Original Article

Application of computed tomography angiography imaging in coronary heart disease screening and analysis of associated risk factors

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Background: Coronary heart disease (CHD) remains a leading cause of morbidity and mortality worldwide. Early detection and risk stratification are crucial for effective management. This study evaluates the efficacy of coronary computed tomography angiography (CTA) in CHD screening and analyses its correlation with traditional risk factors in an asymptomatic population.

Methods: This study focused on 1,000 patients aged 40–80 years who visited two comprehensive tertiary hospitals in the region between January 2020 and December 2022. Patients with a history of coronary revascularisation, arrhythmia or poor image quality were excluded. CTA was used to assess the coronary artery calcium score (CACS), stenosis severity, plaque characteristics and myocardial perfusion and function. These parameters were analysed alongside traditional risk factors (e.g., age, sex, body mass index, blood pressure, glucose and lipid levels, smoking status and family history) using logistic regression to determine their correlation with CHD.

Results: This study found a significant correlation between the CACS and CHD severity. CTA results showed that 41.2% of patients had normal results, 28.8% had mild CHD, 20.0% had moderate CHD and 10.0% had severe CHD. Traditional risk factors were independently associated with CHD. Myocardial perfusion and function parameters also correlated significantly with CTA findings, declining progressively with increasing CHD severity.

Conclusions: CTA provides a comprehensive assessment of CHD, correlating significantly with traditional risk factors and myocardial functional parameters. Its use in screening could facilitate the early detection and tailored management of CHD in asymptomatic individuals. Further research is warranted to establish its predictive value for long-term cardiovascular outcomes.

Keywords: Coronary heart disease (CHD); coronary computed tomography angiography (coronary CTA); coronary artery calcium score (CACS); risk factors; myocardial perfusion

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Introduction

Coronary heart disease (CHD) is a major global cause of morbidity and mortality, characterised by the narrowing or occlusion of the coronary arteries due to the accumulation of atherosclerotic plaques (1). It can lead to various clinical manifestations (e.g., angina, myocardial infarction, heart failure and sudden cardiac death) (2). The prevention and treatment of CHD depend on the early detection and accurate assessment of coronary artery lesions and CHD risk factors (3).

Coronary computed tomography angiography (CTA) is a non-invasive imaging modality that can provide high-resolution, three-dimensional images of the coronary arteries and the heart (4). CTA protocols are well-established and validated in numerous studies as an effective method for excluding coronary artery disease (CAD). These protocols allow for a detailed assessment of coronary anatomy and pathology. CTA not only visualises the coronary artery anatomy and morphology but also quantifies the coronary artery calcium score (CACS), a measure of the calcified plaque burden in the coronary arteries (5). The CTA technique has high sensitivity and specificity for the detection of significant coronary artery stenosis and offers prognostic value for predicting adverse cardiovascular events (6,7). It can also evaluate plaque characteristics (e.g., composition, morphology and vulnerability), reflecting its activity and instability (8,9). By assessing myocardial perfusion and function, CTA can indicate haemodynamic significance and the functional impact of coronary artery lesions (10,11). Therefore, CTA is a useful and comprehensive method for CHD screening, providing valuable information for the diagnosis, risk stratification and management of CHD.

However, CTA also has limitations and challenges (e.g.,, radiation exposure, contrast agent injection and motion artefacts), which may affect image quality and diagnostic accuracy (12,13). Therefore, it is important to optimise the CTA protocol and use advanced technologies. Current techniques, including low-dose scanning, iterative reconstruction, dual-energy computed tomography (CT) and artificial intelligence, are used to improve the performance and applicability of CTA (14,15).

In addition to CTA results, clinical data such as age, sex, body mass index (BMI), blood pressure, glucose and lipid levels, smoking status and family history are important for evaluating CHD risk factors (16,17). These factors influence the development and progression of CHD, as well as treatment outcomes (18,19). Therefore, it is necessary to collect and analyse clinical data and integrate them with CTA results to provide a comprehensive and personalised assessment of CHD risk factors, guiding prevention and treatment.

We aim to explore the application of CTA in CHD screening and to analyse associated risk factors. We enrolled 1,000 patients who were asymptomatic and underwent CTA examination in our hospital to evaluate and analyse CHD risk factors using logistic regression. We hypothesise that the CTA results of the CACS can provide comprehensive and reliable information on CHD severity and prognosis, guiding its evaluation and treatment. We present this article in accordance with the STROBE reporting checklist (available at https://qims.amegroups.com/article/view/10.21037/qims-24-579/rc).

Methods

Participants

This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Ethics Committee of Fuwai Hospital of Chinese Academy of Medical Sciences (Key project of the Ministry of Science and Technology "Research on the Prevention and Control of Major Chronic Non-Communicable Diseases") (No. FYK[2016]803), and informed consent was obtained from all patients. It included 1,000 asymptomatic individuals aged 40–80 years who visited two comprehensive tertiary hospitals in the region between January 2020 and December 2022. Participants were recruited through routine health check-ups and referrals from primary care physicians. A systematic sampling method was used, selecting every third eligible individual from the pool of potential participants to minimise selection bias. The inclusion criteria were as follows: (I) aged between 40–80 years; (II) no history or symptoms of CHD or other cardiovascular diseases; and (III) no contraindications to CTA (e.g., allergy to contrast agent, renal insufficiency or pregnancy). The exclusion criteria were as follows: (I) known CAD; (II) previous coronary revascularisation (e.g., percutaneous coronary intervention or coronary artery bypass grafting); and (III) arrhythmias (e.g., atrial fibrillation or ventricular tachycardia). To address potential selection bias, we compared the demographic characteristics of our study population with those of the general population in our region to ensure representativeness.

The majority of participants (85%) were recruited during routine health check-ups, whereas the remaining 15% were

Table 1 Demographic and clinical characteristics of the subjects

Variable	Value
Number of subjects	1,000
Age (years)	56.3±9.8
Sex	
Male	512 (51.2%)
Female	488 (48.8%)
BMI (kg/m^2)	24.6±3.2
Systolic blood pressure (mmHg)	132.4±15.6
Diastolic blood pressure (mmHg)	82.3±10.4
Fasting blood glucose (mmol/L)	5.4±1.2
Total cholesterol (mmol/L)	4.8±1.1
Triglyceride (mmol/L)	1.6±0.8
High-density lipoprotein (mmol/L)	1.3±0.3
Low-density lipoprotein (mmol/L)	2.9±0.9
Smoking	
Yes	312 (31.2)
No	688 (68.8)
Family history of CHD	
Yes	164 (16.4)
No	836 (83.6)

Data are presented as mean ± standard deviation, number or number (%). BMI, body mass index; CHD, coronary heart disease.

referred by their primary care physicians for cardiovascular risk assessment despite being asymptomatic.

We defined the risk factors for CHD as follows: (I) age: ≥45 years for men and ≥55 years for women; (II) sex: male; (III) hypertension: systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg or use of antihypertensive medication; (IV) diabetes mellitus: fasting blood glucose ≥7.0 mmol/L or use of antidiabetic medication; (V) dyslipidaemia: total cholesterol ≥5.2 mmol/L, low-density lipoprotein cholesterol ≥3.4 mmol/L, high-density lipoprotein cholesterol ≤1.0 mmol/L for men or ≤1.3 mmol/L for women, triglycerides ≥1.7 mmol/L or use of lipid-lowering medication; (VI) smoking: current smoker or quit within the past year; (VII) obesity: BMI ≥30 kg/m^2; (VIII) family history of premature CHD: first-degree relative with CHD before age 55 for men or 65 for women.

The demographic and clinical characteristics of the participants are shown in *Table 1*.

CTA protocol

The CTA examination used a 256-slice CT scanner (Revolution CT, GE Healthcare, Chicago, IL, USA) with the following parameters: 100–120 kV tube voltage, 300–500 mA tube current, 0.28 s rotation time, 0.625 mm slice thickness and 0.2–0.4 pitch. The scan extended from the level of the tracheal bifurcation to the diaphragm. It was performed in prospective electrocardiogram (ECG)-triggered mode, with the scan window set at 70–80% of the RR interval. Heart rate was monitored and controlled with oral or intravenous beta-blockers prior to the scan, with the target heart rate being <65 beats per minute. A bolus of 60–80 mL of iodinated contrast agent (Iohexol, 350 mg I/mL, GE Healthcare) was injected into the antecubital vein at a rate of 4–5 mL/s, followed by 40 mL of saline at the same rate. The scan was triggered by a bolus tracking technique with the region of interest at the ascending aorta and a threshold of 100 Hounsfield units (HU). The radiation dose was recorded and expressed as the dose-length product (DLP) and the effective dose (ED).

CTA analysis

CTA images were reconstructed using an iterative reconstruction algorithm (ASiR-V, GE Healthcare) with a medium-smooth kernel (B26f) and a slice thickness of 0.625 mm. They were then transferred to a dedicated workstation (AW 4.7, GE Healthcare) for analysis by two experienced radiologists blinded to the clinical data. Any discrepancies were resolved through consensus or, if necessary, by a third radiologist.

The CACS was calculated using automated software (SmartScore 4.0, GE Healthcare) based on the Agatston method (20). The CACS was defined as the sum of the individual scores for each calcified plaque in the coronary arteries, defined as lesions with an area of at least 1 mm^2 and a density of at least 130 HU.

The CACS was categorised into four groups based on widely accepted cut-off values:

(I) CACS =0 (no identifiable plaque);
(II) CACS =1–100 (mild calcification);
(III) CACS =101–400 (moderate calcification);
(IV) CACS >400 (severe calcification).

These groupings corresponded to increasing levels of cardiovascular risk and have been validated in previous

large-scale studies (21,22).

The number and severity of coronary artery stenosis were evaluated by a multiplanar reformatted technique and a curved planar reformatted technique. The coronary arteries were divided into 16 segments according to the American Heart Association classification (23). The degree of stenosis was measured by the minimal luminal diameter (MLD) and the reference vessel diameter (RVD) using the following formula: stenosis (%) = (1 – MLD/RVD) × 100. The stenosis was classified as mild (stenosis ≤50%), moderate (stenosis 50–69%) or severe (stenosis ≥70%). The participants were divided into four groups according to the severity of coronary artery stenosis: group 1 (normal), group 2 (mild CHD), group 3 (moderate CHD) and group 4 (severe CHD). Plaque characteristics were evaluated using the volume-rendered technique and maximum intensity projection. Plaque composition was classified as calcified, mixed or non-calcified based on plaque density and morphology. Plaque morphology was categorised based on surface and contour characteristics as smooth, irregular or ulcerated. Plaque vulnerability was assessed based on the presence or absence of positive remodelling, low-attenuation plaque, napkin-ring sign or spotty calcification.

Myocardial perfusion and function were evaluated using dynamic CTA and phase analysis techniques. Dynamic CTA involved acquiring multiple images at different phases of the cardiac cycle, with the injection of a low-dose contrast agent (20 mL of iodinated contrast agent at 4 mL/s, followed by 40 mL of saline at the same rate). The images were reconstructed using the iterative reconstruction algorithm with a medium-smooth kernel (B26f) and a slice thickness of 0.625 mm. Subsequently, the images were transferred to the dedicated workstation for analysis by two experienced radiologists blinded to the clinical data. Myocardial perfusion was assessed by myocardial blood flow (MBF) and myocardial blood volume (MBV), calculated using a deconvolution incorporating arterial input function and the tissue time-attenuation curve. Myocardial function was assessed via left ventricular ejection fraction (LVEF) and regional wall motion abnormality (RWMA), determined by phase analysis using endocardial and epicardial contours. Myocardial perfusion and function were compared among the groups and correlated with CTA results.

Statistical analysis

Statistical analysis was performed using SPSS 22.0 software (IBM, USA). Continuous variables were presented as mean ± standard deviation, and categorical variables were expressed as frequency (percentage). The normality of data distribution was assessed using the Kolmogorov–Smirnov test. To compare data across the groups, one-way analysis of variance was used for continuous variables, and the chi-squared test was employed for categorical variables. Correlation analyses used Pearson's correlation coefficient for continuous variables and Spearman's correlation coefficient for categorical variables. Logistic regression analysis was performed to identify independent risk factors for CHD, with severity as the dependent variable and the CACS along with clinical data as independent variables. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated. A significance level of $P<0.05$ was considered statistically significant.

Results

Correlation of CTA results with the clinical data of the participants

CTA results showed that among the 1,000 patients, 412 (41.2%) had normal CTA results, 288 (28.8%) had mild CHD, 200 (20.0%) had moderate CHD and 100 (10.0%) had severe CHD. The CACS ranged from 0 to 1,987, with a mean of 121.4±256.7. There was a significant correlation between the CACS and severity of coronary artery stenosis and plaque characteristics ($P<0.001$), categorising patients into the normal group (CACS =0), mild group (CACS =1–100), moderate group (CACS =101–400) and severe group (CACS >400) (*Table 2*).

The analysis revealed significant associations between CHD severity and various clinical factors. Increasing stenosis severity was significantly associated with advancing age ($P<0.001$), with mean ages progressively rising from 51.2±8.4 years in the normal group to 66.3±11.1 years in the severe CHD group. Additionally, a significant positive correlation was observed between CHD severity and BMI ($P<0.001$), with mean BMIs increasing from 23.4±2.8 kg/m^2 in the normal group to 26.8±3.7 kg/m^2 in the severe CHD group.

Blood pressure showed a significant positive correlation with CHD severity ($P<0.001$). Mean systolic blood pressure and mean diastolic blood pressure increased from 128.6±14.2 and 80.4±9.8 mmHg, respectively, in the normal group to 140.2±17.1 and 86.4±11.1 mmHg, respectively, in the severe CHD group.

Furthermore, a significant association was found between

Table 2 CTA results and CACS among the groups with different severity of CHD

Project	Group 1 (normal)	Group 2 (mild CHD)	Group 3 (moderate CHD)	Group 4 (severe CHD)
No. of subjects	412	288	200	100
CACS (range)	0 (0)	34.6±28.4 (1–100)	198.7±94.3 (101–400)	687.4±412.6 (>400)
No. of stenosed segments	0	1.2±0.4	2.4±0.6	3.6±0.8
Degree of stenosis (%)	0	32.4±8.7	58.6±6.4	82.4±7.8
Plaque composition (mm^3)	0			
Calcified		0.8±0.4	1.2±0.5	1.6±0.6
Mixed		0.4±0.3	0.8±0.4	1.2±0.5
Non-calcified		0.2±0.2	0.4±0.3	0.8±0.4
Plaque morphology (mm^3)	0			
Smooth		0.9±0.3	1.1±0.4	1.3±0.5
Irregular		0.3±0.2	0.7±0.3	1.1±0.4
Ulcerated		0.1±0.1	0.2±0.2	0.4±0.3
Plaque vulnerability (mm^3)	0			
Positive remodeling		0.1±0.1	0.2±0.2	0.3±0.3
Low-attenuation plaque		0.1±0.1	0.2±0.2	0.3±0.3
Napkin-ring sign		0.1±0.1	0.2±0.2	0.3±0.3
Spotty calcification		0.1±0.1	0.2±0.2	0.3±0.3

Data are presented as mean ± standard deviation or number. CTA, computed tomography angiography; CACS, coronary artery calcium score; CHD, coronary heart disease.

CHD severity and metabolic parameters. Mean fasting blood glucose levels increased from 5.2±1.1 mmol/L in the normal group to 5.8±1.4 mmol/L in the severe CHD group (P<0.001). Total cholesterol and low-density lipoprotein levels also showed positive correlations with CHD severity (P<0.001), whereas high-density lipoprotein levels showed a negative correlation (P<0.001).

Clinical data analysis indicated significant differences in age, sex, BMI, blood pressure, glucose and lipid levels, smoking status and family history among groups with increasing CACS and clinical severity (P<0.001) (*Table 3*).

Logistic regression analysis for risk factors of CHD

Logistic regression analysis showed that the CACS, age, sex, BMI, blood pressure, glucose and lipid levels, smoking status and family history were independent risk factors for CHD (P<0.05). The ORs and 95% CIs of these risk factors are shown in *Table 4*.

Correlation of myocardial perfusion and function with CTA results

Myocardial perfusion and function results showed that MBF, MBV and LVEF were significantly different among all groups, with values markedly lower in groups with more severe CHD (P<0.001). The RWMA also significantly varied among all groups, showing higher values in those with more severe CHD (P<0.001). Furthermore, myocardial perfusion and function results were significantly correlated with the CTA results (P<0.001) (*Table 5*).

Correlation between radiation dose and CTA results

The radiation dose results showed significant differences in the DLP and the ED among all groups, with higher values observed in groups with more severe CHD (P<0.001). These findings were also significantly correlated with the CTA results (P<0.001) (*Table 6*).

Table 3 Clinical data among the groups with different severity of CHD

Variable	Group 1 (normal)	Group 2 (mild CHD)	Group 3 (moderate CHD)	Group 4 (severe CHD)	P value
Number of subjects	412	288	200	100	–
Age (years)	51.2±8.4	56.8±9.6	61.4±10.2	66.3±11.1	<0.001
Sex (male/female)	192/220	160/128	112/88	48/52	<0.001
BMI (kg/m^2)	23.4±2.8	24.2±3.1	25.6±3.4	26.8±3.7	<0.001
Systolic blood pressure (mmHg)	128.6±14.2	132.8±15.4	136.4±16.3	140.2±17.1	<0.001
Diastolic blood pressure (mmHg)	80.4±9.8	82.6±10.2	84.2±10.6	86.4±11.1	<0.001
Fasting blood glucose (mmol/L)	5.2±1.1	5.4±1.2	5.6±1.3	5.8±1.4	<0.001
Total cholesterol (mmol/L)	4.6±1.0	4.8±1.1	5.0±1.2	5.2±1.3	<0.001
Triglyceride (mmol/L)	1.4±0.7	1.6±0.8	1.8±0.9	2.0±1.0	<0.001
High-density lipoprotein (mmol/L)	1.4±0.3	1.3±0.3	1.2±0.3	1.1±0.3	<0.001
Low-density lipoprotein (mmol/L)	2.7±0.8	2.9±0.9	3.1±1.0	3.3±1.1	<0.001
Smoking (yes/no)	112/300	120/168	56/144	24/76	<0.001
Family history of CHD (yes/no)	64/348	56/232	28/172	16/84	<0.001

Data are presented as mean ± standard deviation or number. CHD, coronary heart disease; BMI, body mass index.

Table 4 Logistic regression analysis of the risk factors of CHD

Variable	OR	95% CI	P value
CACS	1.03	1.02–1.04	<0.001
Age	1.06	1.04–1.08	<0.001
Sex (male *vs.* female)	1.82	1.36–2.44	<0.001
BMI	1.12	1.08–1.16	<0.001
Systolic blood pressure	1.02	1.01–1.03	<0.001
Diastolic blood pressure	1.03	1.02–1.05	<0.001
Fasting blood glucose	1.14	1.10–1.19	<0.001
Total cholesterol	1.18	1.13–1.24	<0.001
Triglyceride	1.22	1.16–1.29	<0.001
High-density lipoprotein	0.82	0.76–0.89	<0.001
Low-density lipoprotein	1.26	1.19–1.34	<0.001
Smoking (yes *vs.* no)	1.74	1.29–2.34	<0.001
Family history of CHD (yes *vs.* no)	1.68	1.21–2.32	<0.001

CHD, coronary heart disease; OR, odds ratio; CI, confidence interval; CACS, coronary artery calcium score; BMI, body mass index.

As shown in *Figure 1*, CTA revealed severe stenosis in the distal left anterior descending artery. *Figure 2* demonstrates two-dimensional and three-dimensional reconstructed images depicting the left main coronary artery and its proximal course.

Figure 2 provides complementary information to *Figure 1*, illustrating the effectiveness of different CTA reconstruction techniques. The two-dimensional and three-dimensional reconstructed images in *Figure 2* offer a comprehensive view of the coronary anatomy, allowing for better visualisation of the left main coronary artery and its proximal branches. This multi-view approach enhances our ability to accurately assess coronary artery morphology and detect potential stenoses.

Discussion

This study elucidates the efficacy of CTA as a comprehensive screening tool for CHD. We found that CTA results, combined with the CACS, can provide comprehensive and reliable information on CHD severity and prognosis. Our findings demonstrate a significant

Table 5 Myocardial perfusion and function results among the groups with different severity of CHD

Project	Group 1 (normal)	Group 2 (mild CHD)	Group 3 (moderate CHD)	Group 4 (severe CHD)	P value
No. of subjects	412	288	200	100	–
MBF (mL/min/g)	1.24±0.18	1.12±0.16	0.98±0.14	0.84±0.12	<0.05
MBV (mL/g)	0.14±0.02	0.13±0.02	0.11±0.02	0.09±0.02	<0.05
LVEF (%)	66.4±4.2	62.8±4.6	58.6±5.1	53.4±5.6	<0.05
RWMA	0	0.2±0.4	0.6±0.5	1.2±0.7	<0.05

Data are presented as mean ± standard deviation or number. CHD, coronary heart disease; MBF, myocardial blood flow; MBV, myocardial blood volume; LVEF, left ventricular ejection fraction; RWMA, regional wall motion abnormality.

Table 6 Radiation dose results among the groups with different severity of CHD

Project	Group 1 (normal)	Group 2 (mild CHD)	Group 3 (moderate CHD)	Group 4 (severe CHD)	P value
No. of subjects	412	288	200	100	–
DLP (mGy·cm)	84.6±12.4	96.8±14.2	112.4±16.3	132.6±18.7	<0.05
ED (mSv)	1.2±0.2	1.4±0.2	1.6±0.2	1.9±0.3	<0.05

Data are presented as mean ± standard deviation or number. CHD, coronary heart disease; DLP, dose-length product; ED, effective dose.

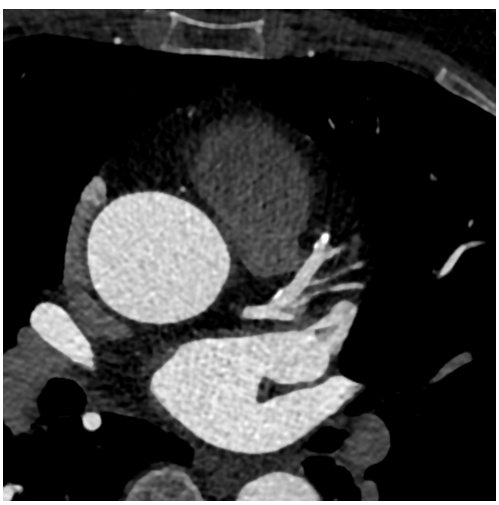

Figure 1 Coronary CT angiography image showing severe stenosis in the distal left anterior descending artery. CT, computed tomography.

correlation between CTA, including the CACS, and the severity of CHD, aligning with previous studies highlighting CTA's diagnostic utility in CHD assessment (20,24,25). Moreover, integrating CTA with clinical risk factors provides a more robust and personalised approach to CHD screening and management.

One of the critical insights from our study is the strong correlation between the CACS and the severity of coronary artery stenosis, plaque characteristics and myocardial perfusion and function. This correlation underscores the prognostic value of the CACS in predicting CHD severity, aligning with prior research that emphasises its predictive utility for adverse cardiovascular events (26). Additionally, our study reinforces the role of traditional risk factors (e.g., age, sex, BMI, blood pressure, glucose and lipid levels, smoking status and family history) in the development and progression of CHD (27,28). These were found to be independent risk factors for CHD in our logistic regression analysis.

The stratification of patients into groups based on CHD severity revealed a progressive decline in myocardial perfusion and function with increasing severity. These findings suggest that, beyond its anatomical assessment, CTA can offer critical insights into the functional impact of coronary artery lesions, which is pivotal for comprehensive patient management (29). Recent studies have also highlighted the importance of assessing myocardial work indices and stress myocardial perfusion in patients with angina and non-obstructive CAD, which could complement the findings from CTA (30). Furthermore, our study addresses the limitations and challenges associated with CTA, including radiation exposure and contrast agent

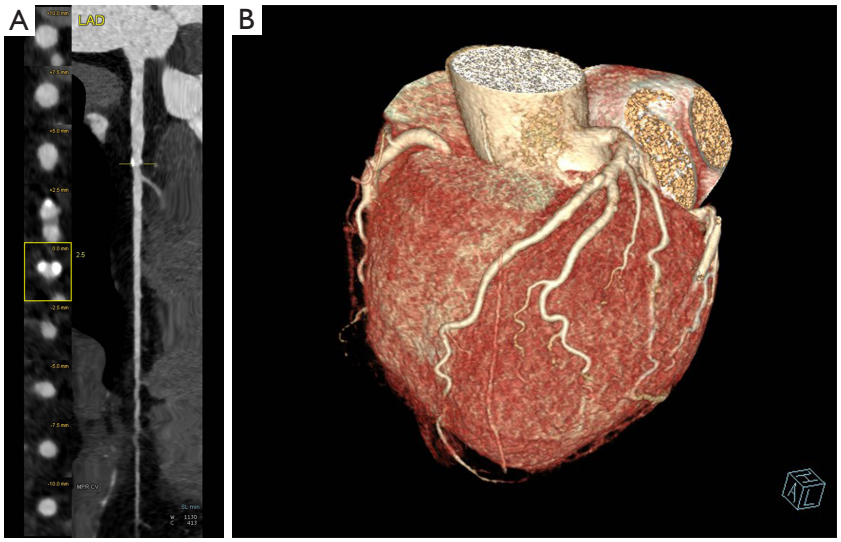

Figure 2 Coronary CT angiography reconstructions. (A) Two-dimensional image showing the left main coronary artery and its proximal branches. (B) Three-dimensional reconstruction providing a comprehensive view of the coronary anatomy. LAD, left anterior descending; MPR CV, multi-plane recombination cardiovascular; SL, scan layer; W, width; C, channel; CT, computed tomography.

injection (31). The observed variation in radiation dose among different severity groups highlights the need for optimised CTA protocols to minimise radiation exposure while ensuring diagnostic accuracy. The application of advanced technologies such as iterative reconstruction and dual-energy CT can be instrumental in this regard (32,33).

Our study demonstrates the feasibility and value of integrating CTA findings with clinical data to provide a more holistic understanding of CHD risk factors. This integrated approach can facilitate targeted interventions and personalised treatment strategies, enhancing the overall management of patients with CHD.

Although CTA provides valuable diagnostic information, it is important to consider the associated radiation exposure, particularly in screening asymptomatic individuals. In this study, the mean ED was 1.53±0.3 mSv, which was lower than the dosage with traditional invasive coronary angiography. However, any radiation exposure carries potential risks. To minimise these risks, we employed several strategies: (I) using prospective ECG-gating, which significantly reduces radiation dose compared with retrospective gating; (II) implementing automatic tube current modulation and tube voltage selection; and (III) employing iterative reconstruction algorithms to maintain image quality at lower radiation doses. Future advancements in CT technology, such as photon-counting detectors, may reduce radiation exposure while maintaining or improving image quality. When considering CTA for CHD screening, the potential benefits of early detection and prevention should be carefully weighed against the individual risks of radiation exposure.

There are several limitations in this study. First, the single-centre design and focus on an asymptomatic population may limit the generalisability of our findings to other populations and clinical settings. Future multi-centre studies including diverse populations are needed to validate our results. Second, the cross-sectional nature of our study does not allow for the assessment of long-term cardiovascular outcomes. As such, the predictive value of CTA findings for future cardiovascular events remains unknown. Longitudinal studies with extended follow-up periods are necessary to evaluate the prognostic significance of our findings. Third, although our study demonstrates strong correlations between CTA findings and traditional risk factors, we cannot establish causality due to the observational nature of our research. Additionally, our initial exclusion criteria did not explicitly exclude individuals with known CAD, which may have introduced bias. However, subsequent data review confirmed that no participants with known CAD were included in the final analysis. Finally, we acknowledge that the exclusion of certain subgroups, such as those with arrhythmias or poor image quality, may have influenced our results. Individuals with arrhythmias may have a higher risk of CHD, and their exclusion could

potentially lead to an underestimation of CHD prevalence in our study population. Similarly, poor image quality could be associated with factors that increase CHD risk, such as obesity or an inability to hold one's breath, which could also affect our results. Future studies should consider alternative imaging techniques or protocols that can accommodate these subgroups to provide a more comprehensive assessment of CHD risk in the general population.

Conclusions

In conclusion, our study suggests that coronary CTA may serve as a comprehensive tool for CHD screening in asymptomatic individuals, providing valuable information on coronary artery calcification, stenosis and plaque characteristics. The strong correlations observed between CTA findings, traditional risk factors and functional parameters highlight the potential utility of CTA in risk stratification. As we refine our understanding of CHD risk assessment, integrating CTA findings with traditional risk factors holds promise for advancing personalised cardiovascular risk management, pending further validation.

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Footnote

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://qims.amegroups.com/article/view/10.21037/qims-24-579/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted in accordance with the Declaration of Helsinki (as revised in 2013) and approved by the Ethics Committee of Fuwai Hospital of Chinese Academy of Medical Sciences (Key project of the Ministry of Science and Technology "Research on the Prevention and Control of Major Chronic Non-Communicable Diseases") (No. FYK[2016]803), and informed consent was obtained from all patients. Since this study was affiliated to the 2016 cooperative project between the Eighth Affiliated Hospital, Sun Yat-sen University and the Fuwai Hospital of the Chinese Academy of Medical Sciences (Key project of the Ministry of Science and Technology "Research on the Prevention and Control of Major Chronic Non-Communicable Diseases"), this study was approved by the Ethics Committee of Fuwai Hospital of Chinese Academy of Medical Sciences.

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