

## Myocardial Tagging and Tissue Velocity MRI:



Young Jin Kim, MD  
 Department of Radiology  
 Severance Hospital  
 Yonsei University College of Medicine

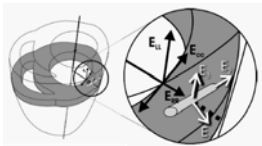


## Evaluation of Myocardial Function using Tagging MRI

### Myocardial Strain Imaging

• Measurement of **fractional change in length (%)** from resting state to the state following myocardial contraction

- Contraction or shortening : (-) values
- Lengthening : (+) values



#### Normal strains

- $E_{CC}$ : Circumferential shortening
- $E_{RR}$ : Radial thickening
- $E_{LL}$ : Longitudinal shortening

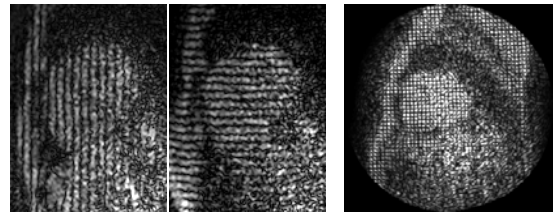
#### Principal strains

- $E1(\lambda_1)$ : Maximal principal strain
- $E2(\lambda_2)$ : Minimal principal strain

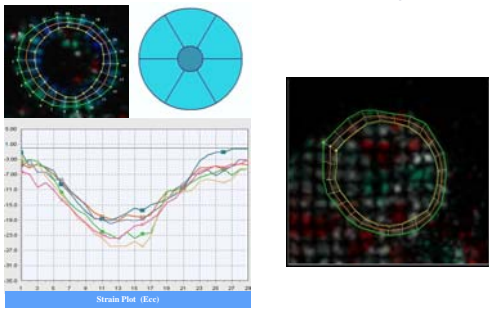
Castillo et al. Radiology 2003

### Myocardial tagging MRI

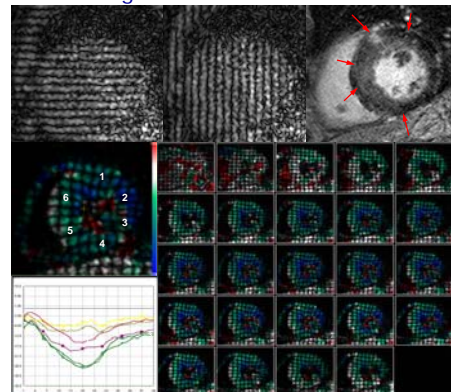
- Cine MRI by applying a special RF pre-pulse  
 → induces a local saturation depicted on images as a dark line superimposed on myocardial tissue



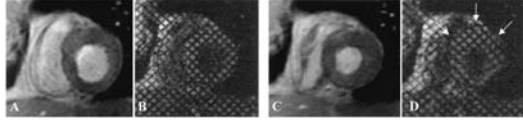
### Quantitative Analysis of Regional Wall Motion on Tagged MRI- Harmonic phase (HARP) analysis



### Assessment of Regional LV Function in HCM



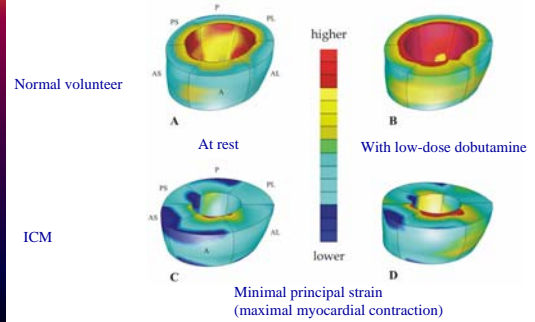
### High-dose dobutamine MR with myocardial tagging For detection of myocardial ischemia



High-dose dobutamine-CMR with myocardial tagging improves the detection of new wall motion abnormalities, which are indicative of myocardial ischemia.  
Dobutamine-CMR with myocardial tagging detected more NWMA compared with dobutamine-CMR without tagging.

*Kuijpers et al. Circulation 2003;107:1592-1597*

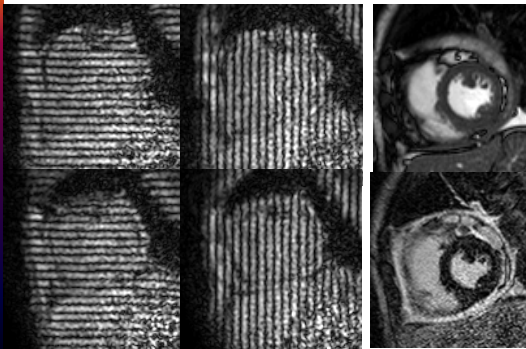
### Assessment of Regional LV Function in ICM



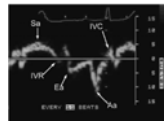
Minimal principal strain  
(maximal myocardial contraction)

*Moustakidis P, et al. J Surg Res 2004*

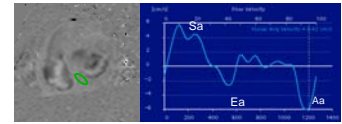
### Constrictive Pericarditis



### Evaluation of Myocardial Function using Tissue Velocity MR

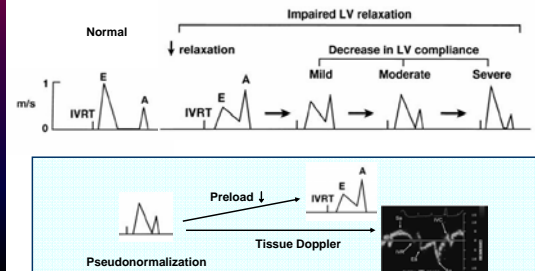
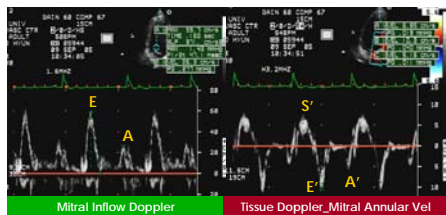
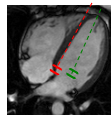


Tissue Doppler



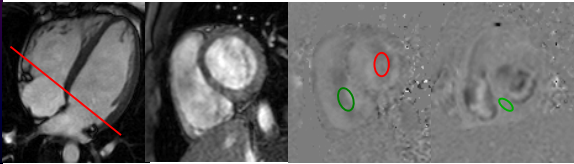
Tissue Velocity MRI

### Tissue Doppler

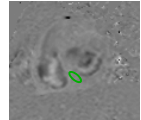
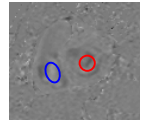
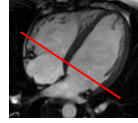


## Velocity encoding MR (Phase Contrast MR)

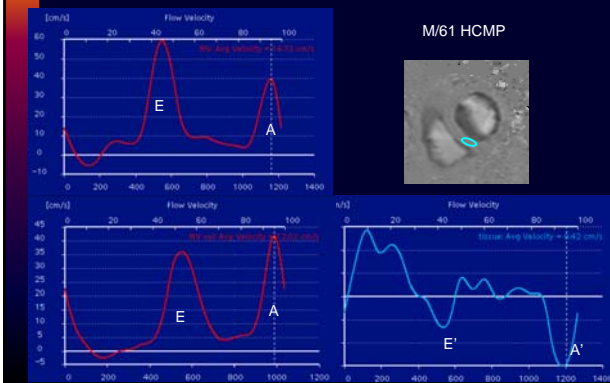
- Evaluation of Diastolic Function by MR
  - Mitral inflow velocity using VENC MR
  - Tissue velocity using VENC MR



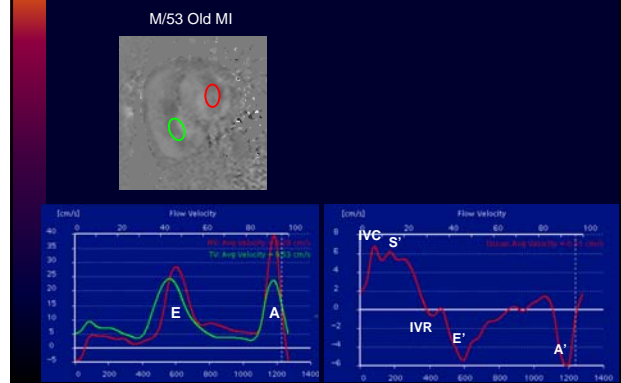
- Mitral Inflow Velocity MR
  - Routine VENC-MR
    - at the level of mitral valve tip
    - TR 5.3ms, TE 3.0ms, FA 15°
    - 128 x 256 matrix, ST 8mm, 1NEX
    - 30-40 phase per cardiac cycle
    - SENSE factor=2
    - V<sub>ENC</sub>=100cm/sec
  - Valsalva VENC-MR
    - During Valsalva maneuver at the same level
    - same parameters
- Tissue velocity MR
  - V<sub>ENC</sub>=50cm/sec
  - ROI: posterior basal septum



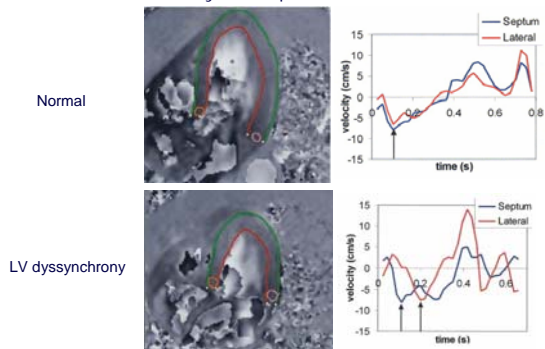
## Evaluation of Diastolic Function by MR



## Evaluation of Diastolic Function by MR



## Assessment of LV dyssynchrony in patients with conduction delay & idiopathic DCMP



Westenberg et al. JACC 2006;47:2042-8