

NONINVASIVE DIAGNOSTICS



ECHOCARDIOGRAPHY

1953

Inspired by sonar technology used in naval applications, reflective ultrasonic techniques are first used to visualize cardiac structures non-invasively



1965

Dr. Harvey Feigenbaum publishes the first textbook on echocardiography, which helps standardize its use in clinical practice

IDENTIFICATION OF CARDIAC BIOMARKERS

1960s

Japanese scientist Setsuro Ebashi discovers troponin, which roughly 40 years later is recognized by the ACC and European Society of Cardiology as a powerful biomarker for diagnosing acute myocardial infarction

1970s

Creatine phosphokinase (CK) isoenzyme is identified as a marker of myocardial infarction

1988

A landmark study in *Nature* describes the discovery of brain natriuretic peptide in porcine brain tissue, providing a non-invasive, rapid diagnostic tool for heart failure



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TREADMILL TESTING

1949 A study in the *Journal of Clinical Investigation*, describes an early treadmill test protocol designed to evaluate patients with suspected coronary artery disease (CAD), building on work by Arthur Master and Enid Oppenheimer from 1929

1963 The Bruce Protocol is published in *Pediatrics* and soon becomes the gold standard for adult stress testing



NUCLEAR STRESS AND VASODILATOR STRESS TESTING

1973 A landmark study in the *New England Journal of Medicine* describes the use of potassium-43 (K-43) planar scintigraphy for imaging blood flow to the heart, laying the groundwork for modern myocardial perfusion imaging (MPI) with technetium-99m (Tc-99m) and thallium-201

1978 A study published in the *Journal of Nuclear Medicine* demonstrates the efficacy of using dipyridamole, a vasodilator, as an effective method for evaluating coronary perfusion and diagnosing ischemia



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CARDIAC MRI



1980

The first applications of nuclear magnetic resonance MRI to the human heart demonstrate the ability to visualize cardiac structures and guide advancements toward clinical cardiac MRI

2006

ACC releases first Appropriateness Criteria for Cardiac Computed Tomography and Cardiac Magnetic Resonance Imaging

CORONARY ARTERY CALCIUM SCORING

1990

A landmark study published in *JACC* introduces the Agatston Score, a standardized method using EBCT to quantify coronary calcium and assess cardiovascular risk

1999

Multi-Ethnic Study of Atherosclerosis (MESA) begins, providing a unique opportunity to explore the distribution of coronary artery calcium based on age, gender and race/ethnicity

2013

ACC/AHA guideline on lipid-lowering therapy indicates that an elevated calcium score may be used an "additional factor" for the decision on treatment of hyperlipidemia



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AMBULATORY AND REMOTE ECG MONITORING

The evolution of ambulatory and remote ECG monitoring, from the early use of Holter monitors to trans telephonic monitoring and, more recently, Bluetooth-enabled remote monitoring of cardiac devices, has significantly advanced the ability to track and manage cardiac health outside of clinical settings, improving patient care and outcomes



CORONARY CT ANGIOGRAPHY

1998 Introduction of the first 4-slice CT scanner, paving the way for subsequent introduction of 16-slice and 64-slice scanners shortly after

2000s Multiple trials like CONFIRM, ACCURACY, ROMICAT, SCOT-HEART evaluate the role and efficacy of CT angiography in different scenarios

2012 Introduction of Fractional Flow Reserve CT (FFR-CT), which provides functional information alongside anatomical data



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