

Study of Serum Electrolytes in Acute Lower Respiratory Tract Infection in children under 5 years of age

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Abstract

Introduction: Lower respiratory tract infections (LRTIs) is one of the serious illnesses in less than 5 years of age requiring hospitalization and attributes 20-30% of death annually worldwide. Electrolyte disturbances is seen in LRTI and affects its outcome.

Material and Methods: Total 150 cases above 2 months and upto 5 years of age group diagnosed with LRTI admitted in pediatric department of J.L.N. Medical College and Hospital Ajmer from August 2018 to October 2019. Children with diseases like Bronchiolitis, Bronchitis, Pneumonia, Pleural effusion and Empyema were included. Data was collected and analysed for statistical significance using chi square test.

Result: Majority of the cases (52.66%) in the study were under 1 year of age. Bronchiolitis had a predominance accounting for 42% of cases. Hyponatremia was seen in 50% cases (p value=0.001) where as 20% cases had hyperkalemia (p value=0.47)

Conclusion: Electrolyte derangements had adverse effect on outcome as recovery was delayed, thus this study suggests that appropriate fluid and electrolyte therapy along with specific therapy of disease would decrease morbidity of LRTI.

Keywords: LRTI, Hyponatremia,

Introduction

Lower respiratory tract infections (LRTIs) is one of the serious illnesses especially in less than 5 years of age requiring hospitalization. It is estimated that upto 25 % of all pediatric admissions in hospital are due to LRTI⁽¹⁾ and attributes 20-30% of death annually worldwide especially due to pneumonia.⁽²⁾ India alone accounts for 43 million cases every year having a mortality rate of 322 per 1 lakh under five population.

Apart from other complications of LRTI, comorbidities in form of fluid and electrolyte disturbances determine final outcome. Electrolyte imbalances especially hyponatremia⁽³⁾ is associated with worst outcome in such patients. Water retention secondary to SIADH has also been described in acute LRTI in children.^(3,4) Other

abnormalities like hypokalemia and hyperkalemia are infrequently seen⁽⁵⁾.

METHODS

A prospective observational study was conducted on 150 pediatric patients above 2 months and upto 5 years of age group diagnosed with Acute Lower Respiratory Tract infection admitted in pediatric department of J.L.N. Medical College and Hospital Ajmer from August 2018 to October 2019.

Inclusion criteria were

- Children with age group of 2 months to 5 years who were hospitalized for Lower Respiratory Tract Infection.
- Patient fulfilling the diagnostic criteria of Acute LRTI based on criteria recommended by WHO's ARI control program i.e. symptoms like fever/cough (duration less than 4 weeks) along with fast breathing (tachypnea) with or without associated respiratory distress. Tachypnea was defined as respiratory rate ≥ 50 /minute from 2 months to 1 year of age and ≥ 40 /minute above 1 year upto 5 year of age

Children having underlying Metabolic / CNS / CVS / Endocrine disorder and children whose parents refused to give consent were excluded from the study.

Clinical history was obtained from reliable source. Vital signs and other relevant findings were elicited and recorded as per standard method. On general physical examination special attention was paid to presence of tachypnoea with or without respiratory distress. SPO₂ was recorded using pulse oximetry. A thorough respiratory system examination was done and physical diagnosis was made. It was further confirmed by relevant investigations (X ray, USG, CT Scan, CBC, Pleural Tap etc). On the basis of thorough history, examination & investigation cases were categorised as

Bronchiolitis, Pneumonia, Pleural effusion, Empyema & Bronchopneumonia.

Serum electrolyte estimation (Sodium, Potassium, Chloride) was done by AVL9181 automated electrolyte analyser (ion selective electrode method).

Data so collected was recorded in a pre-structured performa specially designed for study and tabulated in master chart in Microsoft Excel. Data was analysed for statistical significance using SPSS version 2.0. Chi square test was used to study association between two qualitative variables. P value of greater than 0.05 was considered statistically non significant while less than 0.05 was considered significant.

Observation and Results

Table 1: Diagnosis wise distribution of the LRTI

	Frequency	Percent
Bronchiolitis	63	42.0
Bronchopneumonia	36	24.0
Empyema	12	08.0
Pleural effusion	09	06.0
Pneumonia	30	20.0
Total	150	100.0

In our study bronchiolitis had a predominance accounting for 42% of cases followed by bronchopneumonia 24% and pneumonia 20%, while 24% cases had pleural pathology.

Age and respiratory diseases

Most of the respiratory illness was found during infancy. Infact 70% of pneumonia, 47.6% of bronchiolitis and 44.4% of bronchopneumonia cases were under 1year of age group. In case of empyema the reversal was seen i.e. 5(41.7%) cases were in >4 years of age group. In pleural effusion there were 4 (44.4%) cases in 1-2 years of age and 3(33.3%) cases were in less than 1 year of cases. Different

respiratory diseases showed statistically significant difference with the age (p value =0.001)

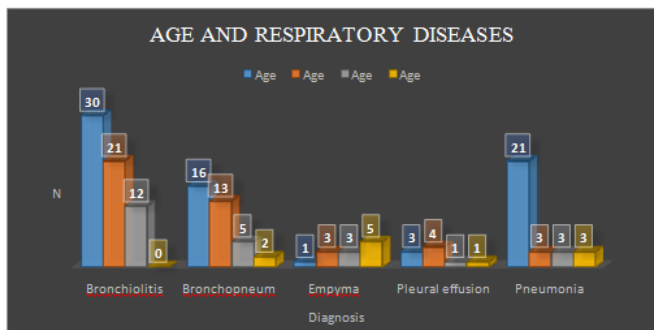


Figure 1 : Age And Respiratory Diseases

Table 2: Electrolyte and respiratory diseases

		Sodium mEq/l	Potassium mEq/l	Chloride mEq/l
Bronchiolitis	Mean	136.6984	4.7635	98.0032
	Std. Deviation	3.13844	.84344	16.49260
Bronchopneumonia	Mean	135.1528	4.7000	100.4361
	Std. Deviation	3.19245	.90554	3.88559
Empyema	Mean	133.8750	5.5250	96.9917
	Std. Deviation	3.10692	1.15375	1.97413
Pleural effusion	Mean	136.1333	4.8556	98.6333
	Std. Deviation	5.45779	1.01379	4.20535
Pneumonia	Mean	134.8800	4.6867	100.3333
	Std. Deviation	2.62776	.83984	4.75991
Total	Mean	135.7040	4.7993	99.0100
	Std. Deviation	3.32525	.90964	11.13491
P value		0.01 (S)	0.06	0.75

Mean level of sodium (mEq/l) was 136.69 in Bronchiolitis, 135.15 in Bronchopneumonia, 133.87 in empyema, 136.13 in pleural effusion and 134.88 in pneumonia. Sodium level showed statistically significant results with diagnosis (p value= 0.01)

Sodium level abnormalities in LRTI

Out of 150 cases studied 75 (50%) cases had hyponatremia while remaining 50% cases had normal sodium level.

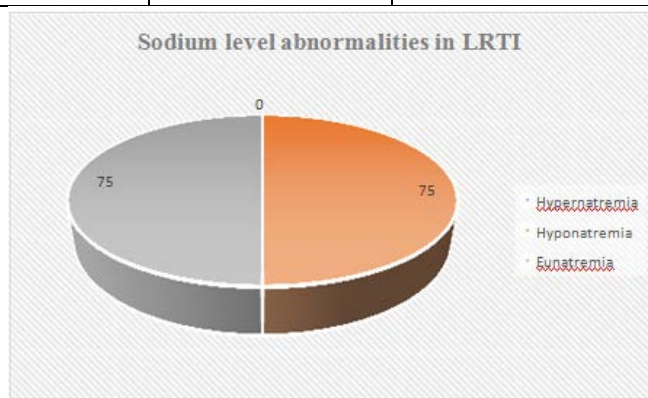


Figure 2 : Sodium level abnormalities in LRTI

Table 3: Hyponatremia and respiratory diseases

			Diagnosis					Total
			Bronchiolitis	Broncho pneumonia	Empyema	Pleural effusion	Pneumonia	
Hyponatremia (mEq/L)	125-129 Moderate	N	2	4	1	1	0	8
		%	3.2%	11.1%	8.3%	11.1%	0.0%	5.3%
	130-135 Mild	N	20	14	10	4	19	67
		%	31.7%	38.9%	83.3%	44.4%	63.3%	44.7%
	>135 Normal	N	41	18	1	4	11	75
		%	65.1%	50.0%	8.3%	44.4%	36.7%	50.0%
Total		N	63	36	12	9	30	150
		%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

P value=0.004 (S)

Out of 75 hyponatremic cases 67 (89.3%) cases had mild hyponatremia while remaining 10.7% cases had moderate hyponatremia (125-129 mEq/l). With p value =0.004 hyponatremia and respiratory diseases showed statistically significant results.

Potassium level abnormalities in LRTI

Out of total 150 cases one third of patients had potassium abnormalities, 30 (20%) cases had hyperkalemia and 20 (13.3%) cases were found to have hypokalemia.

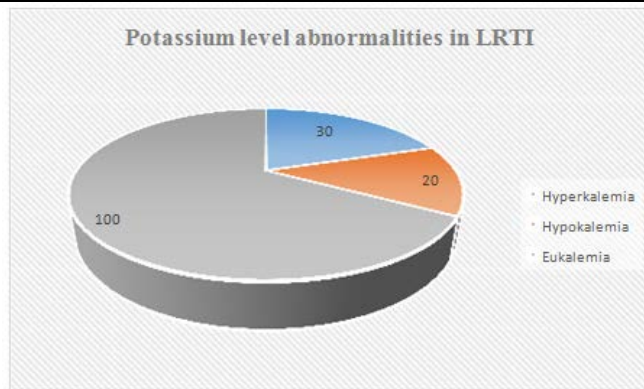


Figure 3: Potassium level abnormalities in LRTI

Table 4: Potassium abnormalities and respiratory diseases

			Diagnosis					Total
			Bronchiolitis	Broncho pneumonia	Empyema	Pleural effusion	Pneumonia	
Potassium (mEq/l)	<3.5	N	8	5	1	2	4	20
		%	12.7%	13.9%	8.3%	22.2%	13.3%	13.3%
	3.5-4.5	N	16	11	0	1	10	38
		%	25.4%	30.6%	0.0%	11.1%	33.3%	25.3%

4.5-5.5	N	24	15	6	4	13	62
	%	38.1%	41.7%	50.0%	44.4%	43.3%	41.3%
>5.5	N	15	5	5	2	3	30
	%	23.8%	13.9%	41.7%	22.2%	10.0%	20.0%
Total	N	63	36	12	9	30	150
	%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

P value=0.47

In empyema 41.7% cases had hyperkalemia, followed by bronchiolitis (23.8%), while pleural effusion and bronchopneumonia had hyperkalemia in (22.2%) and (13.9%) cases respectively. Though hyperkalemia is associated with LRTI in general but statistically the difference is not significant. (p value= 0.47) disease wise.

Table 5: Respiratory disease and chloride abnormalities

		Diagnosis					Total	
		Bronchiolitis	Broncho pneumonia	Empyema	Pleural effusion	Pneumonia		
Chloride (mEq/l)	<95	N	10	4	2	3	1	20
		%	50.0%	20.0%	10.0%	15.0%	5.0%	100.0%
	95-105	N	43	29	10	6	24	112
		%	38.4%	25.9%	8.9%	5.4%	21.4%	100.0%
	>105	N	10	3	0	0	5	18
		%	55.6%	16.7%	0.0%	0.0%	27.8%	100.0%
Total	N	63	36	12	9	30	150	
	%	42.0%	24.0%	8.0%	6.0%	20.0%	100.0%	

P value=0.22

Discussion

Discussion on serum electrolyte level in LRTI

Hyponatremia was found in 75 (50%) cases out of total 150 cases. Further analysis revealed mild hyponatremia in 67 (89.3%) cases and moderate hyponatremia in 8(10.7%) cases.

Chloride level abnormalities in LRTI

Out of total 150 cases, 112(74.66%) had euchloremia, only 20 cases were found to have decreased chloride level, and 18 cases had increased chloride levels. Our study suggests no significant association of chloride level abnormalities with different LRTI.

Similarly study conducted by Mahatre S.S. et al⁽⁶⁾ in (2019) observed hyponatremia in 42.3% of patients. Out of these 36 cases, 25(69.4%) had mild hyponatremia, 8(22.2%) had moderate while 3(8.3%) had severe hyponatremia. This findings were in accordance with our study. Whereas Singhi et al⁽⁷⁾ (1992) found hyponatremia in (27%), and hypernatremia (3.7%). In 2017 study conducted by Das

M. et al⁽⁸⁾ found 33 out of 102 (32.4%) cases of hyponatremia out of which 26(78.78%), 5(15.5%), and 2(1.9%) had mild, moderate and severe hyponatremia respectively.

In present study hyponatremia in bronchiolitis was observed in 34% cases, in bronchopneumonia 50% cases, in pleural effusion 55.5% cases, in lobar pneumonia 63.33% cases and in empyema 91.66% cases had hyponatremia. Thus our study showed statistically significant association in hyponatremia and respiratory diseases (p value= 0.004).

Similarly study conducted by Chaitra K.M. et al⁽⁹⁾ in 2015 observed hyponatremia in 46.7% of cases of bronchopneumonia, in 50% cases of lobar pneumonia, in 12.5% of cases of WARI, in 16.7% cases of bronchiolitis and 100% cases of empyema. In another study done by Attri H.K. et al⁽¹⁰⁾ in (2018) concluded that 7 out of 20 cases of bronchopneumonia i.e.(35%), 10 out of 31 cases of lobar pneumonia(32.25%), 7 out of 28 cases of bronchiolitis(25%) and 7 out of 7 cases of empyema(100%) had hyponatremia which is comparable to our study.

Association of hyponatremia in LRTI has been attributed to the syndrome of inappropriate antidiuretic hormone secretion (SIADH). This syndrome is characterized by hyponatremia and hypoosmolality and results from the inappropriate and continued secretion and/or action of antidiuretic hormone despite normal or increased plasma volume.

In current study out of total 150 cases, 30(20%) cases had increased potassium levels, and only 20(13.3%) cases were found to have decreased potassium level. Similarly study done by Singhi S et al in (1992) found hypokalemia in 12% cases though they found hyperkalemia in 2% cases. Contrary to this findings in study done by Mujawar S.A., et al⁽¹¹⁾ in (2008) 14 out

of 30 patients were hypokalemic (46.66%). In our study we also observed chloride abnormalities, out of total 150 cases we studied we found hypochloremia in 20(13%) cases and hyperchloremia in 18(12%) cases while 112 cases had normal serum chloride levels.

Current study doesn't showed any significant association between potassium and chloride abnormalities and respiratory diseases.

Conclusion

Present study concluded that majority of cases belonged to 2 month to 1 year of age group. Hyponatremia was a common finding in electrolyte abnormalities. Thus this study suggests that appropriate fluid and electrolyte therapy along with specific therapy of disease would help in decreasing morbidity of LRTI.

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