

Assessment of pneumonia and its association with the hyponatremia an observational study

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Background: To assess pneumonia and its association with the hyponatremia. **Material and methods:** A prospective evaluation study was carried out in the Department of Biochemistry, Netaji Subhas Medical College and Hospital, Patna, Bihar India from Oct 2019 to March 2020. Total 100 children of aged 0-5 years identified with the pneumonia were enrolled in the present study. 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. **Result:** Total 100 patient were included in this study. The mean Body temperature 37.74°C , WBC count ($\times 10^3/\text{L}$) 12114.00 ± 5496.26 and CRP $52 (52\%) > 10\text{mg/l}$ were present. Maximum number of children (45%) belonged to below 1 year while the least number of children (25%) belonged to age group between 3 to 5 years. Female to male ratio was 1.5:1 with fairly large number involving female child i.e. 60%. Clinical assessment was done prior to investigation. The clinical parameters that distinguished the grading of pneumonia were done. Cough was present in 53% of studied children while fever was present almost invariably i.e. 82%. There were more children presenting with chest pain (22%). The complaint of nasal congestion was present in 39%. Clinical diagnosis revealed majority of children with severe pneumonia (52%) followed by very severe pneumonia (10%) followed by pneumonia (38%). Frequency of hyponatremia with pneumonia was 44% and 56% patients without hyponatremia. **Conclusion:** 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.

Keywords: pneumonia, hyponatremia, sodium level, childrens

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Introduction

Pneumonia is the single largest infectious cause of death in paediatric age group worldwide. About 0.92 million under-5 children die from pneumonia in a year.[1] On the other hand, Hyponatremia is the most common electrolyte disorder in hospitalized patients[2]. Water retention in extravascular compartment and increase in plasma volume leads to this hyponatremia and inappropriate secretion of Antidiuretic hormone (SIADH) has been proposed to be one of the most Also[3].

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Though the concept of water retention and hyponatremia in pneumonia came in 1920s[4,5], only few case reports were published till the 80s. 6 and till date only 5 published studies are there in children[7] and few more in adults[8-9]. Though danger of fluid overload and importance of fluid restriction has been emphasized in meningitis, precise data about necessary fluid restriction in pneumonia is still lacking. 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 age, 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] 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.[10] 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.[11] 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 assessment of pneumonia and its association with the hyponatremia.

Material and methods

A prospective evaluation study was carried out in the Department of Biochemistry, Netaji Subhas Medical College and Hospital, Patna, Bihar India from Oct 2019 to March 2020, after taking the approval of the protocol review committee and institutional ethics committee. Total 100 children of aged 0-5 years identified with the pneumonia were enrolled in the present study.

Inclusion Criteria

Children with pneumonia
Between 0-5 year years of age

Exclusion Criteria

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

Methodology

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 mmol/L or mEq/L. Hyponatremia is usually defined as a serum sodium concentration of less than 135 mEq/L. After blood sample collection all the biochemical parameters were assessed in the department of Biochemistry.

Statistical analysis

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 19 (SPSS Inc., Chicago, Illinois, USA). Descriptive statistics included computation of percentages and means.

Results:

Table 1: Baseline characteristics and laboratory data of 100 children with pneumonia

Characteristic	Data
Body temperature ($^{\circ}$ C)	37.74
WBC count ($\times 10^3$ /L)	12114.00 \pm 5496.26
Neutrophils (% of WBC)	66.31 \pm 8.37
ESR (mm/h)	13.11 \pm 4.27
Duration of tachypnoea (hours)	39.11 \pm 18.93
Time for defervescence (hours)	36.31 \pm 18.63

Table 2: Distribution of study subjects according to gender base

Gender	
Male	40
Female	60

Table 3: Distribution of study subjects according to age group

Age group (in years)	No. of Cases
Below 1	45
1 – 3 years	30
3 – 5 years	25
Total	100

Table 4: Clinical presentation of patients

Parameter	
Cough	53
Fever	82
Chest pain	22
Nasal congestion	39
CRP	55

Table 5: Distribution of study subjects according to who classification of acute respiratory infections Programme

Classification	No. of Cases
Pneumonia	38
Severe Pneumonia	52
Very Severe Pneumonia	10
Total	100

Table 6: Distribution of pneumonia cases by their range of serum sodium

Serum Sodium (mEq/L)	No. of Cases
120—125	8
126—130	20
131—135	16
135—140	56
Total	100

Table 7: Distribution of study subjects according to frequency of hyponatremia

Severity of pneumonia	With hyponatremia	Without hyponatremia
Pneumonia	8	30
Severe Pneumonia	32	20
Very Severe Pneumonia	4	6
Total	44	56

Discussion

The commonest dyselectrolytemia in hospitalized patients is hyponatremia. 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[12-15]. Electrolyte disturbances have been described in a wide variety of acute infections including pneumonia, which complicates the management and prognosis[16]. Most of the studies have shown hyponatremia due to Syndrome of Inappropriate Anti diuretic Hormone secretion (SIADH) as the most common electrolyte abnormality[17,18]. The stimulus of ADH release in pulmonary disease is likely to be non osmotic; in particular, lung hyperinflation and pulmonary infiltrates may stimulate ADH secretions by causing a false perception of hypovolemia by intrathoracic receptors[19]. The goal of this study was to assessment of hyponatremia in children with pneumonia. Out of 100 children enrolled in the study maximum number of children (45%) below age group one year. Male to female ratio was 1.5:1 with larger number(60%) being the female child. 82% of children were brought with fever while cough in 53% and nasal congestion in 39% while almost all presented with rapid breathing with difficulty. On the basis of WHO classification of ARI sever pneumonia was found in 52% while very severe pneumonia in 10% and pneumonia in 38%. In our study frequency of hyponatremia with pneumonia was 44 % it was high as compared with some other studied. The most common underlying causes of hyponatremia were diarrhoea, pneumonia and meningoencephalitis illnesses. Samadi et al[20] 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[21]. 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 antidiuretic hormone secretion (SIADH)[22-24]. Secretion of anti-diuretic hormone typically results in water retention with minimal weight gain, usually with no oedema formation, and normal blood pressure[23]. Also, some authors reported that high atrial natriuretic

peptide levels (ANP) may play a role in the development of hyponatremia in these patients[25,26]. The danger of fluid overload in children with bacterial meningitis is widely appreciated, 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[27].

Conclusion

Based on the data generated in the present study and the reported findings it can be concluded that 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.

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