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Hyponatremia in Children with Acute Lower Respiratory Tract Infections

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ABSTRACT

Background: Hyponatremia can be a life-threatening illness among hospitalized children. Present study aimed to compare the sodium and CRP level in children with lower respiratory tract Infections (LRTI), and to investigate whether there is a link between hyponatremia and the severity and outcome of LRTI. **Materials and Methods:** Total of 200 children between the age group of 2 months to 5 years were involved in the study which includes 100 as control and 100 of lower respiratory tract infection mainly pneumonia, bronchiolitis, wheezing, empyema. 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 (18.0). P value < 0.05 was considered as statistically significant. **Results:** Statistically significant differences were observed in the mean serum sodium level of controls 136 ± 2.86 and Children with pneumonia (126 ± 4.25). (p = 0.001). Statistically significant differences were observed in the mean serum CRP level of controls (3.46 ± 1.12) and Children suffering from pneumonia (4.11 ± 2.67). After applying Pearson's correlation coefficient it was found that there is a negative correlation between serum sodium level and CRP in cases. Whereas, in control it do not shows any significant correlation. **Conclusion**: Hyponatremia has clearly been shown to be a common electrolyte abnormality in lower respiratory tract disease mainly in pneumonia. Thus the appropriate fluid therapy must be carefully arranged in children with lower respiratory tract infection.

Key words: Bronchiolitis, 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]

Among patients with respiratory tract infections, pneumonia and bronchiolitis are most commonly associated with hyponatremia.

Pneumonia is an infection in one or both of the lungs, and is sometimes called a chest infection. Pneumonia in children can be caused by viruses or bacteria.

Bronchiolitis is a common lung infection in young children and infants. It causes inflammation and congestion in the small airways (bronchioles) of the lung. Bronchiolitis is almost always caused by a virus.[3-5]

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 non-osmotic release of antidiuretic hormone (ADH) as a result of various clinical conditions, such as fever, hypovolemia, and respiratory tract infection.[6]

However, the incidence of hyponatremia according to the etiological involvement of various microorganisms has not yet been studied. As a key event in the pathophysiology of hyponatremia in patients with respiratory tract infections, a syndrome of inappropriate ADH secretion (SIADH) caused by inflammation has been suggested, but it has not been evaluated or validated in a sufficiently large number of children.[7] Thus, on the basis of these considerations the present study aimed to compare the sodium and CRP level in children with lower respiratory tract Infections (LRTI), and to investigate whether there is a link between hyponatremia and the severity and outcome of LRTI.

MATERIALS AND METHODS

The present study was conducted in Department of Pediatrics, TS Mishra Medical College and Hospital Lucknow, Uttar Pradesh, India. A total of 200 children between the age group of 2 months to 5 years were involved in this study which includes 100 children as control and 1000 as cases of lower respiratory tract infection mainly pneumonia. Ethical clearance was taken before the commencement of study. Informed consent was taken from the guardian or the parent after explaining to him or her about the study.

Pneumonia was defined as the presence of infiltration on the chest X-ray. The diagnosis of bronchiolitis was made by the primary critical care physician at time of admission on the basis of clinical signs of tachypnea, hypoxia, rhinorrhoea, cough, wheeze, subcostal or

intercostal retractions, nasal flaring, and grunting. Severity of Hyponatremia was defined as mild = serum sodium concentration 131-135 mmol/L, moderate = 126-130 mmol/L, and severe HNa = less than 125 mmol/L (the normal values for serum sodium at our institution are 135-145 mmol/L). Gender, age, history of prematurity, intravenous fluid intake, and initial severity of illness were analysed as independent risk factors for the development of hyponatremia

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 ± 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.

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

RESULTS

Table 1: Comparison of serum Sodium level between controls and children with pneumonia

Parameter	Control group (n=50) Mean ± SD	Children with pneumonia (n=50) Mean ± SD	p- value
Serum Sodium level (mmol/L)	136 ± 2.86	126 ± 4.25	0.001

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

Parameter	Control group (n=50) Mean ± SD	Children suffering from pneumonia (n=50) Mean ± SD	p-value
Serum CRP (mg/L)	3.46 ± 1.12	4.11 ± 2.67	0.04

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

Parameters	r- value	p-value
Sodium–CRP (in Cases)	- 0.480	0.01
Sodium–CRP (in Control)	0.086	0.56

Table 4: Different grades of Hyponatremia in different types of lower respiratory tract infections,

Type of LRTI	Total no. of cases	Mild hyponatremia (131-135meq/l)	Moderate hyponatremia	Severe hyponatremia (</= 125meq/l)	Cases with hyponatremia
Broncho - Pneumonia	102	38	12	04	54 (52.9%)
Lobar pneumonia	30	12	-	02	14 (46.7%)
Wheeze associated LRTI	28	04	-	-	04 (14.2%)
bronchiolitis	24	04	0	0	04 (16.7%)
Empyema	16	7	8	-	15 (93.75%)
Total	200 cases	65	20	06	91 (45.5%)

Statistically significant differences were observed in the mean serum sodium level of controls 136 ± 2.86 and Children with pneumonia (126 ± 4.25). (p = 0.001) []
The mean serum CRP level of controls (3.46 ± 1.12) and Children suffering from pneumonia (4.11 ± 2.67) showed statistically significant differences. (p= 0.04)
Pearson's correlation coefficient it was found that there is a negative correlation between serum sodium level and CRP in cases. Whereas, in control it do not shows any significant correlation.

DISCUSSION:
Hyponatremia is the most commonly encountered finding in both adults and children with respiratory tract infections. Since Stormont and Waterhouse first reported the association of hyponatremia with pneumonia in 1962, only case reports and a few relevant studies have been published about this relationship in children.[8,9]
Hyponatremia has been shown to be the commonest electrolyte abnormality in hospitalized patients suffering from lower respiratory tract infection mainly pneumonia. The incidence of hyponatremia has been reported to be about 30% in a small number of children with pneumonia or acute HRSV bronchiolitis, but it has not been estimated in children hospitalized with acute tonsillopharyngitis or acute bronchitis. Moreover, no report has considered the incidence of hyponatremia in children with respiratory tract infections according to the viral etiology, such as adenovirus, metapneumovirus, parainfluenza virus, and rhinovirus.[4-7]
Present study aimed to compare the sodium and CRP level in children with lower respiratory tract Infections (LRTI), and to investigate whether there is a link between hyponatremia and the severity and outcome of LRTI.
In various studies hyponatremia was the most frequent electrolyte abnormality in children hospitalized due to pneumonia and was associated with a more severe disease and a poorer outcome. Which is similar to our study which shows low serum sodium level as compared to control.
Chaitra MK et al conducted a prospective study on children admitted to the PICU with a diagnosis of lower respiratory tract infections such as pneumonia, bronchiolitis, wheezing, empyema. They observed that hyponatremia was a frequent finding in children with bronchopneumonia 28 (46.7%). Lobar pneumonia which was next common respiratory infection in our study had hyponatremia in 6 cases (50%).[10]
Similar results have also been observed in present study. Hence, authors suggested that all cases of empyema develop hyponatremia is a new association derived. Patients with lobar segmental pneumonia and bronchopneumonia are at higher risk of developing moderate or severe Hyponatremia. Thus the appropriate fluid therapy must be carefully arranged in children with lower respiratory tract infection.
C-reactive protein (CRP) has shown promise as a measure to reduce unnecessary antibiotic prescribing in respiratory tract infections (RTI), but its use in primary care is still controversial. [11]
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 as compared to children suffering from lower respiratory tract infection mainly due to pneumonia which is conflicting to the observation of Andreeva E et al.[11]
On the other hand after applying correlations between serum sodium level and serum CRP level in cases shows inverse relation and in control it shows no significant difference. This is similar to the result of victor et al.[12]
Hyponatremia occurring in children with pneumonia comprises part of the syndrome of inappropriate antidiüretic hormone secretion (SIADH). ADH is generally secreted by the pituitary gland in response to high plasma osmolality (high serum sodium concentration); however, in various clinical conditions, including fever, hypoxia, hypercarbia, pain, nausea, and vomiting, non osmotic stimulation of ADH secretion can lead to hyponatremia. Also, the stimulus of ADH release in pulmonary disease is likely to be non osmotic; in particular, lung hyperinflation and pulmonary infiltrates may stimulate ADH secretion by causing a false perception of hypovolemia by intrathoracic receptors.[6.8.10,11]

CONCLUSION
Hyponatremia has clearly been shown to be a common electrolyte abnormality in lower respiratory tract disease mainly in pneumonia. Thus the appropriate fluid therapy must be carefully arranged in children with lower respiratory tract infection.

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