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Prevalence of the pneumonia in Childrens with special assessment of hyponatremia

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Abstract
Childhood pneumonia is an important cause of mortality and morbidity in India. Also hyponatremia occurs in 1/4th of CAP and has been associated with increased in severity and worsened outcome of the disease. Hence, this study was undertaken to evaluate the prevalence of pneumonia and its association with the hyponatremia.
The present study was planned in the Department of Paediatrics, Sri Krisna Medical College and Hospital, Muzaffarpur, Bihar. The study was performed from July 2018 to Jan 2019. Total 25 child's of aged 1 to 4 years identified with the pneumonia were enrolled in the present study. Pneumonia was defined as the presence of infiltration on the chest X-ray. The diagnosis of bronchiolitis was made by the primary critical care physician at time of admission on the basis of clinical signs of tachypnea, hypoxia, rhinorrhoea, cough, wheeze, subcostal or intercostal retractions, nasal flaring, and grunting. Venous blood samples were obtained and analysed for serum sodium by flame photometry 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.
Based on the data generated in the present study and the reported findings it can be concluded that mild hyponatremia is common among children hospitalized with lower respiratory tract infections. Thus, serum electrolytes should be measured in children hospitalized for lower respiratory infections; and serum sodium concentration should be monitored regularly. Future research needs to focus not only on how hyponatremia may affect children with pneumonia, but also how severity of hyponatremia impacts hospital outcomes. Studies are needed to evaluate the role of currently available therapies aimed at correction of hyponatremia in improving the outcomes of patients with pneumonia.

Keywords: pneumonia, hyponatremia, sodium level, childrens, 1-4 years, etc

Introduction
Pneumonia is an inflammatory condition of the lung affecting primarily the small air sacs known as alveoli. Typically symptoms include some combination of productive or dry cough, chest pain, fever, and trouble breathing. Severity is variable. Pneumonia is usually caused by infection with viruses or bacteria and less commonly by other microorganisms, certain medications and conditions such as autoimmune diseases. Risk factors include other lung diseases such as cystic fibrosis, COPD, and asthma, diabetes, heart failure, a history of smoking, a poor ability to cough such as following a stroke, or a weak immune system. Diagnosis is often based on the symptoms and physical examination. Chest X-ray, blood tests, and culture of the sputum may help confirm the diagnosis. The disease may be classified by where it was acquired with community, hospital, or health care associated pneumonia [1].
Vaccines to prevent certain types of pneumonia are available. Other methods of prevention include handwashing and not smoking. Treatment depends on the underlying cause. Pneumonia believed to be due to bacteria is treated with antibiotics. If the pneumonia is severe, the affected person is generally hospitalized. Oxygen therapy may be used if oxygen levels are low. People with infectious pneumonia often have a productive cough, fever accompanied by shaking chills, shortness of breath, sharp or stabbing chest pain during deep breaths, and an increased rate of breathing. In elderly people, confusion may be the most prominent sign [2].
The typical signs and symptoms in children under five are fever, cough, and fast or difficult breathing. Fever is not very specific, as it occurs in many other common illnesses and may be absent in those with severe disease, malnutrition or in the elderly. In addition, a cough is frequently absent in children less than 2 months old. More severe signs and symptoms in children may include blue-tinged skin, unwillingness to drink, convulsions, ongoing vomiting, extremes of temperature, or a decreased level of consciousness [3].
Bacterial and viral cases of pneumonia usually result in similar symptoms. Some causes are associated with classic, but non-specific, clinical characteristics. Pneumonia caused by Legionella may occur with abdominal pain, diarrhea, or confusion. Pneumonia caused by Streptococcus pneumoniae is associated with rusty colored sputum. Pneumonia caused by Klebsiella may have bloody sputum often described as "currant jelly". Bloody sputum (known as hemoptysis) may also occur with tuberculosis, Gram-negative pneumonia, lung abscesses and more commonly acute bronchitis. Pneumonia caused by Mycoplasma pneumoniae may occur in association with swelling of the lymph nodes in the neck, joint pain, or a middle ear infection. Viral pneumonia presents more commonly with wheezing than bacterial pneumonia. Pneumonia was historically divided into "typical" and "atypical" based on the belief that the presentation predicted the underlying cause. However, evidence has not supported this distinction, therefore it is no longer emphasized [5].
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 [6]. 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 [6].

Hyponatremia is a low sodium concentration in the blood. It is generally defined as a sodium concentration of less than 135 mmol/L (135 mEq/L), with severe hyponatremia being below 120 mEq/L. Symptoms can be absent, mild or severe. Mild symptoms include a decreased ability to think, headaches, nausea, and poor balance. Severe symptoms include confusion, seizures, and coma [7].

The causes of hyponatremia are typically classified by a person's body fluid status into low volume, normal volume, or high volume. Low volume hyponatremia can occur from diarrhea, vomiting, diuretics, and sweating. Normal volume hyponatremia is divided into cases with dilute urine and concentrated urine. Cases in which the urine is dilute include adrenal insufficiency, hypothyroidism, and drinking too much water or too much beer. Cases in which the urine is concentrated include syndrome of inappropriate antidiuretic hormone secretion (SIADH). High volume hyponatremia can occur from heart failure, liver failure, and kidney failure. Conditions that can lead to falsely low sodium measurements include high blood protein levels such as in multiple myeloma, high blood fat levels, and high blood sugar [8].

Treatment is based on the underlying cause. Correcting hyponatremia too quickly can lead to complications. Rapid partial correction with 3% normal saline is only recommended in those with significant symptoms and occasionally those in whom the condition was of rapid onset. Low volume hyponatremia is typically treated with intravenous normal saline. SIADH is typically treated with fluid restriction while high volume hyponatremia is typically treated with both fluid restriction and a diet low in salt. Correction should generally be gradual in those in whom the low levels have been present for more than two days [9].

Hyponatremia occurs 1) when the hypothalamic-kidney feedback loop is overwhelmed by increased fluid intake, 2) the feedback loop malfunctions such that ADH is always "turned on"; 3) the receptors in the kidney are always "open" regardless of there being no signal from ADH to be open; or 4) there is an increased ADH even though there is no normal stimulus (elevated serum sodium) for ADH to be increased.

Hyponatremia occurs in one of two ways: either the osmoreceptor-aquaporin feedback loop is overwhelmed, or it is interrupted. If it is interrupted, it is either related or not related to ADH. If the feedback system is overwhelmed, this is water intoxication with maximally dilute urine and is caused by 1) pathological water drinking ("psychotic polydipsia"), 2) beer potomania, 3) overzealous intravenous solute free water infusion, or 4) infantile water intoxication. "Impairment of urine diluting ability related to ADH" occurs in nine situations: 1) arterial volume depletion 2) hemodynamically-mediated, 3) congestive heart failure, 4) cirrhosis, 5) nephrosis, 6) spinal cord disease, 7) Addison's disease, 8) cerebral salt wasting, and 9) syndrome of inappropriate antidiuretic hormone secretion (SIADH). If the feed-back system is normal, but an impairment of urine diluting ability unrelated to ADH occurs, this is 1) oliguric kidney failure, 2) tubular interstitial kidney disease, 3) diuretics, or 4) nephrogenic syndrome of antidiuresis [10].

Sodium is the primary positively charged ion outside of the cell and cannot cross from the interstitial space into the cell. This is because charged sodium ions attract around them up to 25 water molecules, thereby creating a large polar structure too large to pass through the cell membrane: "channels" or "pumps" are required. Cell swelling also produces activation of volume-regulated anion channels which is related to the release of taurine and glutamate from astrocytes [11].

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Methodology

The present study was planned in the Department of Paediatrics, Sri Krisna Medical College and Hospital, Muzaffarpur, Bihar. The study was performed from July 2018 to Jan 2019. Total 25 child's of aged 1 to 4 years identified with the pneumonia were enrolled in the present study. Pneumonia was defined as the presence of infiltration on the chest X-ray. The diagnosis of bronchiolitis was made by the primary critical care physician at time of admission on the basis of clinical signs of tachypnea, hypoxia, rhinorrhoea, cough, wheeze, subcostal or intercostal retractions, nasal flaring, and grunting. Venous blood samples were obtained and analysed for serum sodium by flame photometry 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.

All the patients were informed consents. The aim and the objective of the present study were conveyed to them. Approval of the institutional ethical committee was taken prior to conduct of this study.

Following was the inclusion and exclusion criteria for the present study.

Inclusion Criteria: Children with pneumonia between 1-4 years of age

Exclusion Criteria: Children with severe malnutrition, Diarrhea, Congestive heart failure, Meningitis, Nephrotic/Acute Glomerular Nephritis.

Results & Discussion

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 respiratory insufficiency or respiratory failure

due to lower respiratory tract infections 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. The data from the 25 child's 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
Below 1	16
1 – 3 years	4
3 – 4 years	5
Total	25

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

Classification	No. of Cases
Pneumonia	8
Severe Pneumonia	16
Very Severe Pneumonia	1
Total	25

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

Severity of pneumonia	With hyponatremia	Without hyponatremia
Pneumonia	3	5
Severe Pneumonia	6	10
Very Severe Pneumonia	1	0
Total	10	15

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

Serum Sodium (mEq/L)	No. of Cases
120—125	1
126—130	5
131—135	4
135—140	15
Total	25

The most common underlying causes of hyponatremia were diarrhoea, pneumonia and meningoencephalitis illnesses. Samadi *et al*. [12]. found hyponatremia in 20.8% of 1330 Bangladeshi children below 3 years of age with diarrhoea. Similar figures have been reported by other workers from tropics. In contrast to this, the reported frequency of hyponatremic dehydration was only 10% in children with acute diarrhoea in the western countries [13]. Predictably, hyponatremia in diarrhoea was of the hypovolemic type caused by excessive sodium loss in gastro-intestinal secretions; intake of salt free drinks and increased loss of salt through sweating in our climate might have contributed.

Hyponatremia occurring in children with pneumonia comprises part of the syndrome of inappropriate antidiüretic hormone secretion (SIADH) [14-16]. Secretion of anti-diuretic hormone typically results in water retention with minimal weight gain, usually with no oedema formation, and normal blood pressure [15]. Also, some authors reported that high atrial natriuretic peptide levels (ANP) may play a role in the development of hyponatremia in these patients [15, 17-18].

The danger of fluid overload in children with bacterial meningitis is widely appreciated [19], 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 [20].

Conclusion

Based on the data generated in the present study and the reported findings it can be concluded that mild hyponatremia is common among children hospitalized with lower respiratory tract infections. Thus, serum electrolytes should be measured in children hospitalized for lower respiratory infections; and serum sodium concentration should be monitored regularly. Future research needs to focus not only on how hyponatremia may affect children with pneumonia, but also how severity of hyponatremia impacts hospital outcomes. Studies are needed to evaluate the role of currently available therapies aimed at correction of hyponatremia in improving the outcomes of patients with pneumonia.

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