Breast MRI - AI Impact on Diagnostic Confidence

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Dynamic contrast-enhanced MR (DCE MR) is commonly used for detection and characterization of malignancies in the breast. However, suboptimal compromises are often made between temporal and spatial resolution in conventional breast DCE MR
A high spatial resolution is required to characterize lesion morphology, whereas a high temporal resolution is required to accurately characterize contrast uptake both for semi-quantitative and quantitative analysis of contrast enhancement kinetics.
Since 2015, we were able to use a new variable spatiotemporal resolution dynamic contrast enhanced (DCE) MR method (parallel imaging technique SENSE) for imaging of breast cancer. This sequence combines a 3D T1 gradient echo SPGR sequence with fat saturation, a pseudorandom variable density, and a k-space segmentation. This sequence provides high resolution combined with high temporal resolution.

Recently, the ability to combine SENSE with a compressed sensing technique allowed us to reach a faster temporal resolution to study first pass perfusion.
Compressed SENSE ultrafast MRI sequence utilizes kinetic information of the very early phase within 90s after contrast injection with an achieved temporal resolution of 6s per phase. A previous study reported that these ultrafast protocols were useful for distinguishing benign from malignant lesions.

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Moreover, artificial intelligence, particularly deep-learning (DL) techniques, have recently been introduced to improve image quality (SNR and sharpness) as well as to enable scan time reductions. The recent introduction of DL reconstruction algorithm allows to remove noise and Gibbs ringing artifacts prior to final image formation.

The DL reconstruction algorithm is embedded in the MR image reconstruction pipeline, requiring access to raw data. The neural network employs a cascade of over 100,000 unique pattern recognitions for noise and low resolution to reconstruct only the ideal object image. Users have the freedom to select their own level of SNR improvement through a user interface that provides a low, medium or high setting. The result is an image with higher SNR and spatial resolution.

The combination of both techniques drastically improves clinical diagnostic confidence in our daily practice, especially in pre-menopausal women, the fibro glandular tissue enhancement (background parenchymal enhancement –BPE) can be very intense even in the first minute and it is difficult to differentiate breast cancer from the overall enhancement of adjacent tissue.

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