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Frequency of Hyponatremia in Central Nervous System Infections

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Abstract

Central nervous system infections (CNS) limited to the meninges or with brain parenchyma involvement are common causes of hospital admissions. Sodium disorders are associated with considerable morbidity and mortality. Hyponatremia is a common electrolyte disturbance and is a common finding in patients with acute cerebral insult. Current study is plan to ascertain the frequency of hyponatremia in CNS infections, to identify regular screening, as CNS infection, treatment and management is emerging as a great challenge especially in the setting of hyponatremia and its complication. In this study our aim was to determine the frequency of hyponatremia in patients with CNS infections attending tertiary health care hospital. This study was conducted in Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan from 6th May 2014 to 6th November 2014. Total duration of this study was six months. It was a cross sectional study and a total of 192 patients with CNS infections presenting to Hospital were included in this study. Brief history and physical examination was done. Blood sample was collected in a sterile manner for serum sodium levels and was sent to lab. Serum sodium level <130 mmol/L was considered as Hyponatremia. The findings of variables were entered in proforma. Our results showed that the average age of the patients was 43.41 ± 13.64 years. Frequency of hyponatremia in patients with CNS infections was observed in 42.71% (82/192) patients. Frequency of hyponatremia was significant among different age groups, while frequency of hyponatremia was not significant between gender and difference duration of disease Sodium disturbance is serious co morbidity in the neurosurgical population. Physicians should focus on the volume status of hyponatremic patients with neurologic disease to differentiate between Cerebral Salt Wasting (CSW) & Syndrome of Inappropriate Anti Diuretic Hormone (SIADH), because the treatment of the two conditions differs. Healthcare providers should recognize the significance of sodium dysregulation among this population and distinguish between the various therapeutic options in order to advocate safe and effective therapy.

Introduction

Infections to the Central Nervous System (CNS) are notable for their diversity; Infections that affect the CNS can be catastrophic and potentially lethal. They range from common to rare, acute to chronic, benign to fatal. Although some are self-limited or are easily cured with modern treatment, others are relentlessly progressive despite treatment, or have no known treatment. Central nervous system infections (CNS) limited to the meninges or with brain parenchyma involvement are common causes of hospital admissions. Infection of the central nervous system (CNS) can be viral, bacterial, fungal, or parasitic in origin. Infectious microorganisms most often enter the CNS by direct penetration after trauma or by travelling in the bloodstream. People who are immune compromised from conditions such as AIDS, cancer, steroid use, diabetes or alcoholism may be at risk for opportunistic infections which would not ordinarily affect persons with normal immune defenses. Sodium disorders are associated with considerable morbidity and mortality. Hyponatremia is a common electrolyte disturbance and is a common finding in patients with acute cerebral insult. Hyponatremia in CNS infection could be due to two mechanisms, first one is Syndrome of Inappropriate Anti Diuretic Hormone secretion (SIADH) and other one is Cerebral Salt wasting syndrome (CSW). SIADH is a volume-expanded state because of antidiuretic hormone-mediated renal water retention. CSW is characterized by a contracted effective arterial blood volume (EABV) resulting from renal salt wasting. Making an accurate diagnosis is important because the treatment of each condition is quite different. Current study is plan to ascertain the frequency of hyponatremia in CNS infections, to identify regular screening, as CNS infection, treatment and management is emerging as a great challenge especially in the setting of hyponatremia and its complication. CNS infections were labeled as positive/negative in patients having all or one of these which incudes, patient having clinical features like headache, neck stiffness, seizures, altered mental state or fever greater then 101o F, CNS infection proven by Lumbar puncture. Hyponatremia was defined as Serum sodium level less than 130 mmol/L.

Methods

It was a Cross-sectional study and was conducted at department of Medicine, Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan. The duration of study was six months from 6th May 2014 to 6th November 2014. The sample size came out to be 192 patients by taking the prevalence (14.6%) [1] confidence level 'Cl'=95%, d=0.05 using the WHO software. Cerda et al., in a research done in 2010, titled as "Prevalence and Causes of Hyponatremia in the Neurologic Patients" showed that from the 130 patients under study, 14.6% were hyponatremic [1]. Our Sampling technique was non probability consecutive. The inclusion criterion for our study was patients with CNS infections for more than 2 days, Either male or female, Age 20-60 years. The exclusion criteria includes those patients who refuse to give consent (Non consenting patients), Critically ill patients, Congestive cardiac failure (CCF), Post myocardial infarction (MI), Pregnancy, Chronic renal failure (CKD), Chronic liver disease (CLD). This study was conducted in Jinnah Postgraduate Medical Centre (JPMC), Karachi, Pakistan. Cases, meeting inclusion criteria were enrolled in the study from the department of Medicine, JPMC. Permission from the institutional

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ethical review committee was taken prior to conducting the study. Informed consent was obtained from all the patients for assigning them to the study and using their data in research. Brief history and physical examination was done. Blood sample was collected in a sterile manner for serum sodium levels and was sent to lab. Serum sodium level less than 130 mmol/L was considered as Hyponatremia. The finding of variables as mentioned above was entered in proforma attached as annexure. Data was analyzed on SPSS Version 16. Demographic data was presented as simple descriptive statistics, giving mean and standard deviation for age and duration of disease. For qualitative variables like gender and hyponatremia frequency and percentages were calculated. Effect modifiers were controlled through stratification of age, gender, duration of disease to see the effect of these on outcome variable. Post stratification chi square test was applied taking p-value of ≤ 0.05 as statistically significant.

Results

A total of 192 patients with CNS infection presenting to Hospital were included in this study. Age distribution of the patients is presented in Figure 1. The average age of the patients was 43.41 ± 13.64 years similarly mean duration of disease and serum sodium were 7.10 ± 2.76 days and 130.67 ± 10.66 mmol/L respectively as shown in Table 1. Out of 192 cases, 93(48.44%) were male and 99(51.56%) were female.

Frequency of hyponatremia in patients with CNS infections was observed in 42.71% (82/192) patients as presented in Figure 2. Frequency of hyponatremia was significant among different age groups (p=0.022) as shown in Table 2 while frequency of hyponatremia was not significant between gender and difference duration of disease as presented in Tables 3 and 4 respectively.

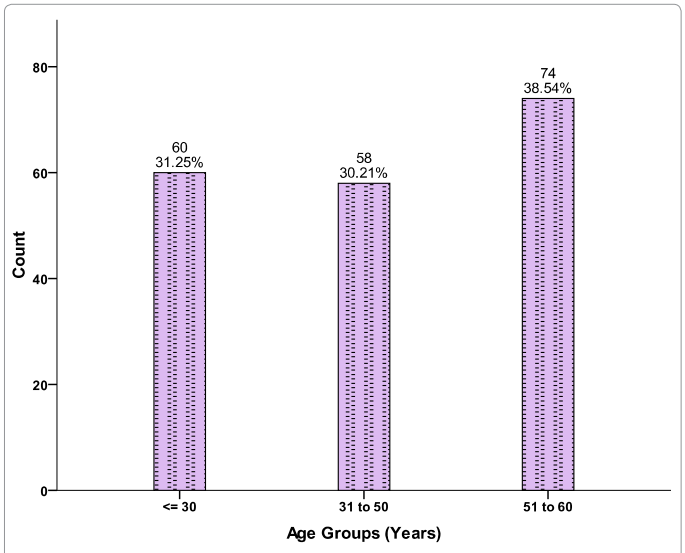

Figure 1: Age distribution of the patients, n=192.

		Age (Years)	Duration of disease (days)	Serum Sodium (mmol/L)
Mean		43.41	7.10	130.67
95% Confidence Interval for Mean	Lower Bound	41.47	6.70	129.15
	Upper Bound	45.35	7.49	132.18
Median		47	6.00	135
Std. Deviation		13.64	2.76	10.66
Minimum		20	3	102
Maximum		60	18	146
Interquartile Range		28	3	15

Table 1: Descriptive statistics of patients (n=192).

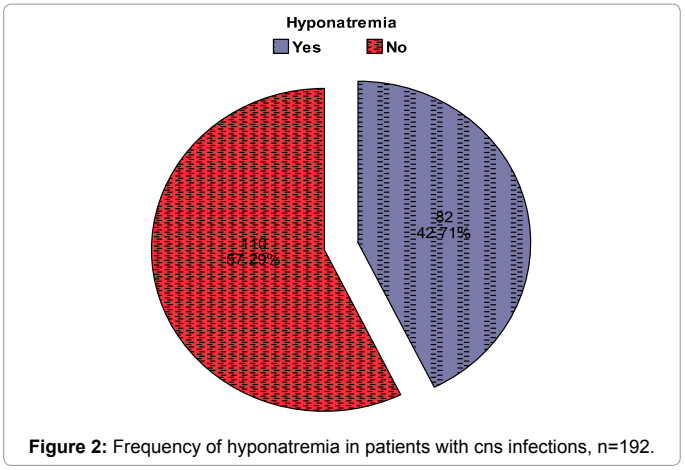

Figure 2: Frequency of hyponatremia in patients with cns infections, n=192.

Age Groups (Years)	Hyponatremia In Patients With CNS Infections		Total
	Yes	No	
≤ 30 Years	17(28.3%)	43(71.7%)	60
31 to 50 Years	27(46.6%)	31(53.4%)	58
51 to 60 Years	38(51.4%)	36(48.6%)	74
Chi-Square = 7.67 p=0.022			

Table 2: Frequency of hyponatremia in patients with CNS Infections with respect to age groups.

Gender	Hyponatremia In Patients With CNS Infections		Total
	Yes	No	
Male	38(40.9%)	55(59.1%)	93
Female	44(44.4%)	55(55.6%)	99
Chi-Square = 0.25 p=0.61			

Table 3: Frequency of Hyponatremia in patients with CNS infections with respect to gender.

Gender	Hyponatremia In Patients With CNS Infections		Total
	Yes	No	
Male	38(40.9%)	55(59.1%)	93
Female	44(44.4%)	55(55.6%)	99
Chi-Square = 0.25 p=0.61			

Table 4: Frequency of Hyponatremia in Patients with CNS infections with respect duration of disease.

Discussion

Electrolyte imbalance is known to be the most frequent systemic complication in patients with neurologic diseases [2]. Hyponatremia is a common electrolyte disturbance. Its high prevalence and potential neurological sequela make its differential diagnosis mandatory before any therapeutic intervention [3]. Hyponatremia is predominantly the result of an excess of extracellular water relative to sodium. This disturbance may be secondary to impaired renal water excretion, excessive water intake, or excessive sodium loss; each resulting in the dilution of sodium in the ECF. Shifts in water from the ECF into the intracellular compartment causes cellular swelling and can acutely

increase brain volume. Large, rapid shifts that cause acute cerebral edema may lead to herniation and even brain death [4-6]. Hyponatremia is a common finding in patients with acute cerebral insult; it is defined as a serum sodium level of less than 130 mEq/L [7]. As a careful clinical and biochemical assessment it is important for the diagnosis to be established, for only then can proper treatment be instituted [8]. In our study, Frequency of hyponatremia in patients with CNS infections was observed in 42.71% (82/192) patients. Von-vigier et al., described hyponatremia in 97 out of 300 (32.3%) patients with CNS infection [9] while, Bussmann et al., reported hyponatremia in 2 out of 23 (8.7%) patients with acute bacterial meningitis, partially treated meningitis and tuberculous meningitis [10]. In other studies the incidence is reported to be 34% of patients with aneurysmal subarachnoid hemorrhage (SAH) [11] and more than 70% in tuberculous meningitis [12]. The prevalence of hyponatremia developed after trans sphenoidal pituitary surgery for tumor resection may range between 25% and 35% [13,14]. In a study at Irish National Neurosciences Centre M Sherlock et al. [15] found that, the pathophysiology of hyponatraemia in neurologic patients was: syndrome of inappropriate antidiuretic hormone secretion (SIADH) in 116 cases (62%), 31 (16.6%) drug-associated), hypovolaemic hyponatraemia in 50 cases (26.7%) (Which included patients with insufficient data to assign to the cerebral salt-wasting group (CSWS), CSWS in nine cases (4.8%), intravenous fluids in seven cases (3.7%) and mixed SIADH/CSWS in five cases (2.7%)? He also stated that hyponatraemic patients with cerebral irritation had significantly lower plasma sodium concentrations (mean (SD) 124.8 (0.34) mmol/l) and had a significantly longer hospital stay [16]. Hyponatremia patients in this study were discharged without adverse consequence. Arrangement for long- term follow up for neurological sequela was not possible. In a study performed in USA it was found that 3.7% of patients had neurological sequela and 12% of them ultimately died, although they reported that the prognosis appears to be more clearly related to the underlying medical disorder rather than to the hyponatremic state or its correction [16].

Conclusion

Sodium disturbances are a serious comorbidity in the neurosurgical population. Lack of proper assessment and management can lead to serious and permanent neurological consequences, including death. Physicians should focus on the volume status of hyponatremic patients with neurologic disease to differentiate between CSW & SIADH because the treatment of the two conditions differs. Healthcare providers should recognize the significance of sodium dysregulation among this population and distinguish between the various therapeutic options in order to advocate safe and effective therapy.

References

1. Cerda-Esteve M, Ruiz-González A, Gudelis M, Goday A, Trujillano J, et al. (2010) [Incidence of hyponatremia and its causes in neurological patients]. Endocrinol Nutr 57: 182-186.
2. Piek J (1995) Medical complications in severe head injury. New Horiz 3: 534-538.
3. Berry PL, Belsha CW (1990) Hyponatremia. Pediatr Clin North Am 37: 351-363.
4. Holliday MA, Kalayci MN, Harrah J (1968) Factors that limit brain volume changes in response to acute and sustained hyper- and hyponatremia. J Clin Invest 47: 1916-1928.
5. Rymer MM, Fishman RA (1973) Protective adaptation of brain to water intoxication. Arch Neurol 28: 49-54.
6. Arieff AI, Llach F, Massry SG (1976) Neurological manifestations and morbidity of hyponatremia: correlation with brain water and electrolytes. Medicine (Baltimore) 55: 121-129.
7. Fraser CL, Arieff AI (1997) Epidemiology, pathophysiology, and management of hyponatremic encephalopathy. Am J Med 102: 67-77.
8. Jayakumar I, Ranjit S, Balasubramaniam C (2006) Hyponatremia in Acute Neurological Disorders – Is It Always Due to SIADH? J Pediatr Neurosci 1:10-5.
9. von Vigier RO, Colombo SM, Stoffel PB, Meregalli P, Truttmann AC, et al. (2001) Circulating sodium in acute meningitis. Am J Nephrol 21: 87-90.
10. Hasan D, Wijdicks EF, Vermeulen M (1990) Hyponatremia is associated with cerebral ischemia in patients with aneurysmal subarachnoid hemorrhage. Ann Neurol 27: 106-108.
11. Bussmann C, Bast T, Rating D (2001) Hyponatraemia in children with acute CNS disease: SIADH or cerebral salt wasting? Childs Nerv Syst 17: 58-62.
12. Karandanis D, Shulman JA (1976) Recent survey of infectious meningitis in adults: review of laboratory findings in bacterial, tuberculous, and aseptic meningitis. South Med J 69: 449-457.
13. Sane T, Rantakari K, Poranen A, Tähtelä R, Välimäki M, et al. (1994) Hyponatremia after transsphenoidal surgery for pituitary tumors. J Clin Endocrinol Metab 79: 1395-1398.
14. Olson BR, Gumowski J, Rubino D, Oldfield EH (1997) Pathophysiology of hyponatremia after transsphenoidal pituitary surgery. J Neurosurg 87: 499-507.
15. Sherlock M, O'Sullivan E, Agha A, Behan LA, Owens D, et al. (2009) Incidence and pathophysiology of severe hyponatraemia in neurosurgical patients. Postgrad Med J 85: 171-175.
16. Wattad A, Chiang ML, Hill LL (1992) Hyponatremia in hospitalized children. Clin Pediatr (Phila) 31: 153-157.

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