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Association of coronary plaque characteristics and the translesional gradient by FFRct in asymptomatic patients with newly diagnosed type-2 diabetes mellitus

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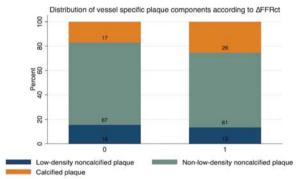
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Background: Coronary CT angiography (CCTA) derived fractional flow reserve (FFRct) is increasingly for decision-making in patients with stable chest pain. The relation between vessel specific plaque characteristics and the translesional gradient by FFRct in patients with type-2 diabetes mellitus (T2DM) is not fully explored.

Purpose: To examine the association between vessel specific plaque characteristics as determined by CCTA and the translesional gradient as assessed by FFRct in asymptomatic patients with newly diagnosed T2DM.

Methods: Total plaque volume and the volumes of calcified plaque (CP), low-density noncalcified plaque (LD-NCP) and non-LD-NCP were assessed on a per-vessel basis by quantitative plaque analysis using Autoplaque. Irregularities of the vessel wall giving a vessel-specific total plaque volume <50 mm^3 were excluded from the analyses. Positive remodeling was defined by a remodeling index >1.1. Spotty calcification was defined as calcifications comprising $<90°$ of the vessel circumference and <3 mm length. FFRct-analysis was performed from standard acquired CCTA data sets by HeartFlow. Any FFRct-value in the major coronary arteries >1.8 mm in diameter was registered. The translesional gradient, defined as the difference of FFRct-values immediately proximal and distal to lesion, was calculated in most severe lesion per-vessel. Lesions were categorized according to a ΔFFRct threshold of 0.06. Plaque analysis and comparison to ΔFFRct were performed by staff blinded to patient data.

Results: A total of 76 patients; age, mean (SD): 56 (11) years; males, n (%): 49 (65), with newly diagnosed (<1 year) T2DM were studied. Haemoglobin A1c, median (IQR) was 45 mmol/L (42–50). Risk factors, mean (SD) were as follows: total-cholesterol, 4.4 mmol/L (1.0); LDL-cholesterol, 2.5 mmol/L (0.8); systolic blood pressure, 131 mmHg (12). In the analysis 57 vessels in 30 patients were included, while 24 vessels were classified as having irregularities. ΔFFRct ≥0.06 was registered in 22 (39%) plaques. Vessel specific plaque volumes (mm^3), ΔFFRct ≥0.06 vs. ΔFFRct <0.06, were, median (IQR): LD-NCP, 28.1 (9.5–62.3) vs. 18.3 (10.2–27.5); non-LD-NCP, 129.5 (74.1–186.8) vs. 98.1 (65.7–142.1); total plaque volume, 209.4 (137.1–359.3) vs. 139.6 (108.3–220.0), all p>0.05. The vessel-specific CP volume, median (IQR), was higher in vessels with ΔFFRct ≥0.06 vs. ΔFFRct <0.06: 51.9 (20.5–85.4) vs. 13.5 (4.1–68.5), p=0.015. Adverse plaque characteristics ΔFFRct ≥0.06 vs. ΔFFRct <0.06, were, n (%): positive remodeling, 21 (95%) vs. 34 (97%) and spotty calcification, 9 (41%) vs. 14 (40%). The relative distribution of vessel specific plaque components according to ΔFFRct is illustrated in the Figure.

Conclusion: In asymptomatic patients with newly diagnosed and well-controlled T2DM, the occurrence of high-risk coronary plaque features was frequently observed. The applied translesional gradient by FFRct was not predictive of adverse coronary plaque characteristics.

Distribution of vessel specific plaque components according to ΔFFRct

0: plaques with ΔFFRct <0.06, 1: plaques with ΔFFRct ≥0.06. Calcified plaque: p = 0.025