Original Research Article

Comparison Between the Clinical Utility of Serum Albumin as a Diagnostic Marker with Serum Pro-BNP in Patients Presenting with Acute Heart Failure Admitted to the Cardiology Department: A Retrospective Study

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Abstract

Introduction: Ability of biomarkers to accurately diagnose a patient's disease in emergency settings in cardiology department can predict the aggressiveness of the treatment given in due course of time. Heart failure is a clinical syndrome characterized by systemic perfusion inadequate to meet the body's metabolic demands as a result of a structural and/or functional cardiac abnormality, resulting in a reduced cardiac output and/ or elevated intracardiac pressure at rest or during stress. Several studies have demonstrated the significant role of NT‑proBNP, in heart failure management from diagnosis to monitoring and recommended its use in clinical practice and the same has been approved by major international guidelines. Acute systemic response reflects increased capillary permeability and redistribution of albumin to extrcellular fluids.

Aim: To compare the clinical utility of serum albumin as a diagnostic marker with serum Pro-BNP in patients presenting with Acute heart failure admitted to the cardiology department.

Materials and Methods: This retrospective evaluation of data was done on patients admitted in cardiology department with acute presentation of symptoms in a government-run Tertiary Care Centre in Western Uttar Pradesh over a period of three months. This study was performed to observe any relationship between serum albumin levels and serum Pro-BNP levels in these patients. The analysis was performed on the data of 95 patients after considering the exclusion criteria and availability of their serum albumin and serum Pro-BNP reports. Based on the Serum NT‑proBNP values, < 125 pg/mL and > 125 pg/mL, the two groups were formed. The comparison between the mean value of serum albumin in these two groups was done was done by unpaired t-test. Value of Serum NT‑proBNP was not distributed normally, hence Spearman rank correlation coefficient was calculated to establish the correlation between serum albumin and Serum NT‑pro BNP levels.

Results: About 45 of patients had Serum NT‑pro BNP values < 125 pg/mL and 50 patients had Serum NT‑pro BNP values > 125 pg/mL.The mean value of serum albumin was lower in the group with higher serum NT-pro BNP (>125pg/mL) as compared to those with Serum NT-pro BNP less than 125pg/mL, which was statistically significant (p value < 0.05). The correlation coefficient between serum NT-pro BNP and serum albumin levels was -0.460 which shows that both the parameters are negatively correlated and statistically significant.

Conclusion: The significant difference was observed between mean serum albumin values in the two groups based on whether the serum value was less than 125 pg/mL and more than 125 pg/mL. The serum albumin levels of the patients were negatively correlated with their serum NT-pro BNP levels and found to be statistically significant. So, this study concluded that the low serum albumin levels can also predict the acute heart failure in patient admitted in emergency of cardiology department.

Introduction

Now a days survival of critically ill patients admitted in cardiology department has improved significantly due to timely decision making that is directly based upon the various laboratory biochemical markers in this era of evidence based medicine. The biomarker's ability to accurately assess the severity of disease and its prognosis in cardiology department can predict the aggressiveness of the treatment given in due course of time. Heart failure is a clinical syndrome characterized by systemic perfusion inadequate to meet the body's metabolic demands as a result of a structural and/or functional cardiac abnormality, resulting in a reduced cardiac output and/ or elevated intracardiac pressure at rest

or during stress.[1-3] Several studies have demonstrated the significant role of NT‑proBNP, in heart failure management from diagnosis to monitoring and recommended its use in clinical practice and the same has been approved by major international guidelines.[1,2] The three natriuretic peptides have been described: atrial natriuretic peptide (ANP), B‑type natriuretic peptide (BNP), and C‑type natriuretic peptide (CNP).[4,5] ANP and BNP, as antagonists of the renin‑angiotensin‑aldosterone system, influence by means of their natriuretic and diuretic properties.[6-8] ProBNP, comprising of 108 amino acids, is secreted mainly by the ventricle and, during this process, is cleaved into physiologically active BNP (77‑108) and the N‑terminal fragment NT‑proBNP (1‑76). In subjects with left ventricular dysfunction, serum levels of BNP increases, as does the concentration of the inactive amino‑terminal fragment, NT‑proBNP. [5,6]

Measurement of NT pro-BNP in human serum and plasma is used to detect even mild forms of cardiac dysfunction. [1-3]The test also aids in the assessment of heart failure severity in patients diagnosed with congestive heart failure.[9,10] and it can also be used for monitoring the treatment in patients with left ventricular dysfunction.[11-14]

Systemic inflammation in response to tissue injury or inflammatory disease down regulates the production of few proteins including the albumin. Acute response might also reflect increased capillary permeability and redistribution of albumin to extrcellular fluids.[15]

The aim of the present study is to compare the utility of serum albumin as a prognostic marker with serum NT pro-BNP in patients admitted in the cardiology department.

Materials and Methodology

A retrospective evaluation of data on patients admitted in cardiology department of a government-run Tertiary Care Centre in eastern Uttar Pradesh over a period of three months was performed to establish a relationship between their serum albumin levels and serum NT pro-BNP levels. Patient presented with cardiac symptoms with acute heart failure, were included in the study. Patients with other causes for abnormal serum albumin levels like chronic liver diseases, chronic renal diseases and severe malnutrition were identified using bio-

chemical reports and clinical history in the case reports and excluded from the study.

The analysis was performed on the data of 95 patients admittedin cardiac emergency after considering the exclusion criteria and availability of serum albumin and serum NT pro-BNP reports of patients. Samples for NT pro-BNP were processed on Cobas e411 analyser (Electrochemiluminescence immunoassay) for the quantitative determination of the in human serum [16]. Samples for serum albumin were processed on RX IMOLA analyzer by Randox. Serum NT-proBNP values < 125 pg/mL used to exclude cardiac dysfunction with a high level of certainty in patients with symptoms suggestive of heart failure e.g. dyspnea and serum NT-proBNP values > 125 pg/mL indicating cardiac dysfunction and associated increased risk of cardiac complications (myocardial infarction, heart failure, death) taken as per literature [1,3,17,18]. In the current study the utility of serum albumin in predicting the same, was evaluated.

Statistical Analysis

Based on the Serum NT‑proBNP values < 125 pg/mL and > 125 pg/mL the two groups were formed and the comparison between the mean value of serum albumin in these two groups was done. Data was analyzed by using Microsoft Excel 365, Statistical Package for the Social Sciences (SPSS) for windows version 23.

Comparison between the mean data of serum albumin (based on the Serum NT‑pro BNP values < 125 pg/mL and > 125 pg/mL), was done by unpaired t-test. Value of Serum NT‑proBNP was not distributed normally, hence Spearman rank correlation coefficient was calculated to establish the correlation between serum albumin and Serum NT‑pro BNP levels. The serum albumin levels were presented as means $\pm$ SD with p-value of <0.05 being indicative of statistical significance.

Results

Total 106 patients were included in the study out of which 11 patients were excluded having known causes of hypoalbuminemia like chronic liver disease, chronic renal disease and severe malnutrition. About 45 of patients had Serum NT‑pro BNP values < 125 pg/mL and 50 patients had Serum NT‑pro BNP values > 125 pg/mL. (Table 1).

Table 1: Table Showing the Association between Categorical Sociodemographic and Clinical Variables and Serum NT-pro BNP Levels of Studied Subjects

| Characteristics	Number of Participants based on Serum NT-pro BNP values	
	Less than 125pg/mL (N=45)	More than 125pg/mL (N=50)
Age (in years)		
Less than 40	7	5
More than 40	38	45
Sex		

| Male | 31 | 39 |
| Female | 14 | 11 |

The mean value of serum albumin was lower in the group with higher serum NT-pro BNP (>125pg/mL) as compared to those with Serum NT-pro BNP less than 125pg/mL. This finding was found to be statistically significant (p value < 0.05). (Table 2)

Table 2: Table showing Comparison between Quantitative Variables based on Serum NT-pro BNP Levels of studied subjects

Characteristics	Serum NT-pro BNP values		p-value	Correlation Coefficient (with Serum NT-pro BNP levels)
	Less than 125pg/mL (N=45) Mean ± SD	More than 125pg/mL (N=50) Mean ± SD		
Serum Albumin Level (g/dL)	2.96 ± 0.24	2.73 ± 0.67	0.0299	- 0.460

The correlation coefficient between serum NT-pro BNP and serum albumin levels was -0.460 which shows that both the parameters are negatively correlated and this finding was statistically significant. (Graph 1, Table 2)
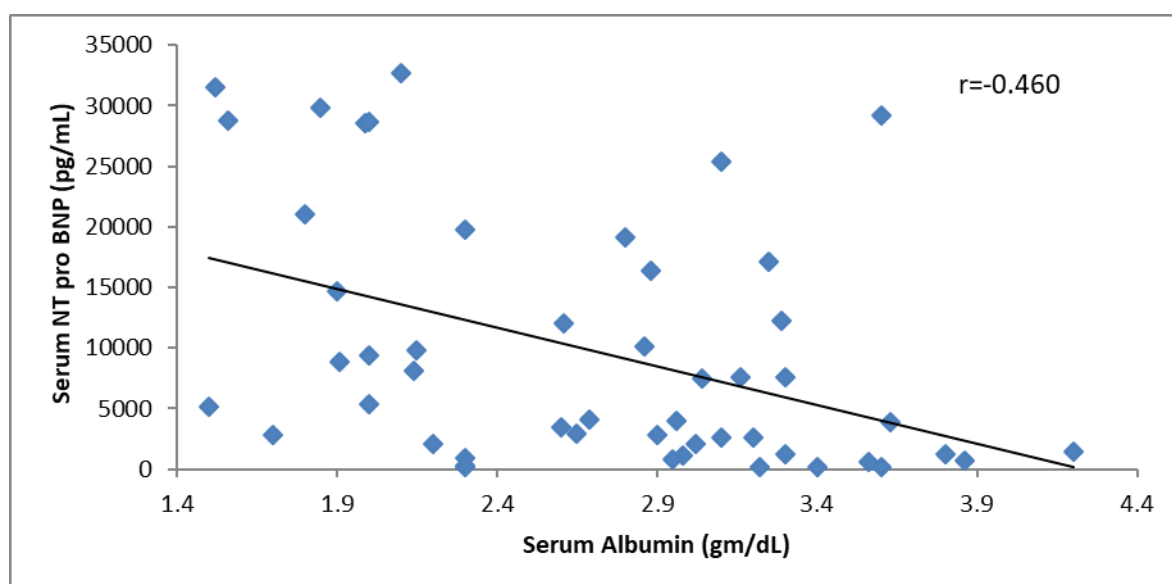
Figure 1: Showing correlation between serum NT-pro BNP and serum albumin levels in studied patients

Discussion

As we are living in a developing country, purpose of this study was to search a low cost but sensitive biomarker that can predict the severity of a cardiac morbidity.

As per the result of this study a low albumin concentration is associated with a high NT-pro BNP levels and it can be used as a marker for the severity of congestive heart failure in acute cardiac illness.

TB Horwich et al. published a study in 2008 showing that albumin levels predicted survival in patients with systolic heart failure [19].

Study of Arques et al. concluded that serum albumin concentration was a powerful predictor of in-hospital death for frail, elderly patients with acute heart failure [20].

Many studies demonstrated that serum albumin concentration is independently associated with cardiac events after discharge, even after adjustment for the well-established risk factors [21,22].

According to the study of Jolliffe N the chronic heart failure itself leads to the hypoalbuminemia [23] but its usefulness in acute heart failure has not been studied much.

This study had few limitations also such as it was based on the measurement of single dependent variable which is serum NT-pro BNP. Bigger sample size may be more predictive than the current study. As this study was an observational study and not an interventional/randomized study, complete adjustment for all confounding factors was almost impossible.

Conclusion

The significant difference was observed between mean serum albumin values in the two groups based on whether the serum value was less than 125 pg/mL and more than 125 pg/mL. The serum albumin levels of the patients were negatively correlated with their serum NT-pro BNP levels which was statistically significant. So this study concluded that the low serum albumin levels can also predict the acute heart failure in patient admitted in emergency of cardiology department.

Authors' Contributions

Sonali Chaurvedi did data collection and contributed to conception of study. Sandeep Singh Soam was responsible for study design, drafted the manuscript, performed statistical analysis and revised it. Both the authors read and approved the final manuscript.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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