Original Article

Correlation between the serum sodium and the severity of liver disease in cirrhotic patients

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Abstract

Though hyponatremia is the common sequel of cirrhotic patient and had impact on the clinical management of cirrhotic patient, no such study had been done yet in Bangladesh, so the present study planned to elucidate the prevalence and to find out any association of hyponatremia and the severity of cirrhosis. The severity was scaled by Child-Pugh score. This study included 85 patient of both sex having mean age of 46.5±11. Hepatitis B virus infection was the main cause of cirrhosis (68%) and 18% cirrhotic patients had attack with hepatitis C virus. The study sought that about 30% of cirrhotic patient had hyponatremia (serum sodium >130 meq/L). We found neither association nor correlation of hyponatremia with Child Pugh score. The study found that serum chloride varied directly with sodium but indirectly with potassium. So we conclude that the hyponatremia was a common manifestation of cirrhosis but the severity of liver disease had no effect on serum electrolytes profile.

Key words: Cirrhosis, child-pugh score, serum electrolytes

Introduction

Hyponatremia is a common abnormal finding in approximately 57% of hospitalized patients with chronic liver disease and in 40% of outpatients with liver disease.[1] Chronic hyponatremia (defined as a serum sodium concentration below 130 meq/L) occurs in up to 22 percent of people with cirrhosis,[2,3] and is often asymptomatic if the serum sodium concentration is above 120 meq/L.[4,5] The hyponatremia is thought to be due to a higher rate of renal retention of water in relation to sodium due to a reduction in solute-free water clearance. The consequent inability to adjust the amount of water excreted in the urine to the amount of water ingested leads to dilutional hyponatraemia.[6] The incidence of dilutional hyponatraemia in cirrhotic patients being treated for an episode of ascites is 35%, and it is one of the most important prognostic factors in these patients.[7,8] Patients with hyponatraemia have a poor survival compared with that of patients without hyponatraemia.[9] According to several recent studies, hyponatremia occurring as a result of a reduced solute-free water clearance was a key prognostic factor in patients with liver cirrhosis when hyponatremia was incorporated into the MELD score.[10] To date, no studies have been conducted to evaluate the prevalence of hyponatremia in any Bangladeshi hospitalized patients with liver cirrhosis. In fact, no studies have evaluated the correlation between serum sodium levels and severity of liver disease in cirrhotic patients. Given the need for further studies regarding this relationship, we conducted this study to evaluate the prevalence of hyponatremia and to correlate hyponatraemia and severity of liver disease in cirrhosis.

Methods

This observational cross sectional study included 85 consecutive patients with cirrhosis of liver admitted in to the department of Hepatology, Bangabandhu Sheik Mujib Medical University from January 2011 to December 2011, were recruited after having their free, fair and full written consent. The study protocol was approved by the ethical and technical board of concerned research council. Patients were included in the study on the basis of diagnosis of cirrhosis confirmed by clinical, biochemical, and ultrasonographic findings, endoscopic findings of oesophageal varices and cirrhotic changes on liver biopsy in necessary cases. The patients with hepatocellular carcinoma (HCC), exudative ascites, hypovolemic and hypervolaemic causes of hyponatraemia and using diuretic within one month were excluded from the study. The cause of cirrhosis other than Hepatitis B, Hepatitis C, and Wilson's disease were classified as 'others'. We defined chronic hyponatremia with serum level of sodium < 130 meq/L.[3] During hospital stay the dietary sodium was restricted to

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70 meq per day for patients with ascites. In patients with mild hyponatraemia, the water intake was restricted to 1000 ml/day and in those with severe hyponatraemia to 750 ml/day. The tests carried out in the patients were serum electrolytes, serum creatinine, LFT, serum albumin, prothrombin time and viral marker, 24 hour urinary copper were estimated in all patients. The severity of cirrhosis was assessed according to Child-Pugh score. A total score from 5-6, 7-9 and 10-15 was classified as class A, B and C respectively.[6]

The quantitative data were presented as their means ± SD, while categorical or nominal data were expressed in percentage. The t-test was used to compare quantitative data, the chi-square test used for categorical data and bivariate correlation test were done to find correlation between variables. All analyses were carried out using SPSS software version 16 (SPSS, Inc. Chicago). P values of less than 0.05 were considered statistically significant. To determine the sample size, we assumed a confidence level of 95%, with a power of 80%. The prevalence of hyponatraemia in chronic liver disease was considered in determination of sample size in the present study as 22% on the basis of previous data.[10]

Results

Of total 85 patient recruited in this study, 61 (75%) were male and 24 (25%) were female (Table 1) with mean age (±SD) in year 46 ± 13and 47± 9 respectively without any statistical significant mean difference (t=0.083, p=0.93). The patients enrolled in this study were divided into class B and class C on the basis of Child-Pugh score. Out of 85 patient 31 were in class B while rest of the patient 54 were in class C and no patient were included in group A. In this present study, we found most of the patient (87%) presenting with Cirrhosis had viral hepatitis. Among the patient having viral hepatitis, majority of them (69%) suffered from Hepatitis B virus infection and rest (18%) had attack with hepatitis C virus. About 09 % patient had Non B and Non C viral infection. Wilson's disease was found in 02% patient as a cause for Cirrhosis. (Table-I)

The mean (SD) serum level of sodium, potassium, chloride and bicarbonate were 132 (5.14) and 3.8 (0.40), 101(.9) and 23.7(2.32) in group B and those were 133 (6.16), 3.8 (.46), 100 (6.7) and 24.5(2.77) in group C respectively. (Table-II)

Table-I: Demographic and clinical type of patients

Parameters	Group	Mean±SD of age in year / Percentage of patient	t value/χ2 value	p value
Gender	Male	61 (75%)	16.01	<0.001
	Female	24 (25%)		
Age	Male	46± 13	0.083	0.93
	Female	47± 9		
	Total	46.6± 11		
Clinical type	HBV	69 (male = 49, female = 20)		
	HCV	18 (male = 13, female = 07)	0.712	0.85
	Non B and Non C	09 (male = 08, female = 02)		
	Wilson's disease	02 (male = 01, female = 01)		
	Others	02 (male = 02)		

The mean differences of the four electrolytes did not varied between two groups as they had t-values (p values) of 0.719 (0.43), 0.397 (0.69), 0.951(0.54) and 1.40 (0.17) respectively. The study sought the percentage of hyponatremia in Cirrhotic patients. The serum sodium <130 meq/L was considered as having hyponatremia.

In our study, we found, about 35% of the Cirrhotic patient had hyponatremia. But we did not had any statistically significant difference in the percentage of hyponatremia between group B and group C based on Child-Pugh score (χ2=0.932, p=0.32). (Table – III)

Table-II: The electrolytes profile of patient in the study

Electrolytes	Study group	Mean ± SD	T value	P value
Sodium (meq/L)	Group B	132±5.14	0.719	0.43
	Group C	133±6.16		
Potassium (meq/L)	Group B	3.80±0.40	0.397	0.69
	Group C	3.85±0.47		
Chloride (meq/L)	Group B	101±5.91	0.951	0.54
	Group C	100±6.7		
Bicarbonate (meq/L)	Group B	23.7±2.32	1.40	0.17
	Group C	24.5±2.77		

Table-III: Comparison of hyponatremia between different cirrhotic groups

Parameters		Hyponatremia		$\chi 2$ value	p value
		Present	Absent		
Child-Pugh score	Group B	13(15.3%)	18(21.2%)	0.932	0.32
	Group C	17(20%)	37(43.5%)		
	Total	30(35.3)	55(64.7)		

The correlation test between the Child-Pugh score and the four electrolytes done in this study showed no significant correlation. But Sodium and potassium had significant correlation with chloride. Sodium had positive (r = 0.42) but potassium (r = 0.35) showed negative correlation with chloride. So we sought that Child Pough score showed no significant impact on the serum electrolytes profile whereas when serum sodium was increased chloride also increased significantly but chloride showed decreasing propensity with the increasing of potassium. (Table IV)

Table-IV: Correlation between serum electrolyte child-pugh class

Correlation parameters		Correlation coefficient (r)	p value
Child-Pugh score	Sodium	0.008*	0.94
	Potassium	0.045*	0.68
	Chloride	0.128*	0.24
	Bicarbonate	0.023*	0.80
Sodium	Chloride	0.425**	0.00
Potassium	Chloride	−0.35**	0.002

* Significant at <0.05 level

** Significant at <0.05 level

Discussion

This study was done to assess the association of the severity of hepatic tissue damage and the serum electrolytes profiles. The severity of the cirrhosis was rated by Child-Pugh score. The study also focused to observe the correlation among the Child-Pugh score and the serum electrolytes level.

The causes of cirrhosis in our study were hepatitis B virus (68%), hepatitis C (19%) virus and other. The study done by Eric Levesque1et al shown that alcoholic cirrhosis was 68% while HBV and HCV were the cause of cirrhosis for 4% and 14% of patient.[11] This picture might reflect high consumption of alcohol in western life than in Bangladesh. The severity of the liver damage was measured on Child-Pugh score. Chronic hyponatremia (defined as a serum sodium concentration below 130 meq/L) occurs in up to 22 percent of people with cirrhosis,[6] and is often asymptomatic if the serum sodium concentration is above 120 meq/L.[5] Jong Hoon Kim et al revealed that the prevalence of dilutional hyponatremia, classified as serum sodium concentrations of ≤135 mmol/L, ≤130 mmol/L, and ≤125 mmol/L, were 20.8%, 14.9%, and 12.2%, respectively.[1]

In our study we considered chronic hyponatremia those who had serum sodium level >130 meq/L and taking this level as cut-off point we found about 35% patient with Cirrhosis had hyponatremia. The percentage of hyponatremia sought in this study more or less conforms to study done by Gines et al. The percent of people with cirrhosis affected by chronic hyponatremia increases to 50 percent if a cutoff for serum sodium concentration of 135 meq/L, the lower limit of normal, is used.[6] The frequency of such profound hyponatremia as seen at presentation in the patient greater than in this case (serum sodium concentration of 105 meq/L) is unclear; a population survey reported that the prevalence of patients with cirrhosis and serum sodium concentrations less than or equal to 120 meq/L is 1.2 percent.[4]

The most common reason for chronic hyponatremia in cirrhosis is impairment in renal solute-free water secretion due to increased antidiuretic hormone secretion and decreased effective arterial volume.[1] The brain is able to compensate for the increased osmolar pressure (which leads to cerebral edema) in chronic hyponatremia by extruding intracellular osmolytes, such as potassium, glutamine and myoinositol, which can take 48 hours for full effect.[11] This adaptive mechanism explains why patients with chronic hyponatremia and serum sodium concentrations above 120 meq/L are often asymptomatic.

In patients with cirrhosis, it is important to recognize the symptoms of hyponatremia, identify and treat any exacerbating conditions early in their course, and correct the serum sodium concentration slowly with frequent monitoring. Jong Hoon Kim et al sought that the serum sodium level was strongly associated with the severity of liver function impairment as assessed by Child-Pugh and MELD scores ($p<0.0001$). In our study we found no such relation that we conclude that severity of the liver disease (Cirrhosis) had no impact on serum sodium level. But we found that chloride varies directly serum sodium level and inversely with serum potassium level.[1]

The electrolytes profiles in cirrhotic patients were measured to have a view on the effect of liver damage. Several study all over world projected that the cirrhosis of the liver frequently leads to a state of chronic hypervolemic hyponatremia. The cause of the hyponatremia is related to a decrease in systemic vascular resistance, which is more prominent in the splanchnic circulation, and compensatory neurohormonal mechanisms that are activated due to the hemodynamic changes. Hyponatremia in cirrhosis can be a severe problem and has been shown to be an independent predictor of mortality in patients waiting for liver transplantation. Our present study found feature of hyponatremia or other electrolytes imbalance in patient with chronic liver disease. But the study found no correlation with Child-Pugh score and the serum electrolytes level in Cirrhotic patient. The limitation we face was the paucity of adequate article on this topic to strengthen the discussion. Further more detailed and meticulous study may elucidate the deeper insight in causal relationship between severity of liver diseases and electrolyte disorder.

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