Redefining MRI:
From Image to Insight

ICMRI 2026
THE 14th INTERNATIONAL CONGRESS ON MRI
& 37th ANNUAL SCIENTIFIC MEETING OF KSMRM

AUGUST 27 - 28, 2026
Grand Walkerhill Seoul, Seoul, Korea
https://icmri.ksmrm.org/2026m

**MSK 2**

**SY04-2**

# Updates in CT-Like MR Imaging

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Bone MR imaging has challenge, since its T2* is on the order of a few hundred microseconds and the signal is therefore lost before conventional echo times are reached. To address this limitation, ultrashort echo time imaging was introduced first, followed by zero echo time (ZTE) imaging, in which encoding is initiated at excitation. In ZTE, the free induction decay is sampled while the readout gradient is already applied. ZTE has since been widely implemented, as signal from bone tissue is directly acquired and the acquisition is rapid, nearly silent, and tolerant of motion.

Recent developments in deep learning have significantly enhanced the image quality of zero echo time (ZTE) imaging, enabling improved visualization and diagnostic performance. Two developments are highlighted. First, when deep learning reconstruction (AIR Recon DL) is applied to ZTE raw data, signal-to-noise ratio and spatial resolution are improved, and cortical margins and small osseous lesions are more clearly depicted. Second, fat–water displacement blurring inherent to radial sampling, which is not corrected by denoising alone, is specifically addressed by deep learning–based chemical shift correction; sharper cortical boundaries have been demonstrated from identical raw data. ZTE has been extended beyond the skull and shoulder to the spine, pelvis, small joints.

Several limitations should be noted, including trade-offs associated with reconstruction strength, gains in reader confidence not accompanied by validation of accuracy, and susceptibility to field inhomogeneity and metallic hardware. Multicenter validation is required before CT can be routinely replaced.

*Keywords:* *Zero echo time (ZTE), CT-like MR imaging, Deep learning reconstruction, Chemical shift correction*