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Original Research Article

Prognostic Significance of 1-Month Post-discharge BNP in Identifying Patients at High Risk of Mortality and Readmission after Decompensated Heart Failure

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Abstract:

Background: The measurement of B-type natriuretic peptide (BNP) levels after hospital discharge is a key indicator for evaluating prognosis in patients with decompensated heart failure. Monitoring BNP levels is essential for risk stratification because they correlate with higher mortality and hospital readmission rates in this patient group.

Methods: This study followed a prospective cohort of 50 patients who had been hospitalized for decompensated heart failure and were discharged from Darbhanga Medical College & Hospital. BNP levels were measured one month after discharge. The study also tracked mortality and readmission rates over one year, employing Kaplan-Meier survival analysis and Cox proportional hazards models for statistical assessment.

Results: Over the one-year observation period, 24% of the participants passed away, and 44% were readmitted for heart failure complications. Patients with BNP levels exceeding 300 pg/mL at one month post-discharge were at a significantly greater risk of dying (33% vs. 12%, p = 0.04) and being readmitted (55% vs. 30%, p = 0.02) than those with lower levels. High BNP levels (>300 pg/mL) were confirmed as independent predictors of both mortality (Hazard Ratio [HR], 2.8; 95% Confidence Interval [CI], 1.2-6.5; p = 0.02) and readmission (HR, 2.3; 95% CI, 1.1-4.8; p = 0.03).

Conclusion: The study underscores the significance of monitoring BNP levels in identifying patients at an increased risk of mortality and readmission following hospitalization for decompensated heart failure. Elevated BNP levels (>300 pg/mL) serve as a crucial prognostic tool for guiding risk assessment and management.

Recommendations: To improve outcomes for patients discharged after decompensated heart failure episodes, it is recommended to include BNP level assessments in their post-discharge care plans. This approach facilitates the early identification of patients at high risk of adverse outcomes, enabling timely and targeted interventions.

Keywords: B-type Natriuretic Peptide, Decompensated Heart Failure, Prognosis, Mortality, Readmission.

Introduction

Cardiology researchers are keenly focused on the prognostic implications of measuring B-type natriuretic peptide (BNP) levels in patients with decompensated heart failure a month after their hospital discharge [1]. BNP, a hormone secreted by the heart in response to increased pressure and volume, serves as a critical indicator of heart function and the severity of heart failure. High levels of BNP post-discharge are recognized as a significant marker for elevated risk of mortality and hospital readmission among these patients [2].

Monitoring BNP levels after patients leave the hospital is increasingly seen as a valuable method for predicting outcomes. Studies, including one by Fonarow et al., [3] demonstrate that individuals with raised BNP levels one month following discharge face a higher likelihood of death or the need for readmission. BNP's role extends beyond diagnosis during hospital stay to a predictive marker for adverse outcomes post-discharge [4].

The utility of BNP measurements lies in their ability to reflect changes in the heart's hemodynamic state and predict potential exacerbations of heart failure [5]. By identifying patients with persistently high BNP levels, healthcare providers can tailor treatment adjustments, such as optimizing medication or considering device implantation, to

improve survival rates and minimize readmission risks [6].

In summary, assessing BNP levels one month after hospital discharge in those with decompensated heart failure is invaluable for predicting high-risk patients. This approach facilitates targeted and effective management strategies, crucial in the context of heart failure's global rise. Utilizing BNP for post-discharge risk stratification aims to enhance patient outcomes and reduce healthcare costs [7].

This study will examine the predictive value of BNP levels measured one month post-discharge in identifying patients with decompensated heart failure at increased risk of mortality or hospital readmission.

Materials and Methods

Study Design: A prospective cohort study was the method used to conduct the research. Patients hospitalized for decompensated heart failure were able to have their BNP levels measured one month after discharge, allowing for the observation of outcomes (mortality and readmission rates).

Study Setting: This research took place at Darbhanga Medical College & Hospital, a tertiary care facility that offers comprehensive medical treatment, including specialized care for patients with heart failure. The convenience of its location and the number of patients it treats made it an ideal choice for this type of research.

Participants: Fifty patients who were admitted to the hospital and later released due to decompensated heart failure were part of the research. Patients having a confirmed diagnosis of decompensated heart failure who were 18 years of age or older were included in the study. Patients were not included if they were unable or unwilling to give informed consent, had a life expectancy of less than one month, or had a fatal illness.

Bias: Patients who met the study's inclusion criteria were enrolled sequentially to reduce the possibility of selection bias. The individuals involved in measuring BNP levels and collecting outcome data were trained, and standardized data collection mechanisms were put in place to mitigate information bias.

Variables: One month after discharge, the BNP level was measured as the main independent variable. Death within one year after release and readmission for heart failure were the dependent variables. Considerations such as age, sex, comorbidities, degree of heart failure upon admission, and treatment received during the initial hospitalization were included as covariates.

Data Collection: Medical records, in-person interviews, and blood testing were the main sources of data collection. A standardized assay was used to detect BNP levels one month after discharge. We used hospital records and phone interviews to gather data on death and readmission rates as a follow-up.

Procedure: Patients were asked to return one month after their discharge for a follow-up appointment when they would have blood samples taken to test BNP. After that, for a year, patients were followed up with frequent phone calls and in-person visits to document any cases of death or readmission.

Statistical Analysis: The features of the patients were summarised using descriptive statistics. After taking relevant confounders into account, the prognostic relevance of BNP levels one month after discharge in predicting mortality and readmission was evaluated using Cox proportional hazards models. An illustration of the time to event (death or readmission) for various levels of BNP was provided by Kaplan-Meier survival curves. It was deemed statistically significant if the p-value was less than 0.05. We used SPSS software to conduct all of our analyses.

Results

Patient Characteristics: Out of the 50 patients in the cohort, 32 (or 64% of the total) were male and 18 (36% of the total) were female, with an average age of 65 years (SD ± 12.5). Hypertension(72%), diabetes mellitus(58%), and prior episodes of heart failure(40%) were the most common medical histories among the patients. A month after discharge, the median BNP level was 350 pg/mL, with an interquartile range of 200-500 pg/mL.

Mortality and Readmission Rates: Twelve patients (or 24%) passed away and twenty-two patients (or 44%) required hospital readmission for worsening heart failure throughout the one-year follow-up. The range from first hospitalization to readmission was 3-6 months, with a median of 4.5 months.

BNP Levels and Outcomes: The study divided patients into two categories based on their BNP levels one month following hospital discharge: those with BNP levels at or below 300 pg/mL were placed in the low BNP group, while those with levels of 300 pg/mL or above were assigned to the high BNP group. The analysis revealed that individuals in the high BNP group experienced significantly higher rates of death (33% versus 12%, $p = 0.04$) and hospital readmission (55% versus 30%, $p = 0.02$) compared to their counterparts in the low BNP group.

Statistical Analysis: After adjusting for factors such as age, gender, and underlying health conditions, the Cox proportional hazards analysis revealed that BNP levels exceeding 300 pg/mL one month after discharge were significantly associated with an increased risk of death (hazard ratio [HR],

2.8; 95% confidence interval [CI], 1.2-6.5; p = 0.02) and hospital readmission (HR, 2.3; 95% CI, 1.1-4.8; p = 0.03). Kaplan-Meier survival curves further highlighted a statistically significant distinction in outcomes between the groups with low and high BNP levels, with differences in mortality (log-rank p = 0.03) and readmission rates (log-rank p = 0.02) being noteworthy.

Table 1: Clinical characteristics of the patients

Characteristic	Overall (N=50)
Total participants (n)	50
Age, years (mean ± SD)	65 ± 12.5
Gender, n (%)	
- Male	32 (64%)
- Female	18 (36%)
Hypertension, n (%)	36 (72%)
Diabetes Mellitus, n (%)	29 (58%)
Previous Heart Failure, n (%)	20 (40%)
BNP 1-month post-discharge, pg/mL (median [IQR])	350 [200-500]

Discussions

The research conducted at Darbhanga Medical College & Hospital involving fifty patients with decompensated heart failure sheds light on the prognostic significance of BNP levels measured one month following hospital discharge. The study's demographic data reveal a predominance of older adults, aged 65 and above, with a significant male majority (64%) [8]. It also notes high incidences of hypertension (72%) and diabetes mellitus (58%) among the participants. Notably, the study recorded a high likelihood of hospital readmission (44%) and a mortality rate of 24% within a year, underscoring the severe long-term impact of heart failure. Crucially, the findings delineate a clear prognostic threshold based on BNP levels a month post-discharge; individuals with BNP levels above 300 pg/mL face a considerably heightened risk of mortality and readmission [9]. The use of Cox proportional hazards models to adjust for other variables further reinforces the association between elevated BNP levels and adverse outcomes, emphasizing BNP's predictive capacity [10]. By measuring BNP levels after patients are discharged, healthcare providers can more accurately assess risk levels and tailor follow-up care, potentially decreasing the likelihood of readmission and mortality among these high-risk patients [11].

Recent studies in India have highlighted the prognostic significance of BNP and Pro-BNP levels in patients with heart failure, showcasing their capability to forecast outcomes post-discharge. Research conducted in North India revealed that patients with acute heart failure (AHF) exhibiting very high Pro-BNP levels (≥2000 pg/ml) faced a higher likelihood of hospitalization and mortality. This indicates a need for aggressive treatment and vigilant follow-up [12]. Additional research from the same region identified sepsis and poor adherence to medication as common contributors to AHF, with Pro-BNP levels serving as a robust mortality predictor. This underlines the biomarker's critical role in guiding clinical decisions. Furthermore, the interaction between elevated BNP levels and comorbid conditions like iron deficiency suggests the potential for more nuanced risk assessment and treatment planning [13].

A study from South India also established a link between NT-pro BNP levels and anaemia in heart failure patients, supporting the biomarker's utility in patient management. Collectively, these findings affirm that BNP and Pro-BNP are vital for prognostication in heart failure treatment in India, offering insights into their application in post-discharge care to improve patient outcomes [14].

Conclusion

Our research underscores the importance of monitoring B-type natriuretic peptide (BNP) levels in patients with decompensated heart failure for at least one month following their discharge. Elevated BNP levels (above 300 pg/mL) during this period serve as a reliable predictor for heightened risks of mortality and readmission, even after accounting for other factors. In such a vulnerable patient population, BNP is an essential tool for conducting personalized risk assessments and formulating effective treatment strategies. Implementing BNP measurements in post-discharge monitoring practices enables the early detection of patients at high risk, supports prompt intervention, and significantly enhances the management of individuals with decompensated heart failure, potentially leading to better patient outcomes.

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