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ELECTROLYTE DISTURBANCES IN HOSPITALIZED PATIENTS WITH ACUTE HEART FAILURE AND THEIR IMPACT ON OUTCOME

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ABSTRACT

Background: Acute heart failure is a considerable burden on healthcare systems, especially in places with limited resources. It is a leading cause of hospitalization and death among adult patients worldwide. Electrolyte disturbances are common in patients hospitalized with acute heart failure, and they are caused by complicated pathophysiological factors such as neurohormonal activation, renal dysfunction, hemodilution, and the use of diuretics and other heart failure drugs. **Objectives:** Is to determine the pattern of electrolyte abnormalities among patients admitted to Tuz General Hospital with acute heart failure. **Methods:** This is a hospital-based observational study. It was conducted between the 15th of June 2024 to the end of October 2025 at the Internal Medicine Department of Tuz General Hospital, Salah Al-Din Governorate, Iraq. The study included patients aged more than or equal to 18 years with a clinical diagnosis of acute heart failure as well as the with affordability of serum electrolyte results within the first 24 hours of admission. On the other hand, patients with end-stage renal disease on dialysis or with medical conditions or medications known to cause severe electrolyte disturbances unrelated to heart failure were excluded. The questionnaire was composed from four parts. The first part for patients' demographic information. The second part for patients' comorbidities. The third part for patients' vital signs at admission. The fourth part for laboratory investigations. **Results:** The study includes 330 patients with heart failure, of them 30 patients had electrolyte disturbances and 300 patients without electrolyte disturbances. The mean age ± standard deviation of the study participants is 74.27 ± 6.42 years. Males represent 175 (53.03%) patients and female represent 155 (46.97%) patients with Male: Female ratio was 1.12:1. Comparison between patients with electrolytes disturbances and those without electrolyte disturbances shows statistically significant difference regarding their mean age (P value <0.001), gender (P value < 0.001), the presence of hypertension (P value <0.001), diabetes mellitus (P value < 0.001), ischemic heart disease (P value = 0.012), their pulse (P value <0.001), blood pressure (P value < 0.001) and respiratory rate (P value < 0.001). **Conclusion:** The study found among heart failure patients, elderly, male patients as well as patients already have hypertension, diabetes and ischemic heart disease are more liable for electrolytes disturbance, which is a fatal complication and indicating poor outcome of patients with heart failure.

KEYWORDS: Adrenal, Crisis, Iraq, Salahiddin, Trauma.

1. INTRODUCTION

Acute heart failure (AHF) is a considerable burden on healthcare systems, especially in places with limited resources. It is a leading cause of hospitalization and death among adult patients worldwide.[1] Heart failure develops when structural or functional problems in the heart cause a state in which the ventricles cannot fill with or eject blood.[2] It encompasses the majority of cardiovascular disorders, including ischemic heart disease, hypertension, valve disease, and

cardiomyopathies.[3] It affects more than 64 million people globally, and its incidence rises with population age and post-myocardial infarction.[4] Heart failure, even with pharmaceutical therapy and devices, leads to high morbidity. The illness is exceedingly fatal, with five-year survival rates higher than those of common tumors like breast and prostate cancer.[5]

Acute heart failure is still a frequent cause of admission to internal medicine wards throughout Iraq. Due to delayed access to care and a lack of diagnostic and therapeutic resources, the condition frequently manifests at advanced stages.[6]

Electrolyte disturbances are common in patients hospitalized with acute heart failure, and they are caused by complicated pathophysiological factors such as neurohormonal activation, renal dysfunction, hemodilution, and the use of diuretics and other heart failure drugs.[7] The most prevalent electrolyte disturbance in AHF is hyponatremia, which is associated with significant disease activity and poor circulatory status. It is frequently linked to greater mortality, longer hospital stays, and higher rehospitalization rates.[8] Potassium abnormalities, such as hypokalemia and hyperkalemia, are clinically significant due to their link to life-threatening cardiac arrhythmias and sudden cardiac death.[9]

Tuz General Hospital has limited access to advanced biomarkers and imaging modalities; nevertheless, standard laboratory tests such as serum electrolytes are easily accessible and affordable. Despite their therapeutic significance, there is a shortage of local data on the electrolyte abnormalities in acute heart failure and their influence on patient outcomes. Thus, the aim of this study is to determine the pattern of electrolyte abnormalities among patients admitted to Tuz General Hospital with acute heart failure. In a context with limited resources, the results might assist guide basic corrective measures and enhance early risk classification.

2. PATIENTS AND METHODS

This is a hospital-based observational study. It was conducted between the 15th of June 2024 to the end of October 2025 at the Internal Medicine Department of Tuz General Hospital, Salah Al-Din Governorate, Iraq.

The study included patients aged more than or equal to 18 years with a clinical diagnosis of acute heart failure as well as the with affordability of serum electrolyte results within the first 24 hours of admission. On the other hand, patients with end-stage renal disease on dialysis or with medical conditions or medications known to cause severe electrolyte disturbances unrelated to heart failure were excluded.

The investigators conducted direct interviews with the patients or with their responsible relative to complete self-administered structured questionnaires. The questionnaire was composed from four parts. The first part for patients' demographic information; including patient age and gender. The second part for patients' comorbidities such as hypertension, diabetes mellitus and ischemic heart disease. The third part for patients' vital signs at admission. The fourth part for laboratory investigations including serum sodium, serum potassium, blood urea and serum creatinine level. Electrolyte disturbances were defined as, hyponatremia when serum sodium < 135 mmol/L and hypernatremia when serum sodium > 145 mmol/L. Hypokalemia when serum potassium < 3.5 mmol/L and Hyperkalemia: serum potassium > 5.0 mmol/L.

Statistical analysis was done by SPSS version 30.0, a statistical analysis tool for social sciences. Scale variables were reported as mean and standard deviation, median and interquartile range, and compared using parametric testing. In all statistical tests and procedures, level of significance P value was set at ≤ 0.05 considered as significant difference or association.

3. RESULTS

The study includes 330 patients with heart failure, of them 30 patients had electrolyte disturbances and 300 patients without electrolyte disturbances. The mean age ± standard deviation of the study participants is 74.27 ± 6.42 years. Males represent 175 (53.03%) patients and female represent 155 (46.97%) patients with Male: Female ratio was 1.12:1.

Table 3.1 shows comparison between patients with electrolytes disturbances and those without electrolyte disturbances regarding their demographic variables. Statistically significant difference between them regarding their mean age (P value <0.001) and gender (P value < 0.001)

Table 3.1: Comparison between patients with electrolytes disturbances and those without electrolyte disturbances regarding their demographic variables (number=330).

Variable	Electrolyte disturbance = 30	No electrolyte disturbance = 300	P value
Patient age, mean ± standard deviation	77.98 ± 6.94	71.30 ± 6.07	**<0.001**
Gender, number (%): -Male -Female	 19 (63.33%) 11 (36.67%)	 156 (52%) 144 (48%)	**<0.001**

Table 3.2 shows comparison between patients with electrolytes disturbances and those without electrolyte disturbances regarding their comorbidities. Statistically significant difference between them regarding the presence of hypertension (P value <0.001), diabetes mellitus (P value < 0.001) and ischemic heart disease (P value = 0.012).

Table 3.2: Comparison between patients with electrolytes disturbances and those without electrolyte disturbances regarding their comorbidities (number=330).

Variable	Electrolyte disturbance = 30	No electrolyte disturbance = 300	P value
Hypertension, number (%): -Yes -No	 26 (86.67%) 4 (13.33%)	 178 (59.33%) 122 (40.67)	**<0.001**
Diabetes, number (%): -Yes -No	 19 (63.33%) 11 (36.67%)	 122 (40.67%) 178 (59.33%)	**<0.001**
Ischemic heart disease, number (%): -Normal -Abnormal	 18 (60%) 22 (40%)	 141 (47%) 159 (53%)	**0.012**

Table 3.3 shows comparison between patients with electrolytes disturbances and those without electrolyte disturbances regarding their vital signs. Statistically significant difference between them regarding their pulse (P value <0.001), blood pressure (P value < 0.001) and respiratory rate (P value < 0.001).

Table 3.3: Comparison between patients with electrolytes disturbances and those without electrolyte disturbances regarding their vital signs (number=330).

Variable	Electrolyte disturbance = 30	No electrolyte disturbance = 300	P value
Pulse, number (%): -Normal -Abnormal	 26 (86.67%) 4 (13.33%)	 181 (60.33%) 119 (39.67)	**<0.001**
Blood pressure, number (%): -Normal -Abnormal	 21 (70%) 9 (30%)	 157 (42.33%) 143 (57.67%)	**<0.001**
Temperature, number (%): -Normal -Abnormal	 5 (16.67%) 25 (83.33%)	 41 (13.67%) 259 (86.33%)	0.990
Respiratory rate, number (%): -Normal -Abnormal	 20 (66.67%) 10 (33.33%)	 102 (34%) 198 (66%)	**<0.001**

4. DISCUSSION

Hospitalized patients with acute heart failure frequently experience electrolyte imbalances, which are significant independent indicators of unfavorable clinical outcomes such as higher in-hospital mortality and 30-day readmissions.[10] The pathophysiology of heart failure, including neurohormonal activation, and the side effects of treatment, especially diuretics and ACE inhibitors, are frequently the cause of these abnormalities.[11]

The study found the age of patients with electrolytes disturbances was significantly older than patients with no electrolytes disturbances. This might occur due to the fact that Glomerular Filtration Rate (GFR) and distal renal tubular function are declined with age makes older adults more vulnerable to imbalances, especially hyperkalemia. Moreover, older patients have a reduced renin and aldosterone response, as well as a diminished sensitivity to the thirst mechanism, which increases their risk of dehydration and water retention. Which is in agreement with Zhao et al study results.[12]

Regarding patients' gender, the study found male gender were significantly had more electrolytes disturbances in comparison to female. This might be related to lower glomerular filtration rates (eGFR) observed in male HF patients. Similar findings found by Biswas et al.[13]

The present study showed patient with electrolytes disturbances reported significantly more history of hypertension in comparison to patients with no electrolytes disturbances, which could be linked to the use of antihypertensive medications, such as diuretics (loop and thiazide) and ACE inhibitors, which can cause hyponatremia, hypokalemia, and hyperkalemia. Abdi had consistent findings.[14] The same with diabetes, the present study found diabetic patients were significantly more likely to develop electrolyte disturbances than non-diabetic patients, which occurred due to hyperglycemic

effect on hemostasis leading to osmotic fluid shifts and diuresis, leading to the loss of sodium and potassium. Eshetu et al had parallel finding.[15] Furthermore, another significant factor found by this study was the presence of ischemic heart disease. Which suggests a common pathogenesis pathway between ischemic heart disease and complicated heart failure. Similar to Biswas et al study findings.[13]

With regard to vital signs, the study explored patient with electrolytes disturbances reported significantly more pulse abnormalities in comparison to patients with no electrolytes disturbances, which explained by the fact that electrolyte disturbances, such as hyponatremia and hypokalemia, are strongly associated with tachycardia and irregular heart rhythms. Comparable results obtained from Urso et al.[15] In addition to pulse, blood pressure abnormalities also found to be significantly more prevalent in patients with electrolyte disturbances. As certain electrolyte disturbances, particularly potassium depletion, are associated with significantly lower blood pressure and an increased risk of life-threatening arrhythmias. This agrees Sato et al study results.[16] The last significant variable found in this study was the respiratory rate, patients with electrolytes disturbances had higher frequency of respiratory disturbances. This is findings explained by mechanisms such as hypokalemia induced muscular weakness and even paralysis or by the effect of electrolytes on acid-base balance. Biswas et al had similar results.[13]

It is crucial to consider the limitations of the current study when assessing the outcomes. First, the small sample size may make it more challenging to extrapolate the findings to other populations. Second, the study was conducted at a single hospital, which likely decreased the external validity of the results.

5. CONCLUSIONS AND RECOMMENDATIONS

The study found among heart failure patients, elderly, male patients as well as patients already have hypertension, diabetes and ischemic heart disease are more liable for electrolytes disturbance, which is a fatal complication and indicating poor outcome of patients with heart failure.

Conflict of Intertest

The authors of this study report no conflicts of interest.

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