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Perspective

Role of Novel Potential Biomarkers in Cardiovascular Diseases

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DESCRIPTION

Biomarkers are crucial in the assessment of disease as well as the development of therapeutic therapies for disease situations. Biomarkers can even assist determine the exact dosages for any particular medicine in the late stages of drug development. Biomarkers are also being used as surrogate end goals for therapeutic trials in recent years. Biomarkers are generally categorized as screening, diagnostic, or prognostic based on their intended function. Recently, there has been a nationwide movement toward precision medicine development, with a particular focus on the creation of novel cancer treatments. In his State of the Union speech on January 30, 2015, US President Barack Obama announced the Precision Medicine Initiative, which emphasizes more effective and tailored treatment objectives by taking into account individual variations in genes, environment, and lifestyle variables.

The term biomarker (biological marker) was first used in 1989 as a Medical Subject Heading (MeSH) term to describe "measurable and quantifiable biological parameters (e.g., specific enzyme concentration, specific hormone concentration, specific gene phenotype distribution in a population, presence of biological substances) that serve as indices for health- and physiology-related assessments, such as disease risk, psychiatric disorders, environmental exposure and its effects, disease progression, and disease prevention." An NIH working committee defined a biomarker as "a property that is objectively measured and analyzed as an indication of normal biological processes, pathogenic processes, or pharmacologic responses to a therapeutic intervention" and specified categories of biomarkers in 2001.

Circulating biomarkers including high-sensitivity C-reactive protein and cardiac troponin have proved critical in the diagnosis, risk assessment, and treatment of patients with Heart Failure (HF) and Acute Coronary Syndrome (ACS). Several new biomarkers from various pathophysiological pathways have recently been discovered to be linked to cardiovascular risk and may give useful prognostic information. The use of various biomarkers in combination has also been found to be beneficial in the risk of biomarkers from cardiac and metabolic-related pathways for predicting cardiovascular risk in secondary preventive settings is the subject of this review. The biomarkers under consideration are: I cardiac-related biomarkers (B-type Natriuretic Peptide (BNP), N-terminal pro-B-type Natriuretic Peptide (NT-proBNP), and cardiac Troponin I (cTnI)]; and (ii) metabolic-related biomarkers (Adiponectin, Adipocyte Fatty Acid-Binding Protein (A-FABP), heart-type fatty these biomarkers are particularly intriguing since they are expected to give enough information to improve cardiovascular risk assessment.

Troponin is a complex of three globular contractile regulatory proteins (troponin T, I, and C) that are found in regular intervals in the thin filament of striated muscle and suppress contraction by preventing actin and myosin from interacting. Cardiac Troponin I (cTnI) and T (cTnT) are heart-specific proteins that are sensitive and specific indicators of myocardial injury. cTnI and cTnT are produced from necrotic myocardium as intact proteins and degradation products during Acute Myocardial Infarction (AMI).

Cardiomyocyte damage is indicated and quantified by the presence of cTn in peripheral blood. Creatine Kinase (CK), its MB isoenzyme (CK-MB), and myoglobin are less sensitive and specific indicators of cardiomyocyte damage than cardiac troponins. A dynamic rise of cardiac troponin above the 99th percentile of healthy persons implies AMI if the clinical presentation is consistent with myocardial ischemia.

In reaction to increasing ventricular stretch or wall stress, the cardiac ventricles produce BNP. It also helps to maintain volume homeostasis and regulates cardiovascular remodeling. Within cardiomyocytes, BNP is produced as proBNP, which is then cleaved into active BNP and the more stable NT-proBNP. BNP has a shorter half-life and less variance than NT-proBNP. In patients with HF, BNP and NT-proBNP are commonly utilized for diagnosis and risk classification. BNP levels in the blood are lower in obese people than in non-obese patients, and they are inversely associated to BMI. Patients with left ventricular hypertrophy and myocardial infarction had higher BNP values.

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Adiponectin is an adipokine produced by fat cells that have anti-inflammatory, anti-atherogenic, and cardioprotective properties. Obesity, insulin resistance, and T2DM lower adiponectin expression, and plasma levels are inversely associated to BMI and metabolic syndrome components including triglycerides and insulin levels. Endothelial dysfunction, increased carotid Intima-Media Thickness (IMT), and CAD severity are all linked to lower adiponectin levels. In patients with CVD, circulating adiponectin has also been proven to predict cardiovascular and all-cause mortality risk. Adiponectin was linked to an increased risk of negative cardiovascular outcomes in individuals with ACS.