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Advanced Radiomics Pipeline to Predict Chronic Kidney Disease Based Bone Fragility using Texture Features

AI radiomics pipeline predicting fracture risk from HR-pQCT scans in chronic kidney disease patients.

Individuals with Chronic Kidney Disease (CKD) have 17x higher risk of bone fracture than those without CKD, with most bone fractures caused by a weakening of the cortical bone. The current imaging gold standard for assessing fracture risk is dual-energy X-ray absorptiometry (DXA), but this technique underestimates the fracture risk in individuals with CKD. An alternative bone imaging technique is high-resolution peripheral quantitative computed tomography (HR-pQCT), which has improved assessment of CKD-associated bone features due to the high-resolution of the images but still misses some cases, thus requiring the use of complementary approaches to increase the detection rate of bone fragility due to CKD. For example, radiomics texture feature extraction could be a useful tool for determining bone fracture-risk characteristics, but it is currently underutilized with bone imaging techniques like HR-pQCT. Radiomics can provide information on CKD-related textural features in the bone using tools such as mathematical analysis and artificial intelligence. Researchers at Purdue University have integrated a radiomics texture feature extraction neural network model trained on HR-pQCT images to increase the reliability of CKD-derived bone fracture risk assessment and enhance current clinical imaging techniques. This can enable earlier identification of fracture risk and inform targeted fracture prevention strategies for individuals with CKD.

Advantages

-Capable of differentiating between CKD and non-CKD individuals based on image analysis of the cortical bone

Applications

-Bone fragility identification for CKD or other diseases that can weaken bone structure, making fracture risk higher

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Category
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Medtech & Digital Health/Health Informatics

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Related Publications

Lee, Y et al. Integrating deep learning and machine learning for improved CKD-related cortical bone assessment in HRpQCT images: A pilot study, Bone Reports, Volume 24, 2025, 101821,

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