Redefining MRI:
From Image to Insight

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Female Pelvic MRI in the Era of Deep Learning Reconstruction: Toward More Robust T2WI and DWI

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T2-weighted imaging (T2WI) remains the cornerstone of female pelvic MRI, providing excellent soft-tissue contrast and detailed anatomical information for the evaluation of a wide range of gynecologic disorders. The accurate assessment relies heavily on high-quality T2WI. Traditionally, fast spin-echo (FSE)-based techniques, including conventional FSE and PROPELLER acquisitions, have been used to obtain diagnostic T2-weighted images. However, image quality may still be compromised by patient motion, bowel peristalsis, and limitations in acquisition time. Recent advances in deep learning (DL)-based image reconstruction have transformed MRI by improving image quality while preserving or even reducing scan time, thereby opening new possibilities for female pelvic imaging.

Single-shot fast spin-echo (SSFSE) imaging has historically been limited to selected applications, such as fetal MRI, because of its relatively low spatial resolution, image blurring, and reduced signal-to-noise ratio. The introduction of DL reconstruction has substantially reduced these drawbacks. As a result, SSFSE T2WI can now achieve image quality that is suitable for routine clinical practice while maintaining the inherent advantages of rapid acquisition and reduced motion sensitivity. Such characteristics are particularly beneficial in female pelvic MRI, where respiratory motion, bowel movement, and uterine peristalsis frequently affect image quality.

Diffusion-weighted imaging (DWI) has become an indispensable component of modern pelvic MRI protocols. It provides functional information regarding tissue cellularity and microstructural characteristics and contributes significantly to lesion detection, characterization, staging, and treatment response assessment in gynecologic malignancies. Although DL reconstruction has improved the signal-to-noise ratio and overall quality of DWI, most commercially available approaches remain based on echo-planar imaging (EPI). Consequently, susceptibility artifacts caused by bowel gas remain major challenges, particularly in the pelvis, where such artifacts may obscure lesions or reduce diagnostic confidence.

PROPELLER DWI offers a promising solution to these limitations. By acquiring multiple overlapping k-space datasets (“blades”) and incorporating intrinsic motion correction, PROPELLER techniques are inherently less sensitive to motion and susceptibility-related distortions than conventional EPI-based DWI. Recent advances in DL reconstruction have further improved image quality and feasibility, facilitating the broader clinical implementation of PROPELLER DWI. This approach is expected to be particularly valuable in diseases of the uterine cervix, where rectal gas frequently degrades image quality and complicates lesion evaluation.

The clinical implications of these developments extend beyond simple image enhancement. More robust T2WI and DWI may improve diagnostic confidence, reduce nondiagnostic examinations.

In this lecture, we will review recent advances in DL-reconstructed MRI of the female pelvis, focusing on SSFSE-based T2WI and PROPELLER DWI. Through representative clinical cases, we will demonstrate how these techniques improve image quality, reduce artifacts, and enhance diagnostic performance. We will also discuss future directions for integrating DL reconstruction into routine gynecologic MRI and its potential role in establishing more robust, reliable, and patient-centered imaging protocols.