Methods En Vogue: How Have They Fared Over Time?
Contrast Agents

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MRI provides a rich pallet of tissue contrasts different and often better than CT and Ultrasound. Accordingly, there was initially some skepticism as to the utility of exogenous contrast agents which add risk and cost to an otherwise extra-ordinarily safe imaging modality. However, time has shown that Gadolinium based and other contrast agents enrich the MRI information to enhance diagnostic accuracy for many diseases, especially inflammation, necrosis and neoplasms. Sometimes, contrast agents do not increase the already high accuracy of pre-contrast MRI but they are still essential because they provide greater diagnostic confidence to facilitate efficient clinical decision making. Often the diagnosis is already known but the desire to push MRI technology for maximum image quality require the huge extra SNR boost attained with exogenous contrast. Paramagnetic exogenous contrast agents shorten T1 relaxation allowing faster T1-weighted acquisitions with higher spatial resolution and SNR. 3D MRI data are readily acquired sufficiently rapidly for breatholding using only modest doses of gadoliniuim based contrast agents.

Many pathways of introduction into the body have been explored. Inhalational agents, e.g. Helium^3, demonstrate patterns of airflow in the lung which may be disturbed in asthmatics and other pulmonary diseases. Ingestable contrast with non-absorbable surgar, e.g. sorbitol, can distend the stomach and small bowel to better delineate mucosal abnormalities of various inflammatory bowel diseases. Rectal/vaginal distension with ultrasound jelly improves depiction of rectal and cervical carcinoma to improve surgical planning.

Unique information from time-resolved imaging of contrast agent passage through the body has led to development of a plethora of sophisticated pulse sequences and reconstruction methods to capture the dynamics and physiological information of the contrast bolus introduction into the body, redistribution into various compartments and its eventual excretion. Agents based upon relatively unique nuclei, e.g. perfluorocarbons and/or hyperpolarization, e.g. Carbon 13 have greater sensitivity for the contrast agents allowing detection and tracking of infinitesimally small quanties. Chemical exchange effects can be captured with CEST and paraCEST agents.

In this talk we review the incorporation of MR Contrast Agents into routine clinical practice and explore future directions for contrast agents advances in utilization and development.