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Research Article

A comparative study of CT coronary angiography findings in diabetic and/or hypertensive versus non-diabetic, non-hypertensive patients with suspected coronary artery disease

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ABSTRACT

Introduction: Coronary artery disease (CAD) remains the leading cause of mortality worldwide. Type 2 diabetes mellitus and hypertension are major cardiometabolic risk factors that accelerate atherosclerosis and may influence plaque burden, distribution as well as morphology. Computed Tomography Coronary Angiography (CTCA) enables comprehensive non-invasive assessment of coronary anatomy, including stenosis severity and plaque characteristics. This study aimed to compare CTCA findings between diabetic and/or hypertensive patients and non-diabetic, non-hypertensive individuals presenting with symptoms suggestive of CAD.

Materials and Methods: This single-center retrospective observational comparative study included 50 symptomatic patients who underwent CTCA for suspected CAD over 12 months. Group A comprised 25 patients with documented diabetes mellitus and/or hypertension, and Group B included 25 patients without diabetes or hypertension. Groups were frequency-matched for age and gender. CTCA parameters analyzed included presence of CAD, number of vessels involved, vessel-wise distribution, severity of stenosis (<50%, 50–70%, >70%) and predominant plaque type (calcified, mixed, non-calcified). Additionally coronary artery calcium (CAC) score categories were also determined for studied cases. For statistical purposes p value less than 0.05 was considered significant.

Results: Prevalence of CAD was significantly higher in the diabetic and or hypertensive patients as compared to controls (88% vs 48%). Multivessel disease was more frequent in Group diabetes and hypertension group (double-vessel: 32% vs 12%; triple-vessel: 32% vs 8%; p=0.005). Severe stenosis (>70%) was observed more commonly in diabetic/hypertensive patients (44% vs 16%; p=0.041). Involvement of the LAD, LCX, and RCA was significantly greater in Group A. Calcified and mixed plaques predominated in diabetic/hypertensive patients (p=0.018). Higher CAC scores (≥100 and ≥400) were also more frequent (p=0.020) in group A.

Conclusion: Diabetic and/or hypertensive patients demonstrated a significantly higher prevalence, severity and anatomical complexity of CAD on CTCA compared to individuals without diabetes and/or hypertension. This reflect a more diffuse and calcific atherosclerotic disease in individuals with diabetes and/or hypertension presenting with symptoms of CAD as compared to individuals without diabetes and/or hypertension.

Keywords: Coronary Artery Disease, Diabetes Mellitus Type 2, Hypertension, Coronary Angiography, Coronary Artery Calcium Score.

INTRODUCTION

Coronary artery disease (CAD) remains the leading cause of death worldwide and a dominant contributor to disability-adjusted life years with a large and growing burden in low- and middle-income countries.[1] In parallel, the prevalence of

type 2 diabetes mellitus and systemic hypertension continues to rise and these conditions frequently coexist in patients presenting with stable or unstable chest pain syndromes. The convergence of suspected CAD with diabetes and hypertension is clinically important because it not only increases lifetime atherosclerotic cardiovascular disease risk but also alters the biology of plaque formation and progression, potentially shifting disease expression from focal, flow-limiting stenoses to more diffuse and complex atherosclerosis. In day-to-day practice, this translates into a substantial population of patients who are "high risk" yet heterogeneous: some harbor non-obstructive but extensive plaque, while others manifest multivessel obstructive disease with higher event rates. Understanding how cardiometabolic comorbidity profiles shape coronary anatomy and plaque characteristics at the time of diagnostic evaluation is therefore essential for appropriate risk stratification and tailored management.[2]

Diabetes accelerates atherogenesis through various mechanisms including chronic hyperglycemia, endothelial dysfunction and oxidative stress. Moreover, advanced glycation end products and pro-inflammatory and pro-thrombotic pathways are also known to cause earlier onset and greater burden of CAD compared with individuals without diabetes. Hypertension, through sustained shear stress, arterial remodeling and endothelial injury promotes atherosclerosis and interacts synergistically with diabetes to accelerate vascular damage. Together, diabetic hypertensive patients are more likely to develop diffuse disease, multivessel involvement, and lesions with adverse morphology. Prior invasive coronary angiography-based comparisons between diabetic and non-diabetic cohorts have consistently demonstrated a higher frequency of multivessel disease and more severe stenosis in diabetes, underscoring the clinical relevance of characterizing coronary involvement by risk factor status. However, one of the drawbacks of invasive angiography is that it primarily outlines the lumen and may underestimate total atherosclerotic burden in the presence of positive remodeling or non-obstructive plaque.[3]

Computed Tomography Coronary Angiography (CTCA) is a non-invasive modality for evaluating suspected CAD. It offers high negative predictive value for ruling out obstructive disease and enables visualization of the vessel wall and can detect presence and extent of plaques. Unlike conventional luminography, CTCA can quantify overall plaque burden and describe plaque composition (calcified, non-calcified, and mixed plaques) and high-risk plaque features such as low-attenuation plaque, positive remodeling, and spotty calcification. These attributes are clinically relevant because adverse plaque phenotypes may occur even when luminal stenosis is mild-to-moderate, and they have been linked to downstream acute coronary events. In symptomatic patients—especially those with intermediate pre-test probability—CTCA therefore provides a comprehensive anatomical assessment that may influence preventive therapies (e.g., statin intensification) and guide downstream testing or invasive evaluation. In populations enriched for diabetes and hypertension, the ability of CTCA to capture both obstructive and non-obstructive disease is particularly valuable, as the clinical risk often exceeds what might be inferred from stenosis severity alone.[4]

Existing literature suggests that diabetes is associated with greater coronary plaque volume and more extensive segment involvement. It is also associated with a higher prevalence of mixed and calcified plaques reflecting accelerated atherosclerotic remodeling as well as chronicity. Hypertension has similarly been associated with increased coronary calcification and higher plaque burden, and the coexistence of diabetes and hypertension may further shift plaque composition and distribution. Yet, despite these general associations, real-world diagnostic cohorts remain variable, influenced by age, sex, symptom profile, and referral patterns; as a result, the precise comparative CTCA phenotype of diabetic hypertensive patients versus metabolically healthier counterparts is not uniform across studies. Moreover, many comparative studies do not ensure comparable baseline demographic distribution between groups, which can confound interpretation because age and male sex are strongly linked to atherosclerotic burden and calcified plaque. For CTCA to be optimally used as a risk-phenotyping tool, comparisons that deliberately balance key demographic characteristics are needed to isolate the incremental influence of diabetes and hypertension on coronary findings in symptomatic patients.[5]

Against this background, an important knowledge gap persists regarding how CTCA-detected disease patterns—extent of vessel involvement, distribution across major epicardial arteries, stenosis severity categories, and plaque composition—differ between diabetic hypertensive patients and non-diabetic, non-hypertensive patients undergoing evaluation for suspected CAD, when age and gender are kept comparable. While invasive angiography-based investigations support the concept of more extensive and severe disease among diabetics, translating these observations to CTCA is essential because CTCA can detect earlier and non-obstructive disease and can characterize plaque beyond luminal narrowing. The present comparative study involving 50 symptomatic patients (25 diabetic hypertensive and 25 non-diabetics, non-hypertensive) with matched age and gender distribution is undertaken to address this existing gap by evaluating CTCA findings across these two groups.

MATERIAL AND METHODS

This was a single-center retrospective observational comparative study conducted over a 12-month period in patients who underwent CT coronary angiography (CTCA) for evaluation of suspected coronary artery disease (CAD). All patients underwent CTCA on Siemens Healthineers SOMATOM-128 slices CT scan. CTCA reports and corresponding clinical case records were reviewed to derive demographic, risk factor, and imaging variables. A total of 50 eligible patients were included and divided into two groups: Group 1 (n=25) comprised patients with documented diabetes mellitus and/or hypertension, and Group 2 (n=25) comprised patients with no documented diabetes and no documented hypertension. To

reduce confounding, the final included cohorts were selected such that age and gender distribution were comparable between the two groups (frequency matching during case selection).

Cases were identified from the CTCA register/archives using the indication "suspected CAD" and then verified from clinical documentation. For the purpose of this study, suspected CAD was operationally defined as patients evaluated for stable chest pain or anginal equivalents (e.g., exertional dyspnea felt to be ischemic in origin) in whom the treating physician documented clinical suspicion of CAD and referred the patient for anatomic assessment with CTCA. Symptom characterization (typical or atypical angina) and referral appropriateness were interpreted in line with widely used chest pain frameworks and guideline-based concepts that support CTCA for symptomatic patients with suspected CAD, particularly when clinical likelihood is not low or when further anatomical clarification is needed after initial assessment. CTCA findings were extracted from the final radiology/cardiac CT reports and tabulated using a structured data sheet. Clinical variables—particularly presence of diabetes mellitus (DM) and hypertension (HPT)—were documented from case papers/medical records. DM and HPT status was considered present if there was a prior physician diagnosis recorded in the file and/or ongoing treatment with antidiabetic or antihypertensive medications. The CTCA variables captured included: (i) overall CTCA impression (normal vs CAD), (ii) number of vessels involved (single-, double-, or triple-vessel disease), (iii) vessel-wise involvement (LAD, LCX, RCA, LM), and (iv) maximum stenosis severity categorized as <50%, 50–70%, and >70% based on the reported luminal narrowing. Where available in the report, plaque morphology descriptors (calcified, non-calcified, mixed) and coronary calcium score categories were also recorded to enable CT-specific comparisons.

Data was compiled in a spreadsheet and analyzed using standard statistical software. Continuous variables were summarized as mean ± standard deviation (or median with interquartile range where appropriate), while categorical variables were expressed as number and percentage. Group comparisons for continuous variables were performed using an independent samples t test (or Mann–Whitney U test for non-normal distributions). Categorical variables were compared using Chi-square test or Fisher's exact test as applicable. For statistical Purposes p value less than 0.05 was considered statistically significant.

Inclusion criteria

- CTCA performed for evaluation of suspected CAD (stable chest pain/anginal equivalent with documented clinical suspicion)
- Group 1: documented DM and/or hypertension in case papers (and/or on treatment)
- Group 2: non-diabetic and non-hypertensive as per case papers.
- CTCA report available with interpretable summary of coronary findings

Exclusion criteria

- Known established CAD (previous MI, PCI, or CABG documented in records)
- CTCA performed for non-CAD indications (e.g., congenital coronary anomalies, pre-operative non-CAD evaluation)
- Incomplete case records for documenting DM/HPT status
- CTCA reports lacking sufficient detail to classify vessel involvement or stenosis severity.

RESULTS

IN this study Males predominated in both groups, comprising 68.0% of the non-diabetic & non-hypertensive group and 60.0% of the diabetic and/or hypertensive group. Females accounted for 32.0% and 40.0% of patients, respectively. The difference in gender distribution between the groups was not statistically significant (p=0.76) (Table 1).

Table 1:- Gender Distribution of Studied cases.

Gender	Diabetic and/or Hypertensive (n=25) n (%)	Non-diabetic & non-hypertensive (n=25) n (%)	p-value
Male	15 (60.0)	17 (68.0)	0.76
Female	10 (40.0)	8 (32.0)	

The majority of patients in both groups were aged 55–64 years (40.0% in the diabetic and/or hypertensive group vs 36.0% in the non-diabetic & non-hypertensive group), followed by 65–70 years (28.0% in each group). The least represented age group was 35–44 years (8.0% vs 12.0%). Mean age was comparable between groups (57.4 ± 7.6 vs 56.9 ± 7.9 years), with no statistically significant difference in age distribution (p=0.82) (Table 2).

Table 2:- Comparison of the age groups in Diabetic and/or Hypertensive and Non-Diabetic, Non-Hypertensive

Age group (years)	Diabetic and/or Hypertensive (n=25) n (%)	Non-diabetic & non-hypertensive (n=25) n (%)	p-value
35–44	2 (8.0)	3 (12.0)	0.82
45–54	6 (24.0)	6 (24.0)	
55–64	10 (40.0)	9 (36.0)	

65–70	7 (28.0)	7 (28.0)	
Mean age (years)	**57.4 ± 7.6**	**56.9 ± 7.9**	

Patients.
Coronary artery disease was markedly more prevalent in the diabetic and/or hypertensive group (88.0%) compared to the non-diabetic & non-hypertensive group (48.0%). Conversely, absence of disease was substantially higher among non-diabetic & non-hypertensive patients (52.0%) than in diabetic and/or hypertensive patients (12.0%) (Figure 1).

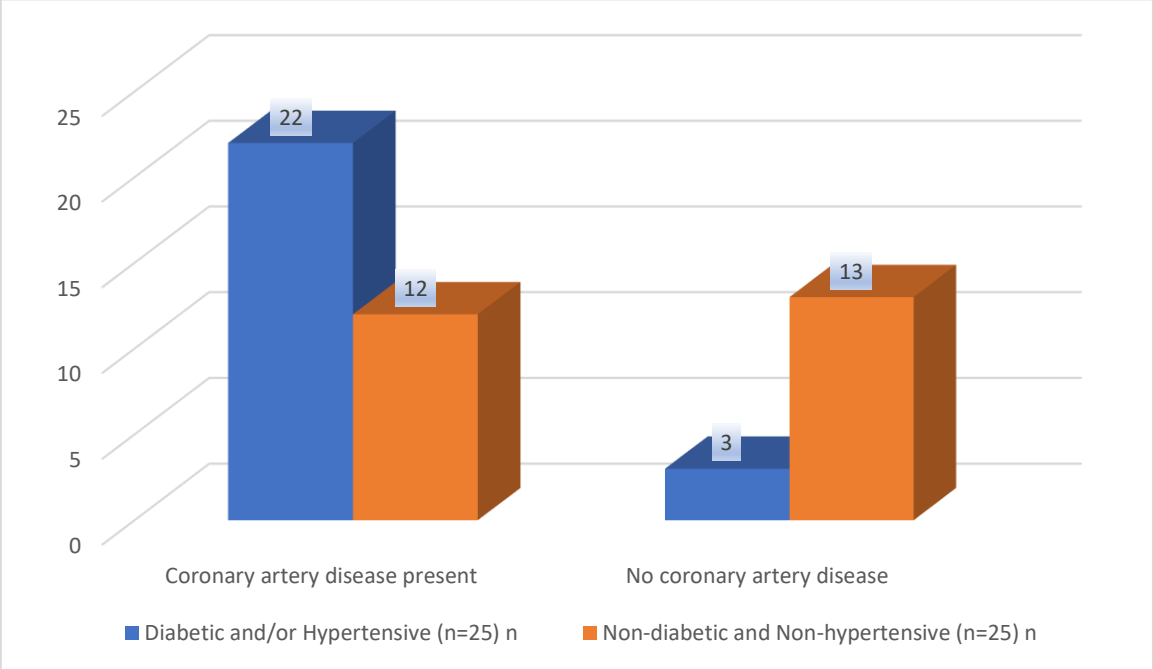

Figure 1:- Prevalence of coronary artery diseases in studied groups.

Normal coronaries were substantially more frequent in the non-diabetic & non-hypertensive group (52.0% vs 12.0%). In contrast, multivessel disease was markedly higher in the diabetic and/or hypertensive group, with both double-vessel and triple-vessel disease each observed in 32.0% of patients compared to 12.0% and 8.0%, respectively, in the non-diabetic & non-hypertensive group. Single-vessel disease showed a comparable distribution between groups (24.0% vs 28.0%). The overall difference in vessel involvement pattern was statistically significant (p=0.005), indicating a higher burden of multivessel disease in diabetic and/or hypertensive patients. (Table 3, Figure 2).

Table 3:- Comparison of coronary vessels involved in Diabetic and/or Hypertensive and Non-Diabetic, Non-Hypertensive Patients.

Number of vessels involved	**Diabetic and/or Hypertensive (n=25) n (%)**	**Non-diabetic & non-hypertensive (n=25) n (%)**	**p-value**
Normal coronaries	3 (12.0)	13 (52.0)	0.005*
Single-vessel disease (SVD)	6 (24.0)	7 (28.0)	
Double-vessel disease (DVD)	8 (32.0)	3 (12.0)	
Triple-vessel disease (TVD)	8 (32.0)	2 (8.0)	
Total	25 (100)	25 (100)	

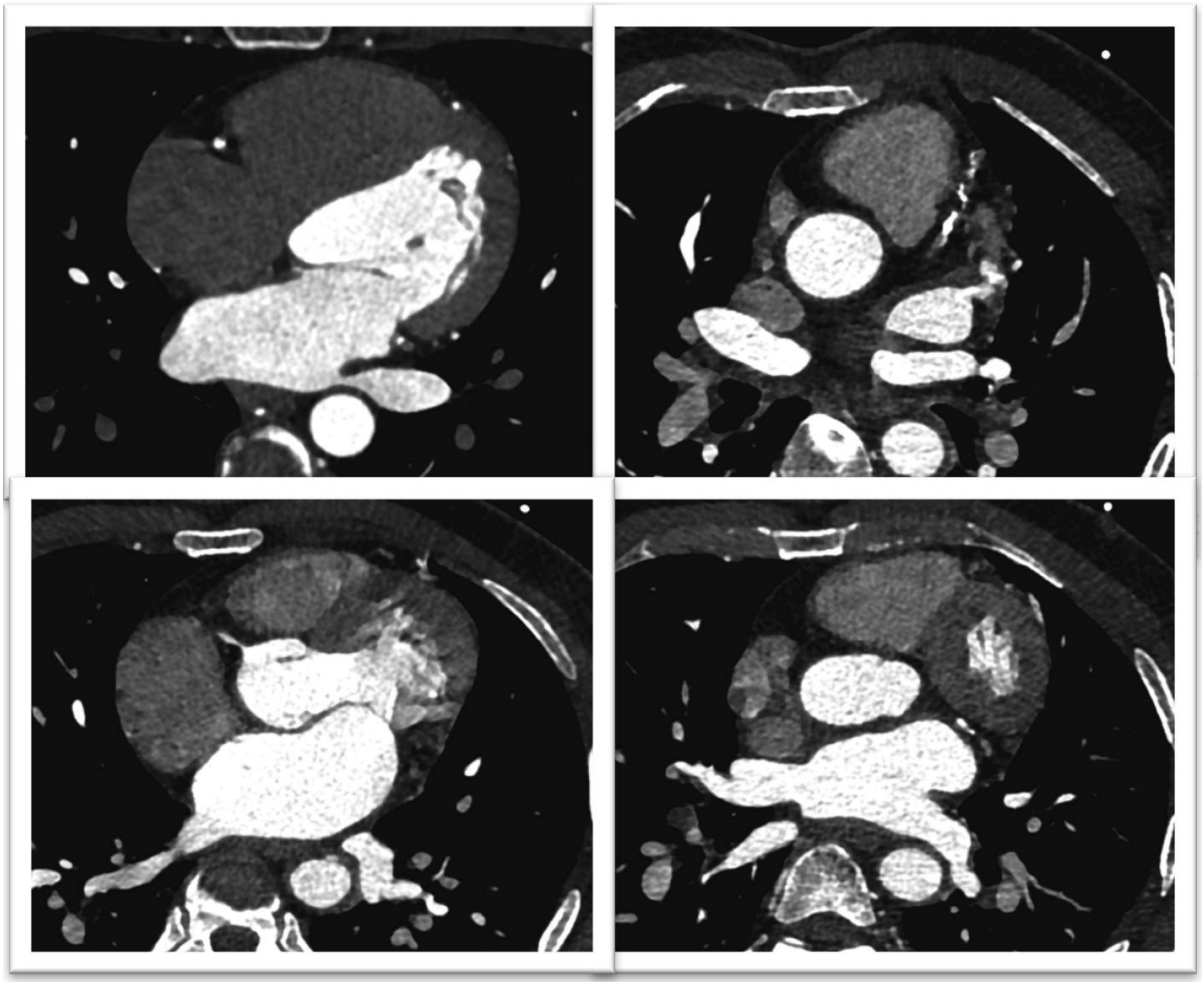

Figure 2:- Axial contrast-enhanced coronary CT angiography images illustrating varying degrees of coronary involvement. Starting clockwise from the left upper panel: (A) Single vessel involvement with minimal stenosis (10–15%) of the right coronary artery (RCA); (B) involvement of the left circumflex artery (LCx); (C) isolated RCA disease; (D) triple vessel disease with simultaneous involvement of the left anterior descending artery (LAD), LCx, and RCA.

Severe stenosis (>70%) was markedly more frequent in the diabetic and/or hypertensive group (44.0%) compared to the non-diabetic & non-hypertensive group (16.0%). Overall, significant stenosis (any degree) was observed in 88.0% of diabetic and/or hypertensive patients versus 48.0% of non-diabetic & non-hypertensive patients. Moderate stenosis showed a comparable distribution between groups (36.0% each), while mild stenosis was less common in the diabetic and/or hypertensive group (8.0% vs 20.0%). The difference in stenosis severity distribution was statistically significant (p=0.041). (Table 4).

Table 4:- Comparison of severity of Stenosis Between Diabetic and/or Hypertensive and Non-Diabetic, Non-Hypertensive Patients.

Stenosis severity	Diabetic and/or Hypertensive (n=25) n (%)	Non-diabetic & non-hypertensive (n=25) n (%)	p-value
Mild (<50%)	2 (8.0)	5 (20.0)	0.041*
Moderate (50–70%)	9 (36.0)	5 (20.0)	
Severe (>70%)	11 (44.0)	2 (8.0)	
Total	22 (88%)	12 (48%)	

The left anterior descending artery was the most commonly involved vessel, particularly in the diabetic and/or hypertensive group (72.0% vs 36.0%, p=0.011). Involvement of the left circumflex (48.0% vs 20.0%, p=0.037) and right coronary artery (44.0% vs 16.0%, p=0.029) was also significantly higher in diabetic and/or hypertensive patients. Left main involvement was more frequent in this group (20.0% vs 4.0%) but did not reach statistical significance (p=0.08). Absence of coronary artery disease was significantly more common in the non-diabetic & non-hypertensive group (52.0% vs 12.0%, p=0.002), reflecting a greater overall burden of vessel involvement among diabetic and/or hypertensive patients. (Table 5).

Table 5:- Comparison of Coronary Vessel Involvement on CT Coronary Angiography Between Diabetic and/or Hypertensive and Non-Diabetic, Non-Hypertensive Patients.

Coronary vessel involved	Diabetic and/or Hypertensive (n=25) n (%)	Non-diabetic and non-hypertensive (n=25) n (%)	p-value
Left anterior descending artery	18 (72.0)	9 (36.0)	0.011
Left circumflex artery	12 (48.0)	5 (20.0)	0.037
Right coronary artery	11 (44.0)	4 (16.0)	0.029
Left main coronary artery	5 (20.0)	1 (4.0)	0.08
No coronary artery disease detected	3 (12.0)	13 (52.0)	0.002
Multiple coronary vessels may be involved in the same patient; hence vessel-wise totals can exceed n=25.			

Calcified plaque was the most common predominant plaque type in the diabetic and/or hypertensive group (36.0% vs 12.0%), followed by mixed plaque (32.0% vs 16.0%). Non-calcified plaque showed equal distribution in both groups (20.0% each). Absence of coronary artery disease was markedly higher in the non-diabetic & non-hypertensive group (52.0% vs 12.0%). The overall difference in plaque type distribution was statistically significant (p=0.018), indicating a greater burden of calcified and mixed plaques in diabetic and/or hypertensive patients (Table 6).

Table 6: Comparison of Predominant Coronary Plaque Type on CT Coronary Angiography Between Diabetic and/or Hypertensive and Non-Diabetic, Non-Hypertensive Patients

Predominant plaque type	Diabetic and/or Hypertensive (n=25) n (%)	Non-diabetic and non-hypertensive (n=25) n (%)	p-value
Calcified plaque predominant	9 (36.0)	3 (12.0)	0.018
Mixed plaque predominant	8 (32.0)	4 (16.0)	
Non-calcified plaque predominant	5 (20.0)	5 (20.0)	
No coronary artery disease detected	3 (12.0)	13 (52.0)	

A calcium score of 0 was most frequent in the non-diabetic & non-hypertensive group (52.0% vs 20.0%). In contrast, higher calcium score categories were more prevalent among diabetic and/or hypertensive patients, particularly scores of 100–399 (32.0% vs 16.0%) and ≥400 (20.0% vs 8.0%). Scores of 1–99 were comparable between groups (28.0% vs 24.0%). The difference in calcium score distribution was statistically significant (p=0.020), indicating a greater coronary calcium burden in diabetic and/or hypertensive patients (Table7).

Table 7:- Comparison of Coronary artery calcium score categories in Diabetic and/or Hypertensive and Non-Diabetic, Non-Hypertensive Patients

Coronary artery calcium score category	Diabetic and/or Hypertensive (n=25) n (%)	Non-diabetic and non-hypertensive (n=25) n (%)	p-value
0	5 (20.0)	13 (52.0)	0.020
1–99	7 (28.0)	6 (24.0)	
100–399	8 (32.0)	4 (16.0)	
≥400	5 (20.0)	2 (8.0)	

DISCUSSION

In the present study, we demonstrated a markedly higher prevalence of coronary artery disease on CT coronary angiography (CTCA) among diabetic and/or hypertensive patients compared with non-diabetic, non-hypertensive individuals presenting with similar symptoms suggestive of CAD. Importantly, age and gender distribution were comparable between groups, minimizing confounding by these powerful determinants of atherosclerotic burden. In a sub-study of the CONFIRM Registry, Min et al reported that diabetic patients undergoing CTCA had a significantly higher chances of obstructive CAD and multivessel disease as compared with non-diabetics.[6] Similarly, Rana et al, analyzing data from the same multinational registry, observed that diabetes was independently associated with greater extent of coronary atherosclerosis and worse outcomes on follow-up. The 88% overall CAD prevalence in our diabetic/hypertensive cohort versus 48% in controls is therefore consistent with the broader CTCA literature suggesting that metabolic comorbidity substantially shifts the pre-test to post-test probability gradient in symptomatic populations.[7]

Our study demonstrated a statistically significant excess of multivessel disease in the diabetic and/or hypertensive group as compared to those without diabetes and hypertension. In the BARI 2D Trial, Frye et al showed that patients with type 2 diabetes frequently exhibited extensive multivessel CAD, influencing revascularization strategies and long-term outcomes.[8] Complementing these findings, Haffner et al, in their landmark epidemiologic analysis demonstrated that

diabetic individuals without prior myocardial infarction had a cardiovascular risk comparable to non-diabetics with established infarction, indirectly reflecting a high burden of occult multivessel disease.[9] Our CTCA-based data extend these observations into a non-invasive imaging context, reinforcing that even when evaluated prior to invasive angiography, diabetic/hypertensive patients are more likely to harbor anatomically extensive disease. The statistically significant difference in vessel involvement pattern (p=0.005) in our cohort underscores that cardiometabolic risk clustering translates into anatomically demonstrable complexity at the time of first-line imaging.

With respect to stenosis severity, severe luminal narrowing (>70%) was substantially more frequent in the diabetic and/or hypertensive group (44% vs 16%), with an overall higher burden of significant stenosis (88% vs 48%). These results are concordant with CT-based prognostic data from Hadamitzky et al, who reported that both extent and severity of CAD on CTCA were greater in diabetic patients and were strongly associated with adverse events during follow-up.[10] In addition, Eleid et al demonstrated that diabetes was linked not only to more frequent obstructive lesions but also to high-risk plaque features on CT, suggesting a mechanistic substrate for the increased event rates observed clinically.[11] The excess of severe stenosis in our diabetic/hypertensive cohort likely reflects the synergistic vascular injury mediated by chronic hyperglycemia and sustained hypertension. By documenting these differences our findings strengthen the inference that metabolic status is a key determinant of severity of coronary artery stenosis on CTCA.

Vessel-wise analysis revealed significantly higher involvement of the left anterior descending artery (72% vs 36%), left circumflex (48% vs 20%) and right coronary arteries (44% vs 16%) in diabetic and/or hypertensive patients. Also, there was a trend toward greater left main disease. This diffuse epicardial distribution is consistent with prior CT investigations of plaque composition and territorial spread. Pundziute et al reported that diabetic patients exhibited more extensive plaque across multiple coronary segments, particularly involving the proximal LAD, on multidetector CT.[12] Likewise, Scholte et al reposted a higher frequency of multisegment and proximal vessel plaque in cases oof diabetics as compared with matched controls.[13] The predominance of LAD involvement in our study is clinically relevant, given the prognostic implications of anterior wall ischemia and the larger myocardial territory at risk. That multiple major vessels were more frequently affected in the diabetic/hypertensive group reinforces the concept that CTCA provides a more holistic depiction of disease burden than single-lesion paradigms derived from conventional angiography.

Plaque characterization and coronary artery calcium (CAC) scoring in our study further showed qualitative differences between studied groups. Calcified and mixed plaques were significantly more common in diabetic and/or hypertensive patients, whereas a CAC score of 0 was predominantly observed in the non-diabetic, non-hypertensive group (52% vs 20%). These findings are in line with Budoff et al, who demonstrated in large CAC registries that diabetes is associated with higher calcium scores and accelerated progression of coronary calcification.[14] Additionally, Motoyama et al showed that adverse plaque characteristics on CT (positive remodeling and low-attenuation components) may confer increased risk of acute coronary events.[15] The higher proportion of CAC ≥100 and ≥400 in our diabetic/hypertensive cohort underscores the chronicity as well as cumulative burden of atherosclerosis in this population. Our results suggest that CTCA not only detects more frequent and severe stenoses in diabetic/hypertensive patients but also shows distinct plaque phenotype characterized by greater calcific burden and multivessel distribution. These observations suggest that there is an important role of CTCA as a relatively non-invasive tool in assessing coronary artery involvement in symptomatic patients with and without diabetes mellitus and or hypertension.

CONCLUSION

Diabetic and/or hypertensive patients presenting with symptoms suggestive of coronary artery disease were found to have higher prevalence of CAD on CTCA as compared to non-diabetic and non-hypertensive individuals. Patients with hypertension and diabetes exhibited greater multivessel involvement, higher frequency of severe stenosis and increased calcified and mixed plaque patterns. Patients with diabetes and/or hypertension were found to have higher coronary artery calcium scores. These findings indicate a more diffuse as well as complex atherosclerotic phenotype in patients with cardiometabolic comorbidities.

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