Cardiovascular MR

CV-I *T1 map and more*
(3 speakers, 90 min)

CV-II *Flow and motion*
(4 speakers, 90 min)

CV-III *Cardiac: Ischemic Heart*
(3 speakers, 90 min)

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Time Table

Saturday, May 21, 2022
Room 203

Time	Topics	Speakers	Moderators
13:30-14:00 (30mins)	T1 map, the basics	Teng-Yi Huang	Hajime Sakuma Chun-Ho Yun
14:00-14:30 (30mins)	Stress T1 mapping	Chun-Ho Yun	Hajime Sakuma Chun-Ho Yun
14:30-15:00 (30mins)	Virtual LGE by ShMOLLI T1 mapping	Vanessa M. Fereirra	Hajime Sakuma Chun-Ho Yun

T1 map and more

Organizer: Chun-Ho Yun

Overview:

T1 mapping has been used for the quantitative measures of myocardium in various cardiovascular diseases. By this gadolinium-free MR technique, stress T1 mapping was applied in detecting myocardial ischemia and microvascular disease in research field recently. In addition, artificial intelligence was used to generate virtual native enhancement (VNE) images from ShMOLLI T1 mapping and CINE images which may increase the feasibility of T1 mapping in clinical practice. In this session, the physics, advanced applications, and artificial intelligence in the field of non-enhanced T1 mapping will be discussed.

T1 map, the basics

- Professor, Department of electrical engineering, National Taiwan University of Science and Technology
- Major interest: Cloud applications, magnetic resonance imaging systems, medical electronics, biomedical imaging and signal processing, high-performance parallel GPU operations.

Teng-Yi Huang, PhD, Taiwan

T1 map, the basics

- **Synopsis:**
- Recent advanced cardiac T1 mapping methods allow the quantitative assessment of cardiac diseases using absolute T1 values of the myocardium. Alterations of myocardial T1 values have been shown associated with tissue characteristics, and quantitative T1 analysis of myocardium has enabled further insight into myocardial fibrosis. The modified Look-Locker inversion recovery (MOLLI) sequence is commonly used for T1 mapping of the heart. The pulse sequence of MOLLI consists of several inversion recovery blocks and balanced SSFP readouts to sample the inversion recovery curve of the myocardium. Subsequently, a pixel-by-pixel fitting with the Look-Locker algorithm is generally applied to achieve myocardial T1 mapping. Later variants of MOLLI, MOLLI5(3s)3, shMOLLI, and SHASA exhibit pros and cons, including breath-hold time, heart-rate sensitivity, absolute accuracy and precision, image artifacts, and reproducibility. In this talk, the speaker will elaborate on the underlying basics and technical considerations of myocardial T1 mapping. The pitfalls of MOLLI variants will be discussed.

Stress T1 mapping

- Associate Professor, MacKay Junior College of Medicine, Nursing and Management
- Senior Attending , Department of Radiology, MacKay memorial hospital, Taipei, Taiwan.
- Major interest: Cardiovascular CT and MRI imaging

Chun-Ho Yun, MD, PhD, Taiwan

Stress T1 mapping

- **Synopsis:**

- Stress T1 mapping has potential applications in patients with CAD. In normal myocardium, the resting T1 is normal, with a 6% rise during stress. In chronic infarcted myocardium, the resting T1 is significantly elevated compared to normal myocardium, with limited change in T1 during stress. Adenosine stress and rest T1 mapping may be used to distinguish normal, infarcted, and ischemic myocardium, without the need for enhanced perfusion images. In recent stress agent study, the dypiridamole revealed similar effect as compared to adenosine. In addition, stress T1 mapping may also be used to assess coronary vasodilatory reserve in patients with microvascular disease.

- **Key Reference**:

- State-of-the-art review: stress T1 mapping-technical considerations, pitfalls and emerging clinical applications. MAGMA. 2018 Feb;31(1):131-141. doi: 10.1007/s10334-017-0649-5.

- Adenosine stress native T1 mapping detects microvascular disease in diabetic cardiomyopathy, without the need for gadolinium-based contrast. JCMR, 2015, 17(Suppl 1):Q55

- Adenosine stress native T1 mapping in severe aortic stenosis: evidence for a role of the intravascular compartment on myocardial T1 values. JCMR, 16, 92 (2014)

Virtual LGE by ShMOLLI T1 mapping

Vanessa M. Ferreira

SB MD DPhil FRCPC FHEA FSCMR

- British Heart Foundation Associate Professor of Cardiovascular Medicine, University of Oxford
- Deputy Director, University of Oxford Centre for Clinical Magnetic Resonance Research (OCMR)
- Honorary Consultant Cardiologist
- Major interest: Cardiovascular magnetic resonance (CMR), Quantitative parametric mapping, Contrast-agent-free CMR approaches

Virtual LGE by ShMOLLI T1 mapping

- **Synopsis:**

- CMR is the imaging gold standard for assessing cardiac structure, function and tissue characterisation. Conventionally, CMR myocardial tissue characterisation requires the injection of gadolinium-based contrast agents (GBCAs) to generate late gadolinium enhancement (LGE) images. Novel CMR technologies are now available to potentially obviate the use of GBCAs. Virtual Native Enhancement (VNE) is an artificial-intelligence machine learning-based approach that can generate "virtual LGE" images using cine images and native T1-mapping. This talk introduces the development of the VNE technology and its potential clinical applications

- **Key Reference:**

- Zhang Q. et al, Toward Replacing Late Gadolinium Enhancement with Artificial Intelligence Virtual Native Enhancement for Gadolinium-Free Cardiovascular Magnetic Resonance Tissue Characterization in Hypertrophic Cardiomyopathy. **Circulation. 2021;144:589–599**. Hann E, et al. "Deep Neural Network Ensemble for On-the-Fly Quality Control-Driven Segmentation of Cardiac MRI T1 Mapping". **Medical Image Analysis 2021 (71),102029**. SK Piechnik et al. Shortened Modified Look-Locker Inversion recovery (ShMOLLI) for clinical myocardial T1-mapping at 1.5 and 3 T within a 9 heartbeat breathhold. **JCMR 2010, 12: 69**