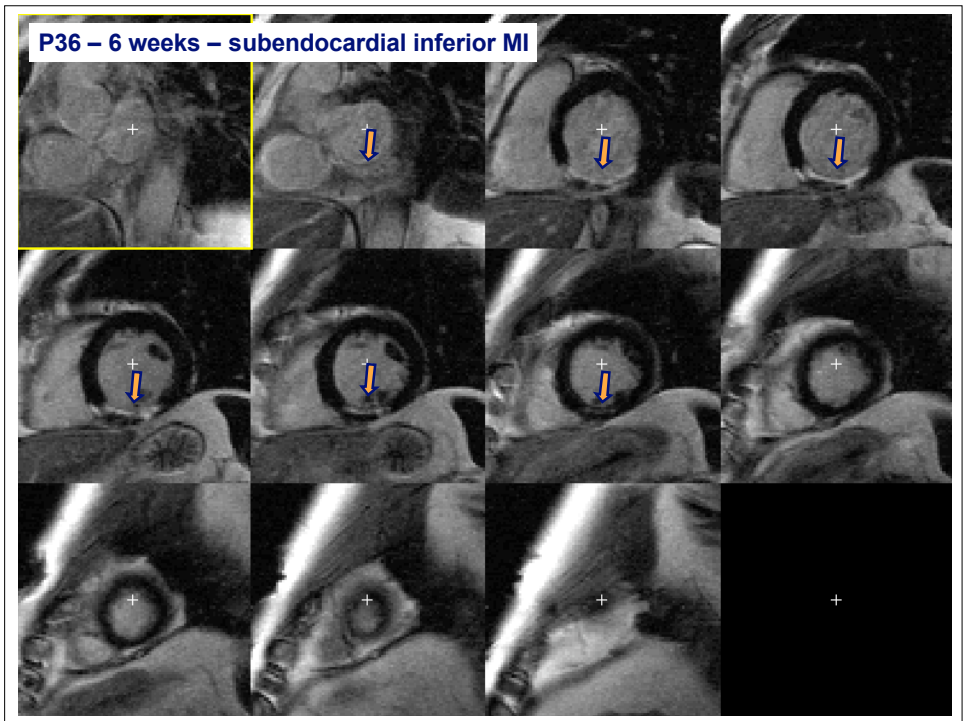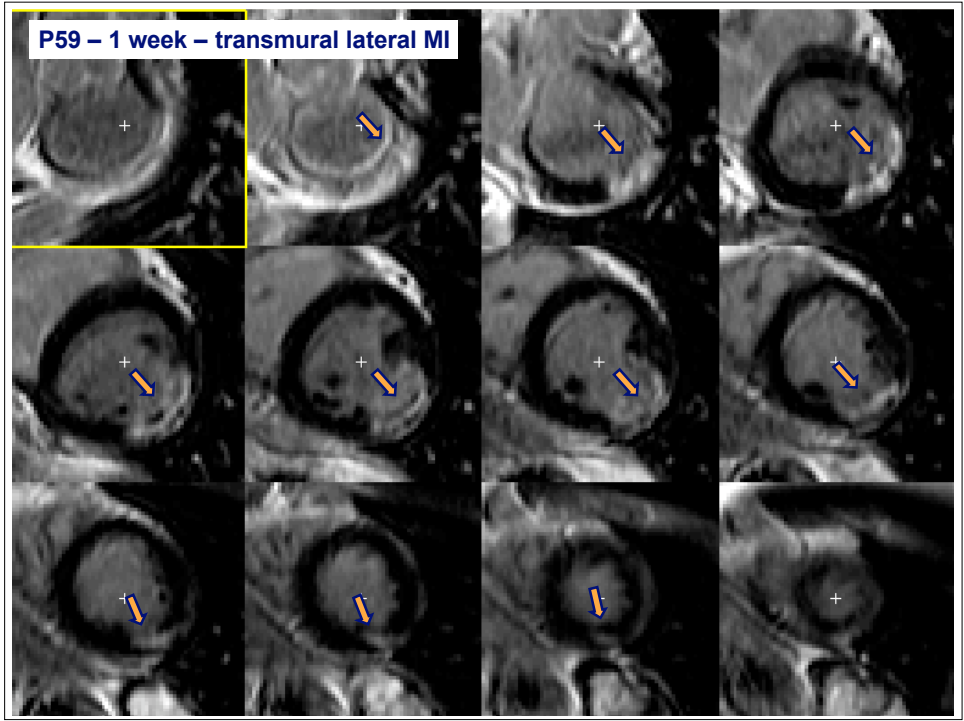# MI DIAGNOSIS FROM REFERENCE TO CARDIAC MRI
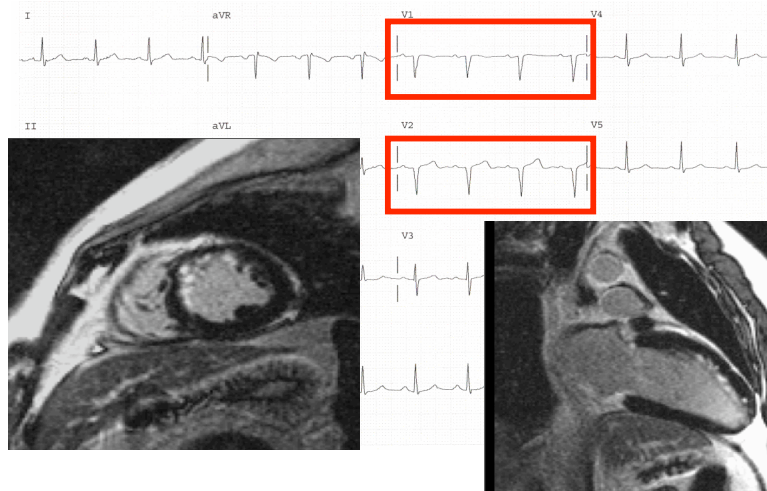
- **Sites and Sizes of First-Time Reperfused Myocardial Infarction Assessed by Cardiac Magnetic Resonance can be Estimated by 12-lead ECG**
  Engblom et al – Lund

- **VVRED 2- The Virtual Visual Reconstructured Electrocardiographic Display Group – 2nd Workshop – Kornreich et al - Halle**

- **Computers in Cardiology 2007 Challenge**
  Wagner et al – Durham

Sites and Sizes of First-Time Reperfused Myocardial Infarction Assessed by Cardiac Magnetic Resonance can be Estimated by 12-lead ECG
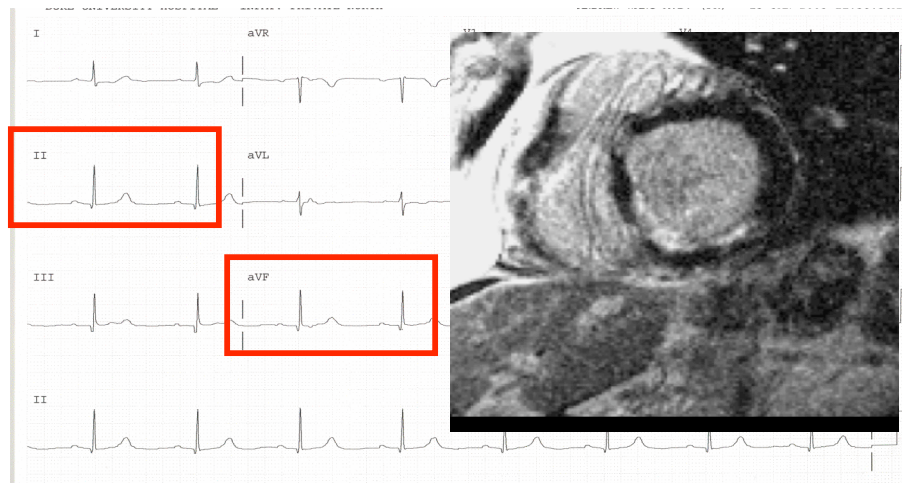**Using the Selvester QRS Scoring System**

Engblom et al – Lund

P59 – 1 week – transmural lateral MI

P36 – 6 weeks – subendocardial inferior MI

Duke: anterior MI - ECG and CMR
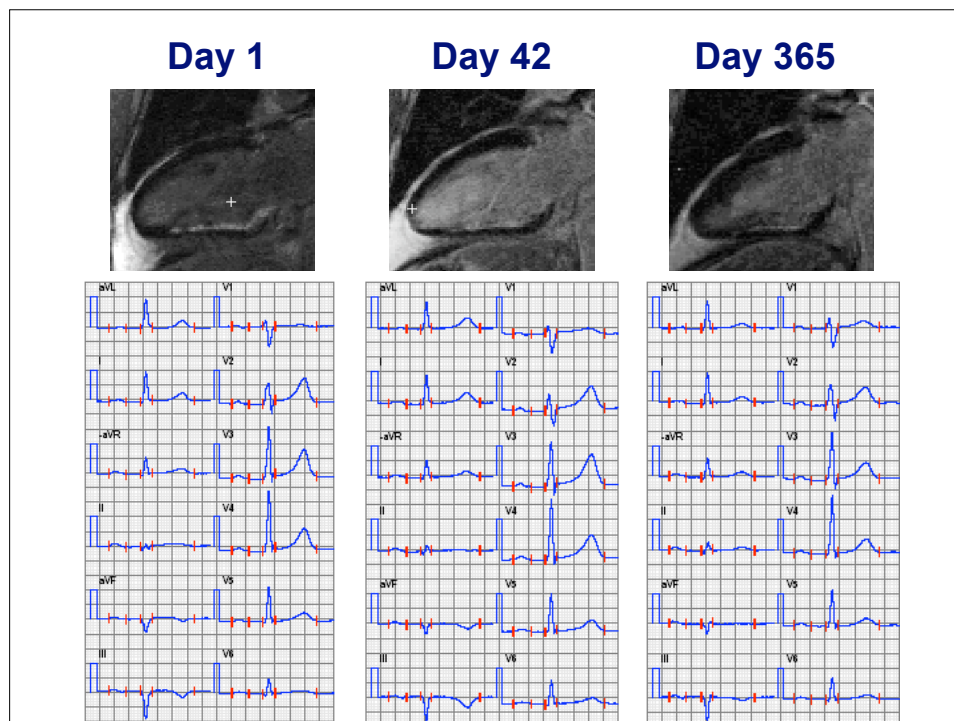

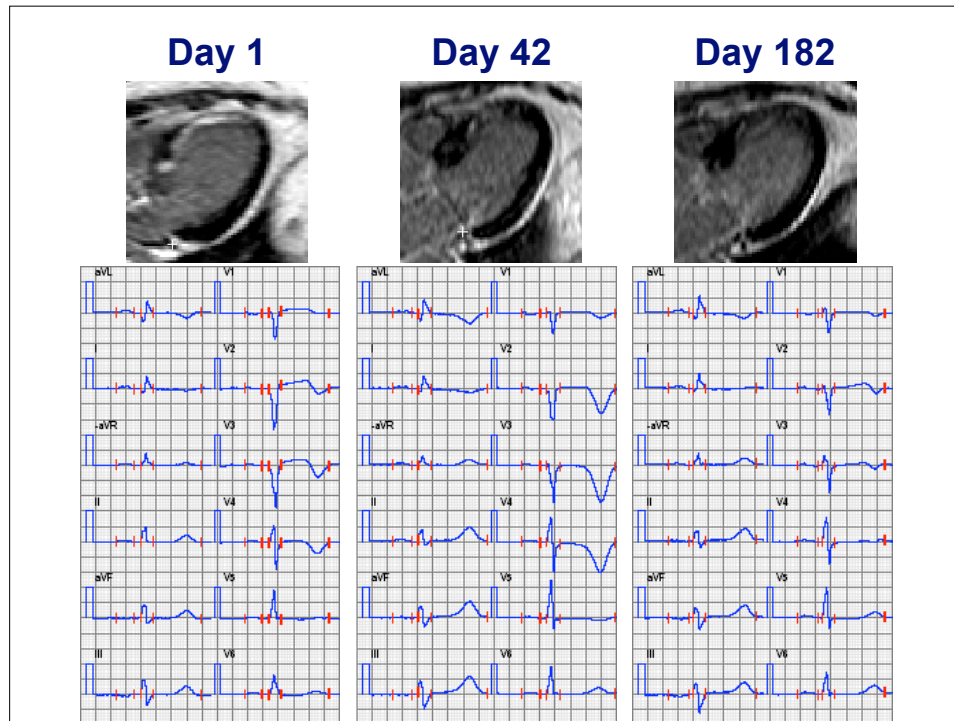# Duke: inferior MI - ECG and CMR

"Lateral MI" –
ECG and Cardiac MRI

Time course and magnitude of infarct involution, functional recovery and electrocardiographic changes in patients with reperfused first myocardial infarction
Engblom et al – subm Circ

Acute STEMI
Reperfusion with PCI
Serial MRI- delayed enhancement
ECG – Selvester Score
Days 1, 7, week 6, months 6,12

Cardiac MRI group
Lund University Hospital

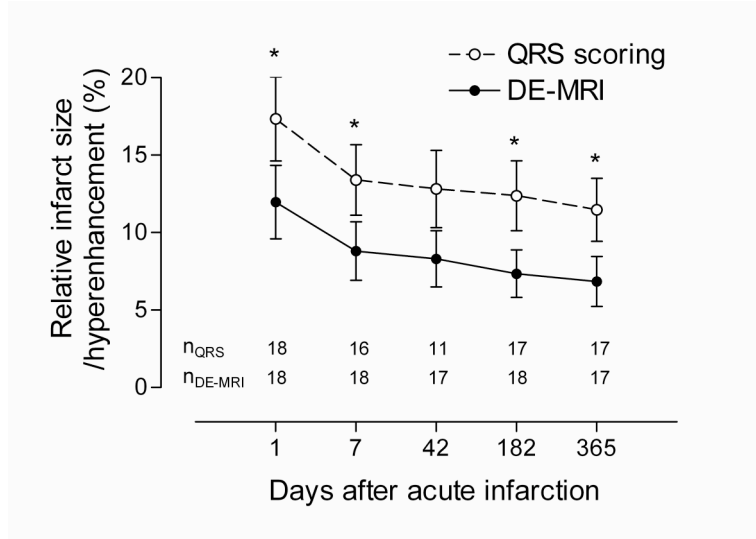| Day 1 | Day 42 | Day 365 |

Day 1 **Day 42** **Day 182**

Selvester QRS Scoring System

- 50 quantitative 12 lead ECG criteria
- 31 points – each equiv 3% LVMI
  - Q and R wave duration
  - R wave amplitude
  - R/Q and R/S amp ratios

QRS score vs MI characteristics

Relative infarct size /hyperenhancement (%)

- -○- QRS scoring
- -●- DE-MRI

	1	7	42	182	365
n_{QRS}	18	16	11	17	17
n_{DE-MRI}	18	18	17	18	17

Days after acute infarction

Cardiac MRI group
Lund University Hospital

VVRED 2

The Virtual Visual Reconstructured Electrocardiographic Display Group
2nd Workshop – June 26,27/06
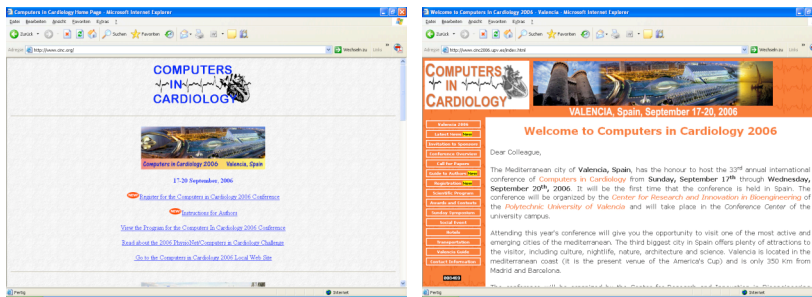**Kornreich et al, Halle**

VVRED 2

- Fred Kornreich
- Anton Gorgels
- Ge van Herpen
- Jan Kors
- Rob MacLeod
- Adriaan van Oosterom
- Ron Selvester
- Galen Wagner

PhysioNet/CiC Challenge

**Computers in Cardiology 2007
ECG Imaging Challenge**
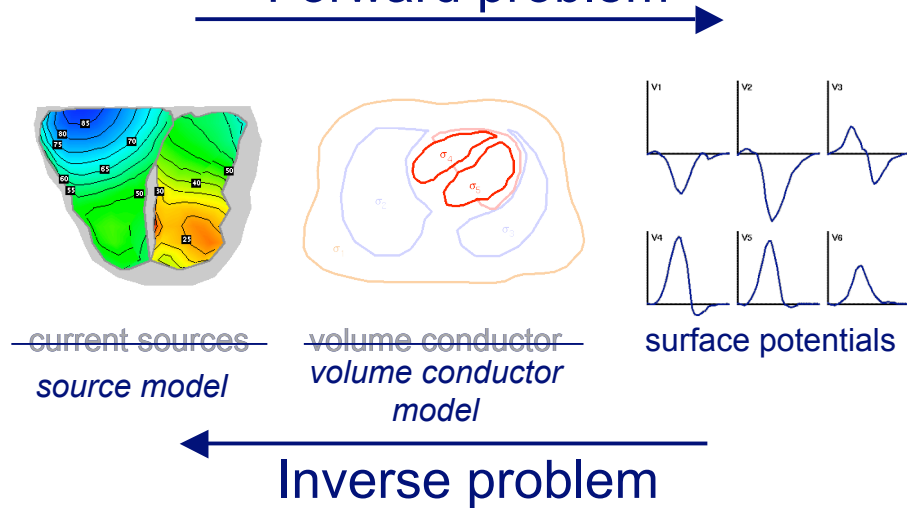
Wagner et al – Durham NC

Hypothesis - 1

Access to
- body surface ECG waveforms and
- cross-sectional MRI images of the heart in the thorax

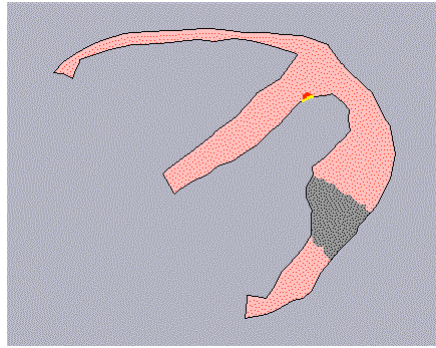provide the basis for locating and quantifying healed myocardial infarction

Hypothesis -2

There will be a direct relationship between:
the number of ECG leads considered
and
the performance of the challengers

What is Cardiac Activation Time Imaging?

Forward problem

current sources
source model

volume conductor
volume conductor model

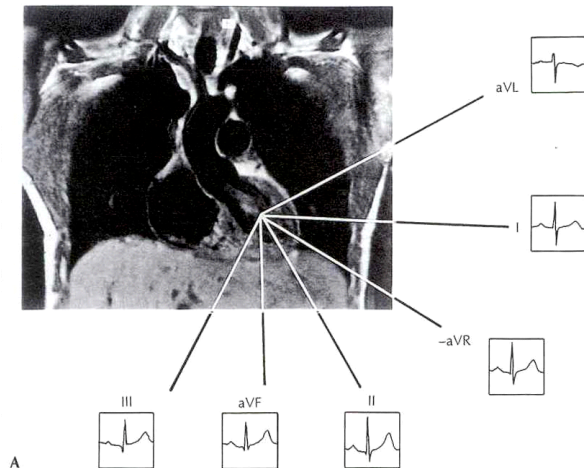surface potentials

Inverse problem

METHODS - Population

MALT Study – Glasgow
30 patients

- Acute First MI
- 1 Year follow-up
- Cardiac MRI
- Standard 12 lead ECG
- 120 lead BSM

ECG DISPLAY FORMAT - ANATOMIC REFERENCE

Frontal plane

aVL

I

−aVR

III   aVF   II

A

9

METHODS
Timeline to Challenge

- July/06 – Protocol development - VVRED Group
- Sept/06 – Introduction of CiC 2007 Challenge at CiC 2006 in Valencia

  George Moody

- Link to Physionet web site via www.cinc.org

METHODS – End Point

- MI site and size determined by delayed enhancement Cardiac MRI

Conclusions

- 1. The ECG has capability for determining the site and estimating the serial sizes of healed first reperfused MIs
- 2. The VVRED Group can provide formulation of the challenges to the creators of ECG imaging
- 3. The CiC 2007 ECG Imaging challenge is a model of the scientific networking required for Inverse ECG – "Going back to the Heart using ECG imaging" – Rudy ICE 2006