0.43

RESULTS

Statistically significant differences were observed in the mean serum sodium level of controls (138 \pm 2.63 mmol/L) and Children with pneumonia (129 \pm 3.215 mmol/L). (p = 0.004)

Statistically significant differences were observed in the mean serum CRP level of controls (3.17 \pm 1.27 mg/L) and Children suffering from pneumonia (6.11 \pm 2.79 mg/L). (p= 0.02)

After applying Pearson's correlation coefficient it was found that there is a negative correlation between serum sodium level and CRP (r = -0.290)in cases. Whereas, in control it do not shows any significant correlation.

DISCUSSION

Hyponatremia has been shown to be the commonest electrolyte abnormality in hospitalized patients suffering from lower respiratory tract infection mainly pneumonia. The goal of this study was to provide a baseline data on prevalence of hyponatremia since no similar study has been carried out in this reason. In various studies hyponatremia was the most frequent electrolyte abnormality in children hospitalized due to pneumonia¹⁰ and was associated with a more severe disease and a poorer outcome.⁴ Which is similar to our study which shows low serum sodium level (129 \pm 3.215) as compared to control (138 \pm 2.63). Which is also

similar to the study by Don et al.¹¹ in which hyponatremia was found in 45.4% of children with community acquired pneumonia. On the other hand C-Reactive protein being an acute phase protein reactant is raised in response to a number of stimuli involving tissue damage also shows a significant difference in control (3.17 ± 1.27) as compared to children suffering from lower respiratory tract infection mainly due to pneumonia (6.11 ± 2.79) which is contradictory to the observation of (Alkahtani et al.¹² On the other hand after applying correlations between serum sodium level and serum CRP level in cases shows inverse relation ($r = -0.290$). ($p=0.03$). And in control it shows no significant difference. This is similar to the result of victor et al.¹³

Limitation of our study was the relatively small size of our study group. Larger studies are needed in order to evaluate whether hyponatremia could impact the outcome of hospitalized children with severe pneumonia.

CONCLUSION

Hyponatremia has clearly been shown to be a common electrolyte abnormality in lower respiratory tract disease mainly in pneumonia. It has also been shown that severe hyponatremia is a marker of severe illness and is associated with high morbidity and mortality. There is a knowledge gap of this condition in our set-up and therefore this study will act as a baseline for other studies in this topic. This study shows a significant difference in mean value of serum sodium and CRP in control as compared to children with pneumonia 138 ± 2.63 , 129 ± 3.215 and 3.17 ± 1.27 , 6.11 ± 2.79 respectively. Describing the burden of this problem will aid in providing useful data that can generate other entry points into studying this condition. Thus, serum electrolytes should be measured in children hospitalised for pneumonia; the appropriate fluid therapy must be carefully arranged in children with hyponatraemia for appropriate management resulting in better outcome of the patient.

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