



## Original Research Article

## A study of hyponatremia in cases of pneumonia in hospitalized children and its correlation with age and sex

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## ABSTRACT

**Objective:** To study the incidence of hyponatremia in children, suffering from pneumonia and to find the association between the presence of hyponatremia with age and gender of children suffering from pneumonia.

**Materials and Methods:** The study was conducted at The Department of Pediatrics, Muzaffarnagar Medical College, Muzaffarnagar. Cases were taken from the Pediatric inpatients department of the hospital. All children, ranging between 01 year and 15 years, admitted for pneumonia from Feb, 2019 to Feb 2020, were taken up for the study.

**Conclusion:** Hyponatremia is an electrolyte abnormality which is quite common in children with pneumonia, and there is no age or sex predisposition seen in association with hyponatremia

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### 1. Introduction

Pneumonia is one of the leading causes of mortality in childhood and it cause death of 19 % (2 million) of children under 5 years age. If we add neonatal period to this the overall death estimate will increase to 29 %. Pneumonia affects every region of the world but its prevalence is mostly seen in South Asia and sub-Saharan Africa where it cause 85% of deaths. Many strategies have been put forward to control it like (Vaccination, Exclusive breastfeeding for 6 months and Vit A supplementation) but its treatment and prevention remains a challenge. Although many children with pneumonia can be treated at home, however studies have shown that 27% get proper treatment.<sup>1</sup> Studies have shown that children with pneumonia also develop electrolyte abnormalities out of which hyponatremia is most significant.<sup>2</sup>

Hyponatremia in pneumonia occurs due to SIADH.<sup>3</sup> Increased ADH causes water retention, which leads to fall in

plasma osmolarity and this acts as a source of free water.<sup>4</sup> Hyponatremia also acts as a prognostic marker for severe disease and increased mortality.<sup>5</sup>

So it is very important for clinicians to timely recognise common electrolyte abnormalities as this will facilitate in administration of appropriate treatment and further giving better outcomes.

### 2. Aims and Objectives

1. To study the incidence of hyponatremia in children, suffering from pneumonia,
2. To find the association between the presence of hyponatremia with age and sex of children suffering from pneumonia

### 3. Material and Methods

The study was conducted at The Department of Pediatrics, Muzaffarnagar Medical College, Muzaffarnagar. Cases were taken from the Pediatric inpatients department of the hospital. All children, ranging between 01 year and

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15 years, admitted for pneumonia from February, 2019 to February, 2020 were taken up for the study.

Prior written consent of the parents/legal guardian of every child included in the study, was taken.

### 3.1. Exclusion criteria

Any child suffering from any of the following conditions was excluded from the study:-

1. Diarrhea with dehydration
2. Renal disease
3. Cardiac disease
4. Any other serious illness

### 3.2. Case definitions

Hyponatremia, for the purpose of the study, was defined as a sodium level of 135mmol/L or below. Children with hyponatremia were further classified into either having mild, moderate or severe hyponatremia in the following fashion.

Mild Hyponatremia – sodium levels of 130-134 mmol/L

Moderate hyponatremia - sodium levels of 125-129mmol/L

Severe hyponatremia - sodium levels of <125mmol/L

The overall prevalence of hyponatremia was calculated as a proportion of all children with hyponatremia to the total number of all children recruited for the study.

Children who had normal sodium levels on admission were followed up over 48 hours during which their fluid intake both orally and intravenously were recorded. For those who received intravenous fluid, the type of fluid and amount was also documented. A repeat blood sample was taken 48 hours after admission to determine the proportion that developed hyponatremia in the ward.

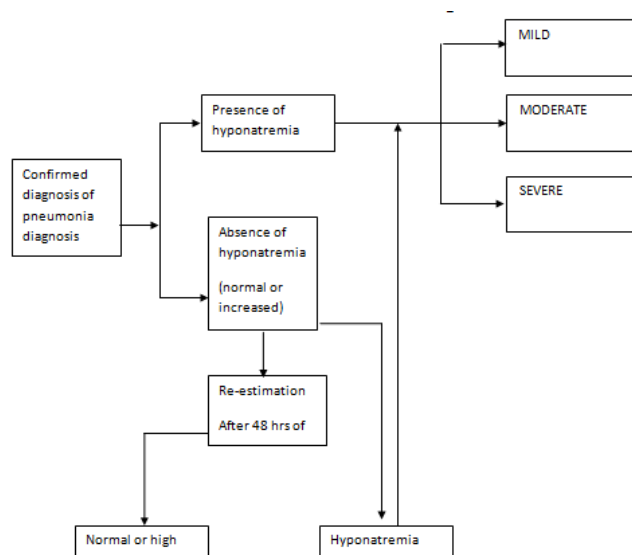
Data was analyzed in an effort to find any correlation of hyponatremia with various clinical and laboratory findings. To determine the statistical significance of such correlation, Chi square test was applied to find the p value. A value below 0.05 was considered significant.

**Table 1:** Age and gender distribution of studied children

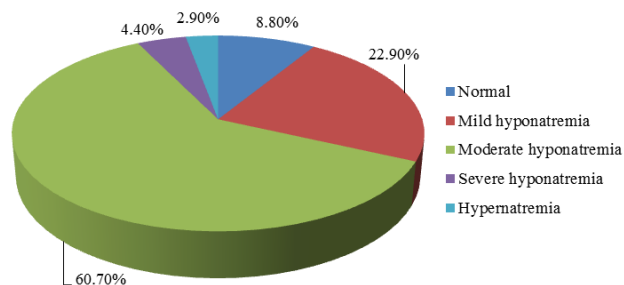
Age	Male	Female	Total
Below 1 year	50	30	80
1 to 5 years	30	14	44
Above 5 years	06	05	11
Total	86	49	135

## 4. Results

A total of 135 cases of children suffering from pneumonia were studied. Various data regarding the demographic characteristics as well as clinical presentations were collected for further interpretation. The results are summarized as follows.-



**Fig. 1:** Scheme of Observations and Investigations



**Fig. 2:** Distribution of patients on the basis of serum sodium levels

### 4.1. Age and Gender

As shown in Table 1, the age of children taken up for study ranged from 2 months to 12 years, with the majority aged less than 1 year (59.3%) and only a few cases above 5 years. Gender distribution was inclined towards male children who outnumbered females by 63.7% to 36.3%.

### 4.2. Hyponatremia

Serum sodium, as shown in Figure 2, ranged between 112 and 152 mEq/L, with a small number of patients having normal sodium levels (8.8%) and a very small number having mild hypernatremia also (2.9%). However, majority of children (88.3%) showed hyponatremia; while, most of them showed moderate hyponatremia (60.7%), some of them had mild hyponatremia and a very small number had severe hyponatremia also.

**Table 2:** Hyponatremia and its degree with relation to age groups

Age	Mild hyponatremia	Moderate hyponatremia	Severe hyponatremia	Total
Below 1year	16 (22.5%)	49 (69%)	6 (8.4%)	71/80 (88.7%)
1 to 5 years	5 (12.8%)	28 (71.7%)	6 (15.3%)	39/44 (88.6%)
Above 5years	2 (22.2%)	5 (55.5%)	2 (22.2%)	9/11 (81.8%)
Total	23 (19.3%)	82 (68.9%)	14 (11.7%)	119/135 (88.1%)

Value: 0.48

**Table 3:** Hyponatremia in relation to gender

Gender	Mild hyponatremia	Moderate hyponatremia	Severe hyponatremia	Total of hyponatremic cases
Male	17 (22.3%)	55 (72.3%)	4(5.2%)	76/86 (88.3%)
Female	14 (32.5%)	27 (62.7%)	2(4.6%)	43/49 (87.7%)

Value: 0.47

#### 4.3. Hyponatremia in relation to age

An effort was made to examine the correlation, if any, between the age and the presence of hyponatremia and also its degree. As can be seen Table 2, there was no significant difference between different age groups as far as the presence of hyponatremia is concerned, the number of children showing low sodium levels ranged between 81.8 to 88.7%. There appears some difference between the 3 age groups as regard the degree, however, this difference also does not appear significant.

#### 4.4. Hyponatremia in relation to gender

Presence of hyponatremia and its degree in relation to the gender of the cases is shown in Table 3. As shown in the table, there is no significant difference between male and female patients with regard to hyponatremia.

### 5. Discussion

Hyponatremia has been shown to be one of the commonest electrolyte abnormalities in hospitalized patients. It complicates many conditions affecting respiratory, cardiovascular and central nervous systems etc and is frequently encountered in children suffering from pneumonia. Not only this, there are reports that it may act as a marker of severe illness resulting in high mortality and morbidity.<sup>6,7</sup> The present study is a small endeavour to study the relationship between hyponatremia and pneumonia in various situations.

#### 5.1. Age and Gender

More children in our study were infants, i.e., younger than 1 year than any other age group (table 1); they constituted almost 60% of all children. This is understandable, as in usual practice, we tend to find pneumonia cases more frequently in younger age group patients. On the other hand, children above 5 years were much fewer, about 8% only. Children between 1 and 5 years were in substantial numbers

(about 32%).

As regards the gender (Table 1), male children were significantly more in number; this can easily be explained by the usual observation that in any public hospital in our country, more male children than females are brought to seek medical treatment.

#### 5.2. Hyponatremia

The overall incidence of hyponatremia, in the present study, was found to be 88.1%. Several other studies on this subject have been conducted in our country and outside. However, in most of the studies the incidence of hyponatremia has been reported to be less frequent. In a study conducted at the PGIMER, Chandigarh, the incidence was only 27%, while in some other studies, the incidence was a little higher, though still much lower than ours.<sup>3,5,8</sup> On the other hand, one study conducted outside the country, the hyponatremia was comparable with our study.<sup>6</sup> Some difference in the findings could be attributed to the fact that hyponatremia was defined as sodium level of <130mmol/l in some studies, while in some other studies including our study, the cut-off level was <135mmol/l.

#### 5.3. Influence of age and gender on hyponatremia and its degree

There was not seen any significant difference between different age groups as regards the overall incidence of hyponatremia, as shown in table 2; the lowest incidence of 81.8% was seen in the highest age group, while rest of the 2 age groups had almost the same incidence. However, an important observation was that higher the age, higher was the frequency of severe hyponatremia; it was lowest in the lowest age group (8.4%) and highest in the highest age group children (>22%), with the middle age group having an incidence in between. Though these changes appeared conspicuous, they were not found statistically significant (P value > 0.5).

When we tried to see the changes in the serum sodium levels in male and female children separately, there was no apparent difference in the overall numbers of hyponatremia cases between the two genders. However, when we tried to see the degree of hyponatremia, mild hyponatremia cases were slightly more often seen in females as compared to male children (72.3% vs 62.7%); the situation was reversed in the case of moderate hyponatremia, while there was no apparent difference in cases of severe hyponatremic cases. Even on statistical analysis, these differences were found insignificant.

Other studies done on this subject also failed to find any significant difference between children of different gender, though 1 study found hyponatremia slightly more common in children of higher age groups.<sup>6,8,9</sup>

Pneumonia is one of the major disorders affecting children and electrolyte abnormalities, especially hyponatremia is a known complication. The present study was conducted at the Department of Pediatrics, Muzaffarnagar Medical College, Muzaffarnagar between February, 2019 and February, 2020 (12 months). The study comprised inpatients children, suffering from pneumonia, up to the age of 15 years. Any child suffering from any other serious illness was excluded. All children were clinically examined and underwent laboratory investigations – total and differential WBC count, ESR and estimation of serum electrolytes, urea and creatinine levels.

Cases were divided in 3 groups on the basis of degree (mild, moderate or severe) of hyponatremia. Cases were analysed to find any correlation of hyponatremia with age and sex of patients

Results were subjected to Chi square test to determine the statistical significance.

The major findings of the study can be summarized as follows:-

1. A great majority of children, over 90% of them suffering from pneumonia and admitted to the inpatients had low levels of serum sodium levels.
2. Most of these cases, more than 60% of the total patients, showed moderate hyponatremia
3. A significant number (23%) of pneumonia cases had mild hyponatremia, while very few cases of pneumonia (less than 5%) showed severe hyponatremia.
4. There was no significant difference between the two sexes, nor between the children of different age groups in the incidence of hyponatremia.

## 6. Conclusions

Hyponatremia is a fairly common finding in children with pneumonia and also there is no age or sex predisposition seen associated with hyponatremia.

## 7. Ethical Clearance

Permitted by the Ethical committee.

## 8. Source of Funding

None.

## 9. Conflict of Interest

None.

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