

A Cross Sectional Study of Hyponatremia in Paediatric Patients with Acute Lower Respiratory Tract Infection

Dr.Karthick sundaram^{1*}

^{1*} Assistant professor, Department of Pediatrics, Tagore Medical College and Hospital, Rathinamangalam, Melakottaiyur, Chennai.

Corresponding Author: Dr.Karthick sundaram

Abstract

Introduction: Lower respiratory tract infection (LRTI) is among the serious health problems specifically in less than 5 years of age needing hospitalization and attributes to 30 % of deaths yearly worldwide especially due to pneumonia as the leading cause. LRTI is infection listed below the level of the throat and might be taken to include: Bronchiolitis, Bronchitis, Pneumonia and empyema. It is swelling of the airways/pulmonary tissue, due to viral or bacterial infection, below the level of the larynx.

Materials and Methods: This was a cross-sectional study carried out in pediatric intensive care unit (PICU) and Pediatric ward at Tagore Medical College and Hospital, Chennai. All children presenting with clinical symptoms suggestive of acute lower respiratory tract infections were evaluated in detail in hospital on IPD basis. Informed consent was taken. After an informed consent (Parent or guardian) in children, a detailed history was taken, and physical examination was done. Information on socio-demographic variables including child's age, gender and also symptoms of acute lower respiratory tract infection, such as the presence and duration of fever associated with chills, cough, nasal discharge, breathlessness or fast breathing and abdominal pain was taken. To know the severity of acute lower respiratory tract infection history of symptoms like grunting, noisy respiration, chest pain was elaborated.

Results: 170 cases of lower respiratory tract infection (16%) of total 925 admissions during study period were included in the study. Out of the 170 cases of lower respiratory tract infection, 118 (69.4%) had pneumonia, 32 (18.8%) had bronchiolitis, 16 (9.4%) had wheeze associated lower respiratory tract infection and 4 (2.35%) presented with acute CROUP syndrome. The prevalence of hyponatremia in lower respiratory tract infection was found to be 42.3% in our study.

Conclusion: The prevalence of hyponatremia in pediatric patients with lower respiratory tract infection was found to be 42.3%. Hyponatremia was more common in pneumonia group (91.66%) as compared to the non-pneumonia group (8.33%). Severe hyponatremia was seen more commonly with increase in severity of pneumonia; so, diagnosing hyponatremia in early stage and correcting by appropriate interventions plays an important role in outcome of children suffering from pneumonia.

Key Words: LRTI, PICU, acute CROUP syndrome

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I. 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 LRTI is infection listed below the level of the throat and might be taken to include: Bronchiolitis, Bronchitis, Pneumonia and empyema. It is swelling of the airways/pulmonary tissue, due to viral or bacterial infection, below the level of the larynx. Pneumonia is the leading reason for major illness and death in children accounting for 20-25 % in under 5 age around the world and it can be generally specified as swelling of the lung parenchyma.² Bronchiolitis is a typical childhood disease and its most typical etiologic representative is breathing syncytial virus (RSV). Hospitalization is required in around 1% of afflicted kids, primarily because of dehydration, insufficient oral intake, or breathing deficiency. Between 10-15% of hospitalized children will need extensive care due to impending breathing failure.³

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.⁴ Hyponatremia typically establishes in severe inflammatory diseases such as meningitis, breathing tract infections, febrile convulsions, and Kawasaki disease in children.⁵ Patients with pneumonia and bronchiolitis, the most typical diseases come across in pediatric basic practice, are at particular danger of

establishing hyponatremia due to anti diuretic hormonal agent (ADH) over secretion. Hyponatremia related to pediatric pneumonia is most typically due to the syndrome of unsuitable anti diuretic hormone secretion (SIADH).⁶

II. Materials And Methods

This was a cross-sectional study carried out in pediatric intensive care unit (PICU) and Pediatric ward at Tagore Medical College and Hospital, Chennai. All children presenting with clinical symptoms suggestive of acute lower respiratory tract infections were evaluated in detail in hospital on IPD basis. Informed consent was taken.

After an informed consent (Parent or guardian) in children, a detailed history was taken, and physical examination was done. Information on socio-demographic variables including child's age, gender and also symptoms of acute lower respiratory tract infection, such as the presence and duration of fever associated with chills, cough, nasal discharge, breathlessness or fast breathing and abdominal pain was taken. To know the severity of acute lower respiratory tract infection history of symptoms like grunting, noisy respiration, chest pain was elaborated.

On general examination the child was examined for signs of respiratory distress like flaring of alar nasi, intercostal and subcostal retractions of chest. Detailed respiratory system examination was done in all patients in relation to inspection, palpation, percussion and auscultation.

Based on the history, general physical examination and systemic examination those children who fulfilled the criteria of acute lower respiratory tract infection mostly on the basis of latest integrated management of neonatal and childhood illness (IMNCI) guidelines were included in the study.

After clinical diagnosis, basic laboratory investigations like Total white blood cells (WBC), erythrocyte sedimentation rate (ESR), CRP, blood culture and chest x-ray were done in each patient. Depending upon the situation of the patient, Chest USG or HRCT chest was done. Same venous sample collected in plain bulb on admission was sent to biochemistry laboratory for serum sodium level measurement. Serum sodium levels were measured using Patholyte-3 machine. Serum sodium levels were measured using a standardization of SrNa-145.

Hyponatremia was defined as a serum sodium level below 135mmol/L. Hyponatremia was classified into three groups as mild (131–135 mmol/L), moderate (126–130 mmol/L), and severe (≤ 125 mmol/L).

Disease severity was assessed by respiratory distress, SpO₂, presence of general danger signs as per integrated management of neonatal and childhood illness (IMNCI) guidelines, respiratory support needed and duration of hospitalization.

The final type of acute lower respiratory tract infection was decided on the basis of history, physical examination and detailed investigations. The frequency of hyponatremia was calculated in all study patients in relation to age, sex and expressed as percentage. The frequency of hyponatremia in pneumonia patients and other types of acute lower respiratory tract infection was estimated and compared.

All relevant data was filled in Microsoft excel sheet and analysis was done using SPSS Version13. The comparison was done by z test. P value < 0.05 was considered as significant.

III. Results

170 cases of lower respiratory tract infection (16%) of total 925 admissions during study period were included in the study. Out of the 170 cases of lower respiratory tract infection, 118 (69.4%) had pneumonia, 32 (18.8%) had bronchiolitis, 16 (9.4%) had wheeze associated lower respiratory tract infection and 4 (2.35%) presented with acute CROUP syndrome. The prevalence of hyponatremia in lower respiratory tract infection was found to be 42.3% in our study.

Hyponatremia was seen in 50% of lower respiratory tract infection below 1 year of age as compared to 30% seen between 3-5 years of age. Only 19.44 % of hyponatremia cases were present between 13 months to 36 months of age. Males were twice more commonly affected than females with hyponatremia in acute lower respiratory tract infection.

Hyponatremia was found with highest percentage (69.4%) in children suffering from pneumonia group. Out of 66 cases of hyponatremia associated with lower respiratory tract infection, 42 (69.4%) had mild hyponatremia, 18 (22.2%) had moderate hyponatremia and 6 (8.3%) had severe hyponatremia.

Hyponatremia was found in all cases of very severe pneumonia i.e. 26(100%) as compared to 32(53.33%) in severe pneumonia group and only 6(18.75%) in pneumonia group, but there was no significant association found between severity of hyponatremia and pneumonia grading as the p value was 0.145 (<0.05).

In our study, out of 72 cases of hyponatremia, 66(91.66%) were present in pneumonia group and only 6(8.33%) presented in non-pneumonia group. As p value is 0.00 and z value is 3.817, the above result was found to be statistically significant.

Age	No. of Hyponatremia Cases (n=72)	Percentage
2-12 months	36	50%
13-36 months	14	19.44%
37-60 months	22	30.55%

Table 1: Age Distribution in Hyponatremia in Lower Respiratory Tract Infection Patients

Total cases	170	Percentage
Pneumonia	118	69.4%
Bronchiolitis	32	18.8%
WALRI	16	9.4%
Acute Croup Syndrome	4	2.35%

Table 2: Different Lower Respiratory Tract Conditions

	Mild Hyponatremia (n=42)	Moderate Hyponatremia (n=18)	Severe Hyponatremia (n=6)
Pneumonia	8	-	-
Severe Pneumonia	24	6	2
Very Severe Pneumonia	10	12	4

Table 3: Severity of Hyponatremia with Pneumonia Grading

LRT Conditions	Hyponatremia (n=72)	Percentage
Pneumonia (n=118)	66	91.66%
Non-Pneumonia Group (n=52)	6	8.33%

Table 4: Comparison of Hyponatremia in Pneumonia and Other Lower Respiratory Tract Conditions

IV. Discussion

Hyponatremia is commonest electrolyte abnormality seen amongst hospitalized children with lower respiratory tract conditions. Presence of hyponatremia substantially increases the morbidity and mortality in children with lower respiratory tract conditions.

Acute, severe hyponatremia that develops within 48 hours can result in acute cerebral oedema and various complications such as headache, lethargy, seizures, and cardiac arrest due to brain stem herniation. Children are more vulnerable than adults to above complications because the brain/intracranial volume ratio is higher in children than in adults.⁷

Recent evidence suggests that even mild chronic hyponatremia can be related to subtle neurologic defects, such as impairments in balance and attention that can increase the incidence of falls.⁸

In our study out of 170 cases of lower respiratory tract infection (16%) of total 925 admissions during study period were included in the study. Out of the 170 cases of lower respiratory tract infection, 118 (69.4%) had pneumonia, 32 (18.8%) had bronchiolitis, 16 (9.4%) had wheeze associated lower respiratory tract infection and 4 (2.35%) presented with acute CROUP syndrome. The prevalence of hyponatremia in lower respiratory tract infection was found to be 42.3% in our study.

The most probable cause of hyponatremia is thought to be the non-osmotic release of antidiuretic hormone (ADH) as a result of various clinical conditions, such as fever, hypovolemia, and respiratory tract infections.⁹

Hyponatremia occurring in children with pneumonia comprises part of the syndrome of inappropriate antidiuretic hormone secretion (SIADH). Antidiuretic hormone 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 antidiuretic hormone secretion can lead to hyponatremia.¹⁰

Among patients with respiratory tract infections, pneumonia and bronchiolitis are most commonly associated with hyponatremia. However, the incidence of hyponatremia according to the etiological involvement of various microorganisms has not yet been studied.

V. Conclusion

The prevalence of hyponatremia in pediatric patients with lower respiratory tract infection was found to be 42.3%. Hyponatremia was more common in pneumonia group (91.66%) as compared to the non-pneumonia group (8.33%). Severe hyponatremia was seen more commonly with increase in severity of pneumonia; so, diagnosing hyponatremia in early stage and correcting by appropriate interventions plays an important role in outcome of children suffering from pneumonia.

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