Clinical perspective:
New clinical pathway for chest pain assessment

Role of cardiac MR

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CMR Laboratory
2 Half of the day every week
5-6 cases in a day
Total 500 CMR exam every year

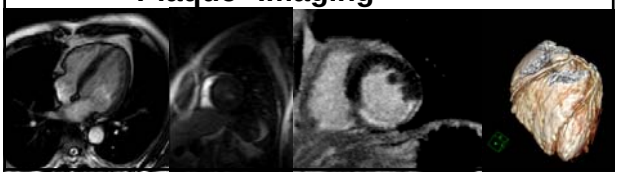
MAGNETOM Avanto

Tokyo Medical University
Hospital

Tokyo Medical University
Hachioji Medical Center

"One Stop Shop"

- **Cine : Morphology and Function**
- **Stress perfusion: ischemia**
- **Late Gadlinium Enhancemnt: Viability**
- **MRCA: Coronary artery Anatomy and Plaque Imaging**



Role of cardiac MR for chest pain assessment

Heart Disease showing Chest Pain

- Ischemic Heart Disease
  Acute chest pain・・AMI
  ACS (u-AP)
  Stable effort or rest chest pain・・AP
- Non ischemic Heart Disease
  Myocarditis, Perimyocarditis, HCM etc

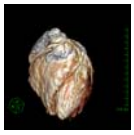
The Chart for PTs with Chest pain

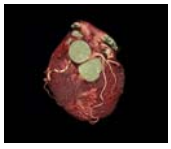
Acute chest pain
（AMI/ACS）

•ECG
•Biomaker
•UCG

Under challenging CCTA

CMR ？？？





Pts with AMI,ACS not yet treated with PCI

Pts are under the intensive care
- Unstable condition
- Monitoring system
- Infusion pump
- Intubation and respirator etc

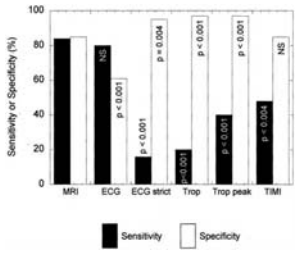
Such Pts is Contraindication For CMR

Detecting Acute coronary Syndrome in the Emergency Department with CMRI

- 161 Pts 30 min chest pain without ECG not diagnostic AMI
- Within 12 hrs of presentation
- LV function,perfusion,LGE

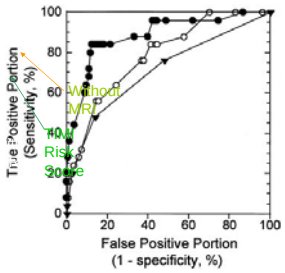
RY Kwong et al; Circulation 2003;107:507-537

Detecting Acute coronary Syndrome in the Emergency Department with CMRI



RY Kwong et al; Circulation 2003;107:507-537

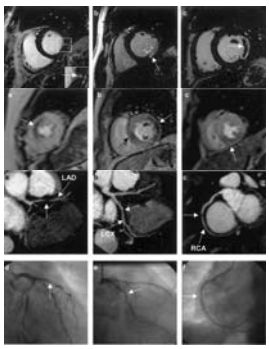
Detecting Acute coronary Syndrome in the Emergency Department with CMRI



RY Kwong et al; Circulation 2003;107:507-537

Assessment of Non-ST-Segment Elevation ACS with CMR

- 68 Pts Non-ST-Segment Elevation ACS underwent CMR
  - Myocardial function
  - Perfusion
  - (rest and adenosin-stress)
  - Viability
  - Coronary artery anatomy
- The ability of CMR to detect coronary stenosis >70%



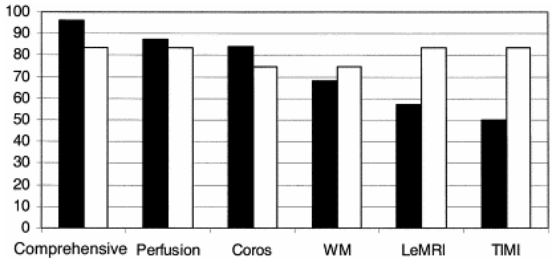
S Plein et al :J Am Coll Cardiol 2004 44:2173-81

Assessment of Non-ST-Segment Elevation ACS with

	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Overall Accuracy (%)
Comprehensive analysis	96 (92–100)	83 (62–100)	96 (91–100)	83 (62–100)	94 (88–100)
Individual component analysis					
Perfusion	88 (79–96)	83 (62–100)	96 (91–100)	59 (35–82)	87 (79–95)
Coronaries	84 (74–94)	75 (51–100)	94 (87–100)	50 (27–73)	82 (73–92)
Wall motion	68 (56–80)	75 (51–100)	93 (85–100)	50 (27–73)	69 (58–80)
Late contrast enhancement	57 (44–70)	83 (62–100)	94 (86–100)	42 (25–58)	62 (50–73)

S Plein et al :J Am Coll Cardiol 2004 44:2173-81

Assessment of Non-ST-Segment Elevation ACS with



S Plein et al :J Am Coll Cardiol 2004 44:2173-81

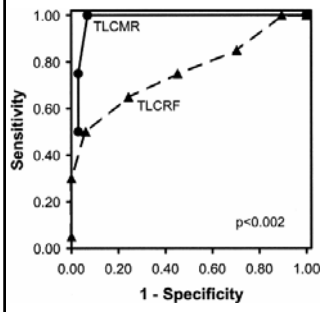
Prognosis of negative Adenosine stress MR in Presenting to an Emergency Department with chest pain

135 Pts troponin-I negative , chest pain (+) was examined stress Adenosine perfusion MR

The outcome was studied in 1y.
- the incidence of significant CAD (stenosis >50%) on CAG,
- abnormal correlative stress test,
- new MI,
- death

Ingkanison WP. et.al. J Am Coll Cardiol 2006; 47:4277-32

Prognosis of negative Adenosine stress MR in Presenting to an Emergency Department with chest pain

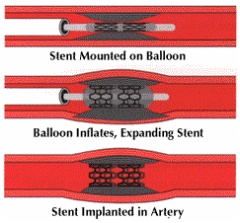


- Both Cardiac Risk factor and CMR were significant in Kaplan-Meire Analysis

Ingkanison WP. et. al. J Am Coll Cardiol 2006; 47:4277-32

Pts with AMI,ACS already treated with PCI and Stentting

Pts under the intensive care → Pts are Free from Intensive care
Unstable Pts condition → Stable condition
Monitoring system
Infusion pump
Intubation and Respirator → Free from Monitor, Infusion Pump, Respirator



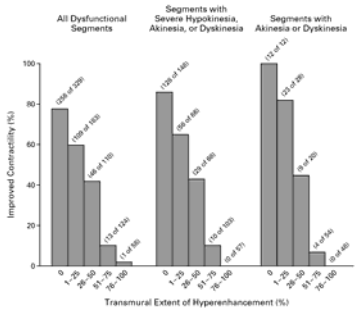
Immediately Following Implantation Coronary Stent MRI is Safety, not dangerous

- **FDA Approved "safety" for MRI Scans *Immediately Following Implantation CYPHER® or* TAXUS® *Stent***
- **This FDA Approval encouraged us to do CMR examination on AMI, or ACS**

Evaluation of AMI with CMR

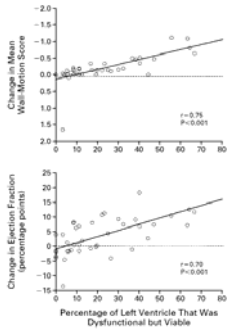
- Viability
- Detectability of infarction
- Evaluation of Infarct size
- Micro Obstruction

The Relationships between Extent of LGE before Revascularization and increase contractility after revascularization



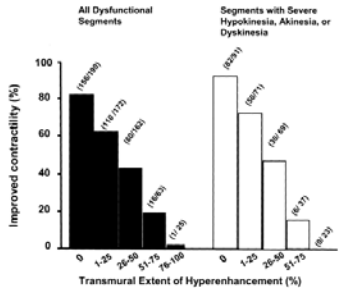
Raymond J. Kim et al: NEJM 2000;343:1445-1453

Evaluation of Viability with LGE



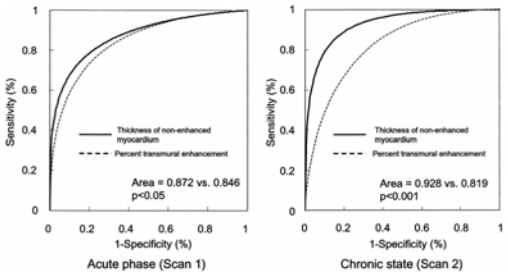
Raymond J. Kim et al: NEJM 2000;343:1445-1453

Value of Delayed-Enhancement Cardiovascular Magnetic Resonance Imaging in Predicting Myocardial Viability After Surgical Revascularization



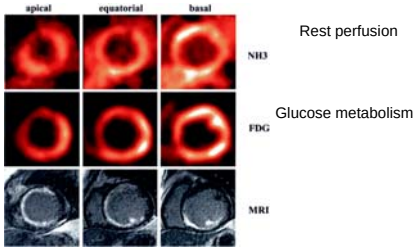
Joseph B. Selvanayagam.et al;Circulation.2004;104:1535-1541

Improved prediction of regional myocardial contraction in the chronic state by measuring thickness of nonenhanced myocardium



Y Ichikawa. H Sakuma. JACC 2005;45:901-909

Assessment of Myocardial Viability With Contrast-Enhanced Magnetic Resonance Imaging Comparison With Positron Emission Tomography

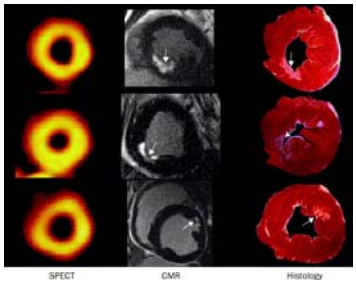


Rest perfusion

Glucose metabolism

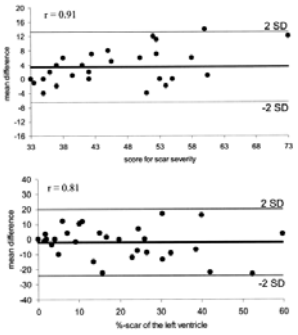
C Klein et al:Circulation,2002;105:162-167

Comparison between LGE-positive and Negative with SPECT



Wagner A et al: Lancet 2003 361:374-9

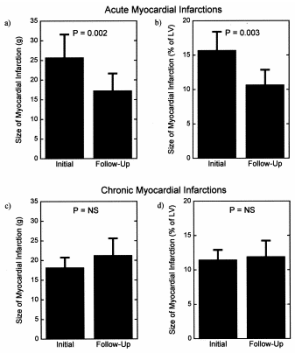
Assessment of Myocardial Viability With Contrast-Enhanced Magnetic Resonance Imaging Comparison With Positron Emission Tomography



Visual Scar score :PET 44.3±9.1
MRI 47.6±11.1

C Klein et al:Circulation,2002;105:162-167

Infarct size in AMI and OMI

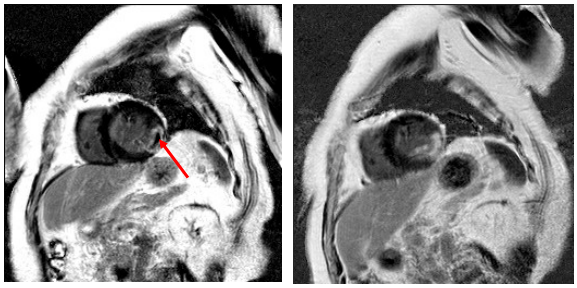


AMI

OMI

Ingkanisorn WP, J Am Coll Cadiol 2004;43:2253-9

Micro Obstruction

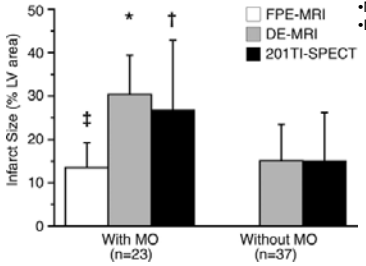


3 day after onset

1 month after onset

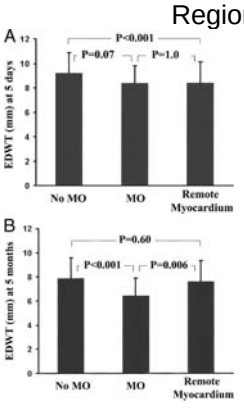
Acute Myocardial Infarction: Evaluation with First-Pass Enhancement and Delayed Enhancement MR Imaging Compared with 201Tl SPECT Imaging

- 60 AMI PTs
- CMR was underwent 6 ±3 days
- MO was evaluated rest perfusion
- Infarct size was evaluated by LGE



GK. Lund et al: Radiology 2004;232:49-57

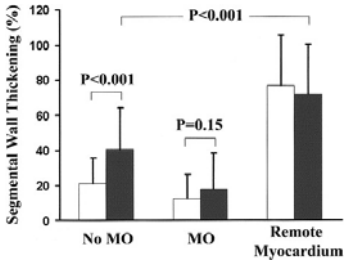
MO influence to the improvement of Regional wall motion



- 22 Pts with AMI
- CMR was underwent at 5 day and 5 month

T Baks ; J Am Coll Cardiol 2006;47:40-44

MO influence to recovery of Regional wall motion

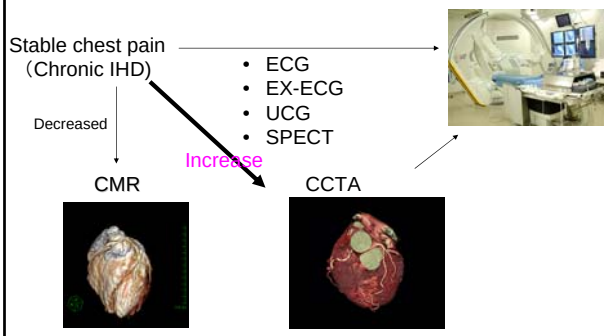


T Baks ; J Am Coll Cardiol 2006;47:40-44

Heart Disease showing Chest Pain

- Ischemic Heart Disease
  Acute chest pain‥AMI
  ACS (u-AP)
  chest pain due to chronic IHD‥AP
- Non ischemic Heart Disease
  Myocarditis, Pericarditis, HCM etc

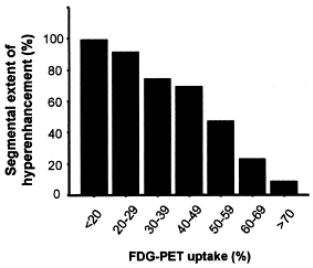
The Chart for Pts with Stable Chest pain



Evaluation of Chronic IHD with CMR

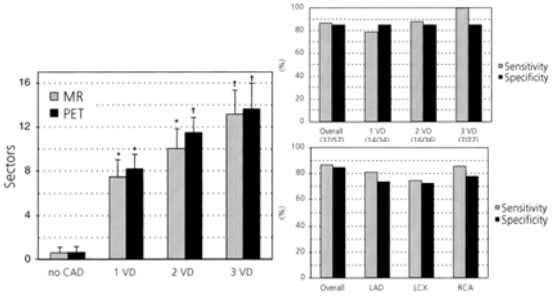
- Viability
- Evaluation of Ischemia
- Evaluation of coronary anatomy

Myocardial viability in chronic ischemic heart disease Comparison of LGE with PET



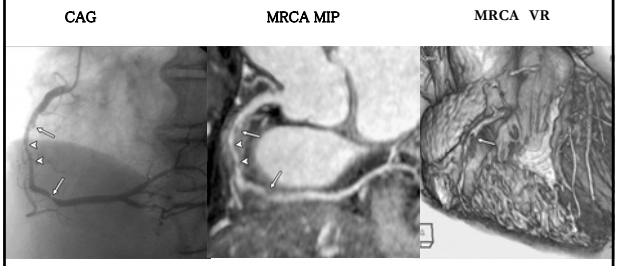
HP Kuhl.et.al;JACC 2003;41:1341-1348

Comparison between Stress Perfusion MR and PET



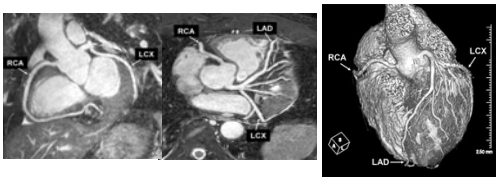
J. Schwitter,et al. Circulation 2001;103:2230-2235

CAG and MRCA



Sakuma, H. et al. Radiology 2005;237:316-321

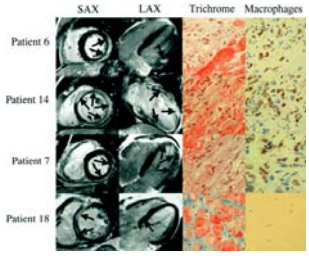
MRCA；Whole Heart MRCA



Parameter	Per Major Coronary Artery*	Per Patient
Sensitivity (%)	82 (14/17)	83 (10/12)
Specificity (%)	91 (39/43)	75 (6/8)
Accuracy (%)	88 (53/60)	80 (16/20)
Positive predictive value (%)	78 (14/18)	83 (10/12)
Negative predictive value (%)	93 (39/42)	75 (6/8)

Sakuma, H. et al. Radiology 2005;237:316-321

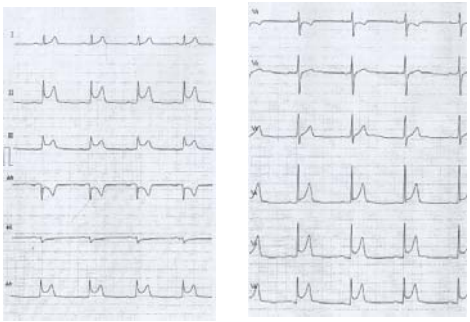
LGE and Biopsy findings with Myocarditis



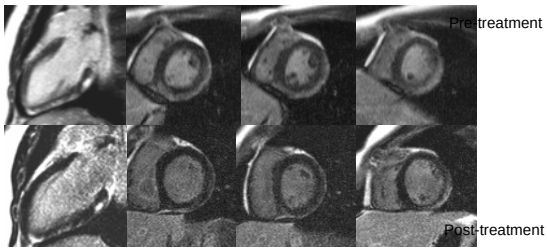
32Pts myocarditis
The findings of biopsy compare with LGE with CMR
Inicial CMR and 3 months later CMR

Heiko Mahrholdt et al *Circulation.* 2004;109:1250–1258

19y Male with Chest pain and unconsciousness



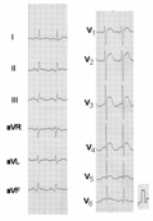
LGE in a patient with perimyocarditis



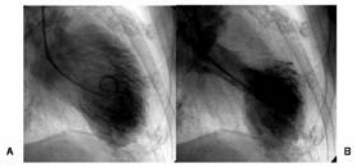
Teraoka K et al. :Int J Cardiovasc Imaging,2005;21:325-329

An Old Wome with Chest pain

- An 88-year-old woman was referred to our hospital, because of a severe chest pain.



Takotsubo Cardiomyopathy

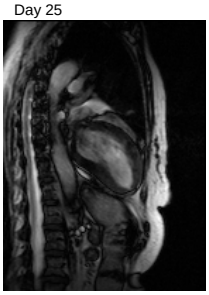


Teraoka K et al, Circulation 2005;111e261-262

Takotsubo Cardiomyopathy

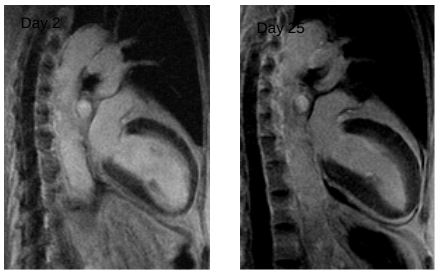
Day 2

Day 25



Teraoka K et al, **Circulation** 2005;111e261-262

Takotsubo Cardiomyopathy with No delayed enhancement



After gadolinium-DTPA injection no late hyperenhancement of the apical portion was observed either on day 2 or day 25.

Teraoka K et al, Circulation2005;111e261-262

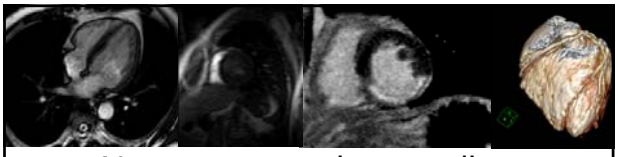
Role of cardiac MR for chest pain assessment

Summary

1) CMR for the Pts with AMI, ACS before PCI
・・・ under the challenging

2) CMR for the Pts with AMI,ACS after PCI,
Chronic ischemic disease, Myocarditis, Cardiomyopathy
・・・already Prepared

Function /Morphology
Detectability of Ischemia and Infarction / Viability /infarct size /Myocardial tissue characterization
Coronary artery anatomy and plaque imaging
(under the challenging)



Now we are at the start-line
for using CMR as clinical routine,
and making the clinical evidence
of the efficacy of CMR for the
chest pain assessment

Soon we will catch up with other modality like …..

Thank You !
Have a Good CMR
Examination