

## **A Prospective Study of the Clinico-Aetiological Profile of Hyponatremia in ICU Patients**

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### **I. Introduction**

Hyponatremia is a disorder that is commonly seen in ICU patients. Hyponatremia occurrence in ICU patients is estimated to be approximately 12%, even though the exact occurrence may vary. The variation in incidence perhaps might have been influenced by the criteria selected for hyponatremia estimation, as well as its antecedent causes. The most frequently used value of serum sodium concentration to be considered as hyponatremia is below 135 mEq/l [1,2]. By definition hyponatremia is nothing but an excess of body water relative to sodium. Amongst all electrolyte abnormalities, hyponatremia is the frequently reported one and is found in 6% of all hospitalized patients [3,4]. Though incidence is quite high, often the symptoms are not manifested especially if hyponatremia is mild or if reduction in sodium content is gradual. In contrast, an abrupt development of hyponatremia where plasma sodium goes down below 120 mmol / l often results in increased morbidity, and at times even leads to mortality [5,6]. Symptoms and its severity show a wide discrepancy i.e from having a mild lethargy or sometimes even lead to coma state. The consequences are not only due to hyponatremia itself but also are a result of antecedent factors. Cardiac failure [7] and hepatic cirrhosis [8] are some of the conditions where severity of hyponatremia has prognostic implications. Drug induced hyponatremia as well as hyponatremia due to other iatrogenic causes is also very common. While treating hyponatremia different factors have to be considered. Rapidity of development, severity of symptoms, the causative factor, presence of CNS complications etc needs to be addressed when managing a case of hyponatremia. Common strategies adopted are sodium-containing crystalloids, diuretics, and vasopressin receptor antagonist.

#### **1.1 Body Changes And Its Responses To Hyponatremia**

As soon as the sodium levels starts dropping, excess water begins to move into neuronal cells which cause brain to swell up, with a consequence of reduction in intracellular osmolality. These changes lead to an adaptive response by brain cells. Electrolytes move out of cells that results in partial restoration of neuronal cell volume within minutes to hrs. But it takes many days to regain the normal brain volume by losing organic solutes. But despite these adaptations, the osmolality is not corrected and remains low even though brain volume is restored. The persistence of low osmolality can lead to neuronal injury if not corrected properly. In contrast, a rapid correction can also result in brain injury. Hence the correction should be at optimal rate as per the latest guidelines [11].

#### **1.2 Classification:**

Hyponatremia can be divided into 3 subgroups depending on volume status: Hypervolemic, Hypovolemic, and Euvolemic. The rationale behind this classification is to aid in the acute management of hyponatremia even if exact aetiology is not sure or is yet to be determined.

#### **1.3 Clinical Features**

Manifestations are diverse and may vary from patient to patient. Some of the factors are age, ECF volume, and abruptness of decrease in serum sodium level - the most important [2]. The most common as well as important symptoms and signs of hyponatremia are especially related to development of cerebral edema. Cellular shift of water in other tissues also plays a role. Often the patients don't have any symptoms with very mild hyponatremia (130-135 mmol/L) but they often complain about lethargy or even nausea if sodium levels are in the range of 125-130 mmol/L. With further reduction in sodium levels (115-120 mmol/L), the patient may experience headache and even they might have signs of confusion and mental clouding on examination. Without a drop in serum sodium below 120mEq/l, the more severe manifestations such as stupor, seizures and coma is rare. Adaptive responses mentioned above happen only when the development of hyponatremia is gradual and chronic. Symptoms also depend on underlying conditions. A proper history and thorough examination will give clues to etiologies related to renal causes, hepatic causes, cardiac causes, hypoadrenalism, hypothyroidism, hypopituitarism etc. Co-existent metabolic abnormalities such as acidosis, hypoxia etc. worsens the clinical manifestations. Restlessness, agitation, myopathy, ataxia, psychosis, apathy, are some of the other manifestations. While assessing volume status parameters such as patients BP, heart rate, skin turgor, CVP, fluid

balance charts etc has to be considered [46,47]. On examination patient may have altered sensorium, diminished deep tendon reflexes, Cheyne-Stokes respiration, pseudo bulbar palsy etc. A rare but serious complication ‘osmotic demyelination’ can occur after rapid correction of hyponatremia [54-56]. Hepatic failure, potassium depletion and malnutrition increase the risk of this complication [18, 57].

## II. Materials And Methods

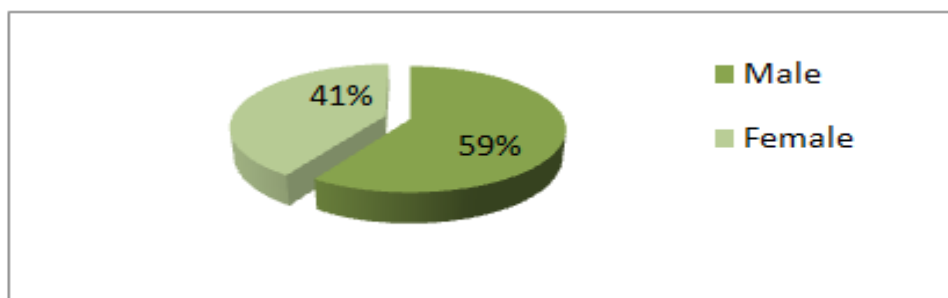
Study design is Prospective cross-sectional study on clinical Profile of hyponatremia patients. Study was conducted at Yenepoya Medical College Hospital on 100 patients above 18 years from June 2015 to March 2016 after ethical clearance and consent. Hyponatremia was defined as serum sodium of < 135 mEq/L. Serum samples were collected, analyzed for hyponatremia and reported by the biochemist. Data on age, sex, diagnosis, BP, heart rate, blood glucose levels and urea, serum creatinine and electrolytes, complete blood counts, urine routine examination with urine osmolality and urine sodium, and also serum osmolality were collected. Imaging of chest, abdomen and heart were done with X-ray, ultrasound and 2D-echo respectively in indicated patients.

## III. Results And Discussion

A total of 100 patients with hyponatremia were studied. These patients were admitted to ICU in Yenepoya Medical College between June 2015 and March 2016.

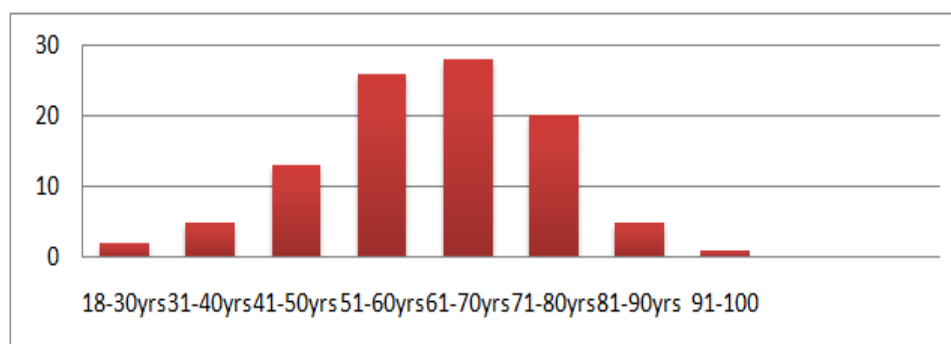
### 3.1 Demographics

Among the subjects 59% were males and 41% were females.



### 3.2 Age Distribution

Majority of patients were among the age groups 51 - 60 yrs and 61 - 70 yrs. The mean age was found to be 55.05 years ± 2SD



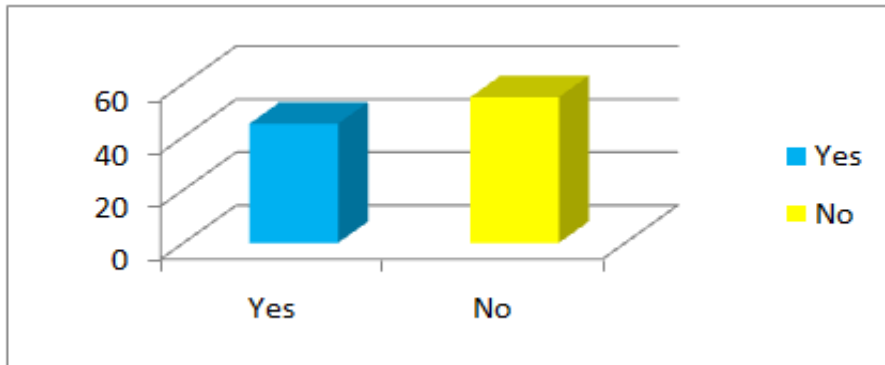
### 3.3 Co-relation of age distribution with clinical profile of hyponatremia

Symptomatic age group was predominantly the elderly population (51 – 80) yrs with Confusion being the commonest manifestation, seizures and coma also occurring in the same age group.

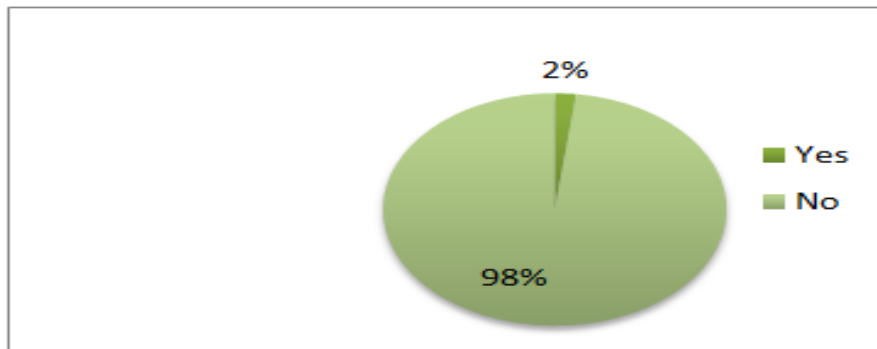
Age group	Confusion	Quadripareisis	Seizure	Delirium	Tremor	Hallucination	Coma
18-30yrs	-	-	-	-	-	-	-
31-40yrs	-	-	-	-	-	-	-
41-50yrs	5	2	1	-	1	-	-
51-60yrs	10	5	3	2	3	1	3
61-70yrs	15	5	2	1	5	1	3
71-80yrs	11	3	1	1	2	-	1
81-90yrs	3	1	1	-	1	-	1
91-100yrs	1	-	-	-	-	-	-

**3.4 Frequency of symptoms**

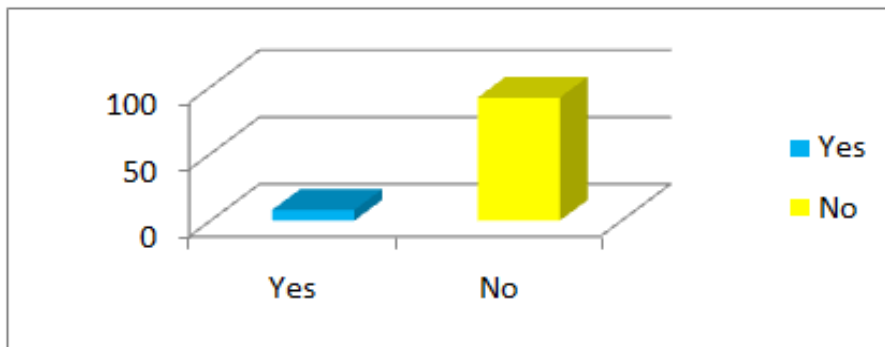
**(i) Confusion:** In our study of total of 100 patients, 45 patients had presentation of confusion which was highest among all variables.



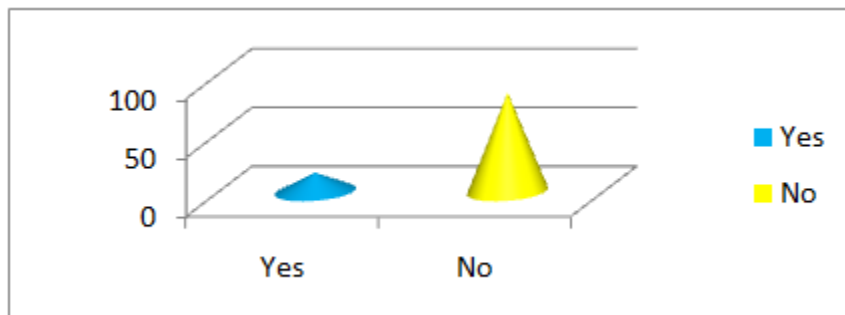
**(ii) Hallucination:** 2 patients included in the study population had hallucinations.



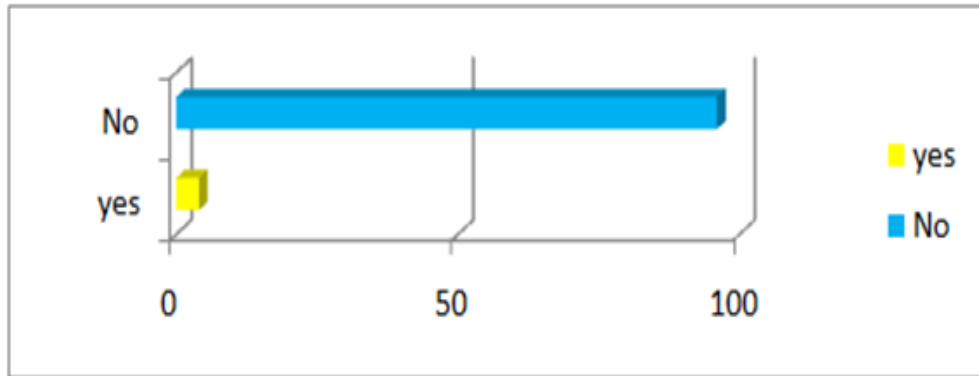
**(iii) Seizures:** 8 patients in the study population had seizures.



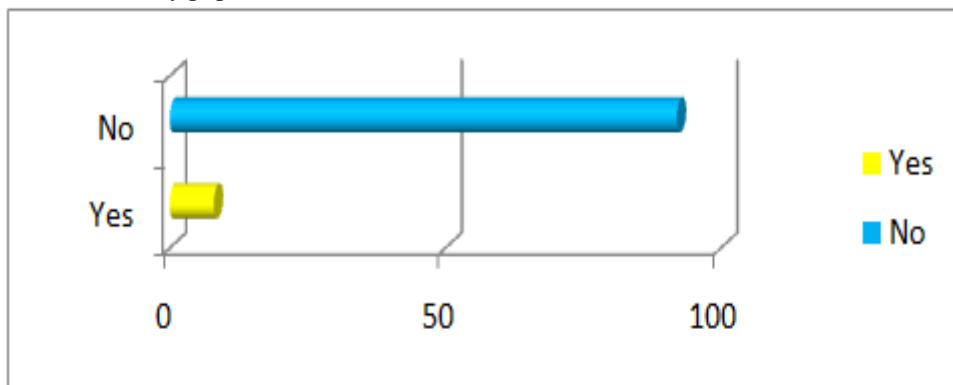
**(iv) Quadriparesis:** 16% of the study population had hyponatremia and associated quadriparesis.



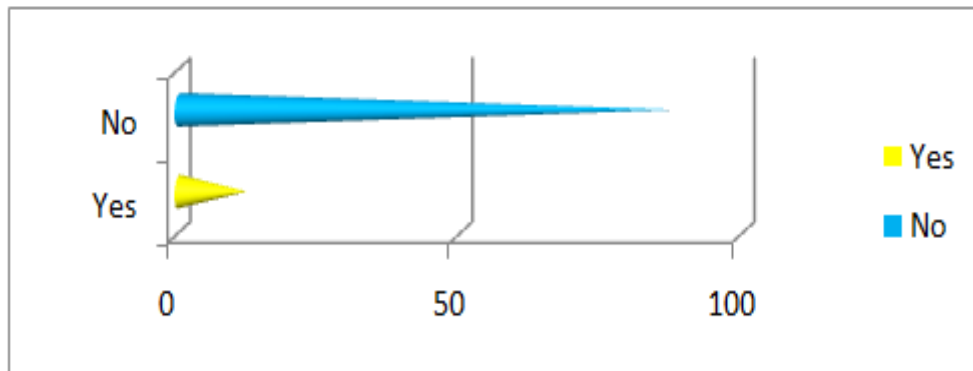
(v) **Delirium:** 4% of the study population suffered from acute delirium.



(vi) **Coma:** 8% of the study population had coma



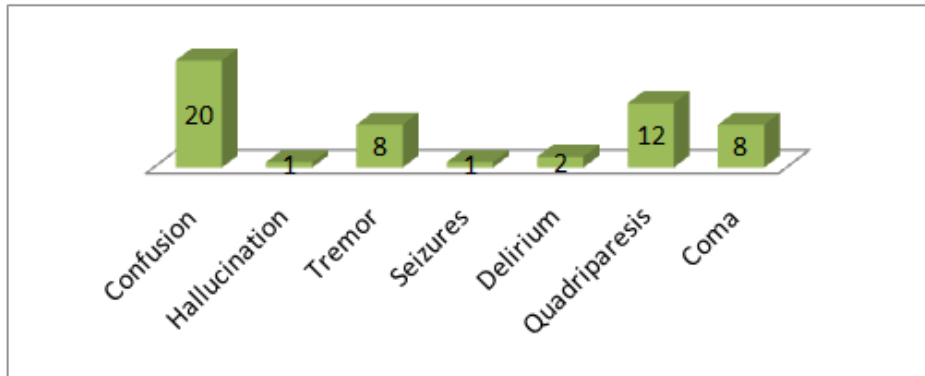
(vii) **Tremors:** 12% patients in the study population had associated tremors.



### 3.5 Correlation of symptoms to different sodium levels

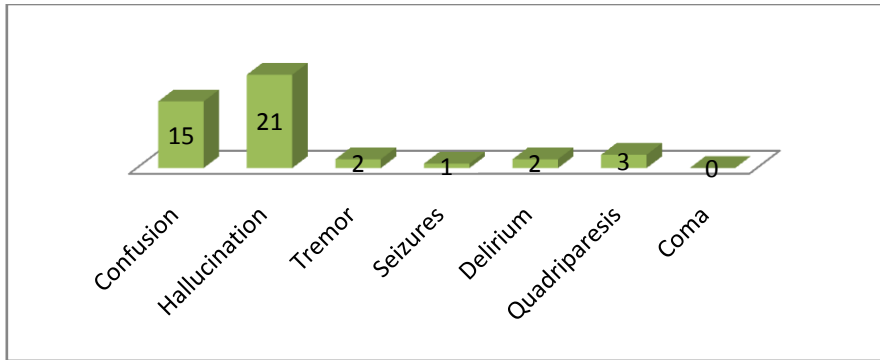
#### i. Clinical profile at serum sodium level < 120 mEq / L.

- Confusion: (20)
- Tremors: (8)
- Hallucinations: (1)
- Seizures: (7)
- Delirium: (2)
- Quadriparesis: (12)
- Coma: (8)



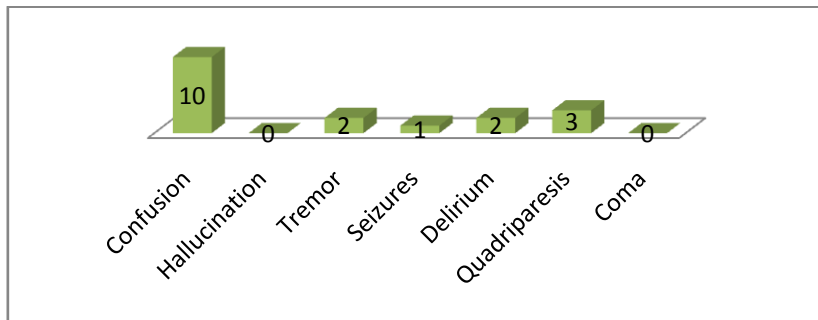
**ii. Clinical profile at serum Sodium level 120 - 125 mEq / L**

Confusion (15)  
 Tremors (2)  
 Hallucinations (1)  
 Seizures (1) Delirium (2)  
 Quadriparesis(3)  
 Coma (0)



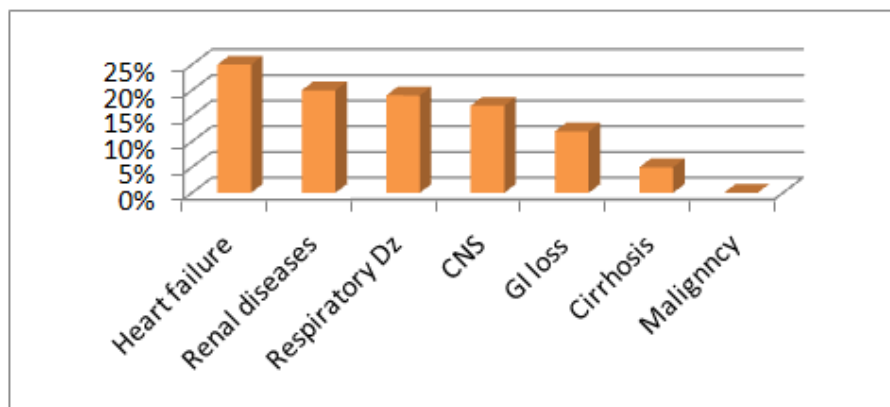
**iii. Clinical profile at serum Sodium level 125 - 135 mEq / L**

Confusion: (10)  
 Tremors: (2)  
 Hallucinations: (0)  
 Seizures: (0)  
 Delirium: (0)  
 Quadriparesis: (1)  
 Coma:(0)



**3.6 Etiological Classification**

Most common cause of hyponatremia was heart failure constituting 25% of patients followed closely by chronic kidney disease with 20% patients. 19% was diagnosed with lower respiratory infection or disease. 15% had stroke and 2% had meningitis. 12% patients presented with gastroenteritis causing hyponatremia. 5% had cirrhosis of liver. Malignancy was diagnosed in 2 patients with one case each of lung and liver malignancy. Among heart failure and CKD patients 50% and 80% were on diuretics respectively prior to admission.



### 3.7 Mortality

In this study of 100 patients there were 12 deaths, heart failure being the commonest etiology accounting for 6 deaths.

## IV. Conclusion.

Since so many conditions can cause hyponatremia with a consequence of further deterioration in health, physicians and intensivists has to be wary about it and needs to actively look for the presence of hyponatremia so that it can be corrected as early as possible. A delay in recognising and managing hyponatremia prolongs the hospital stay and has the potential for developing complications. Preventable causes such as reduced intake especially in patients on liquid diet or Ryle's tube feeds needs to be addressed and avoided by employing a regular serum sodium monitoring. A prompt monitoring of diuretic and intravenous fluid use should be done as excessive as well as inadequate use both can lead to hyponatremia. Urine sodium and osmolality measurement will help in correctly delineating the type of hyponatremia.

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