

ASSOCIATION OF SERUM SODIUM WITH MORTALITY IN PATIENTS OF CONGESTIVE HEART FAILURE

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Abstract

Background and Objectives: Heart failure (HF) is associated with considerable mortality and morbidity. Electrolyte levels are considered to play crucial role in determining the outcome in these patients. This study was conducted to determine the association of serum Sodium with mortality in patients of Congestive Cardiac failure.

Methods: It was an observational study conducted in Department of Medicine, Sir Ganga Ram Hospital, Lahore from 22-12-2021 to 22-6-2022. Sample of 100 patients included. Patients aged between 30-70 years, both genders with congestive heart failure were included in the study and were divided in two groups based on their serum sodium levels. (Group I: with serum sodium level <135 mEq/L). Group II: with serum sodium level \geq 135 mEq/L. They were followed up during their in-hospital stay and mortality was noted in a predesigned proforma. Data were analyzed using SPSS version 24.0, and crude Relative risk calculated.

Results: Patients in exposed group had 52% mortality rate as compared to unexposed group in which mortality rate was only 18% respective crude(RR=2.88). Similarly, elderly patients (Relative Risk=3.23), Male patients (Relative Risk= 3.37), Overweight patients (Relative Risk=3.54), non-diabetic patients (Relative Risk=3.50), hypertensive patients (Relative Risk=2.95), ischemic heart disease patients (Relative Risk=4.12), Smoker (Relative risk=4.41) and duration of congestive HF (Relative Risk= 3.03) had higher risk for mortality.

Conclusion: Results obtained from this study showed that low serum sodium level had a significant effect on patients of congestive HF in terms of mortality. Keeping its prognostic importance, congestive HF patients should be strictly monitored for electrolyte imbalance.

Key Words: Serum sodium, Prognostic, Indicator, Mortality, Congestive Heart Failure.

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Heart failure(HF) is one of the major causes of mortality, although the treatment of HF has been improving.¹ The incidence of congestive HF has not significantly dec-lined over the past 50 years, and overall survival rates are low at 5 years following diagnosis. Numerous studies have shown low serum sodium to be a poor prognostic indicator of all-cause mortality in congestive HF patients,² Despite advances in

treatment, there remain well-recognized morbidity and mortality. Risk stratification requires the identification and validation of biomarkers, old and new. Hyponatremia has re-emerged as a prognostic marker in congestive HF patients.³ Epidemiologic studies estimate that the prevalence of HF with preserved ejection fraction, previously termed diastolic HF, is 1.1% to 5.5% of the general population, and ranges from 40% to 71% among HF patients.⁴ Over the past 3 decades, while the prevalence of HF with reduced ejection fraction or systolic HF has remained stable, HF with preserved ejection fraction has increased commensurately with the aging of the population at a rate of 1% per year.⁵ Hyponatremia has previously been described to be an adverse prognosticator in popu-

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lations with HF.⁶ Hyponatremia and changes towards hyponatremia have been suggested to be associated with adverse outcomes in patients undergoing cardiac resynchronization therapy implantation.^{7,8} One study has found that percentage of mortality was 24.75%, of patients with low serum sodium level and in 4.21% patients with normal serum sodium level ($p < 0.001$).⁹ While another study found that percentage of mortality was 12.1% patients with low serum sodium level and in 0.8% patients with normal serum sodium level ($p < 0.001$).¹⁰⁻¹²

Rationale of this study is to determine the association of low serum sodium as a prognostic indicator of mortality in patients of congestive HF. In routine, serum sodium level is not considered as risk factor for mortality. However, literature showed significantly higher rate of mortality in patients with congestive HF due to hyponatremia. So there is a need to conduct a study to get the evidence and implement the regular screening of patients of congestive HF for serum sodium level as well. So we want to conduct this study to get information and data regarding coexistence of hyponatremia in patients with congestive HF belong to local community and in future we can plan the strategies to improve serum sodium level to prevent its associated complications and mortality.

METHODS

This was an observational study done in Department of Medicine, Sir Ganga Ram Hospital Lahore during 22-12-2021 to 22-06-2022. Sample of 100 patients was included with 90% power of study, 5% significance level and taking percentage of mortality i.e. 24.75% patients with low serum sodium level and in 4.21% patients with normal serum sodium level. Patients aged between 30-70 years, both genders with congestive heart failure were included in the study and divided into two groups based on serum sodium level at the time of presentation. Group I: with serum sodium level < 135 mEq/L, Group II: with serum sodium level ≥ 135 mEq/L. Exclusion Criteria included patients with liver disorders (AST > 25 IU, ALT > 30 IU, hepatitis B or C), renal disorders (eGFR

< 30 mL/min/1.73 m² or creatinine > 2.0 mg/dl or on hemodialysis), any malignancy, anemia (Hb < 9 g/dl), Patients with heart disease, recurrent congestive heart failure or already taking treatment for deranged sodium level. Variables like name, age, gender, Body Mass Index (BMI), history of smoking, history diabetes, hypertension, ischemic heart disease, duration of congestive HF was noted in predesigned proforma. All the patients remained admitted in medical wards and were followed-up during their hospital stay period to observe the out-comes (death or discharge) in two groups. During hospital stay, if patient died, then mortality was labeled. Patients were managed as per standard protocol. All this information was recorded. Quantitative variables like age, BMI, duration of congestive HF and serum sodium level was presented as mean and standard deviation. Qualitative variables like, gender, smoking, diabetes, hypertension, ischemic heart disease and mortality was presented as frequency and percentage. Data were stratified for age, gender, BMI, diabetes, hypertension, ischemic heart disease, smoking and duration of congestive HF. Post-stratification, 2x2 contingency tables were generated for each strata to calculate crude relative risk to determine the association of low serum sodium level with mortality. RR > 1 and p-value ≤ 0.05 was considered as significant.

RESULTS

Mean age of patients in exposed and unexposed group was 54.74 ± 7.47 and 55.04 ± 7.59 years and Mean duration of congestive HF in exposed and unexposed group was 2.70 ± 1.63 and 2.05 ± 1.36 . (Table 1)

Mortality was significantly higher in exposed group as that of unexposed group. i.e. 52% vs. 18%, Crude Relative Risk = 2.88. (Table 2) Value of relative risk showed that patients in case of exposure had 2.88 times higher chances of mortality as compared to those patients in unexposed group. (Table 3)

Table 1: Age of patients and duration of congestive HF in exposed and unexposed group

| Age of patients | Exposed (Serum Sodium <135) mEq/2 | Unexposed (Serum Sodium >135) mEq/2 |
|--------------------------------------|---|---|
| n | 50 | 50 |
| Mean | 54.74 | 55.04 |
| Standard Deviation | 7.477 | 7.597 |
| Minimum | 41 | 38 |
| Maximum | 68 | 69 |
| Duration of congestive heart failure | Exposed (Serum Sodium <135) mEq/2 | Unexposed (Serum Sodium >135) mEq/2 |
| N | 50 | 50 |
| Mean (Days) | 2.70 | 2.05 |
| Standard Deviation | 1.63 | 1.36 |
| Minimum | 0.70 | 0.50 |
| Maximum | 7 | 6 |

Table 2: Mortality in Exposed and unexposed group:

| Death | Exposed (Serum Sodium <135)mEq/2 | Unexposed (Serum Sodium >135)mEq/2 | Total |
|--------------|--|--|------------|
| Yes | 26(52%) | 9(18%) | 35 |
| No | 24(48%) | 41(82%) | 65 |
| Total | 50 | 50 | 100 |

Table 3: Crude relative Risk by Risk Factors

| | Mortality | Exposed | Unexposed | RR |
|----------------------------------|-----------|------------|------------|------|
| Overweight patients | YES | 20 (45.5%) | 5 (12.8%) | 3.54 |
| | NO | 24 (54.5%) | 34 (87.2%) | |
| Diabetic patients | YES | 16(53.3%) | 5 (23.7%) | 2.34 |
| | NO | 14 (46.7%) | 17 (77.3%) | |
| HTN patients | YES | 16 (57.1%) | 6 (19.4%) | 2.95 |
| | NO | 12 (42.9%) | 25 (80.6%) | |
| IHD patients | YES | 14 (53.2%) | 3 (13%) | 4.12 |
| | NO | 12 (46.2%) | 20 (87%) | |
| Patients With History of Smoking | YES | 12(70.6%) | 4 (16%) | 4.41 |
| | NO | 5 (29.4%) | 21 (84%) | |
| Duration Of CHF In Patients | YES | 16 (44.4%) | 6 (14.6%) | 3.03 |
| | NO | 20 (55.6%) | 35(85.4%) | |

DISCUSSION

Hyponatremia is the most common electrolyte disorder and is frequently encountered in patients with advanced HF. In this study we determined the association of low serum sodium with mortality in patients of congestive HF. Results showed that patients in

exposed group had 52% mortality rate as compared to unexposed group in which mortality rate was only 18% respective. Value of relative risk showed that patients in exposed group had 2.88 times higher risk of mortality as compared to those patients in unexposed group. Similarly, elderly patients (Relative Risk=3.23), Male patients (Relative Risk=3.37), Overweight patients (Relative Risk=3.54), hypertensive patients (Relative Risk=2.95), ischemic heart disease patients (Relative Risk=4.12), Smoker (Relative risk=4.41) and higher duration of congestive HF (Relative Risk= 3.03) had increased risk for mortality.

Several observational studies reported similar findings, suggesting hyponatremia as a marker of a more severe clinical condition, but not a target for treatment or intervention.^{2,13-15} One study has found that percentage of mortality was 24.75% patients with low serum sodium level and in 4.21% patients with normal serum sodium level ($p<0.001$).^{9,16} While another study found that percentage of mortality was 12.1% patients with low serum sodium level and in 0.8% patients with normal serum sodium level ($p<0.001$).¹⁰ Results of this study is in line with the findings of above mentioned studies showing higher mortality rate among patients with hyponatremia. However, variability in mortality rate can be seen across studies and that may be due to certain methodological issues like sample size, difference in operational definition of variables like mortality assessment (short term or long term).^{17,18}

In most HF patients' cases, hypervolemic-hyponatremia is the common denominator or nexus. Electrolyte imbalance should be readily monitored in congestive HF patients. These patients frequently exhibit signs of agitation and irritation due to a deficiency of serum sodium. Patients with congestive HF are also adversely affected by hyponatremia. In hyponatremic congestive HF patients, the hospital stay is longer, the condition is more severe, and the blood pressure is altered. Patients with hyponatremic congestive HF are also at a higher risk of dying in hospital when compared with patients normal sodium level. Result of this study should be interpreted considering the size of this study and the fact that we calculated crude relative risk.

CONCLUSION

Results obtained from this study showed that low serum sodium level had effect on patients of congestive HF in terms of mortality. Keeping its prognostic importance congestive HF patients should be strictly monitored for electrolyte imbalance.

Ethical Approval:

The ethical Approval was obtained from College of Physicians and Surgeons Pakistan. (Reference no. CPSP/REU/MED-2019-059-15924)

Conflict of Interest:

None

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