The secret of INOCA: High-risk plaque but not calcium density predicts ischemia, and their relationship with perivascular fat gradient

Authors:
GM Feuchtnet1, F Barbieri1, C Langer1, C Beyer1, G Friedrich1, F Plank1, 1Innsbruck Medical University - Innsbruck - Austria,

Topic(s):
CT-derived FFR

Citation:

BACKGROUND

How high-risk plaque and calcified plaque density impact coronary flow in non-obstructive lesions, and how perivascular fat gradient (PG) correlates with high-risk plaque criteria, has not been explored.

OBJECTIVE

to assess whether high-risk plaque (HRP) or calcified, and non-calcified plaque burden, predicts ischemia using noninvasive computational FFRCT in non-obstructive lesions (INOCA), and how perivascular fat gradient (PG) correlates with plaque morphology

METHODS
120 patients referred to coronary CTA were selected for non-invasive FFR CT analysis (Heartflow Inc. Redwood Ca). The high risk plaque criteria: Low-attenuation-plaque density (HU), Napkin Ring Sign, positive remodelling, Spotty Calcification, and qCTA stenosis (MLA,MLD,%area,%diameter stenosis) was quantified in 89 lesions. Calcium plaque density was quantified (HU). Plaque composition was typed as: 1=calcified (ca), 2=mixed (ca>nonca), 3=mixed (nonca>ca), 4=noncalcified. A novel mixed plaque score (G-score, Sum of 1-4), segment involvement score (SIS) and Coronary Calcium Score were calculated.

Perivascular fat gradient (PG) was calculated among 3 ROIs (size, 0.2mm2) placed radiating (star like) from the lesion, and 2 gradients (PG 1 and 2) were calculated.

Results: The prevalence of lesion-based ischemia (FFRCT<0.8) was higher in high-risk plaque as compared to calcified (25% vs. 2.5%, p=0.007) despite stenosis % was equally in both groups (n=40 vs n=40 lesions), and the prevalence of distal ischemia (40% vs 17.5%), respectively. Lesion- based and distal FFRCT were lower in high-risk-plaque as compared to calcified (0.85 vs 0.93, p<0.001 and 0.79 vs 0.86, p=0.002), resp.

Lower plaque density (HU) (p=0.024) predicted lesion based FFRCT in low attenuation plaque. In all lesions (n=89) including low attenuation and calcified, the correlation strengthened (p=0.003).

Perivascular fat gradient (PG) was higher in high risk plaque as compared to calcified. (PG1: 25.3±13 vs 6.8±13, p<0.001 and PG 2: 19.5 ±13 vs 3.1±5, p< 0.001). PG was markedly higher in high risk plaque with Napkin Ring Sign ("Half moon sign" (n=12) with 27.3 HU ±10.3 as compared to those without NRS 17.05 ±16.5 , p< 0.001 (n=21).

There was an inverse weak trend between lower plaque HU with higher PG (r=-0.212, p=n.s.).

CONCLUSION. High risk plaque and total non-calcified plaque burden predict ischemia in non-obstructive lesions (INOCA) while an increasing calcium compactness acts contrary. The perivascular fat gradient is increased in high-risk plaque, and reflects an indicator for perivascular edema and plaque inflammation. The
Napkin Ring Sign rather than lower plaque density relates to plaque inflammation.