

## A Prospective Observational Study Of Hyponatremia In Lower Respiratory Tract Infection In Children Admitted In Tertiary Care Teaching Hospital

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**Abstract:** Background: The primary objective of our study is to evaluate the incidence and prevalence of hyponatremia in children admitted with Lower respiratory tract infection. Method: 135 patients diagnosed as clinically Lower respiratory tract infection admitted in wards were enrolled in study from >1 months to 12 year of age. Hyponatremia defined on basis of serum sodium level as mild, moderate and severe hyponatremia. According to severity of Hyponatremia and severity of diseases IV fluid and correction was given. Result: Prevalence of Hyponatremia in LRTI cases was 66.6% (90/135) in this study. Among this 52.2%(47/90) were pneumonia; 25.5%(23/90) were bronchiolitis; and 22.2%(20/90) were of empyema. Out of this 42.2%were mild hyponatremia,40% were moderate and 17.7% were severe hyponatremia..Mortality among severe hyponatremia was 2.2%(2/90). Conclusion: There is a high prevalence of hyponatremia in lower respiratory tract infection. Children with pneumonia are more likely to have hyponatremia. Use of early initiation of appropriate IV fluid and correction of hyponatremia gives better outcome of patients of LRTI presented with hyponatremia. [Parekh A Natl J Integr Res Med, 2019; 10(6):11-15]

**Key Words:** Lower Respiratory Tract Infection,Pneumonia,Empyema,Hyponatremia

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**Introduction:** Lower respiratory tract infection is among the serious health problems especially in less than 5 years of age needing hospitalization and attributes to 30% of deaths yearly worldwide especially due to pneumonia as leading cause. LRTI is infection listed below the level of 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 level of larynx. Pneumonia is the leading reason for major illness and death in children accounting for 20-25% in under 5 age around the world. Bronchiolitis is a typical childhood disease and its most important etiologic agent is RSV (Respiratory Syncytial Virus). Hospitalization is required in around 1% of affected children, primarily because of breathing difficulty. Between 10-15% of hospitalized children will care due to impending respiratory failure.<sup>1,2</sup>

Fluids and Electrolytes are the primary pillars in the upkeep of body homeostasis. Hyponatremia is the most common electrolyte irregularity seen in ICU. Pneumonia and brochiolitis are the most typical disease to come across in pediatric practice. Hyponatremia is due to Antidiuretic Hormone over secretion. Hyponatremia related to pediatric pneumonia is most typically due to the syndrome of inappropriate antidiuretic hormone secretion (SIADH).<sup>3-7</sup>.In LRTI patients Hyponatremia is common. Hence we are

undertaking this prospective observational study in our hospital.

**Aims And Objectives:** To evaluate the incidence and prevalence of Hyponatremia in children admitted with Lower respiratory tract infection.

**Materials And Methods:** Study Design: An Observational Prospective Study. The study was carried out at pediatric department of tertiary care centre Sir Takhtasinhji Hospital, Bhavnagar, Gujarat. **STUDY POPULATION;** Children aged >1 months to 12 years admitted at Sir T Hospital Bhavnagar with a diagnosis of lower respiratory tract infection. **SAMPLE SIZE:** 135 patients of clinically LRTI admitted in ward were enrolled in study. Study was started from 10<sup>th</sup> December 2018 to 30<sup>th</sup> august 2019. **SAMPLING PROCEDURE:** Informed and written consent was taken for sample collection. Using aseptic technique, 2 ml of blood was collect from the antecubital fossa of each patient and put in a vacutainer. The blood samples were then transported to laboratory.

Inclusion Criteria: Children >1months to 12 years admitted at Pediatric Department Sir T hospital Bhavnagar with LRTI.

Exclusion Criteria: Children with LRTI carried an additional diagnosis of hypothyroidism, pan hypothyroidism, renal failure, metabolic disease, chromosomal disorder, genetic disorder or any recent surgery. \*Any child with a previous

diagnosis of syndrome of inappropriate antidiuretic hormone syndrome. \*Children with signs and symptoms of diarrhea and dehydration.

**Case Definitions:** Hyponatremia was defined as a sodium level of <135mmol/l. The overall prevalence of hyponatremia was calculated as a proportion of all children with hyponatremia to the total number of all children admitted at per year. Children with Hyponatremia were further classified into Mild, Moderate, or Severe.

**Materials and Methods:** Children admitted with the diagnosis of LRTI to the pediatric wards who fulfilled the inclusion criteria were recruited for the study. 135 children were enrolled for the study based on the sample size required. Written and informed consent was obtained from all the parents before enrolling them into the study. Children were categorized in different types of LRTI depending on clinical features, and clinical signs. Blood samples were taken for investigations, hemoglobin level, Total blood counts were sent. All patients sent for chest radiography in hospital radiology department. Hyponatremia defined on basis of sodium level, categorized into mild, moderate and severe hyponatremia. Vital monitoring was done to see any signs and symptoms of hyponatremia. Depending on patient's condition and severity of hyponatremia patients were kept on normal feeds or IV fluids. In severe cases of hyponatremia correction with 3% Nacl was given.

Discharged criteria: 1. In absence of fever and respiratory distress, 2. Breathing room air comfortably with saturation>96% 3. Tolerating oral feeds.

Statistical methods: Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented as Mean± SD (Min-Max) and results on categorical measurements are presented in Number (%). Chi square test and T value Test was used.

Significant value was considered at p <0.05. \*Not significance (P value>0.05); Suggestive significance (P value: 0.05<P<0.10); Moderately significant (P value: 0.01<P<0.05); Strongly significant (P value: P<-0.01).

Statistical software: Trial version of IBM SPSS Software was used for analysis of the data and

Microsoft word and Excel have been used to generate graphs, tables.

**Results:** During the study period, starting from 10 December 2018 to 30 august 2019 total of 2728 patients were admitted in paediatrics ward. Out of that 220 patients were diagnosed as lower respiratory tract infections. Out of this 135 patients of lower respiratory tract infection were enrolled for study. 85 patients excluded according to exclusion criteria. Among 135 patients, 90 patients had hyponatremia at time of admission. Among 90 patients of hyponatremia, 27 patients had received IV fluid and 5 patients had received both IV fluid and 3% Nacl correction according to severity of hyponatremia. 2 patients of severe hyponatremia expired and 88 patients were discharged successfully. All the 45 children without hyponatremia were discharged.

**Demographic Data:** There was statistically significance (p=0.0005) for age distribution in LRTI cases presented with Hyponatremia and Non Hyponatremia .83.02% patients of age group >1months to 1 year of LRTI cases presented with Hyponatremia.

In Gender distribution Males are more affected than females .M:F Ratio of Hyponatremic Patients in LRTI was 1.14:1.This was statistically not significance(p=0.13).

**Table 1: Prevalence Of Hyponatremia**

Hyponatremia	No.(135)
Present	90 (66.6%)
Absent	45(33.3%)

**Table 2: Hyponatremia In Relation To Clinical Presentation Of Children**

History	LRTI Cases(135)		Hyponatremia Present(90)		Hyponatremia Absent(45)	
	No.	%	No.	%	No	%
Cough	135	100%	90	100%	45	100%
Chest In drawing	122	90.3%	93	68.8%	29	21.48%
Fever	82	60.74%	65	48.14%	17	12.5%
Chest and Abdomi nal Pain	8	5.9%	8	5.9%	0	0

**Table 3: Type Of LRTI Presenting With Hyponatremia**

Type of LRTI	No.(90)	%
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Pneumonia	47	52.22
Brochiolitis/asthma	23	25.55
Empyema/pleural effusion	20	22.22

**Table 4: Severity Of Hyponatremia In Lower Respiratory Tract Infection**

Severity of Hyponatremia	No.(90)	%
Mild	38	42.2%
Moderate	36	40%
Severe	16	17.7%

**Table 5: Hyponatremia In Different Types Of LRTI, Grading Of Severity Of Hyponatremia According To Serum Sodium Level**

Type of LRTI	Hyponatremia			Total
	Mild	Moderate	Severe	
Bronchopneumonia	7	3	1	11
Lobar Pneumonia	13	20	3	36
Bronchiolitis	17	5	1	23
Empyema	1	8	11	20
Total	38	36	16	90

As shown in table 6 hyponatremia was a frequent finding in children with lobar pneumonia (n= 36). In majority of cases, hyponatremia was moderate (n=20). 13 had mild and only 3 had severe hyponatremia. Brochiolitis which was next common LRTI in our study had hyponatremia in 23 cases, out of 17 had mild hyponatremia, 5 had moderate and only one case of brochiolitis had severe hyponatremia. In our study it was found that 20 cases of empyema/ pleural effusion had hyponatremia.

Out of which 11 cases had severe hyponatremia, 8 cases had moderate hyponatremia and only 1 case had mild hyponatremia. The cause of hyponatremia in these cases might be due to prolonged course of the disease, due to prolonged effect on ADH which further leads to hyponatremia in these cases. Bronchopneumonia had less incidence of hyponatremia in our study, only 11 cases had hyponatremia. Out of which 7 cases of mild hyponatremia, 3 cases had moderate hyponatremia and only 1 case had severe hyponatremia.

**Table 6: Potassium Assessment**

Age	Abnormal Potassium level (Hypokalemia +Hyperkalemia)	Normal Potassium level	Chi Square (P value)
>1M-1Y	10	55	7.54

>1Y-5Y	7	49	(p=0.02)
>5Y-12Y	6	8	

**Table No 7: Outcome Of IV Fluid And Correction**

Outcome	IV fluid		3% Nacl correction + IV fluid		Oral feeds	
	No.(27 /90))	%	No (5/ 90)	%	No.(6 3/90)	%
Dis.	25	92	3	60	63	100
Exp.	2	7	2	40	-	-

As shown in Table 8, in severe and moderate hyponatremia patient had started IV fluid and if needed correction, outcome was good; 92% (25/27) patients were discharged successfully who was on IV fluid. 60% (3/5) patients on IV fluid and 3% Nacl correction discharged. 7.4 % (2/27) patients expired due to association of severe hyponatremia.

**Table 8: Outcome Of Hyponatremia In LRTI Children**

Outcome	Hyponatremia				Chi sq Test
	Mild	Moderate	Severe	Total	
Dis.	38	36	14	88	9.46 (P=0.008)
Exp.	0	0	2	2	
Tot.	38	36	16	90	

As shown in Table 8, Association between Severe Hyponatremia and outcome of LRTI was significant. This was statistically significant (p=0.008).

**Table No 9: Outcome Of Hyponatremia And Non Hyponatremia In LRTI Children**

Outcome	Hyponatremia Present	Hyponatremia Absent	Total LRTI children
Dis.	88 (65.2%)	45 (33.33%)	133 (98.5%)
Exp.	2 (1.4%)	0 (0%)	2 (1.4%)
Total	90 (66.6%)	45 (33.33%)	135 (100%)

**Discussion:** LRTI is one of the serious illnesses especially in less than 5 years of age requiring hospitalization and attributes to 30% of deaths worldwide due to pneumonia as the leading cause.

**Table 10 : Comparison Of Prevalence Of Hyponatremia In LRTI**

STUDY	PREVALENCE
Present study	66.6%
Don et al <sup>2</sup>	45.4%
Eunice et al <sup>8</sup>	71.9%

**Table 11: Comparison Of Sex Difference In Hyponatremia**

Study	Males	Females	M:F Ratio
Present study	53.3%	46.6%	1.15:1
Don et al <sup>2</sup>	53%	46%	1.15:1
Eunice et al <sup>8</sup>	57.7%	42.2%	1.35:1

**Table 12: Most Common Age Group Affected**

Study	Most Common Affected Age Group
Present study	>1 month-1year (40%)
Don et al <sup>2</sup>	<12 months (63%)
Eunice et al <sup>8</sup>	<1year (67.5%)

These all studies suggest that hyponatremia is more common in pneumonia. In our study prevalence of hyponatremia in pneumonia was 52.2%. In study done by Don et al prevalence of hyponatremia in pneumonia was 47.2%. Another study was done by Alkahtani Hassan suggest that prevalence of hyponatremia more common in pneumonia (26%). In Study done by Dr. Eunice prevalence of hyponatremia was 71.9 %<sup>2,8</sup>.

As per table no 8 in our study occurrence of hypokalemia in LRTI cases was only 9.6% as compared to study done by Eunice al at Kenyatta<sup>8</sup> (28.9%). This rate was 2.9 times lower in our study. Hyponatremia was common in moderate and severe Hyponatremia in both studies. Hypokalemia was high in with severe hyponatremia compared to moderate hyponatremia.

**Severity Of LRTI:** Children with very severe LRTI (e.g. Empyema and pleural effusion) were more likely to have severe hyponatremia a proportion of 12.2% compared to those with Pneumonia (4.4%). A significant association between severe LRTI and severe hyponatremia. Children with very severe LRTI had also high temperature. It's been postulated that hyponatremia in LRTI is related to SIADH which results in retention of fluid despite normal plasma osmolarity. ADH secretion increases in proportion with the extent of lung

parenchymal involvement. In addition, severe infections are associated with release of inflammatory cells e.g. interleukin 6 which stimulates ADH production. Inflammatory markers also stimulate thermoregulatory centre resulting in reset of the thermostat hence the high temperatures.

As per this study 92% of patients of severe and moderate hyponatremia on IV fluid and 60% patients on IV fluid+ 3% Nacl correction were recovered and discharged. Most common IV fluid used was 0.45DNS% .Studies have been shown that use of IV fluid is associated with recovery of hyponatremia which has better outcome. No complication occurs after IV fluid and 3% correction.

Studies have also demonstrated that respiratory compromise is a co-morbid factor in patients with hyponatremia markedly increasing the risk of death from pneumonia. The underlying mechanism is probably hypoxia, a major risk factor for development of hyponatremic encephalopathy. Studies of hyponatremic animals have revealed that hypoxia impairs volume regulation of brain cell, decrease cerebral perfusion, and increases the probability of neuronal lesions developing. Adaptation of brain to hyponatremia largely depends on extrusion of sodium from the intracellular space via sodium potassium ATPase pumps. This energy dependent process is impaired under hypoxic conditions. The combination of systemic hypoxia and hyponatremia is more deleterious than is either condition alone, because hypoxia impairs the ability to the brain to adapt to hyponatremia, worsening hyponatremic encephalopathy<sup>9</sup>.

The principal outcome measure studied in our study was the reduction of hyponatremic encephalopathy by giving early and proper fluid therapy. Based on the results of this study we recommend to closely monitor electrolytes in respiratory disease as it gives better outcome of patients.

**Conclusion:** Hyponatremia is common amongst children hospitalized with lower respiratory tract infections. Every year respiratory infections in young children is responsible for a quote 3.9 million deaths worldwide. Findings in our study state that there is a high prevalence of hyponatremia in lower respiratory tract infection. Children with pneumonia are more likely to have

hyponatremia. Use of IV fluids and correction gives better outcome of patients without any complication. Thus appropriate fluid therapy must be carefully arranged in children with lower respiratory tract infection.

**What My Study Adds?**

- From this study we added evidence that electrolyte abnormality mainly Sodium level plays role in Lower respiratory Tract Infections.
- Hyponatremia is common electrolyte abnormality seen in LRTI patients.
- Role of IV fluids and 3%Nacl correction is similar to Antibiotics and other treatment of LRTI.It decreases severity of symptoms and mortality of LRTI associated with hyponatremia.

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