Redefining MRI:
From Image to Insight

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Clinical Implementation of Breast CT: The Korean Experience

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Contrast-enhanced breast MRI has become an essential imaging modality in Korea for the preoperative evaluation of breast cancer, providing accurate assessment of disease extent for surgical planning and monitoring tumor response during neoadjuvant chemotherapy. However, its routine clinical use is often limited by high cost, limited availability, prolonged examination time, and patient discomfort associated with prone positioning on a breast coil in a confined scanner.

Recent advances in photon-counting detector technology and AI-based image reconstruction have renewed interest in dedicated breast CT. By combining ultra-low-dose image acquisition with advanced reconstruction algorithms, modern breast CT can generate high-quality contrast-enhanced three-dimensional volumetric images while substantially reducing radiation exposure compared with earlier generations of breast CT. Similar AI-assisted reconstruction techniques have already been successfully implemented across various CT applications.

Dedicated breast CT offers several practical advantages over breast MRI. The examination is performed without breast compression in an open gantry, improving patient comfort and eliminating concerns related to claustrophobia. In addition, breast CT simultaneously depicts both contrast enhancement and microcalcifications within the same three-dimensional dataset. Unlike the conventional approach of mentally correlating mammographic calcifications with MRI enhancement, breast CT enables direct visualization of whether suspicious calcifications correspond to enhancing tumor, potentially improving the assessment of disease extent, particularly in patients with calcified breast cancers.

To evaluate the clinical feasibility of breast CT in Korea, we recently conducted a prospective multicenter pilot study involving three tertiary breast cancer centers in Seoul. Patients with newly diagnosed breast cancer who underwent mammography, breast ultrasound, and preoperative breast MRI additionally underwent contrast-enhanced photon-counting low-dose breast CT. The study investigated whether breast CT could provide diagnostic performance comparable to MRI for preoperative evaluation and explored its potential role in treatment planning and response assessment during neoadjuvant chemotherapy.

Among 34 patients with stage Tis–T2 clinically node-negative breast cancer, photon-counting low-dose breast CT demonstrated diagnostic performance comparable to breast MRI. Index cancer detection, tumor size measurement, lesion-to-nipple distance, and detection of additional ipsilateral lesions showed no significant differences between the two modalities. Although MRI yielded more false-positive findings, breast CT demonstrated significantly lower background parenchymal enhancement, resulting in improved lesion conspicuity. Agreement between imaging findings and pathologic tumor extent was comparable between breast CT and MRI.

As photon-counting technology and AI-based reconstruction continue to advance, dedicated breast CT is expected to become an increasingly valuable complementary imaging modality to breast MRI and may serve as an alternative in selected clinical scenarios. Our early multicenter experience in Korea provides encouraging evidence supporting its integration into the preoperative imaging pathway for breast cancer and highlights its potential role in improving patient comfort, diagnostic confidence, and individualized treatment planning.

Keywords: *Breast computed tomography, Photon-counting CT, Breast MRI, Breast cancer, Contrast-enhanced imaging*