International Journal of Medical and Health Research
ISSN: 2454-9142
www.medicalsciencejournal.com
Volume 4; Issue 7; July 2018; Page No. 181-183

Assessment of serum sodium levels in children with pneumonia: A hospital based study

Sadhana Kumari[1], Ravindra Kumar[2*]
[1] Resident, Department of Paediatrics, ANMMCH, Gaya, Bihar, India.
[2] Assistant Professor, Department of Paediatrics, ANMMCH, Gaya, Bihar, India
[*] Corresponding Author: Dr. Ravindra Kumar

Abstract
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 is scarce. 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 present study was planned on 50 children diagnosed with pneumonia. The study was planned in children referred to IPD and OPD department of Anugrah Narayan Magadh Medical College, Gaya, Bihar. 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 electrolytes, blood urea, glucose levels. Serum sodium was measured by a process known as potentiometry. This method measures the voltage that develops between the inner and outer surfaces of an ion selective electrode.
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 plasma and urine osmolality is necessary to guide appropriate fluid and electrolyte management of children with severe pneumonia requiring hospitalization.

Keywords: pneumonia, sodium level, hyponatremia

Introduction
Pneumonia is a serious lung infection that affects people of all ages, but is particularly dangerous for extremes of ages. The World Health Organization estimates that more than 160 million children around the world develop pneumonia each year, 20 million of whom are hospitalized and 2 million of whom 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 would, and infection can't be flushed from the body. If untreated, the infection may continue to spread, leading to death [1].
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 [2]. 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. for infants and children [3].
Bacteria, viruses, or fungi that live in your nose, mouth, sinuses, or the surrounding environment can enter your lungs and create infections, including pneumonia. You can get the bacteria or viruses from people who are infected with them, 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 jiroveci*) 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 [1].

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 childrens and assess the levels of serum sodium in affected childrens.

Methodology

The present study was planned on 50 children diagnosed with pneumonia. The study was planned in children referred to IPD and OPD department of Anugrah Narayan Magadh Medical College, Gaya, Bihar from period of 1st September 2017 to 31st March 2018. At the time of admission, the patient's clinical history was recorded in prefixed proforma. Venous blood sampling is obtained from each patient enrolled in the study and is sent for estimation of electrolytes, blood urea, glucose levels. Serum sodium was measured by a process known as potentiometry. This method measures the voltage that develops between the inner and outer surfaces of an ion selective electrode.

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.

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/Acute Glomerular Nephritis.

Results & Discussion

The data from the 50 children diagnosed with the pneumonia were collected and discussed as follows.

Table 1: Distribution of Study Subjects According To Age Group.

Age group *(in years)*	No. of Cases
1—2	42
2—4	5
4 -6	3
Total	50

Table 2: Distribution of study subjects according to who classification of acute respiratory infections programme

Classification	No. of Cases
Pneumonia	16
Severe Pneumonia	32
Very Severe Pneumonia	2
Total	50

Table 3: Distribution of study subjects according to frequency of hyponatremia

Severity of pneumonia	With hyponatremia	Without hyponatremia
Pneumonia	5	9
Severe Pneumonia	13	18
Very Severe Pneumonia	2	3
Total	20	30

Table 4: Distribution of pneumonia cases by their range of serum sodium

Serum Sodium (mEq/L)	No. of Cases
120—125	1
126—130	12
131—135	20
135—140	17
Total	50

Hyponatremia is the most common electrolyte abnormality. The etiology of hyponatremia in the critically ill child may reflect an endogenous state of sodium dysregulation, iatrogenic causes, or both. Children admitted to the critical care unit for pneumonia have been recognized as having increased risk for developing hyponatremia possibly due to dysregulation of arginine vasopressin, antidiuretic hormone, excessive free water administration, or deficient sodium intake.

Now, the key question is whether hyponatremia in most patients is simply a powerful marker of severity of the underlying disease or a direct contributor to the adverse outcomes observed. But whatever it may be, hyponatremia is a compelling independent marker of adverse outcome. The danger of fluid overload in children with bacterial meningitis is widely appreciated [4], but it has not been appreciated how commonly fluid restriction is indicated in pneumonia in childhood. Also, most of the Standard English textbooks of paediatrics suggest that an increased fluid intake is needed in bacterial pneumonia, and none of them warn of the danger of fluid overload. An Indian study concluded that fluid therapy in pneumonia should be individualized and could not be generalized. Those having hyponatremia with hyperosmolality need liberal fluids while those with hypoosmolality need fluid restriction and hypotonic fluids including isolyte-P are not the ideal fluid for severe pneumonia patients [5]. Strength of the

study lies in the fact that this is the only study in paediatric age group where correlation of hospital-acquired and hospital-aggravated hyponatremia with morbidity and mortality in hospitalised 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 [6]. 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 [7-8]. Community-acquired (CAP) and nosocomial pneumonias contribute substantially to morbidity and hospital resource utilization [9-10].

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 [11]. It seems that high atrial natriuretic peptide levels (ANP) may play a role [12]. 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 [13-14].

Hyponatremia occurring in children with pneumonia comprises part of the syndrome of inappropriate antidiüretic 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 [15].

Conclusion

Hyponatremia is quite common in community acquired pneumonia cases 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 plasma and urine osmolality is necessary to guide appropriate fluid and electrolyte management of children with severe pneumonia requiring hospitalization.

References

1. http://www.pkids.org/diseases/pneumonia.html
2. Ruuskanen O, Lahti E, Jennings LC, Murdoch DR (April 2011). "Viral pneumonia". Lancet. 377 (9773): 1264–75. doi:10.1016/S0140-6736(10)61459-6. PMID 21435708.
3. Weiss AJ, Wier LM, Stocks C, Blanchard J. Overview of Emergency Department Visits in the United States, 2011. HCUP Statistical Brief #174. Rockville, MD: Agency for Healthcare Research and Quality. Archived from the original on, 2014.
4. Shann F, Germer S Hyponatraemia associated with pneumonia or bacterial meningitis. Arch Dis Child. 1985; 60:963-6.
5. Singhi S, Dhawan A. Frequency and significance of electrolyte abnormalities in pneumonia. Indian Pediatr. 1992; 29:735-40.
6. Stormont JM, Waterhouse C. Severe hyponatraemia associated with pneumonia. Metabolism. 1962; 11:1181-6.
7. 1hann F, Germer S. Hyponatraemia associated with pneumonia or bacterial meningitis. Arch Dis Child. 1985; 60:963-6.
8. Nair V, Niederman MS, Masani F, Fishbane S. Hyponatremia in community-acquired pneumonia. Am J Nephrol. 2007; 27:184-190.
9. Zilberberg MD, Exuzides A, Spalding J, *et al*. Hyponatremia and hospital outcomes among patients with pneumonia: a retrospective cohort study. BMC Pulmonary Medicine, 2008, 8.
10. Jabłoński S, Modrzewski W, Rysz J, Machała W, Jabłonowski Z, Kordiak J. Pulmonary abscesses – aetiology and treatment. Ten-year experience of the Department of General and Thoracic Surgery in Lodz, Poland. Arch Med Sci. 2006; 2:47-54.
11. Don M, Valerio G, Korppi M, Canciani M. Hyponatremia in pediatric community-acquired pneumonia. Pediatr Nephrol. 2008; 23:2247-53.
12. Haviv M, Haver E, Lichtstein D, Hurvitz H, Klar A. Atrial natriuretic peptide in children with pneumonia. Pediatr Pulmonol. 2005; 40:306-9.
13. Yap LB, Mukerjee D, Timms PM, Ashrafian H, Coghlan JG. Natriuretic peptides, respiratory disease, and the right heart. Chest. 2004; 126:1330-6.
14. Wilkins MR, Redondo J, Brown LA. The natriuretic-peptide family. Lancet. 1997; 349:1307-10.
15. Gozal D, Colin AA, Jaffe M, Hochberg Z. Water, electrolyte, and endocrine homeostasis in infants with bronchiolitis. Pediatr Res. 1990; 27(2):204-9.