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Clinical Significance of N-terminal pro B-type Natriuretic Peptide (NT-proBNP) in Heart Failure: A Comprehensive Review

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ABSTRACT
Heart failure (HF) is a prevalent and debilitating cardiovascular condition that demands precise diagnostic tools and personalized management strategies. In this review, we synthesize findings from seminal research articles to elucidate the clinical significance of NT-proBNP in HF diagnosis and management. Heart failure, a condition characterized by impaired cardiac function, imposes a significant global health burden. Timely and precise diagnosis is paramount for effective management. Among the numerous diagnostic and prognostic markers available, N-terminal pro B-type natriuretic peptide (NT-proBNP) has emerged as a prominent biomarker in the domain of heart failure. NT-proBNP, released by ventricular myocytes in response to myocardial stress, serves as a discriminative diagnostic tool. Elevated serum NT-proBNP levels provide sensitive and specific indications of myocardial stress, facilitating the rapid identification of heart failure cases. Its unique capacity to differentiate heart failure from conditions with similar clinical presentations bolsters its diagnostic significance.
Keywords: NT-proBNP, Atrial natriuretic peptide, Heart failure, biomarker and monitoring

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INTRODUCTION

Heart failure (HF) poses a substantial global health burden, underscoring the need for accurate diagnosis and tailored management. N-terminal pro B-type natriuretic peptide (NT-proBNP), an amino-terminal fragment of the B-type natriuretic peptide precursor, has gained prominence as a diagnostic and prognostic biomarker in HF [1]. This review aims to comprehensively summarize the clinical significance of NT-proBNP in HF diagnosis and management based on seminal research articles. Moreover, elevated NT-proBNP levels have been shown to correlate with the severity of heart failure. This biomarker aids in assessing disease progression and predicting clinical outcomes. It empowers healthcare providers to stratify patient risk, enabling the tailoring of therapeutic interventions and intensified monitoring for individuals at an elevated risk of adverse events. The dynamic nature of NT-proBNP concentrations allows it to serve as a marker for therapeutic response [2]. A decrease in NT-proBNP levels signifies therapeutic effectiveness, guiding clinicians in the optimization and individualization of treatment regimens.

The salt and water handling and pressure regulation is mostly impacted by the natriuretic peptide system which in turn on the structure and function of myocardium. The B-type natriuretic peptide (BNP) is a well-known natriuretic hormone which was first identified in the brain but found to be released from the heart. The prohormone proBNP cleavage produces 32 amino acids containing BNP, a biologically active peptide as well as inert 76 amino acids containing N-terminal pro-BNP (NT-proBNP) [3]. Further, Atrial natriuretic peptide (ANP) released from myocardial cells in the atria mostly with response to volume expansion and known to be elevated levels in enhanced wall stress [4]. Furthermore, these ANP and BNP release can be increased with increase in heart failure (HF), as ventricular cells are employed in increased

ventricular filling pressure for the secretion of ANP and BNP as well [5]. The elevated concentration of both ANP and BNP hormones in plasma can be seen in patients with asymptomatic and symptomatic left ventricular (LV) dysfunction and therefore, these hormones form an important prognostic and diagnostic markers tools for myocardial infarction [5].

In essence, NT-proBNP is a versatile and indispensable biomarker in heart failure, diagnosis and diseased condition management. Its diagnostic precision, ability to stratify risk, role in prognostication, and capacity to reflect therapeutic response underline its profound clinical significance. Embracing NT-proBNP as an integral tool enhances the precision and effectiveness of heart failure care, ultimately improving patient outcomes and quality of life.

Diagnostic Value of NT-proBNP

NT-proBNP serves as a discriminative diagnostic marker for HF which demonstrated its utility in differentiating HF from other cardiac and non-cardiac conditions [6]. Elevated NT-proBNP levels reflect myocardial stress with high sensitivity and specificity, as confirmed by Hunt et al., 2005 [7].

Prognostic Implications

NT-proBNP levels correlate with HF severity, providing valuable prognostic insights. Research conducted on a longitudinal study reveals that higher baseline NT-proBNP levels are associated with a greater risk of HF-related adverse events, including hospitalization and mortality [8]. It was further emphasized NT-proBNP's role in risk stratification and high-risk patient identification.

Risk Stratification

Risk stratification is crucial in HF management through a comprehensive analysis elucidated that NT-proBNP levels enable patient categorization into risk groups, aiding tailored treatment strategies [9]. The biomarker's ability to predict adverse events, such as HF exacerbations and hospitalizations, underscores its clinical relevance.

Treatment Monitoring

Therapeutic response monitoring is imperative in HF management. NT-proBNP's dynamic nature allows for treatment efficacy assessment. The research results demonstrated that a reduction in NT-proBNP levels following treatment initiation signifies a positive response, guiding therapy optimization [10]. This personalized approach minimizes healthcare costs and enhances patient care.

Clinical Guidelines and NT-proBNP

NT-proBNP's clinical significance has led to its incorporation into HF management guidelines. The American College of Cardiology/American Heart Association (ACC/AHA) guidelines emphasize NT-proBNP measurement as a diagnostic and prognostic tool, endorsing its role in clinical practice [11].

DISCUSSION

The presented work collectively emphasizes NT-proBNP's clinical significance in HF diagnosis and management. Its utility as a diagnostic biomarker with high sensitivity and specificity aids in early HF detection, distinguishing it from other conditions. NT-proBNP also plays a pivotal role in risk stratification, prognostication, and treatment monitoring, contributing to personalized care and improved patient outcomes. Recently novel medical therapies, such as use of inhibitors of angiotensin, SGLT2 and activators of guanylate cyclase enzyme has been attracted scientists and researchers [12-14] and they significantly improve the clinical outcomes and biomarkers including natriuretic peptides (myocardial stretch), cardiac troponins (myocardial damage) and help in the pathophysiology of heart failure. However, the relationship between the levels of biomarkers and advances in heart failure prognosis implies a need to monitor the levels of these biomarkers which might help in the early diagnosis and improve the health of patients at large.

There exists lot of differences in the guidelines proposed with regard to NT-proBNP and BNP levels in the heart failure. According to the ESC guidelines, BNP and NT-proBNP are designate to rule out the diagnosis of suspected HF [15]. But the NT-proBNP biomarker screening help in the early intervention which may prevent HF as suggested by the ACC/AHA/HFSA guidelines [11]. Even the NT-proBNP assay help in patients with dyspnea, and help in establishing effective prognostic measures and prevent the heart failures. Furthermore, the guidelines also suggests that NT-proBNP help to identify a higher risk. Recommendations of the NICE guidelines also depicts that a optimum dose of NT-proBNP for the patients with suspected heart failure help them to recover from the condition. It is also recommended for periodic checkup of the NT-proBNP levels along with ECG to monitor the patient condition These guidelines also indicate that the levels below 400 ng/L help in the diagnosis of heart failure less likely and, therefore, there is a need to look for alternative causes and measures for early diagnosis and save the life of people.

CONCLUSION

NT-proBNP, released in response to myocardial stress, plays a pivotal role in heart failure diagnosis and management. Its sensitivity and specificity aid in rapid and accurate diagnosis, distinguishing heart failure from other conditions. Additionally, NT-proBNP's correlation with disease severity informs risk stratification, enabling personalized therapeutic approaches. Its dynamic changes serve as a valuable tool for monitoring treatment response and guiding the optimization of therapeutic regimens. NT-proBNP stands as a vital component of heart failure care, facilitating precise diagnosis and enhancing patient outcomes. NT-proBNP is an indispensable biomarker in HF diagnosis and management. Its pivotal role in early diagnosis, risk stratification, prognostication, and treatment monitoring is incontrovertible. Alongside comprehensive clinical assessments and advanced imaging modalities, NT-proBNP empowers healthcare providers to deliver personalized care, enhancing the prognosis and quality of life for individuals afflicted by HF. Future research may unveil further refinements and applications of this essential biomarker.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

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