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Radiomic features of high risk coronary atherosclerotic plaques in coronary CT angiography

Abstract: P534

Radiomic features of high risk coronary atherosclerotic plaques in coronary CT angiography

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Introduction: Positive remodeling (PR), low attenuation (LA), spotty calcium (SC) and the napkin-ring sign (NRS) have been associated with major adverse cardiac events. PR, LA, SC are semi-quantitative plaque features, and require quantitative measurements, while the NRS is a qualitative parameter showing a distinct morphology. The NRS is described as: a non-calcified plaque cross-section with a central area of low CT attenuation that is apparently in contact with the lumen, which is surrounded by a ring-like higher attenuation plaque tissue. The reproducible identification of NRS is challenging since it relies solely on qualitative image interpretation. Radiomics is the process of extracting various different quantitative features from a given pathology to describe morphology. Therefore, our aim was to assess whether radiomic features are capable to identify the NRS.

Methods: We included 20 patients (mean age: 63.8±8.9, 20% female), 10 with NRS plaque and 10 matched patients with non-NRS lesions. We matched the patients and plaques based-on plaque localization, plaque type and stenosis severity. Coronary lesions were segmented and voxels containing the vessel wall were exported as a DICOM dataset. Radiomic features were calculated on the exported datasets. Radiomic feature values were compared between the two groups using Wilcoxon signed-rank test. Diagnostic accuracy was described using the Area Under the Curve (AUC) of Receiver Operating Characteristics calculations.

Results: Overall, 15608 quantitative features were calculated for each lesion. 4619 (29.6%) parameters showed significant difference between the two groups at a $p<0.05$ level, 1270 (8.1%) at $p<0.01$. In total, 2834 (18.3%) of the calculated parameters had a AUC value greater than 0.8, 510 (3.3%) had a value greater than 0.9 and 83 (0.5%) had an AUC value greater than 0.95.

Conclusions: To the best of our knowledge, this is the first study to demonstrate the feasibility of calculating radiomic features on coronary lesions. Based on our results, radiomics seems to be a promising new technique capable of quantifying lesion morphology and identifying high-risk coronary plaques.