

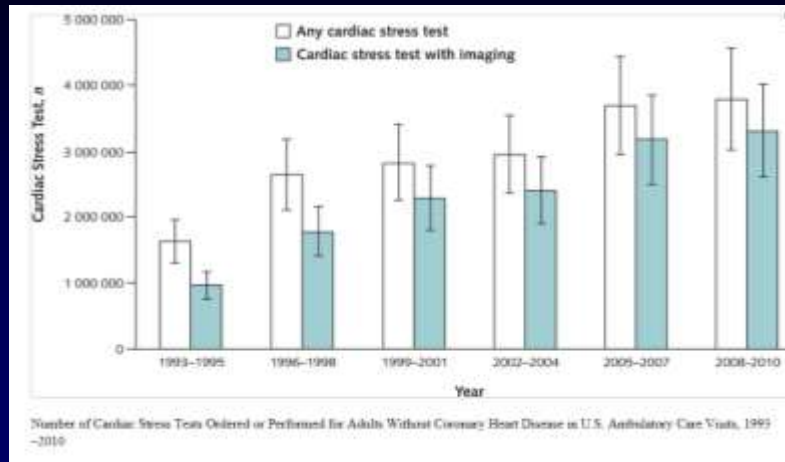
Stress Cardiac MRI

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Disclosure

- **None**

Temporal Trends in Cardiac Stress Testing



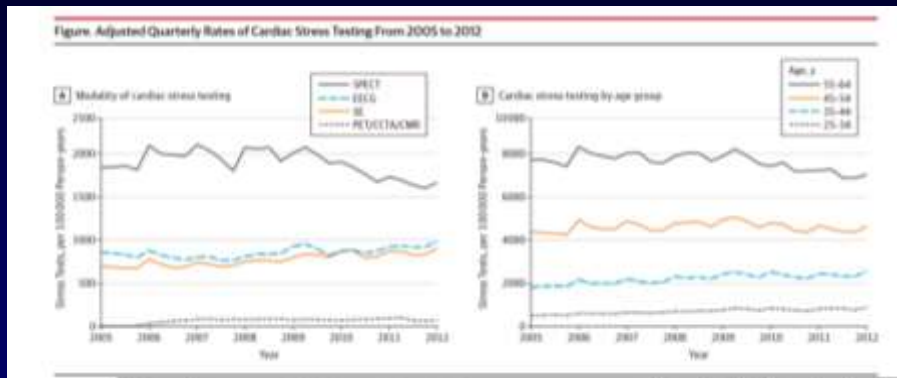
Joseph A. Ladapo, MD, PhD et al, Ann Intern Med. 2014

Temporal Trends in Stress Test 2005-2012 in patients aged 65 years or less

Test	No. (%)				P Value for χ^2 test
	2005-2006 (n = 11376087)	2007-2008 (n = 11599670)	2009-2010 (n = 10463888)	2011-2012 (n = 9995615)	
SPECT	298390 (2.6)	310935 (2.7)	273026 (2.6)	232277 (2.2)	.03
SE	317548 (2.8)	334458 (2.9)	318786 (3.1)	312692 (3.1)	< .001
EECG	126798 (1.1)	124487 (1.1)	127325 (1.2)	122504 (1.2)	< .001
PET, CTA, and CMR	4421 (0.04)	3904 (0.3)	11638 (0.1)	11200 (0.1)	< .001
Total	537159 (4.6)	561984 (4.8)	529775 (5.1)	456673 (4.6)	.01

JAMA Cardiol. 2016;1(9):1038-1042

Cardiac Stress Test Trends Among US Patients Younger Than 65 Years



Stress CMR

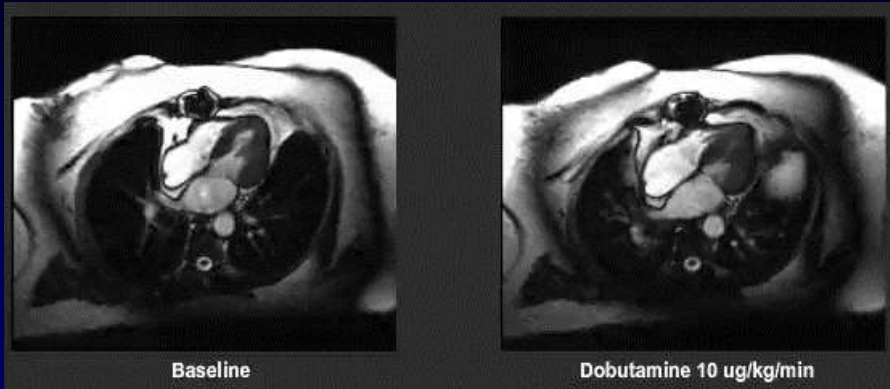
1-Dobutamine Stress CMR

- Designed to detect stress induced wall motion abnormalities.
- Pharmacologic agents need to increase rate/pressure products to induce wall motion abnormalities during stress.
- Dobutamine is the agent of choice, atropine can be added to achieve at least 85% of the MPRH
- Less commonly used due to some technical difficulties

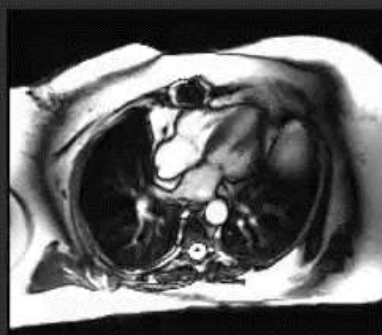
Dobutamine stress CMR

- Dobutamine stress protocols are similar to Dobutamine stress echo
- DE images will be used to correlate characteristic ischemic scar pattern with wall motion abnormalities
- Difficulties: Patient co-operation during tachycardia (Gating is not a major issue since these are just cine images)

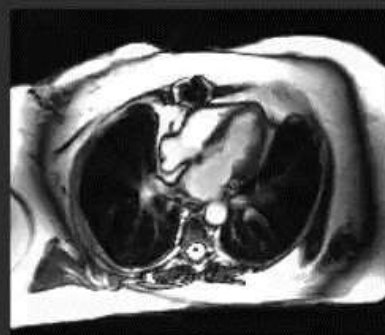
Dobutamine Stress CMR



Dobutamine Stress CMR



Dobutamine 40 ug/kg/min

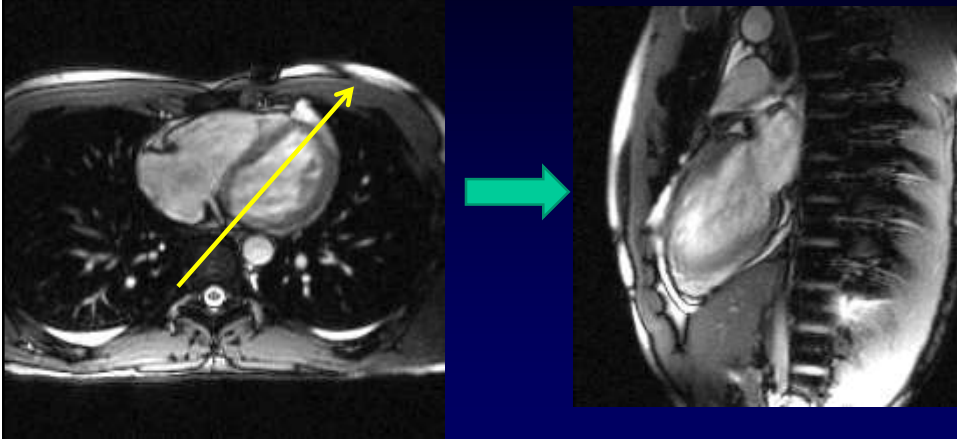


Dobutamine 40 ug/kg/min + Atropine

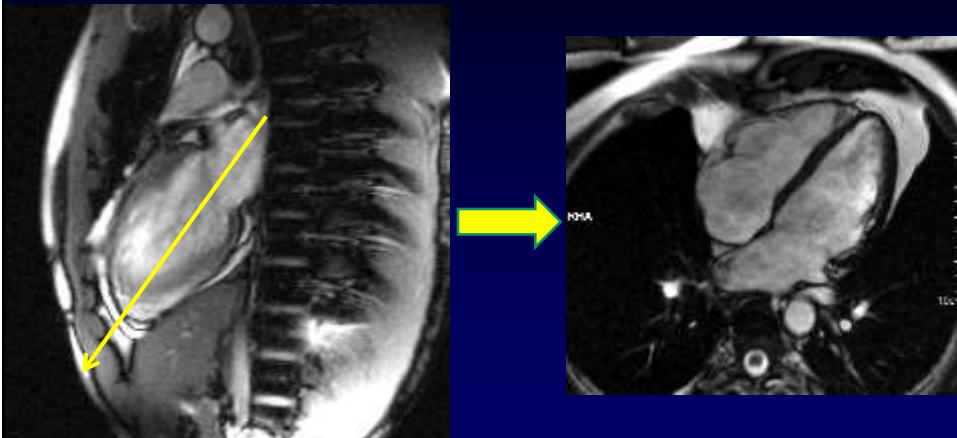
Perfusion CMR Imaging

- Vasodilator based stress testing.
- The most commonly used agent is adenosine (uncover regional differences in blood flow via preferential vasodilatation).
- Ischemic areas are identified by decreased enhancement during first pass imaging after intravenous administration of adenosine.

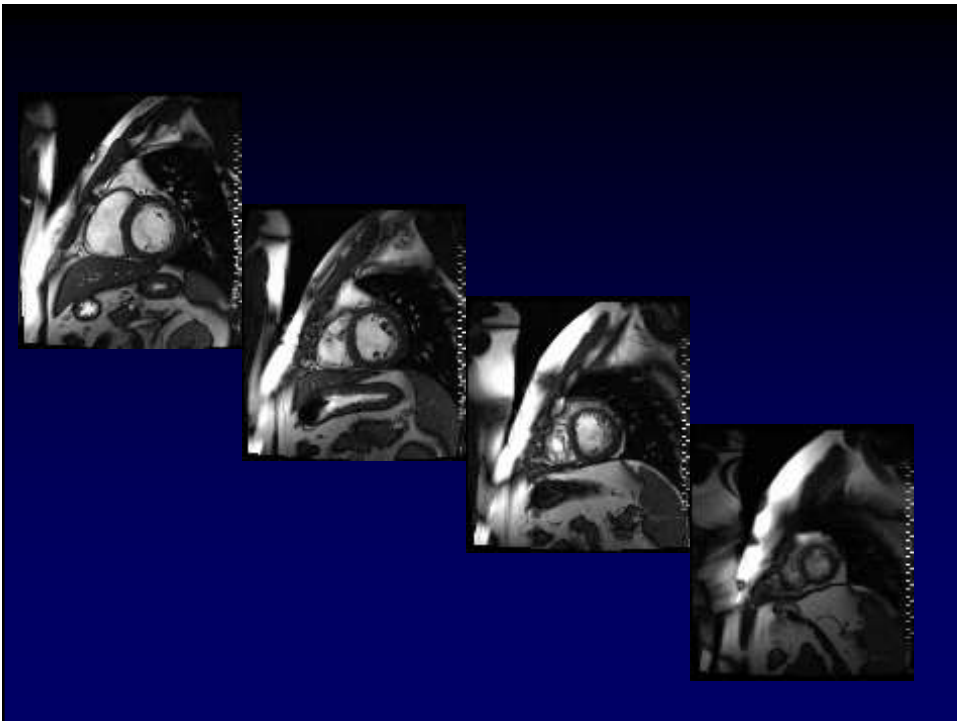
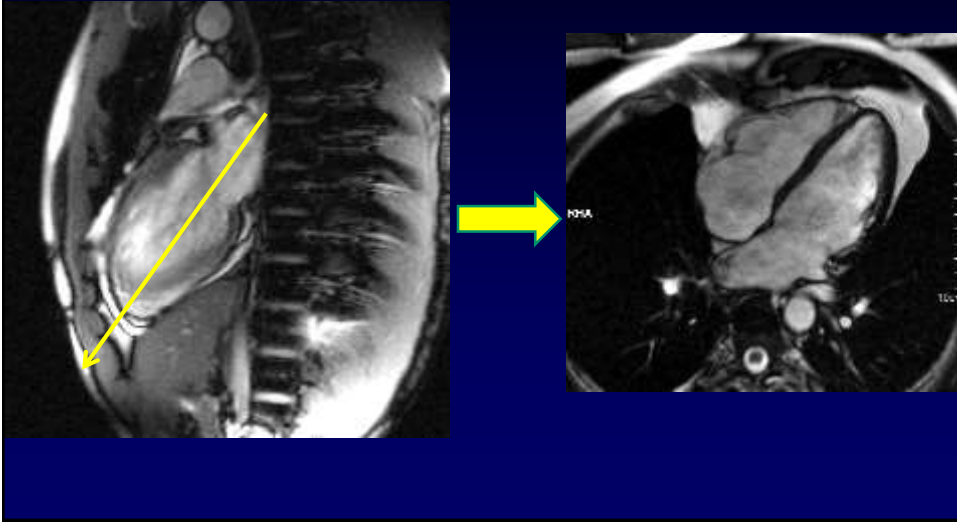
Creating standard views and assessing wall motion by cine imaging



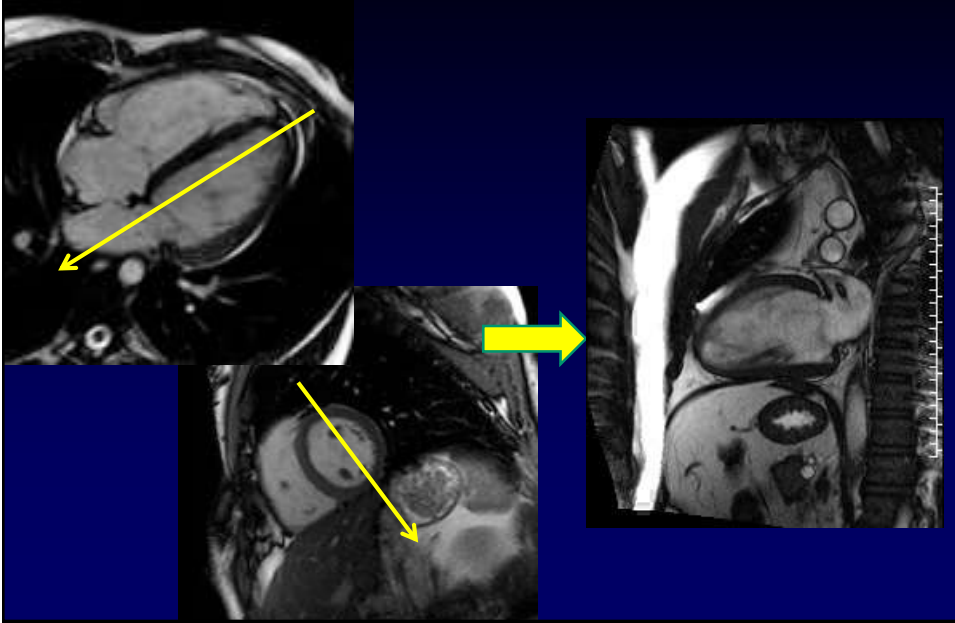
4 Chamber HLA



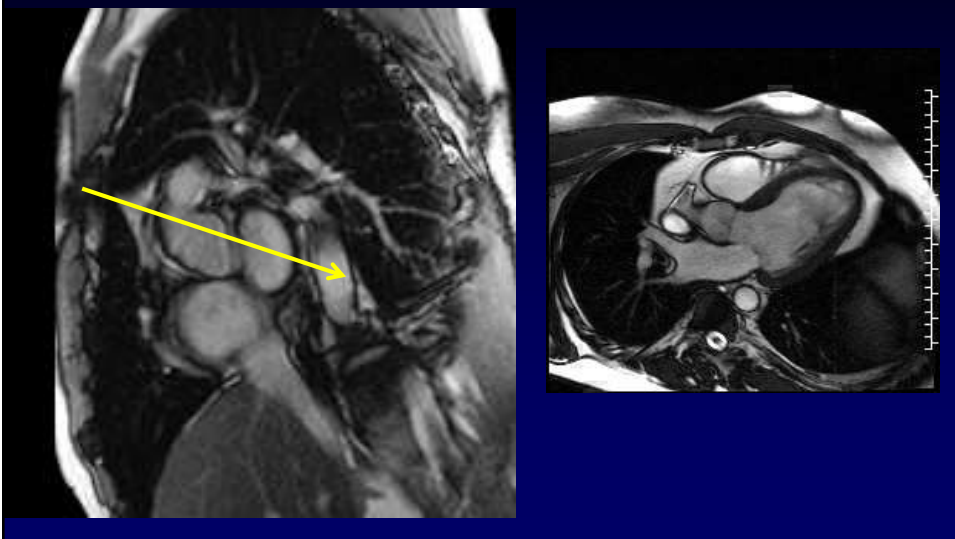
4 Chamber HLA



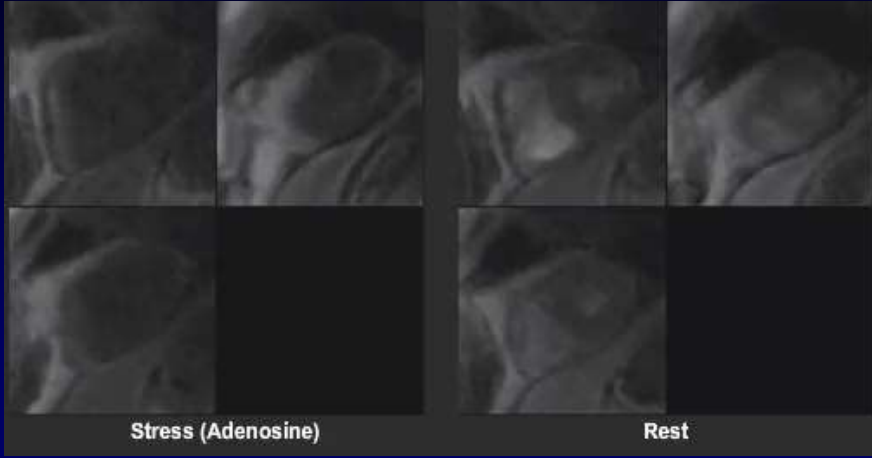
2 chamber VLA



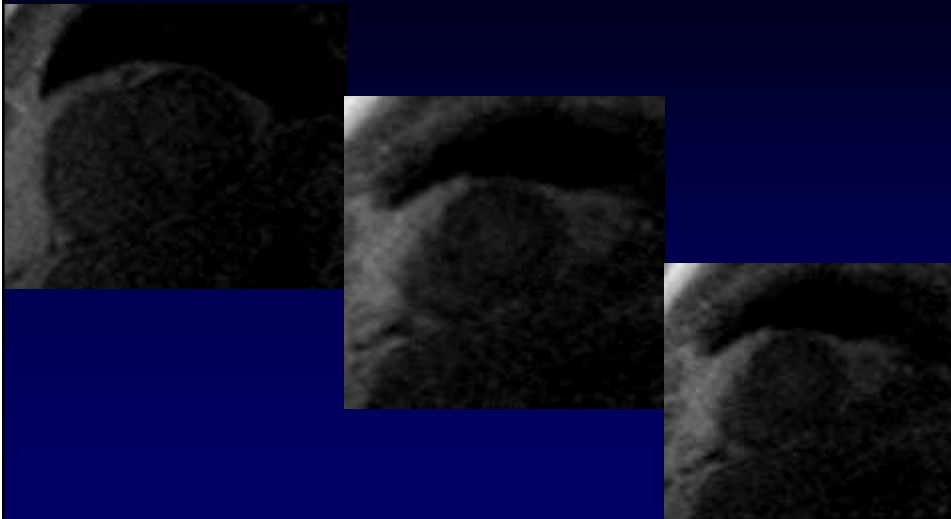
3 Chamber



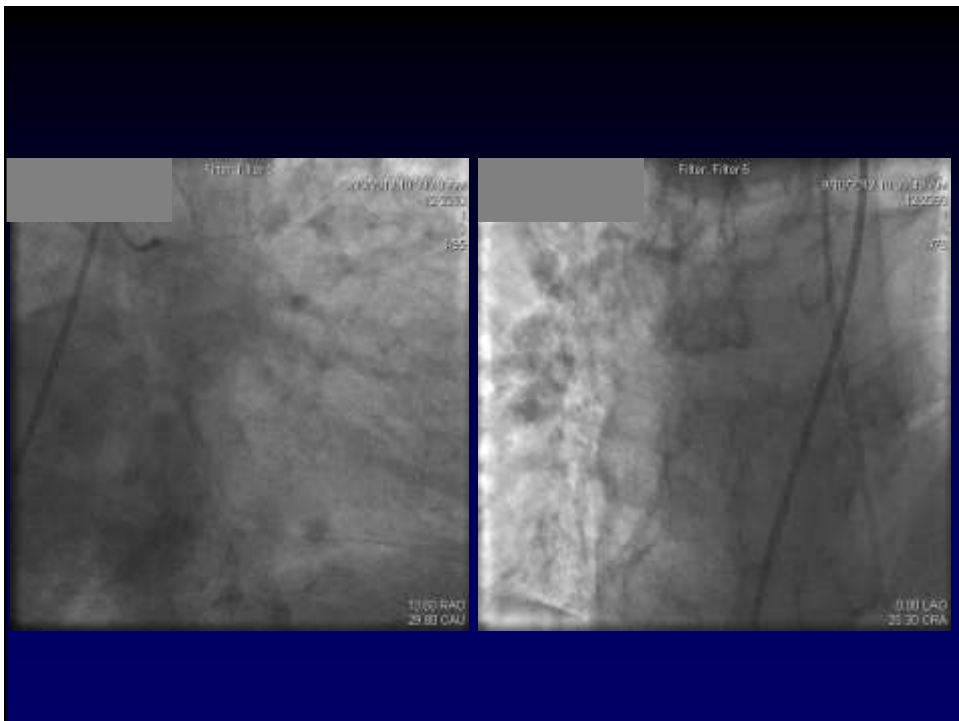
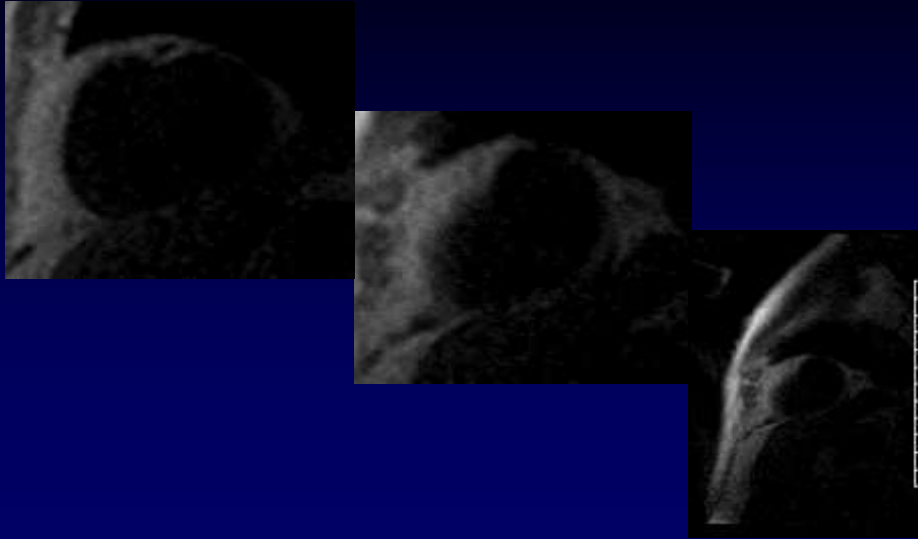
Stress Perfusion, comparing stress and rest first pass imaging.



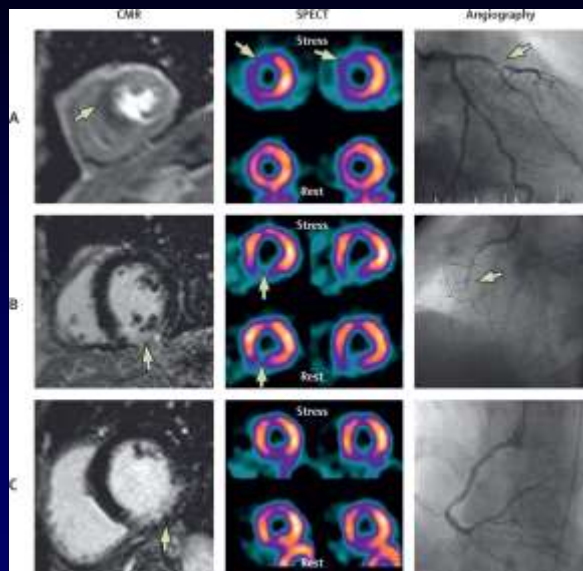
Stress Perfusion, comparing stress and rest first pass imaging.



Stress Perfusion, comparing stress and rest first pass imaging.



DHE



Stress CMR: evidence

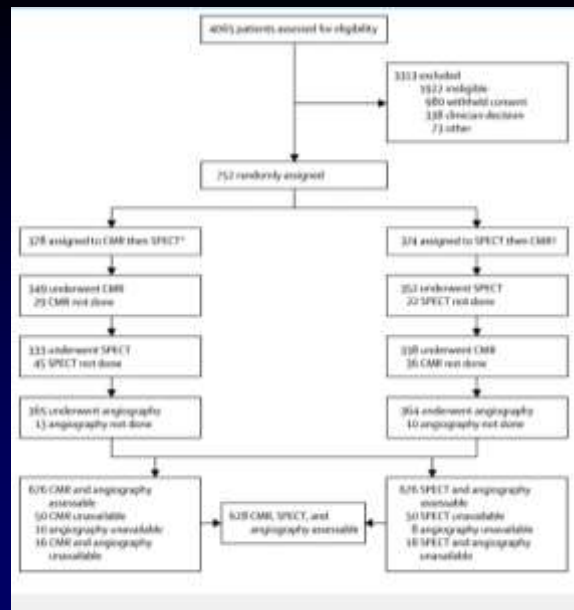
Cardiovascular magnetic resonance and single-photon emission computed tomography for diagnosis of coronary heart disease (CE-MARC): a prospective trial

John P Greenwood, Neil Marwede, John F Younger, Julia M Brown, Jane Nixon, Colin C Everett, Petra Ripstein, John P Ridgway, Aleksandra Radjenovic, Catherine J Dickinson, Stephen G Ball, Sam Plein

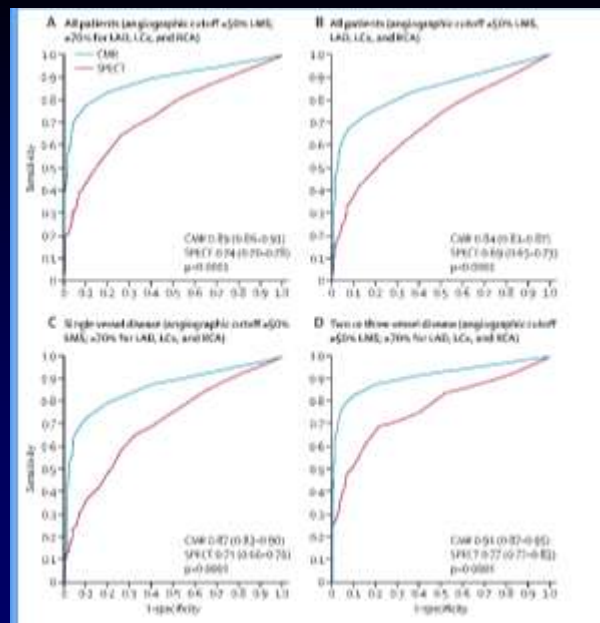
Lancet. 2012 Feb 4;379(9814):453-60

CE-MARC Trial

- Well designed study.
- Screened patient with suspected angina and at least one risk factor for CAD.
- No verification bias “used coronary angiography as **“Gold Standard”**”
- Pharmacologic stress modality was regadenosine in both CMR and SPECT



Lancet. 2012 Feb 4;379(9814):453-60

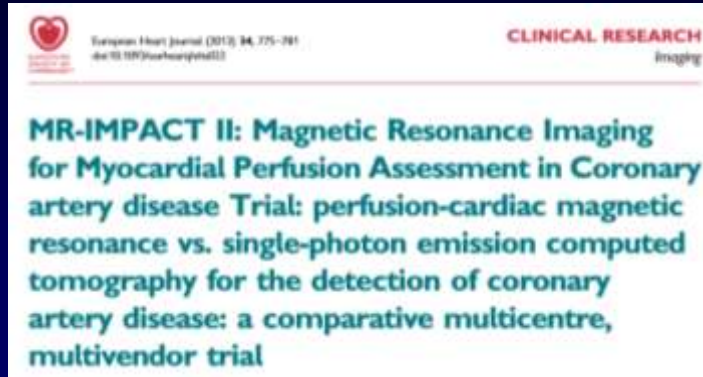


Lancet. 2012 Feb 4;379(9814):453-60

CE-MARC Trial

- **CMR: Sensitivity 86.5% (95% CI 81.8–90.1),
Specificity 83.4% (79.5–86.7),
PPV: 77.2%
NPV: 90.5%**
- **SPECT Sensitivity 66.5% (95% CI 60.4–72.1)
Specificity 82.6% (78.5–86.1)
PPV: 71.4%
NPV: 79.1%**

Stress CMR: Evidence



MR IMPACT II trial

- Similar design, 33 centers in Europe and US
- 533 pt, were scheduled to undergo SPECT and/or angiography consented for Stress CMR
- Primary endpoint was non-inferiority compared to SPECT imaging.

Conclusion: In this large multicenter, multivendor study, the sensitivity of perfusion-CMR to detect CAD was superior to SPECT, while its specificity was inferior to SPECT.

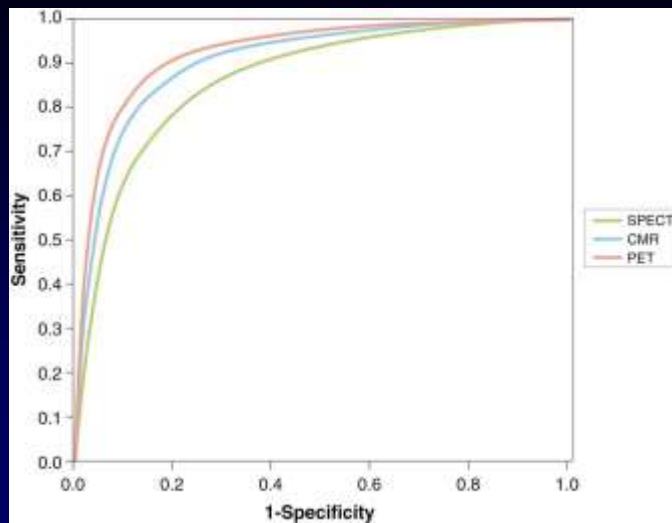
Stress CMR: Evidence

JACC: Cardiovascular Imaging

Volume 9, Issue 11, November 2016
DOI: 10.1016/j.jcmg.2016.09.010

CMR First-Pass Perfusion for Suspected Inducible Myocardial Ischemia

Robert C. Hendel, Matthias G. Friedrich, Jeanette Schulz-Menger, Claudia Zemmerich, Frank Bengel, Daniel S. Berman, Paolo G. Camici, Scott D. Flamm, Dominique Le Guludec, Raymond Kim, Massimo Lombardi, John Mahmarian, Udo Sechtem and Elke Nagel



Robert C. Hendel et al. JIMG 2016;9:1338-1348

Conclusion

- **Stress Perfusion CMR is non-inferior to SPECT imaging in patients with suspected CAD.**
- **Stress perfusion MRI will continue to grow but it will remain limited by availability and other MRI standard limitations.**

Thank you