

**CLINICAL OUTCOMES OF HYPONATREMIA IN HOSPITALISED ELDERLY
PATIENT'S RESIDING NEAR SEACOAST AREAS****Bellam Meghana^{1a}, Maganti Yamuna^{1b}, H. G. Revanasiddappa², Singanamala Chandrababu³, Thota
Madhulekha⁴, Shaik Ahammad Basha⁵ and Pasupuleti Sreenivasa Rao^{*6abc}**^{1a,1b}Student, Dept. of General Medicine, Narayana Medical College and Hospital.^{2,3}Professor, Dept. of General Medicine, Narayana Medical College and Hospital.⁴Assistant Professor, Department of General Medicine, Narayana Medical College and Hospital.⁵Assistant Professor, Dept. of Community Medicine, Narayana Medical College and Hospital.^{6a}Senior Research Scientist, Central Research Laboratory /Dept. of ARC, Narayana Medical College and Hospital.^{6b}Professor, Department of Biochemistry, Narayana Medical College and Hospital.^{6c}Research Advisory Professor, Narayana College of Pharmacy, Nellore-524003, Andhra Pradesh, India.***Corresponding Author: Dr. Pasupuleti Sreenivasa Rao****Senior Research Scientist & Head** Central Research laboratory /Dept of ARC**Professor**, Department of Biochemistry Narayana Medical College and Hospital Nellore-524003, Andhra Pradesh, India.

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ABSTRACT

Electrolyte disorder of sodium and water metabolism are commonly seen in clinical practice. Elderly age group are more prone for hyponatremia. Many of hospitalised elderly patients with severe hyponatremia association between causes, outcome is not clear. Hence, the present study is to understand the etiology, symptoms, and the outcome of elderly patients who were the residents of sea coast areas. A hospital based study conducted at Narayana Medical College & Hospital, which is situated within 10-15 km radius of seacoast in Nellore district of Andhra Pradesh, India. 50 subjects who were residing near sea coastal areas were selected, out of these hyponatremia was observed more in age group in between 71-80 years with 62% who were more compared to other age groups and 64% of male patients were observed comparatively more than females who were about 36% only. Findings indicate that hyponatremia incidence is high in patients with hypertension 46% followed by diabetes mellitus with 34%, altered sensorium is the most common CNS symptom observed in 32%. Most common cause of hyponatremia is SIADH which was caused by CVA followed by pneumonia. From the study it is observed that euvoolemia and hypovolemia is more in symptomatic patients, hypervolemia is observed more in asymptomatic patients where mortality rate is also more in hypervolemic subjects. Thus the present study concludes that overall risk factors for hyponatremia are elderly age group with comorbidities like DM, HTN, causes like SIADH, hydration status. More frequently presented with neurological symptoms, SIADH is the largest subgroup with euvolemic hyponatremia. Majority of mortality were caused by underlying primary illnesses. This demands clinicians should be aware of prevalence, occurrence of hyponatremia in elderly and approach in a systemic approach using simple standardized diagnostic methods, can considerably improve the assessment and therapy of hyponatremia.

KEYWORDS: Hyponatremia, Elderly age group, seacoast areas.**INTRODUCTION**

Sodium and water metabolism remains as common problems that are diagnosed in clinical practice among elderly age group patients. High rates of Morbidity and mortality resulting from rapid correction and from hyponatremia itself is seen in hospitalized patients.^[1,2] In India earlier studies reports it's prevalence is in between 18% to 22.3% where as in another study conducted in hospitalised patients revealed its occurrence was in the range of 1% to 40%.^[3]

Hyponatremia is defined based on the serum sodium concentration ie, <135mEq/L. Based on serum sodium levels three types of hyponatremia is defined.^[4]

In Mild hyponatremia the sodium levels in the serum will be in between 130-134 mmol/L, while in moderate hyponatremia it is between 120 - 129mmol/L, where as in severe hyponatremia it will be less than 120mmol/L, which results in significant morbidity and mortality. Severe hyponatremia patients clinically presents in many ways from mild asymptomatic to non-specific symptoms like nausea, headache, fatigue to severe neurological symptoms like seizures, altered sensorium, coma.^[5]

Some patients presented with altered sensorium were residents of coastal areas who were exposed to harsh environmental conditions like hot, humid climate, poor salt intake, are the causing factors and more susceptible to develop hyponatremia. Hence early diagnosing and management of hyponatremia along with restoring sodium and water homeostasis can reduce the morbidity and mortality.

Further Hyponatremia is majorly classified into three general categories based on volume of ECF (Extra cellular Fluid) that includes hypovolemic hyponatremia, hypervolemic hyponatremia and euvolemic hyponatremia.^[6,7] In the first type of hypovolemic hyponatremia, fluid loss is the major cause, which occurs due to vomiting, diarrhoea, and sometimes severe burns, and even bleeding; excess use of diuretics more with thiazides, and subjects with pancreatitis, and well as in subjects with deficit of mineralocorticoids, elevates ADH (Antidiuretic Hormone) secretion which helps in fluid retention. Sometimes renal factors also influence fluid loss, results in urine sodium levels $>40\text{mEq/L}$, whereas in extra renal loss urine sodium levels $<20\text{mEq/L}$. This fluid loss is due to renal factors causing hyponatremia, leading to serum hypo-osmolality, further causing urine-osmolality $>100\text{-}300\text{mOsm/kg H}_2\text{O}$, and as well as urine sodium levels were elevated $>40\text{mEq/L}$, were majorly observed in cerebral salt wasting condition which was an uncommon cause and also observed in salt wasting nephropathy.^[8]

In second type hypervolemic hyponatremia the major causes are Cirrhosis of liver and, heart failure. Kidneys receives less blood circulation due to decreased cardiac output which enhances ADH secretion levels causing sodium and water retention, in which water is more retained, leading to dilutional hyponatremia. Hypotonic fluids, stressful conditions, primary polydipsia are commonly noticed in psychiatric patients. Moreover the above said factors are often observed among hospitalised elderly patients where capacity of diluting urine is compromised resulting in fluid retention.^[7]

In third type Euvolemic hyponatremia, the major causing factors includes SIADH (Syndrome of inappropriate anti-diuretic hormone secretion), Hypothyroidism, Adrenal insufficiency, stress, and medications. In addition comorbidities contributes high rates of morbidity and mortality. Among elderly, aging process affects kidneys and other major organs, enhanced by multiple risk factors, and as well as their sedentary life style that includes dietary habits causing hyponatremia, whereas the other factors like low socioeconomic status, environmental changes also causes hyponatremia.^[9]

SIADH induced hyponatremia arises due to Tuberculosis, CNS diseases and frequent usage of other drugs, which alters ADH secretion also known as vasopressin from posterior pituitary gland. Moreover the treatment strategies of SIADH is completely different to

the treatment of other causes of hyponatremia.^[10] Thus the early diagnosis and differentiation among the various types, and causes of hyponatremia is necessitated, particularly in elderly age group patients to prevent misdiagnosis, mismanagement and mortality.^[5,11] Moreover In India the studies on the clinical outcome of hyponatremia in elderly patients who were residing near the seacoastal areas is limited. Thus the present study is undertaken to determine clinical outcome of hyponatremia in elderly patients who were residing near the sea coastal areas of Nellore district, Andhra Pradesh State, India.

MATERIALS AND METHODS

Study Design: A hospital based observational study has been carried out in inpatient section of the department of general medicine, Narayana Medical College & Hospital(NMCH), Nellore, Andhra Pradesh, India, situated near seacoast areas.

Period of Study: The study was carried out from DEC 2019-MAY 2021, over a period of 18 months.

Inclusion Criteria: All patients of age more than 60 years of both genders who were hospitalised, diagnosed as hyponatremia by serum sodium levels less than 125mEq/L residing along the sea coast with informed consent are included in the study.

Exclusion Criteria: Those who were not willing/interested, age group of less than 60 years of both genders, were excluded.

Sample Size: Study subjects : 50

Details of The Study: All hospitalised elderly residents of sea coast areas were taken in the study group. After approval from the Institute Ethics Committee we advised Routine blood investigations like CBP, RBS, RFT, LFT, SERUM ELECTROLYTES, VIRAL SCREENING, and urine investigations like CUE, urine spot sodium, Imaging studies as required were done. Patients having serum sodium less than 125mMol/L are taken and serum osmolality, urine osmolality, urine spot sodium are measured accordingly. In the present study, With clinical diagnosis and blood investigations patients were classified into hypovolemic, isovolemic, hypervolemic hyponatremia. Correction of hyponatremia as per guidelines, formulas is done to these patients and their outcome was recorded.

Statistical analysis

For statistical analysis, SPSS- 16 version software is used. Differences among various subjects were obtained through 't-test' for testing continuous variables. 'Chi-Square test' was also performed. P value of <0.05 was considered as significant and followed the procedure's as described.^[12,13,14]

RESULTS

The study was conducted among elderly patients' who were residing along the seacoast areas in Nellore district Andhra Pradesh. Hospitalised Subjects with hyponatremia nearly 50 were enrolled in the study with their informed consent, in the Department of General Medicine, Narayana Medical College and Hospital, Nellore. In this study, Out of 50 subjects, maximum subjects are in the age group of 71-80 years (62%) followed by above 80 years of age group (22%) and 61-70 years (16%) respectively. Out of 50 subjects 32 (64%) are males and 18 (36%) were females. Among the study subjects, several co-morbidities were noticed. The most common co-morbidity was hypertension, observed in 46% cases, followed by DM (diabetes mellitus) noticed in 34% of cases. Few cases presented with co-morbidities the include CAD (Coronary artery disease), CLD (Chronic Liver disease), CKD (Chronic Kidney Disease), Hypothyroidism with 2%, 6%, 4%, and 4% respectively. Most of the subjects were symptomatic with vomitings (34%) followed by altered sensorium, nausea, drowsiness, seizures, lethargy and headache with 32%, 32%, 26%, 10%, 8%, and 6% respectively. In this study 32% subjects were Asymptomatic. (Table-1). Next we assessed the severity of hyponatremia among the elderly based on serum sodium levels as mentioned earlier. 14% of the cases exhibited their serum sodium levels in the range of 100-105 mEq/L, followed by 26% in between 106-110 mEq/L, while 22% in 111-115 mEq/L range, and 38% in 116-125 mEq/L range respectively.

Next we studied Hydration status in hyponatremia subjects with Euvolemia, hypovolemia, and hypervolemia. The majority of cases up to 58% reported with Euvolemia, followed by 24% of subjects with hypervolemia, and subsequent 18% of cases with hypovolemia were observed. Next we elucidated the association between levels of hydration status and symptoms among the elderly subjects. Findings indicate that the hypervolemia is more in asymptomatic subjects (66.6%) observed, while euvolemia (82.76%) and hypovolemia (66.6%) in symptomatic subjects exhibited clear cut demarcation. Further we studied the hydration status, when compared with chi square test, it showed statistically significance as $p < 0.05$. (Table-2).

Later we studied the common causes for hyponatremia. Earlier studies revealed that SIADH is more common. Hence we also assessed among the elderly and nearly 48% of cases with SIADH; 13 cases are associated with neurological disorders, and as well as other diseases like CVA presented in 10 cases, subsequent follow up by 3 cases with meningitis, 9 with pulmonary disorders, 7 with pneumonia, 2 tuberculosis, 1 with drug

(SSRI'S) induced, and the last case reported with rheumatoid arthritis.

Next we evaluated the other causing factors for hyponatremia. We observed few cases up to 14% related to renal disorders, 12% cases in CLD (Chronic liver diseases), 8% cases related to GI (Gastro intestinal) loss, 6% of cases with both CCF (congestive cardiac failure) and sepsis, and the last few cases up to 2% reported with hypothyroidism and drugs. Among the subjects assessed, we observed few cases with SIADH had euvolemic hyposmolar hyponatremia. Similarly few cases presented with cirrhosis, CCF, and renal diseases had hypervolemic hyposmolar hyponatremia while majority of cases with GI loss had hypovolemic hyposmolar/iso osmolar hyponatremia which has statistical significance $p < 0.001$ (Table-3).

Next we studied the rate of mortality. The mortality rate was up to 12%, out of which 25% reported in hypervolemic cases, followed by 11.11% in hypovolemic cases and 6.9% in euvolemic cases respectively. Later we compared the rate of mortality with hydration status using Chi square test, and found insignificant $p > 0.05$. (Table-4).

Table 1: Characteristics of Study Subjects In Relation To Different Variables.

VARIABLES	N	%
AGE GROUP		
61-70	8	16
71-80	31	62
>80	11	22
SEX GROUP		
MALE	32	64
FEMALE	18	36
COMORBIDITIES		
CAD	1	2
CLD	3	6
CKD	2	4
DM	17	34
HYPOTHYROIDISM	2	4
HTN	23	46
SYMPTOMS		
ALTERED SENSORIUM	16	32
DROWSINESS	13	26
SEIZURES	5	10
LETHARGY	4	8
HEADACHE	3	6
NAUSEA	13	32
VOMITING	17	34
ASYMPTOMATIC	16	32

Table 2: Hydration Status According To Symptoms In Hyponatremia Patients.

HYPONATREMIA	SYMPTOMATIC N=34(%)	ASYMPTOMATIC N=16(%)	TOTAL N=50(%)	P VALUE
EUVOLEMIA	24(82.76%)	5(17.24%)	29(58%)	0.006
HYPERVOLEMIA	4(33.33%)	8(66.67%)	12(24%)	
HYPOVOLEMIA	6(66.67%)	3(33.3%)	9(18%)	

Table 3: Causes of Hyponatremia with Hydration Status.

CAUSES	EUVOLEMIA N=29(%)	HYPERVOLEMIA N=12(%)	HYPOVOLEMIA N=9(%)	TOTAL N=50(%)	P VALUE
CCF	0(0%)	3(100%)	0(0%)	3(6%)	<0.01
CKD	0(0%)	1(100%)	0(0%)	1(2%)	
CLD	1(16.67%)	4(66.67%)	1(16.67%)	6(12%)	
DRUGS	1(100%)	0(0%)	0(0%)	1(2%)	
GI LOSS	1(25%)	0(0%)	3(75%)	4(8%)	
HYPOTHYROIDISM	0(0%)	0(0%)	1(100%)	1(2%)	
RENAL	4(28.57%)	4(57.14%)	1(14.29%)	7(14%)	
SEPSIS	0(0%)	0(0%)	3(100%)	3(6%)	
SIADH	0(100%)	0(0%)	0(0%)	24(48%)	

Table 4: Outcome Among Study Subjects According To Hydration Status.

OUTCOME	EUVOLEMIA N=29(%)	HYPERVOLEMIA N=12(%)	HYPOVOLEMIA N=9(%)	TOTAL N=50(%)	P VALUE
SURVIVOR	27(93.10%)	9(75%)	8(88.89%)	44(88%)	0.27
NON SURVIVOR	2(6.90%)	3(25%)	1(11.11%)	6(12%)	

DISCUSSION

Earlier studies clearly demonstrated the possible risk factors responsible for Hyponatremia, which affects nearly 15 to 30% of patients in tertiary care institutions.^[3] The elderly people are most likely to develop this condition because of their reduced ability in maintaining water and electrolyte homeostasis in response to dietary and environmental changes. There is a limited information about the prevalence of hyponatremia in elderly patients residing along the sea coast areas in India.^[15] Previous studies revealed that elderly age group people are more susceptible to dehydration and electrolyte abnormalities.^[15] Causes like physical disability, restricting fluid intake, iatrogenic causes, pre-existing comorbidities, multiple drug intake, make elderly age group people more susceptible to dehydration and electrolyte imbalances.

Several studies revealed and demonstrated the potential causing factors for hyponatremia^[5,16,17], to the best of our knowledge; there has been no direct demonstration of hyponatremia due to environmental changes among the elderly patients residing near sea coast areas of southern India. In one study it has shown that prevalence of hyponatremia in elderly is more in Karwar city of coastal Karnataka but its association with causes, outcome has not been studied. Hence, studying the clinical profile of hyponatremia with outcomes is essential in order to prevent, control, and effective management of complications. Therefore the present study is conducted in an aim to assess the clinical outcome of hyponatremia in hospitalised elderly subjects along the sea coast of Nellore district of Andhra Pradesh in southern India.

In the present study, 50 subjects were enrolled. Initially various variables were assessed and findings were demonstrated in Table-1. Previous studies have reported that mean age group developing hyponatremia is 73 +/- 6 years.^[1,18] Therefore, we studied these variables and from our study age group of 71-80 years (62%) followed by >80 years (22%) and 61-70 years (16%) respectively. The above findings demonstrate that the elderly people are predisposed to hyponatremia due to reduction in GFR (Glomerular Filtration Rate), diminished ability to preserve salt by the kidney, elevated levels of ADH secretion in response to osmotic stimulation, as well as drugs taken by patients, and the presence of comorbidities. 64% were males which was comparatively more as compared to females 36%.^[18,19] Among the comorbidities assessed, from the study we found that hypertension is the most common comorbidity associated with hyponatremia followed by diabetes mellitus with 46% and 34% respectively which was also observed in other studies too.^[18,19] Among the symptoms assessed, we screened CNS symptoms like altered sensorium, drowsiness, seizures, lethargy and headache, which was found in 32%, 26%, 10%, 8%, and 6% of the subjects respectively. Mostly cases up to 32% in our study are asymptomatic, whereas other studies demonstrated that the drowsiness was the most common neurological symptom with 42%, lethargy is the most common symptom noticed in 50% of the cases.^[17,18,20]

In Table-2 we observed hydration status in hyponatremia subjects, 58% of cases presented with euvoolemia, while 24% with hypervolemia and 18% with hypovolemia were enrolled respectively, which was correlated with

other studies.^[18,19,21] From our study, we noticed that majority of the patients with hyponatremia had SIADH(48%), followed by Renal disorders (14%), CLD(12%), GI loss(8%), CCF(6%) as well as sepsis(6%), CKD (2%), hypothyroidism(2%), and drugs(2%) respectively. Moreover the subjects with SIADH also had euvolemic hypoosmolar hyponatremia demonstrated in Table-3. Similarly majority of the subjects with CLD (66.6%), CCF, CKD, Renal diseases had hypervolemic hypoosmolar hyponatremia and with few cases with GI loss and Hypothyroidism had hypovolemic hypoosmolar hyponatremia which showed statistical significance as $p < 0.05$.

In the present study mortality was reported in 12% of the subjects which was comparable with other studies too.^[1] The Table-4 demonstrates the outcome of hydration status in the study subjects and the mortality rate was reported more in hypervolemic 25% followed by hypovolemic 11.11% and euvolemic 6.69% respectively. However statistical analysis revealed insignificant difference which was found as $p > 0.05$ using chi square test. Interestingly few earlier studies reported mortality which is higher than our study.^[18,22,23]

Thus findings from the present study indicate that elderly age group with comorbidities have high risk for developing hyponatremia with most common symptoms like altered sensorium. In addition SIADH is the most common cause followed by renal disorders, CLD. Hydration status also revealed that hypervolemia subjects were asymptomatic while cases in euvolemia and, hypovolemia are symptomatic. Mortality rate was reported high in hypervolemia followed by hypovolemic, and euvolemic hyponatremia.

The statistical analysis also clearly defined that there is a significant relationship between hydration status and symptoms ($p = 0.006$), followed by significant association between causes and hydration status ($p = 0.01$) but when mortality is compared with hydration status statistical insignificance was noticed ($p = 0.27$). Overall from the present study it was observed that risk factors for hyponatremia that include age factors, causes, comorbidities, hydration status.

CONCLUSION

Thus the present study concludes that in elderly subjects the prevalence of symptomatic hyponatremia among hospitalised subjects is high in those who were residing along coastal areas due to hot and humid climate which made them much more vulnerable to develop hyponatremia. The major risk factors are associated with neurological symptoms. The prevalence is higher in euvolemic hyponatremia cases with SIADH. Statistical analysis indicates that majority of deaths were caused by underlying primary illnesses hence clinicians should approach hyponatremia case in a systemic manner using simple standardized diagnostic algorithms and

establishing the mechanism of hyponatremia can improve the assessment and therapy of hyponatremia.

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