Original Research Article

Hyponatremia in Children with Pneumonia: A Single Centre Study

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Abstract: *Introduction:* Lower respirational tract infections (LRTIs) are common during childhood and can have high morbidity and mortality rates if not treated. It is among the serious health problems specifically in less than 5 years of age requiring hospitalization and attributes to 30% of deaths yearly worldwide especially due to pneumonia as the leading cause. *Aim of the study:* Aim of the study was to identify the hyponatremia in children with pneumonia. *Material & Methods:* This prospective study was conducted in Plasma maternity & general hospital, Bangabandhu Avenue, Oxygen moor Chittagong. The study period was from January, 2019 to December, 2019. A total of 120 patients were included for the study. Other investigations were done whenever required. Collected data were analyzed by frequencies, percentages, mean, and standard deviation and by Chi-square test by using SPSS 16.0. *Results:* The mean age of children was 1.3 (±) 2.5 years. Maximum number of children (60%) belonged to age group between 2 months to 12 months while the least number of children (18%) belonged to age group between 3 to 5 years. Male to female ratio was 2.1:1. In children with moderate hyponatremia 16% of them suffered from moderate pneumonia and 10% had very severe pneumonia and 4% had pneumonia. Among children with pneumonia 12% had pneumonia only while 2% had severe pneumonia and 6% had very severe pneumonia. *Conclusion:* Hyponatremia is prevalent in children with pneumonia. The children admitted with pneumonia have higher morbidity when associated with hyponatremia. In our study too hyponatremia was detected in children with pneumonia that was statistically significant.
Keywords: Hyponatremia, Children, Pneumonia, Cough, Nasal Congestion.

INTRODUCTION

Lower respiratory tract infections (LRTIs) are common during childhood and can have high morbidity and mortality rates if not treated [1]. The 2005 report of the World Health Organization states that LRTIs cause approximately 19% of the 10.5 million annual deaths [2]. It is among the serious health problems specifically in less than 5 years of age requiring hospitalization and attributes to 30% of deaths yearly worldwide especially due to pneumonia as the leading cause [3]. LRTI is infection listed below the level of the throat where there is swelling of the airways/pulmonary tissue due to viral or bacterial infection and might be taken to include: Bronchiolitis, bronchitis, pneumonia and empyema. Pneumonia is the leading reason for major illness and death in children accounting for 20-25% in under 5 age around the world and it can

be generally specified as swelling of the lung parenchyma. Bronchiolitis is a typical childhood disease and its most typical etiologic representative is breathing syncytial virus (RSV) [3]. Hospitalization is required in around 1% of afflicted kids, primarily because of dehydration, insufficient oral intake, or breathing deficiency. Between 10-15% of hospitalized children needs extensive care due to impending breathing failure [3, 4]. Fluids and electrolytes are the primary pillars in the upkeep of body homeostasis. The most essential among electrolytes is salt which the abundant cation of the extracellular fluid is. Hyponatremia is the most common electrolyte abnormality seen in the intensive care unit (ICU), with an occurrence as high as 30% in some reports [4]. Patients with pneumonia the most typical diseases that come across in pediatric basic practice, are at particular danger of establishing hyponatremia due to antidiuretic hormonal agent (ADH) oversecretion [5]. Hyponatremia related to paediatric pneumonia is most typically due to the syndrome of unsuitable antidiuretic hormone secretion (SIADH) [6]. Hyponatremia is defined as a serum sodium level below 135 mmol/L. It is the most common clinical electrolyte imbalance [7]. The hyponatremia rate in inpatients is 15%-30% [8]. Hyponatremia can be classified into three groups as mild (131-135 mmol/L), moderate (126-130 mmol/L), and severe (125 mmol/L) [9]. Mild hyponatremia is the most common type and usually produces no clinical findings. Severe hyponatremia is rare and has high morbidity and mortality rates if not treated [10]. The main causes of hyponatremia are volume depletion (bleeding, vomiung, diarrhea, and urinary loss), syndrome of inappropriate antidiuretic hormone (SIADH) secretion, congestive heart failure, thiazide diuretics, cirrhosis, renal failure, primary polydipsia, adrenal insu ciency, hypothyroidism, and pregnancy [10]. Several lung disorders, including pneumonia, can cause SIADH through unknown mechanisms [11].

METHODOLOGY AND MATERIALS

This prospective study was conducted in Plasma maternity & general hospital, Bangabandhu Avenue, Oxygen moor Chittagong. The study period was from January, 2019 to December, 2019. A total of 120 patients were included for the study according to following inclusion and exclusion criteria. Infants from 2 months to 1 year: chest recession, nasal flaring, cyanosis, intermittent apnoea, grunting respiration, not feeding, capillary refill time more than 2 secs, oxygen saturation less than 92%. Children 1 to 5 years: chest recession, nasal falring, cyanosis, grunting respiration,

capillary refill time more than 2 secs, oxygen saturation less than 92%. At the time of enrollment an informed written consent was obtained from the parents. Detailed history was taken from parents/guardians with relevance to the case. Detailed clinical examination was done. Chest x-ray was taken. All children were screened for dyselectrolytemia on admission. Other investigations were done whenever required. Collected data were analyzed by frequencies, percentages, mean, and standard deviation and by Chi-square test by using SPSS 16.0.

Inclusion Criteria
- Children between 2 months to 5 years with radiologically confirmed pneumonia and clinical features defined as per modified WHO/BTS guidelines.

Exclusion Criteria
- Infants less than 2 months of age
- Children more than 5 years of age
- Children with renal disorders
- Children with associated CNS infections
- Children with gastroenteritis
- Children with chromosomal or genetic disorder
- Children on drugs which can cause electrolyte imbalance such as diuretics, anticonvulsants etc.

RESULTS

A total of 120 children of age ranging from 2 months to 5 years who were admitted with clinical or radiological diagnosis of pneumonia were enrolled in the study. The mean age of children was 1.3 (±) 2.5 years. Maximum number of children (60%) belonged to age group between 2 months to 12 months while the least number of children (18%) belonged to age group between 3 to 5 years. Male to female ratio was 2.1:1 with fairly large number involving male child 68%. Most of the parents who brought their child for assessment belonged to Hindu religion (82%) (Table I). Respiratory rate was increased in all the children. Mean respiratory rate was for 2 month to 12 months ranging from 52 to 80 per minute. Mean respiratory rate was for those above 12 months with respiratory rate ranging from 46 to 76 per minute. Cough was present in 76% of studied children while fever was present almost invariably i.e. 92%. There were more children presenting with abdominal pain (28%) than those with chest pain (20%). The complaint of nasal congestion was present in 26%. Clinical diagnosis revealed majority of children with severe pneumonia (40%) followed by very severe pneumonia (34%) followed by pneumonia (26%) (Table II). Leukocytosis was seen in 70% of children

while leucopenia in 20% of the children. Acute phase reactants CRP was positive in 86% of the children. Hyponatremia was revealed in 80% of the children with pneumonia. Mean sodium level was 128.34 +/- 7.3 ranging from 112 to 145 meq/L (Table III). 34% of the studied children had hyponatremia while 30% had moderate hyponatremia and 16% and 20% had normal sodium level (Table IV). Among children between 2 months to 12 months (20%) had severe hyponatremia while children in age group between 1 to 3 years 6% had severe hyponatremia and between 3 to 5 yrs of children 8% had severe hyponatremia. The relation was statistically not significant (Table V). 18% of the children with severe hyponatremia had very severe pneumonia. While 14% with severe hyponatremia had severe pneumonia and only 2% of the children with severe hyponatremia had pneumonia. In children with moderate hyponatremia 16% of them suffered from moderate pneumonia and 10% had very severe

pneumonia and 4% had pneumonia. Among children with pneumonia 12% had pneumonia only while 2% had severe pneumonia and 6% had very severe pneumonia. The data is statistically significant (Table VI).

Table I: Socio- demographic characters (n=120)

Variables	N=120	%
Age		
2mo-<12mo	72	60
1-<3yrs	26	22
3-</=5yrs	22	18
Gender		
Male	82	68
Female	38	32
Religion of parents		
Hindu	98	82
Muslim	17	14
Buddhist	5	4

Table II: Clinical Presentation

Variables	N=120	%
Cough		
Present	91	76
Absent	29	24
Fever		
Present	110	92
Absent	10	8
Chest Pain		
Present	24	20
Absent	96	80
Nasal Congestion		
Present	31	26
Absent	89	74
Abdominal Pain		
Present	34	28
Absent	86	72
Grading of Pneumonia		
Pneumonia	31	26
Severe pneumonia	48	40
Very severe pneumonia	41	34

Table III: Lab parameters

Variables	N=120	%
Total Leukocyte Count		
4000-11000 cu/mm	12	10
>11,000 cu/mm	84	70
<4,000 cu/mm	24	20
CRP		
Positive	103	86
Negative	17	14
Sodium		
Normal sodium level (135-145 meq/L)	24	20
Hyponatremia (<135 meq/L)	96	80

Table IV: Grading of Severity of hyponatremia

Grading of hyponatremia	Frequency	%
Normal sodium level	24	20
Mild hyponatremia (131-135 meq/l)	19	16
Moderate hyponatremia (126-130 meq/l)	36	30
Severe hyponatremia (</=125 meq/l)	41	34

Table V: Association of age of children with grading of hyponatremia

Grading of hyponatremia				
Age	Normal sodium level	Mild hyponatremia (131-135 meq/l)	Moderate hyponatremia (126-130 meq/l)	Severe hyponatremia (</=125 meq/l)
2mo-<12mo	10(8%)	12(10%)	26(22%)	24(20%)
1-<3yrs	10(8%)	2(2%)	7(6%)	7(6%)
3-</=5yrs	5(4%)	5(4%)	2(2%)	10(8%)

Table VI: Association of grading of hyponatremia with grading of pneumonia

Grading of hyponatremia				
Grading pneumonia	Normal sodium level	Mild hyponatremia (131-135 meq/l)	Moderate hyponatremia (126-130 meq/l)	Severe hyponatremia (</=125 meq/l)
Pneumonia	14(12%)	10(8%)	5(4%)	2(2%)
Severe Pneumonia	2(2%)	10(8%)	19(16%)	17(14%)
Very severe pneumonia	7(6%)	0(0%)	12(10%)	22(18%)

DISCUSSION

Out of 120 children enrolled in the study maximum number of children (60%) belonged to age group between 2 months to 12 months. Male to female ratio was 2.1:1 with larger number(68%) being the male child. 92% of children were brought with fever while cough in 76% and nasal congestion in 28% while almost all presented with rapid breathing with di culty [12]. On the basis of WHO classification of ARI severe pneumonia was found in 40% while very severe pneumonia in 34% and pneumonia in 26%. Leukocytosis was observed in 70% of the children while CRP was positive in 86%. The prevalence of hyponatremia was found to be 80% which is similar to the study done in Kenyatta hospital by Dr. Eunice [13] where the prevalence was 71.9%. In India the prevalence of hyponatremia was 27% which is 2.5 times lower than that found in the current study [14]. These findings could be attributed to the fact that hyponatremia was defined as sodium level of <130mmol/l in the study done in India as compared to study done here where hyponatremia is <135 mmol/l. Severe hyponatremia was found in 34% of the children and moderate hyponatremia in 30% while mild hyponatremia in 16% of the children. 42% of the children with hyponatremia belonged to age group between 2 months to 12 months. However, none of the cases had severe hyponatremia which is in contrast to our

studies [15]. It complicates many conditions including respiratory, central nervous system, malignancies etc and it's a marker of severe illness resulting in high mortality and morbidity [16-18]. There was no statistical significance between the age group of children with hyponatremia though. (p=0.58). Moderate hyponatremia was more common (22%) in children age group between 2 months to 12 months, while moderate and severe hyponatremia were equally common(6%each) in children aged 1 to 3 years. Among children between 3 to 5 years severe hyponatremia was more common (8%). The association of age of children with grading of hyponatremia was done and it was statistically not significant. (p=0.56) The association of total leukocyte count with sodium values were compared and it too was statistically not significant (p=0.94) though higher numbers of children with hyponatremia (58%) had leukocytosis. 76% of children with hyponatremia had positive CRP. The association between CRP and hyponatremia was statistically significant. (p=0.02) The grading of severity of pneumonia was compared with grading of hyponatremia. In this study 18% of the children with severe hyponatremia had very severe pneumonia. The data is statistically significant. The grading of pneumonia as against the grading of hyponatremia was statistically significant. (p = 0.002) similar to a significant association between

very severe pneumonia and hyponatremia (p=0.002) that was observed in a study done at kanyatta hospital [13].

Limitations of the Study

The study was the sample size which was small and the cases were included from only one center. The other investigations like serum and urine osmolality and urine sodium could not be done since our facility was not equipped with these investigations.

CONCLUSION AND RECOMMENDATIONS

Hyponatremia is prevalent in children with pneumonia. The children admitted with pneumonia have higher morbidity when associated with hyponatremia. In our study too hyponatremia was detected in children with pneumonia that was statistically significant. Hence along with management of pneumonia, hyponatremia should also be cautiously addressed in these patients. Children admitted with clinical or radiological diagnosis of pneumonia should be promptly checked for serum sodium value and management should be started. Care should be taken while instituting fluid in these children as electrolyte imbalance might be aggravated.

Conflict of interest: None declared.

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