# Can Artificial Intelligence Guided Quantitative Evaluation of Atherosclerosis Predict Events?

Anha Telluri BA, Yumin Kim BA, Isabella Lipkin BA, Andrew J. Bradley MD, Alfateh Sidahmed MD, CONSERVE Investigators, James P. Earls MD and Andrew D. Choi, MD.
Department of Medicine (Cardiology) and Radiology, The George Washington University School of Medicine, Washington DC

## BACKGROUND

- **Artificial intelligence (AI) and machine learning** applied to cardiovascular medicine now enables analysis of complex data sets which mirror human cognition to allow for improved clinical care.
- AI applied to coronary computed tomographic angiography (CCTA) allows for **accurate whole heart quantitative CCTA analysis of atherosclerosis**, a process that has been previously both time-intensive and limited to high expert readers.
- AI-QCT further enables identification of **novel plaque thresholds that allow for better prognostication of major adverse cardiovascular events (MACE)** beyond a conventional % stenosis-based category.

## METHODS

- We compared MACE of AI-QCT using CCTA data from the selective referral arm of the international **22-center CCTA for Selective Cardiac Catheterization (CONSERVE) Trial.**
- CCTA exams were analyzed using novel FDA-cleared cloud-based software (Figure 1; Cleerly, NY, NY) that performs AI-enabled coronary segmentation, lumen and wall determination, plaque quantification and stenosis determination. AI-QCT findings were adjudicated to MACE at median 1-year follow-up.
- Plaque volume (PV) were calculated for each coronary lesion and then summated to compute the total plaque volume at the patient level. PV was further categorized using **Hounsfield unit (HU) ranges with non-calcified plaque (NCP) defined as HU between -30 and +350; low-density-non calcified plaque (LD-NCP) as plaques < 30 HU, and calcified plaque (CP) defined as > 350 HU.**
- The consistency of clinical ASCVD risk, AI-enabled CAD-RADS, AI-enabled Percent Atheroma Volume, and AI-enabled Plaque Volume were assessed by evaluating correlation and numeric agreement.

**Figure 1**: AI-QCT Methodology

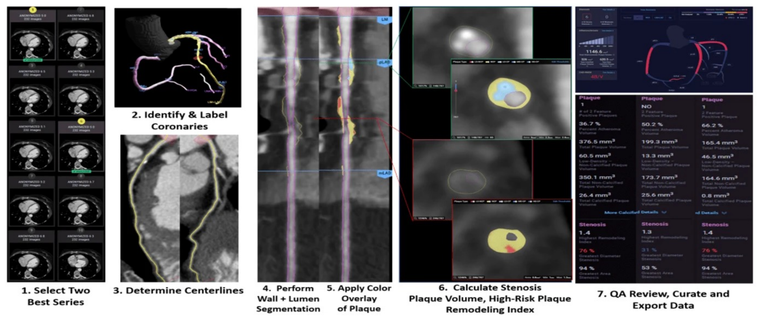


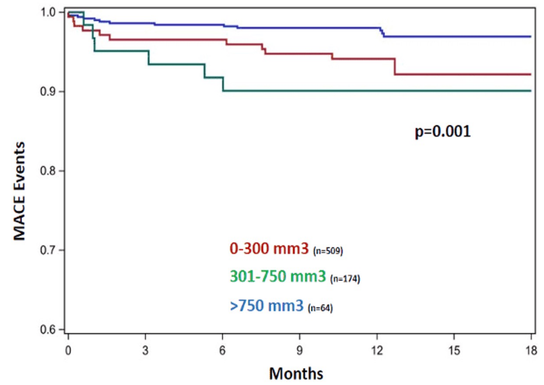

**Table 1**: Baseline Demographics and Clinical Characteristics

| Variable (% or mean±SD) | All Patients (N=747) |
|---|---|
| Age, years | 60 ±12.2 |
| Women | 49% (363) |
| Body Mass Index, kg/m$^2$ | 25.6 ±4.0 |
| Race / Ethnicity | |
| African American | 0.5% (4) |
| Asian | 86% (639) |
| Hispanic | 0.5% (4) |
| White | 13% (98) |
| Hypertension | 57% (427) |
| Dyslipidemia | 33% (249) |
| Diabetes | 26% (193) |
| Family History of CAD | 9% (67) |
| Current Smoker or History of Smoking ≤ 1 year | 30% (224) |
| Symptoms | |
| Typical Angina | 30% (224) |
| Atypical Angina | 40% (300) |
| Non-Cardiac Chest Pain | 2% (17) |
| Asymptomatic | 12% (90) |
| Other | 15% (115) |

## RESULTS

747 stable patients (60±12.2 years, 49% women) were included. Using AI-QCT, 9% of patients had no CAD as compared with 34% in the original clinical CONSERVE CCTA reads. There was a **linear and significant association (Figure 2) between total plaque volume (TPV) and MACE**; 2.6% for TPV of 1-300 mm3, 7% for TPV of 301-750 mm3, and 9% for TPV $^3$750 mm3 (p=0.001).

**Figure 2**: Plaque Volume (TPV) v. MACE




| Variable | Hazard Ratio | P-Value |
|---|---|---|
| Plaque Category (0-300 / 301-750/ >750) | 2.0 95% CI (1.3, 3.0) | 0.0012 |
| Total Plaque Volume, per 200mm increase | 1.2 95% CI (1.06, 1.4) | 0.0073 |

## CONCLUSIONS AND LIMITATIONS

In post-hoc analysis of an international, multi-center study, application of AI-QCT identified **plaque volume quantification thresholds of MACE prognostication** that enables improved identification of **at-risk patients for CAD**. AI-QCT may enable enhanced **prevention of future heart attacks**.

The present study is not without **limitations**. The current analysis was performed ***post hoc*** from an international, multicenter, RCT. Furthermore, AI-QCT was compared to the clinical site interpretation by expert readers, but **no blinding** was employed.

## Disclosures and Acknowledgements

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