HYPONATRAEMIA IN PATIENTS WITH END-STAGE RENAL DISEASE IN MAIDUGURI

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ABSTRACT

Objectives: To determine the prevalence of hyponatraemia in patients with End Stage Renal Disease (ESRD) in our centre.
Methods; One hundred patients with CKD comprising 68 males and 32 females were enrolled into the study. Patients' demographic data were compared with controls. Serum samples were taken for electrolytes, urea and creatinine, calcium, phosphate, total protein albumin and virology. Ultrasonography was also done on all the patients.
Results; 100 patients aged between 15 and 74yrs (mean±SD of 35.29±14.17) and 57 controls aged 15 to 75yrs (mean±SD of 39.9±13.58) were studied. There was no significant difference in the ages of the patients and controls (p=0.79). The cases comprised 68 males and 32 females. Mean±SD age of males was 41±13.27yrs and that of the females was 36.06±13.64yrs. Two (2%) of the study population had severe hyponatraemia with serum Na less than 120mmol/l, while 47 (47%) had mild to moderate hyponatraemia with serum Na between 120-134mmol/l; in contrast to 49 (49%) who had normal serum Na between 135-145mm0l/l, and 2 (2%) who had hypernatraema with serum Na greater than 145mmol/l.
There is no age or sex predilection in the distribution of hyponatraemia in the study group (p=0.854 and p=0.436, respectively).
We conclude that there is no statistical difference in the serum Na concentration among patients with CKD regardless of the aetiology and degree of renal dysfunction (p=0.076 and p=0.722). Hyponatremia is common among ESRD patients undergoing haemodialysis and this problem should always be looked for because majority of patients with this condition are asymptomatic.

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INTRODUCTION

Hyponatremia is defined as a decrease in serum sodium concentration to a level below 135 mmol per liter. It can be associated with low, normal, or high tonicity[1,2]. Effective osmolality or tonicity refers to the contribution to osmolality of solutes, such as sodium and glucose, which cannot move freely across cell membranes, thereby inducing transcellular shifts in water[3]. Dilutional hyponatremia, by far the most common form of the disorder, is caused by water retention. If water intake exceeds the capacity of the kidneys to excrete water, dilution of body solutes results, causing hypo-osmolality and hypotonicity. Hypotonicity, in turn, can lead to cerebral edema; a potentially life-threatening complication[4]. Hypotonic hyponatremia can be associated, however, with normal or even high serum osmolality if sufficient amounts of solutes that can permeate cell membranes (e.g., urea and ethanol) have been retained. Importantly, patients who have hypotonic hyponatremia but normal or high serum osmolality are as subject to the risks of hypotonicity as are patients with hypo-osmolar hyponatremia. The nonhypotonic hyponatremias are hypertonic (or translocational) hyponatremia, isotonic hyponatremia, and pseudohyponatremia[1,2]. Translocational hyponatremia results from a shift of water from cells to the extracellular fluid that is driven by solutes confined in the extracellular compartment (as occurs with hyperglycemia or retention of hypertonic mannitol); serum osmolality is increased, as is tonicity, the latter causing dehydration of cells. Retention in the extracellular space of large volumes of isotonic fluids that do not contain sodium (e.g., mannitol) generates iso-osmolar and isotonic hyponatremia but no transcellular shifts of water. Pseudohyponatremia is a spurious form of iso-osmolar and isotonic hyponatremia identified when severe hypertriglyceridemia or paraproteinemia increases substantially the solid phase of plasma and the sodium concentration is measured by means of flame photometry[1,2]. The increasing availability of direct measurement of serum sodium with the ion-specific electrode has all but eliminated this laboratory artifact[5]. A common clinical problem, hyponatremia frequently develops in hospitalized patients[6]. Worldwide the incidence of hyponatremia among hospitalized patients is found to be 0.97% while prevalence is 2.48%[7]. The majority of patients with hyponatremia are asymptomatic. The manifestations are

variable and occur only at a serum Na+ concentration below 125mmol/l. Although gastrointestinal complaints occur early, the majority of the manifestations of hyponatremia are neuropsychiatric, including lethargic, psychosis, and seizures, designated as hyponatremic encephalopathy[8-10]. Although morbidity varies widely in severity, serious complications can arise from the disorder itself as well as from errors in management. We have observed that significant percentage of our patients were found to have hyponatremia and so in this article, we are aimed at determining the prevalence of hyponatremia in patients with End-Stage Renal Disease (ESRD)

MATERIALS AND METHODS

In this prospective study of incident kidney failure patients who presented for hemodialysis treatment at University of Maiduguri Teaching Hospital we included all the adults seen between January 2005 and December 2005. The University Teaching Hospital in Maiduguri is the largest tertiary health center with the biggest dialysis facility capable of dialyzing 20 patients a day in the North East of Nigeria with some patients traveling for up to 500 kilometers to reach the center for treatment. Obviously we saw only a fraction of the number of patients that required dialysis treatment mainly because of financial and transportation constraints. The members of the study population had clinical assessment in which the demographic data was obtained. All of the patients were black African Nigerians from the various indigenous tribes of the North east and the rest of Nigeria. We evaluated the patients by biochemical tests including serum sodium, urea and creatinine measurements and by ultrasonographic assessment of the kidneys. We included all the patients who had creatinine clearance results that were less than 15ml/min and had evidence of chronicity such as shrunken kidneys and the absence of reversible renal impairment.

Statistical Analysis: Descriptive analysis was used to present the data of this study as means and percentages. Groups were compared using the Chi square test and p values less than 0.05 were considered significant.

RESULTS

One hundred consecutive kidney failure patients made up of 68 males (68%) and 32 females (32%) were enrolled into the study. Table 1 show the age and sex distribution of the patients. Most of the patients (53%) were in their 3rd and 4th decades of life. Their ages ranged between 15 and 74 years with a mean (± SD) of 39.9 ± 13.58 years. The mean (± SD) age of the male patients was 41.71 ± 13.27 years and that of female patients was 36.06 ± 13.64 years. 79 (79%) of the patients comprising of 52 males and 27 females were married while 21 (21%) of the patients comprising of 16 males and 5 females were single.

Two (2%) of the study population had severe hyponatremia with serum Na less than 120mmol/l, while 47 (47%) of the study population mild to moderate hyponatremia; in contrast to 49 (49%) who had normal serum Na and 2 (2%) who had hypernatrema. It has also been seen that 7% of the study patients had symptomatic hyponatremia (Table 2).

There is no age or sex predilection in the distributon of hyponatremia in the study group (p=0.854 and p=0.436 respectively) as shown in table 3 and 4 respectively.

This study also concludes that there is no statistical difference in the serum Na concentration among patients with varying etiologies of CKD and degree of renal dysfunction (p=0.076 and p=0.722) as illustrated in tables 5 and 6 resectively.

Table 1: Age and sex distribution of study patients

Age (yrs)	Sex		Total n (%)
	Male n (%)	Female n (%)	
≤19	3 (3%)	3 (3%)	6 (6%)
20-29	9 (9%)	8 (8%)	17 (17%)
30-39	17 (17%)	7 (7%)	24 (24%)
40-49	20 (20%)	9 (9%)	29 (29%)
50-59	11 (11%)	3 (3%)	14 (14%)
60-69	6 (6%)	2 (2%)	8 (8%)
≥70	2 (2%)	0 (0%)	2 (2%)
Total	**68 (68%)**	**32 (32%)**	**100 (100%)**

Table 2: Percentage hyponatraemia among study patients

Serum sodium concentration (mmol/l)	Patients	
	Number (n)	Percentage (%)
<120	2	2
120-134	47	47
135-145	49	49
>145	2	2
Total	100	100
Symptomatic hyponatremia (<125mmol/l)	7	7

Table 3: Age distribution of hyponatraemia among study group

Age group	Number (n) of patients with serum Na concentration				Total
	<120mmol/l	120-134mmol/l	135-145mmol/l	>145mml/l	
10-19	0	1	5	0	6
20-29	0	10	7	0	17
30-39	1	10	12	1	24
40-49	0	13	15	1	29
50-59	1	6	7	0	14
60-59	0	5	3	0	8
70-79	0	2	0	0	2
Total	**2**	**47**	**49**	**2**	**100**

P=0.854

Table 4: Sex distribution of hyponatraemia among study patients

Sex	Number (n) of patients with serum Na concentration				Total
	<120mmol/l	120-134mmol/l	135-145mmol/l	>145mmol/l	
Male	1	29	37	1	68
Female	1	18	12	1	32
Total	**2**	**47**	**49**	**2**	**100**

P=0.436

Table 5: Hyponatremia in relation to etiologies of CKD

Etiology of CKD	Number (n) of patients with serum Na concentration				Total
	<120 mmol/l	120-134 mmol/l	135-145 mmol/l	>145mmol/l	
Hypertension	1	20	14	0	35
*CGN	0	18	9	1	28
Diabetes mellitus	0	4	7	1	12
Alport's syndrome	0	0	2	0	2
**ADPKD	0	0	2	0	2
***Obstructive urop	0	1	1	0	2
****MSK	1	0	0	0	1
Unclassified	0	4	14	0	18
Total	**2**	**47**	**49**	**2**	**100**

P=0.076
*Chronic Glomerulonephritis
**Autosomal Dominant Polycystic Kidney Disease
***Obstructive Uropathy
****Medullary Sponge Kidneys

Table 6: Hyponatremia in relation to creatinine clearance range

Creatinine Clearance (mls/min)<120	Number (n) of patients with serum Na concentration				Total
	120-134 mmol/l	135-145 mmol/l	>145mmol/l		
<5	1	17	13	0	31
≥5 but < 10	0	19	22	1	42
≥10 but < 15	1	11	14	1	27
Total	**2**	**47**	**49**	**2**	**100**

P=0.727

DISCUSSIONS

In our study we determined the prevalence of severe hyponatremia in the high risk population of incident dialysis patients to be about 2% and mild to moderate hyponatremia as 47%, giving a combined prevalence of 49%. We have found out in this study that 7% of the patients have symptomatic hyponatremia. This is high when compared with the worldwide incidence of hyponatremia which is 0.97% while prevalence which is 2.48%[7]. Although the worldwide prevalence quoted above is a general prevalence among hospitalized patients while our value is the prevalence among patients with ESRD undergoing haemodialysis. Patients with ESRD undergoing haemodialysis are subset of patients with high risk of developing hyponatremia. The majority of patients we studied were asymptomatic as has been reported by other researchers[8-10] but a few that presented with symptoms were found to be neuropsychiatric and mostly presented with symptoms when serum sodium concentration was below 125mmol/l.

CONCLUSION AND RECOMMENDATION

Hyponatremia is a common finding in patients with ESRD undergoing haemodialysis and presents initially asymptomatic unless serum sodium concentration falls below 125mmol/l. Nephrologist should always suspect such complication in all patients with ESRD undergoing haemodialysis. This will help in detecting the asymptomatic patients and aid prompt correction early enough. Additionally the reason for the high prevalence of hyponatremia among patients with ESRD undergoing haemodialysis needs to be investigated.

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