Integration of the Clinical Laboratory in Cardiovascular Medicine

Peter A. McCullough, MD, MPH, FACC, FACP, FCCP, FAHA

Department of Medicine, Divisions of Cardiology, Nutrition, and Preventive Medicine, William Beaumont Hospital, Royal Oak, MI

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It has been said on teaching rounds: "The only reason to order a test on a patient is to change management." In the modern age of genetics, proteomics, functional cellular assays, advanced imaging, and tissue characterization, this old razor should be discarded. The advancement in medical diagnostics over the past several decades has been breathtaking. Our collective ability to anticipate, recognize, and handle medical illnesses has driven the development of our prevention and treatment strategies. Cardiovascular medicine, because of the research efforts placed on physiology and imaging over the decades, has had relatively less attention dedicated to the establishment of laboratory measures into clinical practice as compared with the fields of endocrinology, rheumatology, and infectious diseases. At the time of this writing, however, we are witnessing an explosion of activity using laboratory medicine to advance the understanding of both chronic and acute cardiovascular illness.

Major Domains of Laboratory Utilization

There are 4 major reasons to order a test: screening, diagnosis, prognosis, and management (Figure 1). Some diagnostic tests function in only a single domain, such as a fecal occult blood test to screen for colon cancer. Other tests are quite versatile, and in clinical practice are used in all 4 domains, such as blood prostate-specific antigen levels. In cardiovascular medicine, we accept many different permutations of this concept. For example, low-density lipoprotein cholesterol (LDL-C) is not useful in screening for atherosclerosis and is only helpful in making a diagnosis in a few recognized lipid disorders. It is prognostic for coronary heart disease and stroke events but only in combination with other risk factors. However, LDL-C is an essential treatment target in the management of atherosclerosis.

Natriuretic Peptides

The discovery of the natriuretic peptides (NP), their cardiac origin, and their physiologic actions are well known in cardiovascular medicine (Figure 2). The recognition that the heart is an endocrine, paracrine, and neuroendocrine organ was a paradigm shift that allowed a leap forward in the understanding of the cardiovascular system.[1] Of all the laboratory tests in cardiology, both B-type NP (BNP) and N-terminal prohormone B-type NP (NT-proBNP) are probably the most versatile. Using very low cutpoints, studies have shown that both BNP and NT-proBNP can be used as population screening tools for left ventricular dysfunction and occult heart failure (HF).[2] Both tests have been clearly shown in large, prospective, blinded studies to aid in the diagnosis of decompensated HF.[3] There is an enormous body of literature demonstrating the prognostic value of BNP and NT-proBNP in the setting of acute and chronic HF, ACS, pulmonary embolism, noncardiac surgery, chronic kidney disease, and end-stage renal disease.[4-9] Lastly, there has been creative use of these blood tests in altering the management of patients in HF that has improved outcomes including HF hospitalization and all-cause mortality.[10]

Acute Coronary Syndromes

There have been considerable advances in the risk stratification of patients presenting with suspected acute coronary syndromes (ACS). In addition to the presenting symptoms, past medical history, and electrocardiogram (ECG), blood biomarkers are firmly integrated into our clinical strategies.[11] This supplement to *Reviews in Cardiovascular Medicine* provides a valuable resource to researchers and clinicians who

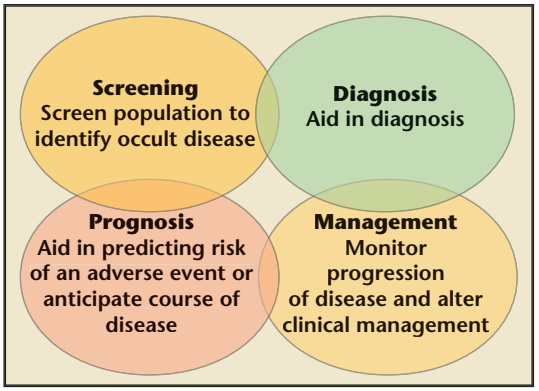

Figure 1. *Four major domains of activity in the use of the clinical laboratory.*

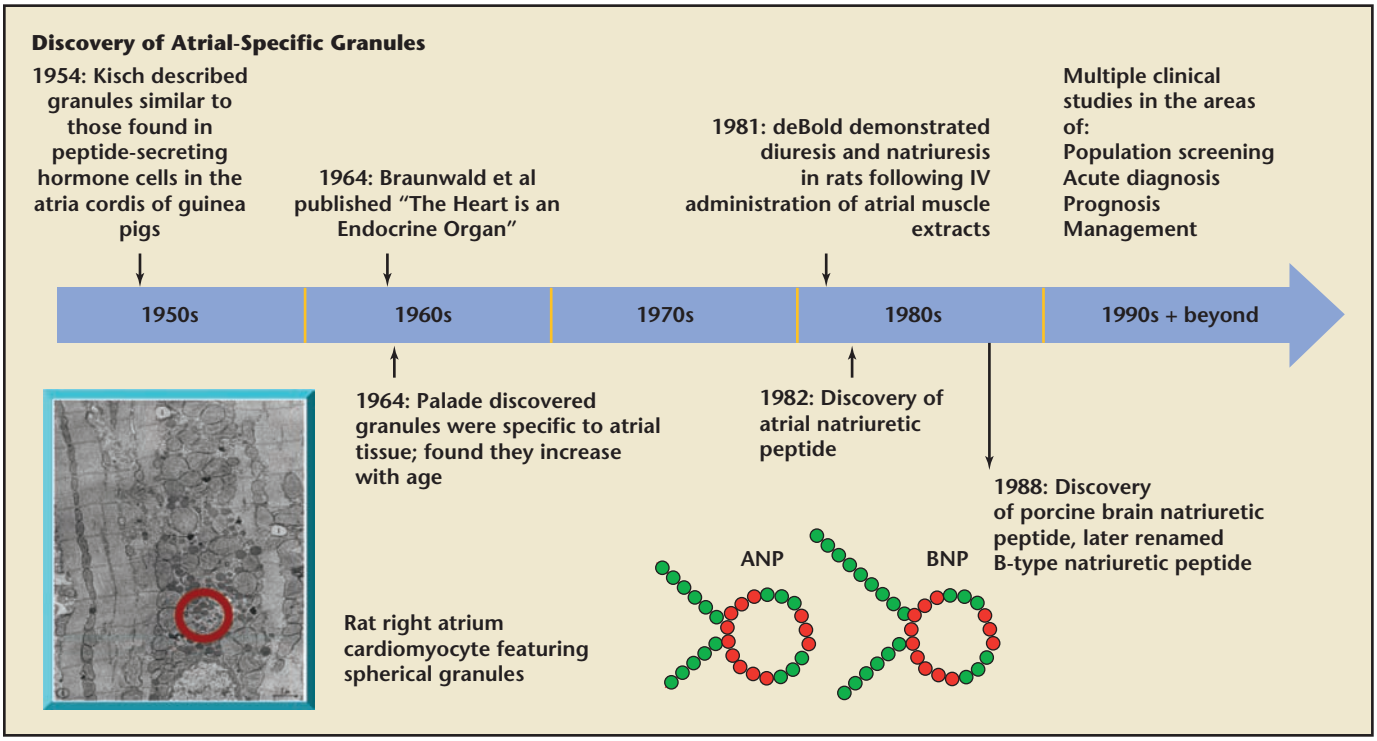

Figure 2. *Historical timeline of the discovery of cardiac natriuretic peptides. IV, intravenous.*

are involved in the management of ACS patients. The use of biomarkers alone and in combination with imaging of coronary atherosclerosis and its dynamic stages including plaque destabilization, intraplaque hemorrhage, thrombosis, and downstream embolization is reviewed. Importantly, a recently recognized process of cell-to-cell death driven by labile-iron–dependent generation of oxygen free-radicals is presented. Understanding this stage of ACS is critical in limiting the extent of infarction and reducing complications after restoration of perfusion has been achieved. The articles in this issue emphasize the complementary nature of medical information including history, examination, ECG, laboratory results, and imaging studies. Another major theme is that ACS and HF commonly overlap; thus presenting symptoms and test results must be interpreted broadly. In the final piece, an evidence-based, teachable algorithm is presented that utilizes currently available tests suggested by the American College of Cardiology and American Heart Association with the goal of both simplifying and advancing the bedside understanding of the laboratory results in patients with ACS.[12,13] ■

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