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## **Quantitative CT-based radiomics texture features for identifying histological phenotypes in kidney biopsy**

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**Objectives:** Kidney biopsy is a golden standard for various kidney diseases, providing semi-quantitative histological information. Despite its diagnostic and prognostic values, kidney biopsy is selectively performed due to its invasiveness. Recently, radiomics has been of growing research interest as a potential tool to quantify medical images. In this study, we aimed to evaluate the association between CT-based radiomics features and histological findings in kidney biopsy.

**Methods:** We included patients aged  $\geq 18$  years who underwent kidney biopsy and abdominal CT scan within a month from kidney biopsy at the Inha University Hospital. Left kidney was segmented using a semi-automatic software in two ways (whole renal parenchyma and isovolume cortical sampling). First-order and texture features (GLCM, GLSZM, GLRLM, GLDM) were extracted from three dimensional CT images with pyradiomics packages after resampling and kernel normalization.

**Results:** Of the 49 patients, 42.9% were men, and mean age was 51.4 years. Mean estimated glomerular filtration rate (eGFR) was 58.9 ml/min/1.73m<sup>2</sup>, and 51% had eGFR <60ml/min/1.73m<sup>2</sup>. Some texture features extracted from entire kidney parenchyma had correlation coefficients of 0.3-0.4 with interstitial fibrosis and tubular atrophy. The most correlated feature was GLSZM LargeAreaHighGrayLevelEmphasis. GLSZM LargeAreaHighGrayLevelEmphasis showed an AUC of 0.75-0.76 for interstitial fibrosis or tubular atrophy. To reduce the effect of mask volume on texture feature values, we analyzed with features extracted from the same volume of cortex. As a result, the AUCs of most texture features were decreased. However, some volume-independent features such as GLSZM GrayLevelNonUniformityNormalized and GLCM Idn showed significant AUC values for histological findings. GLSZM GrayLevelNonUniformityNormalized was the most accurate texture feature for glomerular sclerosis.

**Conclusions:** In conclusion, we identified the associations between CT-based texture features and histological findings in kidney biopsy. We found that CT-based texture features consist of volume-dependent and independent texture features. Further larger studies are warranted.

Figure 1. ROC curves and feature maps of GLSZM LargeAreaHighGrayLevelEmphasis and GLSZM GrayLevelNonUniformityNormalized