



## EVALUATION OF SODIUM LEVELS IN CHILDRENS SUFFERED FROM PNEUMONIA IN HOSPITAL FROM BIHAR REGION

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### Abstract:

Hyponatremia is the most common electrolyte abnormality. Patho physiologically, hyponatremia are classified into two groups: hyponatremia due to non-osmotic hypersecretion of vasopressin (hypovolemic, hypervolemic, euvoletic) and hyponatremia of non-hyper vasopressinemic origin (pseudo hyponatremia, water intoxication, cerebral salt wasting syndrome). The aim of this study was to identify the incidence of hyponatremia in children with pneumonia and to investigated whether there is a link between hyponatremia and the severity and outcome of pneumonia.

The present study was planned on 25 children diagnosed with pneumonia in department of Paediatrics in Nalanda Medical College and Hospital, Patna, from March 2016 to Dec 2016. At the time of admission, the patient's clinical history was recorded in prefixed proforma. 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.

Based on the above findings it can be concluded that serum electrolytes should be measured in children hospitalized for pneumonia; the appropriate fluid therapy must be carefully arranged in children with hyponatremia, and both serum and urine sodium levels should be closely monitored. 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.

**Keywords:** pneumonia, sodium level, Hyponatremia, etc.

### Introduction:

Pneumonia is an infection that inflames the air sacs in one or both lungs. The air sacs may fill with fluid or pus, causing cough with phlegm or

pus, fever, chills and difficulty breathing. A variety of organisms, including bacteria, viruses and fungi, can cause pneumonia. Pneumonia can range in seriousness from mild to life-

threatening. It is most serious for infants and young children, people older than age 65, and people with underlying health problems or weakened immune systems. Antibiotics and antiviral medications can treat many common forms of pneumonia.

Community-acquired pneumonia is the most common type of pneumonia. It occurs outside of hospitals and other health care facilities, and may be caused by: [1]

- **Bacteria**, such as *Streptococcus pneumoniae*. Bacterial community-acquired pneumonia can occur on its own or after you have a cold or respiratory flu. This type of pneumonia often affects one area (lobe) of the lung, a condition called lobar pneumonia.
- **Bacteria-like organisms**, such as *Mycoplasma pneumoniae*, which typically produce milder signs and symptoms than do other types of pneumonia. "Walking pneumonia," a term used to describe pneumonia that isn't severe enough to require bed rest, may result from *Mycoplasma pneumoniae*.
- **Viruses**, including some that are the same type of viruses that cause colds and flu. Viruses are the most common cause of pneumonia in children younger than 2 years. Viral pneumonia is usually mild. But viral pneumonia caused by certain influenza viruses, such as sudden acute respiratory syndrome (SARS), can become very serious.
- **Fungi**, which can be found in soil and in bird droppings. This type of pneumonia is most common in people with an underlying health problem or weakened immune system and in people who have inhaled a large dose of the organisms.

Hyponatremia is defined as a serum or plasma sodium less than 135 mEq/L. Hyponatremia is among the most common electrolyte abnormalities in children. Drops in sodium level can lead to neurologic findings and in severe cases significant morbidity and mortality,

especially in those with acute and rapid changes in plasma or serum sodium.

The true incidence of pediatric hyponatremia is unknown, as published data are based on hospitalized children. As examples, the reported incidence of hyponatremia was 17 percent of children at the time of hospital admission in Japan, which was higher in febrile children [2]. The incidence increased to 45 percent in an Italian study in children with pneumonia [3]. This is most likely due to the release of antidiuretic hormone (ADH) associated with a number of clinical conditions that result in hospitalization. These include hypovolemia, fever, head injury, central nervous system (CNS) infections, and respiratory disorders (eg, pneumonia and respiratory syncytial virus bronchiolitis) [2,4].

In addition, in-hospital interventions, such as recent surgery (which is associated with ADH release), and the administration of hypotonic intravenous solutions, may contribute to the development of hyponatremia [5].

Although previous studies have already established that low serum sodium levels commonly occur in critically ill children who require hospitalization, a team of Polish researchers aimed to more closely evaluate the link between hyponatremia and the severity of a child's community-acquired pneumonia (CAP).

In their recent "Hyponatremia in Children Hospitalized Due to Pneumonia" clinical study published in *Neurobiology of Respiration*, Teresa Jackowska, MD, PhD, and colleagues from the pediatrics department at Bielski Hospital in Warsaw, Poland, conducted a retrospective analysis of the medical records of 312 children between the ages of 33 days and 16 years who had been hospitalized with CAP.

The authors divided the pediatric patients into two groups under and over the age of four and used "breath frequency, heart rate, capillary blood saturation, body temperature, time for defervescence, duration of antibiotic treatment and hospital stay, and the serum inflammatory markers neutrophil count, C-reactive protein

(CRP), and procalcitonin level” to predict CAP disease severity.

According to the study results, hyponatremia was observed in 104 of the 312 children hospitalized with CAP. The researchers’ completed analysis showed that regardless of age, the hyponatremic children had higher neutrophil counts, “higher CRP and tended to have higher procalcitonin than children without hyponatremia, (and) body temperature was higher and duration of hospitalization was longer in hyponatremic (children) compared with non-hyponatremic children.” However, the investigators found no correlation between the patients’ serum sodium levels and “either breath frequency, heart rate, capillary blood saturation, time for defeverescence, or time of antibiotic treatment.” [6]

Hyponatremia is the most common electrolyte abnormality. Patho physiologically, hyponatremias are classified into two groups: hyponatremia due to non-osmotic hypersecretion of vasopressin (hypovolemic, hypervolemic, euvolemic) and hyponatremia of non-hyper vasopressinemic origin (pseudo hyponatremia, water intoxication, cerebral salt wasting syndrome). [7] The aim of this study was to identify the incidence of hyponatremia in children with pneumonia and to investigated whether there is a link between hyponatremia and the severity and outcome of pneumonia.

**Methodology:**

The present study was planned on 25 children diagnosed with pneumonia in department of

Paediatrics in Nalanda Medical College and Hospital, Patna, from March 2016 to Dec 2016. At the time of admission, the patient’s clinical history was recorded in prefixed proforma. 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. All the patients were informed consents. The approval of the institutional Ethical committee was prior to conduct of the study. The aim and the objective of the present study were conveyed to the family members of the 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. The child patients with pneumonia between 1 - 8 years of age were included in the present study. The child patients with severe malnutrition, Diarrhea, Congestive heart failure, Meningitis, Nephrotic/Acute Glomerular Nephritis were excluded from the present study.

**Results & Discussion:**

The data from the 25 children diagnosed with the pneumonia were collected and discussed as follows. 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.

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

Age group (in years)	No. of Cases	Percentage Cases
Below 2 years	14	56
2 – 5 years	7	28
5 – 8 years	4	24
<b>Total</b>	<b>25</b>	<b>100 %</b>

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

Classification	No. of Cases	Percentage Cases
Pneumonia	15	60
Severe Pneumonia	6	24
Very Severe Pneumonia	4	16
<b>Total</b>	<b>25</b>	<b>100 %</b>

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

Severity of pneumonia	With hyponatremia		Without hyponatremia	
	No. of Cases	Percentage Cases	No. of Cases	Percentage Cases
Normal	10	67	5	50
Severe	3	20	3	30
Very Severe	2	13	2	20
<b>Total</b>	<b>15</b>	<b>100 %</b>	<b>10</b>	<b>100 %</b>

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

Serum Sodium (mEq/L)	No. of Cases	Percentage Cases
Below 130	11	44
131–135	9	36
Above 135	5	20
<b>Total</b>	<b>25</b>	<b>100%</b>

Hyponatraemia is considered a common laboratory finding in children with community-acquired pneumonia (CAP), which can be defined clinically as the presence of signs and symptoms of pneumonia in a previously healthy child due to an infection which has been acquired outside hospital [8]. Few studies, though, explore the correlation of HN and pneumonia in children [9]. Based on the published studies, the severity of CAP and Hyponatraemia due to CAP are associated with the need of hospitalization, the presence of prolonged and high fever, and elevated serum non-specific inflammatory markers, such as serum C-reactive protein (CRP) and serum procalcitonin.

Moreover, lower respiratory infections (LRIs), including acute lower respiratory tract infections,

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 [9].

Hyponatraemia could result from a sodium deficit, or surplus of water. Primary illness, impaired water excretion, “inappropriate” release of vasopressin, use of hypotonic fluids, redistribution of sodium and water, sickle cell syndrome, and several drugs may contribute to hyponatraemia. Hyponatraemia is a frequent finding in children with pneumonia. Usually, it comprises part of the syndrome of inappropriate SIADH. Secretion of anti-diuretic hormone typically results in water retention with minimal

weight gain, usually with no oedema formation, and normal blood pressure. According to studies, SIADH occurs in about one third of children hospitalized for pneumonia, and was associated with a more severe disease and a poorer outcome [10].

Patients with mild hyponatremia are almost always asymptomatic. Severe hyponatremia is usually associated with central nervous system symptoms and can be life-threatening. Diagnostic evaluation of patients with hyponatremia is directed toward identifying the extracellular fluid volume status, neurological symptoms and signs, severity and duration of hyponatremia, and the rate at which hyponatremia developed. [11] Hyponatremia occurring in children with pneumonia comprises part of the syndrome of inappropriate antidiuretic hormone secretion (SIADH). [11-13] Secretion of anti-diuretic hormone typically results in water retention with minimal weight gain, usually with no oedema formation, and normal blood pressure. [13] Also, some authors reported that high atrial natriuretic peptide levels (ANP) may play a role in the development of hyponatremia in these patients. [13, 15-16] Atrial natriuretic peptide is a member of the family of natriuretic peptides, and regulates diuresis and natriuresis. Increased levels of ANP is correlated with hypoxia in lung diseases [13]. Some studies postulated an interaction between ANP and ADH [13, 15-16]. They measured ANP levels 6 times higher than the normal range in SIADH patients. Haviv et al. [13] demonstrated that high ANP levels may play a role in maintaining water and electrolyte equilibrium during a state of inappropriate ADH secretion accompanying pneumonia.

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. [15]

#### **Conclusion:**

Based on the above findings it can be concluded that serum electrolytes should be measured in children hospitalized for pneumonia; the appropriate fluid therapy must be carefully arranged in children with hyponatremia, and both serum and urine sodium levels should be closely monitored. 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.

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