Diagnostic Value of Cardio Imaging

BY C12

Introduction

- Cardio imaging has evolved greatly in recent years and offers valuable insights into the functional and structural aspects of the cardiovascular system.
- Cardiovascular diseases are a leading cause of mortality and morbidity worldwide which makes cardio imaging necessary for early intervention and treatment.
- This presentation will provide a comprehensive review of the value of cardio imaging modalities including, nuclear cardiology, echocardiography, cardiac MRI, and Cardiac CT.

Objectives

- Define cardiovascular disease
- Define cardiovascular imaging
- Discuss the different modalities used in cardiovascular imaging
- Compare the different modalities used for cardiovascular imaging

Cardiovascular Disease (CVD)

Definitions

- CVD - A group of disorders that affect the heart and surrounding blood vessels
- Sensitivity- a test's ability to determine if an individual is positive for a disease
- Specificity- a test's ability to designate an individual who does not have a disease or is negative

Most common disorders

- Coronary Artery Disease (CAD)
- Valve Disease
- Aneurysm
- Cardiac Arrhythmia
- Cardiomyopathy
- Pericarditis
- Heart Failure

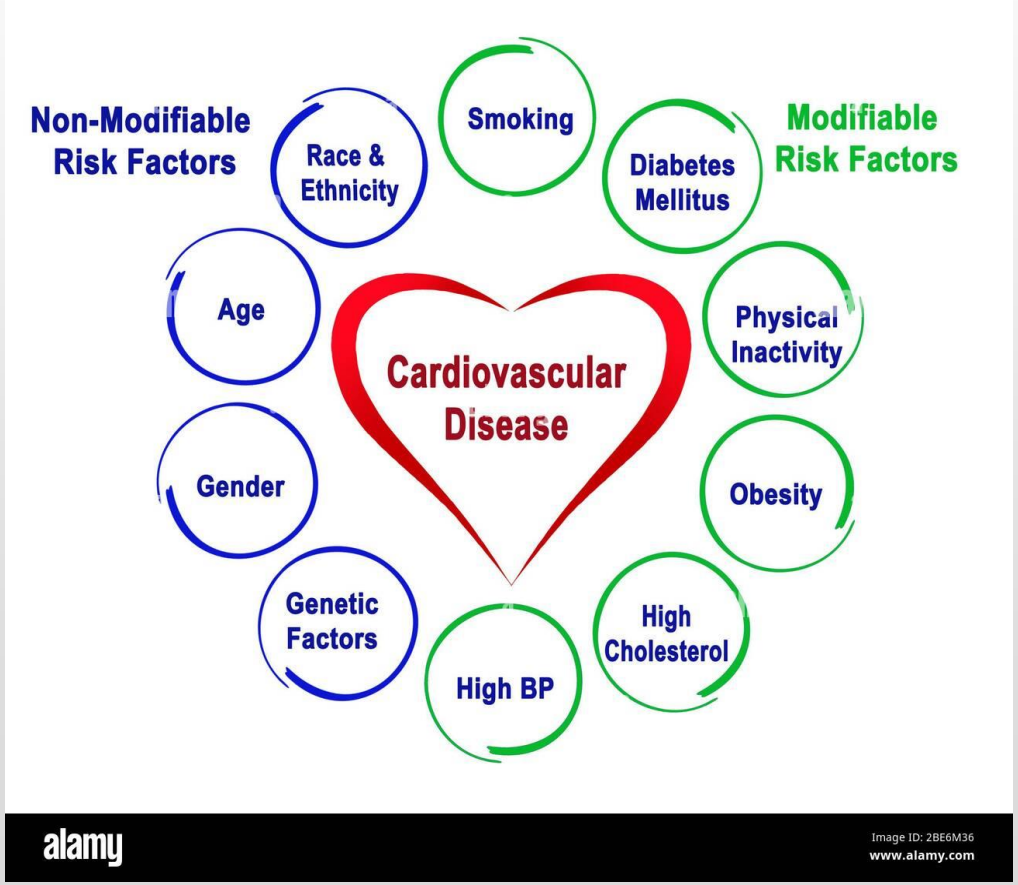
CVD RISK FACTORS

Modifiable Risk Factors

- High blood pressure
- High cholesterol
- Use of tobacco products
- Obesity
- Diet
- Lack of physical activity

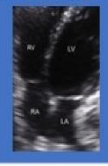
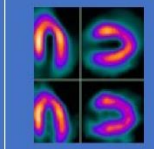
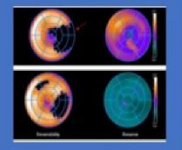
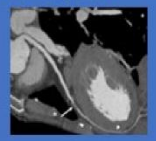
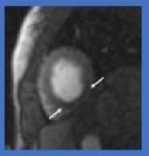
Non-Modifiable Risk Factors

- Race and ethnicity
- Age
- Gender
- Genetic Factors

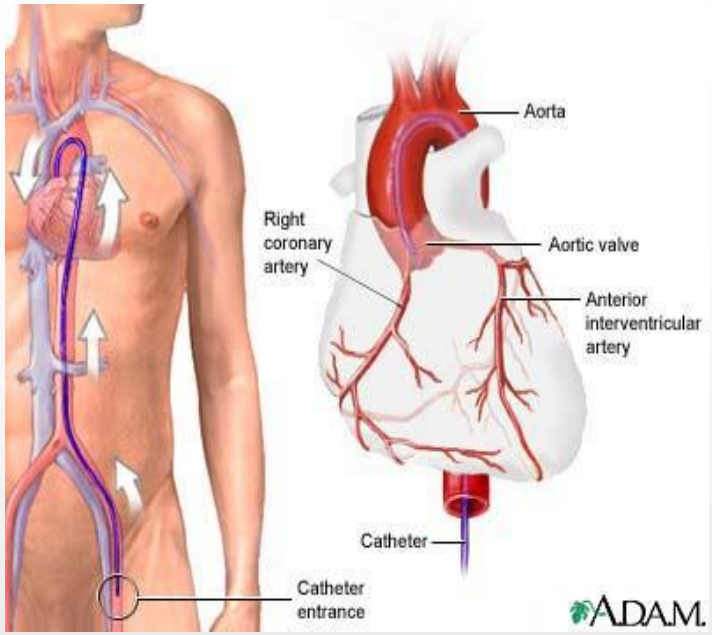


Cardiovascular Imaging

- Cardiovascular Imaging is a broad term used to describe several different ways to image the heart.
- Equipment used:
  - Fluoroscopy
  - Ultrasound
  - Computed Tomography
  - Magnetic Resonance Imaging

Imaging Modality	Exercise Stress Testing 	Stress Echocardiography 	SPECT-MPI 	PET-MPI 	Coronary CT-angiography 	Cardiac MRI 
Advantages	• Cheap • Widely available • No radiation exposure	• Widely available • No radiation exposure • Provides structural information • New techniques for viability testing	• Widely available • Provides functional information • Can be performed in all patients	• High accuracy • Provides functional information • Quantitative information on MBF • Novel techniques for plaque vulnerability	• Widely available • Provides anatomical information • High diagnostic performance • Novel techniques for functional information	• Highly accurate • No radiation exposure • Provides functional and anatomical information • Quantitative information on MBF • Useful in MINOCA
Disadvantages	• Lower sensitivity and specificity • Poorer performance among women relative to men	• Lower sensitivity and specificity compared with MRI, CT and PET • Operator variability • Poorer-quality images in larger patients	• Lower sensitivity and specificity compared with MRI, CT and PET • Radiation exposure • False-positives from breast attenuation	• Limited availability • Radiation exposure • Expensive	• Use of contrast may preclude use renal failure • Radiation exposure • Image quality reduced in patients with high heart rate, elevated BMI and dense coronary calcifications	• Limited availability • Implanted devices may preclude its use • Gadolinium contrast may limit use in renal failure

https://www.mdpi.com/2308-3425/9/10/350



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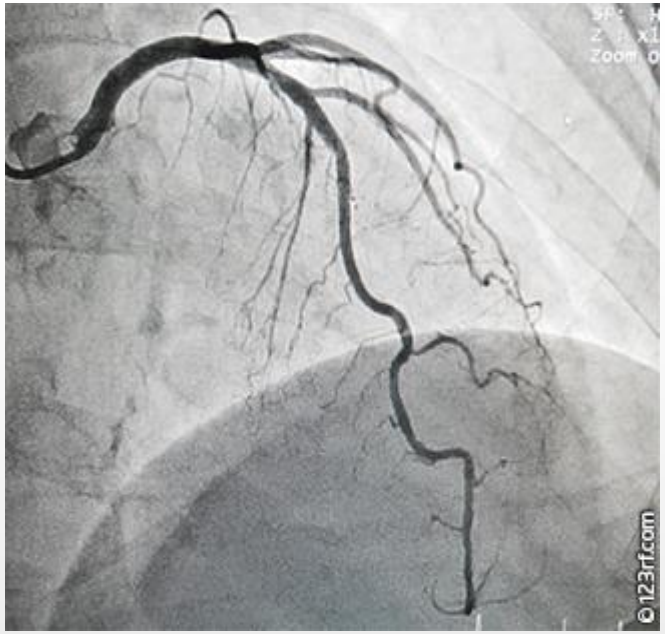
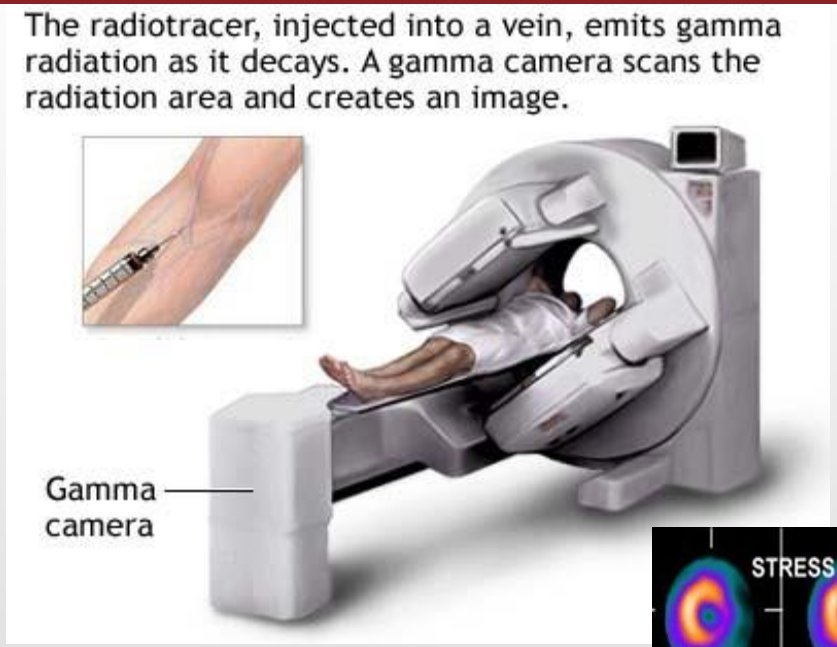


https://bjcardio.co.uk/2017/10/current-diagnostic-yield-of-invasive-coronary-angiography-at-a-district-general-hospital/

Invasive Coronary Angiography

- A catheter is inserted into a blood vessel and is passed up to the heart where contrast is injected to see the heart and surrounding blood vessels under fluoroscopy or CT.
- Considered the gold standard
- Sensitivity of 96%
- Specificity of 86%

Nuclear Cardiology



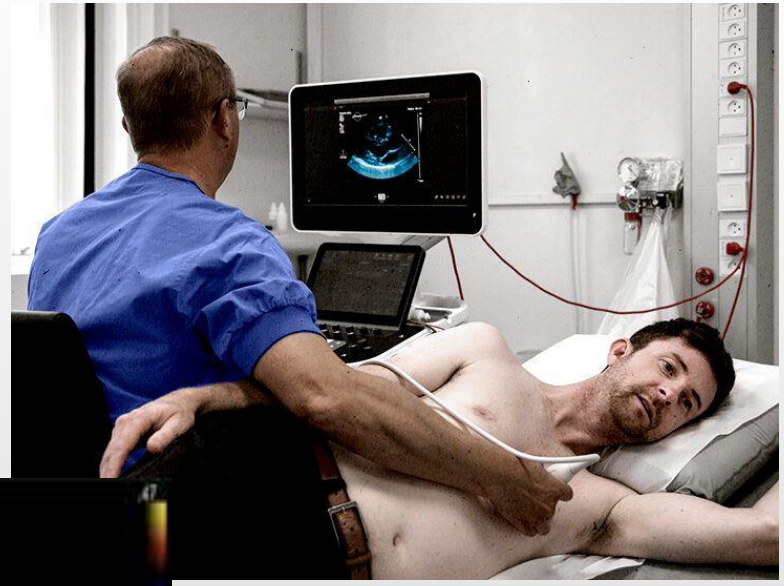
https://medlineplus.gov/ency/article/007201.htm

https://centrelakeimaging.com/nuclear-stress-test

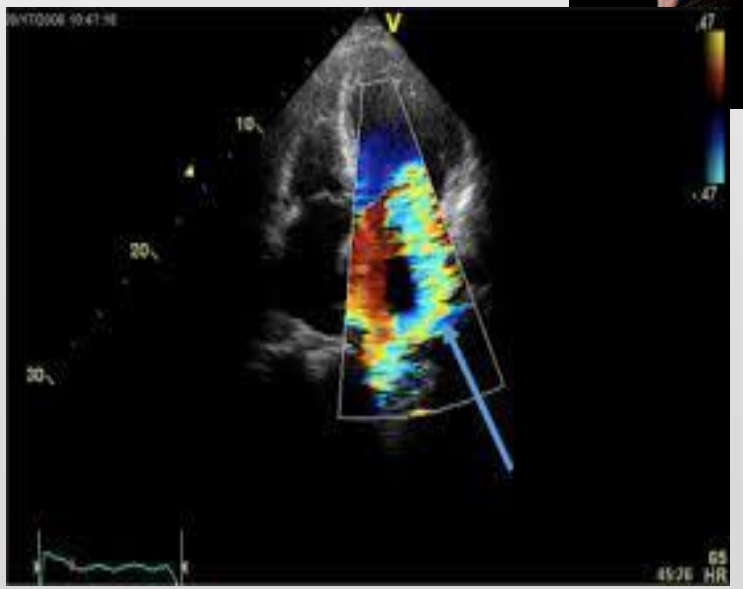
- **Nuclear Cardiology**
  - Uses radionuclides and imaging to study the structure and function of the heart
- **Myocardial perfusion imaging**
  - Uses a radionuclide to assess blood flow through the heart
- Sensitivity of 85-90%
- Specificity of 70-75%

Echocardiography

- **Echocardiogram**
  - Uses high frequency sound waves or ultrasound to create live pictures of the heart and surrounding blood vessels
- **Doppler Echocardiogram**
  - Uses ultrasound to track and assess blood flow through the heart
- Sensitivity of 80-85%
- Specificity of 84-86%



https://www.health.com/echocardiogram-7106716

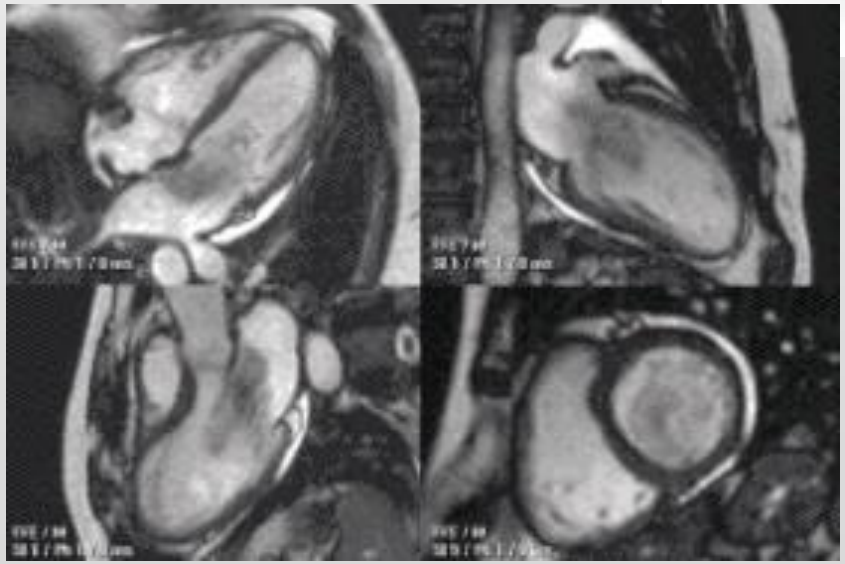


https://www.sciencedirect.com/topics/medicine-and-dentistry/color-doppler-echocardiography

Cardiac MRI

- Magnetic Resonance Imaging - Uses a strong magnetic field and radio waves to produce images of the heart and blood vessels
- Sensitivity of 90%
- Specificity of 81%

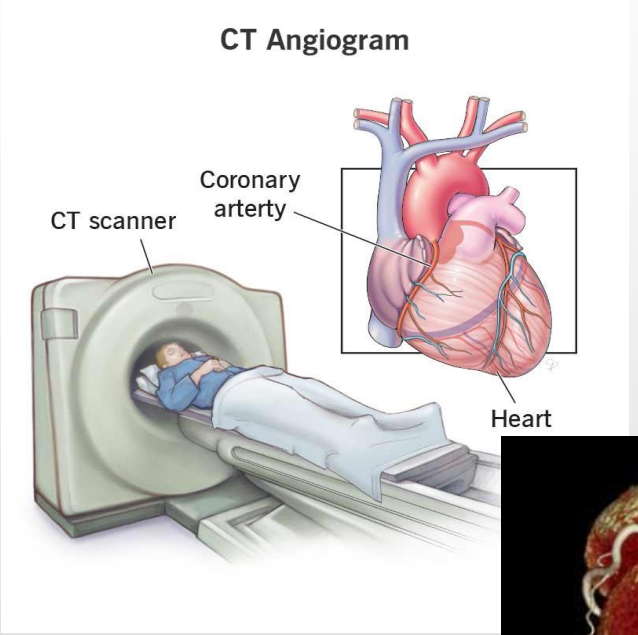
https://www.mountsinai.org/health-library/tests/heart-mri



https://en.wikipedia.org/wiki/Cardiac_magnetic_resonance_imaging

Cardiac CT

- Computed Tomography
  - Uses a narrow beam of x-rays that is rotated around the patient to create a 3D image of the patient's anatomy
  - Cardiac CT
  - Directs the narrow beam of x-rays at the patient's heart to create images of the heart and surrounding blood vessels
- Sensitivity of 94%
- Specificity of 97%



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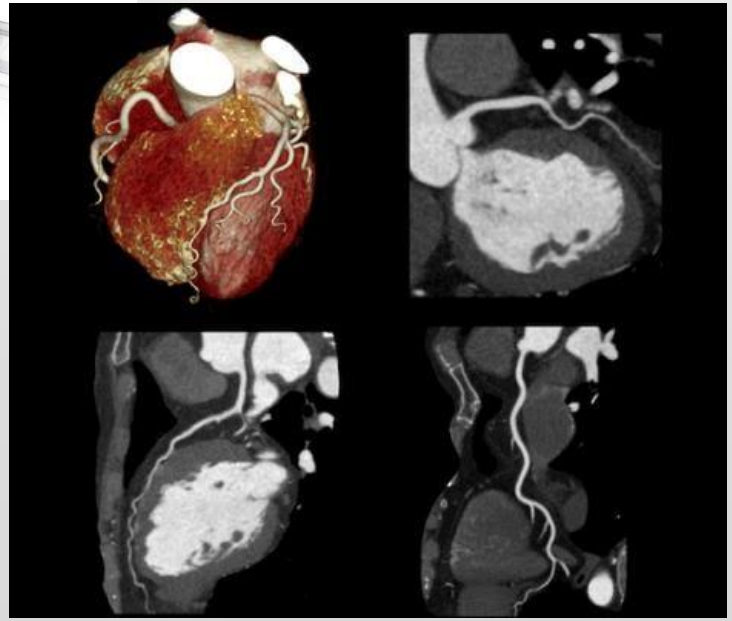

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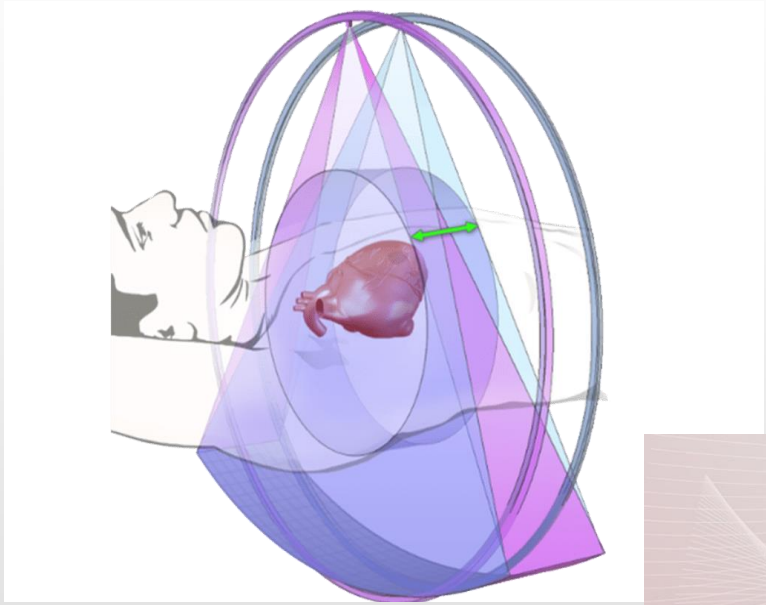
Dual Beam CT technology

- Dual beam technology uses two overlapping x-ray beams to focus on the patient's heart
- Focused field of view for better resolution



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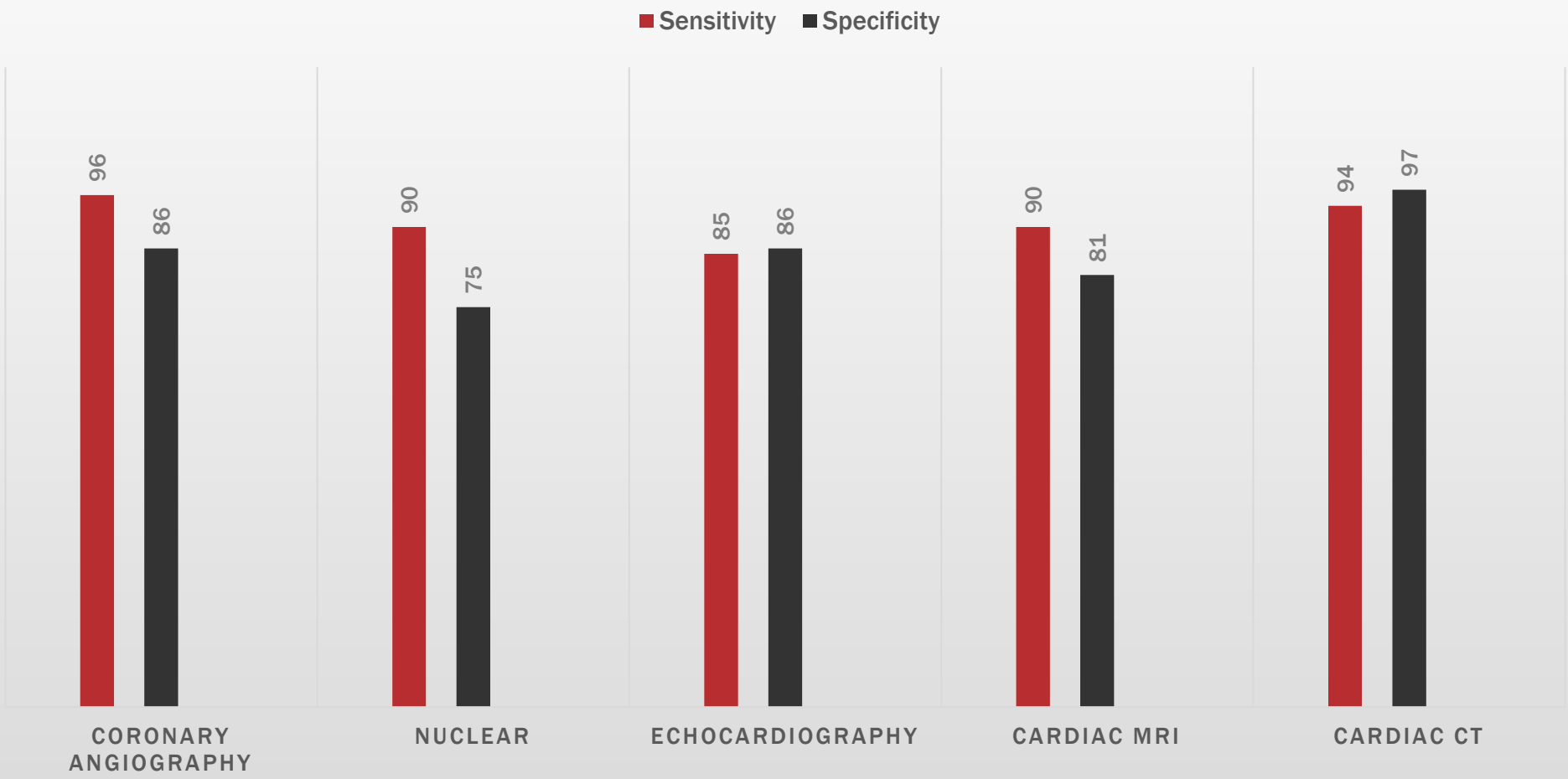
Sensitivity and Specificity



Conclusion

- Cardio imaging is a set of diagnostic procedures and modalities used to assess the heart
- Advances in cardio imaging have allowed healthcare providers a better understanding of cardiovascular diseases
- AI and future technologies will help advance these procedures and help increase the diagnostic value.
- Thank you for your time

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