

ORIGINAL ARTICLE**Evaluation of Serum Sodium Levels Among Pediatric Patients Hospitalized with Lower Respiratory Tract Infections in a Tertiary Care Facility**¹Vinay Kumar Rai, ²Anil Kumar Gupta¹Associate Professor, Department of Paediatrics, F H Medical & Hospital, Agra, Uttar Pradesh, India;²Professor, Department of Paediatrics, Venkateshwara Institute of Medical Sciences, Gajraula, Uttar Pradesh, India**ABSTRACT:**

Background: A lower respiratory tract infection, situated below the larynx, encompasses conditions such as pneumonia, wheeze-associated LRTI, bronchiolitis, and empyema. This study seeks to ascertain the prevalence of hyponatremia among pediatric patients while also investigating potential electrolyte imbalances in children experiencing severe pneumonia and their impact on clinical outcomes. **Aim:** Assessing the serum sodium levels in pediatric patients admitted in hospitals suffering from LRTI. **Materials and methods:** This retrospective descriptive study was carried out at the Department of Pediatrics over a one-year period. The study comprised all children aged between 2 months and 4 years who exhibited signs and symptoms of lower respiratory tract infections (LRTI). We collected data on various parameters, including the length of hospitalization in the Pediatric Intensive Care Unit (PICU) or ward, the necessity for oxygen therapy, the requirement for ventilator support, the duration of mechanical ventilation, and the ultimate patient outcomes, encompassing complications, discharge, and mortality. Our objective is to assess the impact of hyponatremia on morbidity and mortality in pneumonia patients, comparing those with hyponatremia to those with normal sodium levels. **Results:** In this study, we observed an equal distribution of patients between the hyponatremia and normonatremia groups, with a higher prevalence of males in our sample. Interestingly, we found a significantly higher occurrence of hyponatremia among patients diagnosed with pneumonia when compared to those with diagnoses of empyema and bronchiolitis. However, it's worth noting that our study did not reveal a significant association between hyponatremia and poor clinical outcomes. **Conclusion:** The present study documented higher incidence of the hyponatremia among the patients with lower respiratory tract infection, the hyponatremia was more common among the children with pneumonia compared to the other lower respiratory tract infections in the study. Also the study did not find the significant effect on the outcome of the patients.

Keyword: Infection, Pneumonia, Lower Respiratory Tract Infection.

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INTRODUCTION

The term lower respiratory tract infection (LRTI) refers to infections that occur below the larynx and encompass conditions such as pneumonia, wheeze-associated LRTI, bronchiolitis, and empyema. Notably, LRTIs are a leading cause of morbidity and mortality worldwide, especially in children under the age of 4^{1,2}. Acute lower respiratory infections (ALRI) stand as the foremost infectious cause of mortality among children globally, responsible for approximately 2-3 million deaths and 10 million hospital admissions³⁻⁵. Pneumonia alone contributes to 20% of all child fatalities under the age of four in India. A study conducted in India revealed that the direct expenses associated with hospitalization due to ALRI were estimated at 30% of the annual per capita income⁶. Hyponatremia is a common electrolyte imbalance frequently encountered, which can complicate the management and prognosis of pneumonia⁷. Lower respiratory tract infections (LRTI) present several contributing factors to the development of hyponatremia, including reduced water excretion, inappropriate vasopressin secretion

(SIADH), the administration of low osmolality fluids, fluid and electrolyte imbalances, and the influence of various medications. Hyponatremia is defined by a serum sodium level below 130 meq/L⁸. Often, electrolyte imbalances can go unnoticed, and they can substantially contribute to morbidity and mortality, regardless of the underlying primary condition. If abnormalities in serum electrolyte levels go undetected and untreated, they can result in potentially serious consequences. Hence, this study aimed to assess the prevalence of hyponatremia in children and to investigate potential correlations between electrolyte disturbances and the outcomes of children with severe pneumonia

MATERIALS AND METHODS

This retrospective descriptive study encompassed all patients admitted to the Department of Pediatrics with lower respiratory tract infections (LRTI) over the course of one year. The study population consisted of children aged between 2 months and 4 years exhibiting signs and symptoms of LRTI. Excluded from the study were children undergoing drug

therapies known to potentially induce hyponatremia, those diagnosed with conditions like tuberculosis or asthma, and individuals with hyperlipidemia, hyperproteinemia, and hyperglycemia.

Following approval from the ethical committee, this study will involve the inclusion of 40 patients admitted to the Department of Pediatrics, who meet the specified inclusion and exclusion criteria. Demographic information, including the patient's name, age, gender, and address, will be collected. Additionally, anthropometric measurements such as height and weight will also be recorded. We will collect and analyze symptoms (including cough, fever, breathlessness, wheezing, stridor, grunting, and chest indrawing) as well as signs (such as tachypnea, chest indrawing, and audible wheezing) presented by the patients. All systemic findings, vital signs, and laboratory test results will be extracted and recorded from the case records. The laboratory tests to be documented include a complete blood count (CBC) and serum electrolyte levels. We will also document radiological investigations, including chest X-rays. Additionally, relevant data concerning the management of patients, such as mechanical ventilation, fluid and inotrope administration, blood product transfusions, antibiotics, and any other indicated medications, will be included in the analysis. Ultimately, we will record and analyze the patient outcomes.

Hyponatremia is classified as follows: mild with a serum sodium concentration of 126-130 mEq/L, moderate with 122-126 mEq/L, and severe with less than 122 mEq/L. We will assess the severity of hyponatremia in relation to the type of pneumonia and other lower respiratory tract infections based on X-ray findings⁶. We will gather data on several factors, including the duration of hospitalization in the Pediatric Intensive Care Unit (PICU) or ward, the requirement for oxygen therapy, the need for ventilator support, the duration of mechanical ventilation, and the ultimate patient outcomes, which encompass complications, discharge, and mortality. Our primary objective is to assess the impact of hyponatremia on morbidity and mortality in patients with pneumonia, comparing those with hyponatremia to those with normal sodium levels.

Statistical analysis: We entered the data into Microsoft Excel and conducted statistical analyses using SPSS version 23.0. The results were presented in terms of frequency and percentage for categorical variables, while continuous variables were expressed as mean and standard deviation. A significance level of P < 0.05 was used to determine statistical significance.

RESULTS

In this study, we observed a total of 26 patients with hyponatremia and 14 patients in the normonatremia group, with a predominance of males in the study.

Table 1: Demographic details of the patients compared

		Hyponatremia		Normonatremia		Chi Square {p-Value}
		count	Column N {%}	count	N {%}	
sex	female	8	32.3%	6	41.9%	0.422 (0.51)
	male	18	67.8%	8	58.1%	
age	2m-1yr	10	41.8%	9	62.3%	1.264
	1yr-4yr	16	58.3%	5	37.7%	

Table2: Comparison of clinical presentation between the groups

		Hyponatremia		Normonatremia		Chi-square (p-value)
		Count	N%	Count	N%	
Pallor	Absent	24	82.0%	25	77.6%	0.09 (0.924)
	Present	5	20.0%	6	22.4%	
oxygen saturation	<90	2	15.3%	5	28.6%	1.02(0.311)
	>90	13	84.7%	12	74.4%	

Table3 : Comparison of the blood parameters between mean and SD of hyponatremia and normonatremia

	Hyponatremia		Normonatremia		p-value
	Mean	SD	Mean	SD	
Hb	1.9	3.5	12.3	2.3	0.475
TLC	16.71	5.03	14.52	12.45	0.03*
Neutrophils	44.0	22.0	36.0	14.0	0.113
Lymphocytes	42.0	18.5	52.9	18.5	0.175
Plateletcount	352.1	149.3	298.1	158.9	0.309
ESR	32	20	25	24	0.473

When evaluating blood parameters in the context of hyponatremia, a notable finding is the significant association of higher total leukocyte count (TLC) among patients with hyponatremia compared to those with normonatremia

		Hyponatremia		Normonatremia		Chi-square (p-value)
		Count	N%	Count	N%	
Diagnosis	Pneumonia	15	64.5%	8	46.9%	1.10 (0.02)*
	Empyema	4	16.5%	0	0.0%	
	Bronchiolitis	6	28.0%	9	58.1%	

When assessing the type of lower respiratory tract infection (LRTI) in relation to hyponatremia, we observed a significantly higher incidence of hyponatremia among patients diagnosed with pneumonia compared to those diagnosed with empyema and bronchiolitis.

DISCUSSION

The most common electrolyte imbalance observed in critically unwell children is hyponatremia. Hyponatremia in severely ill children may stem from endogenous sodium dysregulation, iatrogenic factors, or a combination of both. Particularly, children admitted to the critical care unit due to respiratory insufficiency or failure resulting from lower respiratory tract infections face an elevated risk of developing hyponatremia. This susceptibility may arise from dysregulation of arginine vasopressin, antidiuretic hormone, excessive administration of free water, or sodium deficiency. Significantly, hyponatremia substantially heightens morbidity and mortality rates among children grappling with lower respiratory tract diseases.

In our study, we observed a significantly higher incidence of hyponatremia among patients diagnosed with pneumonia when compared to those diagnosed with empyema and bronchiolitis. This finding aligns with the research conducted by Chaitra et al., where hyponatremia was identified in 28 (47.7%) of children with bronchopneumonia. Fortunately, the majority of these cases exhibited mild hyponatremia, with 29 (71%) classified as mild, 8 (21.4%) as moderate, and only 3 (7%) as severe hyponatremia. Interestingly, patients with moderate hyponatremia typically remained asymptomatic⁵. Lobar pneumonia, the second most prevalent respiratory infection in our study, was associated with hyponatremia in 8 cases (50%), with 7 exhibiting moderate hyponatremia and 1 severe hyponatremia.

In a study conducted by Channawar K S, 60 cases of hyponatremia were identified, with 20 (18.5%) classified as moderate hyponatremia and three (5.5%) as severe hyponatremia. Several other investigations have reported similar findings⁷. Singhi et al., for instance, found that the presence of severe hyponatremia was associated with a threefold increase in the risk of mortality. Similarly, a prospective study conducted by Dhawan and colleagues revealed a 4.5-fold increase in mortality among hyponatremia patients compared to those with normonatremia, mirroring the results observed in our present study⁸.

CONCLUSION

In our study, we noted a higher incidence of hyponatremia among patients with lower respiratory tract infections, with pneumonia being the most common condition associated with hyponatremia when compared to other lower respiratory tract infections. Interestingly, our study did not reveal a significant impact on patient outcomes. However, it's worth noting that meticulous fluid management, including fluid restriction therapy, in conjunction with tailored treatment addressing the underlying cause, can prove highly effective in mitigating the risk of morbidity and associated complications in these pediatric patients.

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