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## **Deep Dive into Clinical Application of Deep Learning: K-Radiology**

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This lecture introduces “K-Radiology,” a practice-oriented perspective on how deep learning technologies are being integrated into everyday clinical neuroradiology. Rather than focusing on experimental models, the talk emphasizes applications that have already demonstrated clinical feasibility and are reshaping workflows across acquisition, interpretation, and prognostic assessment. The structure of the lecture follows the radiologic workflow—upstream, midstream, and downstream—highlighting both the strengths and limitations of these approaches.

In the upstream domain, physics-based accelerated MRI acquisition has proven effective in reducing scan times while preserving diagnostic image quality in routine brain imaging. Such acceleration is particularly valuable in high-volume tertiary centers, where efficiency is essential. Deep learning-based super-resolution and denoising algorithms enhance perfusion MRI, improving reproducibility and diagnostic consistency in pharmacokinetic assessments of the blood-brain barrier. Furthermore, unsupervised learning strategies allow generation of parametric maps without the need for arterial input function measurements, addressing long-standing technical limitations of conventional quantitative imaging.

The midstream stage illustrates how automation supports radiologists in quantification and lesion detection. CT-based body composition analysis has emerged as a clinically relevant biomarker in neurodegenerative disease cohorts, providing prognostic information that complements conventional pulmonary function tests. In neuroimaging, AI-assisted detection of acute intracranial hemorrhage on CT improves diagnostic accuracy for both specialists and non-specialists, reducing the risk of missed findings in urgent care. Real-time ultrasound applications, such as automated thyroid nodule detection and segmentation, further demonstrate how AI can provide immediate clinical support during routine examinations.

Downstream, imaging-based prediction models show growing utility in prognosis estimation and clinical decision-making. Despite encouraging results, these models remain vulnerable to overfitting and data dependency, underscoring the need for robust validation, multi-center evaluation, and careful consideration of generalizability. As these systems evolve, their integration into multimodal frameworks combining imaging and clinical data offers the potential to further enhance predictive accuracy.

In summary, deep learning is steadily being translated into daily clinical practice. “K-Radiology” reflects its role in this process, with innovative Korean startup products helping to accelerate real-world adoption. At the same time, balanced evaluation of reproducibility, safety, and clinical value remains essential to ensure that these technologies contribute meaningfully to patient care.

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