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Electrolyte and Renal Function Status in Congestive Cardiac Failure Patients attending at Tertiary Hospital, Dhaka, Bangladesh

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Abstract

Background: Congestive cardiac failure may involve the renal function. Objective: The purpose of the present study was to describe the status of electrolyte and renal abnormalities in patients with congestive cardiac failure. Methodology: This was a cross-sectional study at Department of Medicine and Department of Cardiology at Dhaka Medical College Hospital, Dhaka, Bangladesh for six months after approval of the protocol on patients suffering from CCF. Study population were selected in the study group based on age more than 18 years with both sexes as well as diagnosed case of CCF and willing to participate. Result: A total number of 100 participants were included in this study. In addition Lab investigation showed mean serum creatinine 133.5±76.9 µmol/L. The mean serum sodium was 136.2±5.7 mmol/L. Hyponatraemia was present in 38.0% cases of the patients while 6.0% cases had hypenatraemia. The mean serum potassium was 4.3±0.7 mmol/L and hypokalaemia and hyperkalaemia were present in 14.0% and 6.0% of the patients respectively. The frequency of acute kidney injury (AKI) was 29.0% cases; however, 30.0% cases of total study population had chronic kidney disease (CKD). Conclusion: In conclusion majority patients have electrolyte disturbance among CCF patients. *[Journal of National Institute of Neurosciences Bangladesh, January 2022;8(1): 42-45]*

Keywords: Congestive heart failure; acute kidney injury; chronic kidney disease; electrolyte; hyponatraemia; hypernatremia; hypokalaemia; hyperkalaemia

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Introduction

Congestive heart failure is one of the main causes of hospitalization, in-hospital mortality and health spending[1]. Subjects with congestive heart failure usually show acid–base and electrolyte disorders and renal dysfunction by several mechanism. However, irrespective of etiology and mechanism, these are often reflecting the severity of CHF and contribute to the functional impairment and to the poor long-term prognosis[2-5]. For that reason, knowing initial status of electrolyte and renal function is essential for further management and or long-term outcome[4-6].

Considering the paucity of the literature, the study was planned to assess the electrolyte and renal function status in CCF patients during hospital admission. The study findings will help the clinicians and cardiologist to know the current status of these groups of patients and eventually help the patients. The common electrolyte abnormalities are hyponatremia, hypokalemia, and hypomagnesemia. Hypercalcemia and hypomagnesemia

also are observed in patients with diabetes, hypertension, and obesity[7]. Patients with cardiac insufficiency are often administered diuretic therapy that may further exacerbate ion imbalance. The acid–base disturbances generally observed are metabolic alkalosis pure or combined with respiratory alkalosis[8].

Several mechanisms interact to produce these alterations. The decrease in cardiac output leads directly to a reduction in renal blood flow, with impairment of renal excretion of water and electrolytes, and it causes the activation of several neurohormonal responses that affect both cardiovascular homeostasis and electrolyte balance. The therapy of CHF subjects includes the discovery and management of these electrolyte abnormalities that have a role in the development of ventricular arrhythmias. The highest risk groups for rapid progression of renal dysfunction were the individuals with an eGFR more than 90 ml/min at baseline[9].

Thus, it appears that preserved renal function does not protect an individual with systolic dysfunction from developing worsening renal function and those that have renal dysfunction have a poorer prognosis than those with stable, preserved renal function. Weiner, et al concluded after evaluating the associations between baseline and change in renal function and cardiovascular events that the presence of abnormal renal function, even with some degree of variability where there is biochemical improvement is associated with increased cardiovascular morbidity[10].

Until date, there are few studies on initial status of electrolytes and renal function in CCF patients on admission in Bangladesh. Therefore, this study was designed to look for electrolyte and renal status in CCF patients.

Methodology

This was a cross-sectional study in the Department of Medicine and Department of Cardiology at Dhaka Medical College Hospital, Dhaka, Bangladesh for six months after approval of the protocol on patients suffering from congestive cardiac failure. Study population was selected in the study group whose age more than 18 years of both sexes and diagnosed case of CCF. Study population was excluded who were severely ill, known case of CKD and not willing to participate. After selecting the patients, informed written consent was taken from the subjects following describing the purpose, methods, benefits and hazards of study. All patients were subjected to detailed history, clinical examination and relevant investigation. Face to face interview was conducted by using a semi-structured questionnaire containing socio-demographic parameters and clinical presentations. Diagnosis, clinical sign and investigation profile were collected from patient registry file. After collection of all the required data, these were checked, verified for consistency and tabulated using the SPSS version 23.0 software. Statistical significance was set as 95.0% confidence level at 5.0% acceptable error level. Data were presented as the proportion of valid cases for discrete variables and as means with standard deviations and/or medians for continuous variables. Differences in baseline characteristics were compared using both the unpaired t test and the Pearson chi square test. Results were presented with a 95.0% confidence interval (95% CI). A p value of less than 0.05 was considered significant.

Results

A total number of 100 cases were recruited for this study. Lab investigation showed mean serum creatinine 133.5±76.9 µmol/L, mean serum Na+ 136.2±5.7 mmol/L and mean serum K+ was 4.3±0.7 mmol/L (Table 1).

Table 1: Important Clinical Examinations and Lab Investigations of CCF Patients (n= 100)

Serum Electrolytes	Mean ± Standard deviation
Serum Creatinine	133.5 ± 76.9 µmol/L
Serum Na+	136.2 ± 5.7 mmol/L
Serum K+	4.3 ± 0.7 mmol/L

In this study hyponatraemia was present in 38.0% patients while 6.0% patients had hypenatraemia and the rest of 56.0% patients had normal sodium level (Figure I).

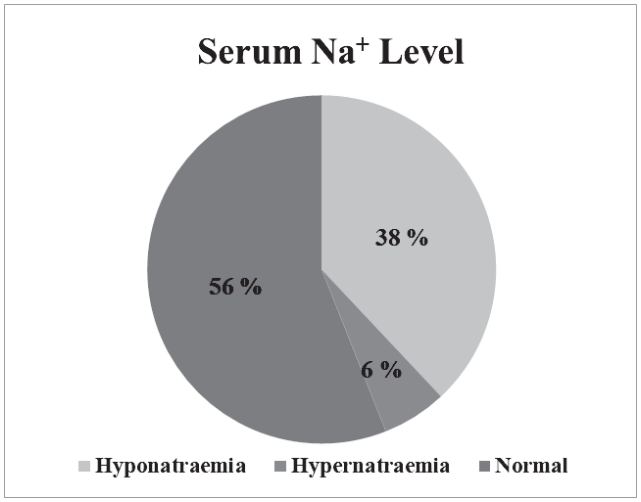

Figure I: Distribution of CCF patients according to serum Na+ Level (n=100)

Hypokalaemia and hyperkalaemia were present in 14.0% cases and 6.0% cases of the patients respectively. Rest 80.0% cases had normal serum potassium value (Figure II).

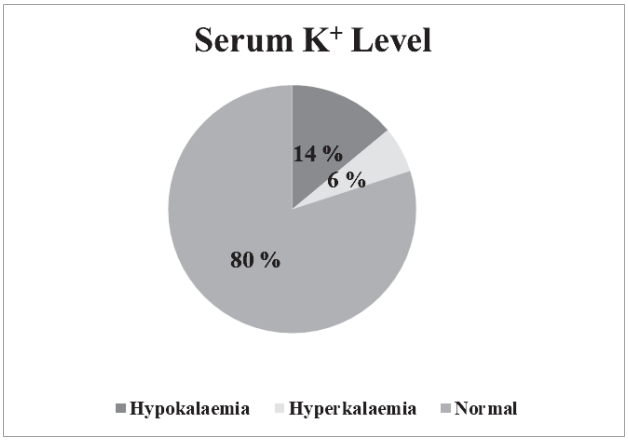

Figure II: Showing CCF Patients according to Serum K+ Level (n=100)

Frequency of acute kidney injury (AKI) among CCF patients was in 29.0% cases (Figure III).

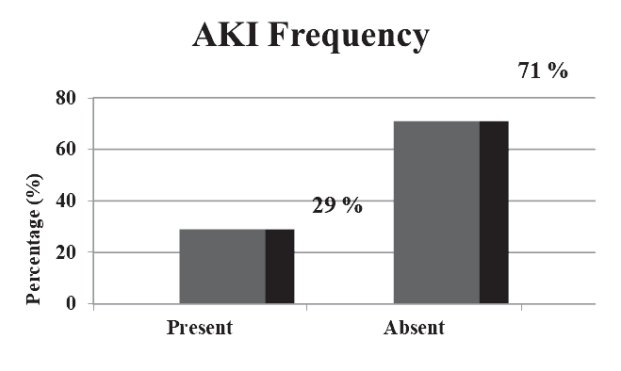

Figure III: Showing AKI in Study Population (n=100)

In this study 30.0% cases of total study population had chronic kidney disease (CKD) and 70.0% cases had not (Figure IV).

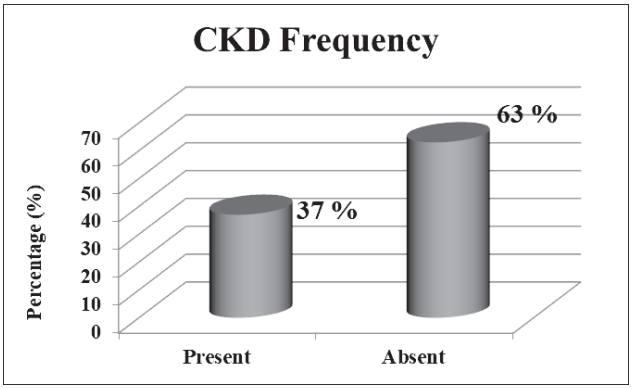

Figure IV: Frequency of CKD in study population (n=100)

Discussion

Cardiovascular diseases are one of the main causes of morbidity and mortality in this country now. Congestive cardiac failure (CCF) is a significant and growing health problem as the population ages[11]. Despite the significant advances in therapies and prevention, mortality and morbidity are still high and quality of life poor[12]. It is found that mean serum creatinine 133.5±76.9 µmol/L, mean serum Na+ 136.2±5.7 mmol/L and mean serum K+ was 4.3±0.7 mmol/L. Other studies[11-13] also showed similar results as mean serum creatinine 155.18±276.7 µmol/L, mean serum Na+ 137.21±6.6 mmol/L and mean serum K+ was 4.38±0.66 mmol/L. In this study hyponatraemia was present in 38.0% of the patients while 6.0% cases had hypenatraemia and rest 56.0% patients had normal sodium level. Barasa et al[13] found hyponatraemia was present in 35.6% of the patients while 7.4% had hypernatraemia. Hyponatraemia is particularly common in CCF and OPTIMIZE-HF registry recorded that 25.3% of 47,647 heart failure patients had hyponatraemia on admission which also supports this present study. Hyponatraemia generally identifies CHF patients in more advanced stages of the syndrome and, thus, a more activated neuro-hormonal system[14].

Hypokalaemia in relation to hyponatraemia was less common affecting 14.0% patients followed by hyperkalaemia in 6.0% patients. Barasa et al[15] showed hypokalaemia and hyperkalaemia were present in 7.4% and 2.9% patients of their study. Hypokalemia has been associated with a poor prognosis in patients with CHF. Thus, it is likely that hypokalemia is as much a marker of other pathophysiologic factors or of the severity of CHF itself as it is an isolated predictor of adverse events[14].

Frequency of acute kidney injury (AKI) in congestive cardiac failure showed 29.0% patients of CCF patients developed AKI where 71.0% not. Depending on the population, 27.0% to 40% of patients hospitalized for ADHF develop acute kidney injury16. This figure is lower than that found by Ghonemy et al[16] who got 47.0% patients with CHF had developed AKI.

Regarding CKD in this study population, 37.0% cases of total patients had chronic kidney disease (CKD) and 63% cases had not. Ezekowitz et al[14] also showed 37.0% cases and 39.0% patients with CCF developed chronic kidney disease respectively which is almost similar to our study.

Conclusion

In conclusion almost one third of the patients had been

found developed either AKI and or CKD. On the other hand, both sodium and potassium deficiency are prominent than hypernatremia and hyperkalemia. However, further study with larger sample size is recommended to explore the clearer picture.

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