Incremental prognostic value of coronary plaque features on CT angiography in symptomatic patients with obstructive CAD

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Background: Several coronary computed tomography angiography (CCTA) studies have shown the strong prognostic value of the coronary artery disease (CAD) burden and the potential interest of the plaque composition analysis. However, the incremental prognostic value of this plaque analysis above the CAD burden in patients with obstructive CAD is not well established.

Purpose: To assess the incremental prognostic value of the plaque composition analysis using CCTA to predict major adverse cardiovascular events (MACEs) above traditional risk factors and CAD burden in consecutive symptomatic patients with obstructive CAD.

Methods: In a large multicentric registry, consecutive symptomatic patients without known CAD referred for CCTA were screened between 2008-2020. All patients with obstructive CAD (at least 1 ≥ 50% stenosis on CCTA) were included. The primary composite outcome was MACE defined by cardiovascular death or nonfatal myocardial infarction. CCTA data were interpreted using multiplanar reconstruction according to the 16-segment coronary artery model. Coronary segments were scored visually for both degree of luminal stenosis and composition of coronary plaque which were classified as noncalcified, mixed, or calcified.

To assess the prognostic value of each CCTA findings, different multivariable Cox regression models were used (Model 1: clinical [traditional risk factors]; Model 2: model 1 + CAD burden [number of proximal segments with stenosis ≥50% + number of vessels with obstructive CAD]; Model 3: model 2 + plaques feature [number of segments with noncalcified plaques]). The additional predictive value of each model for predicting MACEs was calculated using C-statistic increment, continuous net reclassification improvement (NRI), and the integrative discrimination index (IDI).

Results: Of 2,312 patients referred for CCTA, 2,038 (mean age 70±12 years, 46% men) completed follow-up (median 6.7 years; interquartile range: 5.9-9.1 years), and 319 experienced a MACE (14%). After adjustment for traditional risk factors, number of proximal segments with >50% stenosis, number of vessels with obstructive CAD, number of segments with noncalcified were all strongly associated with MACEs (all \( p < 0.001 \)).

After adjustment, the addition of the analysis of plaque features (model 3) showed the best improvement in model discrimination and reclassification above a model including traditional risk factors and CAD burden (model 2) (C-statistic improvement=0.03; NRI=45.0%; IDI=9.8%, Chi-2 global=412, all \( p < 0.001 \); LR-test \( p < 0.001 \)).

Conclusions: In a large cohort of symptomatic patients with obstructive CAD on CCTA, the analysis of plaque features had an incremental prognostic value to predict MACEs over and above a model combining traditional risk factors and CAD burden.
Survival curves for MACE

A- Number of proximal segments with >50%

HR= 1.70 (1.34-2.15)
p < 0.0001

B- Number of segments with non-calcified plaques

HR= 2.11 (1.82-2.46)
p < 0.0001
Incremental prognostic value of CCTA

<table>
<thead>
<tr>
<th>Model</th>
<th>C-index</th>
<th>NRI</th>
<th>IDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 1 Clinical</td>
<td>0.71</td>
<td>Reference</td>
<td>Reference</td>
</tr>
<tr>
<td>Model 2 Clinical + CAD burden</td>
<td>0.76</td>
<td>37.4%</td>
<td>45.0%</td>
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<tr>
<td>Model 3 Clinical + CAD burden + Plaque features</td>
<td>0.79</td>
<td>4.6%</td>
<td>9.6%</td>
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</tbody>
</table>

p < 0.001 for all