Mini Symposium: Atrial Fibrillation and MRI

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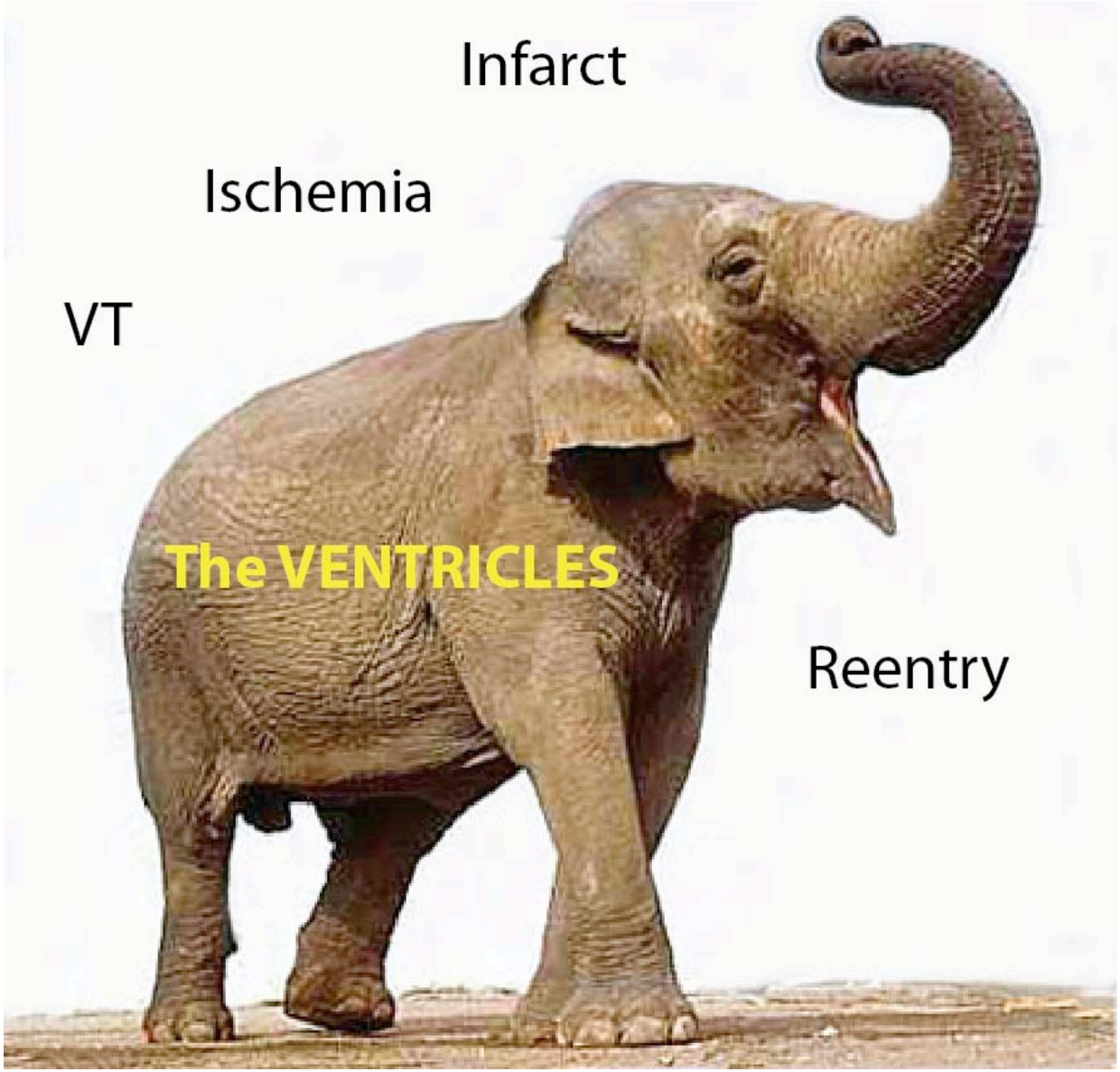

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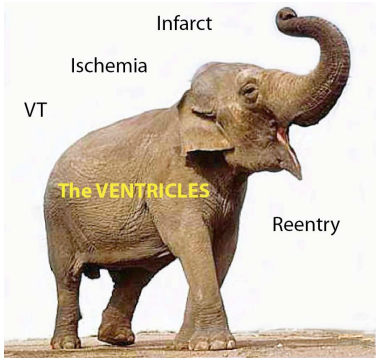

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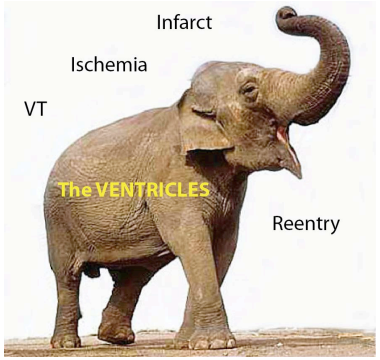
The Plan

1. AFib: Mechanisms and Clinical Practice (Ravi Ranjan, CARMA)
2. AFib: Imaging, Image Analysis, and Modeling (Rob MacLeod, CARMA)
3. Panel Discussion
   - Martin Bishop (University of Oxford)
   - Martin Kreuger (Karlsruhe Institute of Technology)
   - Kawal Rhode (King's College London)
   - Daniel Rueckert (Imperial College London)
   - Nic Smith (King's College London)
   - Graham Wright (University of Toronto)



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34


vancouver 2010
5

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Ravi Ranjan MD PhD

Atrial Fibrillation: Mechanisms and Clinical Perspectives

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Imaging and Modeling in Atrial Fibrillation:

An Engineer's Garden

Rob MacLeod, University of Utah
CARMA Center, SCI Institute, CVRTI
Bioengineering Department

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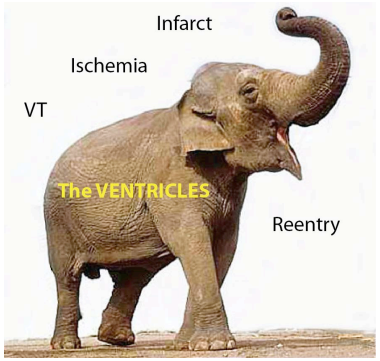
An Engineer's Garden??



Garden of Delight

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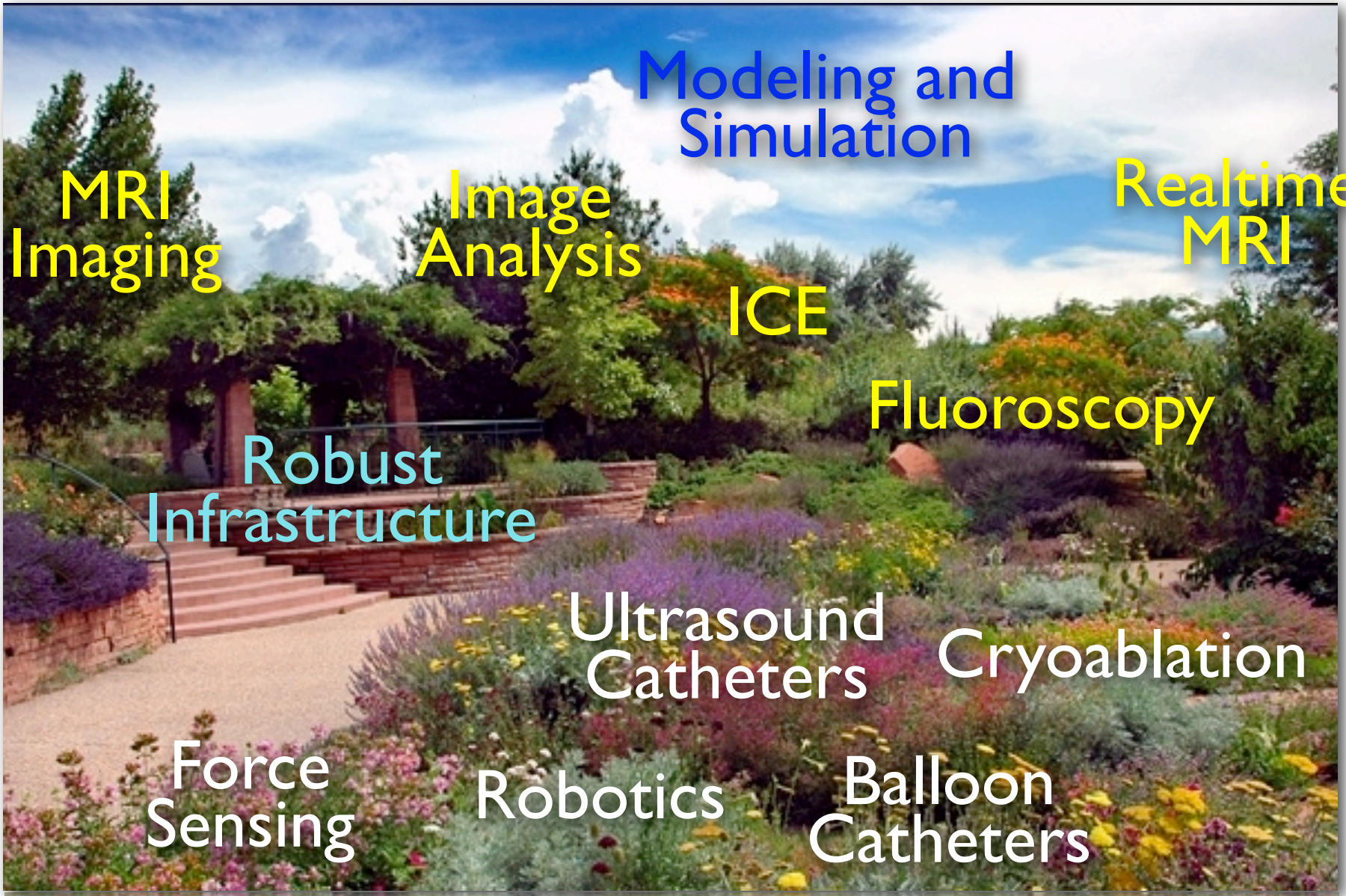
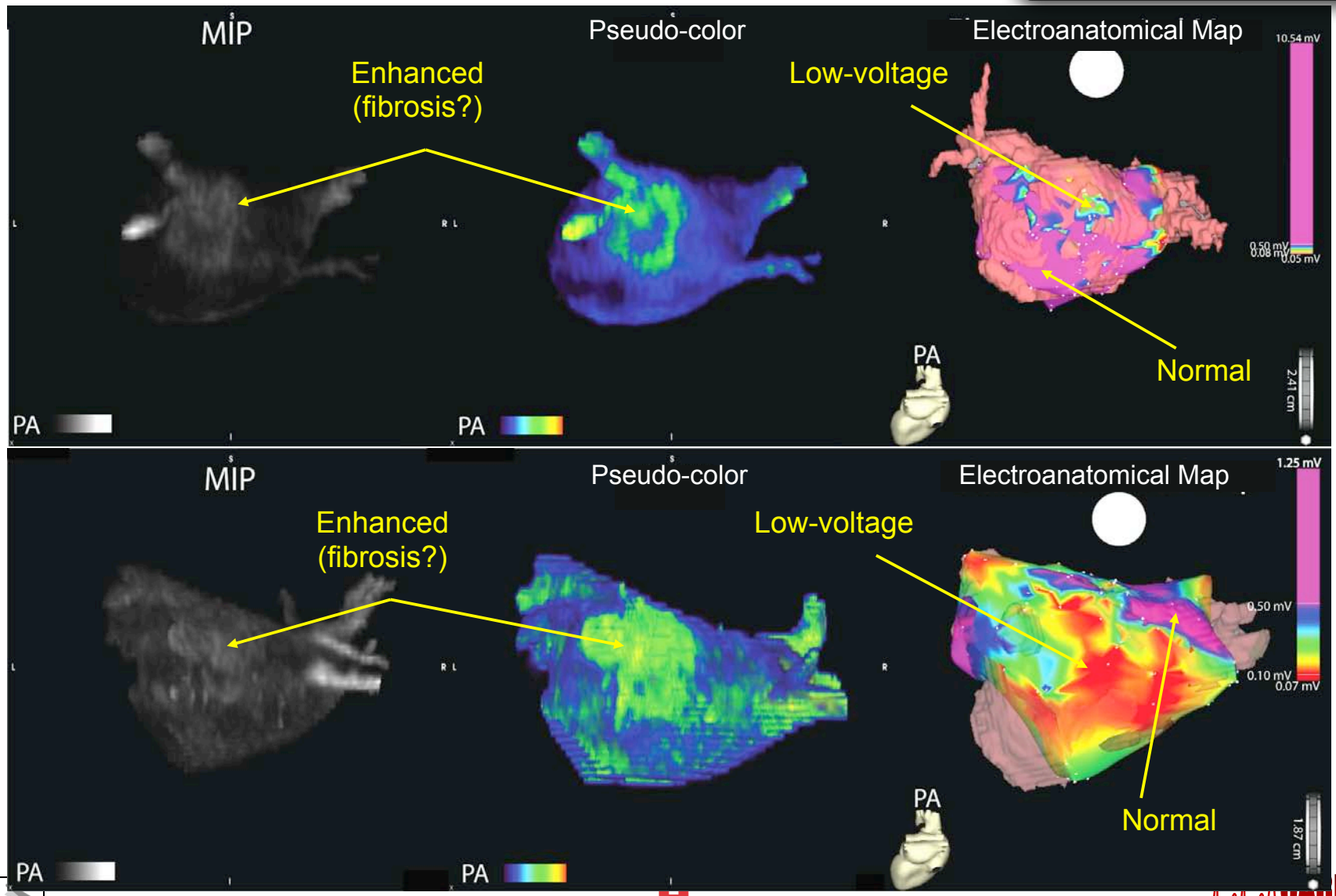

Modeling and Simulation
MRI Imaging
Image Analysis
Realtime MRI
ICE
Fluoroscopy
Robust Infrastructure
Ultrasound Catheters
Cryoablation
Force Sensing
Robotics
Balloon Catheters

Patient Workflow

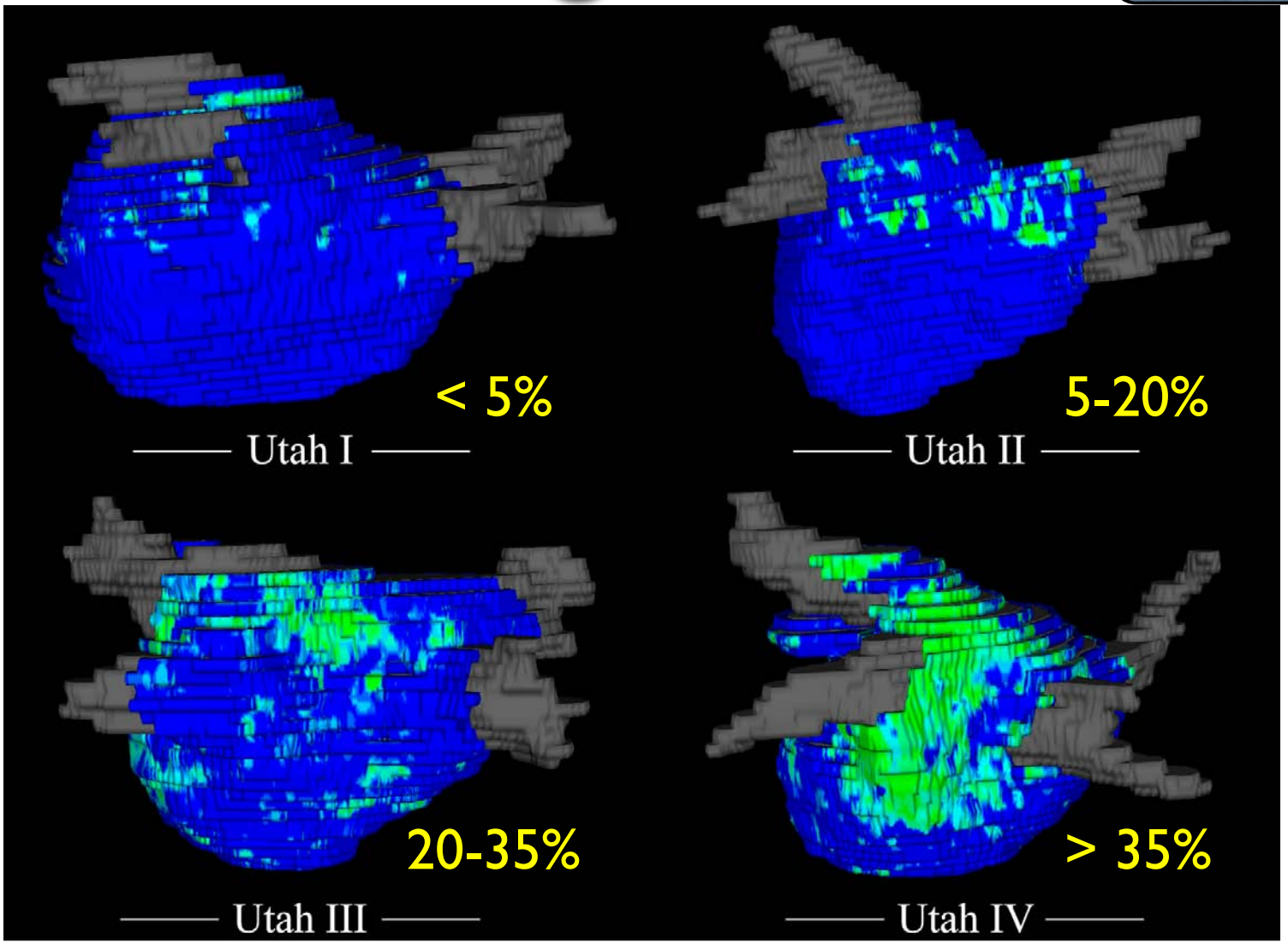
Fibrosis and Outcome

Evaluation



Utah Scoring Scheme

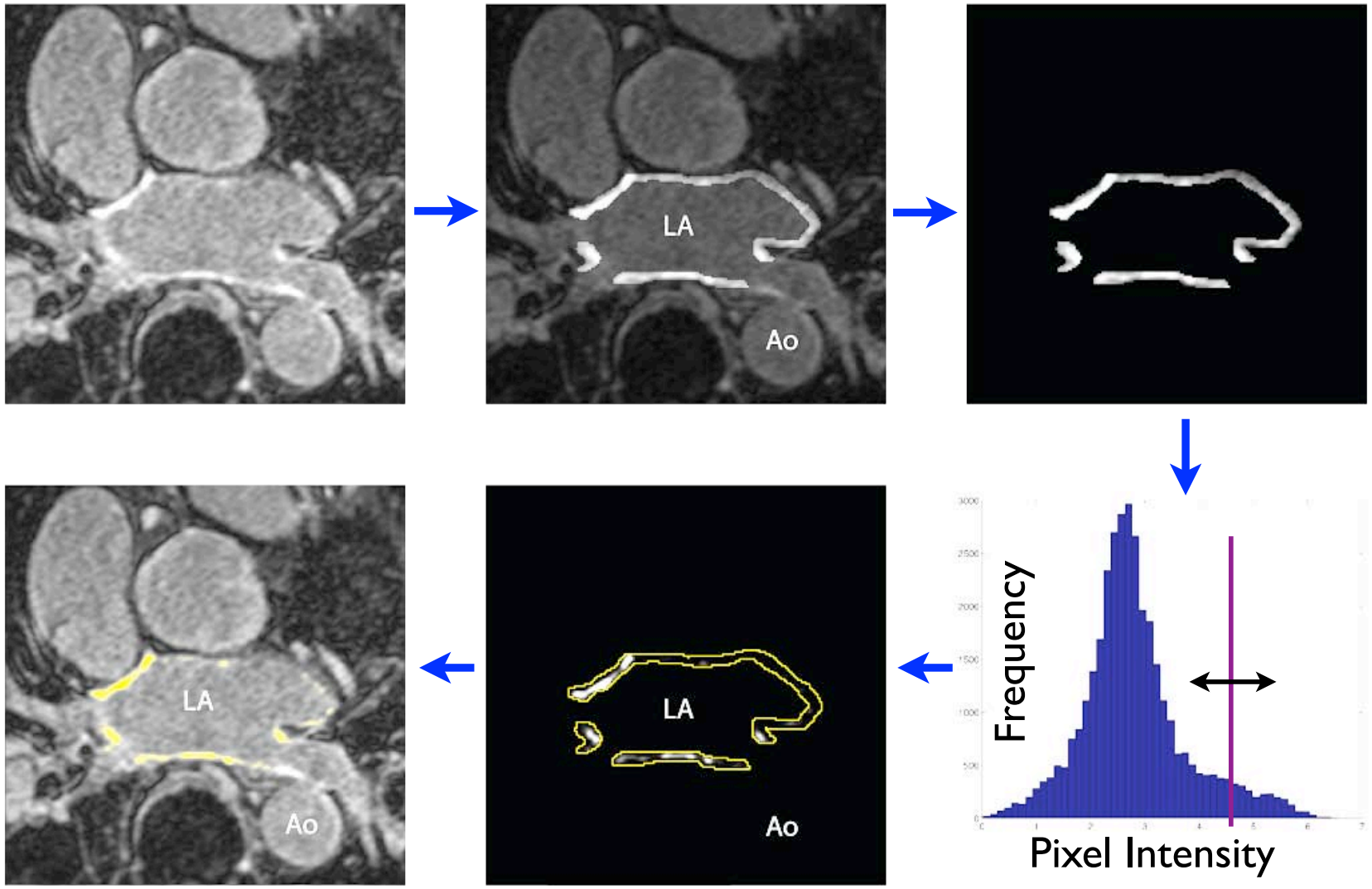
Evaluation



Akoum et al. J Cardiovasc Electrophysiol, 22:16-22, 2011

Fibrosis Imaging

Evaluation



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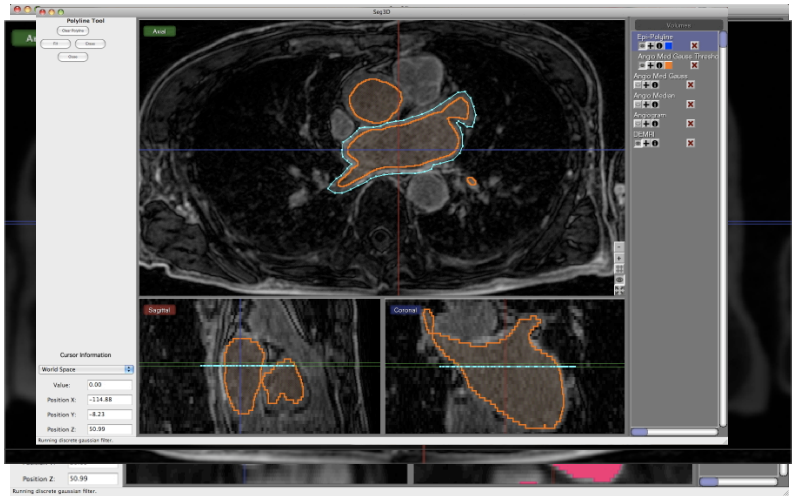
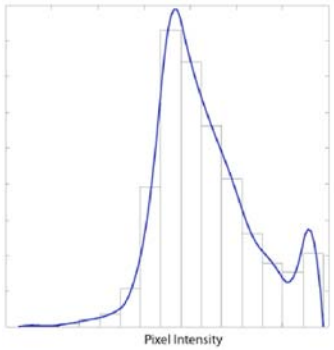
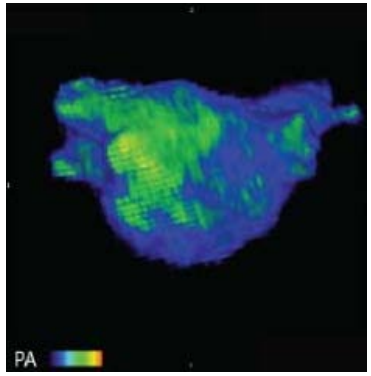
Past Workflow

Evaluation







Seg3D

MATLAB SIMULINK

OSIRIX

Corview

The University of Utah
Comprehensive Arrhythmia Research and Management Center
MARREK

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Corview

Evaluation

Corview (Alpha) 0.1.8 – Corview Example Patient

Segmentation | Analysis

Analysis

Layers

Data: Original
Endo: Endo
Wall: Wall

Options

Show Image Mask
Show Non-Mask
Opacity: 75 (0 – 100)
Show Threshold
Opacity: 75 (0 – 100)
Histogram Bars: Scar Quantification
Histogram Bins: 250
Histogram Mode: Linear
Color Map: Cool to Warm
Background Color: Black
Threshold Seeds: Clear | Set | Add

Advanced

Current Project | Analysis

30/44

17 232 447 662 877

Histogram

Lower Threshold: 381.30 Upper Threshold: 877.00 Percent: Click to show/hide

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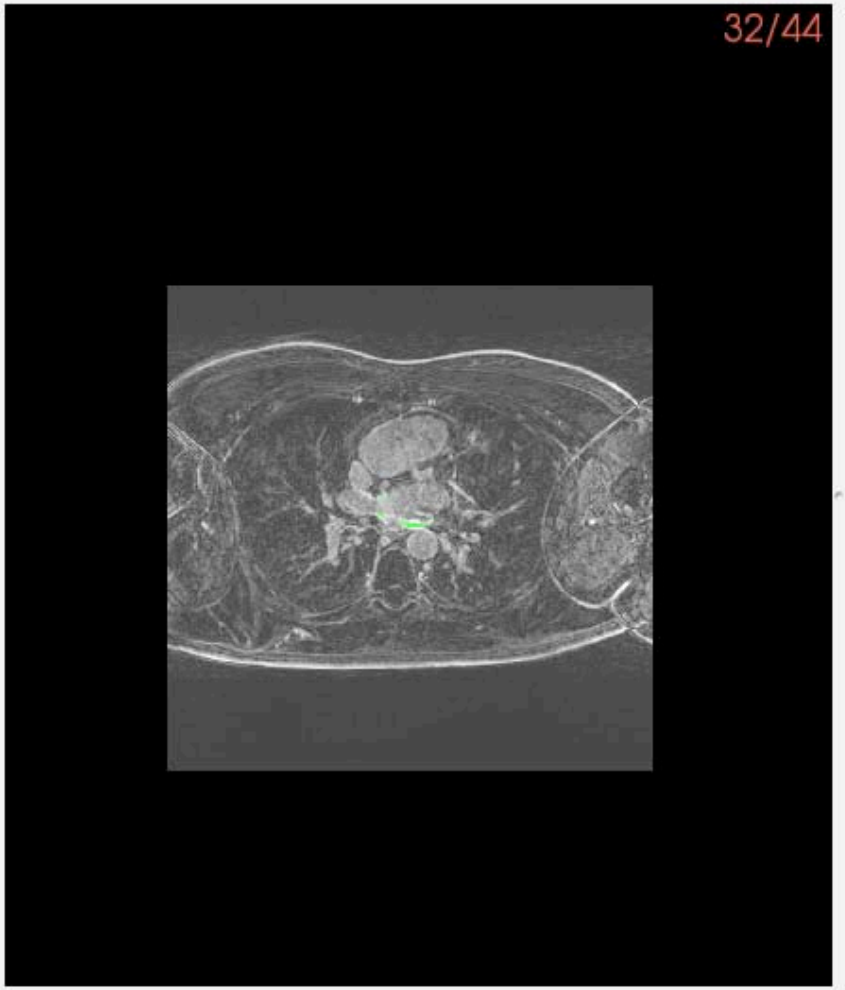
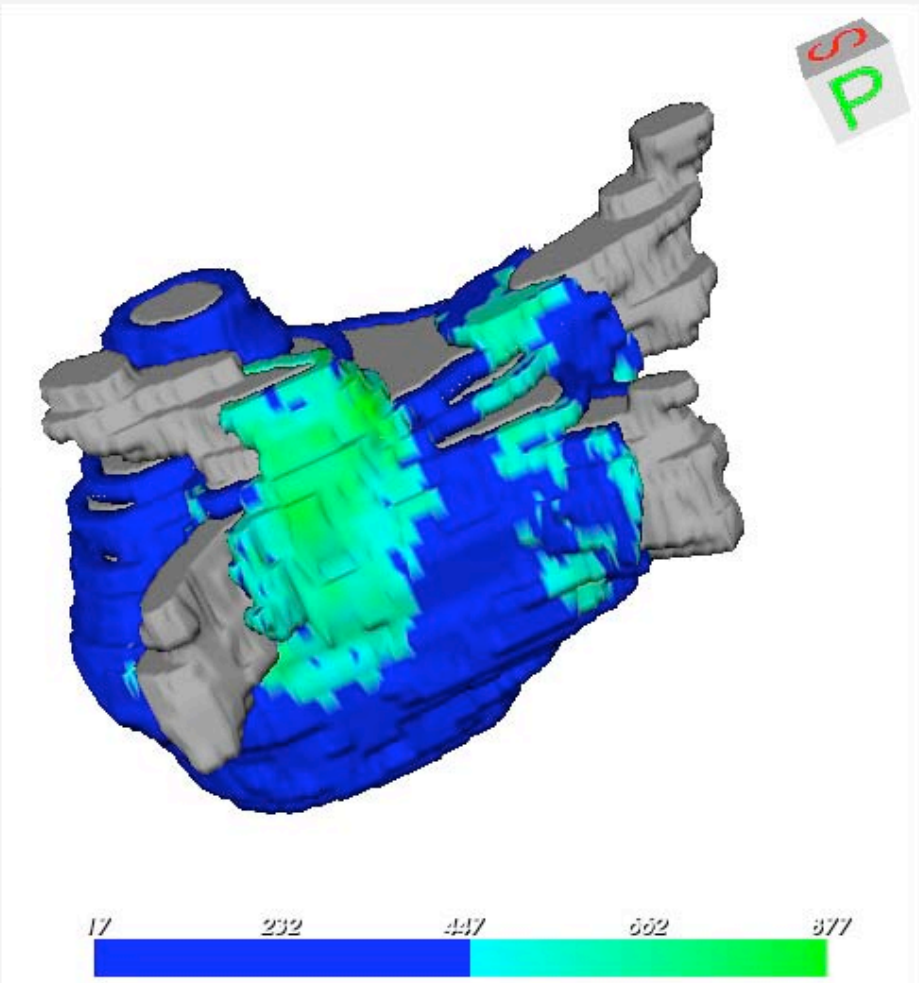
Corview

Evaluation





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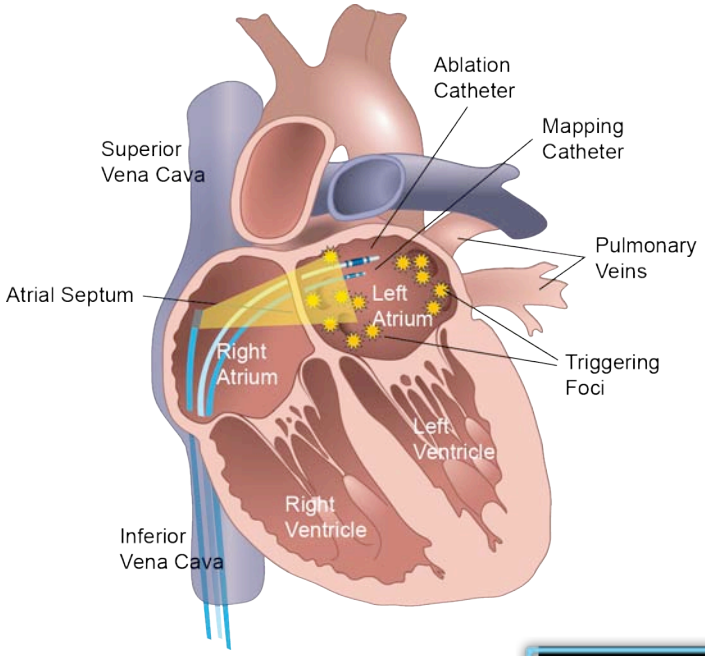
Patient Workflow

Ablation Guidance

Treatment



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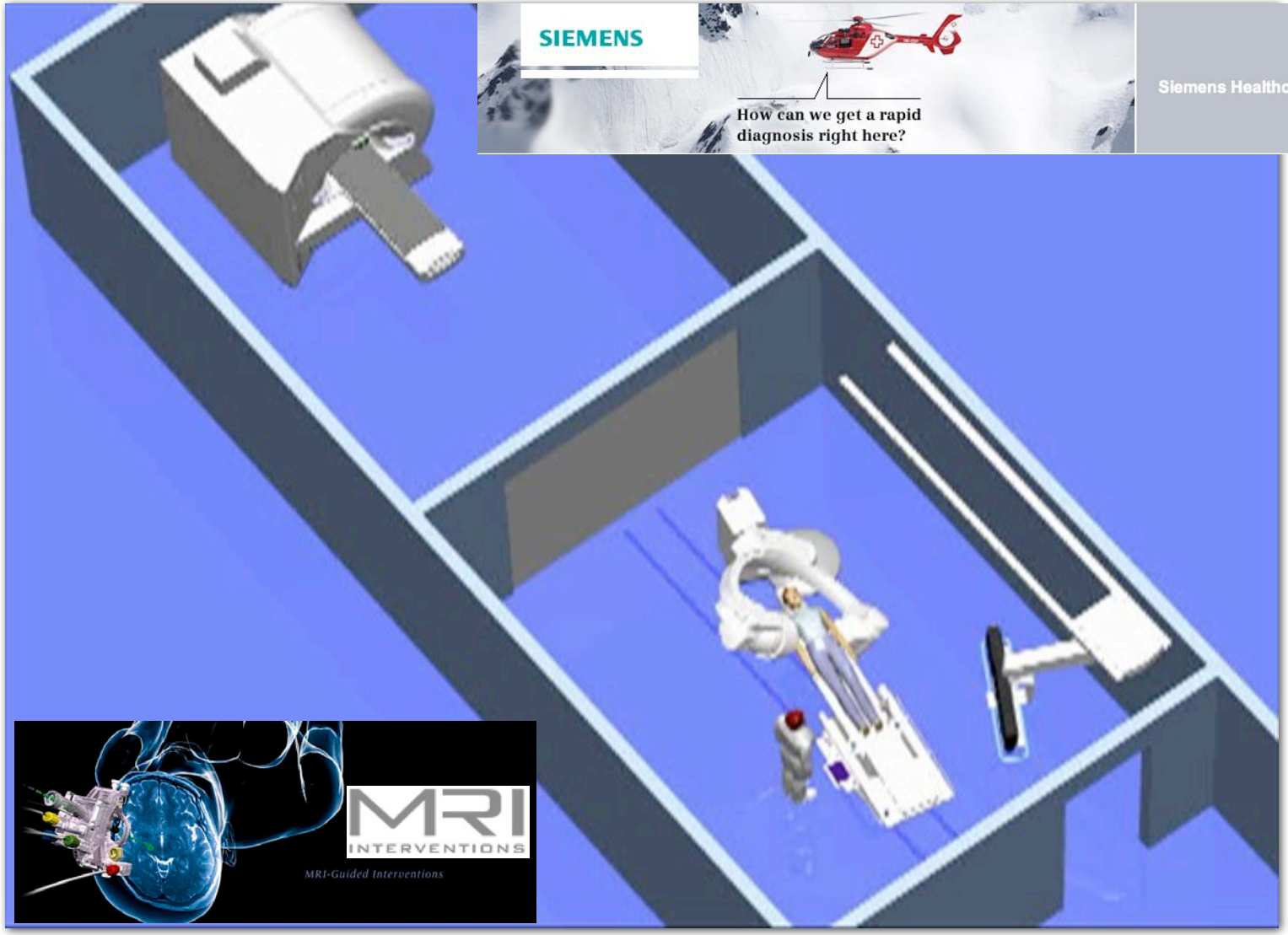
Real Time MRI

Treatment



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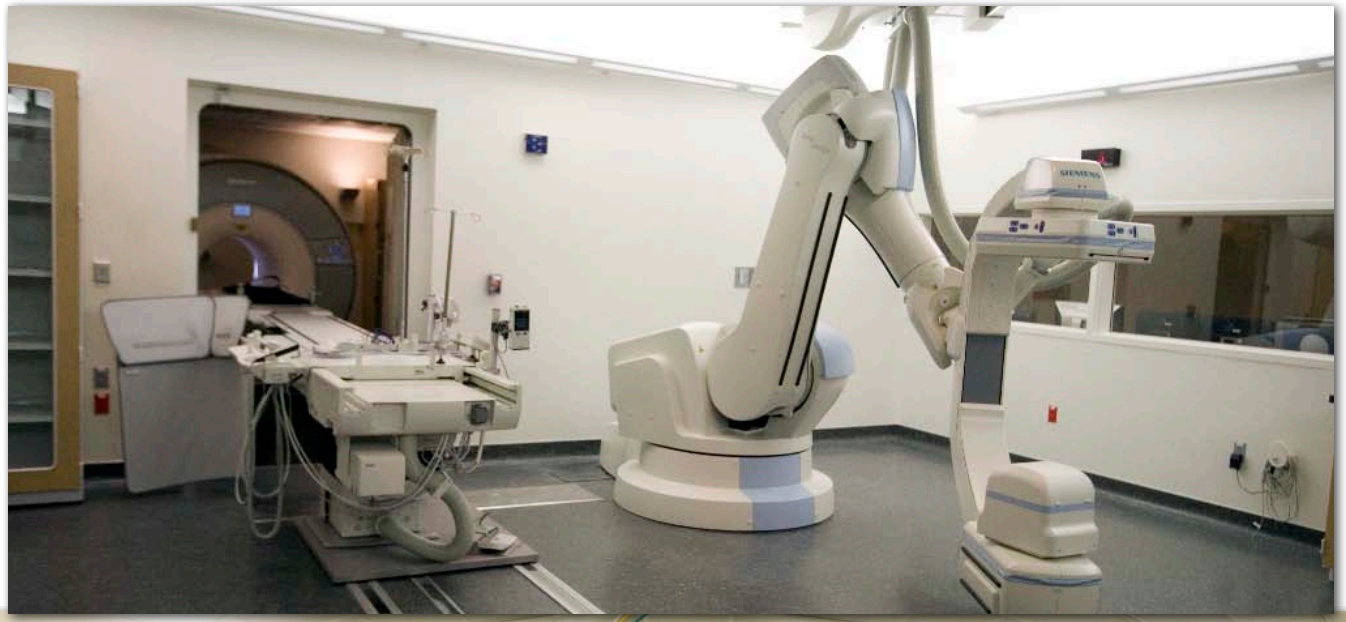
Real Time MRI

Treatment



Experiments!

Treatment

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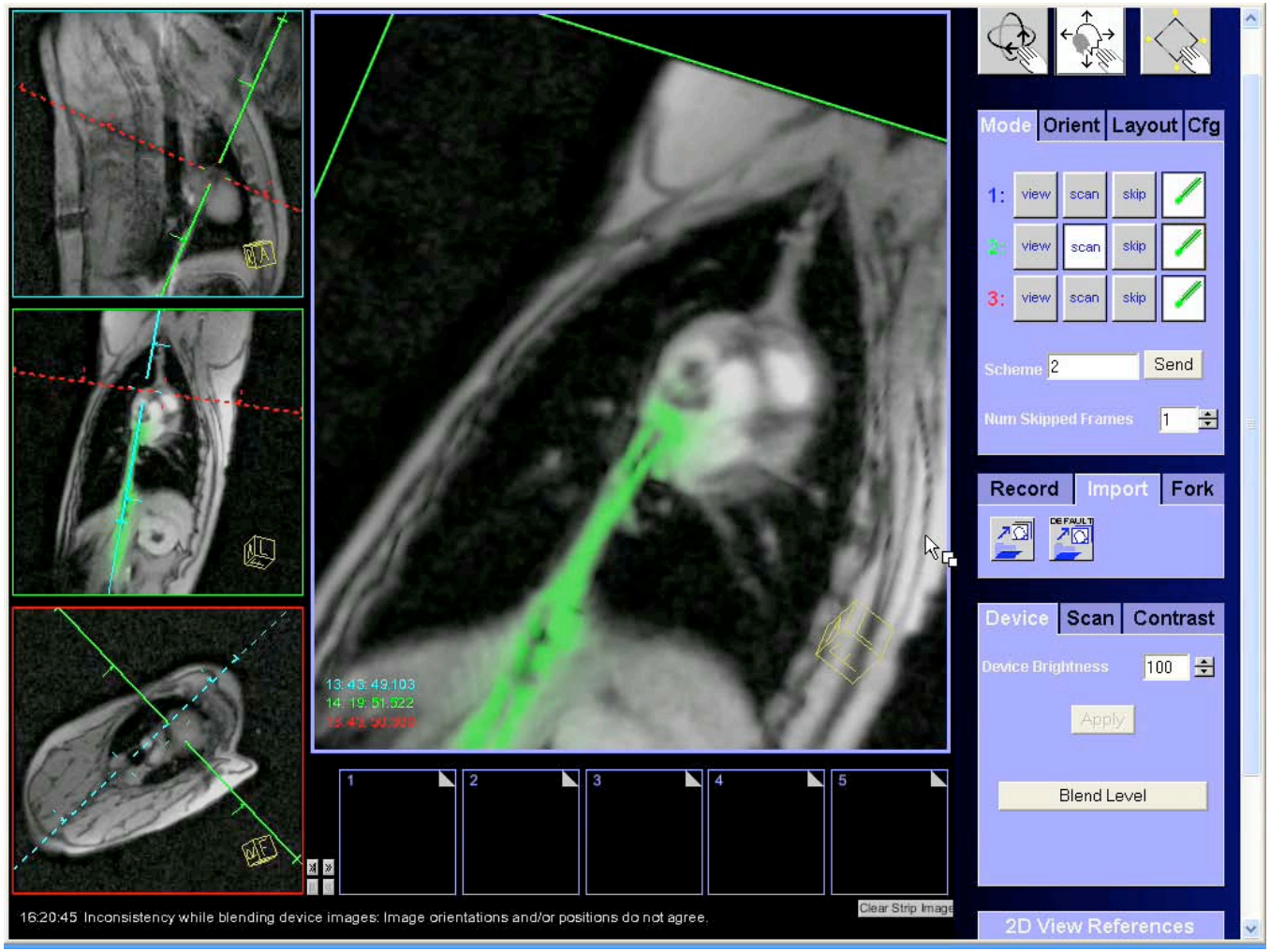
Real Time MRI

Treatment



December 2007

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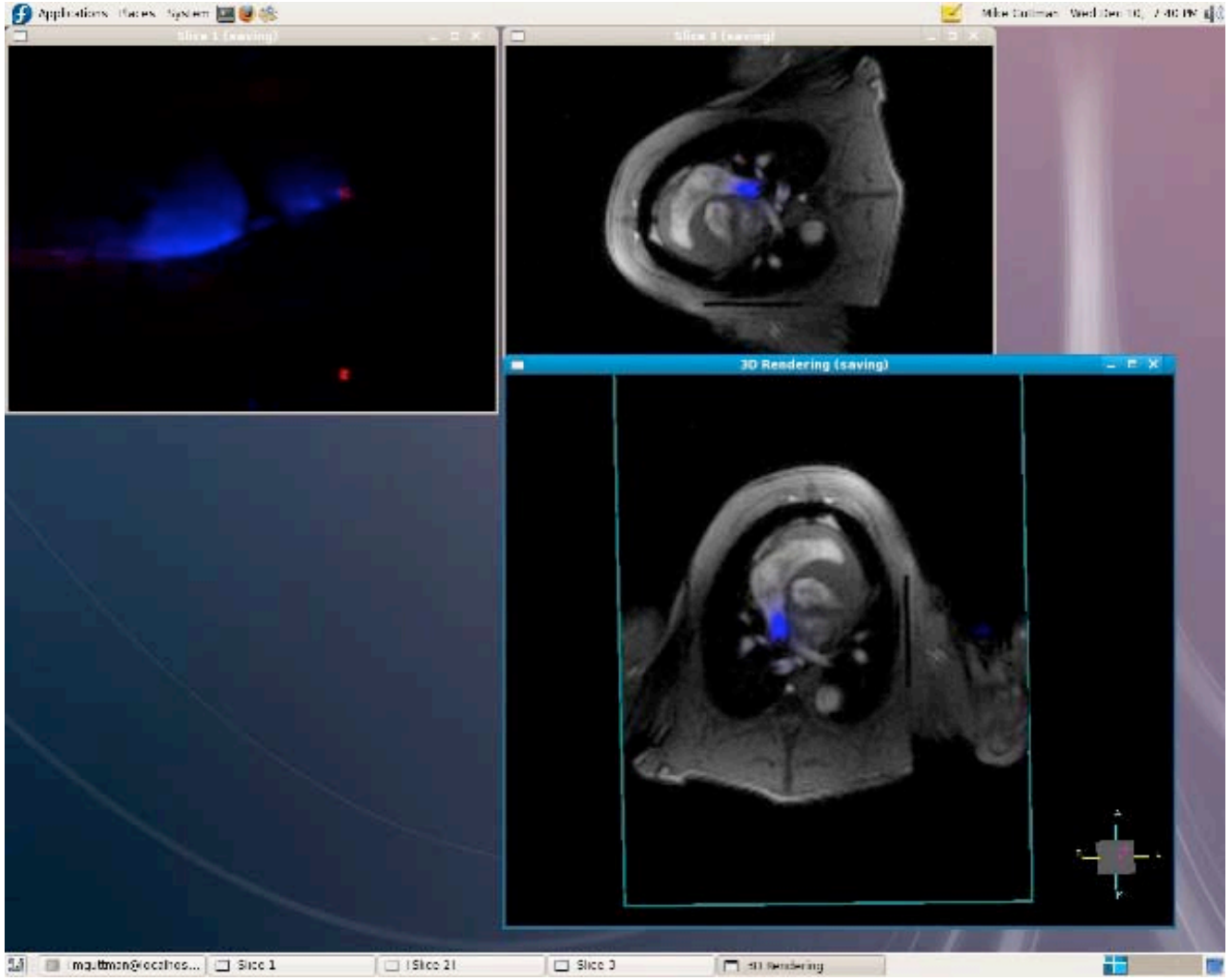
Real Time MRI

Treatment



December 2008

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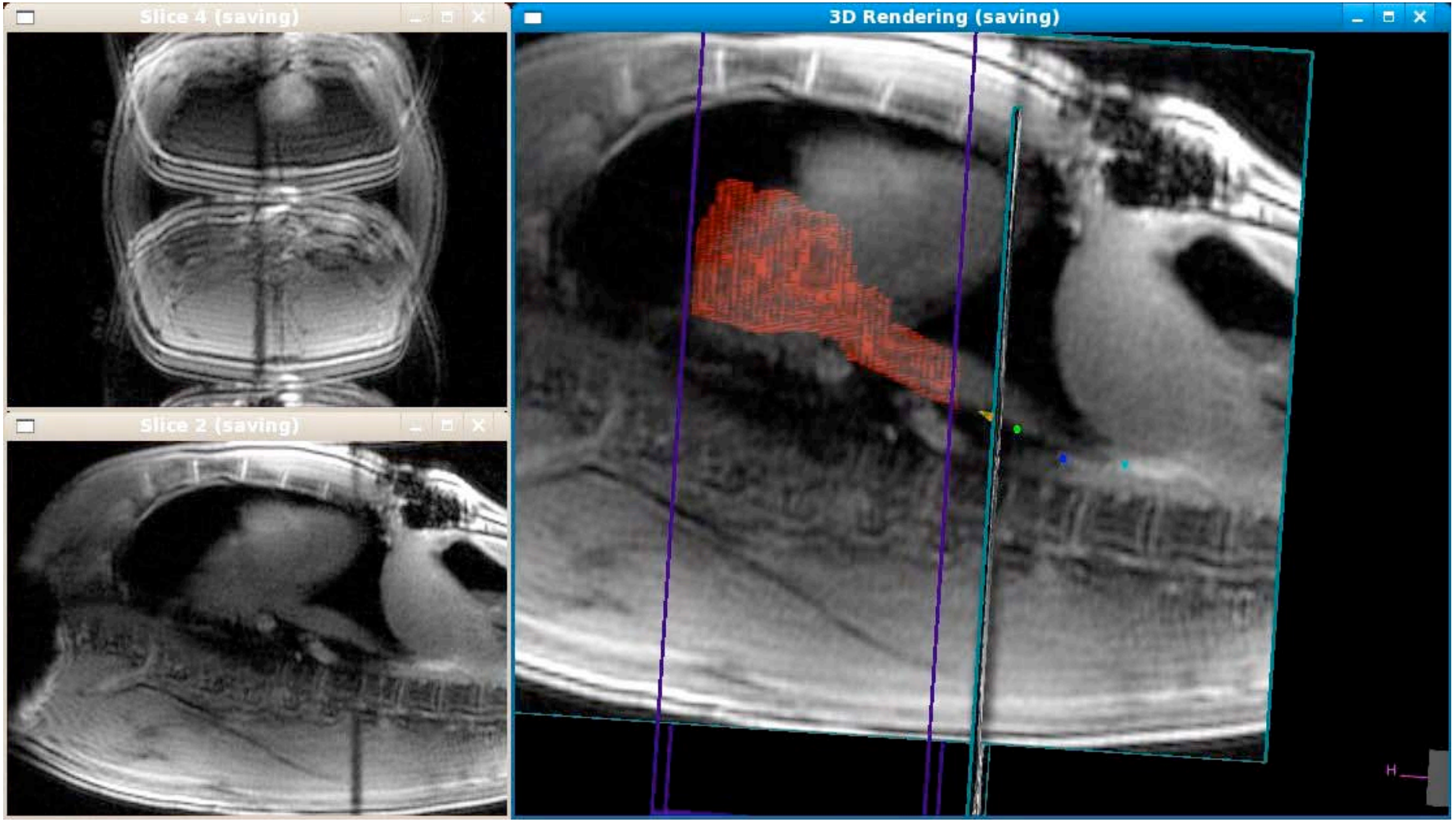
Real Time MRI

Treatment



February, 2010

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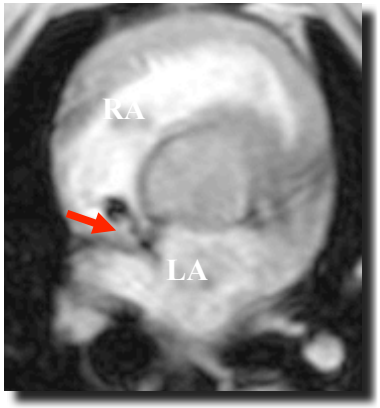
Real Time MRI

Treatment

Lesion Imaging

Treatment

catheter



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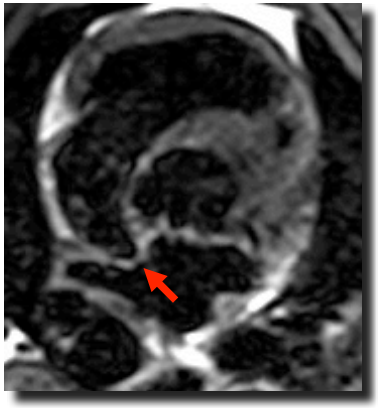
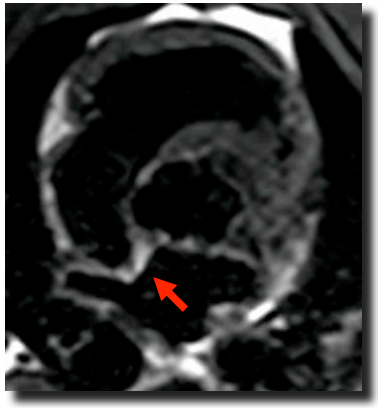
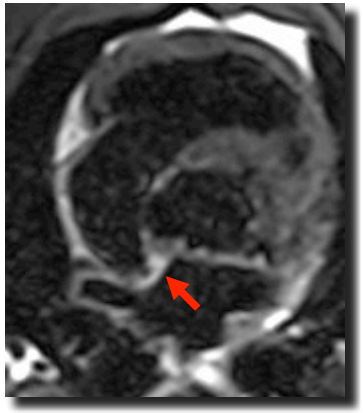


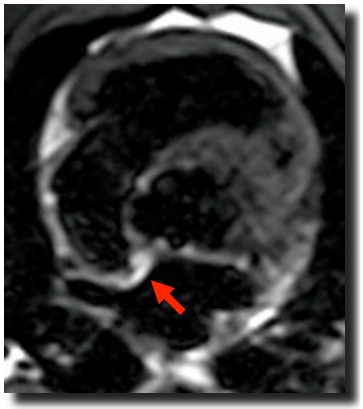
post 20 sec



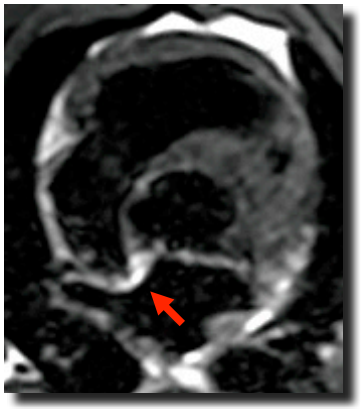
50 sec



post 2:30 min

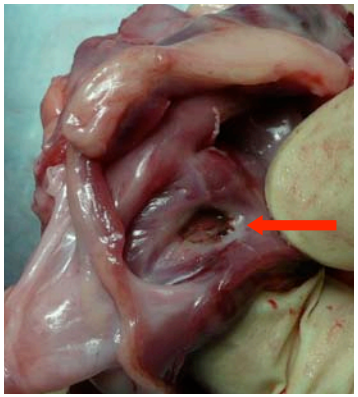


6 min



postmortem

excised LA



Ablation: 30 Watts, 30 sec

Vergara et al. HRS 2011 vol. 8 (2) pp. 295-303

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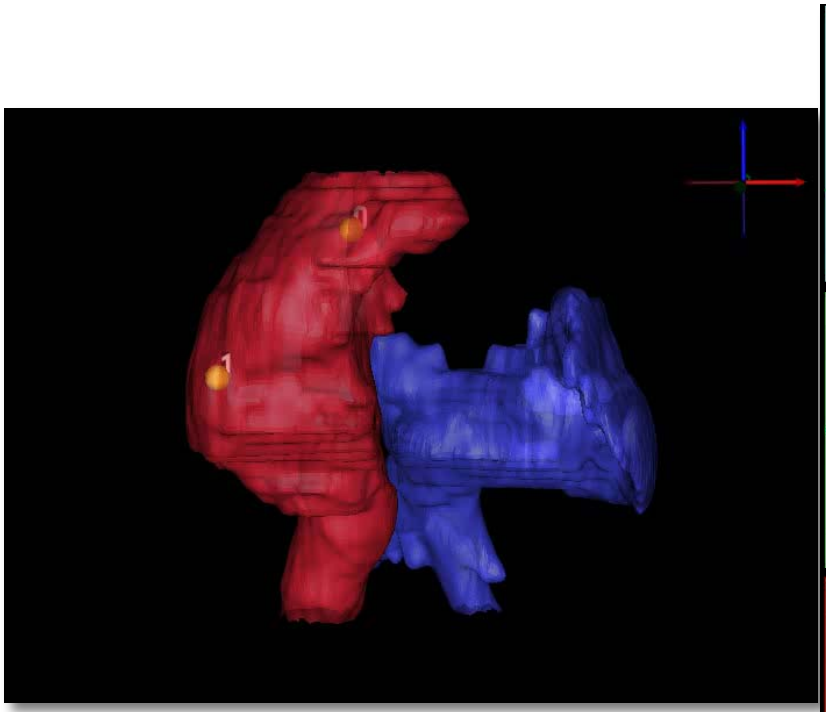
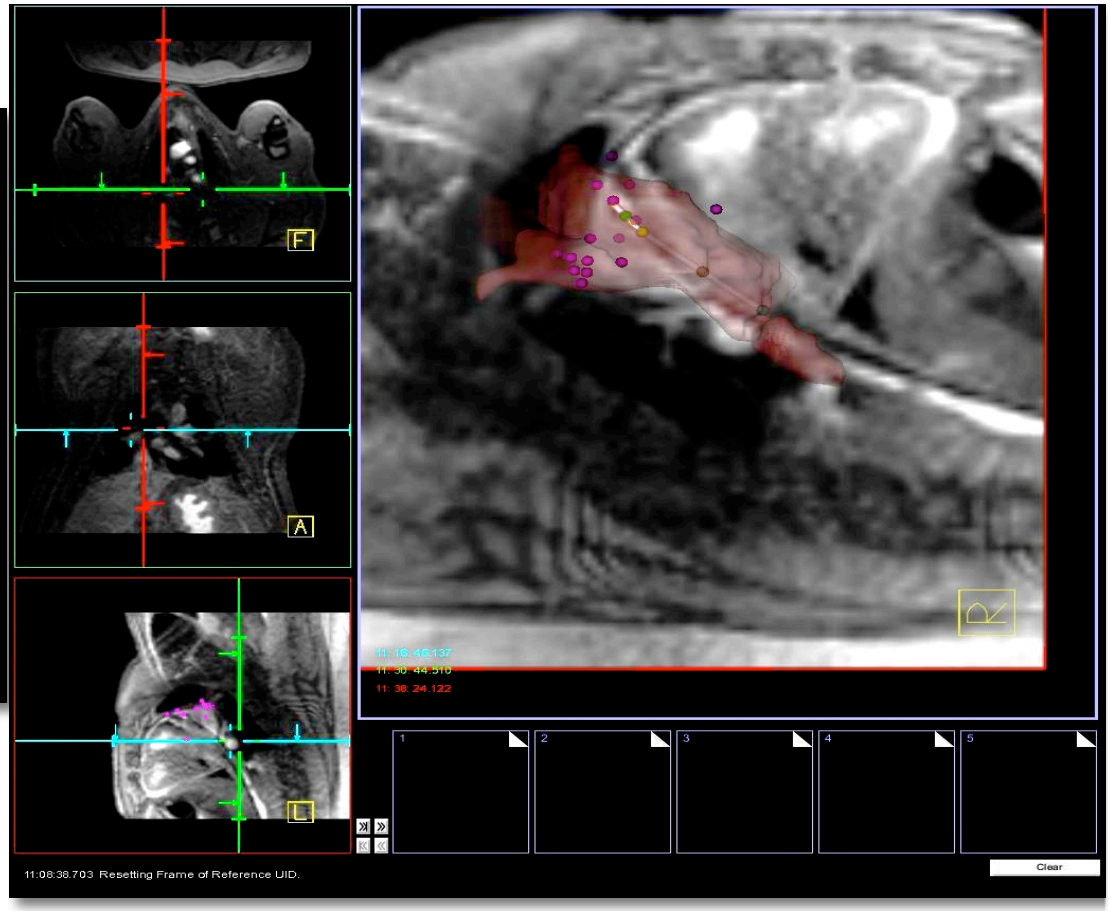
Segmentation for Guidance

Treatment





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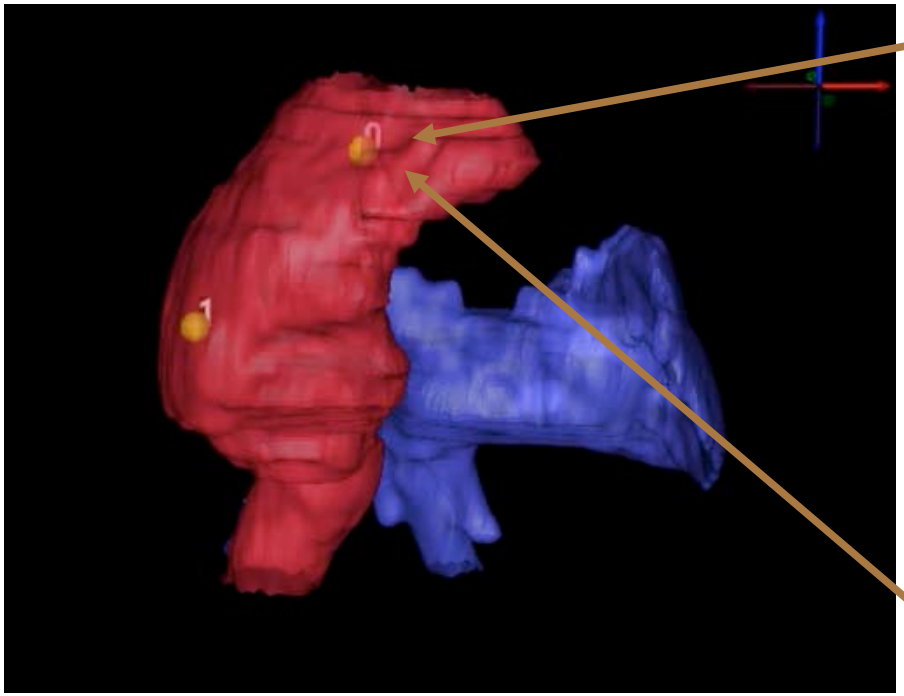
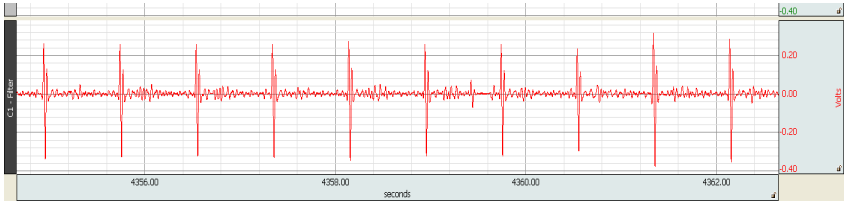
Electrogram Recording

Treatment

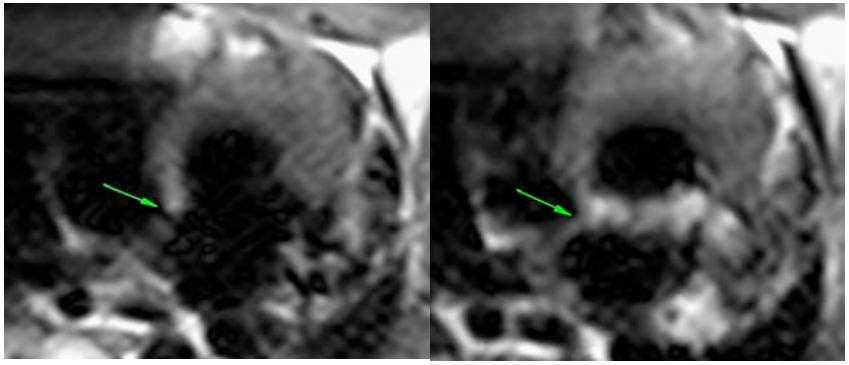


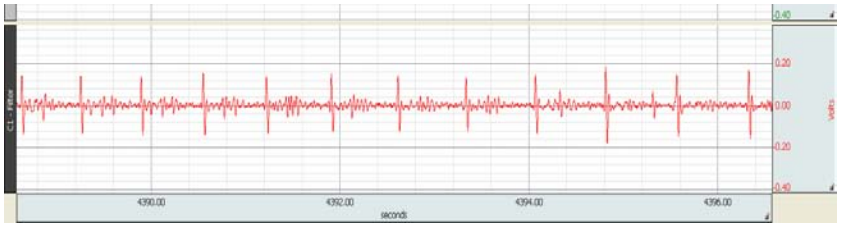
Pre-ablation EGM



T2w HASTE, T=0

T2w HASTE, T=40s





Post-ablation EGM

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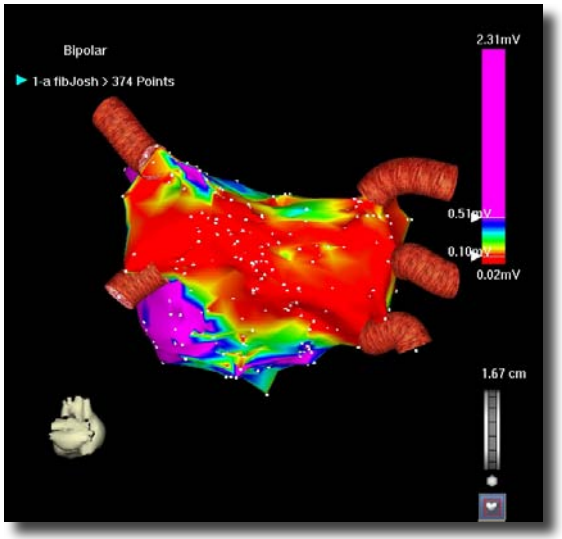
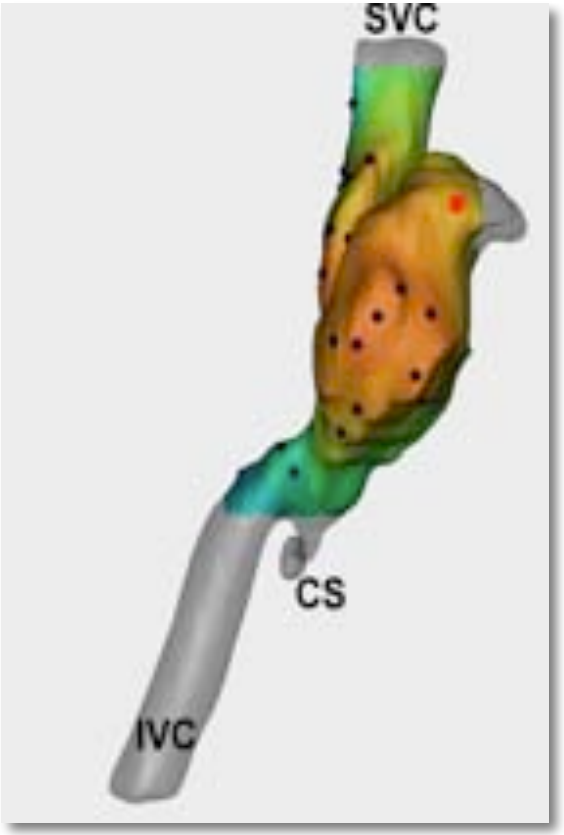
Electroanatomical Mapping

Treatment





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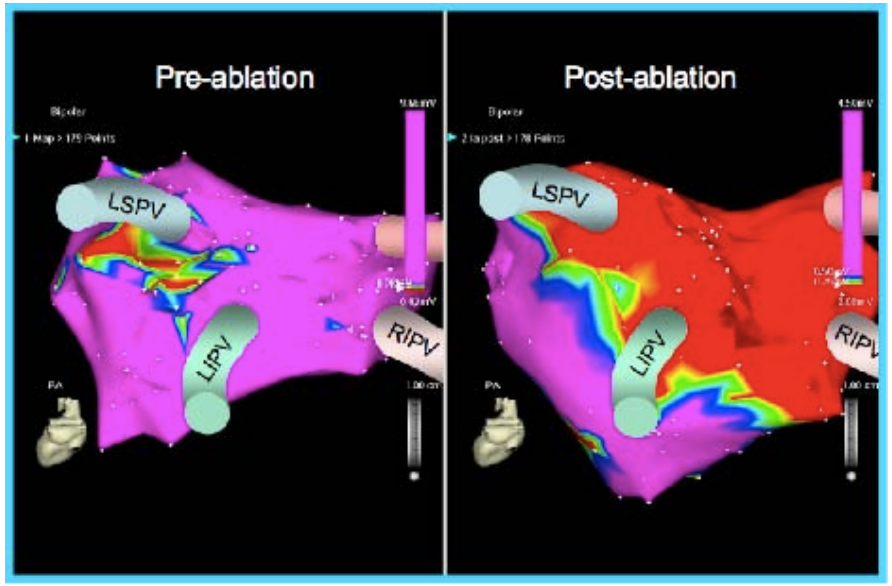
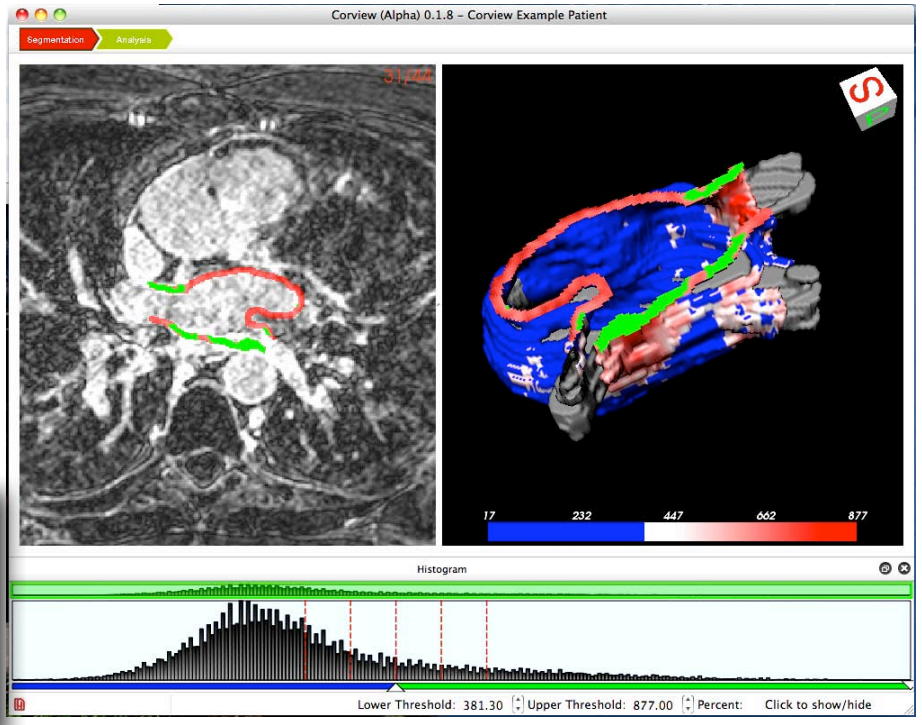
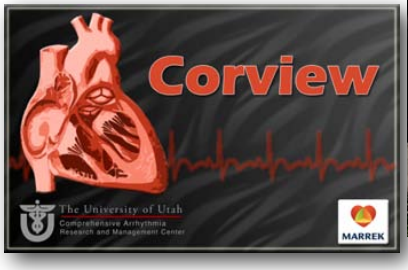
Patient Workflow

EAM vs. MRI

Followup







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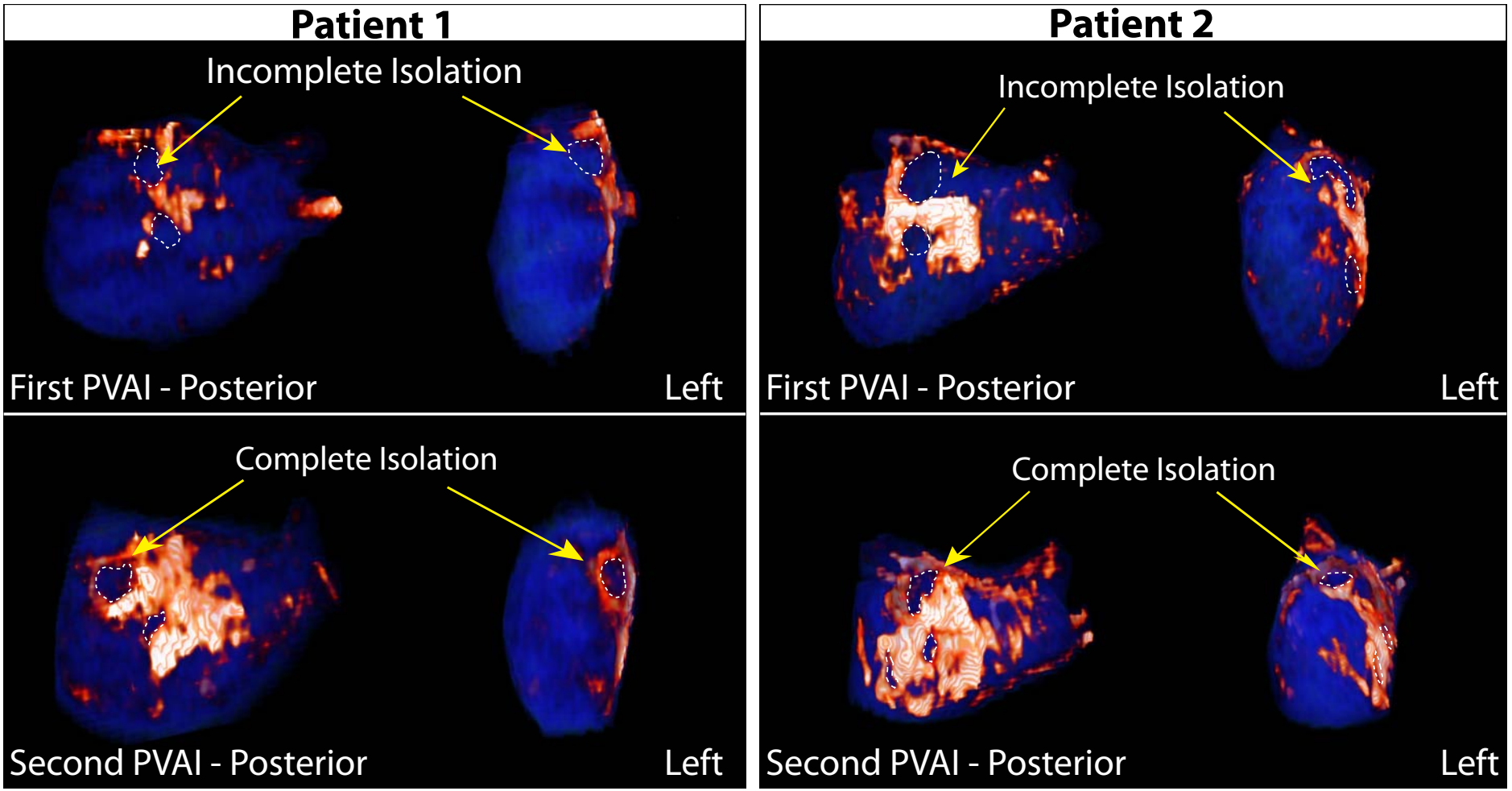
Repeat Ablation

Followup



McGann et al. JACC,52(15): 1263-1272, 2008

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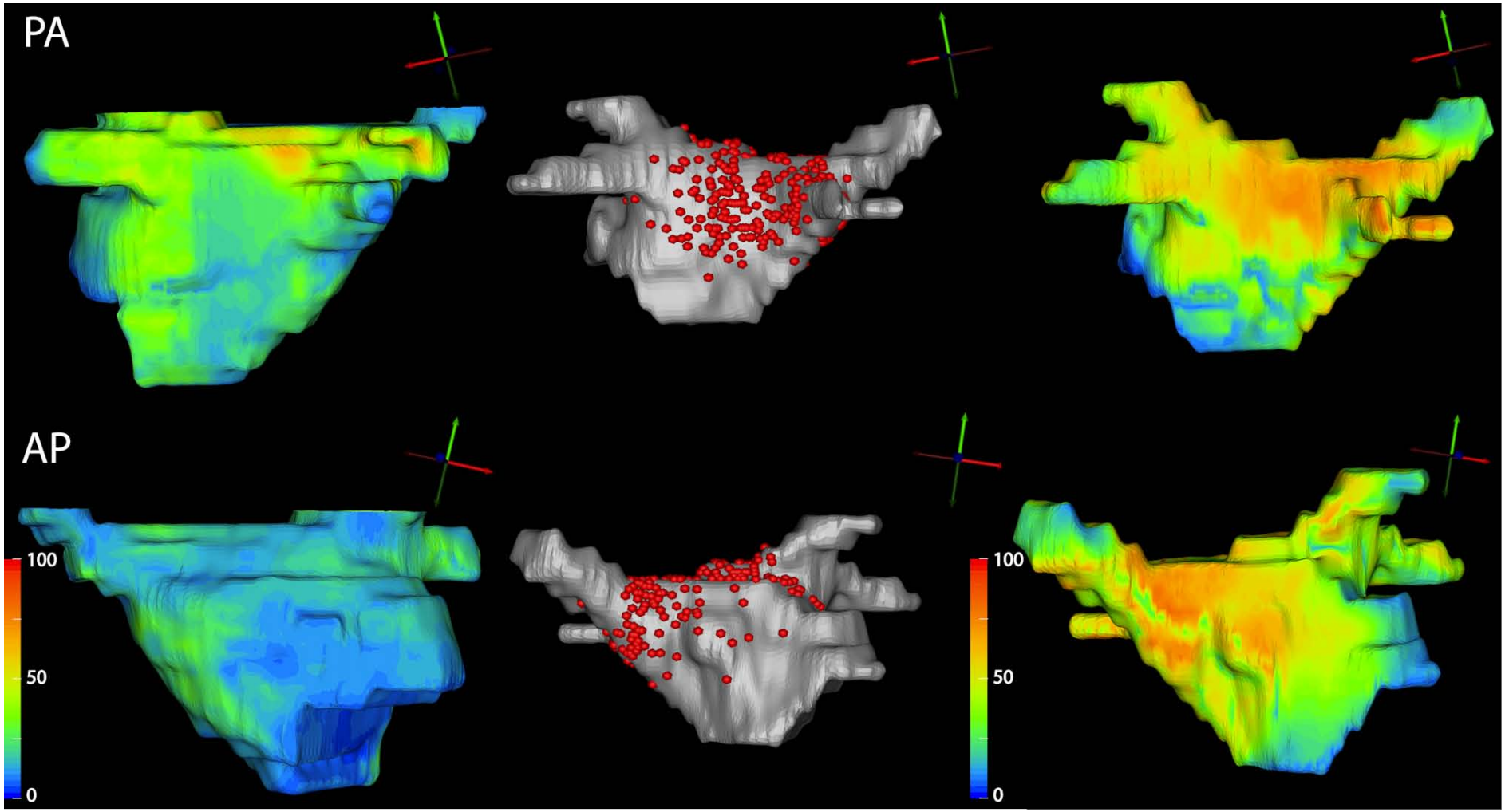
Immediate Response

Followup

Pre-Ablation Lesion Map 30 min Post Ablation



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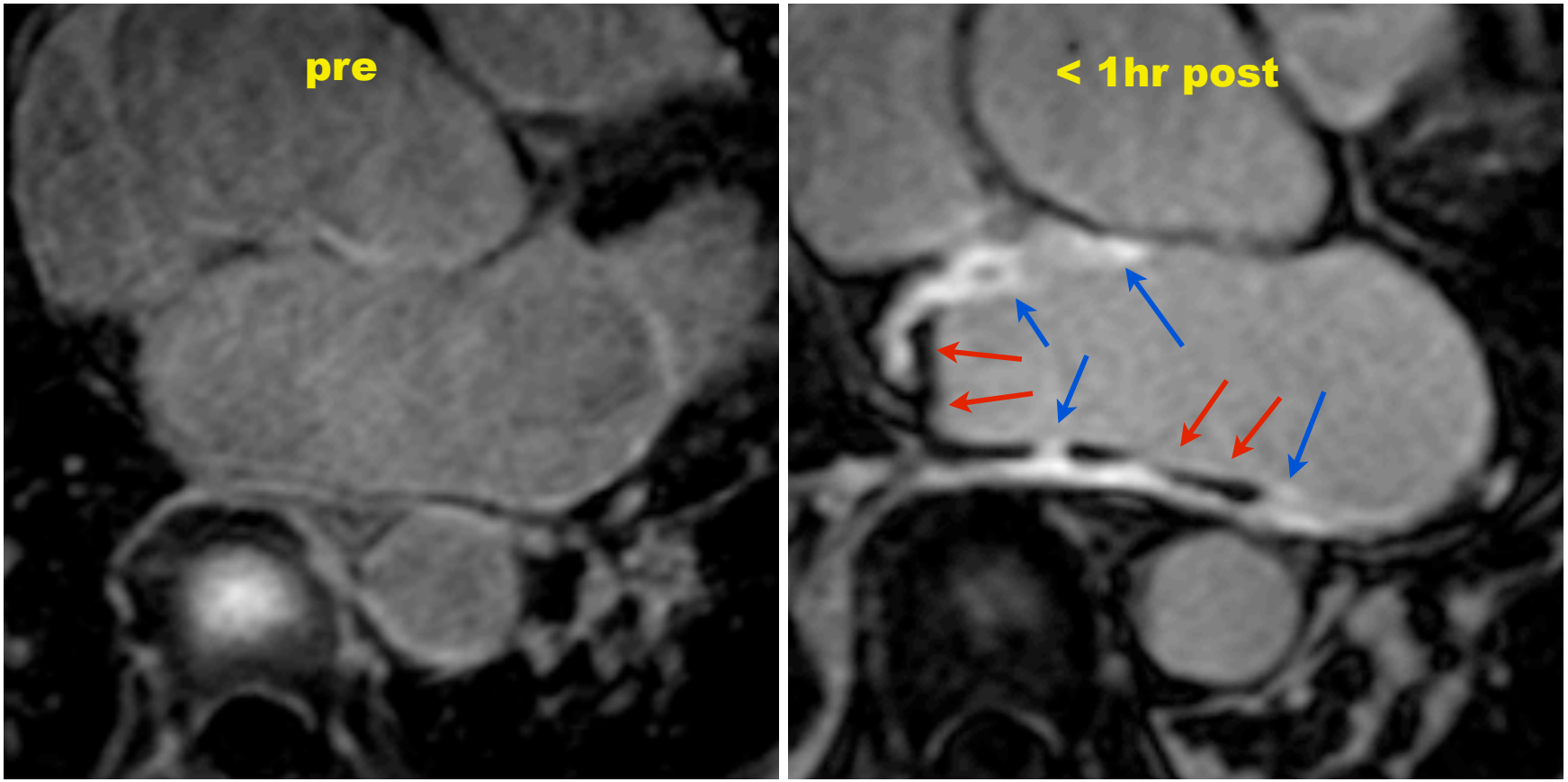
"No Reflow"

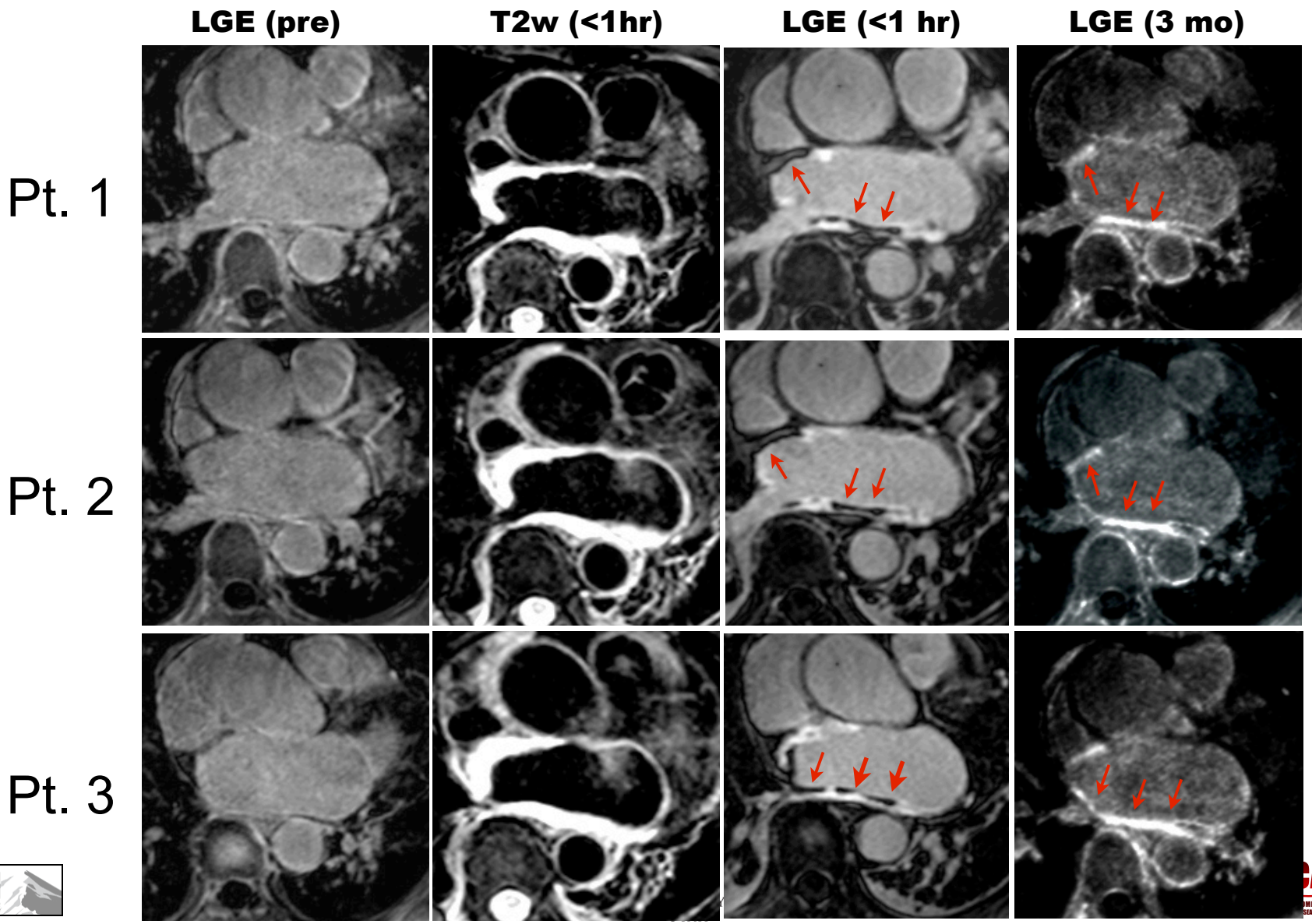
Followup

LGE



Predicting Success

Followup



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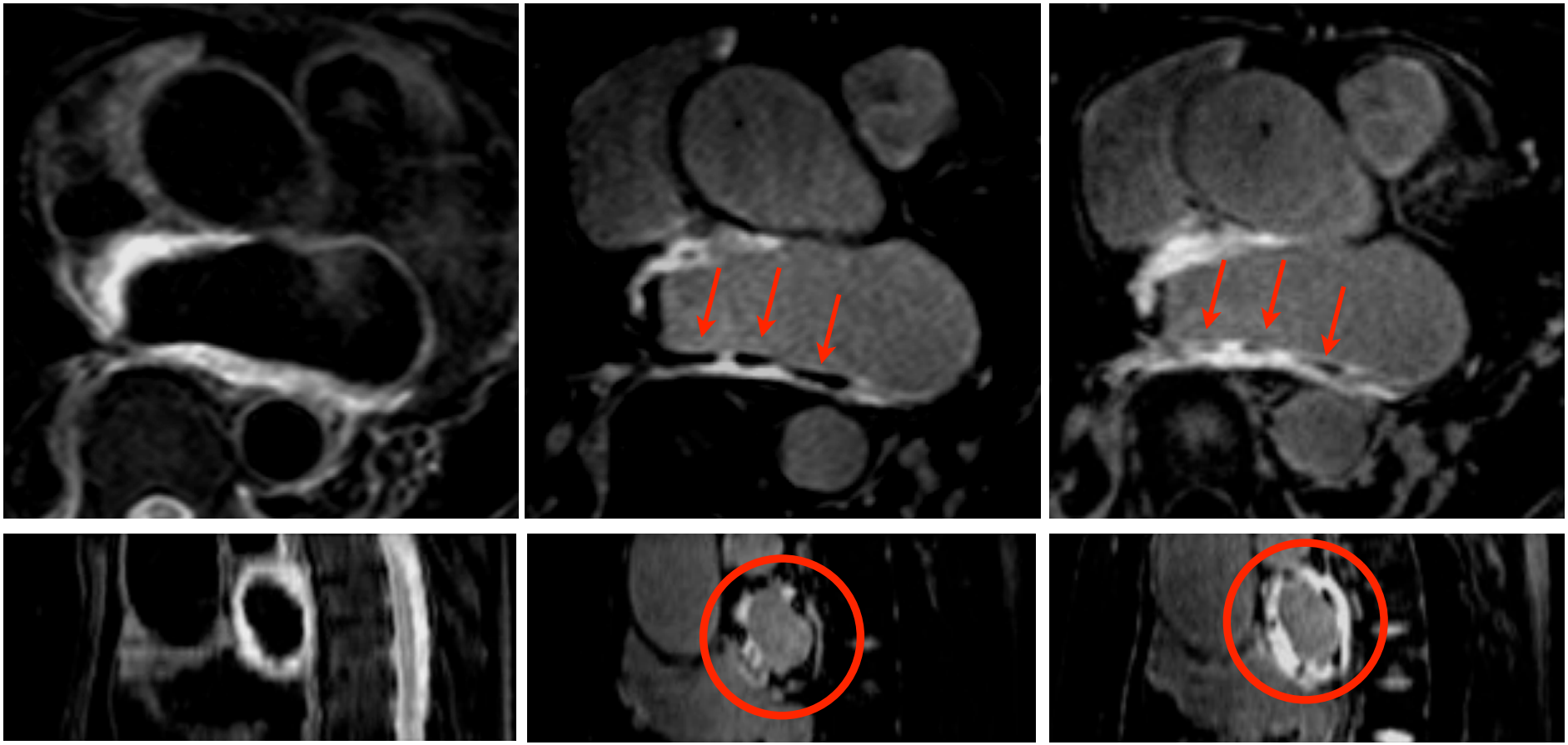
"Slow Reflow"

Followup

T2w-IP | LGE-13 min | LGE-27 min



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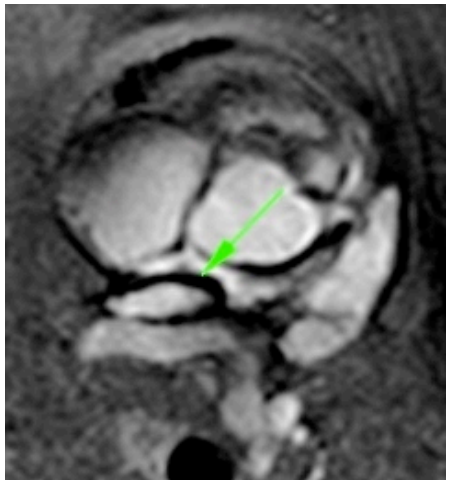
A Day in the Life

Followup

10 min



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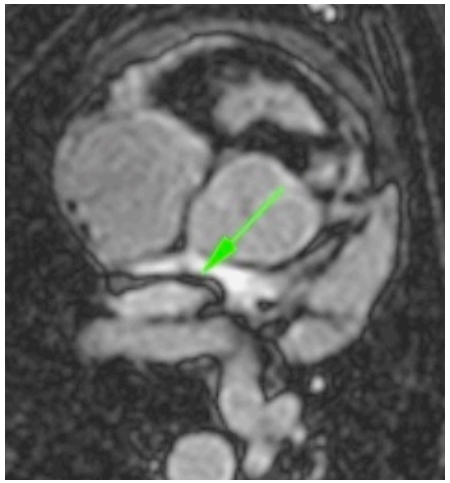

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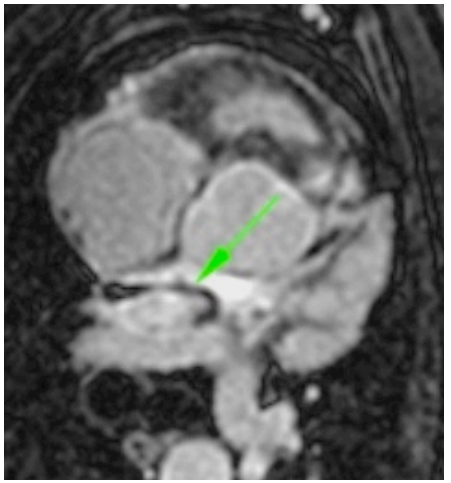

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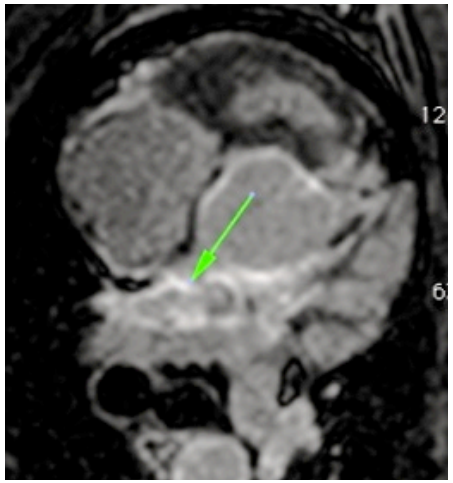
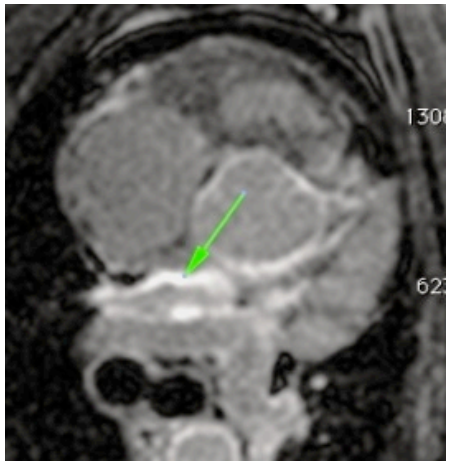


55 min



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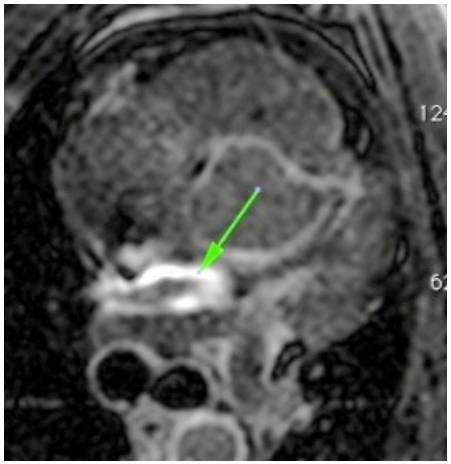

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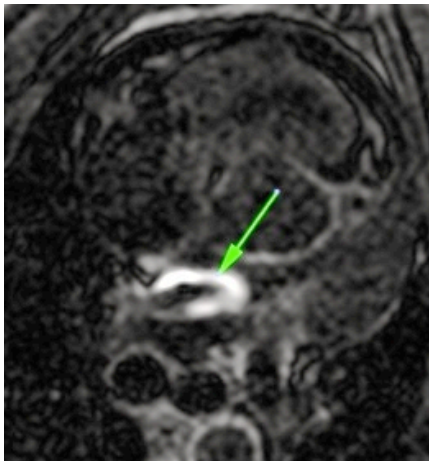

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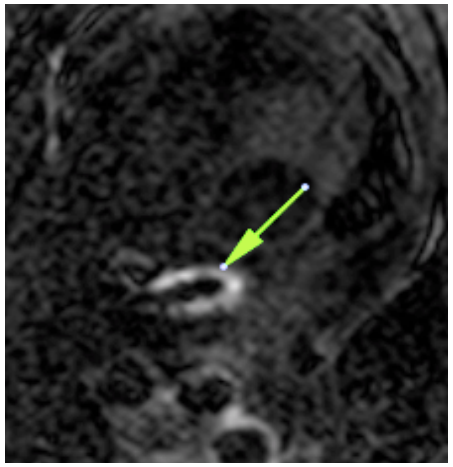

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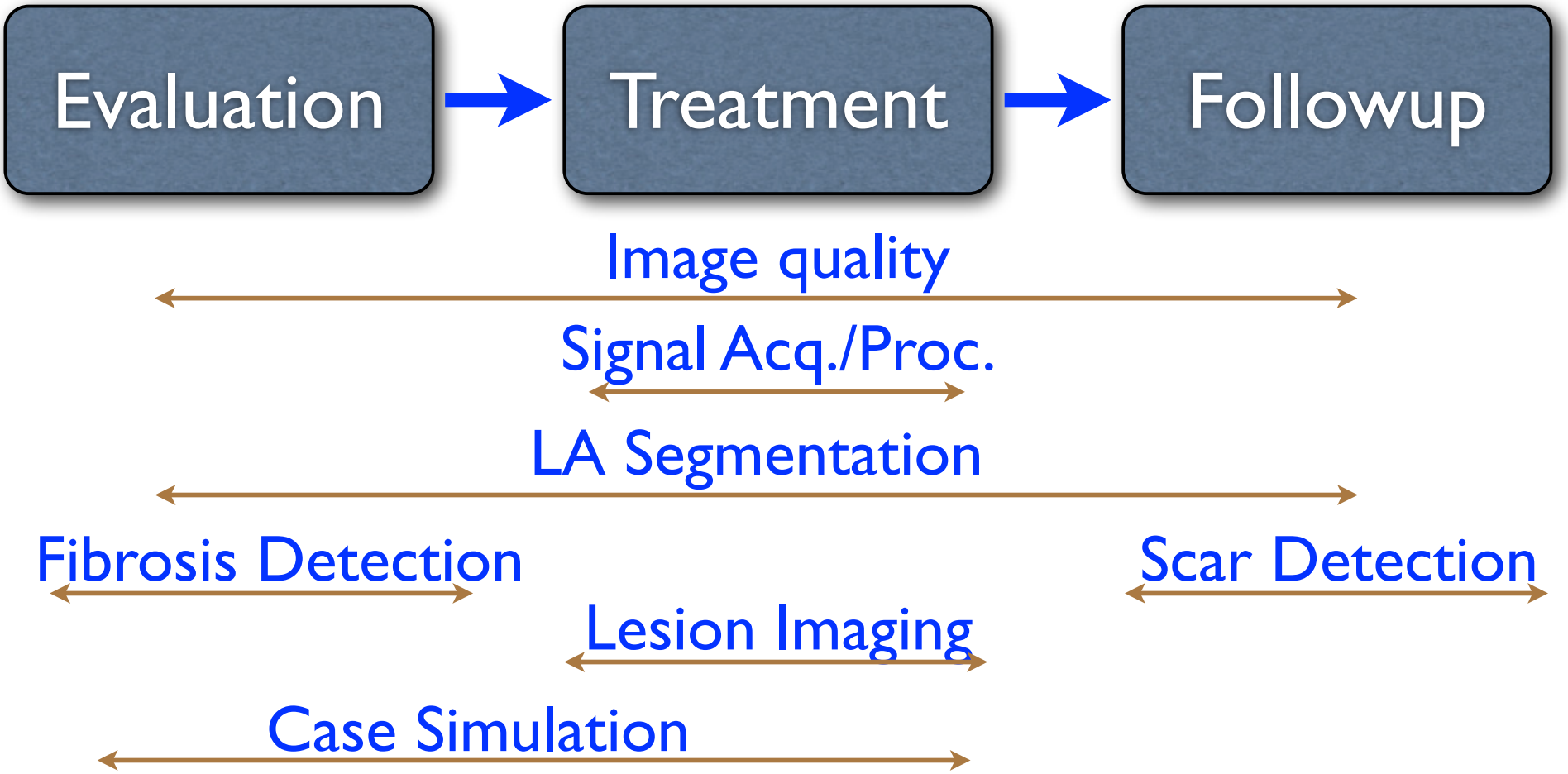
Open Challenges



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The Plan

1. AFib: Mechanisms and Clinical Practice (Ravi Ranjan, CARMA)
2. AFib: Imaging, Image Analysis, and Modeling (Rob MacLeod, CARMA)
3. Panel Discussion
   - Martin Bishop (University of Oxford)
   - Martin Kreuger (Karlsruhe Institute of Technology)
   - Kawal Rhode (King's College London)
   - Daniel Rueckert (Imperial College London)
   - Nic Smith (King's College London)
   - Graham Wright (University of Toronto)

Martin Bishop
(University of Oxford)

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Graham Wright
(U of Toronto)

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How can we improve imaging of the LA?
Roof and floor?
Appendage?

How can we improve and automate segmentation of the LA wall?
How much of the PVs?
Shape models?
Other constraints?

How do we quantify enhancement (fibrosis or scar)?

What are the most relevant simulation questions?

What is tissue remodeling in the atria and what are the functional consequences?