

# Frequency of Hyponatraemia in Patients Admitted with Community Acquired Pneumonia in Medical Unit of DHQ Teaching Tertiary Care Hospital

Salman Khan<sup>1✉</sup>, Abdur Rehman<sup>1</sup>, Muhammad Zubair<sup>2</sup>, Moeen ul Haq<sup>1</sup>, Nisar Khan<sup>3</sup>

<sup>1</sup>Department of Medicine, DHQ Teaching Hospital, Gomal Medical College, Dera Ismail Khan - Pakistan

<sup>2</sup>Department of

Medicine, DHQ Teaching Hospital, Dera Ismail Khan - Pakistan

<sup>3</sup>Department of Medicine, MMM Teaching Hospital, Gomal

Medical College, Dera Ismail Khan - Pakistan

## Corresponding Author:

Salman Khan

Department of Medicine,  
DHQ Teaching Hospital,  
Gomal Medical College,  
Dera Ismail Khan - Pakistan  
Email: [salmankhn663@gmail.com](mailto:salmankhn663@gmail.com)

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## A B S T R A C T

**Background:** Hyponatraemia is frequently found in community acquired pneumonia (CAP) and contributes to higher rate of morbidity and mortality. There is paucity of data on mechanism and treatment of hyponatremia in CAP.

**Objective:** The present study was conducted with the aim of the present study was to determine the frequency of hyponatremia in patients admitted with community acquired pneumonia in tertiary care hospital.

**Methodology:** This prospective observational study was carried out on 1246 CAP patients admitted to the Medical Unit of DHQ hospital, Dera Ismail Khan from July 2020 to January 2022. Patients who experienced the onset of pneumonia and hyponatremia (with sodium levels  $\leq 130$  mmol/L) within the initial 48 hours of admission were incorporated into the study. In a total of eligible patient's admissions for community-acquired pneumonia (CAP), the prevalence and corresponding mortality rates for each subtype of hyponatremia were investigated. A subgroup of patients diagnosed with the Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIAD) was actively observed over time to record and study the natural progression of SIAD in the context of community-acquired pneumonia (CAP).

**Results:** The prevalence of hyponatremia ( $\leq 130$  mmol/L) in CAP patients was 9.5% (n=118). Among 118 hyponatraemia patients, the incidence of euvolaemic hyponatremia, hypovolemic hyponatremia (HEN) and hypotonic hyponatremia (HON) was 50.8% (n=60), 8.5% (n=10) and 40.7% (n=48) respectively. Out of 60 euvolaemic hyponatremia cases, the incidence of Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIAD) and steroid deficiency was 47.5% (n=56) and 3.4% (n=4) respectively. Hypovolemic hyponatremia consistently stemmed from concurrent congestive cardiac failure. The mortality rate was elevated among individuals in the HEN group compared to those in the HON, SIAD, or normonatremic groups.

**Conclusion:** In cases of community-acquired pneumonia (CAP), hyponatremia is typically attributed to either the Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIAD) or hypovolemia. However, it's important to note that while Hypovolemic Euvolemic Hyponatremia (HEN) is less frequently encountered, it carries a more adverse prognosis.

**Keywords:** Community-acquired Pneumonia; Hyponatraemia; SIAD

## Introduction

Community-acquired pneumonia (CAP) stands out as one of the most prevalent infections that lead to hospital admissions and patient fatalities. Each year, an estimated 5.6 million cases of pneumonia occur, resulting in over 1 million hospitalizations.<sup>1,2</sup> While many individuals with CAP experience a smooth recovery, it remains the primary cause of death attributed to infectious diseases and ranks as the seventh leading cause of mortality overall. Over the years, medical professionals have observed a connection between pulmonary conditions and the occurrence of hyponatremia. Specifically, hyponatremia has been documented in patients with conditions like lung cancer, pulmonary tuberculosis, pneumonia, legionella infection, and chronic obstructive pulmonary disease.<sup>3-5</sup>

The incidence of hyponatremia varies from 8% to 31% among community-acquired pneumonia (CAP) adult patients,<sup>6,7</sup> and its incidence is even higher in children, ranging from 27% to 45%, and particularly in cases of Legionella pneumonia (44%).<sup>8,9</sup> In CAP, hyponatremia typically presents as mild and asymptomatic.<sup>10</sup> However, another investigation reliably indicates that individuals with CAP and hyponatremia experience increased mortality, a higher likelihood of admission to the intensive care unit (ITU), and extended hospital stays.<sup>11</sup> Consequently, the presence of hyponatremia in CAP patients has been linked to elevated hospital costs. Hyponatremia is the prevailing electrolyte imbalance encountered in clinical practice. Additionally, it frequently co-occurs with pulmonary conditions, encompassing both infectious and neoplastic diseases.<sup>12</sup> In studies involving diverse patient populations, it has been observed that hyponatremia has an adverse impact on clinical outcomes. In the context of pneumonia, a recent study conducted at a single medical center revealed that 28% of patients with community-acquired pneumonia (CAP) exhibited hyponatremia upon admission to the hospital.<sup>13</sup> Notably, the presence of hyponatremia was not only linked to an extension of hospitalization (HLOS) but also a rise in hospital mortality. The approach to treating hyponatremia depends on its underlying cause.<sup>14</sup> Research in pediatric populations has indicated that most cases of hyponatremia in CAP are secondary to SIAD.<sup>15</sup> There is paucity of data on mechanism and treatment of hyponatremia in CAP.

## Objective

The present study was conducted with the aim of the present study was to determine the frequency of hyponatremia in patients admitted with community acquired pneumonia in tertiary care hospital.

## Methodology

This prospective observational study was carried out on 1246 CAP patients admitted to the Medical Unit of DHQ hospital Dera Ismail Khan from July 2020 to January 2022. Patients who experienced the onset of pneumonia and hyponatremia (with sodium levels  $\leq 130$  mmol/L) within the initial 48 hours of admission were incorporated into the study. In a total of eligible patient's admissions for community-acquired pneumonia (CAP), the prevalence and corresponding mortality rates for each subtype of hyponatremia were investigated. A subgroup of patients diagnosed with the Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIAD) was actively observed over time to record and study the natural progression of SIAD in the context of community-acquired pneumonia (CAP). Patients were categorized as hypovolemic, hypervolemic, or euvolemic based on established clinical and laboratory criteria. In cases where the initial parameters indicated the possibility of syndrome of inappropriate antidiuretic hormone secretion (SIAD), additional tests were performed, including measurements of plasma free thyroxine and thyroid-stimulating hormone (TSH), as well as the determination of 0900h plasma cortisol concentration.

SPSS version 27 was used for descriptive statistics. Quantitative variables are displayed as number (%) while qualitative parameters are represented as mean (SD) if they follow a normal distribution or median (IQR) if they do not. When applicable, we employed the  $\chi^2$  test to compare categorical variables and the t-test to compare continuous variables. The significance level was established at  $p < 0.05$ .

## Results

The incidence of hyponatremia ( $\leq 130$  mmol/l) in CAP patients was 9.5% ( $n=118$ ). Among 118 hyponatraemia patients, the incidence of euvolaemic hyponatremia, hypovolemic hyponatremia (HEN) and hypotonic hyponatremia (HON) was 50.8% ( $n=60$ ), 8.5% ( $n=10$ ) and 40.7% ( $n=48$ ) respectively. Out of 60 euvolaemic hyponatremia cases, the incidence of Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIAD) and steroid deficiency was 47.5% ( $n=56$ ) and 3.4% ( $n=4$ ) respectively. Hypovolemic hyponatremia consistently stemmed from concurrent congestive cardiac failure. The mortality rate was elevated among individuals in the HEN group compared to those in the HON, SIAD, or normonatremic groups. The plasma sodium concentration returned to normal levels in 7 out of 10 patients (70%) by day 7. Among the three patients who continued to experience hyponatremia, underlying bronchiectasis was identified as the cause. Clinical details of patients are shown in Table 1. Figure 1 demonstrate the incidence of

Table 1. Clinical details of patients

| Variables                    | Hyponatraemia<br>N=118   | Euvolaemic<br>hyponatraemia<br>(N=60) | Syndrome of<br>Inappropriate<br>Antidiuretic<br>Hormone<br>Secretion<br>(SIAD) (N=56) | Hypervolaemic<br>hyponatraemia<br>(N=10) | Hypotonic<br>hyponatremia<br>(N=48) | P-value |
|------------------------------|--------------------------|---------------------------------------|---------------------------------------------------------------------------------------|------------------------------------------|-------------------------------------|---------|
| Age (years)                  | 74 ± 4                   | 68 ± 8                                | 72 ± 6                                                                                | 67 ± 11                                  | 71 ± 7                              | NS      |
| Gender<br>Male<br>Female     | 58 (49.2%)<br>60 (50.8%) | 31 (51.7%)<br>29 (48.3%)              | 26 (46.4%)<br>30 (53.6%)                                                              | 4 (40%)<br>6 (60%)                       | 23 (47.9%)<br>25 (52.1%)            | NS      |
| Plasma<br>sodium<br>(mmol/L) | 134 ± 2.3                | 129 ± 3.4                             | 132 ± 4.2                                                                             | 128 ± 6.4                                | 125 ± 8.2                           | <0.0001 |
| Arterial BP<br>(mm Hg)       | 85 ± 4.6                 | 79 ± 5.8                              | 82 ± 4.2                                                                              | 68 ± 10.4                                | 76 ± 6.2                            | <0.0001 |
| Urea (mmol/L)                | 8.3 ± 4.2                | 7.3 ± 6.3                             | 5.6 ± 3.4                                                                             | 10.1 ± 3.8                               | 11.9 ± 3.2                          | <0.0001 |
| CRP (Nmol/L)                 | 103 (40-190)             | 166 (85-220)                          | 110 (85-201)                                                                          | 208 (140-250)                            | 129 (80-204)                        | <0.0001 |

different hyponatraemia in CAP patients.

## Discussion

Our research has demonstrated that hyponatremia is a common occurrence during hospitalization for pneumonia. Importantly, our findings reinforce the notion that hyponatremia has an independent influence on the length of hospital stay. Furthermore, we have established that hyponatremia has a detrimental effect on various critical outcomes, including the requirement for mechanical ventilation (MV), admission to the intensive care unit (ICU), and the duration of stay in the ICU. Prior studies have indicated that hyponatremia in the context of severe Legionella pneumonia, necessitating an ICU stay, serves as a robust independent predictor of mortality.<sup>16</sup> Nevertheless, there has been limited exploration into the connection between hyponatremia and outcomes among all patients admitted to the hospital with community-acquired pneumonia (CAP), with only one prior cohort study conducted at a single institution addressing this relationship.<sup>17</sup>

The etiology, or underlying causes, of hyponatremia in CAP is a crucial aspect to comprehend for two primary reasons. Initially, there is a higher mortality rate in individuals with hyponatremia caused by hypovolemic hyponatremia (HEN) and hypotonic hyponatremia (HON) when compared to cases attributed to the syndrome of inappropriate antidiuretic hormone secretion (SIAD).<sup>18</sup>

Therefore, the mechanism behind the development of hyponatremia plays a significant role in influencing patient outcomes.<sup>19</sup>

The substantial occurrence of hypovolemia comes as no surprise, given that skins and lungs are susceptible to water losses amplified by factors like hyperventilation and fever. Furthermore, volume depletion can worsen when there is inadequate oral rehydration, especially if the patient is experiencing gastrointestinal losses through vomiting or diarrhea. Identifying hypovolemia holds significant clinical importance, as it should prompt healthcare providers to prioritize volume expansion through intravenous fluids.<sup>20</sup>

In our study, we have also drawn attention to the presence of 8.5% hypovolemic hyponatremia cases, primarily attributable to concurrent cardiac failure.<sup>21</sup> A higher mortality rate was observed in these subgroups of patients. Consequently, diagnosing hypervolemic hyponatremia not only alters the treatment approach towards diuretic-based interventions with poorer outcomes.<sup>22</sup>

An earlier study conducted on 160 CAP patients reported that 20% patients inhaled steroids failed to pass synacthen test, suggesting that adrenal insufficiency is a frequent occurrence following the administration of exogenous glucocorticoids.<sup>23</sup> For patients who present with the SIAD and pneumonia, it is advisable to conduct routine assessments for adrenal insufficiency, especially if they have a history of prior steroid use.<sup>24</sup> Similarly, once the decision to admit a patient to the

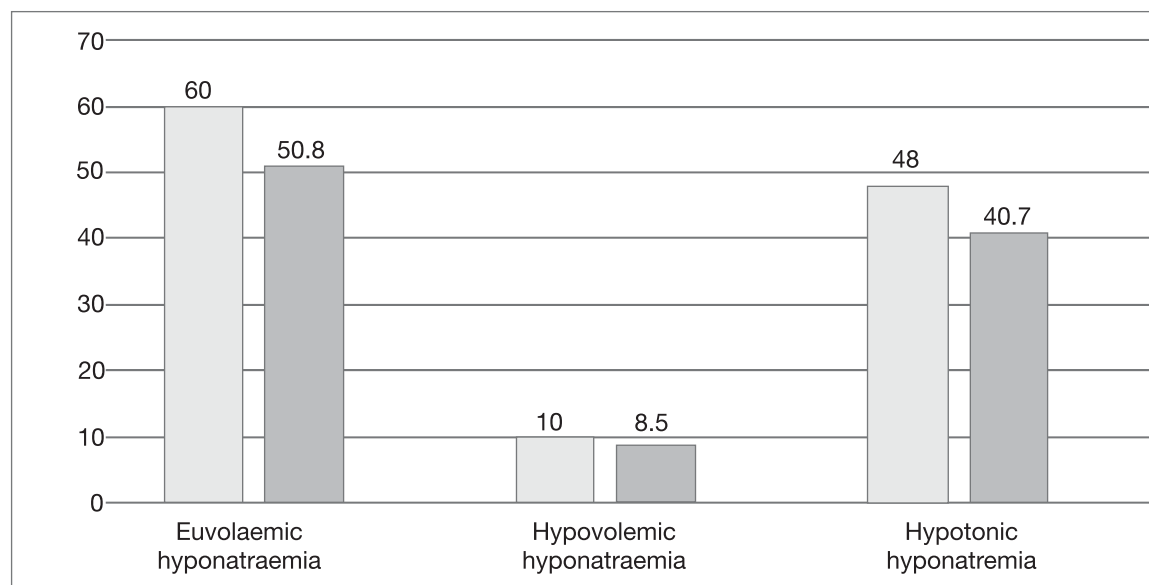


Figure 1. incidence of different hyponatraemia in CAP patients (N=118)

hospital has been made, focusing on factors that can be modified to improve hospital outcomes becomes a crucial aspect of pneumonia care. As an example, a randomized controlled trial demonstrated that a straightforward intervention, which involved ensuring that a patient with community-acquired pneumonia (CAP) spends at least 20 minutes sitting out of bed or walking during the initial 24 hours of hospitalization, reduced the average length of hospital stay (HLOS) by a full day without leading to an increase in adverse events.<sup>25</sup>

## Conclusion

In cases of community-acquired pneumonia (CAP), hyponatremia is typically attributed to either the Syndrome of Inappropriate Antidiuretic Hormone Secretion (SIAD) or hypovolemia. However, it's important to note that while Hypovolemic Euvoletic Hyponatremia (HEN) is less frequently encountered, it carries a more adverse prognosis. Through prospective observation, it has been shown that in SIAD cases, treatment with antimicrobials can lead to the normalization of both plasma arginine vasopressin (AVP) levels and sodium concentrations. However, if this reversal doesn't occur, it may indicate an underlying lung condition, such as bronchiectasis.

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