

Original article:

Study of incidence of medical neurological causes of hyponatremia

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Abstract:

Introduction: Hyponatremia is a common electrolyte disturbance due to various causes. Hyponatremia is of clinical significance as a rapidly decreasing serum sodium concentration as well as rapid correction of hyponatremia may lead to neurological symptoms.

Materials and methods: The sample was collected from, patients admitted in NTU/ICU/CCU and various medical wards of ruby hall Clinic, Pune . The sample size was determined with the help of expert.

Results : The rate of decline in serum sodium concentration, the patient's age, and the volume of extracellular fluid (ECF) all affect the clinical presentation.⁵³In this study 86 i.e. 57.3% patients were Male and 64 i.e. 42.7% patients were Female.

Male to Female ratio is- 1.34:1 (Table-2)In this study there are 50 Euvolemic patients, out of that 34 i.e.68 % were due to SIADH, 13 i.e. 26 % were due to low intake and 3(6 %) were due to Hypothyroidism.

Conclusion: Elderly patients are having more chances of getting hyponatremia than young patients. Overall SIADH is most common cause of hyponatremia followed by CSW and CCF.

Introduction

Hyponatremia is a common electrolyte disturbance due to various causes. Hyponatremia is of clinical significance as a rapidly decreasing serum sodium concentration as well as rapid correction of hyponatremia may lead to neurological symptoms. It can present with signs and symptoms mimicking neurological disorder and worsen the existing neurological deficit. It also presents with symptoms affecting other systems . Previously it was thought that hyponatremia occurring in patients with neurological disorders was mainly because of SIADH¹ In 1953 Peter et al showed that it is also occurs due to cerebral salt wasting syndrome. But it was seen that two are almost opposite conditions and the treatment differs

Sodium is found in the body fluids outside the cells.It is very important for maintaining blood pressure.Sodium is also needed for nerves and muscles to work properly. In case of hyponatremia when amount of sodium in fluids outside cells drops,water moves into cells to balance the levels.This causes swelling of cells.Although most cells can handle this swelling, brain cells can not,because skull bones confine them.Brain swelling causes most of the symptoms of hyponatremia.²

Serum sodium concentration and serum osmolarity normally are maintained under precise control by homeostatic mechanisms involving stimulation of thirst, secretion of antidiuretic hormone (ADH), and renal handling of filtered sodium.

Though clearly not indicative of the overall prevalence internationally, hyponatremia has been observed in as high as 42.6% of patients in a large acute care hospital in Singapore and in 30% of patients hospitalized in an acute care setting in Rotterdam^{3,4,5}

So, in our study we tried to study various etiologies of hyponatremia, their presentation and response to correction of hyponatremia, and neurological outcome after treatment.

Materials and methods:

The sample was collected from, patients admitted in NTU/ICU/CCU and various medical wards of ruby hall Clinic, Pune . The sample size was determined with the help of expert.

Inclusion criteria-

All cases of hyponatremia who was admitted with hyponatremia and who developed it during first 4 days of admission to hospital

Hyponatremia will be considered with serum sodium level < 130 mmol/lit

Normal sodium level in this hospital is 130-150 mmol/lit

These cases will be divided into groups like

- 1.130-120 mmol/lit -mild
- 2.120-110 mmol/lit-moderate
- 3.110-100mmol/lit -severe
- 4.<100 mmol/lit -critical

Patients plasma osmolality will be calculated by formula-

$$2 \text{ Na}^+ + \text{BSL}/18 + \text{BUL}/2.8$$

(mg/dl) (mg/dl)

Affording patients measured osmolality will be recorded and then difference between measured and calculated osmolality will be noted and cause for same will be found

Patient's clinical picture will be correlated with level of hyponatremia and clinical picture after correction will be studied and also other factors affecting clinical picture will be noted

Exclusion criteria-

All cases who develop hyponatremia after 4 days of hospital admission will be excluded

Definitions

1-Hyponatremia- serum sodium level <130 meq/L

2- Organic neurological disease: proved by CT scan, MRI and CSF studies

Cases meeting the above inclusion criteria have been selected randomly and studied.

Once selected in study following information about the patient has been collected:

The detail history was collected.

The data was processed using the statistical tools like Microsoft Office Excel 2010, SPSS 17 software, t test, coefficient of relation (r value), Wilcoxon Z value, Mean , Standard deviation etc.

Observations and results:

Table 1: Age wise distribution of cases in study group-

Age (Years)	No of cases	Percentage
<50	59	39.3
50 – 60	31	20.7

60 – 70	35	23.3
70 & above	25	16.7
Total	150	100

In this study 59 (i.e. 39.3%) patients were below the 50 years old and 91 patients (i.e.60.7%) were above the age of 50. So most patients who had hyponatremia were of the age group of above 50 years.

Table 2: Sex wise distribution of cases in study group-

Sex	No of cases	Percentage
Male	86	57.3
Female	64	42.7
Total	150	100

In this study 86 i.e. 57.3% patients were Male and 64 i.e. 42.7% patients were Female
Male to Female ratio is- 1.34:1.

Table 3: Distribution of Hyponatremia cases of Euvolemic type in study group-

Euvolemic	No of cases	Percentage
SIADH	34	68
Low intake	13	26
Hypothyroidism	3	6
Total	50	100

In this study there are 50 Euvolemic patients, out of that 34 i.e.68 % were due to SIADH, 13 i.e. 26 % were due to low intake and 3(6 %) were due to Hypothyroidism.

Table 4: Distribution of Hyponatremiacases of Hypervolemic type in study group-

Hypervolemic	No of cases	Percentage
ARF	7	13.73
CKD	13	25.49
CCF	16	31.37
Cirrhosis	13	25.49
Sepsis	2	3.92
Total	51	100

There are 51 patients with hypervolemic type of hyponatremia. In this study 16 patients i.e.31.37% were due to CCF, 13 i.e.25.49 % were due to Cirrhosis, 13 i.e. 25.49 % were due to CKD and 7 i.e. 13.73% were due to ARF and 2 i.e. 3.92% were due to sepsis.

Table 5: Distribution of Hyponatremia cases of Hypovolemic type in study group-

Hypovolemic	No of cases	Percentage
CSW	17	34.69
V/D	12	24.49
Diuretic excess	10	20.41
Trauma/ blood loss	9	18.37
Pancreatitis	1	2.04
Total	49	100

There are 49 patients of hypovolemic type of hyponatremia.17 patients i.e. 34.69 % were due to CSW, 12 patients i.e. 24.49 % were due to vomiting and Diarrhea,10 i.e.20.41 % were due to Diuretic excess, 9 i.e.18.37 % were due to Trauma/blood loss and 1 i.e. 2.04% was due to Pancreatitis.

Table 6: Types of Hyponatremia cases according to volume status in study group

Type of hyponatremia	No of cases	Percentage
Euvolemic	50	33.33
Hypervolemic	51	34
Hypovolemic	49	32.67
Total	150	100

In this study 50 i.e. 33.33% patients were Euvolemic, 51 i.e.34% patients were Hypervolemic and 49 patients i.e.32.66% patients were Hypovolemic. Individual distribution is given above for each type. In this study all 3 types were almost same in number. Criteria for all these 3 types are given above.

Table 7:Study of 3 types of Hyponatremia according to volume status-

Type of hyponatremia	n	Sr Na	Sr. Osmolality	Urine Osmolality	urine Na
		Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD
Euvolemic	50	119.66±5.05	253.8±10.31	395.3±32.72	29 ± 6.46
Hypervolemic	51	119.25±4.23	263.29±14.22	393.63±36.01	22.35 ± 11.89
Hypovolemic	49	116.56±7.85	248.32±15.52	413.88±51.06	51.45 ± 44.93

For Euvolemichyponatremia there are 50 patients. For them Mean sodium level is 119.66 with standard deviation (SD) of 5.05, Mean serum osmolality is 253.8 with SD of 10.31, Mean urine osmolality is 395.3 with SD of 32.72, Mean urinary sodium is 29 with SD 6.46.

For Hypervolemichyponatremia there are 51 patients. For them Mean sodium level is 119.25 with SD of 4.23, Mean serum osmolality is 263.29 with SD of 14.22, Mean urine osmolality is 393.63 with SD of 36.01, Mean urinary sodium 22.35 is with SD of 11.89.

For Hypovolemic hyponatremia there are 49 patients. For them Mean sodium level is 116.56 with SD of 7.85, Mean serum osmolality is 248.32 with SD of 15.52, Mean urine osmolality is 413.88 with SD of 51.06, Mean urinary sodium is 51.45 with SD of 44.93.

Table 8: Causes of SIADH wise distribution of cases in study group-

Causes of SIADH	No of cases	Percentage
Stroke	19	55.88
I C Bleed	4	11.76
TBM	3	8.82
Brain SOL/Post surgery	2	5.88
Lung Ca	2	5.88
Pulmonary TB	2	5.88
Pneumonia	1	2.94
Meningitis	1	2.94
Total	34	100

In this study SIADH is found to be most common cause of hyponatremia, 34 cases out of 150 patients i.e.22.67%. Etiology of SIADH is due to multiple causes affecting various systems of body.

Stroke is found to most common cause of SIADH, 19 cases i.e.55.88%, followed by 4 cases i.e.11.76% due to I.C. bleed. TBM is responsible for 3 i.e. 8.82% cases of SIADH. 2 cases i.e. 5.88% each is due to Lung Ca, Pulmonary TB, Brain SOL/Post surgery. Pneumonia and Meningitis are responsible for 1 i.e.2.94 case each of SIADH.

Discussion

Present study is a prospective study conducted on 150 patients admitted in Ruby Hall Clinic, Pune. They were studied with respect to the incidence, etiology and outcome of treatment of hyponatremia. They were evaluated with desired investigations to find out the cause of hyponatremia. The patients were followed up with Glasgow coma scale and serial sodium estimation.

In this study 59 (i.e. 39.3%) patients were below the 50 years old and 91 patients (i.e.60.7%) were above the age of 50. So most patients who had hyponatremia were of the age group of above 50 years (Table- 1)

The rate of decline in serum sodium concentration, the patient's age, and the volume of extracellular fluid (ECF) all affect the clinical presentation.⁵³In this study 86 i.e. 57.3% patients were Male and 64 i.e. 42.7% patients were Female.

Male to Female ratio is- 1.34:1 (Table-2)In this study there are 50 Euvolemic patients, out of that 34 i.e.68 % were due to SIADH, 13 i.e. 26 % were due to low intake and 3(6 %) were due to Hypothyroidism.(table 3)

In a study done by Indira Jayakumar, S Ranjit, Department of Pediatric Intensive Care Kanchi Trust Hospital, Nungambakkam, Chennai, India, all cases were of hypo-osmotic hyponatremia, The causes were SIADH in 19 (33%), hyponatremia due to dehydration (vomiting, diarrhea) in 16 (28%), drug induced hyponatremia in 13 (22%) and CSW in 10 (17%) patients.⁶

Wijdicks EFM, ten Haff et al, in 1985 described CSW in 11 patients with rupture of intracranial aneurysm, and SIADH in 10 patients.

There are 51 patients with hypervolemic type of hyponatremia. In this study 16 patients i.e.31.37% were due to CCF, 13 i.e.25.49 % were due to Cirrhosis, 13 i.e. 25.49 % were due to CKD and 7 i.e. 13.73% were due to ARF and 2 i.e. 3.92% were due to sepsis.(table-4)

In inpatient and outpatient CCF populations, hyponatremia is a strong predictor of poor outcome, including hospitalization and death.⁷

Hyponatremia occurs even more commonly in cirrhosis, particularly those with advanced chronic disease.⁸

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Criteria used to differentiate between various causes of hyponatremia based on urinary sodium are- Urinary sodium ≤ 20 meq/L and > 20 meq/L.

In this study 54 patients i.e. 36% are having urinary sodium ≤ 20 meq/L and remaining 96 patients i.e.64 % are having urinary sodium > 20 meq/L.(table 15)

Diagnosis wise 16 CCF patients , 13 cirrhosis patients, 11 patients of vomiting/diarrhea,9 patients with trauma/blood loss, 2 patients with sepsis and 1 patient each with Hypothyroidism, Pancreatitis and CKD are having urinary sodium ≤ 20 meq/L.(table 16)

In case of urinary sodium >20 meq/L, 34 patients are of SIADH, 17 are of CSW, 13 of Low intake, 12 of CKD, 10 of Diuretic excess, 7 of ARF, 2 of Hypothyroidism and 1 of Vomiting and diarrhea.

This findings are similar to algorithm given in Harrison's Textbook of Medicine for differentiating between various causes of hyponatremia.⁹

Newer interventions should keep in mind. Such data should be collected at large scale and by using data mining techniques, it should further validate. ^{10,11}

Conclusion:

Elderly patients are having more chances of getting hyponatremia than young patients. Overall SIADH is most common cause of hyponatremia followed by CSW and CCF.

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