CMR in daily clinical practice

Dr Rory O' Hanlon
Dr Deirdre Waterhouse

Centre for Cardiovascular Magnetic Resonance

Beacon Hospital
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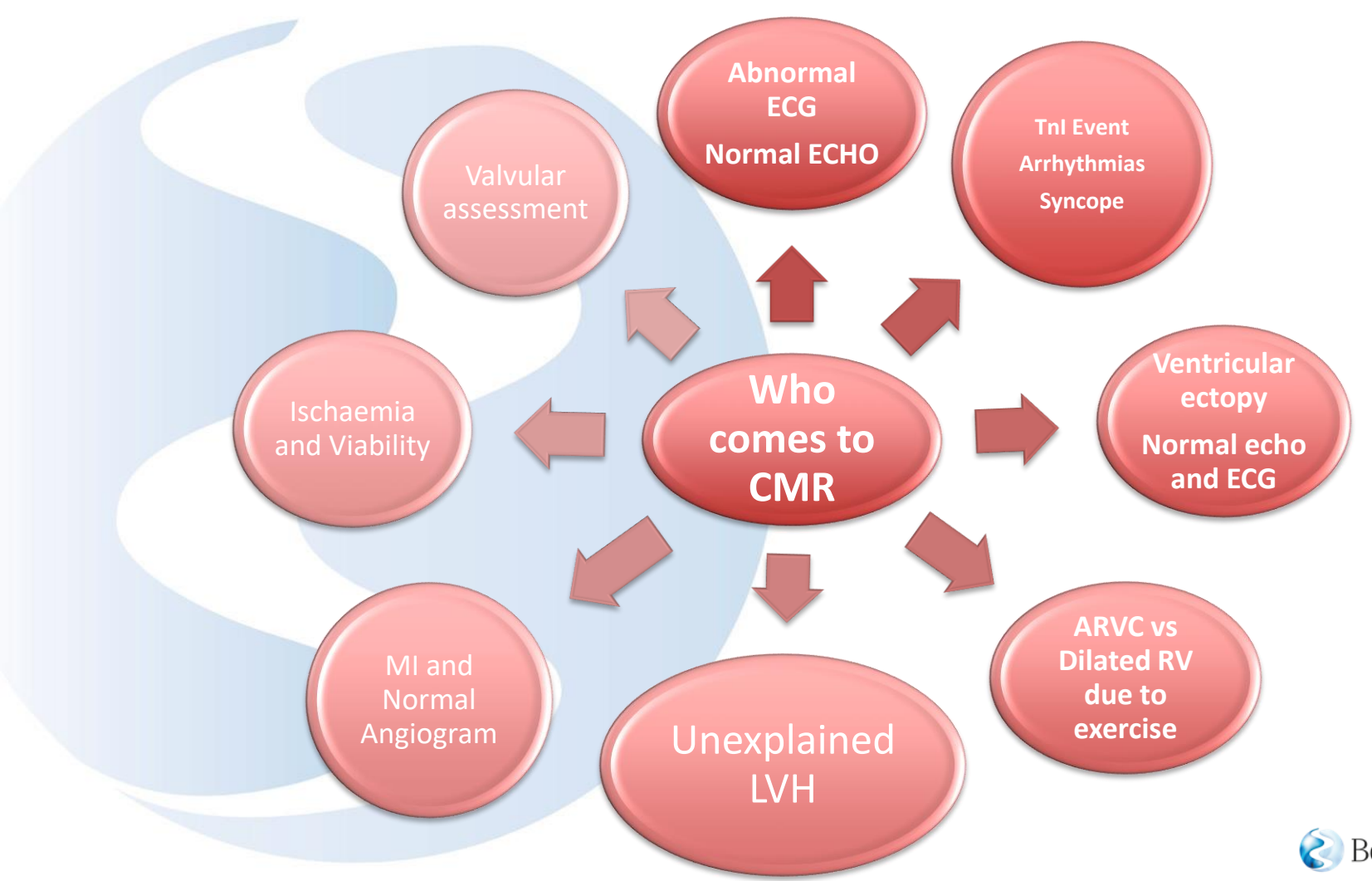

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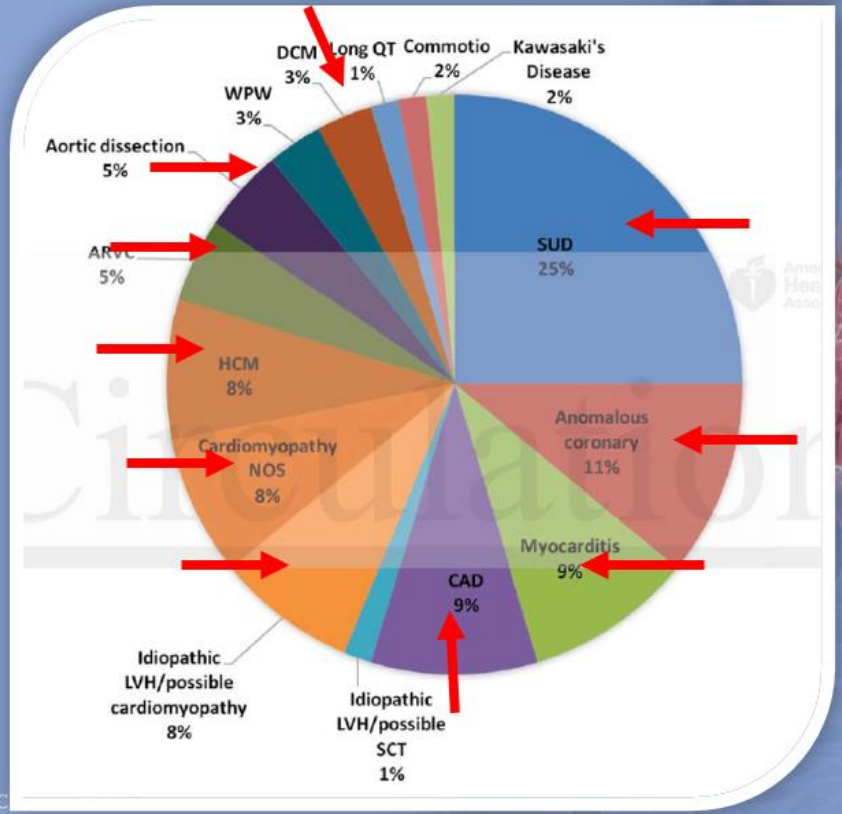
Incidence, Etiology, and Comparative Frequency of Sudden Cardiac Death in NCAA Athletes: A Decade in Review

Running title: *Harmon et al.; Sudden Cardiac Death in NCAA Athletes: 10-Years*

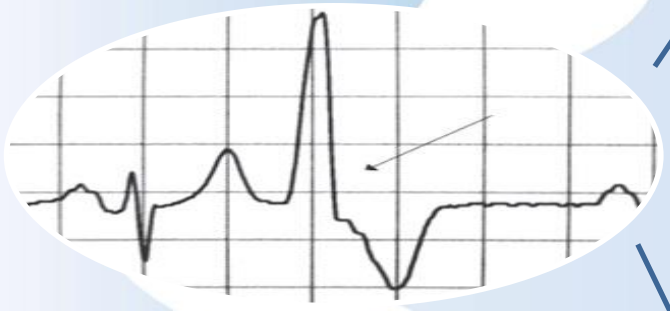


Blackrock Clinic | Centre for C

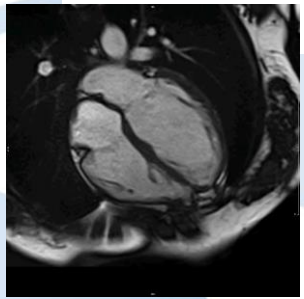
con Hospital

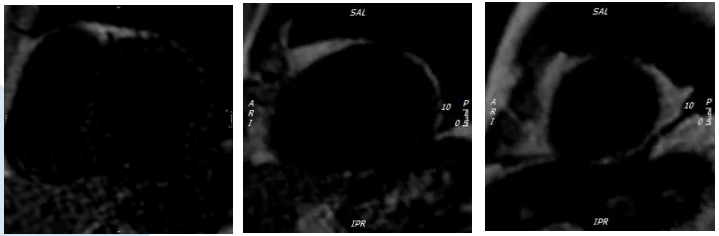
An example

Palpitations/ectopy (PVCs)

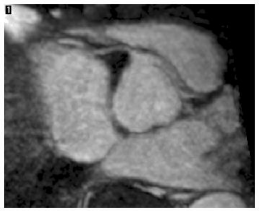


- Myocarditis
- HCM
  ARVC
  ALVC
- CAD/MI
- Valvular Disease
- Cardiomyopathy

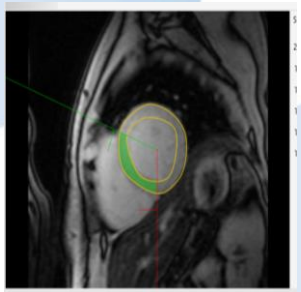




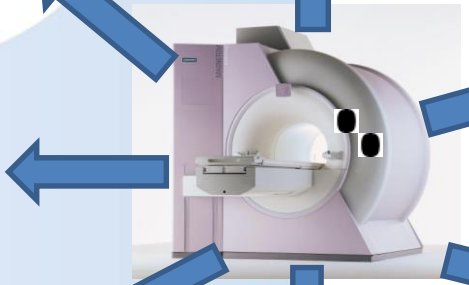
Perfusion

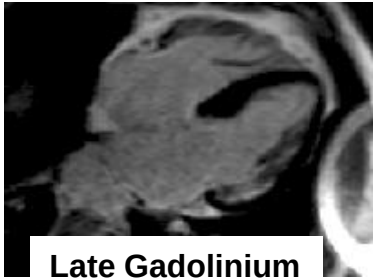


Proximal Coronaries

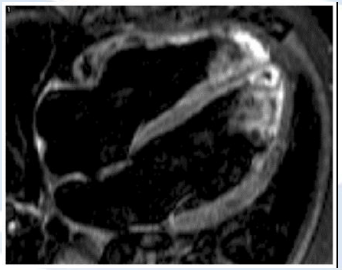


T2* Iron

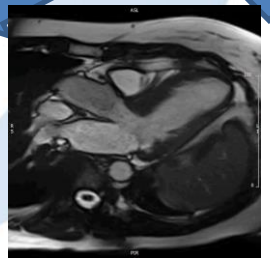


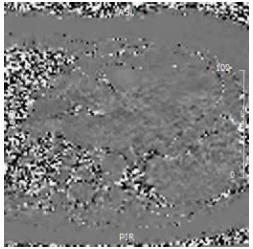


Late Gadolinium



STIRS





Flow Mapping

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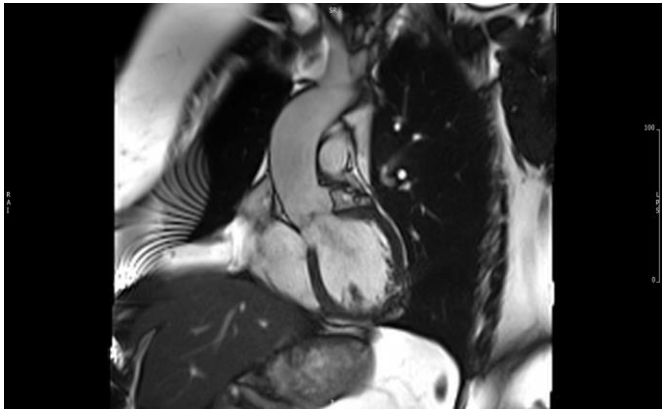
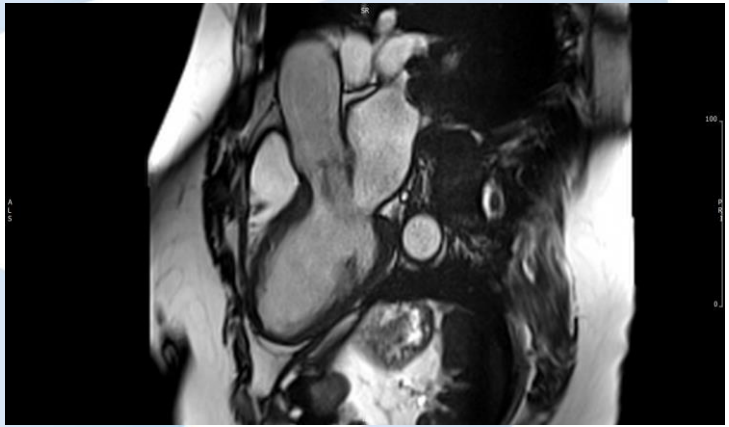
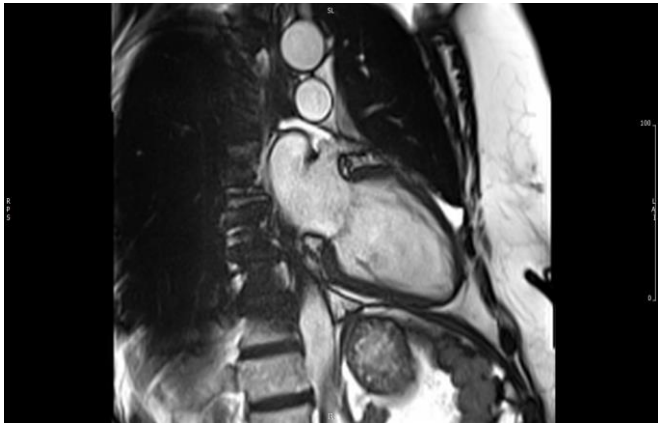
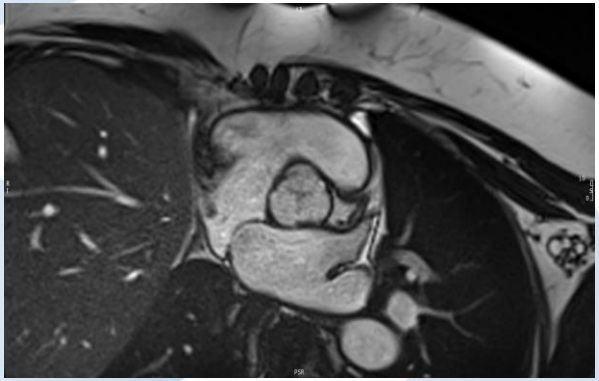
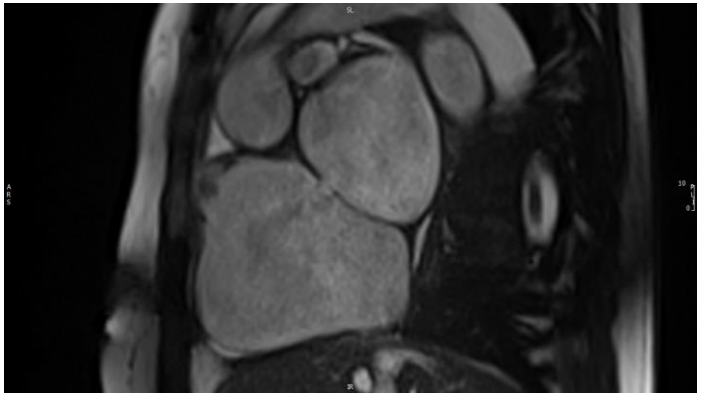
AIR
PSL

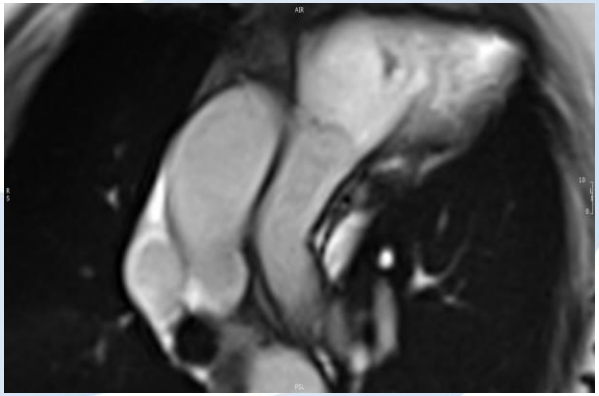

SI
RAI

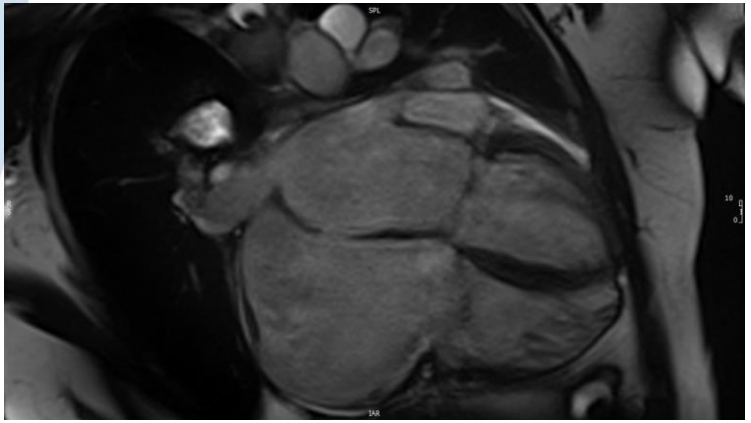

SR
ALS


SL
RPS









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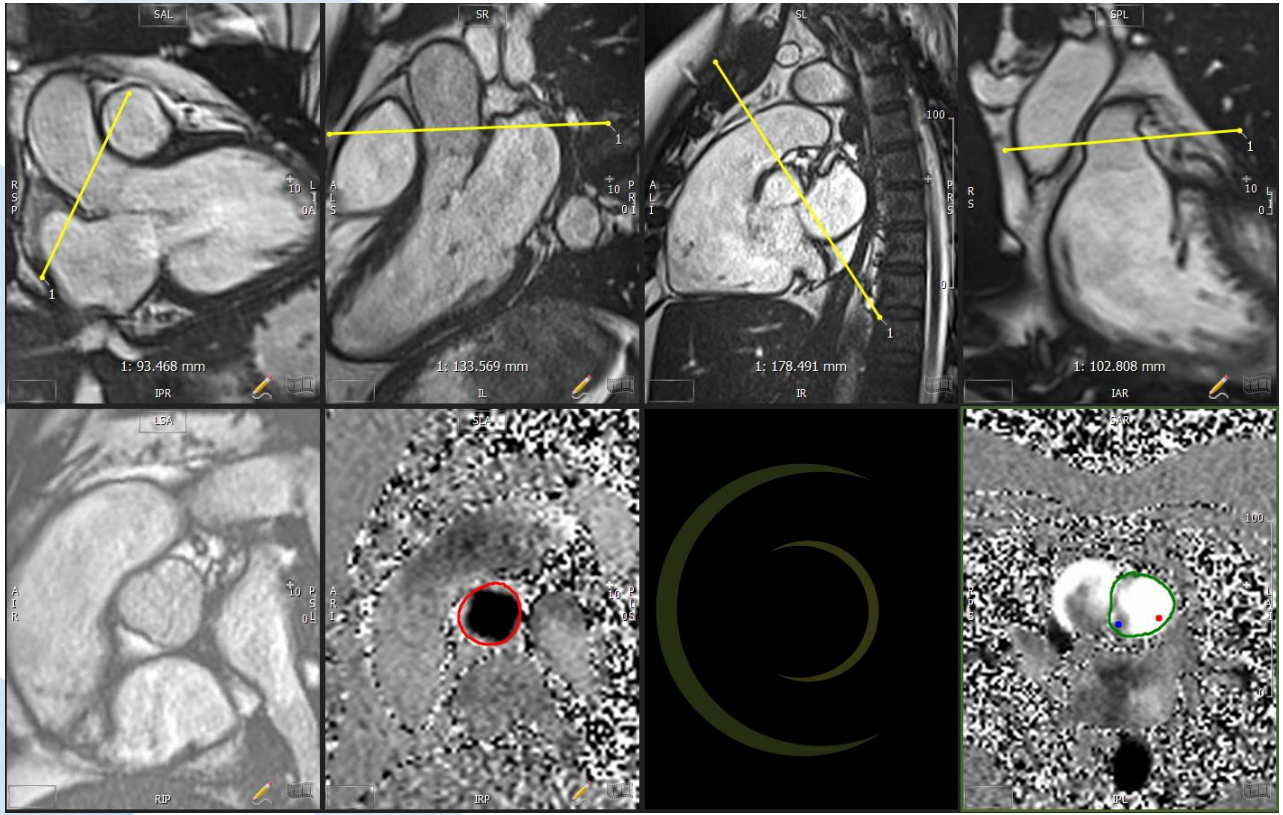

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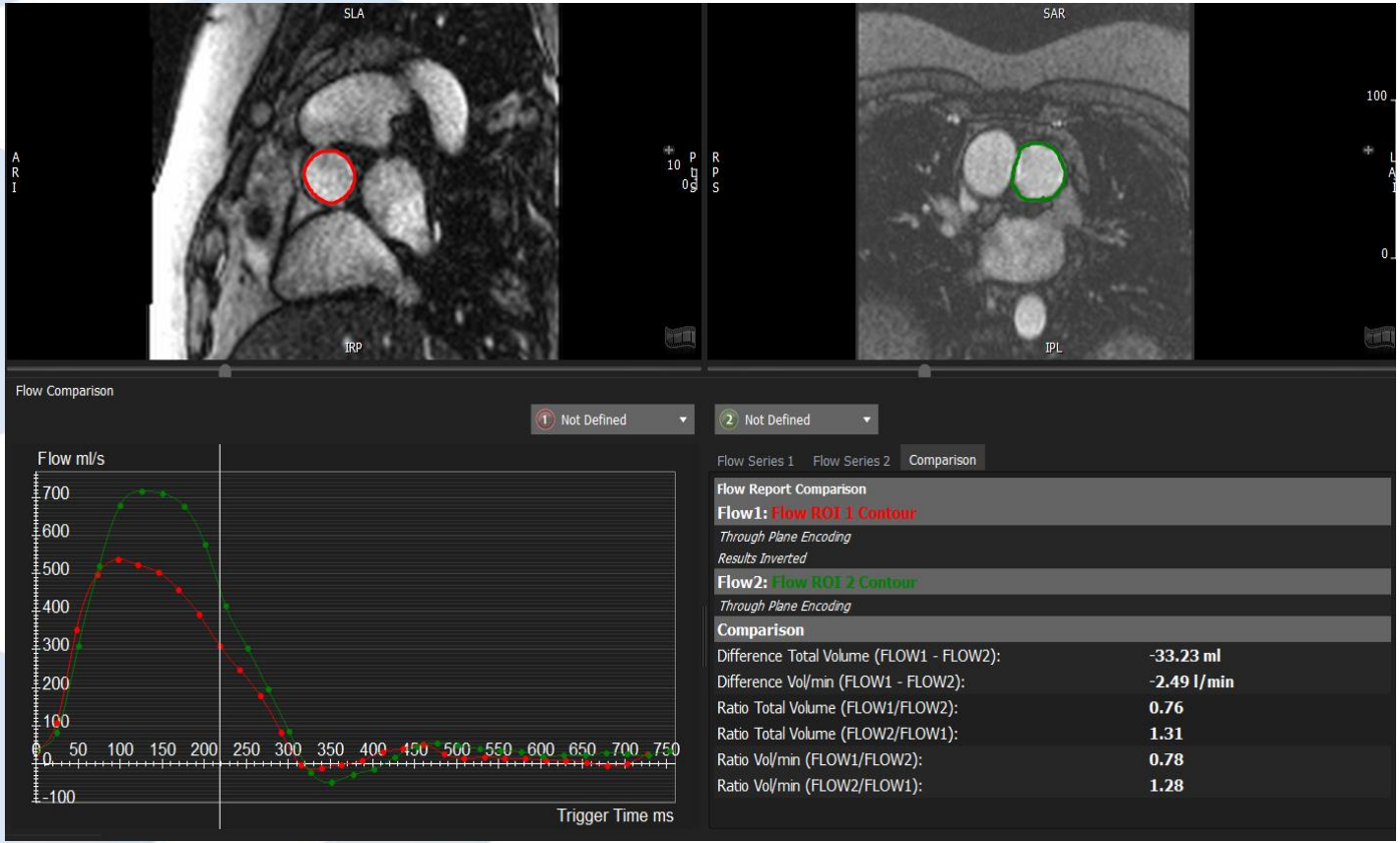
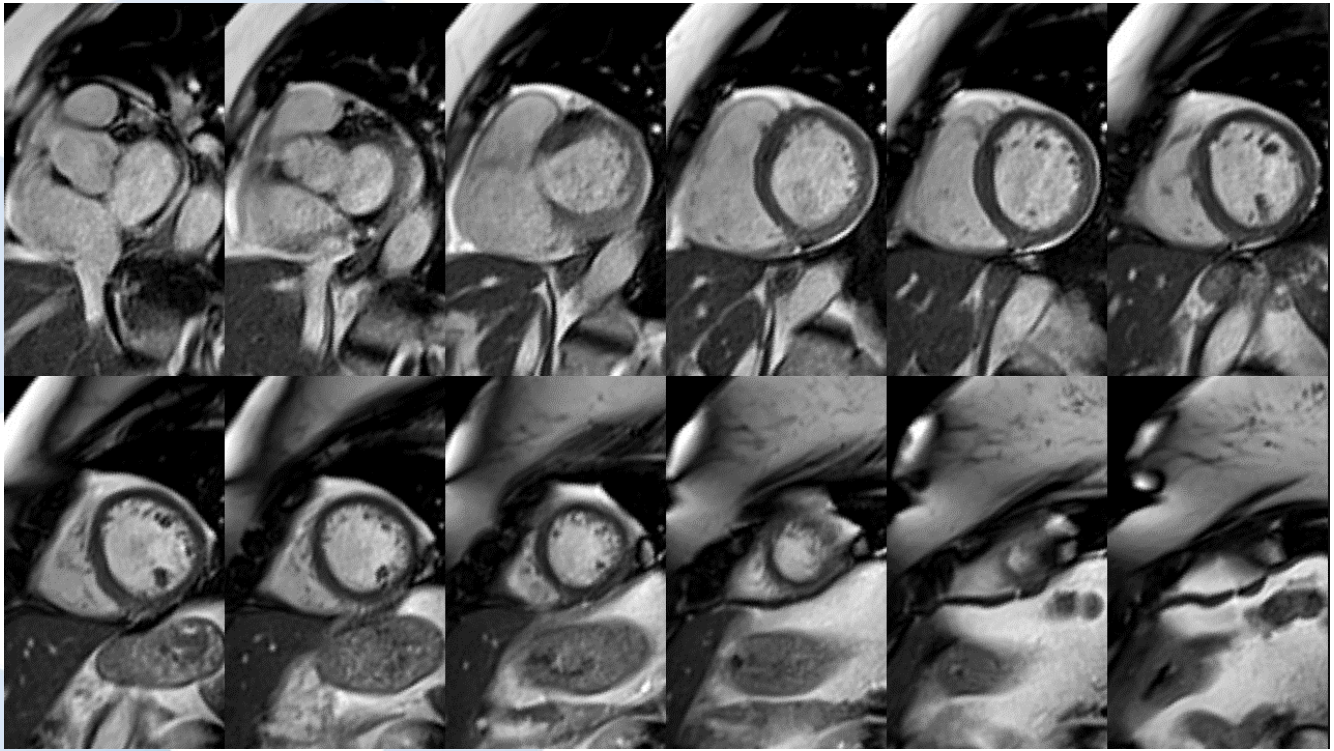
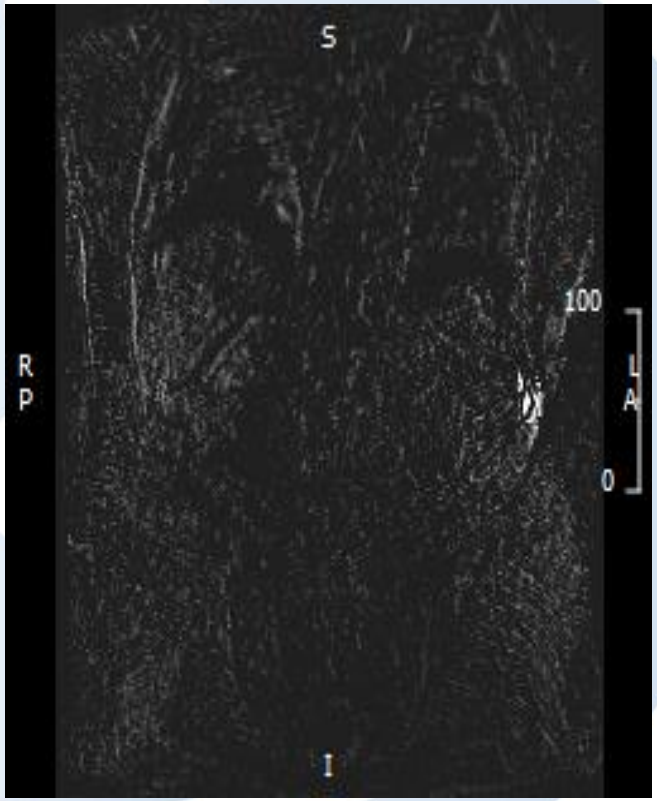
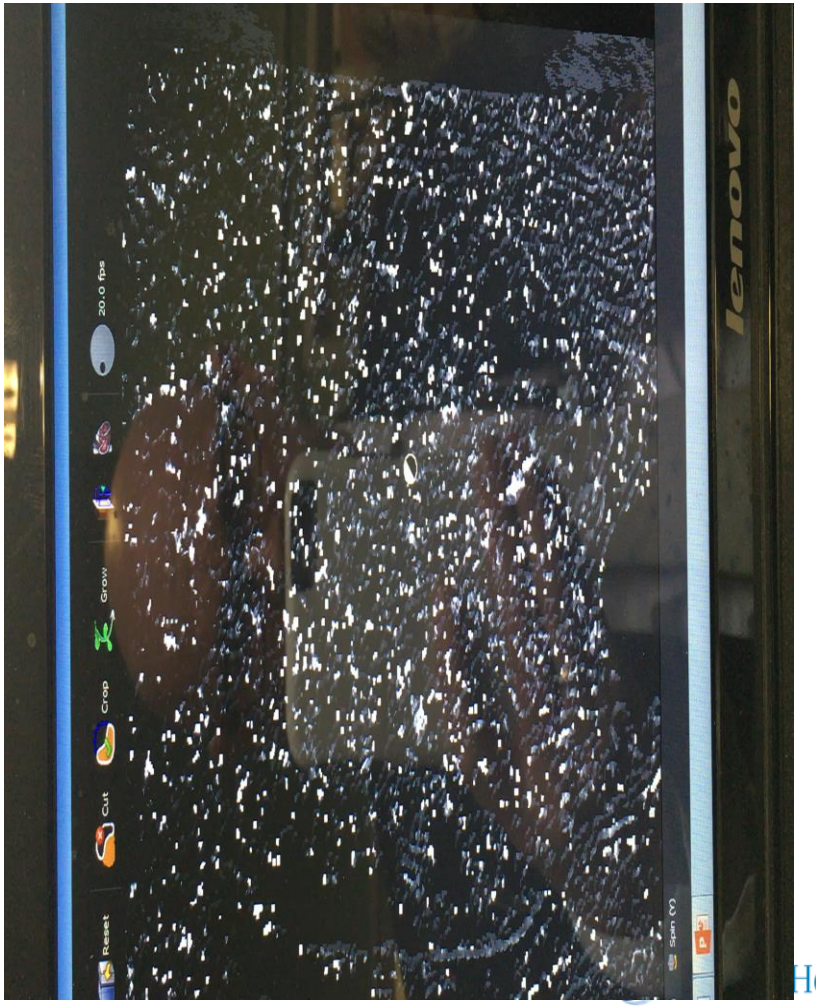

SLA
A
R
I
10
P
H
S
0
IRP
SAR
R
P
S
100
L
A
I
0
IPL
Flow Comparison
1 Not Defined
2 Not Defined
Flow ml/s
700
600
500
400
300
200
100
0
-100
0 50 100 150 200 250 300 350 400 450 500 550 600 650 700 750
Trigger Time ms
Flow Series 1
Flow Series 2
Comparison
Flow Report Comparison
Flow1: Flow ROI 1 Contour
Through Plane Encoding
Results Inverted
Flow2: Flow ROI 2 Contour
Through Plane Encoding
Comparison
Difference Total Volume (FLOW1 - FLOW2): -33.23 ml
Difference Vol/min (FLOW1 - FLOW2): -2.49 l/min
Ratio Total Volume (FLOW1/FLOW2): 0.76
Ratio Total Volume (FLOW2/FLOW1): 1.31
Ratio Vol/min (FLOW1/FLOW2): 0.78
Ratio Vol/min (FLOW2/FLOW1): 1.28



Instant Imaging





Hospital

The Typical Workup for Cardiology patients

ECG- LBBB, old Q waves, LVH with ST/T wave changes, AF
Holter – palpitations, syncope etc
ECHO

- LVH or not
- Dilated LV?
- Valve issues?
- Regional wall motion abnormalities - ?IHD
- RV

ETT

- To screen for CAD

Angiogram
+/- FFR, TOE, CT

Just Do a CMR

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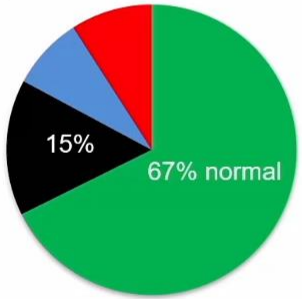
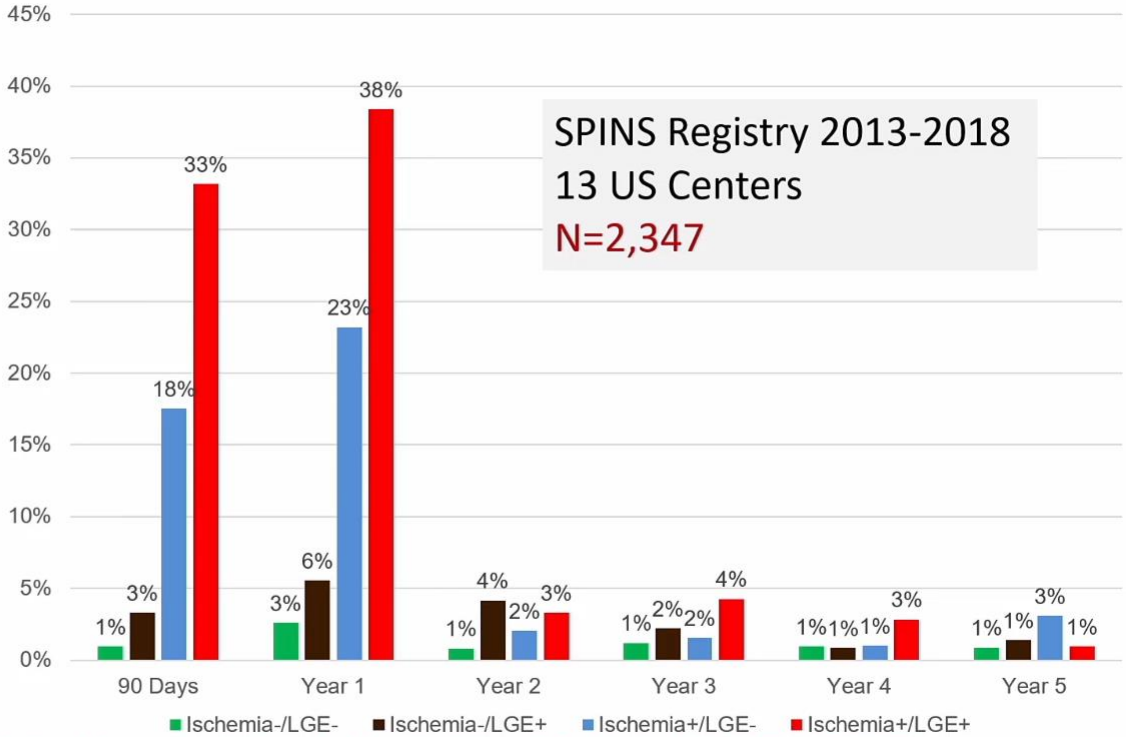
Need for Coronary Revascularization was low for patients with normal stress CMR

Rates of
CA revascularization
after Stress CMR (%)

SPINS Registry
N=2,347



SPINS Registry 2013-2018
13 US Centers
N=2,347



Kwong RY et al. Cardiac Magnetic Resonance Stress Perfusion Imaging for Evaluation of Patients with Chest Pain. J Am Coll Cardiol. 2019 Oct 8;74(14):1741

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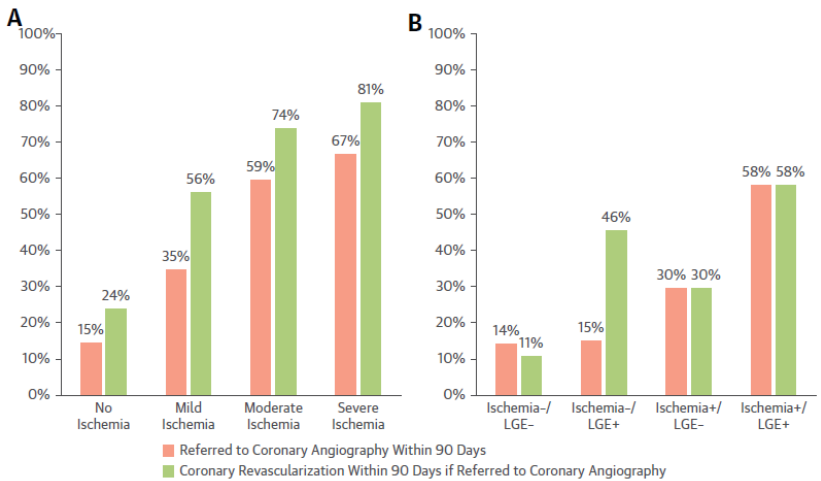
ORIGINAL RESEARCH

Prognostic Value of Stress CMR Perfusion Imaging in Patients With Reduced Left Ventricular Function

Yin Ge, MD,[a] Panagiotis Antiochos, MD,[a] Kevin Steel, DO,[b] Scott Bingham, MD,[c] Shuaib Abdullah, MD,[d] Yi-Yun Chen, MD, MPH,[a] J Ronald Mikolich, MD,[e] Andrew E. Arai, MD,[f] W. Patricia Bandettini, MD,[f] Sujata M. Shanbhag, MD, MPH,[f] Amit R. Patel, MD,[g] Afshin Farzaneh-Far, MD, PhD,[h] John F. Heitner, MD,[i] Chetan Shenoy, MD,[j] Steve W. Leung, MD,[k] Jorge A. Gonzalez, MD,[l] Dipan J. Shah, MD,[m] Subha V. Raman, MD,[n] Victor A. Ferrari, MD,[o] Jeanette Schulz-Menger, MD,[p] Matthias Stuber, PhD,[q] Orlando P. Simonetti, PhD,[n] Raymond Y. Kwong, MD, MPH[a]

FIGURE 4 Invasive Coronary Angiography and Revascularization at 90 Days



Primary – CV death and non fatal MI

Secondary- as above, HF/angina hospitalisation, unplanned late CABG

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Does Ischaemia Matter?

Indications for revascularization in patients with stable angina or silent ischaemia

Extent of CAD (anatomical and/or functional)		Class[a]	Level[b]
For prognosis	Left main disease with stenosis >50%.[c] [68–71]	I	A
	Proximal LAD stenosis >50%.[c] [62,68,70,72]	I	A
	Two- or three-vessel disease with stenosis >50% with impaired LV function (LVEF ≤35%).[c] [61,62,68,70,73–83]	I	A
	Large area of ischaemia detected by functional testing (>10% LV) or abnormal invasive FFR.[d] [24,59,84–90]	I	B
	Single remaining patent coronary artery with stenosis >50%.[c]	I	C
For symptoms	Haemodynamically significant coronary stenosis[c] in the presence of limiting angina or angina equivalent, with insufficient response to optimized medical therapy.[e] [24,63,91–97]	I	A

CAD = coronary artery disease; FFR = fractional flow reserve; iwFR = instantaneous wave-free ratio; LAD = left anterior descending coronary artery; LV = left ventricular; LVEF = left ventricular ejection fraction.

[a]Class of recommendation.

[b]Level of evidence.

[c]With documented ischaemia or a haemodynamically relevant lesion defined by FFR ≤0.80 or iwFR ≤0.89 (see section 3.2.1.1), or >90% stenosis in a major coronary vessel.

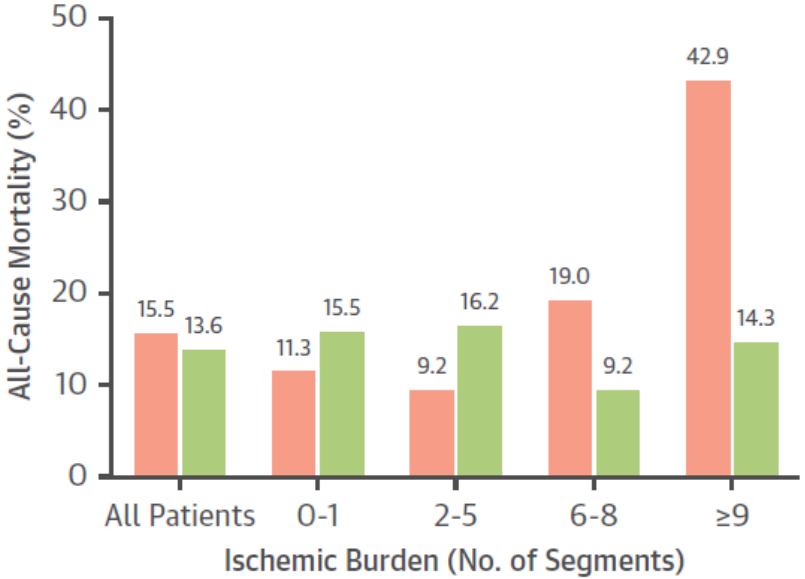
[d]Based on FFR <0.75 indicating a prognostically relevant lesion (see section 3.2.1.1).

[e]In consideration of patient compliance and wishes in relation to the intensity of anti-anginal therapy.

Vasodilator Stress CMR and All-Cause Mortality in Stable Ischemic Heart Disease

A Large Retrospective Registry

B



	All Patients	0-1	2-5	6-8	≥9
Non-Revascularized:	80/516	8/71	21/229	33/174	18/42
Revascularized:	70/516	11/71	37/229	16/174	6/42
p Value:	0.4	0.5	0.03	0.009	0.004

Some Cases

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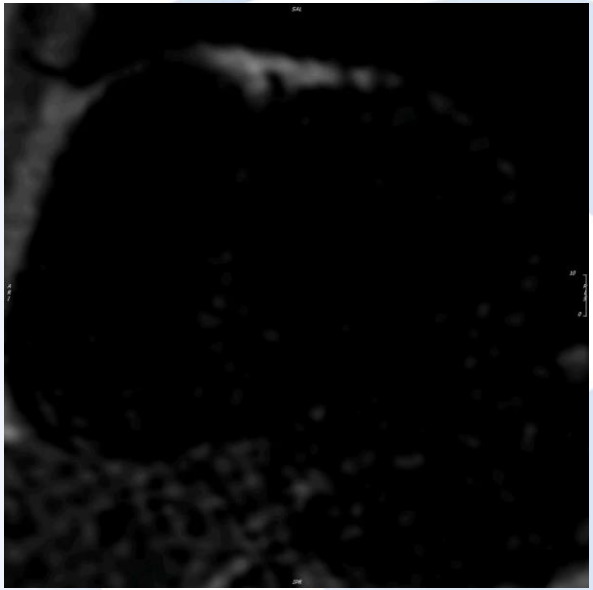
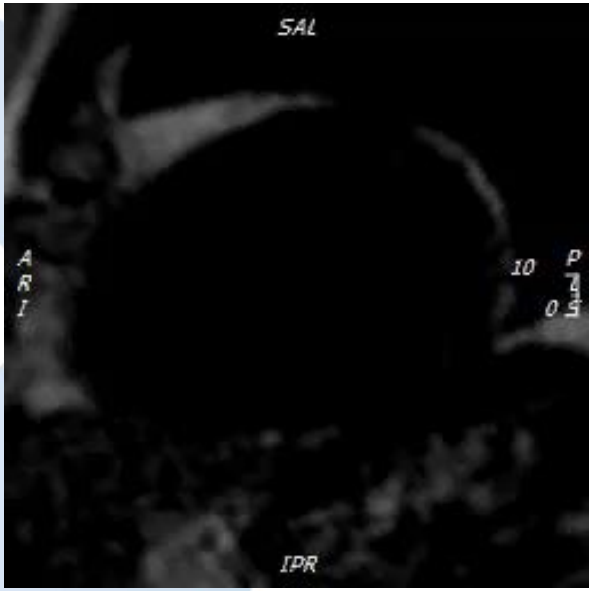
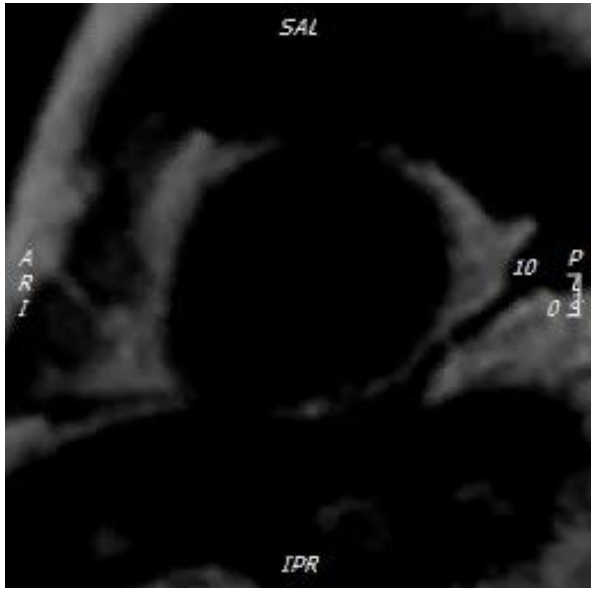
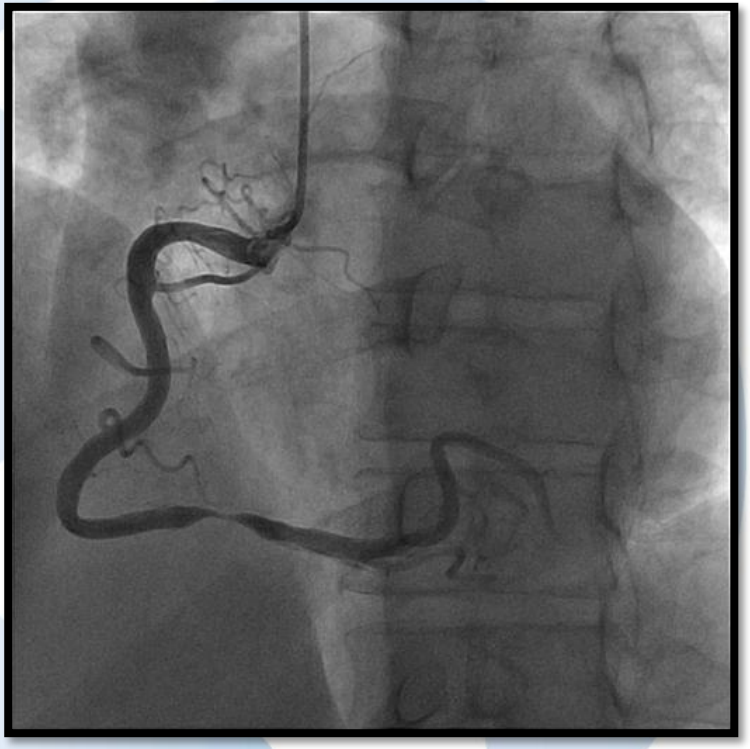
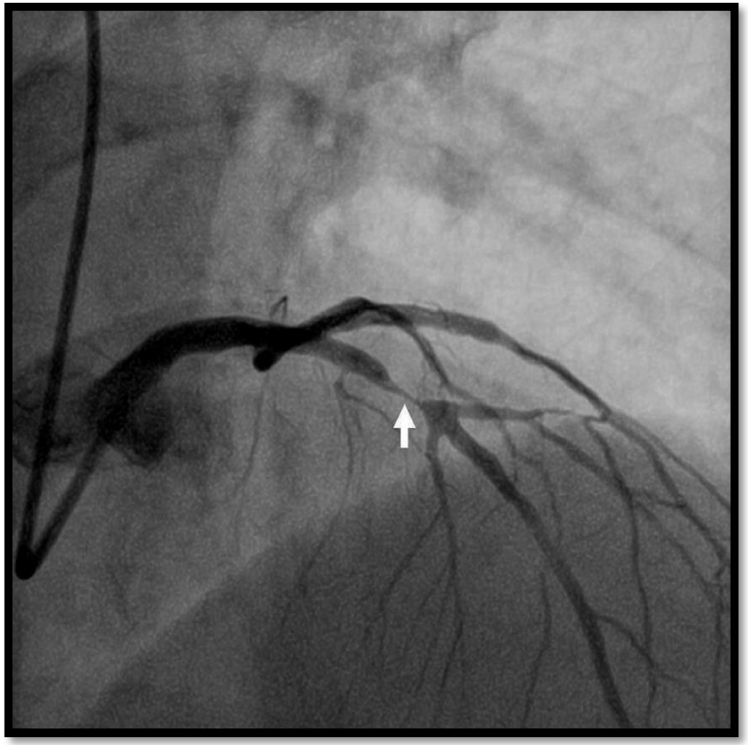


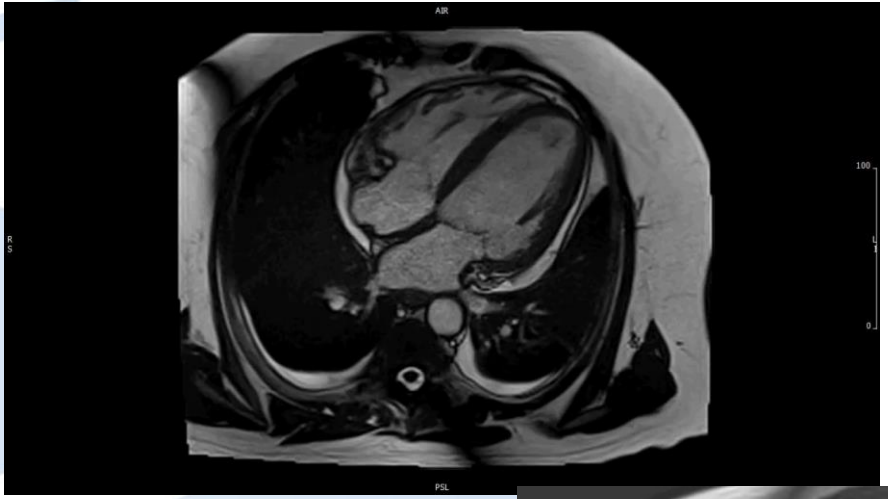


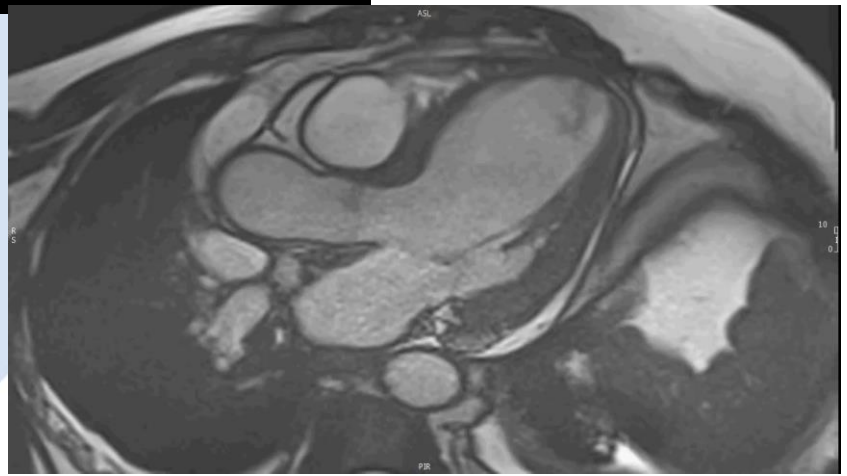


- 62 year old male
- Lockdown life changes
- Fam hx, LDL 3.8, BP 141/81 on 24 hr BP
- Slight disproportionate unexplained fatigue in afternoons
- Worried re family hx









61 Yr old ex smoker
STEMI
PCI performed

Told it was an excellent angiographic result

Echo said mild inferior and lateral wall hypokinesis but good LVEF

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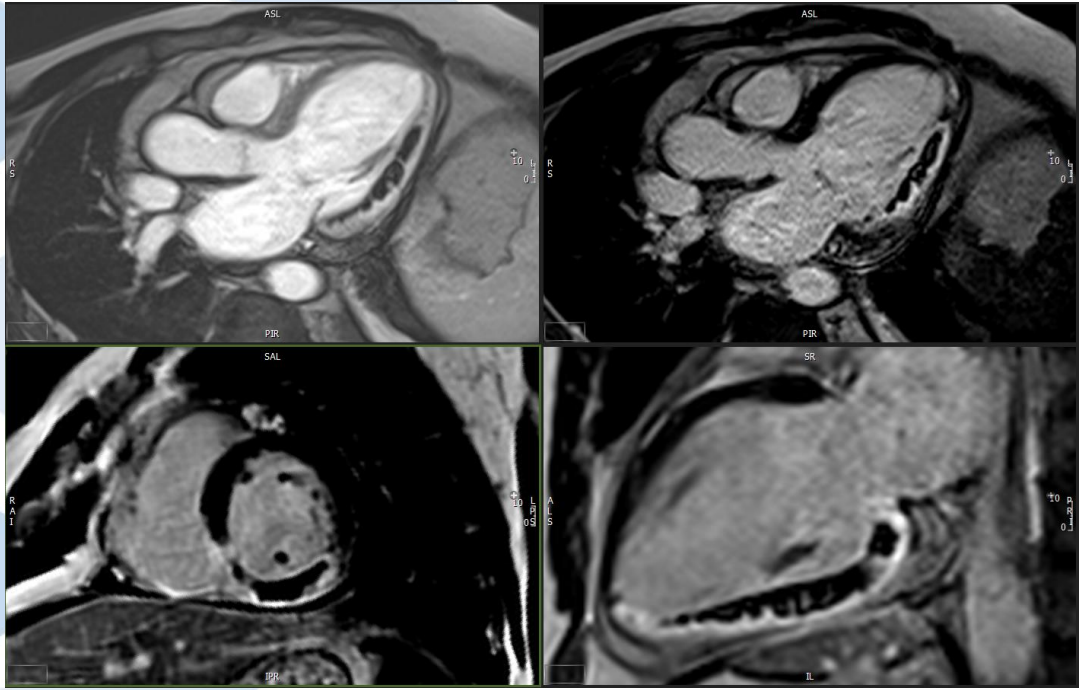
Post Contrast Images



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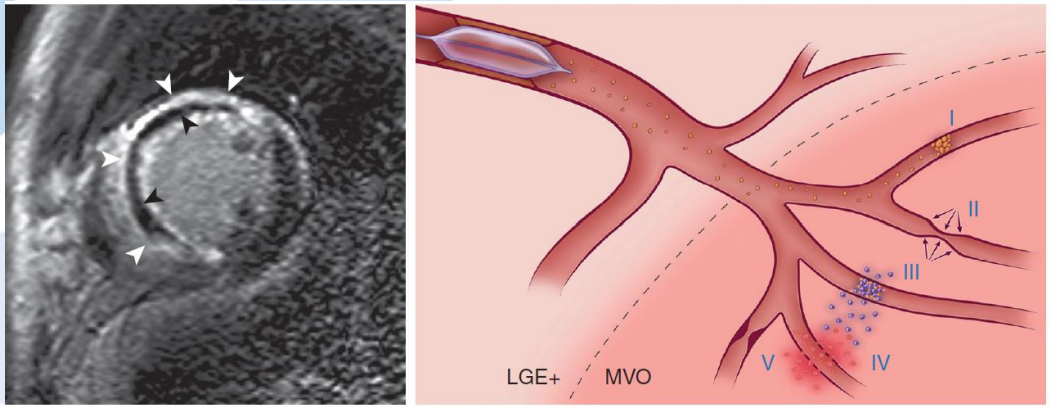
Long-Term Incremental Prognostic Value of Cardiovascular Magnetic Resonance After ST-Segment Elevation Myocardial Infarction

A Study of the Collaborative Registry on CMR in STEMI



CONCLUSIONS

Early post-infarction CMR-based MVO is a strong independent prognosticator in reperfused STEMI patients at long-term follow-up. Remarkably, MVO extent ≥2.6% of LV was the strongest independent predictor of death and HF hospitalization, overriding the prognostic performance of traditional outcome predictors and leading to better long-term risk stratification.

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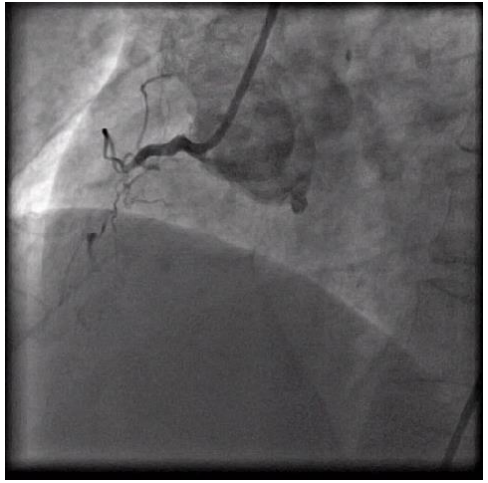
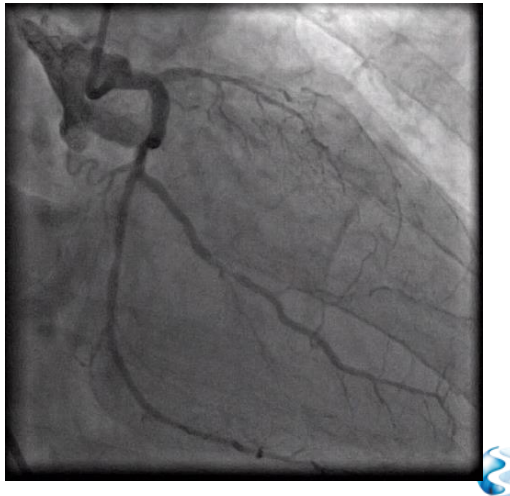
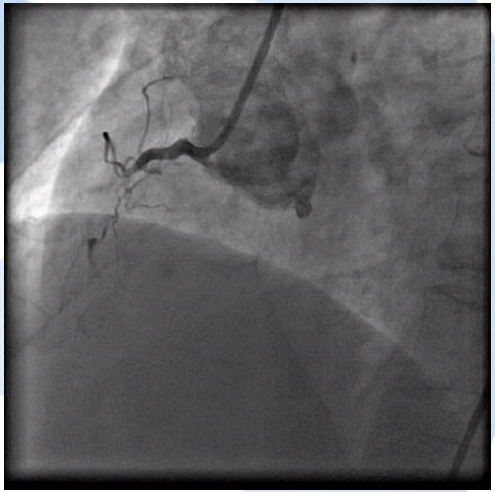
Example

- 60 yr old male
- C2H5 XS
- EF 31%
- Occluded RCA and LAD
- CMR to assess for viability
- No angina
- NYHA III



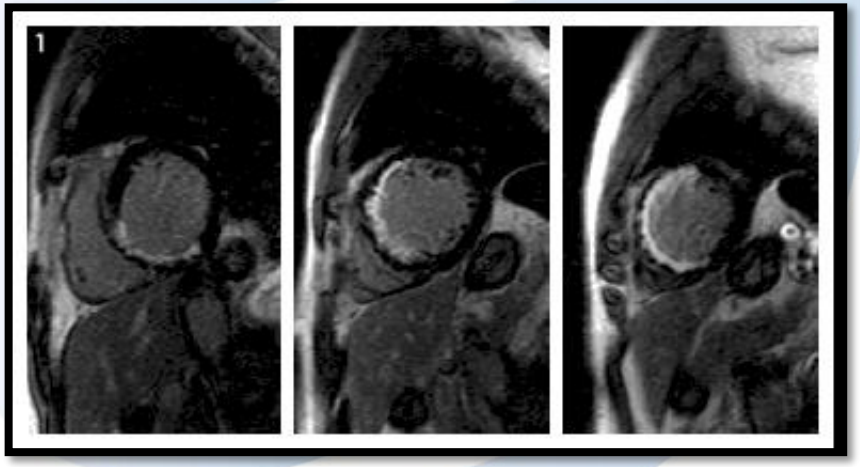


NYHA III, Exertional dizziness, CCS I

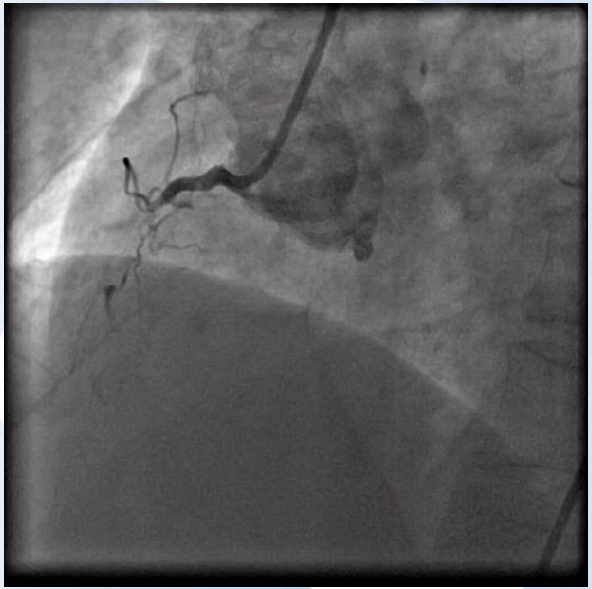


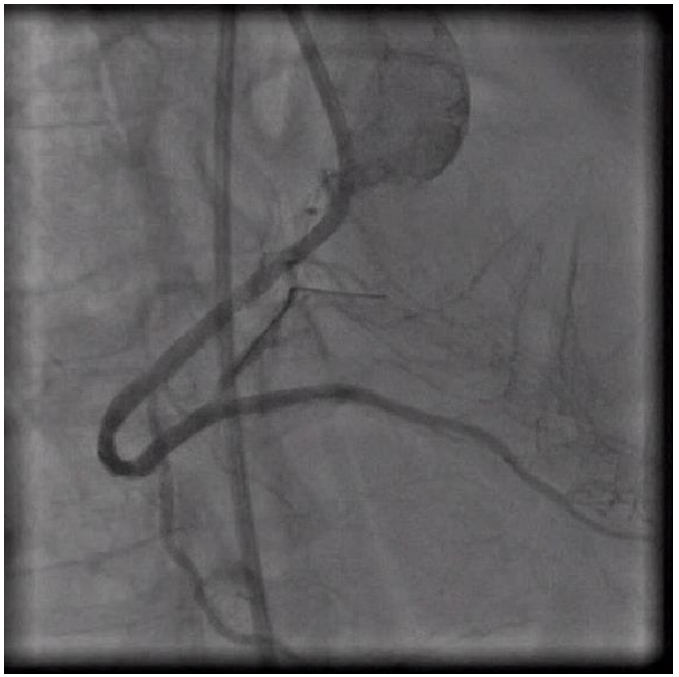
Occluded LAD/RCA, EF 30%

Non viable myocardium
Recommend Medical Mx



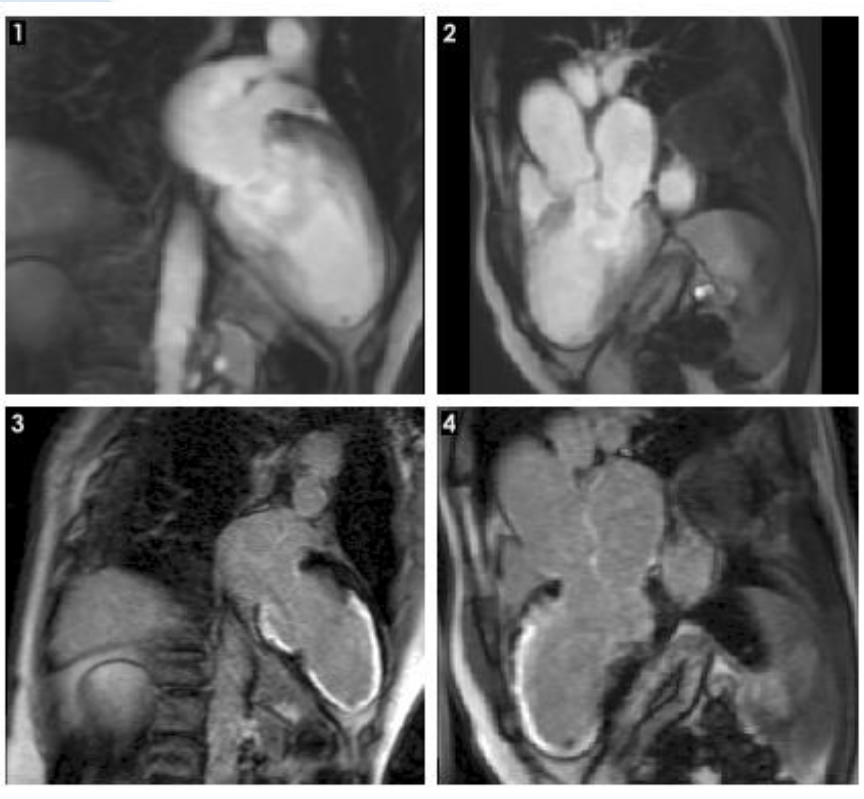
NYHA III, Exertional dizziness, CCS I





NYHA III, Exertional dizziness, CCS I

Follow Up CMR



CKD, eGFR 29
New Apical Thrombus
No Angina, NYHA III
EF Unchanged

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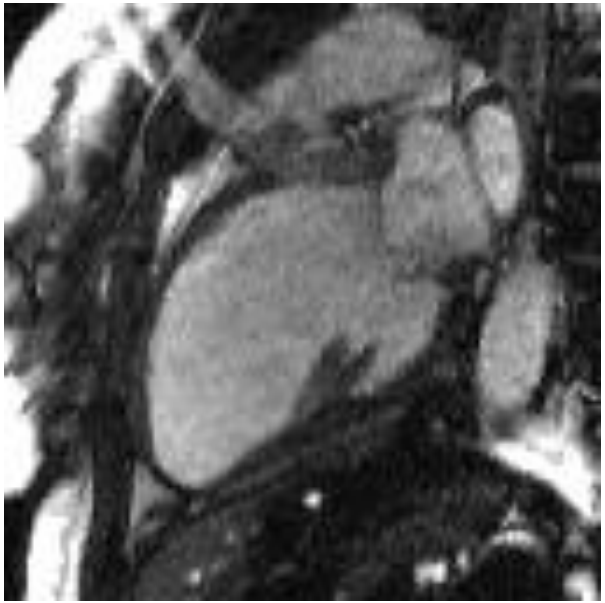
CABG vs PCI



CTO LAD and RCA.
Large LCx with 50-70% proximal stenosis and collaterals to RCA and LAD
CCS 1, NYHA II^{+}

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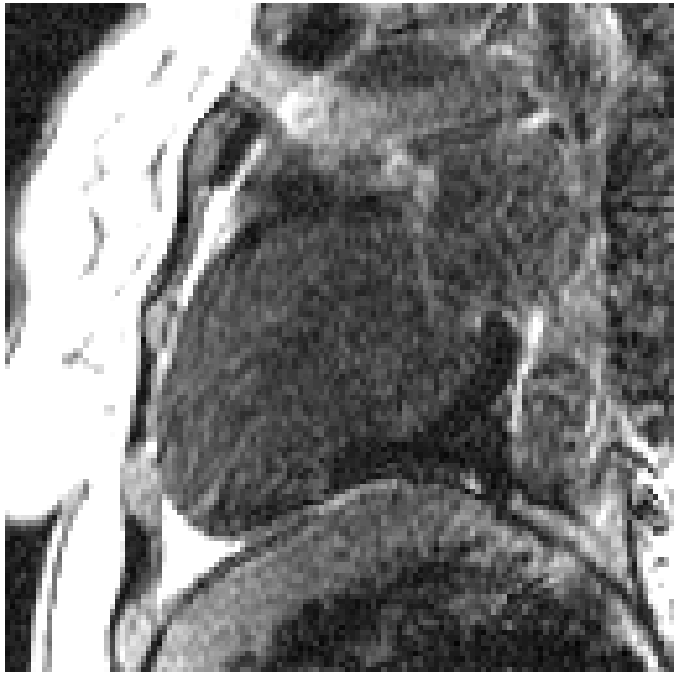
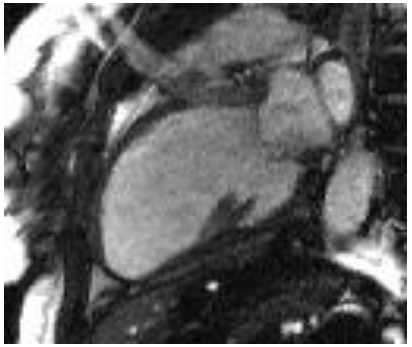
LGE Study



Absence of late enhancement

Hibernating myocardium

Pre revasc



EF: 19%

Post revasc

EF: 37%

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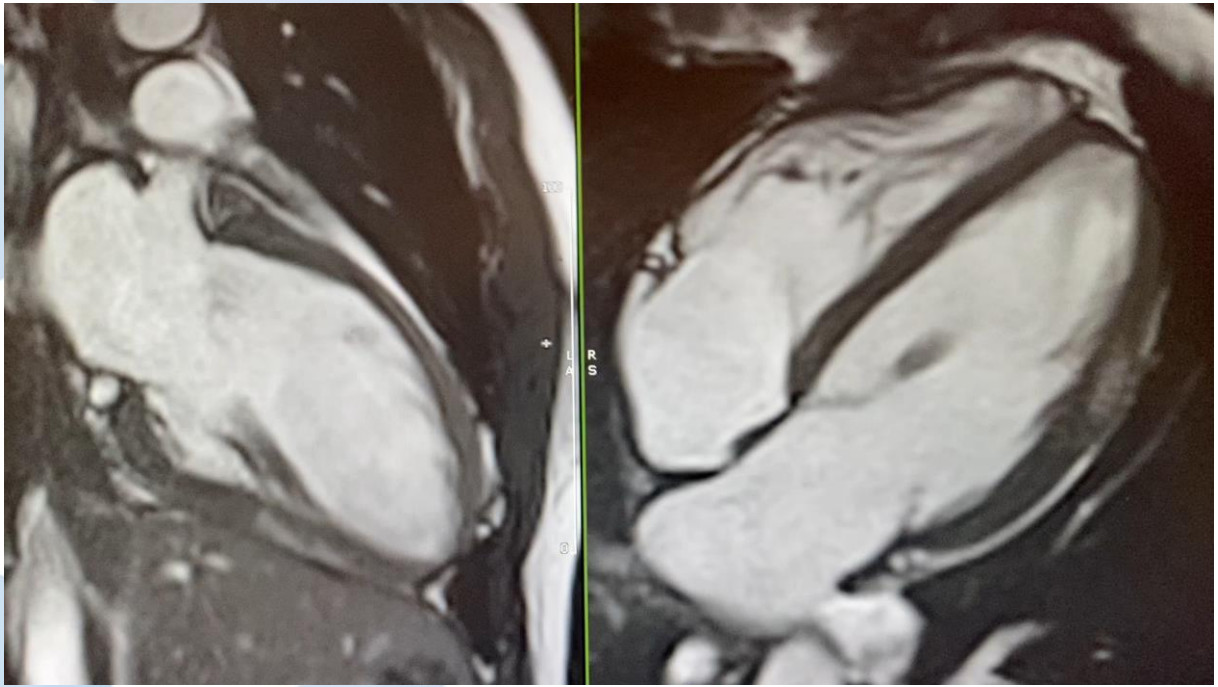

22 Year old. TnI positive chest pain.
Recent COVID.

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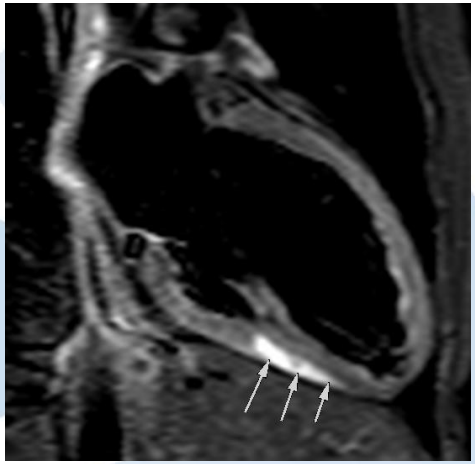

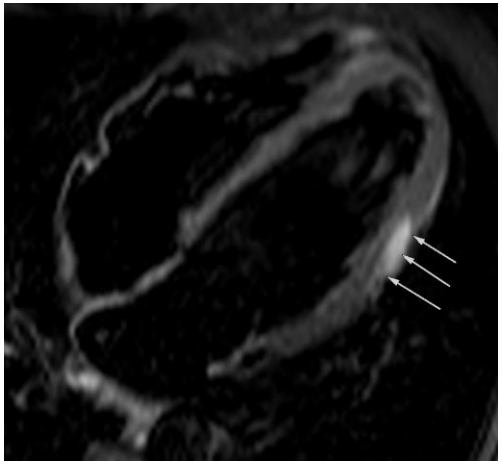

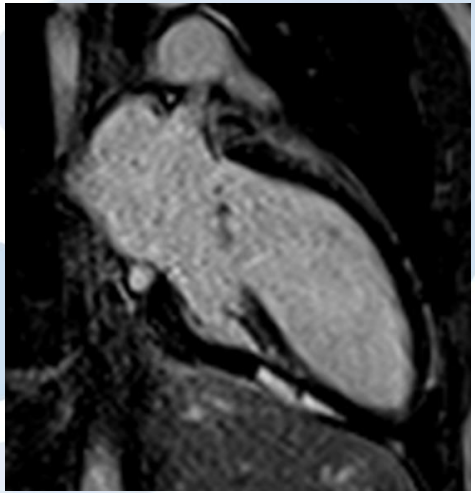

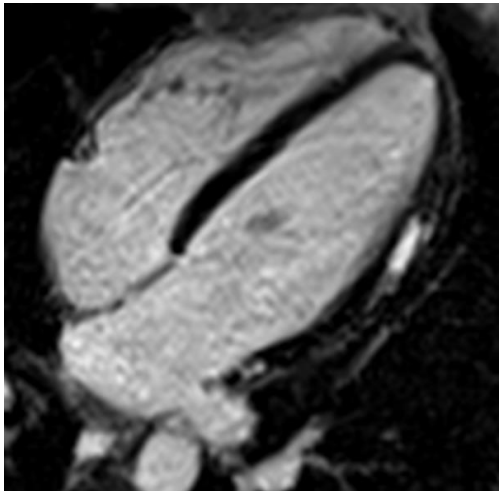

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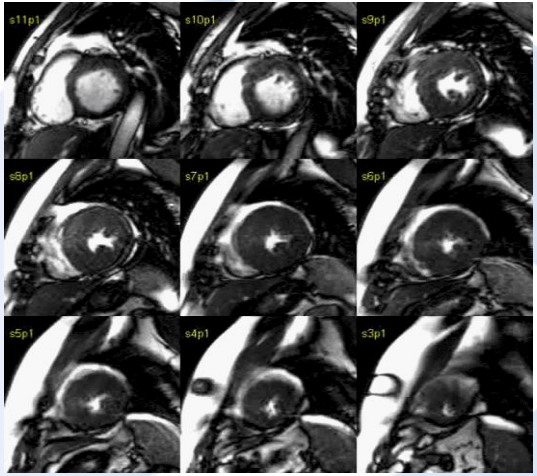

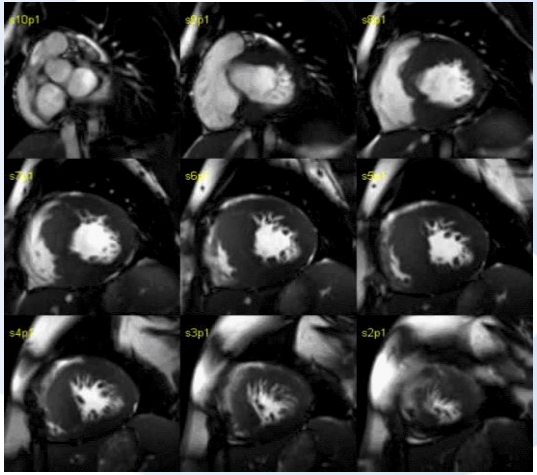

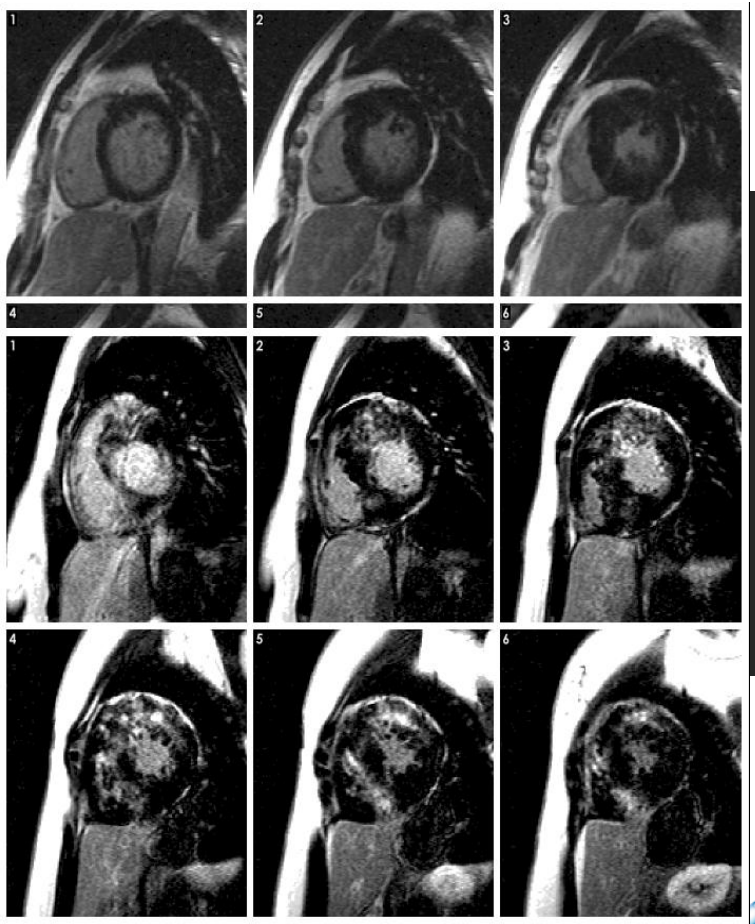

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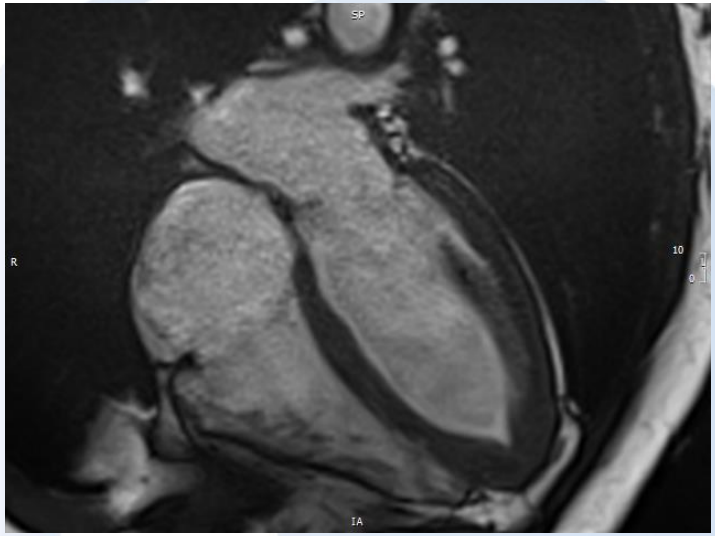
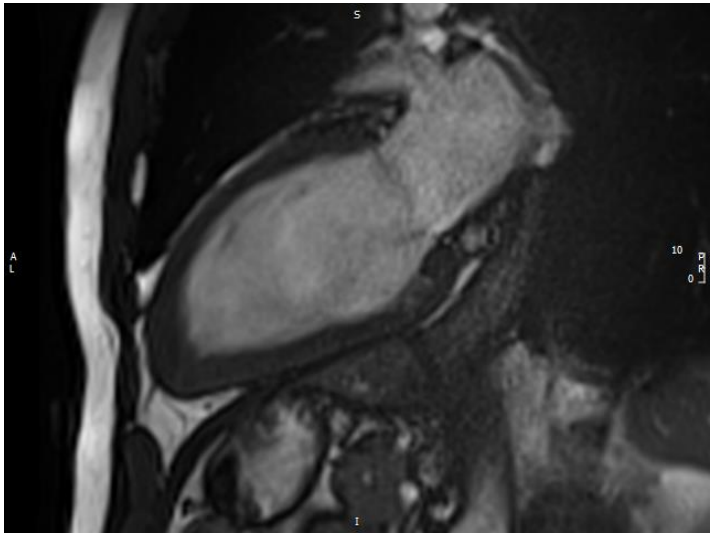
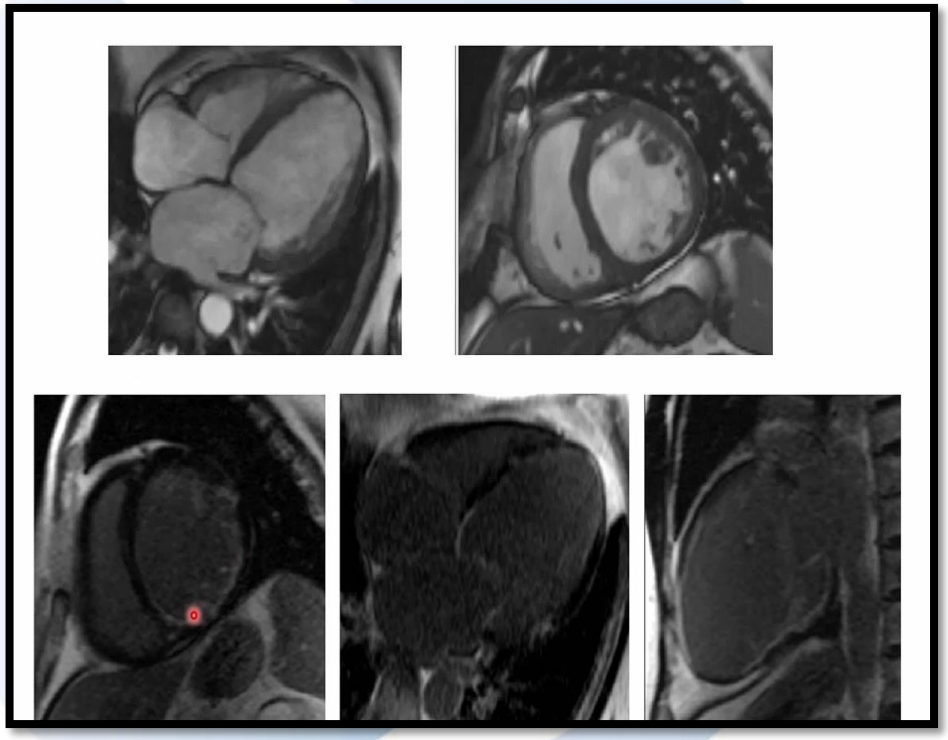
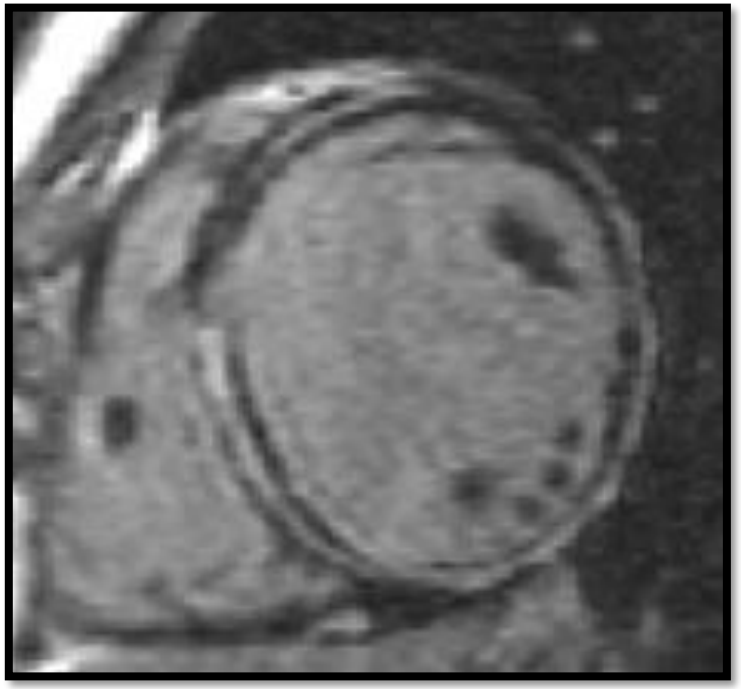


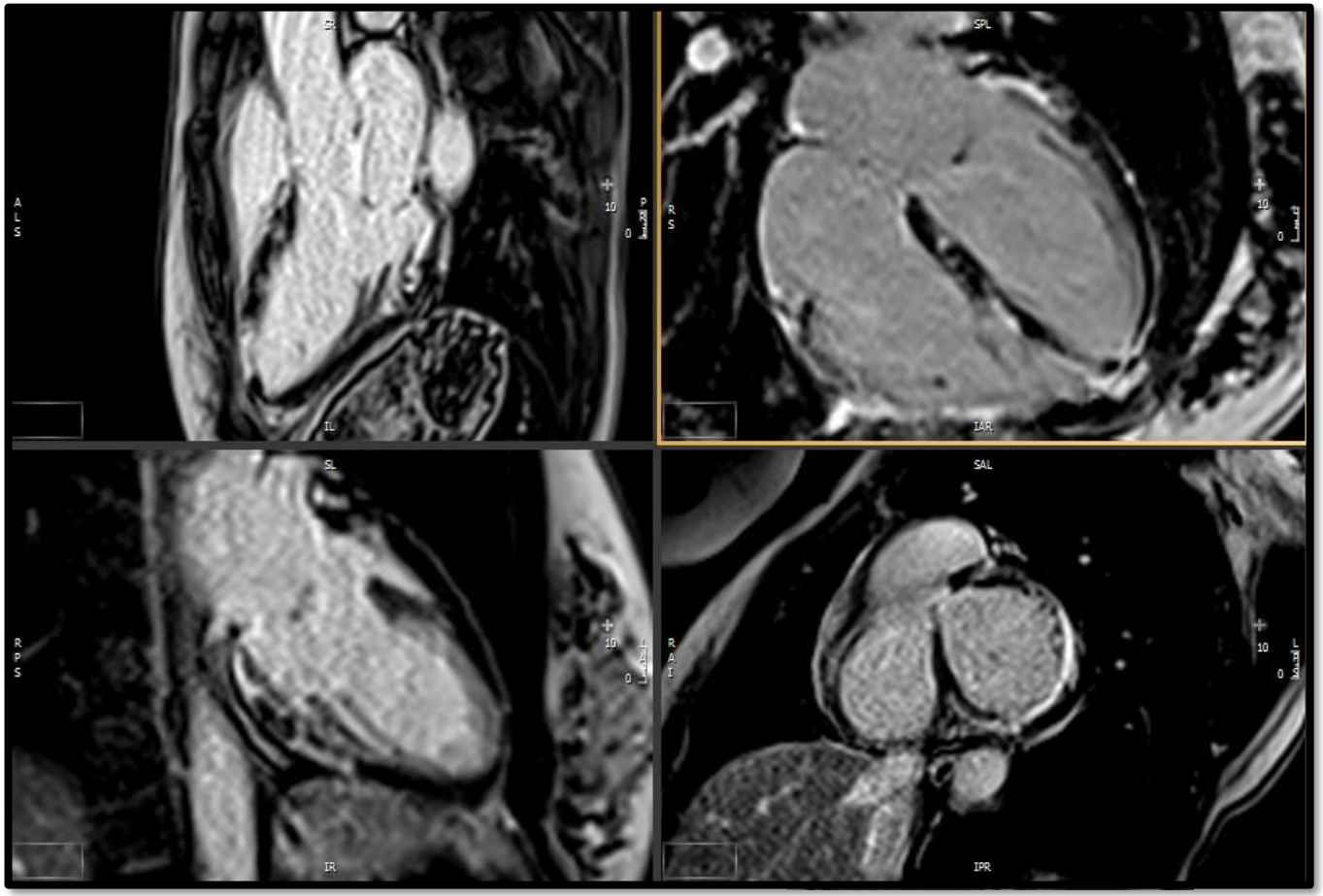


- 51 year high level runner
- Sinus brady 46bpm but significant TWI throughout
- Normal echo

The Dilated Heart







41 year old regular exerciser. Vague palpitations. No syncope. Normal echo and PVCs on 24 hr holter.

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In summary – who should you consider for CMR in the community

Family hx SCD- was it an MI? Could it have been cardiomyopathy or anomalous coronaries?
Frequent ventricular ectopy- despite a normal echo
Unexplained LVH- on echo or ECG
Suboptimal echo- ie valvular assessment
Syncope
Unexplained LV or RV dilatation/enlargement
Post MI
MI with normal coronary arteries (MINOCA)
Post myocarditis
Pericardial assessment
Aorta assessment (no radiation)

It is **not** a good screening test for non obstructive CAD/early atheroma. CMR detects ischaemia.