FREQUENCY OF HYPONATREMIA AND IN-HOSPITAL CLINICAL OUTCOMES IN THESE PATIENTS HOSPITALIZED FOR HEART FAILURE

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ABSTRACT

Objective: To determine the frequency of hyponatremia and in-hospital clinical outcomes in hyponatremic patients hospitalized for heart failure.

Methodology: This was a descriptive study conducted in department of cardiology, Lady Reading Hospital, Peshawar. Both male and female patients aged 14 years and above admitted with heart failure fulfilling the inclusion criteria, were included in the study. Patients were subjected to detailed history and clinical examination. Admission Serum sodium was measured in all patients. All the patients were managed according to guidelines. All patients were followed for in hospital mortality and length of hospital stay (LOHS).

Results: The total number of patients was 241. Mean age was 59.2 ± 14.9 (range 18–100) years. Females were 123 (51%) patients. Mean serum sodium was 136±5.1mmol/L. Hyponatremia (serum sodium ≤135mmol/L) was found in 85 (35.3%) patients. The overall in-hospital mortality rate was 5.4%. Lower values of serum sodium at admission was associated with higher in-hospital mortality of 8.2% as compared with 3.8% for those patients with normal serum sodium (p=0.23). Mean Length of Hospital stay (LOHS) for overall CHF patients was 3.8+2.24 days. Longer mean LOHS, 4.1±1.8 days was observed for hyponatremic group compared with 3.7±2.4days for normonatremic group (p=0.009).

Conclusions: Hyponatremia is a common finding in hospitalized heart failure patients and is associated with significantly longer length of hospital stay. In addition hyponatremia is associated with higher but statistically insignificant in-hospital mortality in heart failure patients.

Key Words: Hyponatremia, Congestive heart failure, In-hospital mortality, length of hospital stay.

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INTRODUCTION

Heart failure (HF) is a clinical syndrome, resulting from structural or functional cardiac disorders that impair the ability of the cardiac pump to support a physiological circulation[1]. Congestive heart failure affects about 2% of the western population, with prevalence increasing sharply from 1% in 40 years old to 10% above age 75 and it is the most common cause of hospitalization in patients over 65 years of age[2].

In the western world where there are reliable epidemiological studies, HF is a major health problem, not only in terms of the high morbidity and mortality, but also in terms of total cost to the different nations[3-5]. In the developing countries where not much data are available, in addition to ischemic heart disease, hypertensive, diabetic and infective heart diseases leading to heart failure are prevalent[3,6-9].

Electrolyte disorders are common among patients with congestive heart failure (CHF) and may be caused by the disease itself or its treatment[10]. All patients with evidence of volume overload or a history of fluid retention should be treated with diuretics[11]. The minimum required dose should be used because over-diuresis exacerbates the activation of the Renin Angiotensin System and may result in electrolyte abnormalities[12,13]. Hy-

ponatremia, defined as a serum sodium concentration <135 mmol/L, is a relatively common finding in patients admitted to the hospital with heart failure[14]. A study conducted recently showed that 24% patients with CHF develop hyponatremia[15]. In another study hyponatremia was present in (23.8%) patients[16].

Hyponatremia in patients with CHF signifies poor prognosis[17]. Hyponatraemia in CHF is associated with significantly higher rates of in-hospital and follow-up mortality and longer hospital stays[14]. An incremental increase in the risk of in-hospital death, follow up mortality and rehospitalization was reported in one study for each 3mmol/L decrease in admission serum sodium below 140mmol/L[14].

In OPTIMIZE-HF Registry lower admission serum sodium was associated with higher in-hospital mortality, 6.0% for the lower sodium group compared with 3.2% for those patients with higher serum sodium[14]. In ESCAPE Trial it was found that patients with persistent hyponatremia had an increased risk of all-cause mortality (31%) compared with normonatremic patients[16]. In addition hyponatremia has been proved to predict poor long term prognosis in patients with heart failure with preserved ejection fraction[18].

Electrolyte disorders are frequently overlooked in heart failure patients. Most of the data on hyponatremia in heart failure is from west which is genetically and environmentally different from our population, therefore the purpose of this study was to see if our patient population behaves similarly to neurohormonal changes and if hyponatremia is an equally important prognostic marker of adverse outcomes in heart failure. The study also highlights the importance of close serum sodium monitoring and possible measures to correct this abnormality.

METHODOLOGY

This was a descriptive cross sectional study conducted at cardiology department, Lady Reading Hospital, Peshawar from 9 August 2011, to 2nd January 2012. The study was approved by hospital ethical committee. The purpose and benefits of the study were explained to patients and written informed consent was taken from all the patients. A total of 241 patients were recruited in this study using (6%)[7] proportion of in hospital death among patients of HF with hyponatremia, 95% confidence level and 3% margin of error. Sampling technique was non-probability consecutive. Study population included were those HF patients who were on heart failure treatment including diuretics for ≥6 month and were admitted with congestive heart failure.

Complete history and physical examination of the eligible patients was carried out. The diagnosis of congestive cardiac failure was based upon any two of the following features i.e. orthopnea, exertional dyspnea, paroxysmal nocturnal dyspnea, raised jugular venous pressure, bilateral ankle edema and lung crepitation. Patients with previous diagnosis of chronic renal failure, chronic liver disease, hypothyroidism, nephrotic syndrome were excluded from the study to control bias.

Before initiation of treatment 5cc of blood was taken from all patients under strict aseptic technique and sent to hospital laboratory for serum sodium estimation. A serum sodium of ≤135mmol/L was defined as hyponatremia. All the laboratory investigations were done under supervision of expert pathologist and using same standard laboratory equipment (EasyLyte Plus. Medica Corporation 5 Oak Park Drive Bedford, MA 01730-1413 USA).

All the patients were managed according to guidelines and followed during hospital stay for in-hospital mortality and LOHS. Those who survived the hospital course were discharged on standard HF medications as indicated.

All data was analyzed with SPSS version 16.0. Mean and SD was calculated for continuous variables. Frequencies and percentages were calculated for categorical variables. Hyponatremia and clinical outcomes were stratified among age and gender to see the effect modifications. P value was calculated with chi square test. All results were arranged and presented in the form of tables and graphs.

RESULTS

A total of 241 patients were included in the study. Mean age was 59.2 ± 14.9 (range 18–100) years. A total of 123 (51%)patients were female whereas 118 (49%) patients were male. The most common cause of CHF was coronary artery disease that had a frequency of 141 (58.5%) patients. Cardiomyopathy and valvular heart disease was the cause of CHF in 74 (30.7%) patients and 23 (9.5%) patients respectively. Other causes of heart failure were found in 3 (1.2%) patients. (Fig 2) CAD was more common in male patients as compared to female patients (65.3% vs 52%) while cardiomyopathy and valvular heart disease was common in female patients (33.3% vs 28%) and (13.8% vs 5.1%) respectively.

Overall, the enrolled patients displayed a wide distribution of admission sodium values (Figure 1). Mean serum sodium was 136±5.1mmol/L (ranged 116-151). Hyponatremia (serum sodium ≤135mmol/L) was present in 85 (35.3%) patients. Hyponatremia was equally common in male and female patients 37.3% vs. 33.3% (Table 1). Patients admitted with hyponatremia were clinically similar to patients with normonatremia in terms of age, gender and New York Heart Association (NYHA) class at admission. No difference was observed in the baseline (at the time of admission) use of Angiotensin convert-

Figure: 1 Distribution of admission serum sodium (mmol/L) in patients hospitalized with heart failure (n=241)

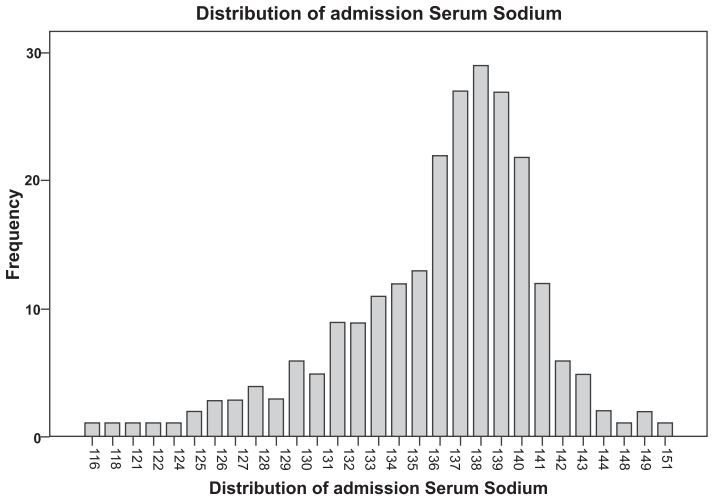

Table 1: Age and Gender distribution of hyponatremia in patients with HF

	Hyponatremia n (%)	Chi square test P value
Male	44 (37.3)	0.59
Female	41 (33.3)	
Overall	85 (35.3)	

Table 2: Baseline variables of enrolled patients

Variable	Na >135 mmol/L (n =156)	Na ≤135 mmol/L (n =85)	2-sided p value	Overall (n=241)
Mean age years ± (SD)	59.94 (15)	57.8(14.7		59.2(14.9)
CAD n (%)	95(60.9)	46(54.1)	0.339	141(58.5)
Cardiomyopathy n (%)	47(30.1)	27(31.8)	0.889	74(30.7)
Valvular heart disease n(%)	14(9)	9(10.6)	0.655	23(9.5)
ACE-Inhibitor and/or ARBs at admission n (%)	103 (66)	55(64.7)	0.887	158(65.5)
BB at admission n (%)	51(32.7)	27(31.7)	1.00	78(32.3)
Aldosteron antagonists at admission n (%)	78(50)	44(51.8)	0.893	122(50.6)
Loop diuretics at admission n (%)	118(75.6)	66(77.6)	0.754	184(76.3)
Digoxin at admission n (%)	52(33.3)	30(35.3)	0.777	82(34)
NYHA Class III at admission n (%)	46(29.5)	24(28)	0.883	70(29)
NYHA Class IV at admission n (%)	110(70.5)	61(72)	0.883	171(71)

Table 3: In-hospital mortality and LOHS in patients admitted with Heart Failure

Outcome	Na >135 mmol/L (n=156)	Na ≤135 mmol/L (n=85)	2-sided p value	Overall (n=241)
In-hospital mortality n (%)	6 (3.8)	7 (8.2)	0.23	13 (5.4)
Mean LOHS±SD (days)	3.7± 2.4	4.1± 1.8	0.009	3.8 ±2.24

ing enzyme (ACE) inhibitors and/or ARBs, Beta-blockers, Aldosterone antagonists and Loop diuretics. Majority of the patients were in NYHA class IV (71%) (Table 2).

The overall in-hospital mortality rate was 5.4%. Lower admission serum sodium was associated with higher in-hospital mortality, 8.2% for the lower sodium group compared with 3.8% for those patients with normal serum sodium (p =0.23). Overall, the mean length of hospital stay (LOHS) was 3.8+2.24 days. Lower admission serum sodium was associated with longer mean hospital LOHS, 4.1±1.8 for lower sodium group compared with 3.7±2.4 for higher group (p=0.009) (Table 3).

DISCUSSION

The findings of this study demonstrate that hyponatremia at the time of admission is relatively common in patients hospitalized with acute decompensated heart failure. Mean serum sodium was 136 ±5.1 mmol/L. Another study reported the mean admission serum sodium of 138±5 mmol/L[7]. In this study the hyponatremia was recorded in 35.3% of patients with chronic heart failure. Earlier studies conducted in acutely destabalized heart failure patients have reported hyponatremia in 22-27% patients[15-20].

The reason for a higher frequency of hyponatremia in this study is because most of the study population was in NYHA class IV heart failure and peripheral edema was quite frequent.

The overall in-hospital mortality rate was 5.4%. Lower admission serum sodium was associated with higher in-hospital mortality, 8.2% for hyponatremic group compared to 3.8% for those patients with normal serum sodium. In this study 8.2% chronic heart failure patients with hyponatremia died during their admission for decompensated heart failure. Sub group analysis showed a higher but statistically insignificant in-hospital mortality in females (11.6% vs 4.8% p=0.433).

Liviu Klein et all reported 5.9% in-hospital mortality in a similar group of patients[21]. Another study OPTIMIZE-HF registry by Gheorghiade et all showed a total of 3.8% in-hospital mortality in patients hospitalized with heart failure. His study reported similarly high mortality in hyponatremic group 6.0% as compared to 3.2% in normonatremic group[14].

One study reported that the risk of death appeared to increase linearly with serum sodium levels <140 mmol/L. Hyponatemia in heat failure is also associated with increased short and long term mortality as compared to normonatremia[18,19,22].

The reason for higher in hospital mortality in our study was that majority of our patients were sicker than those recruited in previous studies as evident from higher New York Heart Association (NYHA) functional class at presentation which is one of the prognostic factor[17]. In our study 71% patients were in NYHA class IV as compared to 49% in another study[21]. Also unlike in the study by Gheorghiadeet et al who reported 6% in hospital mortality, no patient was offered LV assist device, mechanical ventilation and the use of newer vasodilator i.e. Neseritide and milrinone[14].

In our study mean length of hospital stay (LOHS) was 3.8±2.24 days. Similar in-hospital mortality rates were described in a multicenter study[23], while an analysis from the OPTIMIZE-HF registry showed longer overall mean length of hospital stay but like our study hyponatremic patients had longer hospital stay as compared to normonatremic patients[14]. Overall shorter hospital stay in our study was probably the result shortage of medical facilities resulting in premature discharge of patients[14]. Whyte et al. also showed that severe hyponatraemia is associated with longer hospitalizaion time and increased mortality compared with normonatraemic patients[24].

The high short-term mortality and morbidity rates in patients hospitalized with worsening heart failure and hyponatremia underline the importance of identification of hyponatremia. Based on the results of my study I would suggest further larger studies to assess the frequency of hyponatremia and its effect on long term outcome in chronic heart failure patients in our population.

LIMITATIONS

There were certain study limitations. This was a small single center study and in addition the number of patients enrolled in the study were small, therefore larger scale studies are needed to validate the study findings. The study sample consists solely of patients with chronic heart failure and relatively preserved renal function. Whether serum sodium concentration would be predictive of outcomes in patients hospitalized for heart failure and more advanced renal dysfunction deserves further investigation.

CONCLUSION

Hyponatremia is a common finding in hospitalized heart failure patients and is associated with significantly longer length of hospital stay. In addition hyponatremia is associated with higher but statistically insignificant in-hospital mortality in heart failure patients.

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CONTRIBUTORS

FA performed planning and writing of the manuscript. AH, MAI, IA, YA, MRH, SA collected data and did data analysis. MH supervised the study. All authors contributed significantly to the final manuscript.