Chapter 35
BNP

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A 67-year-old man presented to the ER with increasing shortness of breath, tiredness, and weight gain. Immunoassay for BNP showed a value of 800 pg/mL.

Questions

1. What is BNP and NT-proBNP?
2. What are the normal levels and conditions that cause elevated levels?
3. How do these markers aid in the diagnosis of heart failure?
4. What are the other uses outside diagnosing heart failure?
5. Are there limitations?
6. What is heart failure and why is it important to diagnose it?

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Answers

1. B-type natriuretic peptide is also called brain-type natriuretic peptide (BNP) as it was first described in 1988 after isolation from porcine brain. However, it was soon found to originate mainly from the heart. B-type natriuretic peptide (BNP) and N-terminal proBNP (NT-proBNP) are released by the ventricular myocardium in response to myocardial wall stress initially as a 108 amino acid prohormone. It is cleaved by enzymes corin/furin to BNP the 32 amino-acid, biologically active part of the prohormone and NT-proBNP which is the 76 amino acid, biologically inactive compound. BNP produces a variety of biological effects by interaction with the natriuretic peptide receptor type A (NPR-A) causing intracellular cGMP production. These include natriuresis/diuresis, peripheral vasodilatation, and inhibition of the renin–angiotensin–aldosterone system (RAAS) and the sympathetic nervous system (SNS).

   All effects ultimately lead to decreased afterload.

   BNP has a half-life of 20 min and is cleared by binding to the natriuretic peptide receptor type C (NPR-C) and through proteolysis by endopeptidases. NT-proBNP has a half-life of 120 min and is cleared by renal excretion [1, 2].

2. BNP levels are normally less than 100 pg/mL and the NT-proBNP is less than 300 pg/mL [2]. The levels are higher in:

   (a) females due to differences in metabolism
   (b) advancing age
   (c) worsening renal function (NT-proBNP affected more due to renal clearance)
   (d) LV hypertrophy
   (e) Systolic and diastolic dysfunction
   (f) Fluid overload

3. BNP and NT pro BNP serve as good markers of heart failure. The levels for both markers are different to exclude or confirm the diagnosis of heart failure [3].

   BNP—level < 100 pg/mL heart failure (HF) unlikely; level > 500 pg/mL HF very likely.

   Levels 100–500 use clinical judgment.

   NT-proBNP—level < 300 pg/mL HF unlikely

   Age < 50 years, level > 450 pg/mL—HF likely

   Age 50–75 years, level > 900 pg/mL—HF likely

   Age > 75 years, level > 1800 pg/mL—HF likely

   A good correlation has been made between increasing levels of BNP and functional class of NYHA classification as depicted in the Fig. 35.1.

4. BNP and NT-proBNP provide strong **prognostic information**, and elevated levels are associated with an unfavorable outcome (death, sudden cardiac death, readmission, or cardiac events) in patients with heart failure or asymptomatic left ventricular dysfunction [3, 4].

   They are also useful for choosing optimal treatment and monitoring its effects in heart failure.

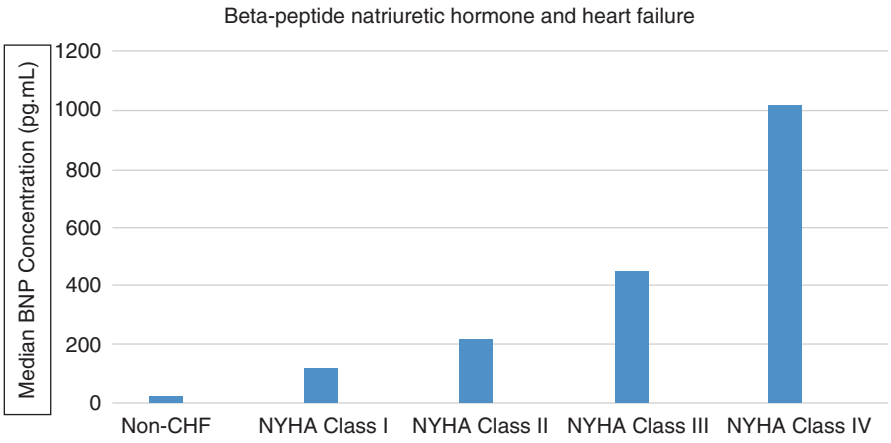

Fig. 35.1 BNP and heart failure

The current American College of Cardiology/American Heart Association (ACC/AHA) guidelines for managing heart failure have incorporated using natriuretic peptide levels in establishing the prognosis and disease severity of chronic heart failure.

In patients with severe heart failure BNP and NT-proBNP assays can be used in **resynchronization therapy**.

Both are also used as markers and to aid in prognosis in acute and stable **coronary heart disease**. Higher values are associated with worse outcomes [5].

In **aortic stenosis**, the levels indicate disease severity, progression, functional status, and also the optimum time for valve replacement after which the levels decline.

In **atrial fibrillation**, the levels are elevated and predict the success of cardioversion.

5. Limitations include **false low levels** in:

   (a) Obesity
   (b) Early acute heart failure
   (c) Heart failure due to causes upstream from the left ventricle, e.g., mitral valve or pericardial disease

False high levels as already mentioned in:

   (a) Females
   (b) Advancing age
   (c) Renal failure

6. Heart failure affects approximately 5.7 million Americans, and about 670,000 new cases are diagnosed annually in the United States. It is a leading cause of

hospital admissions and readmissions in people over 65 years. The estimated total health-care cost of HF in the United States in 2010 was $39.2 billion or 1–2% of all health-care expenditures. The risk of death is about 35% in the year after diagnosis after which it decreases to below 10% each year.

HF is either diastolic, decreased left ventricular filling, or systolic, decreased pump function. It is a diagnosis that is made clinically by history (breathlessness and fatigue) and physical exam (elevated jugular venous pressure and lung crackles). These features are not sensitive or specific, and there is no gold standard investigation to make the diagnosis. The severity is classified based on symptoms and functional limitations into four grades according to the New York Heart Association. Patients with heart failure suffer a decreased quality of life with significantly reduced physical and mental health. So, early diagnosis of heart failure, identification of the cause to determine reversibility, and institution of appropriate management strategies which include lifestyle changes, medications, and/or surgery can potentially make a big impact on the quality and duration of life.

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