RESEARCH PAPER | Medical Science | Volume : 6 | Issue : 6 | June 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

# Frequency of Hyponatremia in Critically ill Patients

KEYWORDS: Hyponatremia, Critically ill patients, ICU, SIADH, APACHE II

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**ABSTRACT** *INTRODUCTION:Brain and Kidney has a major role in regulating normal sodium and water balance by neuroendocrine regulation. Hyponatremia is an important electrolyte disorder in critically ill patients, This study was carried out to identify the causes of hyponatremia in critically ill patients.*

*MATERIALS AND METHODS: It was a prospective observational study, where the clinical diagnosis and biochemical parameters were taken in all ICU admitted cases.*

*RESULTS: The frequency of hyponatremia on ICU admission was 33.6%, most were euvolumic, 60.1%. Females comprised of 57.4%. The mean age was 55.2 + _ 15.4 years. The hyponatremic patients had significant higher APACHE II score when compared to those of normal serum sodium levels, 31+- 9.1 and 25+_ 6.9 (P value < 0.01). 34.6% of hyponatremic group met the criteria for SIADH.*

*CONCLUSION: The major cause of hyponatremia is Syndrome of inappropriate Antidiuretic Hormone (SIADH) and it is an independent risk factor for poor prognosis.*

**INTRODUCTION:**

Hyponatremia is a common electrolyte abnormality seen in critically ill patients[1]. Hyponatremia is defined when seum sodium levels are < 135 mmol/L, hyponatremia has been reported in 1-15% of inpatients and is associated with mortality increase of 7- 60%[2,3,4]. The causes of hyponatremia are numerous, the main causes are Syndrome of inappropriate Antidiuretic Hormone (SIADH) or Cerebral salt wasting syndrome(CSWS) where the treatment for SIADH is fluid restriction and for CSWS is salt and fluid replacement. So, it is important to know the causes for hyponatremia for the better outcome of the patients.

Hyponatremia can be classified on the basis of serum osmolality, volume status and urinary sodium into hypertonic, isotonic and hypotonic types. Hypotonic hyponatremia is further classified into hypervolemic, euvolemic and hypovolemic as follows[5]

Hypovolemic hyponatremia: Decreased total body sodium and decreased total body water. The sodium deficit exceeding water deficit

Euvolemic hyponatremia: Normal body sodium with increase in total body water

Hypervolemic hyponatremia: Increase in total body sodium with greater increase in total body water.

The treatment of hyponatremia depends on the duration of hyponatremia and volume status of the patients. There is serious neurologic sequelae if hyponatremia is inappropriately treated. Limited data is available on whether the presence of hyponatremia on intensive care unit (ICU) admission is independently associated with excess mortality. This study was done to ascertain the frequency, aetiology and outcome in critically ill patients admitted to the ICU with hyponatremia.

**MATERIALS AND METHODS:**

A prospective observational study was conducted in ICU patients during a 6-month period. Hyponatremia was defined as a serum sodium level less than 135 mmol/L.The patients were divided into two groups: Hyponatremic (serum sodium level less than 135 mmol/L) and normal serum sodium (135-145 mmol/L) groups. Clinical history, Drug history particularly use of thiazides diuretics and detailed examination was taken in all the patients at the time of ICU admission. Parameters like age, gender , ICU stay in days, variables useful to calculate Acute Physiology and Chronic Health Evaluation II (APACHE II) were recorded. Laboratory data included values for complete blood count, fasting blood glucose, serumelectrolytes, serum urea, serum creatinine, serum uric acid, liver function tests, lipid profile, thyroid function tests. Urine sodium, urine osmolality, serum osmolality, were assessed and the patients were diagnosed to have Syndrome of inappropriate Antidiuretic Hormone (SIADH) if they met its criteria as proposed by Bartter and Schwartz in 1967[6]. Unpaired *t*-tests were used and all *P* values were 2-tailed and $P < 0.05$ was considered to be statically significant.

**RESULTS:**

A total of 300 patients were studied, out of them 199 patients had normal serum sodium (66.3%)and 101 pateints has hyponatremia at the time of ICU ( 33.6%) $p < 0.01$.

Volume : 6 | Issue : 6 | June 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

Males of 42.6% comprised of hyponatremia and 54.3% with normal serum sodium,where as Females of 57.4% with hyponatremia and 45.7% with normal serum sodium. The mean age of patients with hyponatremia was55.2 ± 15.4. The hyponatremic patients had significantly higher APACHE II score when compared to those of the normal serum sodium levels 31 ± 9.1 and 25 ± 6.98 ($P < 0.01$). 35 patients (34.6%) of the hyponatremic group met the criteria for a diagnosis of SIADH. (Table:1 and Table:2 about here)

**Table:1 Variables in study group**

| Variables | Hyponatremia (n=101) | Eunatremia (n=199) | P-Value |
|---|---|---|---|
| Age (yrs) | 55.2 ±15.4 | 58.5 ± 16.1 | |
| Female(%) | 57.4 % (58) | 45.7% (91) | < 0.05 |
| Male(%) | 42.6% (43) | 54.3%(108) | < 0.05 |
| ICU stay-days | 14 ± 5 | 10 ± 4 | < 0.05 |
| APACHE II score | 31 ± 9.1 | 25 ± 6.98 | < 0.01 |
| Serum sodium levels –mmol/L | 114 ± 5.4 | 136 ± 3.6 | <0.05 |

**Table:2 Causes for Hyponatremia**

| **Disorders** | No. of patients (n=101) | Percentage |
|---|---|---|
| SIADH | 35 | 34.6 |
| Sepsis | 21 | 20.7 |
| Renal failure | 18 | 17.8 |
| Heart failure | 11 | 10.9 |
| Thiazides | 11 | 10.9 |
| Liver cirrhosis | 3 | 2.9 |
| hypothyroidism | 1 | 0.9 |

**DISCUSSION:**

In our study, the frequency of hyponatremia on ICU admission was 33.6% of 300 ICU admissions, p value < 0.01 and goes in accordance with recent studies which have reported hyponatremia to occur in about 30-40% of ICU patients[1]

Females comprised of 57.4% of hyponatremic patients and 45.7% of normal serum sodium group. The risk of developing hyponatremia and its complications is higher in women and children compared with men, because of differences in respect of muscle mass and hormonal and anatomical factors[7].

In our study, SIADH is the most common cause of hyponatremia. In a study by Berghmans *et al*. also found that SIADH is the most frequent cause of hyponatremia[8]. Coussement *et al*. also found SIADH as a common and potentially lethal complication in critically ill patients[9].

In our study severe sepsis is the second most cause for hyponatremia. Hannon and Boston observed that hyponatraemia associated with sepsis is known to have an increased morbidity and mortality. The cause of this phenomenon is unknown, but may be related to dilution of the extracellular space with retained exogenous fluid[10].

Bissram *et al*. found that symptomatic hyponatraemia was associated with volume depletion (32.6%), congestive heart failure (HF) (26%), SIADH (26%), thiazide diuretic use (26%) and selective serotonin re-uptake inhibitor use (26%). In 21.7% of cases, the cause was multifactorial (congestive HF, SIADH or medication use with volume depletion[11].

In our study, hyponatremic patients had longer ICU stay, and had an increased mortality. Shakhe *et al*. also found an increased mortality and ICU length of stay and increased ventilator days among hyponatremic patients admitted to ICU[12].

In a large a retrospective study in 77 medical, surgical and mixed ICUs in Austria, with a database of 151,486 adults admitted consecutively over a period of 10 years Funk *et al*. demonstrated that all types and grades of dysnatremia were associated with increased mortality[13].

However, taking into account all comorbidities and relative severity of illness mortality comparison would require a large scale regression analysis and subgroup analysis as per volume status for a definitive comment on prognosis[14].

**CONCLUSION:**

Hyponatremia is a frequent finding in the critically ill; SIADH is the most common cause of hyponatremia in critically ill. Pneumonia being the leading cause of SIADH. Severe sepsis, trauma, surgery (elective more than emergency), thiazides and other drugs (SSRIs and Carbamazapine), renal failure, HF, liver cirrhosis, subarachnoid haemorrhage and,hypothyroidism are other causes for hyponatremia ($P < 0.05$). Hyponatremic patients had longer ICU stay and longer mechanical ventilation days and higher mortality. Patients with hyponatremia had a higher APACHE II score and higher mortality rate than those with normal serum sodium; so, it is important to emphasize on serum sodium levels for the better outcome of patients.

**ACKNOWLEDGEMENTS:** The authors are thankful to the staff of Critical care and Department of Biochemistry for their cooperation in the study.

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Volume : 6 | Issue : 6 | June 2016 | ISSN - 2249-555X | IF : 3.919 | IC Value : 74.50

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