

“ASSESSMENT OF SERUM SODIUM LEVELS IN CHILDREN ADMITTED WITH LOWER RESPIRATORY TRACT INFECTIONS (LRTI) IN A TERTIARY CARE HOSPITAL”

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Abstract

Background: Lower respiratory tract infection is an infection beneath the larynx which includes: Pneumonia, Wheeze associated LRTI, Bronchiolitis and Empyema. Study aimed to determine frequency of hyponatremia in children and an attempt has been made to correlate the possible electrolyte disturbances in children suffering from severe pneumonia and their outcome.

Material & Method: This retrospective descriptive study was conducted among the patients attending the Department of Paediatrics of YMCH, Mangalore, during the period of one year from January 2021 to December 2021. All children between 1 month to 5 yrs and with signs and symptoms of LRTI are included in the study. Presence of severity of hyponatremia was compared with type of pneumonia and other lower respiratory tract infections based on x-ray findings. The data were collected regarding duration of hospital stay in PICU or Ward, need of oxygen, need of ventilator support and duration of mechanical ventilator and the final outcome of the patient in terms of complications, discharge and death and will be assessing hyponatremia in terms of morbidity and mortality in pneumonia patients in comparison to patients of pneumonia with normonatremia. Data were entered into Microsoft excel and the statistical analysis was performed using statistical software SPSS version 23.0.

Results: The present study documented equal distribution of the patients in hyponatremia and normonatremia group, with male preponderance in the study. There was significant higher incidence of the hyponatremia among the patients diagnosed with pneumonia compared to the patients diagnosed with empyema and bronchiolitis. There is no significant associated noted in the present study with the hyponatremia and poor outcome.

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, Suppurative lung disease, Bronchiolitis, Hyponatremia.

Introduction:

Lower respiratory tract infection is the infection beneath the larynx which includes: Pneumonia, Wheeze associated LRTI and Bronchiolitis, Empyema.¹ Lower respiratory tract infections (LRTI) are amongst the most common infectious cause of morbidity and mortality in the world, particularly in children younger than 5 years (1 billion episodes per year and 703 918 deaths [104.8 deaths per 100 000 children under 5 years]).^{1,2} Acute lower respiratory infections (ALRI) are the leading infectious cause of death in children worldwide, accounting for 1-2 million fatalities and 12 million hospitalizations.³⁻⁵ Pneumonia accounts for 17% of all fatalities in children under the age of five in India.⁴ In a 2013 research from India, the direct cost of an ALRI-related hospitalisation episode was estimated to be 34% of the yearly per capita income.⁶ Due to the significant illness and economic

burden, evidence-based public health measures for ALRI prevention and treatment, including a better knowledge of aetiology, are required.

Hyponatremia is a frequent electrolyte imbalance found which complicate the treatment and outcome of pneumonia.⁷ In LRTI, various factors like decreased water excretion, inappropriate vasopressin secretion (SIADH), use of low osmolality fluids, fluid and electrolyte imbalance and numerous drugs may lead to the increase of hyponatremia. Hyponatremia is characterized as a serum sodium value less than 135meq/L.⁸ Electrolyte imbalances may remain unrecognized many times contributing significantly to the morbidity and mortality, irrespective of the initial problem. This may lead to alarming consequences if abnormalities of serum electrolyte concentration remain undetected and untreated.

Thus, this study was conducted to determine frequency of hyponatremia in children and an attempt has been made to correlate the possible electrolyte disturbances in children suffering from severe pneumonia and their outcome.

Material & Method:

This retrospective descriptive study was conducted among all the patients who were admitted with LRTI in the Department of Pediatrics of YMCH, Mangalore during the period of one year from January 2021 to December 2021. All children between 1month to 5yrs and with signs and symptoms of LRTI are included in the study. Children who are on drug therapy which can cause hyponatremia such as diuretics, diagnosed case of tuberculosis or asthma, hyperlipidaemia, hyperproteinaemia, and hyperglycemia

Method: After obtaining clearance from the ethical committee. 30 patients admitted in the Department of paediatrics, who comply with inclusion and exclusion criteria will be included in this study. The demographic data include the patients name, age, sex and address. The anthropometric data such as height and weight will also be noted. The symptoms (cough, fever, breathlessness, wheeze, stridor or grunting and chest indrawing) and signs (tachypnea, chest indrawing, audible wheeze) presented will be collected and analyzed. All the systemic findings , vital signs and laboratory test results will be collected from the case records and noted. The laboratory tests includes complete blood count (CBC) and serum electrolytes. The radiological investigations like chest x-ray will be noted. Then , the relevant data regarding the management, such as mechanical ventilation , fluids and inotropes, blood products, antibiotics and other indicated medication will be included. Finally the outcome will be noted for analysis. Hyponatremia is characterized as mild serum sodium concentration =131-134 Meq/ L, moderate hyponatremia = 126-130 meq/L and severe hyponatremia = less than 125 meq/ L. Presence of severity of hyponatremia will be compared with type of pneumonia and other lower respiratory tract infections based on x-ray findings. The data will be collected regarding duration of hospital stay in PICU or Ward, need of oxygen, need of ventilator support and duration of mechanical ventilator and the final outcome of the patient in terms of complications, discharge and death and will be assessing hyponatremia in terms of morbidity and mortality in pneumonia patients in comparison to patients of pneumonia with normonatremia

Statistical analysis: Data were entered into Microsoft excel and the statistical analysis was performed using statistical software SPSS version 23.0. The results were presented as frequency and percentage

for categorical variables and mean and standard deviation for continuous variables. P value <0.05 was considered statistically significant.

Results:

The present study documented patients with hyponatremia (n=16) and normonatremia group (n=14), with male preponderance in the study.

Table 1: Demographic details of the patients compared

		Hyponatremia		Normonatremia		Chi-square (p- value)
		Count	Column N %	Count	N %	
sex	Female	5	31.3%	6	42.9%	0.433 (0.51)
	Male	11	68.8%	8	57.1%	
Age months	1m-1yr	7	43.8%	9	64.3%	1.265 (0.261)
	1-5yr	9	56.3%	5	35.7%	

Table 2: Patients symptoms compared between the groups

		Hyponatremia		Normonatremia		Chi-square (p- value)
		Count	N %	Count	N %	
Cough	Absent	2	12.5%	1	7.1%	0.238 (0.626)
	Present	14	87.5%	13	92.9%	
Fever	Absent	4	25.0%	2	14.3%	0.536 (0.464)
	Present	12	75.0%	12	85.7%	
breathlessness	Absent	3	18.8%	7	50.0%	3.281 (0.07)
	Present	13	81.3%	7	50.0%	
wheeze	Absent	6	37.5%	10	71.4%	3.45 (0.063)
	Present	10	62.5%	4	28.6%	
stridor	Absent	7	43.8%	9	64.3%	1.265 (0.265)
	Present	9	56.3%	5	35.7%	
grunting	Absent	8	50.0%	10	71.4%	1.429 (0.232)
	Present	8	50.0%	4	28.6%	
Chest in drawing	Absent	2	12.5%	6	42.9%	3.51 (0.061)
	Present	14	87.5%	8	57.1%	

On assessment of the symptoms there was no significant difference noted between the group with respect to the fever, breathlessness, wheeze, stridor, grunting and chest indrawing among the patients.

Table 3: Comparison of clinical presentation between the groups

		Hyponatremia		Normonatremia		Chi-square (p- value)
		Count	N %	Count	N %	
Pallor	Absent	12	80.0%	11	78.6%	0.09

	Present	3	20.0%	3	21.4%	(0.924)
oxygen saturation	<95	2	13.3%	4	28.6%	1.02
	>95	13	86.7%	10	71.4%	(0.311)

There was equal distribution of patients with the presence of pallor and requirement of oxygen saturation between the groups.

Table 4: Comparison of the clinical examination of patients

		Hyponatremia		Normonatremia		Chi-square (p-value)
		Count	N %	Count	N %	
Chest symmetrical	No	1	8.3%	1	7.7%	0.03 (0.953)
	Yes	11	91.7%	12	92.3%	
percussion	Suprasternal	1	6.3%	4	28.6%	3.129 (0.211)
	Intercostals	3	18.8%	1	7.1%	
	Subcostal	12	75.0%	9	64.3%	
Auscultation	Creps	5	31.3%	2	14.3%	3.76 (0.439)
	Creps + Rhonchi	5	31.3%	3	21.4%	
	Rhonchi	1	6.3%	1	21.4%	
	Normal	5	31.3%	6	42.9%	

On assessment of the respiratory system, there was similar findings between the groups with respect to the chest symmetrical, percussion findings and auscultation findings among the patients.

Table 5: Comparison of the blood parameters between mean and SD of hyponatremia and normonatremia

	Hyponatremia		Normonatremia		p-value
	Mean	SD	Mean	SD	
Hb	10.9	2.5	10.3	1.3	0.475
TLC	15.71	6.03	13.52	10.45	0.03*
Neutrophils	46.0	21.0	35.0	15.0	0.113
Lymphocytes	43.0	17.5	51.9	17.5	0.175
Platelet count	353.1	149.3	295.1	156.9	0.309
ESR	31	20	25	23	0.473

On assessment of blood parameters with the presence of hyponatremia, there is significant relation of the higher TLC count among the hyponatremia patients compared to the normonatremia patients.

Table 6: Comparison of the diagnosis of the patients between the groups

		Hyponatremia		Normonatremia		Chi-square (p-value)
		Count	N %	Count	N %	
Diagnosis	Pneumonia	10	62.5%	6	42.9%	1.10 (0.02)*
	Empyema	2	12.5%	0	0.0%	
	Bronchiolitis	4	25.0%	8	57.1%	

On assessment of type of LRTI with the hyponatremia, there was significant higher incidence of the hyponatremia among the patients diagnosed with pneumonia compared to the patients diagnosed with empyema and bronchiolitis.

Table 7: Comparison of the patients outcome between the groups

		Hyponatremia		Normonatremia		Chi-square (p- value)
		Count	N %	Count	N %	
Outcome	Complications	0	0.0%	0	0.0%	1.10 (0.292)
	Death	0	0.0%	1	7.1%	
	Discharge	15	100.0%	13	92.9%	

There is no significant associated noted in the present study with the hyponatremia and worst outcome. All the patients were discharged in the group with hyponatremia during the admission.

Discussion:

The most prevalent electrolyte imbalance is hyponatremia. The causes of hyponatremia in critically unwell children may include endogenous sodium dysregulation, iatrogenic causes, or both. Children admitted to the critical care unit for respiratory insufficiency or respiratory failure due to lower respiratory tract infections are at increased risk of developing hyponatremia, possibly due to dysregulation of arginine vasopressin, antidiuretic hormone, excessive free water administration, or sodium deficiency. Hyponatremia considerably increases morbidity and mortality rates in children with lower respiratory tract diseases.^{7,9}

The present study documented a was significant higher incidence of the hyponatremia among the patients diagnosed with pneumonia compared to the patients diagnosed with empyema and bronchiolitis. Similarly in study by Chaitra et al., Hyponatremia was seen in 28 (46.7%) of the children with bronchopneumonia. Fortunately, the majority of individuals had mild hyponatremia, with 20 (71%), 6 (21.4%) having moderate, and only 2 (7%) having severe hyponatremia. Patients with moderate hyponatremia nearly always have no symptoms. Lobar pneumonia, the second most prevalent respiratory infection in our sample, had hyponatremia in 6 cases (50%), with 5 having moderate hyponatremia and 1 having severe hyponatremia.¹

In concordance to present study, Mhatre SS et al., documented Hyponatremia was reported to be 42.3% prevalent in paediatric patients with lower respiratory tract infection. Hyponatremia was more prevalent in the pneumonia group (91.66%) than in the non-pneumonia group (8.33%). Severe hyponatremia was detected more frequently as the severity of pneumonia increased; hence, detecting hyponatremia early and addressing it with suitable therapies plays a significant role in the prognosis of children suffering from pneumonia.¹⁰

Another study by Attri HK et al., documented all clinical indicators in hyponatremic vs isonatremic groups in different age groups were evaluated, it was shown that clinical signs of respiratory distress were more prevalent in the hyponatremic group (HN) than in the isonatremic group (I) (IN). The current investigation found that clinical symptoms were more prevalent in the hyponatremic group than in the isonatremic group in both age groups, and this difference was not statistically significant (p=0.983).¹¹ This was in concordance to our study.

According to a research conducted by Channawar K S, out of 54 identified hyponatremia cases, 10 (18.5%) had moderate hyponatremia and three (5.5%) had severe hyponatremia.¹² Several more investigations found comparable results. According to Singhi et al,¹³ the presence of severe hyponatremia is related with a threefold increase in the risk of mortality. Another prospective research conducted by Dhawan and colleagues¹⁴ revealed a 3.5-fold increase in mortality in hyponatremia patients compared to normonatremia patients. This was similar to our present study.

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. Careful fluid management, particularly fluid restriction therapy, combined with targeted treatment of the underlying cause can be highly beneficial in minimising the risk of morbidity and consequences in these children.

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