

Serum Sodium Levels in Children with Pneumonia: A Hospital Based Study

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Abstract

Original Research Article

Pneumonia is an infection in the lungs. It can cause breathing problems, a fever, coughing and wheezing. Pneumonia can affect people of any age, but babies and young children are at higher risk because their immune systems are not yet fully developed. Hence the current study was planned to evaluate the prevalence of the pneumonia in children and assess the level of serum sodium in affected children. The aim of our study was to assess the Serum sodium levels in children with pneumonia and the scenario of pneumonia in children in Bangladesh. The study was planned in the department of Pediatrics, Rangamati Medical College, Rangamati, Bangladesh during the period from January 2017 to 30th June 2017. One hundred and twenty five (125) study subjects were selected purposively. At the time of admission, the patient's clinical history was recorded in prefixed preform. Venous blood sampling was obtained from each patient enrolled in the study and sent for estimation of serum electrolytes, glucose levels, X-Ray Chest. Data were analyzed by using SPSS version 21. serum sodium range of the highest 50 (40%) number of patients were in (131-135) range group, 41(32.8%) were in (135-140) range group, 32 (25.6%) were in (126-130) range group and the lowest 2(1.6%) were in (120-125) range group, respectively. Hyponatremia is quite common in community acquired pneumonia cases that needed hospitalization. Initial measurement of serum sodium is recommended in all hospitalized pneumonia patients. Regular follow up of serum sodium level during the period of hospital stay should be considered to pick up the high risk cases at an early stage. Based on the above findings it can be concluded that regular estimation of serum electrolyte concentration and 30% has been curtailed from the regular daily intake fluid volume to guide appropriate fluid and electrolyte management of children with severe pneumonia requiring hospitalization.

Keywords: Pneumonia, Sodium level, Hyponatremia.

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INTRODUCTION

Pneumonia is an infection in the lungs. It can cause breathing problems, fever, coughing and wheezing. Pneumonia can affect people of any age, but babies and young children are at higher risk as because their immune systems are not yet fully developed. The World Health Organization (WHO) estimates that more than 160 million children around the world develop pneumonia each year, and 20 million of them get hospitalized and 2 million of them die. Worldwide, pneumonia is the leading cause of death for children under the age of five. Sub-Saharan Africa is disproportionately affected, accounting for more than half of such cases. In developed countries, access to antibiotics and vaccines has mostly controlled incidents of childhood pneumonia. However, in developing countries, pneumonia takes the lives of more children than any other single cause each year, including any other single disease, war, or famine. Despite this terrible

reality, programs to fight childhood pneumonia remain critically underfunded, with large amounts of resources being devoted to HIV/AIDS and malaria. Estimates show that 1.3 million of childhood pneumonia deaths could be avoided if prevention and treatment efforts were implemented worldwide. After the germs reach the lungs, the lungs become inflamed and fill up with fluid. This causes breathing difficulties, which makes it difficult for enough oxygen to enter the bloodstream. The body's cells can't function as they normally do, and infection can't be flushed from the body. If untreated, the infection may continue to spread, leading to death. In 2008, pneumonia occurred in approximately 156 million children (151 million in the developing world and 5 million in the developed world). In 2010, it resulted in 1.3 million deaths, or 18% of all deaths in those under five years, of which 95% occurred in the developing world. Countries with the greatest burden of disease include India (43 million), China (21 million)

and Pakistan (10 million). It is the leading cause of death among children in low income countries [1]. Many of these deaths occur in the newborn period. The World Health Organization estimates that one in three newborn infant deaths is due to pneumonia. Approximately half of these deaths can be prevented, as they are caused by the bacteria for which an effective vaccine is available. In 2011, pneumonia was the most common reason for admission to the hospital after an emergency department visit in the U.S.A for infants and children [2]. Bacteria, viruses, or fungi that live in nose, mouth, sinuses, or the surrounding environment can enter into lungs and create infections, including pneumonia. One can get the bacteria or viruses from others who are infected with those, whether they show symptoms or not. The leading cause of severe pneumonia in children in developing countries is *Streptococcus pneumoniae* bacteria or *pneumococcus*. Another leading cause is *Haemophilus influenzae* type-b or Hib. Other causes of pneumonia include influenza, staph infections, human respiratory syncytial virus, rhinovirus, herpes simplex virus, and severe acute respiratory syndrome (SARS). Less common types of pneumonia can be acquired through the inhalation of food, liquids, gases, dust, and certain fungi. *Pneumocystis carinii* (now renamed *Pneumocystis jirovecii*) pneumonia (PCP) is a fungal infection that can affect people with weakened immune systems, including those with HIV/AIDS. Practicing good hygiene and health habits help prevent pneumonia. Thorough and frequent hand cleaning, coughing or sneezing into an elbow or sleeve instead of hands, avoiding interaction with those who are sick, receiving proper nutrition, and getting adequate rest are all things you and your children can do to ward off the bacteria and viruses that can cause pneumonia. Avoiding tobacco smoke and other pollutants help prevent pneumonia. Increasing access to immunization, reducing indoor and outdoor air pollution, and becoming knowledgeable about warning signs to identify infection, specifically a cough, fast breathing, and/or difficulty breathing will help prevent infection. Breastfeeding during the first six months is critical in preventing pneumonia. Breast milk contains ample supply of nutrients, antioxidants, hormones and antibodies needed for growth and development of a child. The literature findings suggest that the lower respiratory infections (LRIs), pneumonia, atypical pneumonia, bronchitis, bronchiolitis, and severe acute respiratory syndrome (SARS), continue to threaten the health of children worldwide and especially in developing countries, where poor nutrition prevails and access to health care are scarce. Hence the current study was planned to evaluate the prevalence of the pneumonia in the children's and assess the levels of serum sodium in affected children's.

OBJECTIVES

a) General Objective

- To assess Serum Sodium Levels in Children with Pneumonia

b) Specific Objectives

- To observe the scenario of pneumonia in children in Bangladesh.

MATERIALS & METHODS

The present study was conducted on 125 children diagnosed with pneumonia in the Department of Pediatrics, Rangamati Medical College, Rangamati, Bangladesh during the period from January 2017 to 30th June 2017. At the time of admission, the patient's clinical history was recorded in prefixed proforma. Venous blood sampling was obtained from each patient enrolled in the study and sent for estimation of serum electrolytes and glucose levels. Chest X-Ray was done in all patients. Normal values of serum sodium ranges from 136-145 m mol/L or mEq/L. Hyponatremia is usually defined as a serum sodium concentration of less than 135 mEq/L³. A pre-designed questioner had been used to collect all the necessary data from the participants. Program MS-Excel was used in collecting data, SPSS version 21 was used in analyzing data. On the other hand, several tables were used to disseminate data. Following was the inclusion and exclusion criteria of the present study.

Inclusion Criteria

- Children with pneumonia between 1-6 years of age

Exclusion Criteria

- Children with severe malnutrition, Diarrhea, Congestive heart failure, Meningitis, Nephrotic syndrome and Acute Glomerular Nephritis.

RESULTS

The data from the 125 children diagnosed with the pneumonia were collected and discussed as follows. Table-1 showed that the distribution of study subjects according to age group, the majority age group (1-2 years) was 105(84%) then age group (2-4 years) 13(10.4%) and lowest age group (4-6 years) was 7(5.6%). In Table-2 the highest acute respiratory infection severe pneumonia was found 80(64%), Pneumonia was 40(32%) and the lowest one very severe Pneumonia was 5(4%). Distribution of study subjects according to frequency of hyponatremia in Table-3 the severity of pneumonia there are two groups (groups I, group II) with hyponatremia 50(40%) Where Severe Pneumonia was found 33(26.4%), pneumonia was 13(10.4%) and very severe pneumonia was 4(3.2%). In group II without hyponatremia 75(60%) where severe pneumonia was found 46(36.8%), pneumonia was 22(17.6%) and very severe pneumonia

was 7(5.6%). Distribution of pneumonia cases by their range of serum sodium in Table-4, serum sodium range of the highest 50 (40%) number of patients were in (131-135) range group, 41(32.8%) were in (135-140)

range group, 32 (25.6%) were in (126-130) range group and the lowest 2(1.6%) were in (120-125) range group respectively.

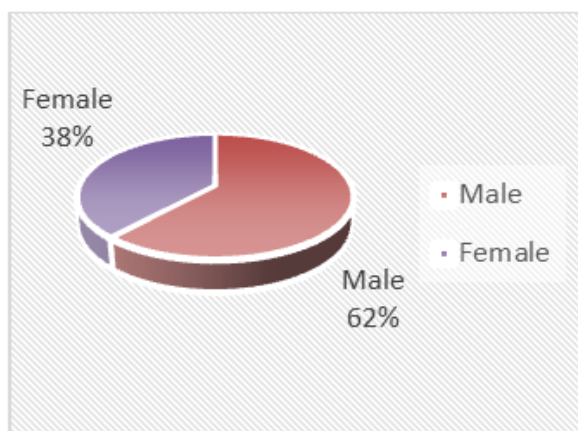


Fig-1: Gender distribution of Participants (N=125)

Table-1: Distribution of study subjects according to age group (N=125)

Age group (in years)	No. of Cases(N=125)	
	N	%
1-2	105	84
2-4	13	10.4
4-6	7	5.6
Total	125	100

Table-2: Distribution of study subjects according to WHO (World Health Organization) classification of acute respiratory tract infections (N=125)

Classification	No. of Cases (N=125)	
	N	%
Pneumonia	40	32
Severe Pneumonia	80	64
Very Severe Pneumonia	5	4
Total	125	100

Table-3: Distribution of study subjects according to frequency of hyponatremia (N=125)

Severity of pneumonia	(group-1) With hyponatremia		(group-2) Without hyponatremia	
	N	%	N	%
	Pneumonia	13	10.4	22
Severe Pneumonia	33	26.4	46	36.8
Very Severe Pneumonia	4	3.2	7	5.6
Total	50	40	75	60

Table-4: Distribution of pneumonia cases by their range of serum sodium (N=125)

Serum Sodium Range (mEq/L)	N	%
131-135	50	40
135-140	41	32.8
126-130	32	25.6
120-125	2	1.6

DISCUSSION

Hyponatremia is the most common serum electrolyte abnormality. The etiology of hyponatremia in the critically ill child may reflect an endogenous state

of sodium deregulation, iatrogenic causes, or both. Children admitted to the critical care study lies in the fact that this is the only study in pediatric age group where correlation of hospital-acquired and hospital-aggravated hyponatremia with morbidity and mortality

in hospitalized pneumonia patients is sought for. Few studies exist concerning the correlation of hyponatremia and pneumonia in children. It was first described by Stormont and Waterhouse in 1962 [3]. Since then and during the past 35 years, only case reports and a few relevant studies on the association between hyponatremia and pneumonia have been published, of which only three concern children [4, 5]. Community-acquired pneumonia (CAP) and nosocomial pneumonias contribute substantially to morbidity and hospital resource utilization [6, 7]. Hyponatraemia, occurring in more than 1/4 of patients with CAP, is associated with greater disease severity and worsened outcomes. Hyponatraemia is usually mild in children with CAP [8]. It seems that high atrial natriuretic peptide levels (ANP) may play a role [9]. Atrial natriuretic peptide is a member of the family of natriuretic peptides, and regulates a variety of physiological parameters, such as diuresis and natriuresis, and reduces systemic blood pressure. It is synthesized and secreted from cardiac atria. Increased levels of ANP were found in diseases affecting the lungs. Over-secretion of ANP is correlated with hypoxia, which leads to pulmonary vasoconstriction, pulmonary hypertension, and right-heart overload [10, 11]. Hyponatremia occurring in children with pneumonia comprises part of the syndrome of inappropriate antidiuretic hormone secretion (SIADH). ADH is generally secreted by the pituitary gland in response to high plasma osmolality (high serum sodium concentration); however, in various clinical conditions, including fever, hypoxia, hypercarbia, pain, nausea, and vomiting, nonosmotic stimulation of ADH secretion can lead to hyponatremia. Also, the stimulus of ADH release in pulmonary disease is likely to be nonosmotic; in particular, lung hyperinflation and pulmonary infiltrates may stimulate ADH secretion by causing a false perception of hypovolemia by intrathoracic receptors [12]. In our study, the highest serum sodium pneumonia (mEq/L) in (131-135) range was 50 (40%), higher (135-140) range was 41(32.8%), high (126-130) range was 32 (25.6%) and lowest (120-125) range was 2(1.6%). Electrolyte disturbances especially hyponatremia (serum sodium <135m Eq/L) have been described in a wide variety of acute infections including pneumonia. Other abnormalities like hypernatremia (serum sodium >145m Eq/L), hypekalemia (serum potassium 6m Eq/L) are other infrequent electrolyte disorders seen in Pneumonia [13]. Hyponatremia, occurring in more than one-fourth of patients with CAP, is associated with greater disease severity and worsened outcomes [14]. Recent single-center cohort study found the incidence of hyponatremia at hospital admission among CAP patients to be 28% [15]. In our study, the severity of pneumonia there are two groups (groups I, group II) with hyponatremia 50 (40%) Where Severe Pneumonia was found 33(26.4%), pneumonia was 13(10.4%) and very severe pneumonia was 4(3.2%). In group II without hyponatremia 75(60%) where severe pneumonia was found 46(36.8%), pneumonia was

22(17.6%) and very severe pneumonia was 7(5.6%). A study conducted by Afroditi Sakellaropoulou *et al.*, in 2008 on 54 patients revealed that, 33.33% of children had mild hypo-natremia and 1 child (1.90%) had moderate hyponatremia [16]. In another study done by Wrote KA *et al.*, hyponatremia was observed in 33.3 % patients [17].

LIMITATION OF THE STUDY

This was a single centered observational study with a small sample size. So the findings of this study may not reflect the exact scenarios of whole country.

CONCLUSION AND RECOMMENDATIONS

Initial measurement of serum sodium is recommended in all hospitalized pneumonic patients. Regular follow up of serum sodium level during the period of hospital stay should be considered to pick up the high risk cases at an early stage. Based on the above findings it can be concluded that regular estimation of serum electrolyte concentration is necessary to guide appropriate fluid and electrolyte management of children with severe pneumonia in hospital.

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