Journal of Cardiovascular Computed Tomography 17 (2023) 407–412

Contents lists available at ScienceDirect

Journal of Cardiovascular Computed Tomography

journal homepage: www.JournalofCardiovascularCT.com

Research paper

How early can atherosclerosis be detected by coronary CT angiography? Insights from quantitative CT analysis of serial scans in the PARADIGM trial

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ARTICLE INFO

Keywords:
Coronary CT angiography
Artificial intelligence

ABSTRACT

Background: Non-obstructing small coronary plaques may not be well recognized by expert readers during coronary computed tomography angiography (CCTA) evaluation. Recent developments in atherosclerosis

Abbreviations: AI-QCT, atherosclerosis-imaging quantitative computed tomography (AI-QCT); CAD, coronary artery disease; CCTA, coronary CT angiography; CT, computed tomography; IQR, interquartile range; PARADIGM, Progression of Atherosclerotic Plaque Determined by Computed Tomographic Angiography Imaging.

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https://doi.org/10.1016/j.jcct.2023.08.012
Received 22 March 2023; Received in revised form 20 July 2023; Accepted 21 August 2023
Available online 3 October 2023

Small plaque
Atherosclerosis
Coronary

imaging quantitative computed tomography (AI-QCT) enabled by machine learning allow for whole-heart coronary phenotyping of atherosclerosis, but its diagnostic role for detection of small plaques on CCTA is unknown.

Methods: We performed AI-QCT in patients who underwent serial CCTA in the multinational PARADIGM study. AI-QCT results were verified by a level III experienced reader, who was blinded to baseline and follow-up status of CCTA. This retrospective analysis aimed to characterize small plaques on baseline CCTA and evaluate their serial changes on follow-up imaging. Small plaques were defined as a total plaque volume <50 mm^3.

Results: A total of 99 patients with 502 small plaques were included. The median total plaque volume was 6.8 mm^3 (IQR 3.5–13.9 mm^3), most of which was non-calcified (median 6.2 mm^3; 2.9–12.3 mm^3). The median age at the time of baseline CCTA was 61 years old and 63% were male. The mean interscan period was 3.8 ± 1.6 years. On follow-up CCTA, 437 (87%) plaques were present at the same location as small plaques on baseline CCTA; 72% were larger and 15% decreased in volume. The median total plaque volume and non-calcified plaque volume increased to 18.9 mm^3 (IQR 8.3–45.2 mm^3) and 13.8 mm^3 (IQR 5.7–33.4 mm^3), respectively, among plaques that persisted on follow-up CCTA. Small plaques no longer visualized on follow-up CCTA were significantly more likely to be of lower volume, shorter in length, non-calcified, and more distal in the coronary artery, as compared with plaques that persisted at follow-up.

Conclusion: In this retrospective analysis from the PARADIGM study, small plaques (<50 mm^3) identified by AI-QCT persisted at the same location and were often larger on follow-up CCTA.

1. Introduction

Atherosclerosis is the leading cause of cardiovascular death worldwide. In particular, coronary artery disease (CAD) affects nearly 200 million cases worldwide, causing more than 9 million yearly deaths.[1] CAD is also a major cause of disability, leading to approximately 182 million disability-adjusted life years globally.[1] Moreover, prior declines in ischemic heart disease prevalence and mortality have been threatened by the increasing prevalence of obesity and diabetes mellitus.[2]

Advances in non-invasive coronary computed tomography angiography (CCTA) coupled with robust epidemiological data has convincingly proven the role of non-obstructive plaque in the genesis of acute coronary events and cardiovascular mortality. On average, patients with non-obstructive CAD have an annual event rate that is 8-fold higher as compared with patients who do not have coronary atherosclerosis.[3] On multivariable adjusted analyses, the hazard ratio for major adverse cardiovascular events is 1.5–7.2 when comparing nonobstructive CAD to no CAD.[3]

It is not well known, however, whether the prognostic implications of nonobstructive CAD also apply to small plaque volumes identified on CCTA and if there is a threshold beyond which risk starts to increase. To understand this, the first step is to characterize the natural history of small volume plaque seen on CCTA. Typically, small non-calcified plaques represent a challenge for cardiac CT readers, as they may be difficult to differentiate from pericoronary fat, other soft tissue, or artifact/noise. Therefore, such plaques are less likely to be reported because of uncertainty regarding their presence and significance.

Recently, atherosclerosis imaging quantitative computed tomography (AI-QCT) has emerged as a novel, non-invasive approach driven by machine learning to quantify and characterize coronary atherosclerosis. In practice, AI-QCT often identifies small plaques that are missed by interpreting physicians. Herein, we sought to characterize the presence and natural history of small plaques in CCTA studies in the Progression of Atherosclerotic Plaque Determined by Computed Tomographic Angiography Imaging (PARADIGM) study.

2. Methods

2.1. Subjects

We retrospectively evaluated patients who underwent CCTA at baseline and during follow-up of the PARADIGM study (NCT02803411). The PARADIGM study was a registry of 2252 patients from 7 countries, including 13 different sites, who underwent serial CCTA for known or suspected CAD.[4] The minimum interscan period between baseline (CCTA-1) and follow-up (CCTA-2) studies was 2 years, per study protocol. Patients were enrolled between 2003 and 2015.[5] In this study, we restricted inclusion to the first 99 patients who underwent CCTA in the cohort. This number was chosen as a feasibility study, without an analysis of statistical power for any particular outcome. Furthermore, analyses were limited to small plaques on CCTA-1, defined as those with 0.1–50 mm^3. An additional 2 patients were screened and excluded due to the absence of qualifying plaques (≤ 50 mm^3).

2.2. CCTA acquisition and post-processing

All CCTAs were performed in agreement with the Society of Cardiovascular Computed Tomography guidelines.[6,7] CCTA-1 and CCTA-2 were performed using ≥64-detector row, in single- or dual-source scanners, using either prospective or retrospective ECG-gating. Tube current and voltage were variable, per each site's standard practice. Most cases had only a single phase available for image interpretation. In cases where multiple phases were available for image interpretation, the phase with best image quality was chosen. This selection was independent of the presence or amount of plaque noted in each phase.

Atherosclerotic plaque quantification and characterization were performed with an FDA-cleared artificial intelligence enabled software (Cleerly Lab, Cleerly, Denver, CO).[8–10] The software performs automated evaluation of CCTA with validated convolutional neural network models to determine coronary segmentation, vessel and lumen contour, and plaque characterization. Coronary artery segments are labeled automatically by the software after segmentation. The % diameter stenosis is calculated by using a reference diameter as the closest normal proximal reference cross section. Coronary plaques are classified as calcified, non-calcified, and low-density non-calcified plaque, based on Hounsfield unit densities of >350, 30–350, and <30, respectively.[3]

2.3. Study design

We sought to investigate small coronary plaques identified by CCTA with an AI-QCT software for plaque quantification. The AI-QCT based output results were verified by a level III experienced reader, who was blinded to the status of each study as CCTA-1 or CCTA-2. Plaques were characterized in location, length, remodeling index, and volume. Total volume of each individual small plaque was computed, as well as the volume stratified by calcified, non-calcified, and low-density non-calcified components.

Specifically, we were interested in three aspects. First, the proportion of small plaques identified on CCTA-1 that were present on CCTA-2, as a metric of determining the specificity of the software in identifying small plaques. Small plaques on CCTA-1 present at the same location on CCTA-2 likely represent true plaque. In contrast, plaque present on CCTA-1, but

not on CCTA-2, could be due to plaque regression or, more likely, false positive identification of plaque on CCTA-1. Second, we aimed to report on the characteristics of small plaques in this patient population, stratified by each component of calcified, non-calcified, and low-density non-calcified plaque. And third, we also sought to evaluate features associated with progression of small plaque. The institutional review board of each participating center approved the study protocol.

2.4. Statistical analyses

Continuous data were described as mean ± standard deviation or median (interquartile range, IQR) and analyzed with Student's t-tests or Mann-Whitney U tests as determined by Shapiro-Wilks normality tests. Numeric CCTA characteristics were analyzed with Wilcoxon signed rank tests. Categorical data were described as frequencies (percentages) and analyzed with Chi-square tests of association or Fisher exact tests. We also performed logistic regression to model the absence vs. presence of plaques on CCTA-2 by AI-QCT at the same location of small plaques seen on CCTA-1. Univariable models were performed with plaque characteristics (distance from ostium, plaque length, total plaque volume, volume of non-calcified plaque, presence of calcified plaque); patient characteristics (age, sex, hypertension, history of smoking, family history of CAD, hypercholesterolemia, diabetes, and statin use at baseline); and scanner characteristics (vendor, tube voltage, and tube current) as the independent variables. Spearman rank correlation was used to check for multicollinearity in the logistic regression, whereby plaque length and total plaque volume were be determined to be collinear. Total plaque volume was chosen for the multivariable logistic regression. Multivariable logistic regression was performed with the following explanatory variables: total plaque volume, age, sex, hypertension, history of smoking, diabetes, and statin use at baseline.

We also performed univariable linear regression to evaluate whether statin therapy use at follow-up was associated with different plaque behavior, i.e., whether it was predictive of the change in total plaque volume or the volume of plaque components (non-calcified volume, low-density non-calcified volume, or calcified plaque volume). A multivariable analysis including the same variables as previously described was performed to evaluate for an independent association between statin use at follow-up and plaque characteristics that were significant on univariable models. The changes in plaque volume for linear regression was modeled both as a natural log difference (ln of plaque volume in CCTA2 – ln of plaque volume in CCTA1). This was performed due to the non-linear behavior of plaque progression and regression. Tests were two-tailed and considered statistically significant with a p-value <0.05. All statistical analyses were conducted using STATA MP version 17 (College Station, TX).

3. Results

A total of 99 patients with 502 small plaques were included. Table 1 outlines the baseline characteristics of research participants, stratified by use of statin therapy at baseline. The median age at the time of CCTA-1 was 61 years, and 63% were male. The prevalence of traditional risk factors was as follows: hypertension (55%); current or prior smoking (40%); family history of coronary artery disease (33%); hypercholesterolemia (31%); and diabetes (12%).

The median total plaque volume on CCTA-1 was 6.8 mm^3 (3.5–13.9 mm^3), most of which was non-calcified plaque (median 6.2 mm^3, interquartile range 2.9–12.3 mm^3). The mean interscan period between CCTA-1 and CCTA-2 was 3.8 ± 1.6 years. On follow-up imaging, there were 437 (87%) small plaques present at the same location as small plaques on baseline CCTA. Smaller plaques <2 mm^3 on CCTA-1 were present at the same location on follow-up imaging in 41 of 62 cases (66%). In contrast, small plaques >2 mm^3 at baseline were present in 395 of 439 cases (90%) on follow-up CCTA imaging (Fig. 1). Fig. 2 shows a representative example of small plaque analysis with the same AI-QCT software, wherein a 3.6 mm^3 plaque in the left circumflex artery progressed to 43.4 mm^3 after 8 years.

Table 2 outlines the characteristics of small plaques present at the same location in both CCTA-1 and CCTA-2 (n = 437). On CCTA-1, the median total plaque volume was 7.1 mm^3 (IQR 3.8–15.4 mm^3) and plaques were predominantly non-calcified, with a median total volume of non-calcified plaque of 6.7 mm^3 (IQR 3.2–13.7 mm^3). The median volume of calcified plaque was 0 (IQR 0–1.1 mm^3). On CCTA-2, the median total plaque volume increased to 18.9 mm^3 (IQR 8.3–45.2 mm^3). The median volume of non-calcified and calcified plaque also increased to 13.8 mm^3 (IQR 5.8–33.4 mm^3) and 2.5 mm^3 (0–9.6 mm^3), respectively.

When compared with small plaques at baseline that persisted on follow-up imaging (n = 437; 87%), small plaques identified on baseline CCTA but not present on follow-up imaging (n = 65; 13%) were significantly more likely ($p < 0.05$) to have a lower volume, a shorter length, and a longer distance from vessel ostium (Table 3). Within the 87% of small plaques that were present at the same location on follow-up imaging, 72% (n = 361) were larger, whereas 15% (n = 75) regressed in volume. Univariable logistic regression was performed modeling the absence vs. presence of plaque by AI-QCT on CCTA-2 at the same location of small plaques on CCTA-1. All plaque-related variables significantly predicted absent plaque ($p < 0.05$): longer distance from ostium; shorter plaque length; lower total plaque volume; lower volume of non-calcified plaque; and absence of calcified component in plaque. In contrast, none of the patient-related factors were predictive ($p > 0.05$): age, sex, hypertension, smoking history, body mass index, family history of CAD, hypercholesterolemia, diabetes, and use of statin at baseline. Similarly, none of the scanner-related parameters were predictive of present vs. absent plaque on the follow-up scan, including scanner vendor, tube current, and tube voltage. In a multivariable logistic regression model including total plaque volume and patient-related factors, a smaller total plaque volume remained predictive of absent plaque at follow-up ($p < 0.05$).

Statins were used by 48% and 68% of patients at CCTA-1 and CCTA-2 ($p < 0.001$), respectively. Among 429 small plaques seen at baseline (with data on statin use) and later confirmed as plaque persistence at the same location on CCTA-2, 145 (33.8%) occurred in individuals who were still not taking statin therapy at the time of follow-up CCTA. The volume of total plaque and non-calcified plaque were not significantly different

Table 1
Baseline characteristics of 99 patients included in the study, stratified by statin users vs. non-users at the time of follow-up CCTA.

	All patients (n = 99)	Statin users (n = 67)	Non-statin users (n = 32)	p-value
Male, n (%)	62 (63%)	40 (59.7%)	22 (68.8%)	0.38
Age (years), median (IQR)	61 (54–67)	63 (57–68)	60 (51–63)	0.06
BMI (Kg/m^2), median (IQR)	25.2 (23.9–27.6)	25.2 (23.9–27)	25.3 (23.4–28.1)	0.62
Diabetes, n (%)	12 (12.1%)	11 (16.4%)	1 (3.1%)	0.10
Hypertension, n (%)	55 (55.6%)	36 (53.7%)	19 (59.4%)	0.60
Hyperlipidemia, n (%)	31 (31.3%)	29 (43.3%)	2 (6.3%)	<0.001
History of smoking, n (%)	40 (40.4%)	26 (38.8%)	14 (43.8%)	0.64
Family history of CAD, n (%)	33 (33.4%)	21 (31.3%)	12 (37.5%)	0.54
Statin use at baseline, n (%)	44 (44.4%)	44 (65.7%)	0 (0%)	<0.001

BMI: body mass index; CAD: coronary artery disease; IQR: interquartile range.

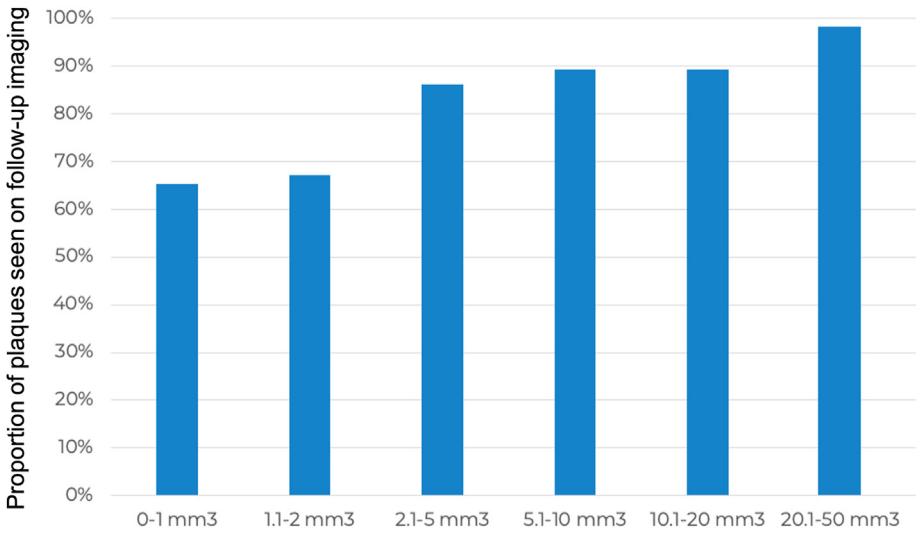

Fig. 1. The proportion of small plaques on baseline imaging that were present at the same location on follow-up CCTA increased proportionally to an increase in the volume of small plaque.

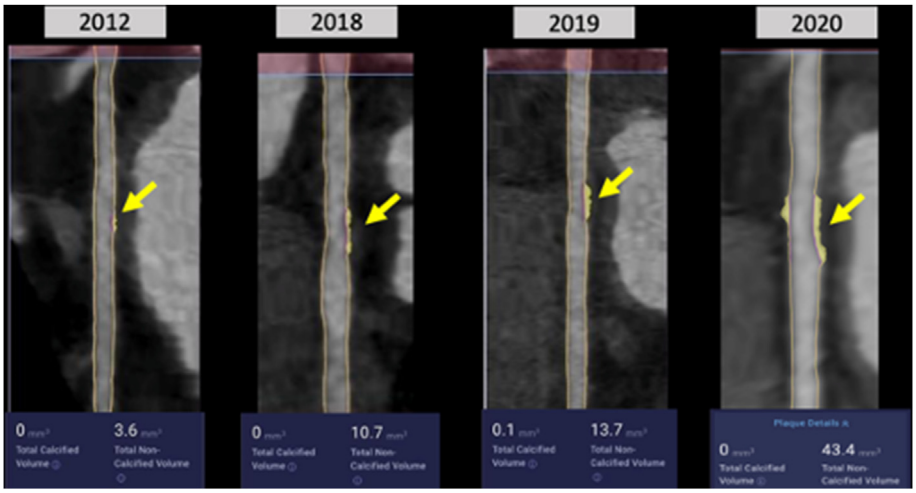

Fig. 2. Progression of a small plaque (3.6 mm^3) at the same location in the left circumflex artery over 8 years as detected by AI-based automated plaque quantification. Image courtesy of Ronald Karlsberg, MD.

Table 2
Characteristics of small plaques present at the same location on CCTA-1 and CCTA-2, as detected by an AI-based software for automated plaque quantification on CCTA.

	CCTA-1 (n = 437)	CCTA-2 (n = 437)	p-value
Distance from ostium (mm)	12.7 (1.5–34.8)	4 (0–24.8)	<0.001
Plaque length (mm)	6.0 (4.0–9.8)	12 (6.8–23.6)	<0.001
Total plaque volume (mm^3)	7.1 (3.8–15.4)	18.95 (8.3–45.2)	<0.001
Non-calcified plaque volume (mm^3)	6.7 (3.2–13.7)	13.8 (5.75–33.35)	<0.001
Low-density non-calcified plaque volume (mm^3)	0 (0–0)	0 (0–0)	<0.001
Calcified plaque volume (mm^3)	0 (0–1.1)	2.45 (0–9.65)	<0.001
Remodeling index	1.1 (1.1–1.2)	1.2 (1.1–1.3)	0.009
Diameter stenosis (%)	6 (3–12)	13 (6–23)	<0.001

AI: artificial intelligence; CCTA-1: baseline coronary computed tomography angiography; CCTA-2: follow-up coronary computed tomography angiography. Data are presented as median (interquartile range).

Table 3
Comparison of small plaques at baseline, stratified by whether plaque was absent vs. present at the same location on follow-up CCTA.

	Small plaques on CCTA-1 not seen on CCTA-2 (n = 65)	Small plaques on CCTA-1, seen on CCTA-2 (n = 437)	p-value
Distance from ostium (mm)	21.8 (5.15–52.1)	12.6 (1.5–34.75)	<.001
Plaque length (mm)	4.5 (3–6.65)	6 (4–9.8)	<.001
Total plaque volume (mm^3)	3.9 (1.95–8.4)	7 (3.8–15.6)	<.001
Non-calcified plaque volume (mm^3)	3.7 (1.65–8.05)	6.7 (3.2–13.8)	<.001
Low-density non-calcified plaque volume (mm^3)	0 (0–0)	0 (0–0)	<.001
Calcified plaque volume (mm^3)	0 (0–0)	0 (0–1)	<.001
Remodeling index	1.1 (1.1–1.2)	1.1 (1.1–1.2)	.01
Diameter stenosis (%)	3 (0–5)	6 (3–12)	<.001

*CCTA-1: baseline coronary computed tomography angiography; CCTA-2: follow-up coronary computed tomography angiography. Data are presented as median (interquartile range).

Table 4
Use of statin therapy at the time of CCTA-2, restricted to patients with small plaques on CCTA-1 that were redemonstrated at the same location on CCTA-2.

Plaques in the same location on CCTA-1 and CCTA-2 (n = 429)	Statin use (n = 284)	No statin use (n = 145)	p-value
Total plaque volume (mm^3)	19.4 mm^3 (8.3–50.9)	18.15 mm^3 (8.3–33.9)	0.21
Non-calcified plaque volume (mm^3)	12.8 mm^3 (5.4–37.8)	14.35 mm^3 (7.25–27.4)	0.68
Calcified plaque volume (mm^3)	3.9 mm^3 (0.5–13.7)	0.2 mm^3 (0–3.7)	<0.001

between plaques in statin users vs. non-users. However, the volume of calcified plaque was significantly higher in statin users (3.9 mm^3) vs. non-users (0.2 mm^3), as shown in Table 4. Of note, except for hypercholesterolemia, which was more prevalent in statin users vs. non-users, there was no significant difference in any other demographic or risk factor characteristic between statin users vs. non-users, including age and sex (Table 1).

We also performed univariable linear regression to evaluate whether the use of statin therapy at follow-up was associated with progression or regression of total plaque volume and volume of plaque subtypes (non-calcified, low-density, and calcified). Statin use at follow-up was significantly associated with the change in volume of calcified plaque ($p < 0.001$), but not with the change in total plaque volume ($p = 0.30$), non-calcified plaque volume ($p = 0.70$), and low-density non-calcified plaque volume ($p = 0.68$).

4. Discussion

In this retrospective analysis with AI-QCT of 502 small plaques, as defined by ≤ 50 mm^3 volume, from 99 patients in the PARADIGM study, the main findings were as follows: (1) 437 (87%) plaques were present at the same location on follow-up imaging, with a median interscan period of 3.8 ± 1.6 years, suggesting that AI-QCT is reproducible and that such small plaques likely represent actual atherosclerosis; (2) the total plaque volume of small plaques tripled from 6.8 mm^3 (IQR 3.5–13.9 mm^3) at baseline to 18.9 mm^3 (IQR 8.3–45.2 mm^3) on follow-up CCTA; and (3) small plaques that were not present on follow-up imaging were more likely to have a lower volume and shorter length, less likely to have a calcified component, and were more distal in the epicardial coronary vessel.

Developments in cardiovascular research over the last decade, much of which has been led by the field of cardiac CT, have convincingly demonstrated that total plaque burden is the main independent predictor of major adverse atherosclerotic endpoints.[3,11] In a cohort of nearly 24,000 symptomatic patients referred for cardiac CT, the presence of obstructive coronary artery disease was not associated with higher risk than non-obstructive plaque, when stratified by total burden of calcified plaque, as measured by the calcium score.[12] Therefore, there has been great interest in developing artificial intelligence-based tools for evaluation of stenosis severity and plaque quantification.[8,9] The CT Evaluation by Artificial Intelligence for Atherosclerosis, Stenosis and Vascular Morphology (CLARIFY) study demonstrated an excellent performance of an AI-aided approach to CCTA interpretation, as compared to 3 experienced level III CCTA readers for the diagnosis of >70% stenosis, with an overall accuracy of 99.7%.[10] In fact, AI-QCT may perform better than expert readers in some aspects. A recent analysis from CLARIFY showed that expert readers have high levels of interobserver variability and elevated discordance with AI when performing quantification of plaque composition.[13]

Although AI-QCT and expert readers have had moderate to high correlation in quantifying total plaque volume, the accuracy, sensitivity, and specificity of CCTA for diagnosis of small plaques, particularly non-calcified and low-density plaques, by experienced readers or AI-QCT is not well known. Differentiation of small plaques from artifact related to background noise can be challenging, despite optimal image quality. In the Scottish Computed Tomography of the Heart (SCOT-HEART) trial, the per-segment intraobserver and interobserver agreement for the classification of CCTA as no coronary artery disease, mild, moderate, or severe obstructive disease were less-than-ideal.[14] The κ coefficient measured 0.52 (95% CI 0.49–0.55) and 0.46 (95% CI 0.43–0.49), respectively, for intraobserver and interobserver agreement. Moreover, no coronary artery disease, in that study, was defined as < 10% luminal stenosis, such that true absence of plaque vs. small plaque were not differentiated. It can only be assumed that intraobserver and interobserver agreement would be even lower for identifying small plaques vs. no plaque.

Part of the difficulty in studying the identification of small plaques by CCTA lies in the absence of a non-invasive 'gold standard' method for identifying true small plaques vs. artifacts. In this work, we used follow-up CCTA data as a metric for whether small plaques identified at baseline were, indeed, truly plaque. While the absence of plaque at the same location cannot differentiate between plaque regression vs. artifact on baseline CCTA, the presence of plaque at the same location on follow-up imaging supports the existence of small plaques identified on the baseline examination. With this approach, we observed that 87% of small plaques, defined as total plaque volume <50 mm^3 at baseline, were indeed present on follow-up imaging. Even if the remaining 13% of small plaques were artifactual in nature, that leaves an 87% positive predictive value for this particular AI-QCT approach for identifying plaques <50 mm^3. Moreover, the association of statin therapy at follow-up with interval progression of calcified plaque volume is consistent with a known effect of statin therapy to increase atheroma calcification.[15] This biology supports the conclusion that AI-QCT findings were, indeed, small plaques.

The fact that patient-related factors, including statin use at baseline, were not predictive of absent plaque on follow-up CCTA suggests that the 13% of small plaques identified by AI-QCT on baseline CCTA and later not seen on serial imaging were indeed artifacts. This hypothesis is corroborated by the plaque-related factors that were predictive of small plaques that 'disappeared' on follow-up imaging. A more distal location in the vessel and lower total plaque volume are also associated with more noise and more challenging discrimination between atherosclerosis and artifact.

It is well known that the presence of non-obstructive plaque portends a higher risk of major adverse atherosclerotic endpoints as compared with no plaque.[16–18] Recent data suggests that small amounts of plaque (>0–250 mm^3) increases 10-year incidence of major adverse cardiovascular events, as compared with no plaque.[19] However, the prognostic significance of diminutive amounts of plaque (<50 mm^3) is not yet well defined. The magnitude of increase in risk and therapeutic implications of having *only* small plaque, relative to no plaque, is uncertain. Similarly, it is unknown whether the identification of small plaque alone can have an impact in adherence to healthy lifestyle habits and preventive medical therapy, as has been shown with calcium scoring and non-obstructive plaque on CCTA.[20,21] Undoubtedly, the ability to quantify and characterize small plaque in an accurate and reproducible manner, particularly through the use of artificial intelligence, is an essential step towards answering such questions.[22]

This study is not without limitations. First, this was a post-hoc analysis of the PARADIGM trial. It is unlikely that biases were introduced, given the blinded nature of study review by experienced CCTA readers; however, whether findings would be confirmed in a prospective clinical trial remains to be determined. Second, the AI-QCT analysis of small plaques in this study was performed with a particular software; the reproducibility of these results with other vendors is not known. Third,

similarly to any interpretation of CCTA, AI-QCT is highly dependent on image quality and standardization regarding plaque quantification are rapidly evolving.[23] How these findings apply beyond the context of a standardized multinational registry is unknown. Nevertheless, continued advances in CT hardware and software technology have made significant improvements in image quality in real-world cardiac CT applications. Fourth, the role of the level III reader was to perform quality assurance and verify the output of AI-QCT, but not to analyze small plaques on CCTA without AI-QCT. Therefore, we are not able to compare the results of AI-QCT with those of a level III reader, which was not the objective of this study. Of note a prior analysis of patients who underwent CCTA with both visual and AI-based analysis of plaque reported 7.1 mm^3 as the minimum plaque volume necessary for visual detection.[24] And, finally, this study did not provide any information on patient outcomes during follow-up and thus the prognostic value of small plaques remains to be determined. Similarly, our findings on statin therapy and interval changes to small plaque should be interpreted with caution, considering this was a secondary endpoint of this feasibility study. Therapeutic implications of statins and other preventive therapies on small plaques are unknown.

5. Conclusion

Small plaques ($\leq$50 mm^3) identified by AI-QCT persisted on follow-up CCTA imaging in 87% of cases, with an average 3-fold increase in plaque volume over a mean follow-up of 3.8 years. Future studies are warranted to evaluate the prognostic significance of small plaques on CCTA and its ensuant therapeutic implications.

Disclosures

J.K. Min: Ownership Interest; Significant; Cleerly, Inc. Research Grant; Modest; GE Healthcare. Other; Modest; GE Healthcare, Arineta. Employment; Significant; Cleerly, Inc. Ownership Interest; Significant; Cleerly, Inc. Other; Modest; Arineta. Employment; Significant; Cleerly, Inc. Ownership Interest; Significant; Cleerly, Inc. Other; Modest; Arineta. **A. Choi:** Stock Shareholder; Modest; Cleerly. Other Research Support; Significant; GW Heart and Vascular Institute; Cleerly, Inc. Consultant, Siemens. **J. Earls:** Ownership Interest; Significant; Cleerly, Inc. Employment; Significant; Cleerly Inc. All other authors have no disclosures. **R.Cardoso:** Research Support; Modest; Cleerly.

Funding

This was an investigator initiated study without external funding, however AI-QCT processing of the exams was provided by Cleerly Inc.

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