

Low serum Sodium levels in children presenting with Pneumonia at a tertiary care hospital

DR. AYESHA BUKHARI, MBBS

NISHTAR HOSPITAL, MULTAN, PAKISTAN.

DR. JAVARIA MANZOOR, MBBS

NISHTAR HOSPITAL, MULTAN, PAKISTAN.

DR. TEHZEEB ASHRAF, MBBS

NISHTAR HOSPITAL, MULTAN, PAKISTAN.

Abstract

Background; Hyponatraemia which is common feature of pneumonia in children leads to significant increase in morbidity, higher ICU admissions and mortality. We studied hyponatremia among hospitalized children with pneumonia at Nishtar Hospital Multan. **Objective;** Determine the frequency of hyponatremia among hospitalized children suffering from pneumonia. **Material and Methods;** The cross-sectional study was conducted at Unit-I Department of Pediatric Medicine, Nishtar Medical University and Hospital, Multan from March 2016 to May 2018. A total of 150 patients with aged 2 – 12 years of either gender with pneumonia were included in our study. All the relevant baseline investigations were done including chest X-Ray were done. History regarding fever, coughing, tachypnea and increased work of breathing. Venous blood sample (3ml) was drawn and sent to laboratory for serum sodium levels analysis. **Results;** of these 150 study cases, 79 (52.7%) were boys and 71 (47.3%) were girls. Mean age of our study cases was 5.77 ± 2.49 years. Majority of our patients i.e. 111 (74%) had community acquired pneumonia while hospital acquired pneumonia was in only 26 % of our study cases. Hypotonic intravenous fluid therapy was noted in 16 (10.7%) of our study cases. Mean disease duration of our study cases was 9.05 ± 2.55 days. Frequency of ICU admission was noted in 28 (18.7%) of our study cases. Mean serum sodium level was noted to be 136.43 ± 2.68 nmol/L. Hyponatremia was present in 33 (22%) of our study cases. **Conclusion;** Frequency of hyponatremia in children with pneumonia was high in our study cases. Hyponatremia was significantly associated with hypotonic fluid therapy, prolonged hospital stay and ICU admission. Hyponatremia is generally neglected while treating pediatric pneumonia so pediatricians must check Serum sodium levels on routine basis among this targeted population which will help to reduce morbidity and adverse clinical outcomes.

Keywords; Hyponatremia, Pneumonia, Serum sodium.

Introduction;

Pneumonia is one of the leading causes of serious diseases and mortalities among children all over the world which may be generally regarded as inflammatory lung parenchyma. Various illnesses in pediatric population such as bacterial sepsis, severe anemia and malaria usually exhibit range of varying clinical signs and symptoms which may significantly overlap with that of pneumonia; hence making its diagnosis more challenging¹⁻².

Hyponatremia is known as one of the most common electrolyte derangements among hospitalized patients presenting with pneumonia. Furthermore, hyponatremia is associated with higher grades of disease severity in these children. The exact mechanism is yet unknown, however primary disease, impaired water

excretion, “inappropriate” release of vasopressin, redistribution of Na and water, sickle cell syndrome, use of hypotonic fluids and many other drugs may lead to the development of hyponatremia³.

The relationship of various respiratory diseases with that of hyponatremia has been well documented for 75 years. Winkler and Crankshaw were the first to describe hyponatremia among pulmonary tuberculosis patients while data regarding hyponatremia in patients with pneumonia started to publish afterwards which has also been reported to be implicated with the severity of pneumonia⁴⁻⁶. In literature, varying frequency rates of hyponatremia have been reported in children suffering from Pneumonia. Wrotek et al. reported 33.3% frequency of hyponatremia in children suffering from pneumonia⁵. A study from Korea⁷ reported hyponatremia in 10.9% children having pneumonia. A study from Bangladesh reported 15 % children suffering pneumonia were having hyponatremia⁶.

Hyponatremia has also been reported to be correlated with increased disease morbidity in different patient subsets⁸⁻¹². However the underlying mechanisms of such associations still remains to be explored.

Hyponatremia is associated with worse outcomes in children suffering from pneumonia; various studies conducted abroad have reported varying frequencies of hyponatremia in the targeted population. But no such study has been conducted in Pakistan so far. This study was planned to ascertain the rates of hyponatremia in our local population.

Material and Methods;

The cross-sectional study was conducted at Unit-I Department of Pediatric Medicine, Nishtar Medical College and Hospital, Multan from March 2016 to May 2018. A total of 150 patients with aged 2 – 12 years of either gender with pneumonia were included in our study. Sample size was calculated using; $p = 10.9$ ⁷ (frequency of hyponatremia in pneumonia in children), $q = 100 - p$, $d = 5\%$.

Patients with wheezing or underlying pulmonary pathology such as cystic fibrosis, bronchiectasis and broncho-pulmonary dysplasia, patients taking medication that can potentially cause hyponatremia and those with the history of excessive intake of salt or water, having malignancy, significant heart disease, hemoglobinopathy and upper airway mechanical problems were excluded from our study.

Pneumonia was defined as if fever ≥ 101 F⁰, cough (Irrespective of duration and severity), difficulty in breathing and tachypnea (for children 2-3 years age 40-50 breaths/minute, for 3-5 years age 30 breaths/minute and for more than 5 years 24 breaths/minute) while “hyponatremia was defined as serum Na levels less than 135 nmol/L”. Once registered in the study, all the relevant baseline investigations were done including chest X-Ray. History regarding fever, coughing, tachypnea and increased work of breathing. Venous blood sample (3ml) was drawn and sent to laboratory for serum sodium levels analysis and recorded on the predesigned proforma. Mean and standard deviation for the age of the patients, duration of hospitalization and serum sodium levels were calculated using SPSS 18. Frequencies and percentage have been tabulated for the categorical variables like ICU admission (Yes/No), etiology (such as Community acquired pneumonia/hospital acquired pneumonia), gender and hyponatremia (Yes/No). Effect modifiers like age, etiology, duration of illness, Hypotonic IV fluid therapy, duration of hospitalization, ICU admissions and gender were stratified with regards to hyponatremia by applying chi-square test at 95 % confidence interval.

Results;

Of these 150 study cases, 79 (52.7%) were boys and 71 (47.3%) were girls. Mean age of our study cases was 5.77 ± 2.49 years (ranging from 2 years to 11 years). Mean age of the boys was 5.56 ± 2.53 years while that of girls was 6.01 ± 2.01 years ($p = 0.264$ while 105 (70%) belonged to the age group of 2 – 7 years. Majority of our patients i.e. 111 (74%) had community acquired pneumonia while hospital acquired pneumonia was in only 26 % of our study cases. Hypotonic intravenous fluid therapy was noted in 16 (10.7%) of our study cases. Mean disease duration of our study cases was 9.05 ± 2.55 days (range; 5 days to 14 days) while 100 (66.7%) had disease duration less than 10 days. Frequency of NICU admission was noted in 28 (18.7%) of our study cases.

Mean serum sodium level was noted to be 136.43 ± 2.68 nmol/L (ranging from 129 nmol/L to 140 nmol/L). Hyponatremia was present in 33 (22%) of our study cases. Hyponatremia was stratified with regards to gender, age, etiology, hypotonic IV fluid therapy, disease duration and ICU admission. (Table No. 1 - 6).

Table No. 1 Cross-tabulation of hyponatremia with regards to different parameters.
 (n = 150)

Parameters		Hyponatremia		P – value
		Yes (n =33)	No (n =117)	
Gender	Male (n =79)	14	65	0.236
	Female (n = 71)	19	52	
Age groups	2 – 7 Years (n =105)	22	83	0.670
	8 – 12 Years (n = 45)	11	34	
Hypotonic fluid therapy	Yes (n =16)	09	07	0.002
	No (n = 134)	24	110	
Etiology	Community acquired pneumonia (n =111)	23	88	0.509
	Hospital Acquired (n = 39)	10	29	
Disease duration	Less than 10 days (n =100)	21	79	0.681
	More than 10 (n = 50)	12	38	
ICU admission	Yes (n =28)	17	11	0.000
	No (n = 122)	16	106	

Table No. 2

Stratification of hyponatremia with regards to mean duration of hospital stay.

(n = 150)

Hyponatremia	Hospital stay (in days)		P – value
	Mean	SD	
Yes (n =33)	5.61	1.67	0.000
No (n = 117)	3.50	0.906	

Discussion;

Hyponatraemia is regarded as a common laboratory feature among pediatric population presenting with community-acquired pneumonia (CAP)^{13, 14} however very few studies have explored the role of hyponatremia in pneumonia. The available literature on the topic have correlated hyponatremia in children with pneumonia with increased rates of hospitalizations, high grade fever with prolonged duration, elevated serum C-reactive protein (CRP) and serum procalcitonin levels.¹⁵⁻¹⁷ Of these 150 having pneumonia children included in our study, 79 (52.7%) were boys and 71 (47.3%) were girls. Sakellaropoulou et al¹⁸ reported 59.25 % boys with pneumonia showing male gender preponderance. Our study results are similar to that of Sakellaropoulou et al¹⁸ in terms of male gender predominance. Duru et al¹⁹ from Turkey reported 57% male gender preponderance in children with pneumonia, similar to our results.

Mean age of our study cases was 5.77 ± 2.49 years (ranging from 2 years to 11 years). Mean age of the boys was 5.56 ± 2.53 years while that of girls was 6.01 ± 2.01 years ($p = 0.264$) while 105 (70%) belonged to the age group of 2 – 7 years. Sakellaropoulou et al¹⁸ reported mean age of children with pneumonia to be 4.67 ± 0.39 years (ranging 2 years to 12 years). Our study results are similar to that of reported by Sakellaropoulou et al¹⁸. Duru et al¹⁹ from Turkey 8.2 ± 4.2 years mean age of the children with pneumonia, close to our results.

Majority of our patients i.e. 111 (74%) had community acquired pneumonia while hospital acquired pneumonia was in only 26 % of our study cases. Hypotonic intravenous fluid therapy was noted in 16 (10.7%) of our study cases.

Mean disease duration of our study cases was 9.05 ± 2.55 days (ranging from 5 days to 14 days) while 100 (66.7%) had disease duration less than 10 days. Frequency of NICU admission was noted in 28 (18.7%) of our study cases. Duru et al¹⁹ from Turkey reported 10.3 ± 5.4 days mean duration of illness which is similar to our study results.

Mean serum sodium level was noted to be 136.43 ± 2.68 nmol/L (ranging from 129 nmol/L to 140 nmol/L). Hyponatremia was present in 33 (22%) of our study cases. Sakellaropoulou et al¹⁸ reported hyponatremia in 35 % of children with pneumonia (mean serum sodium level in boys was 136.09 ± 0.54 nmol/L while in girls was 136.54 ± 0.61 nmol/L). These findings are similar to that of our study cases. Don et al²⁰ reported 45 % hyponatremia in children with community acquired pneumonia which quite higher than reported in our study. Wrotek et al. reported 33.3% frequency of hyponatremia in children suffering from pneumonia⁵. They also reported that children with hyponatremia had prolonged hospital stay. Duru et al from Turkey¹⁹ reported 33 % hyponatremia in children with pneumonia which is close to our study results. These findings are similar to that of our study results. A study from Korea⁷ reported hyponatremia in 10.9% children having pneumonia which is quite less than that reported in our study. A study from Bangladesh reported 15 % children suffering pneumonia were having hyponatremia⁶ which is similar to that of our study results.

Conclusion;

Frequency of hyponatremia in children with pneumonia was high in our study cases. Hyponatremia was significantly associated with hypotonic fluid therapy, prolonged hospital stay and ICU admission. Hyponatremia is generally neglected while treating pediatric pneumonia so pediatricians must check Serum sodium levels on routine basis among this targeted population which will help to reduce morbidity and adverse clinical outcomes.

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