MRI Reading Center Report

March 8th, 2011

João Lima and the JHU-NIH CC

MESA MRI RC team

MRI Reading Center staff

QC/Planning:	Chia-Ying Liu, PhD
MRI Database:	John Eng, MD
Research Program Manager:	Erin Ricketts, MSPH
Core Variables (Scar):	Marcelo Nacif, MD
Core Variables (LV mass):	Ela Chamera, Melisa George, Harjit Chahal, MD
MRI Tagging:	Sirisha Donekal, MD, Kihei Yoneyama, MD
Aortic Distensibility:	Gisela Teixido-Tura, MD
MRI DE (fibrosis)	Marcelo Nacif, MD, Nathan Mewton MD, Wenjing Liu, MD, Chia Liu, PhD

Full CMRI Protocol with Gd

Localizers (scout images)

Pseudo vertical view

Cine Four Chamber

Pre-Contrast T1 map

Short Axis Tagging

Short Axis Cine (SSFP)

Cine Two Chamber

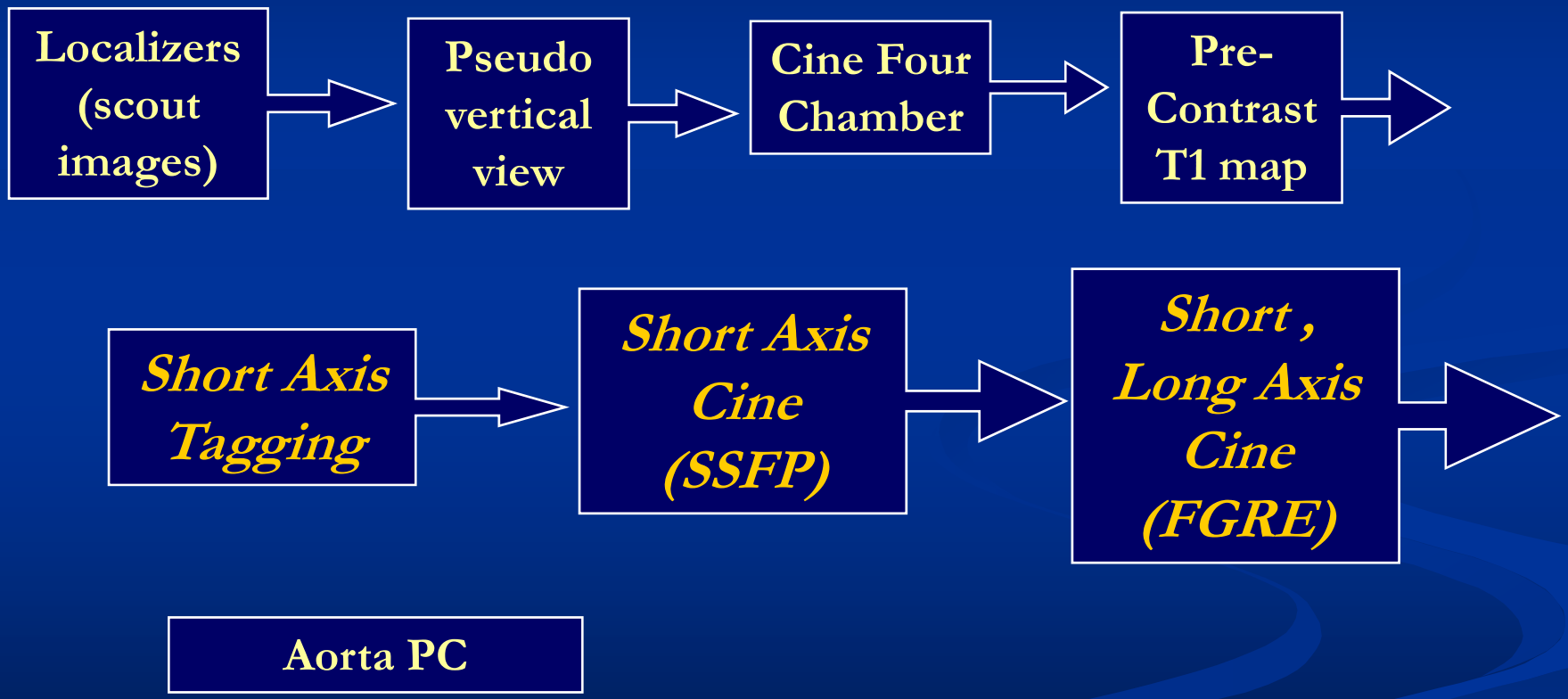
Aorta PC

Post-Contrast T1 map (12 mins)

Short Axis, 4- and 2 chamber delayed Gd

Post-Contrast T1 map (25 mins)

CMRI Protocol without Gd



Certification Status

Site #	Site	# MRI techs certified for MESA 5 protocol	# MRI techs certified for COPD protocol
3	Wake Forest	3	N/A
4	Columbia	2	1
5	Johns Hopkins	4	4
6	Minnesota	3	N/A
7	Northwestern	4	3
8	UCLA	4	2
Overall		20	10

Operations Update

- 1,433 MRI studies received through 03/01/11
  - 5 studies are re-scans
  - 933 studies are with gadolinium (65.1%)
  - 1,327 (92.6%) results have been sent to the CC for studies through 02/12/11
  - 29 alerts issued to date

Wake Forest = 8	Minnesota = 5
Columbia = 2	Northwestern = 4
Johns Hopkins = 6	UCLA = 4

Exam 5 MRI Scan Times

Site #	Site Name	# scans	Mean time (mins)	SD
3	Wake Forest	252	48.4	9.4
4	Columbia	208	44.5	6.6
5	Johns Hopkins	180	42.2	5.0
6	Minnesota	225	42.5	7.2
7	Northwestern	296	40.6	7.0
8	UCLA	182	45.9	7.3
Overall		1,343	43.9	7.8

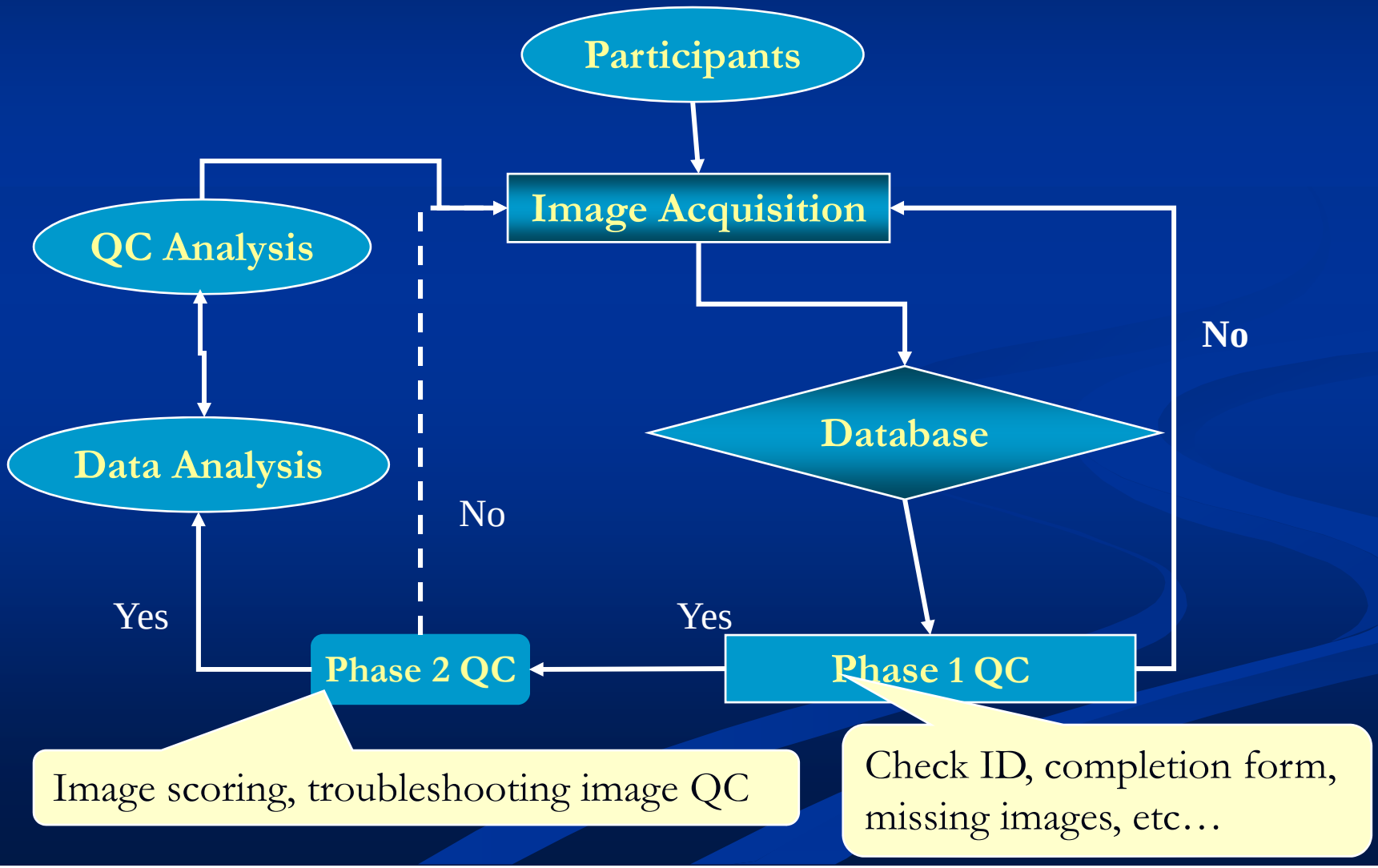
Exam 5 MRI Scan Times

Site #	Site Name	# scans	75th %	Max	% meeting target of 45 minutes
3	Wake Forest	252	54.2	72.2	26.6
4	Columbia	208	48.0	63.2	49.0
5	Johns Hopkins	180	45.6	55.8	71.1
6	Minnesota	225	46.2	88.6	69.8
7	Northwestern	296	45.2	65.8	74.0
8	UCLA	182	49.7	74.2	40.7
Overall		1343	48.2	88.6	55.6

Gadolinium Supply from Bayer

- Bayer has sent 1,000 doses of Magnevist to JHU and 200 doses will continue to be sent monthly going forward
- JHU (Erin) has been shipping doses to each of the 6 sites equally, now that all MTAs have been received
- Field Centers will continue to receive shipments for the next six months
- MRI centers should only charge the study for contrast, if they do not have any of the Bayer supplied Magnevist

High Level Flow Chart of QA & QC



Quality Control - Scoring System

0=missing; 1=non-diagnostic; 2=acceptable; 3=good

Sample QC form

Series	Score	Comments
HLA CINE - SSFP		
Tagging		
SA CINE - SSFP		
VLA CINE - SSFP		
SA DE		
HLA DE		
VLA DE		
HLA CINE - FGRE		
SA CINE - FGRE		
VLAA CINE - FGRE		

Quality Control - Scoring System

- 1=non-diagnostic: Severe imaging artifacts, wrong imaging position or not enough images to analyze
- 2=acceptable: artifacts, but not severe, protocol deviation but image quality is still good
- 3=good: None of above
- Study will not be accepted if cardiac function (based on SSFP CINE) cannot be assessed.

Image Quality and Protocol Adherence

Site #	Site	# Scans	Mean quality score	SD
3	Wake Forest	262	2.84	0.32
4	Columbia	214	2.90	0.21
5	Johns Hopkins	193	2.92	0.18
6	Minnesota	239	2.90	0.18
7	Northwestern	305	2.83	0.27
8	UCLA	192	2.94	0.18
Overall		1,405	2.88	0.24

Image Quality and Protocol Adherence

Site #	Site	# Scans	Number not accepted	Percent not accepted
3	Wake Forest	262	10	3.8
4	Columbia	214	2	0.9
5	Johns Hopkins	193	2	1.0
6	Minnesota	239	0	0.0
7	Northwestern	305	2	0.7
8	UCLA	192	1	0.5
Overall		1,405	17	1.2

Inter-reader Variability[1]

Number of cases	End diastolic mass[2]	End diastolic volume
1 to 100	8.5	6.9
101 to 200	7.9	7.0
201 to 300	7.7	6.4
301 to 400	5.7	5.6
401 to 500	5.7	5.6
501 to 600	5.8	5.6
601 to 700	6.8	6.2

[1]Numbers are percent technical error of measurement

[2]The mean difference in Exam 1 was 5%. In single center studies, the variability is typically around 5%. In multi-center studies, the variability ranges from 5-10%.

Review of Interesting Cases

- Total MESA 5 cases with clinical read = 1,345
- Disease = 95 (7%) (Scars, dissection, etc.)
- Normal or minor aging problems = 1,250

MESA MRI Alert Report

Participant ID #: **3021270MOORNOM**

Date of MRI: **12/14/2010**

Field Center (indicate one)

_X_3 - Wake Forest University
___4- Columbia
___5 -Johns Hopkins
___ 6 - Minnesota
___ 7 - Northwestern
___ 8 - UCLA

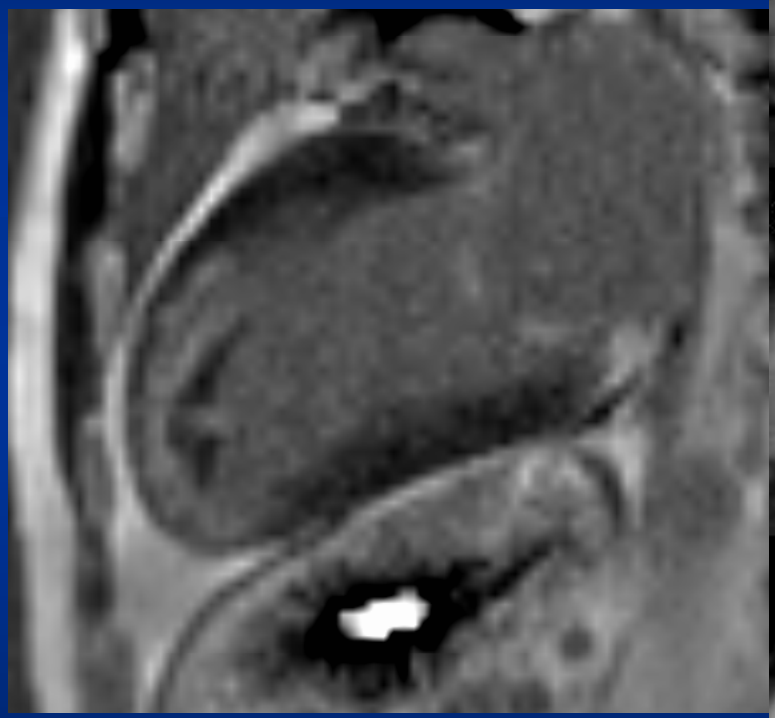
Abnormal findings:
Myocardial scar in the distribution of the left anterior descending coronary artery. Reduced ejection fraction. Small left ventricle apical thrombus (about 3x1.5) cm.

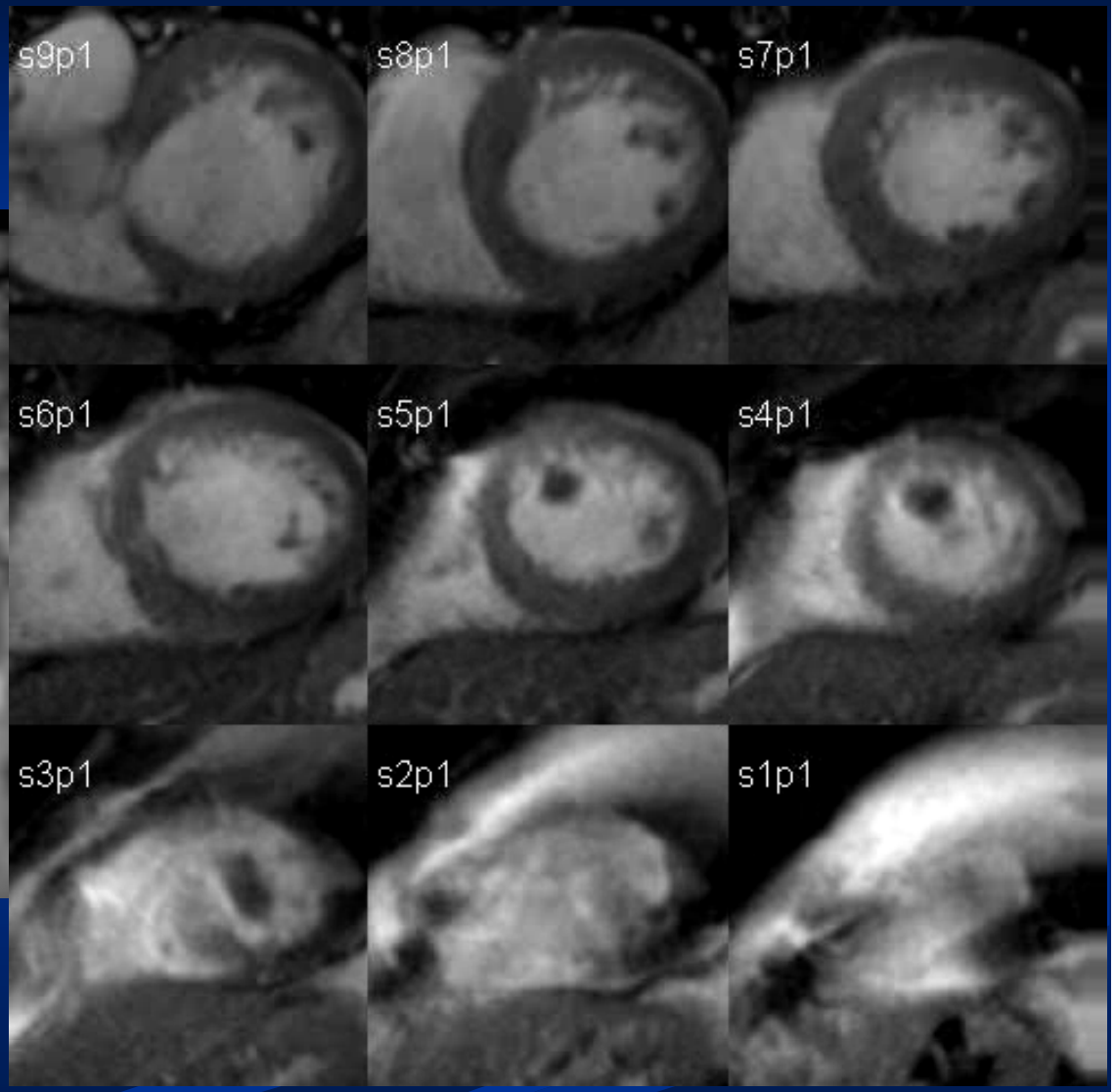
Was the finding communicated to the MESA Field Center PI? Y/N Date 1/20/2011

Name of Physician completing form: **Marcelo Souto Nacif / Bluemke MD**

Date form completed: **12/23/2010**

(form rev 6-4-10)

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MESA MRI Alert Report

Participant ID #: 4017447MURPJOM

Date of MRI: **9/30/2010**

Field Center (indicate one)

___3 - Wake Forest University
_X_4- Columbia
___5 -Johns Hopkins
___ 6 - Minnesota
___ 7 - Northwestern
___ 8 - UCLA

Measurements
EF = 43% / LVM = 207 g / EDV = 150 ml / ESV = 85.5 ml

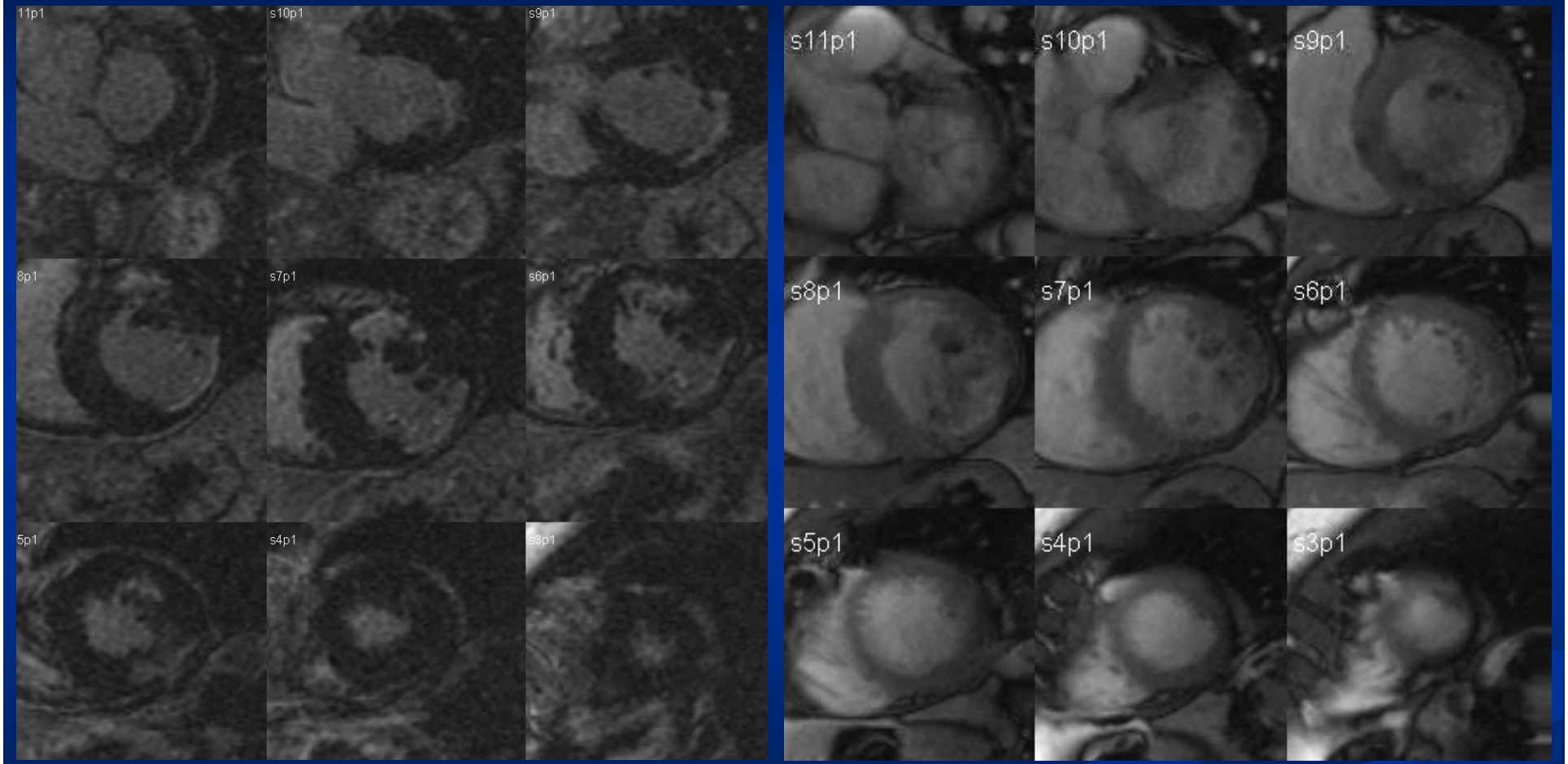
Abnormal findings:
Reduced ejection fraction and transmural myocardial scar in the anterior LV wall and lateral wall.

Was the finding communicated to the MESA Field Center PI? Y/N Date **11/8/2010**

Name of Physician completing form: **Bluemke MD**

Date form completed: **10/28/2010**

(form rev 6-4-10)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MESA MRI Alert Report

Participant ID #: **5018285DURHMAM**

Date of MRI: **11/9/2010**

Field Center (indicate one)

___3 - Wake Forest University
___4- Columbia
_X_5 -Johns Hopkins
___ 6 - Minnesota
___ 7 - Northwestern
___ 8 - UCLA

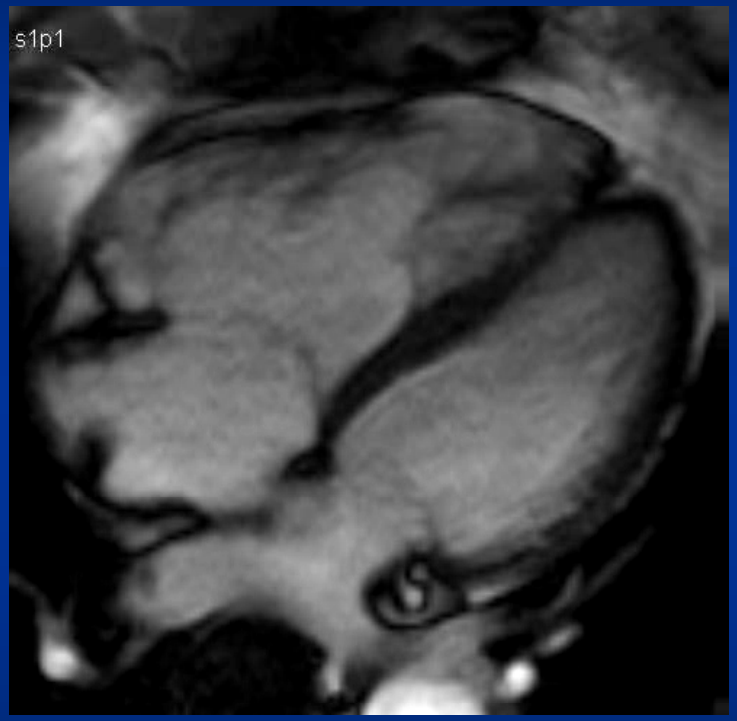
Findings:
The right ventricle is moderately enlarged with reduced ejection fraction. Tricuspid regurgitation. Consider clinical and echocardiography follow up.

Was the finding communicated to the MESA Field Center PI? Y Date 11-23-10

Name of Physician completing form: **Marcelo Souto Nacif / Bluemke MD**

Date form completed: 11/23/2010

(form rev 6-4-10)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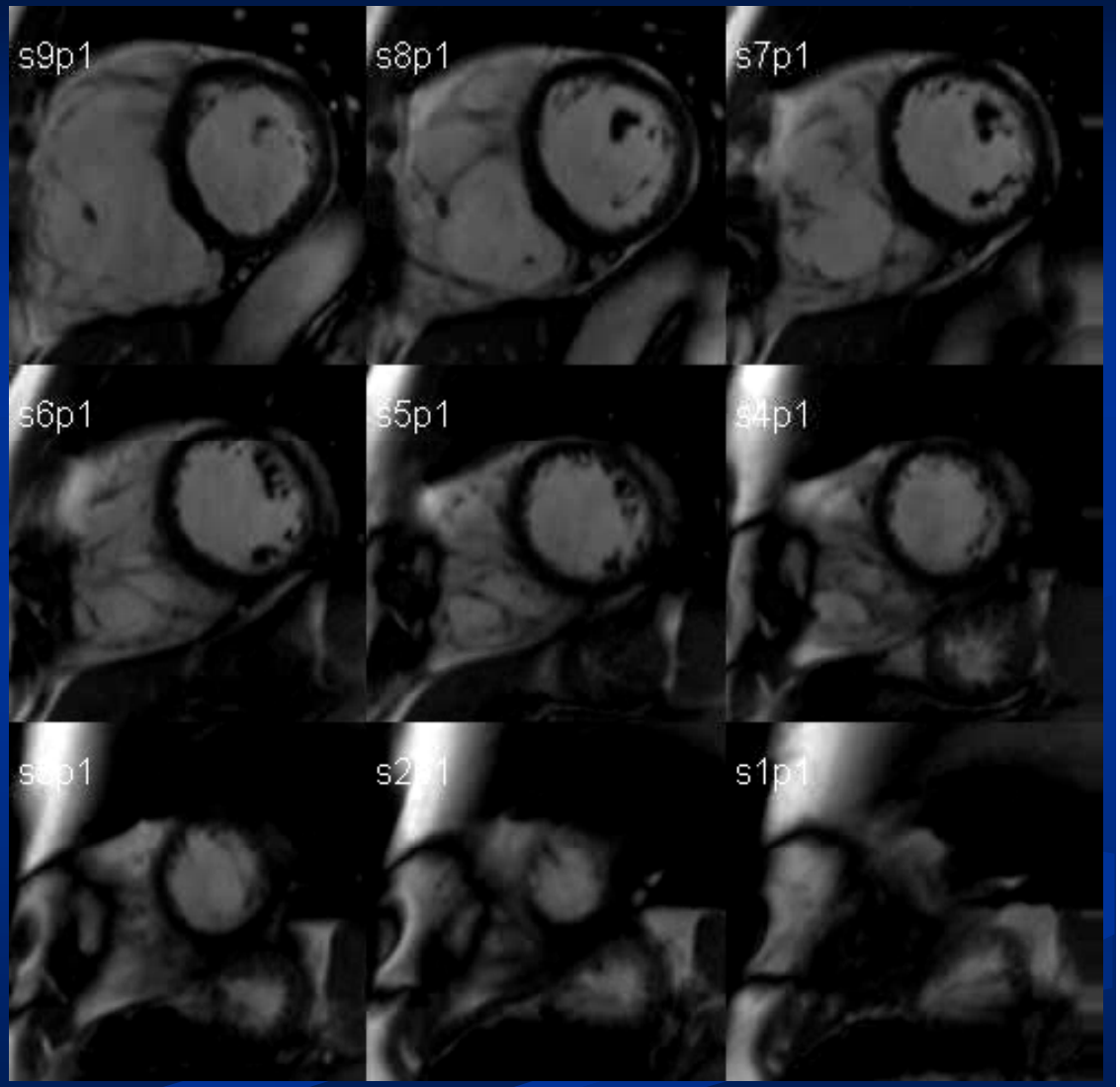
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MESA MRI Alert Report

Participant ID #: 6014410FIRNGEM

Date of MRI: **12/10/2010**

Field Center (indicate one)

___3 - Wake Forest University
___4- Columbia
___5 -Johns Hopkins
_X_ 6 - Minnesota
___ 7 - Northwestern
___ 8 – UCLA

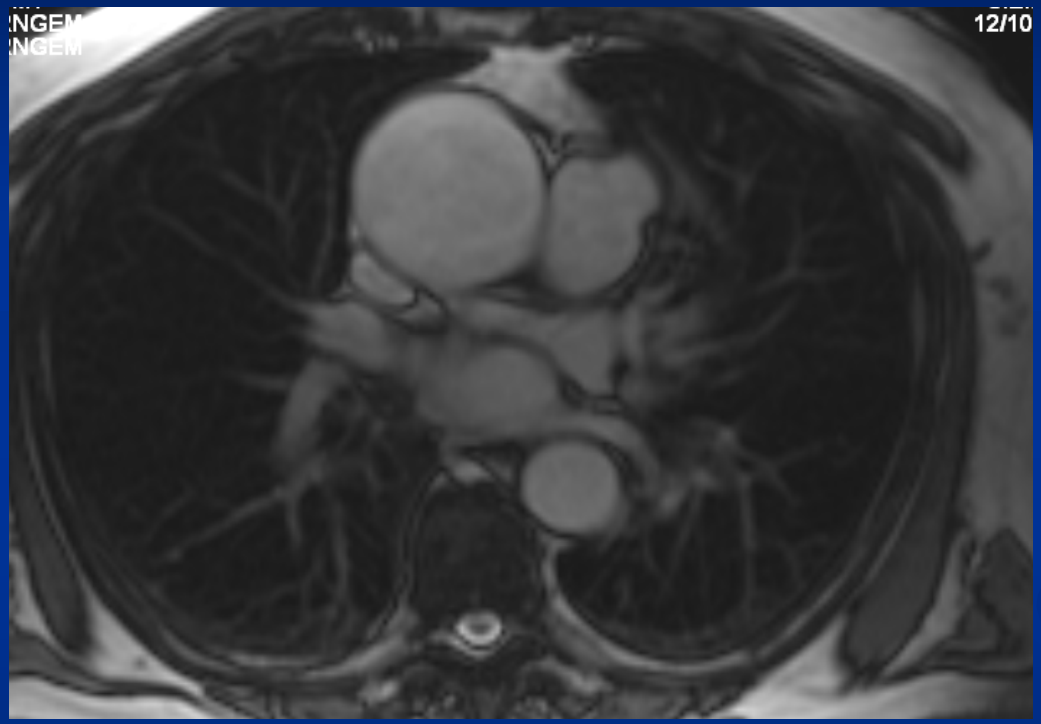
Abnormal findings:
Ascending aortic aneurysm, measuring 5.5 cm in diameter. Consider echocardiography follow up.

Was the finding communicated to the MESA Field Center PI? Y Date 1/20/2011

Name of Physician completing form: **Marcelo Souto Nacif /Bluemke MD**

Date form completed: 12/23/2010

(form rev 6-4-10)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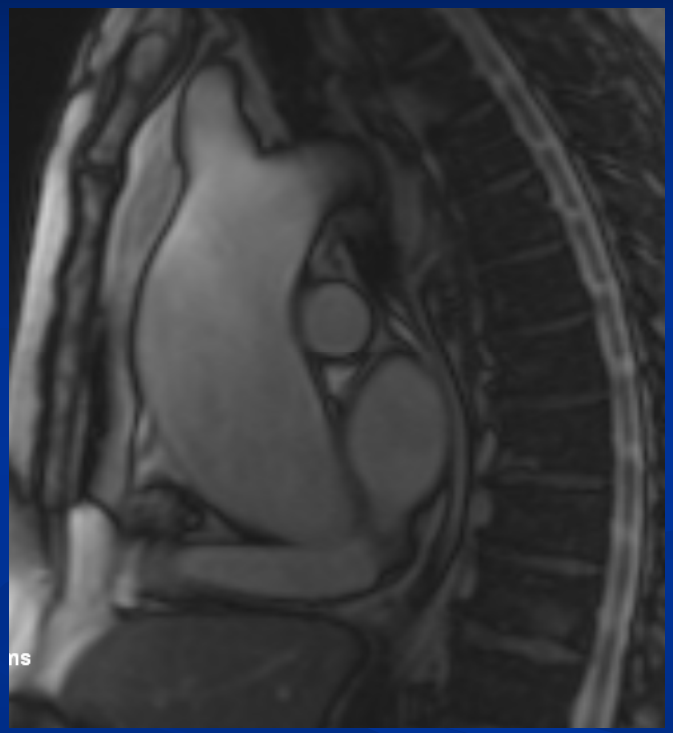


MESA MRI Alert Report

1.Participant ID #: **7013361WATSBEM**

2.Date of MRI: **8/6/2010**

LV MEASURES/VOLUMES	RESULT	REFERENCE
Final diastolic volume	167	< 115 ml
Final systolic volume	61	< 49 ml
Ejection Fraction	63 %	50 - 70%
LV Mass (Diastole)	176	< 261 grams

3.Field Center (indicate one)

___3 - Wake Forest University ___ 6 - Minnesota

___4- Columbia _X_ **7 - Northwestern**

___5 -Johns Hopkins ___ 8 – UCLA

4. Measurements

5.Abnormal findings:

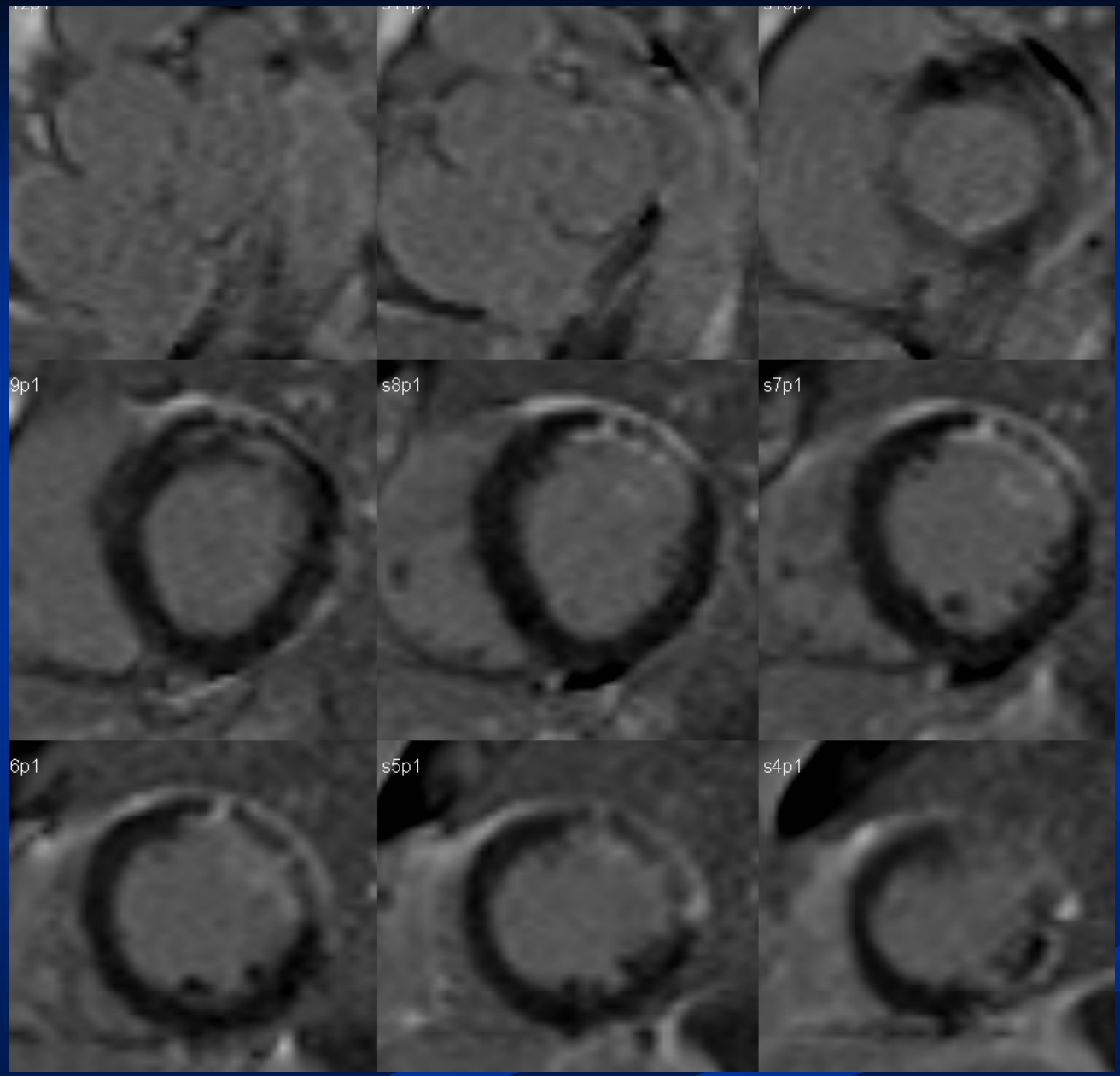
Transmural myocardium scar (8% of the myocardium mass) in the distribution of the left anterior descending coronary artery (anteriorly and anterolaterally at the base and midcavity of the left ventricle)

6.Was the finding communicated to the MESA Field Center PI? Y 9-14-2010

7.Name of Physician completing form: **Marcelo Souto Nacif / Bluemke MD**

8.Date form completed: **8/22/2010**

(form rev 6-4-10)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MESA MRI Alert Report

Without history of infarct on Database at that time

1.Participant ID #: **8019096MORELEM**

Date of MRI: **6/15/2010**

Field Center (indicate one)

___3 - Wake Forest University
___4- Columbia
___5 -Johns Hopkins
___ 6 - Minnesota
___ 7 - Northwestern
_X_ 8 – UCLA

4.Measurements (LV)

EDV =	**ESV =**	**SV =**	**EF =**	**MASS =**
103.8 ml	**36.0 ml**	**67.7ml**	**65.2%**	**134.4g**

5. Abnormal findings:

Small myocardial infarct at the anterolateral middle segment of left ventricle and at the papillary muscle.

6.Was the finding communicated to the MESA Field Center PI? Y/N **07/26/10**

7.Name of Physician completing form: **Marcelo Souto Nacif / Bluemke MD**

Date form completed: **07/26/10**

(form rev 6-4-10)


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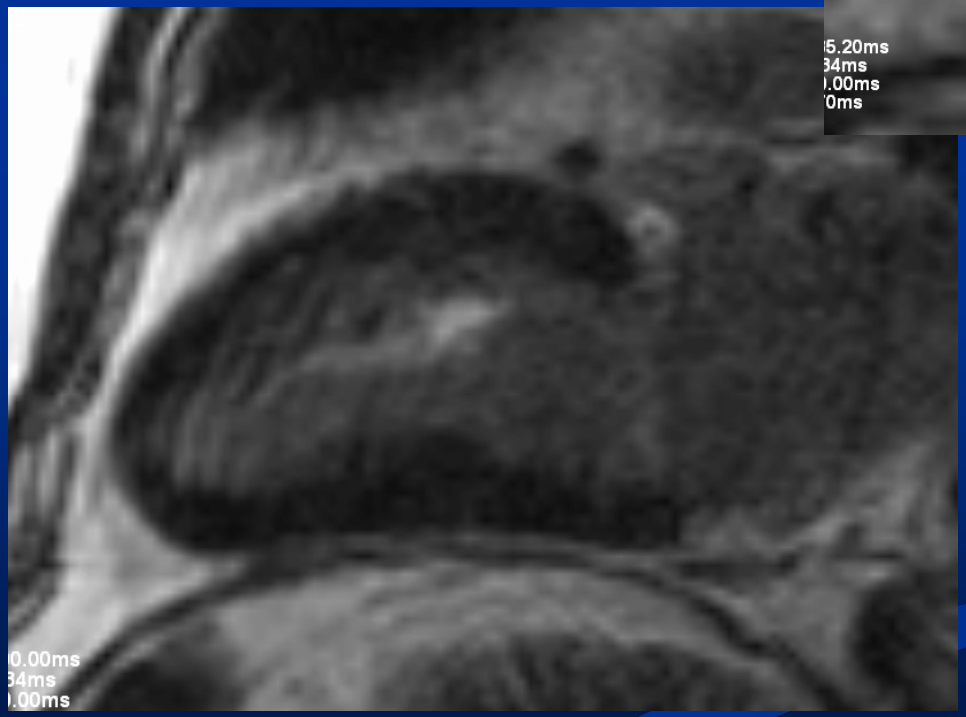
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MESA MRI Alert Report
Participant ID #: **8016984CANSYOF**

Date of MRI: **11/9/2010**

Field Center (indicate one)

___3 - Wake Forest University
___4- Columbia
___5 -Johns Hopkins
___ 6 - Minnesota
___ 7 - Northwestern
_X_ 8 - UCLA

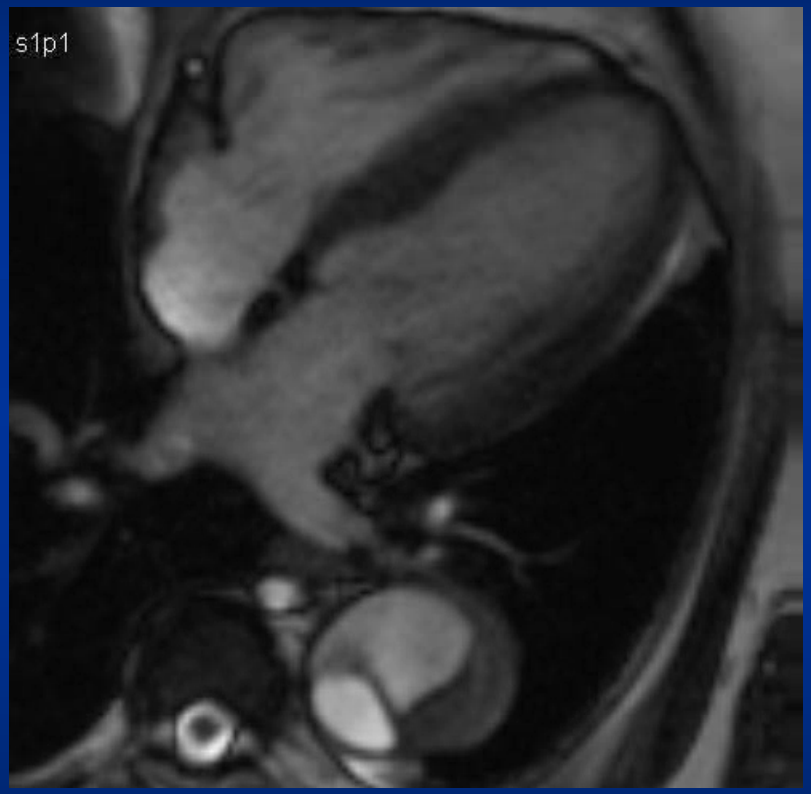
Findings:
Ascending aorta post-surgery status. Descending Aortic Aneurysm, measuring 4.7 cm in diameter with a dissection from the isthmus to the abdomen. Consider Angio-CT follow up.

Was the finding communicated to the MESA Field Center PI? Y

Name of Physician completing form: **Marcelo Souto Nacif / Bluemke MD**

Date form completed: **11/23/2010**

(form rev 6-4-10)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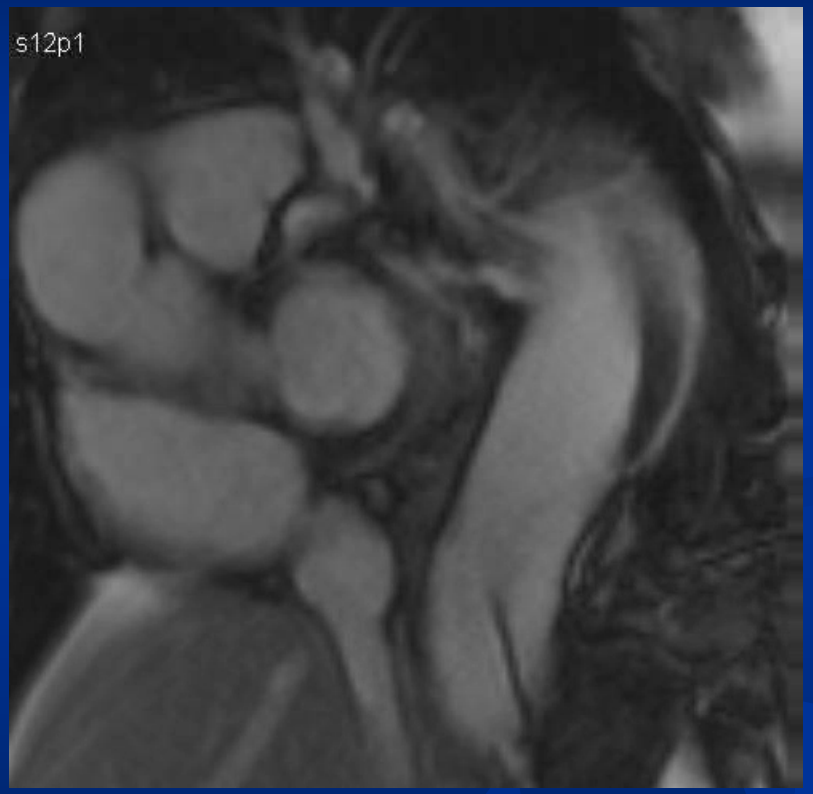
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Ancillary Studies - Completed

- MRI tagging
- MRI carotid imaging
- MESA RV
- MESA echo
- MESA BNP

Ancillary Studies - Ongoing

- Aortic structure and function
- MESA COPD
- MESA fibrosis (T1 mapping)
- CAP (Atlas project)
- EDIC/MESA comparison
- MESA SHARe (LV structure and function working group)

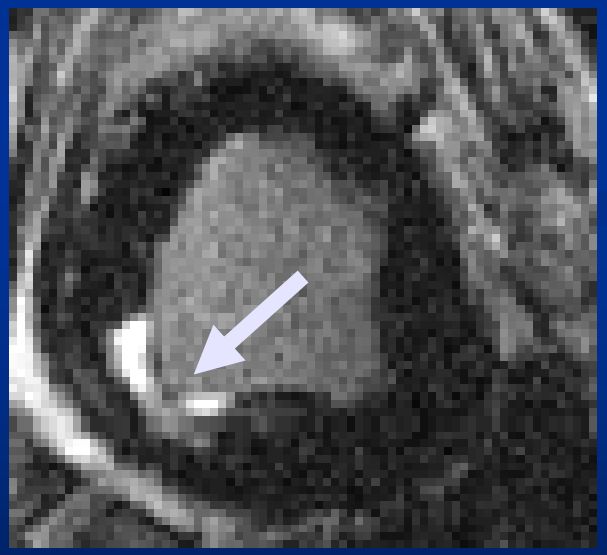
MESA Paper Proposals…

1. Incidence of myocardial scar in the MESA population
2. Relationship between myocardial scar and myocardial strain
3. Relationship between traditional risk factors and change in myocardial mass, structure and function
4. Age-related changes in myocardial mass: longitudinal analysis
5. Myocardial strain changes relative to risk factors and subclinical LV disease
6. Aortic structural changes and risk factors and subclinical LV disease

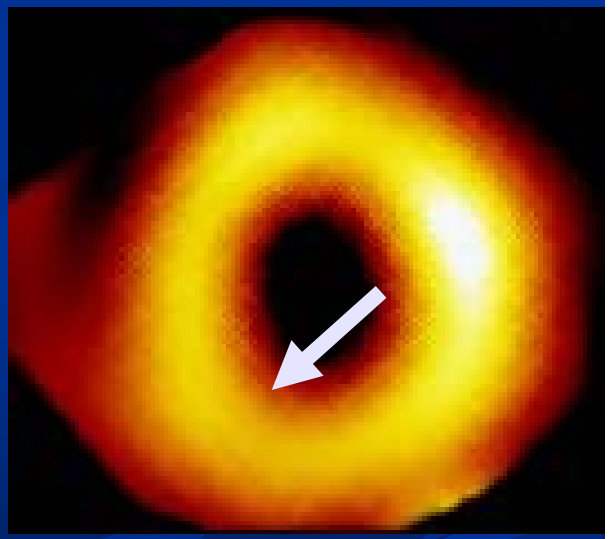
MESA: Myocardial Scar

Gadolinium MRI is the clinical and research standard of reference for *noninvasive* detection of myocardial scar

Path



MRI



SPECT

Wagner A. et al., Lancet. 2003 Feb 1;361(9355):374-9

MESA 5 Design: Gadolinium MRI

- Main study: funded 1,000 participants with gadolinium MRI
- Goal: determine the functional and clinical correlates of myocardial scar
- *Ancillary funding: Bayer, 2,000 additional participants (3,000 gad total/4,000 MRI's expected, 75%)*

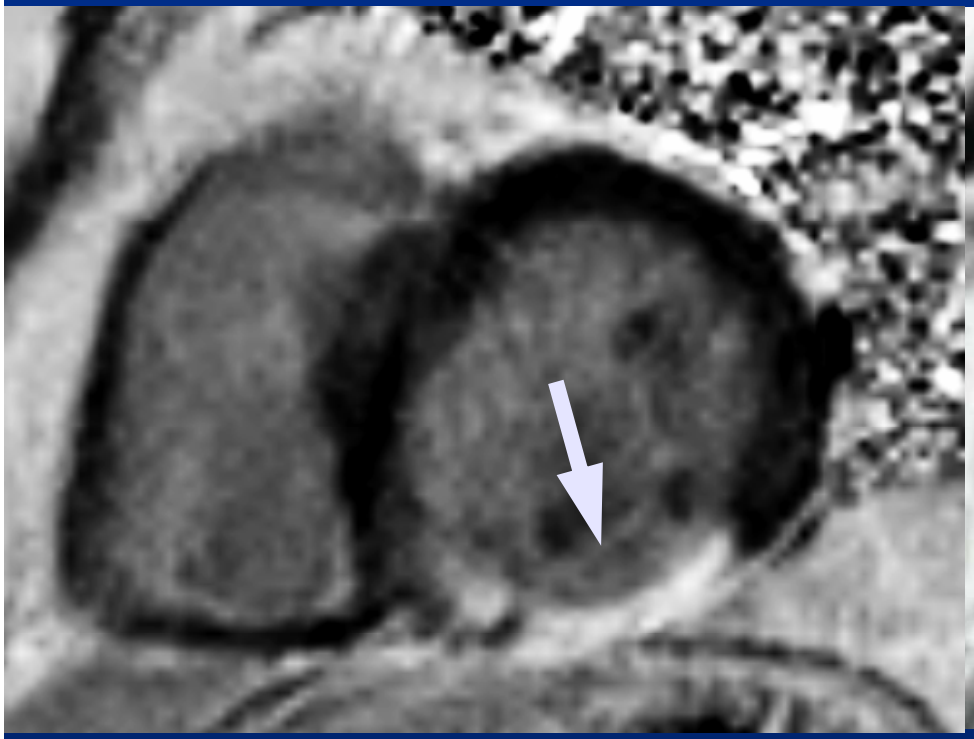
MESA 5 Design: Gadolinium MRI eGFR

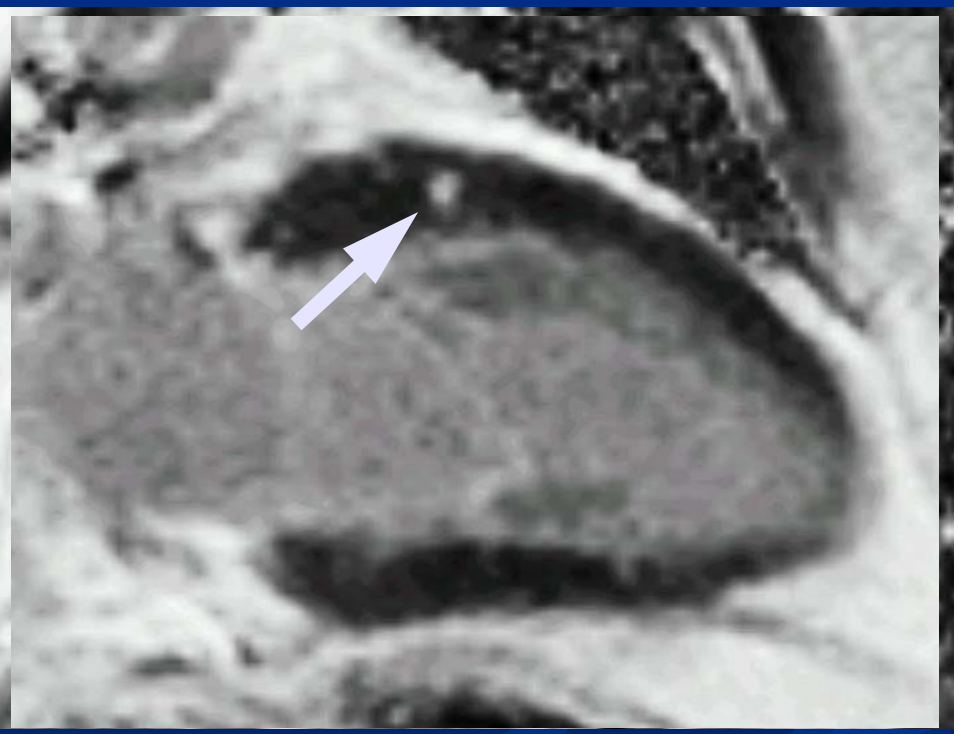
- Most sites: <45 ml/min/1.73 m^2 excluded
- Northwestern: <60 ml/min/1.73 m^2 excluded ("moderate" dysfunction excluded)
- FDA: 30 ml/min/1.73 m^2 for patients, <30 stage 4 severe dysfunction

Myocardial Scar

- Kwong et al. (Circ. 2008; 118:1011):
  - Symptomatic T2 diabetics referred to MRI for CAD
  - Prevalence of scar: 28% (30/107 patients)
- Barbier et al. (JACC 2006; 48:765):
  - Age: survey of 70 year olds in Upsalla, Sweden
  - Prevalence of scar: 24% (72/248 patients)
- Meijs MF et al. Heart (2009;95:728-32)
  - Age 53: patients with manifest "arterial disease"
  - Prevalence of scar: 9.4% (45/480 patients)
- Turkbey et al. Submitted
  - Age 49: type 1 diabetes
  - Prevalence of scar: 4.3% (32/749 patients)
- Risk factors: high LV mass, HTN, kidney dz, DM

EDIC: Typical infarct, transmural (50% of cases)





Typical infarct
50% of participants

Atypical/nonischemic
50% of participants

MESA preliminary data (Nacif)

- MESA 5 = 883/1,345 (65%) studies with gad (target was 75%)
- 65/883 (7.3%) have scar
- Average age: ? (69 average MESA age)
- 55/65 men (85%)
- 29 ischemic scars (27M:2W)
- 36 nonischemic scars (28M:8W)


Thank you