[SY19] Chest Symposium l

SY19-01

Perfusion MR

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The aim of this presentation is to indicate the utility of perfusion MRI by introducing recent literatures.

Several methods have been developed for perfusion MRI, and they are divided into non-contrast and contrast-enhanced imaging methods.

Phase-contrast MRI is a non-contrast method that can measure the blood flow of the large pulmonary vessels in patients with pulmonary hypertension and interstitial pneumonia (1). Liu CY, et al reported that PA strain, measured by phase-contrast MRI was reduced in the patients with chronic obstructive lung disease (COPD) compared with controls (P=0.002) and was inversely correlated with COPD severity (P=0.004) (2). Fourier decomposition is a contrast-agent-free 1H MR image acquisition and post-processing method for lung perfusion and ventilation assessment. This method can demonstrate ventilation–perfusion mismatch in patients with chronic thromboembolic hypertension and those with chronic obstructive pulmonary disease (3).

Contrast-enhanced perfusion imaging is widely used clinically. The indicator dilution theory has been used to calculate indices of lung perfusion such as mean transit time (MTT), pulmonary blood flow (PBF), and pulmonary blood volume (PBV) by dedicated post-processing software. Whether the lungs are receiving blood from the pulmonary and bronchial arteries must be determined, and the double-input function has recently been used to quantify total lung perfusion. Contrast-enhanced perfusion MRI is used to differentiate benign and malignant pulmonary nodules. Dynamic first-pass contrast-enhanced MRI with a 3D gradient recalled echo sequence and ultrashort echo time has demonstrated superior diagnostic performance in a direct and prospective comparison study of dynamic contrast-enhanced computed tomography (CT) and co-registered fluorodeoxyglucose-positron emission tomography/CT (4). Perfusion MRI is also used to predict postoperative lung function (5).

Perfusion MRI is useful for assessing pulmonary perfusion, understanding pathophysiological mechanisms, and diagnosing multiple pulmonary diseases.

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SY19-02

UTE MR and application to functional imaging

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Lung MRI has been limited in its use mainly due to following innate characteristics of the lung: a paucity of protons; shortened T2* due to large magnetic-susceptibility differences at the interface between airspace and bronchovascular structure; and cardiopulmonary motions. Such difficulties can be mitigated with ultrashort-echo time (UTE) MRI. UTE-MRI provides high-resolution 3D MR images and gives a chance to produce a functional lung imaging with endogenous tissue contrast or exogenous contrast media. In this session, we will review the current status of UTE-MRI for anatomic and functional lung imaging.

Keywords : Ultra-short echo time, Magnetic resonance imaging, Lung

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SY19-03

Ventilation MR Imaging

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Ventilation is one of the essential pulmonary functions and its appropriate evaluation is an important biomarker of pulmonary function. PFT (Pulmonary Function Test) is the most widely used test of the respiratory system and provides some valuable measurements of ventilation such as FVC (Forced Volume Capability), FEV1(Forced Expiratory Volume at the first second), FEF (Forced Expiratory Flow) etc. Recently, image-based evaluation of ventilation using CT and MRI has been proposed which provides a ventilation (weighted) map of the lung. Especially, with versatility in image contrast and no risk of radiation exposure, MR imaging is getting more and more attention in ventilation imaging despite some technical challenges caused by low proton density, respiratory motion, and magnetic susceptibility artifacts. In this talk, I will review several existing ventilation MR imaging methods in terms of their pros and cons, including the hyperpolarized gas (e.g., 129Xe and 3He) imaging, the oxygen-enhanced imaging, and some other methods which do not use any exogenous gases, e.g., PREFUL (Phase Resolved Functional Lung) imaging, SENCEFUL (Self-gated Non-contrast-enhanced Functional Lung) imaging, and UTE (ultrashort echo-time) imaging. Then I will introduce what our lab is working on these days, that is, the feasibility of 3D UTE imaging with retrospective respiratory gating for evaluating ventilation, not relying on both exogenous gases and image registration (or interpolation) between expiration and inspiration.