Hyponatremia in Children Requiring Hospitalization

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Abstract:

This prospective study evaluated the frequency, etiological causes of children with hyponatremia (serum sodium< 135 mEq/L) in 500 children aged between 1 month and 14 years of age admitted at tertiary care hospital in Rajasthan, India. Hyponatremia was found in 37% (185/500). Meningitis/encephalitis accounted for 20.5% followed by pneumonia and acute diarrhea each accounting for 12.43% of cases. Other causes were septicemia (7.6%), seizure (7.6%), cardiac diseases (3.2%), renal diseases (5.3%), liver diseases (2.7%). This study shows hyponatremia occurs frequently in children requiring hospitalization and thus should be anticipated and given attention in management plan.

Key words: Hyponatremia, Encephalitis, Meningitis, Sodium, Diarrhea, Sepsis.

Introduction

Hyponatremia is defined as serum sodium below 135 mEq/L [1]. It is a commonly occurring phenomenon in hospitalized children [2]. Severe degree of hyponatremia is associated with significant morbidity and mortality [3]. Acute severe hyponatremia can rapidly cause cerebral edema and brain stem herniation [4]. Routine use of hypotonic fluids (N/5 with 5% dextrose) as maintenance fluids in hospitalized children further increases chances of hyponatremia. Studies pertaining to incidence of hyponatremia in children are in paucity, hence we took up this study to find incidence and clinical association of hyponatremia in children requiring hospitalization.

Methodology

This was a prospective observational study carried out at a tertiary-care referral teaching hospital in Rajasthan, India. The study was carried out after ethical approval from institute's ethical committee and taking informed consent from parents.

A total of 500 hospitalized children in our center between age of 1 month and 14 years were included. Children were included irrespective of initial diagnoses and disease severity. Study was carried out in two stages during

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summers (July & August 2007) and winters (December 2007 & January 2008) and in each stage 250 patients were recruited. The baseline demographics and clinical characteristics of patients were obtained at the time of admission. Patient's serum samples for electrolytes were drawn before starting treatment. Patients were followed during the course of hospital stay their final diagnoses and laboratory results were ascertained. Patients were classified on basis of serum sodium concentration into normonatremic (serum sodium between 135 mEq/L and 145 meq/L) and hyponatremic (serum sodium < 135 mEq/L). Hyponatremic children were further classified as mild hyponatremia (sodium between 130 and 135 mEq/L), moderate hyponatremia (serum sodium between 125 and 130 mEq/L) and severe hyponatremia (serum sodium< 125 mEq/L). Frequency of hyponatremia was calculated for total sample in relation to age, sex, season and diagnosis. The statistical significance of the difference in frequency distribution was determined by Chi-square test and group means by 't' test.

Results

Total 500 hospitalized children were studied which included 176 boys and 74 girls in summer months and 166 boys with 84 girls in winter months. Of the 500 children studied 185 (37%) had hyponatremia which comprised 47 females and 138 males. There were 130 (26%) cases of mild, 39 (8%) cases of moderate and 16 (3%) cases of severe hyponatremia respectively. Amongst children with severe hyponatremia, 15 cases had sodium ranging between 121-125 mEq/L and one case with sodium between 116-120 mEq/L. The mean age ± SD in children was 4.32±3.935 years. The mean age of patients with hyponatremia during summers and winters was 4.31±4.054 and 4.24±4.073 years respectively.

The incidence of hyponatremia during summers and winters was 40.8% and 33.2% respectively. The difference was statistically not significant. The mean level of sodium in hyponatremic subjects in summers was 130.23 mEq/L similar to that in winter which was 131.1mEq/L. Meningitis/encephalitis was single most important cause of hyponatremia accounting for 20.54% of cases, pneumonia for 12.43%, diarrhea for 12.43%, sepsis for 7.56%, seizure for 7.56%, cardiac diseases 3.2%, renal diseases for 5.7% and liver disorders for 2.7%. There was no significant seasonal variation in occurrence of hyponatremia across various etiological categories [Table 1]. It was found that among children with congenital heart diseases 67% had hyponatremia, with septicemia around 52% had hyponatremia [Table 2]. Mild hyponatremia was most commonly found across all diagnostic categories [Table 3].

Discussion

The study sample was representative of the type of sick children admitted to our center. It was found that hyponatremia was present in 37% of cases. Thus more than a third of patients have hyponatremia at presentation to hospital and further administration of hypoosmotic fluids is more likely to increase the proportion of children who will have hyponatremia. When compared to other reported data in children by Sunit Singhi *et al* [2] who reported 29.8% incidence of hyponatremia, the present study showed incidence of 37%. The higher percentage in our study is probably due to different cut-off taken for hyponatremia in the two studies.

In the present study there was no significant age, sex, or seasonal difference in frequency of hyponatremia. The most common causes were meningoencephelitis, diarrhea and pneumonia. The proportion of cases with hyponatremia across various diagnostic categories ranged from 3 to 20%. In a recent study by Don M *et al,*

hyponatremia was found in 45.4% of children with community acquired pneumonia [5] incidence of which was similar to present study. 46.5% children with pneumonia had hyponatremia in our study. In another study, mild hyponatremia was found in 33.3% of hyponatremia and moderate hyponatremia was found in 1.9% of children with pneumonia [6]. In a recent published literature by Shah GS *et al* hyponatremia was present in 56% of children presenting with diarrhea [7], it was much higher than present study where 37.7% of children with diarrhea had hyponatremia.

Meningitis/encephalitis were the most common causes of hyponatremia in our study accounting to about 20.54% of all cases of hyponatremia. 35% of children with meningitis/encephalitis had hyponatremia. In a work by Bussmann C 10.3% of children with various acute central nervous system disordershad sodium level below 130 mmol/L [8]. In another study by von Vigier RO *et al* who studied circulating sodium in acute meningitis and found that 97 children out of 300 children with meningitis had sodium level below 133 mmol/L [9].

Table 1: Frequency of hyponatremia according to diagnostic categories and their seasonal variation.

Diagnostic categories	Summer			Winter			χ2	P-value	Significance
	Hyponatremia			Hyponatremia					
	Present n (%)	Absent n (%)	Total n(%)	Presentn (%)	Absent n (%)	Total n(%)			
Pneumonia	8 (57.14)	6 (42.86)	14 (100.00)	15 (42.86)	20 (57.14)	35 (100.00)	0.821	> .05	NS
Meningitis / encephalitis	24 (35.82)	43 (64.18)	67 (100.00)	14 (35.00)	26 (65.00)	40 (100.00)	0.008	> .05	NS
Acute diarrhea	12 (42.85)	16 (57.15)	28 (100.00)	11 (33.30)	22 (66.67)	33 (100.00)	0.583	> .05	NS
Seizure	6 (21.43)	22 (78.57)	28 (100.00)	8 (33.33)	16 (66.67)	24 (100.00)	0.933	> .05	NS
Septicemia	8 (61.54)	5 (38.46)	13 (100.00)	6 (42.86)	8 (57.14)	14 (100.00)	0.943	> .05	NS
Renal disease	6 (46.15)	7 (53.85)	13 (100.00)	4 (36.36)	7 (36.36)	11 (100.00)	0.005	> .05	NS
Liver disease	4 (33.33)	8 (66.67)	12 (100.00)	1 (8.33)	11 (91.67)	12 (100.00)	1.010	> .05	NS
CHD	4 (57.14)	3 (42.86)	7 (100.00)	2 (100.00)	0 (0.00)	2 (100.00)	-	-	-
Miscellaneous	30 (44.78)	38 (55.22)	68 (100.00)	22 (27.85)	57 (72.15)	79 (100.00)			
Total	102 (40.80)	148 (59.2)	250 (100.00)	83 (33.20)	167 (66.80)	250 (100.00)			

Table 2: Percentage wise occurrence of hyponatremia within a diagnostic category.

	Total Patients	Patients with Hyponatremia
Pneumonia	49	23(46.5%)
Acute diarrhea	61	23(37.70%)
Meningitis /encephalitis	107	38(35.51%)
Septicemia	27	14(51.85%)
CHD	9	6(66.66%)
Seizure	52	14(26.92%)
Renal disease	24	10(41.66%)
Liver disease	24	5(20.83%)
Miscellaneous	147	52(35.37%)
Total	500	185

Table 3: Severity of hyponatremia across various diagnostic categories.

	Summer					Winter				
	Mild	Mod	Severe	Normal	Total	Mild	Mod	Severe	Normal	Total
Pneumonia	5	2	1	6	14	12	3	0	20	35
Meningitis / encephalitis	14	6	4	43	67	10	4	0	26	40
Acute diarrhea	7	3	2	16	28	10	0	1	22	33
Seizure	5	1	0	22	28	4	3	1	16	24
Septicemia	5	2	1	5	13	5	1	0	8	14
Renal disease	6	0	0	7	13	3	1	0	7	11
Liver disease	3	0	1	8	12	0	0	1	11	12
CHD	3	0	1	3	7	2	0	0	0	2
Miscellaneous	22	6	2	38	68	14	8	0	57	79
Total	70	20	12	148	250	60	20	3	167	250

Conclusion

From our study we infer that hyponatremia is common entity in varied clinical conditions in children. Hyponatremia is mild in variety though in acute neurological disease more severe variety have higher propensity to occur [Table 3]. Further studies are required to find out underlying mechanism of hyponatremia in various clinical states and to design rational fluid protocols for sick children.

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