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ORIGINAL RESEARCH

Synergistic Impact of Glycaemic Control and Coronary Stenosis Severity on Long-Term Prognosis in Diabetes with Chronic Coronary Syndrome: A Ten-Year Retrospective Study

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Aim: This 10-year study aimed to evaluate how glycaemic control, diabetes duration and coronary stenosis severity affect mortality in patients with stable coronary artery disease (CAD) and type 2 diabetes mellitus (T2DM) and to perform multifactorial risk analysis to find key modifiable factors for better risk stratification and secondary prevention.

Methods: This retrospective cohort study involved 150 patients with T2DM with chronic coronary syndrome who had coronary angiography at a single centre between 2011 and 2012. Demographic and biochemical data were collected. Patients were divided into intensified and relaxed control groups based on glycated haemoglobin (HbA1c) levels (≤7.5% and >7.5%). The Gensini score was used to assess coronary angiography results. Multivariate Cox regression analysis was used to find risk factors. Kaplan–Meier analysis was used to compare glycaemic control incidence in subgroups.

Results: The median diabetes duration was 2.0 years. Adjusted hazard ratios (95% CI) for all-cause mortality were 1.10 (1.06–1.15) for age, 1.29 (1.12–1.48) for HbA1c, 1.06 (1.02–1.10) for diabetic duration and 1.02 (1.01–1.02) for Gensini score. For cardiovascular mortality, the ratios were 1.10 (1.05–1.15) for age, 1.36 (1.16–1.58) for HbA1c, 1.06 (1.00–1.10) for diabetic duration, 1.12 (1.04–1.23) for direct bilirubin, 0.89 (0.83–0.95) for serum total protein and 1.02 (1.01–1.03) for Gensini score. Kaplan–Meier analysis showed higher cardiovascular mortality in patients with HbA1c >7.5% and diabetic duration >10 years ($p = 0.0004$).

Conclusion: When deciding on glycaemic control, individual frailty, life expectancy, diabetes duration and coronary stenosis should be considered. This study combines diabetes duration, Gensini-scored coronary stenosis severity and glycaemic control into a prognostic model, providing a new framework for personalised risk stratification in patients with T2DM with stable CAD.

Keywords: intensive glucose control, relaxed glycaemic control, Gensini score, diabetes duration

Introduction

Type 2 diabetes mellitus (T2DM) affects 537 million adults globally, with projections exceeding 783 million by 2045.[1] It has attracted much attention in recent years due to its dominant global prevalence (accounting for 90–95% of diabetes cases) and its strong epidemiological link to coronary artery disease (CAD).[2] Cardiovascular disease (CVD) accounts for 50% of mortality in T2DM, and CAD represents its most lethal manifestation.[3] Unlike type 1 diabetes, T2DM involves insulin resistance, chronic inflammation and dyslipidaemia, which synergistically accelerate atherosclerosis.[4]

Prolonged hyperglycaemia drives CAD pathogenesis through multiple pathways: (1) oxidative stress-induced endothelial dysfunction, (2) advanced glycation end-product (AGE)-mediated vascular inflammation and (3) dyslipidaemia-enhanced plaque instability.[5–7] Although intensive glucose control reduced microvascular complications in landmark trials (such as the UK Prospective Diabetes Study), its macrovascular benefits remain contested. The Action to Control Cardiovascular Risk in Diabetes trial reported increased mortality with glycated haemoglobin (HbA1c) <6.5%,[8] whereas

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the Action in Diabetes and Vascular Disease: PreterAx and DiamicroN Controlled Evaluation and the Veterans Affairs Diabetes Trial found neutral effects on major CVD events.[9] This paradox underscores the need for personalised glycaemic targets tailored to factors such as diabetes duration, comorbidities and vascular pathology.[10,11] Given these unique mechanisms and the rising burden of T2DM in ageing populations, clarifying optimal glycaemic targets for this subgroup remains clinically urgent.

Current guidelines lack granularity for patients with T2DM with established CAD. The 2023 American Diabetes Association (ADA) standards advocate HbA1c <7–8% for high-risk patients but omit stratification by coronary stenosis severity.[12] Similarly, the European Society of Cardiology chronic coronary syndrome (CCS) guidelines prioritise lipid and blood pressure control without specifying glucose targets for advanced atherosclerosis.[13]

To bridge this gap, we investigate how glycaemic control, diabetes duration and coronary stenosis severity (quantified by the Gensini score) jointly influence long-term mortality in patients with T2DM–CCS.

Methods

Study Design and Population

This study retrospectively included a total of 390 patients with T2DM and CCS who underwent coronary angiography between 2011 and 2012. The inclusion criteria were as follows: (1) participants aged >18 years; (2) patients clinically diagnosed with T2DM and confirmed to have CAD through coronary angiography. The exclusion criteria were as follows: (1) patients lacking essential laboratory data, such as HbA1c levels; (2) patients with severe liver or kidney dysfunction or malignant tumours; (3) patients with concomitant congenital heart diseases or cardiomyopathies.

After screening, a total of 150 patients were included for final analysis (Figure 1). Patients were stratified into the intensified control group and the relaxed control group based on their HbA1c levels being ≤7.5% or >7.5%, respectively. The HbA1c threshold of 7.5% was selected based on three considerations: (1) the ADA guidelines recommend individualised targets (HbA1c <7.5%) for patients with advanced CVD;[14] (2) this cutoff aligns with studies focusing on high-risk T2DM populations, where stringent control (<6.5%) showed no mortality benefit;[15] (3) it reflects real-world clinical practice balancing hypoglycaemia risk and glycaemic management in comorbid patients.[16]

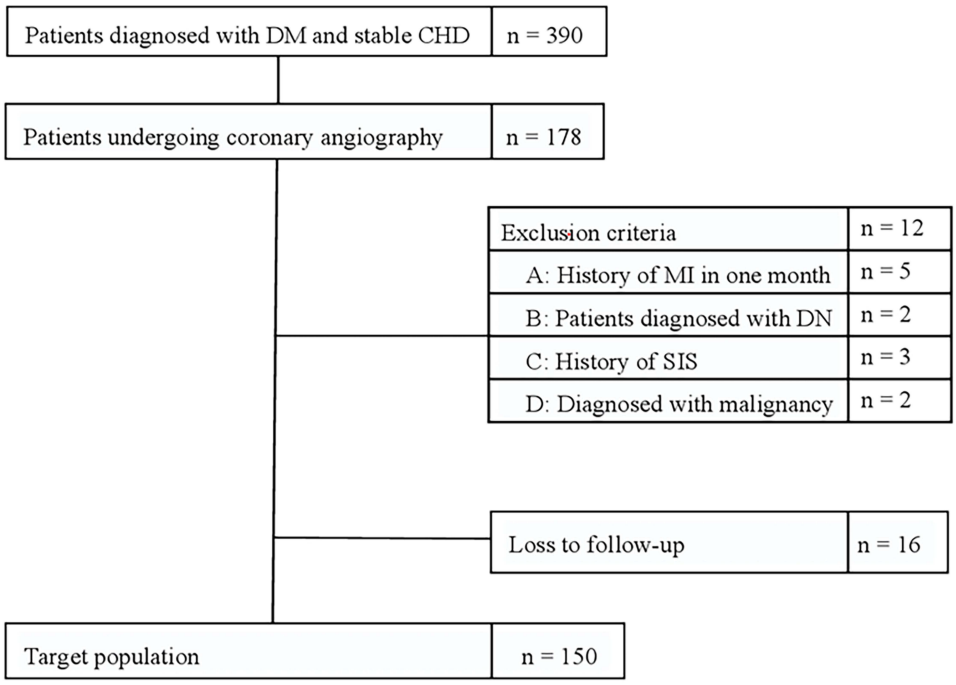

Figure 1 Flow chart.

All reporting adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) standards.[17] All patients were assessed at the Second Affiliated Hospital of Xi'an Medical University through outpatient visits every 6 months or telephone interviews. The clinical information and outcome events were recorded in study-specific databases. The participants were telephoned with their consent and informed of the purpose of the study. In this study, patients or their family members agreed by telephone or verbal consent during outpatient follow-up. They were told that this was a retrospective study and all data were anonymised during the analysis process and did not compromise the privacy of patients; furthermore, the study covered a long period and involved a retrospective analysis of hospitalised patients from up to 10 years ago. Some patients died or were unable to sign informed consent due to complications during the follow-up.

Ethical approval was obtained from the Institutional Review Board of The Second Affiliated Hospital of Xi'an Medical University (No. X2Y202352). The study adhered to the Declaration of Helsinki and STROBE guidelines. All participants or their legal surrogates provided verbal informed consent via telephone interviews. The process of obtaining consent was meticulously documented through audio recordings, which were stored securely and archived. Participants were informed about the purpose of the study, the nature of the data collection, and how their data would be used. It was explicitly stated that all data would be anonymised during the analysis process to ensure the privacy and confidentiality of the participants. Additionally, participants were assured that their participation was voluntary and that they could withdraw from the study at any time without any repercussions.

Variables Collection

The Beckman Coulter Automatic Biochemical Analyzer AU5800 and Beckman Coulter reagents were used to test the baseline data of laboratory measurements, such as low-density lipoprotein cholesterol (LDL-C), triglycerides, total cholesterol, high-density lipoprotein cholesterol (HDL-C), blood glucose, uric acid, total bilirubin (TBIL), direct and indirect bilirubin (DBIL and IBIL, respectively) and serum creatinine. Glycated haemoglobin was measured using the AU5800 analyser with immunoturbidimetric reagents certified by the National Glycohemoglobin Standardization Program. The results of the coronary angiography were interpreted by a cardiologist who had >5 years of working experience. The results of the angiographic CAD were quantified precisely using the Gensini score,[18] which quantifies coronary artery stenosis severity by assigning weights to each lesion based on its location and degree of luminal narrowing; higher scores indicate more extensive coronary disease.

Outcomes

Patients were divided into two categories based on their HbA1c levels at the index date, and the incidence of all-cause and cardiovascular death was compared between the subgroups. The incidence of each component was evaluated in the same way. Any death recorded in the diagnosis procedure combination data for the whole observable period following the index date was considered an all-cause death. Cardiovascular death was defined as myocardial infarction (MI), angina pectoris, malignant arrhythmia, acute heart failure or ischaemic stroke.

Statistical Analysis

All data analyses were performed using the statistical software SPSS 26.0, GraphPad Prism 7 and R version 4.2.2. The median (interquartile, Q1–Q3) was used to express the non-normally distributed data, whereas the mean and standard deviation (SD) were used to portray the variables with a normal distribution. Student's *t*-test (data with a normal distribution) and Pearson's chi-squared test (categorical variables) were run for the comparative analysis between the two groups. The multivariate Cox proportional hazards model was used to compare the risk of endpoints between the HbA1c subgroups. Kaplan–Meier survival analyses with Log rank tests were performed to show differences between groups.

Results

Study Population and Patient Characteristics

Patients were recruited between 1 January 2012 and 31 December 2013, and observation continued until 31 May 2022, for a total of 104.8 ± 35.7 months. In total, 150 patients with T2DM and stable CAD were registered in the cohort. The median diabetic duration was 2.0 years (0.50–10.0 years).

The mean (standard deviation) of age, Hb A1c, follow-up period, fasting glucose, 2-hour postprandial blood glucose, haemoglobin, serum albumin, serum total protein, total cholesterol, creatinine and urea nitrogen at enrolment was 63.5 years (10.8 years), 7.3% (1.8%), 104.8 months (35.7 months), 8.0 mmol/L (2.9 mmol/L), 13.1 mmol/L (4.8 mmol/L), 133 g/L (18.7 g/L), 42.3 g/L (4.3 g/L), 65.6 g/L (5.7 g/L), 1.6 mmol/L (0.8 mmol/L), 81.6 mmol/L (82.5 mmol/L) and 6.7 mmol/L (5.9 mmol/L), respectively. The number (proportion) of men, smokers, hypertension and history of MI or percutaneous coronary intervention were 83 (55.3%), 44 (29.3%), 102 (68%) and 52 (34.7%), respectively.

Hypertension, triglycerides, HDL-C, LDL-C, uric acid, TBIL and DBIL had no statistically significant differences between groups (all $p > 0.05$). During the observation period, a total of 53 patients died (35%); Table 1 displays the characteristics of the study participants divided into the deceased and surviving groups. Clinical outcomes at 10 years are summarised in Table 2.

All-Cause Mortality Risk Factors and Survival Analysis

Multivariate Cox regression analysis showed that all-cause mortality was significantly associated with age, HbA1c, diabetic duration, creatinine and Gensini score (Table 3). Adjusted hazard ratios (HRs) (95% CIs) of all-cause mortality were 1.10 (1.06–1.15) for age, 1.29 (1.12–1.48) for HbA1c, 1.06 (1.02–1.10) for diabetic duration, 1.00 (1.00–1.01) for creatinine and 1.02 (1.01–1.02) for Gensini score. Figure 2 displays the survival curve of different groups according to the level of HbA1c (>7.5% or ≤7.5%). A higher mortality rate was observed in patients with HbA1c of >7.5% among

Table 1 Characteristics of Study Participants

Baseline Characteristics	Deceased (n= 53)	Surviving (n = 97)	P-value[§]
Clinical characteristics			
Male, n (%)	25(47.2)	58(59.8)	0.170
Age (years)	71.5±8.6	59.2±9.3	<0.001
Diabetic duration (years)	10 (3.00-12.50)	1.00 (0.83-3.00)	<0.001
MI or PCI, n (%)	28(52.8)	24(24.7)	0.001
Hypertension, n (%)	38(71.7)	64(66.0)	0.583
Smoking, n (%)	9(17.0)	35(36.1)	0.015
Laboratory parameters			
Fasting glucose (mmol/L)	9.23±3.55	7.27±2.11	<0.001
2hPG (mmol/L)	14.59±5.44	12.36±4.28	0.006
HbA1c (%)	8.03±1.84	6.86±1.71	0.001
Hgb (g/dL)	125.21±20.79	135.67±16.40	0.001
PLT ($\times 10^9$/L)	172.05±56.82	174.70±52.24	0.774
WBC ($\times 10^9$/L)	6.71±1.70	6.65±1.83	0.833
Serum albumin (g/dL)	40.77±4.06	43.15±4.23	0.001
Serum total protein (g/dL)	64.15±5.63	66.37±5.60	0.022
Total cholesterol (mg/dL)	1.44±0.71	1.74±0.86	0.033
Triglycerides (mg/dL)	2.75±0.90	2.70±0.92	0.725
HDL (mg/dL)	1.06±0.16	1.07±0.16	0.836
LDL (mg/dL)	1.02±0.22	1.02±0.24	0.815
Creatinine (ummol/L)	107.80±131.68	67.32±24.27	0.004
Urea nitrogen (ummol/L)	8.21±5.73	5.95±5.92	0.025
Uric Acid (umol/L)	327.55±85.26	304.82±91.25	0.138
TBIL (umol/L)	12.19±6.82	12.96±14.10	0.710
DBIL (umol/L)	4.40±4.79	3.99±1.90	0.451
Gensini score	63.77±41.63	24.11±27.43	<0.001
Follow-up period (months)	65.00±42.29	125.52±7.85	<0.001

Notes: Data are presented as mean±standard deviation. § t-tests and χ^2-tests were used for comparison of mean values of continuous data and categorical variables, respectively.

Abbreviations: DD, Diabetic duration; MI, myocardial infarction; PCI, percutaneous coronary intervention; 2hPG, 2-hour postprandial blood glucose; HbA1c, glycosylated hemoglobin; PLT, Blood platelet; WBC, white blood cells; TBIL, Total bilirubin; DBIL, direct bilirubin.

Table 2 Clinical Outcomes at 10 Years

Outcome	Patients with Event, No. (%)		*P*-value[§]
	HbA1c>7.5%,	HbA1c<=7.5%	
All-cause mortality	32 (57.1)	20 (21.5)	**<0.001**[a]
Kidney failure	3	2	-
Malignant tumor	1	1	-
Infectious diseases	0	1	-
Others	1	2	-
Cardiovascular mortality	29 (51.8)	12 (12.9)	**<0.001**[b]
Myocardial infarction	6	3	-
Stroke	2	2	-
Angina pectoris	6	4	-
Heart failure	7	6	-
Malignant arrhythmia	2	3	-

Notes: Bold values denote statistical significance compared between the two groups ($p < 0.001$). [§]Chi-square test statistics: All-cause mortality (a: $\chi^2 = 19.54$); Cardiovascular mortality (b: $\chi^2 = 26.90$).

Table 3 Cox Survival Analysis of All-Cause Mortality

	Univariate Analysis		Multivariable Analysis	
	HR (95% CI)	*P*-value	HR (95% CI)	*P*-value
Age (years)	1.142 (1.099–1.186)	<0.001	1.101 (1.057–1.146)	<0.001
HbA1c (%)	1.250 (1.114–1.401)	<0.001	1.289 (1.120–1.484)	<0.001
DD (years)	1.101 (1.071–1.032)	<0.001	1.059 (1.020–1.100)	0.003
Fasting glucose (mmol/L)	1.153 (1.080–1.230)	<0.001	-	-
Gensini score	1.019 (1.014–1.025)	<0.001	1.016 (1.009–1.023)	<0.001
MI or PCI, n (%)	2.679 (1.560–4.603)	<0.001	-	-
2hPG (mmol/L)	1.073 (1.023–1.126)	0.004	-	-
Urea nitrogen (ummol/L)	1.029 (1.004–1.054)	0.021	-	-
Creatinine (ummol/L)	1.003 (1.001–1.005)	0.001	1.004 (1.002–1.006)	<0.001
Serum albumin (g/dL)	0.916 (0.869–0.967)	0.001	-	-
Serum total protein (g/dL)	0.946 (0.903–0.991)	0.018	-	-
Hgb (g/dL)	0.978 (0.965–0.990)	0.001	-	-
HCT (%)	0.947 (0.915–0.981)	0.003	-	-

Abbreviations: HbA1c, glycosylated hemoglobin; DD, Diabetic duration; MI, myocardial infarction; PCI, percutaneous coronary intervention; 2hPG, 2-hour postprandial blood glucose; Hgb, hemoglobin; HCT, hematokrit.

those with diabetic duration >10 years ($p = 0.0115$, Figure 2a). There was no significant difference between the two groups among those with diabetic duration of <5 years ($p = 0.1425$, Figure 2b). In the group of Gensini scores of >60 points, no significant differences were detected between patients with HbA1c of >7.5% and ≤7.5% ($p = 0.1182$, Figure 2c). However, patients with HbA1c of ≤7.5% had less all-cause survival than those with HbA1c of >7.5%, with Gensini scores of ≤60 points (p = 0.0160, Figure 2d). Figure 2d.

Cardiovascular Mortality Risk Factors and Survival Analysis

As shown in Table 4, six variables were selected by the Cox model: age, HbA1c, diabetic duration, DBIL, serum total protein and Gensini score. The adjusted HRs (95% CIs) of cardiovascular mortality were 1.10 (1.05–1.15) for age, 1.36 (1.16–1.58) for HbA1c, 1.06 (1.00–1.10) for the diabetic duration, 1.12 (1.04–1.23) for DBIL, 0.89 (0.83–0.95) for serum total protein and 1.02 (1.01–1.03) for Gensini score. Kaplan–Meier analysis revealed a higher cardiovascular mortality rate in patients with HbA1c of >7.5% and diabetic duration of >10 years ($p = 0.0004$, Figure 3a). There was no

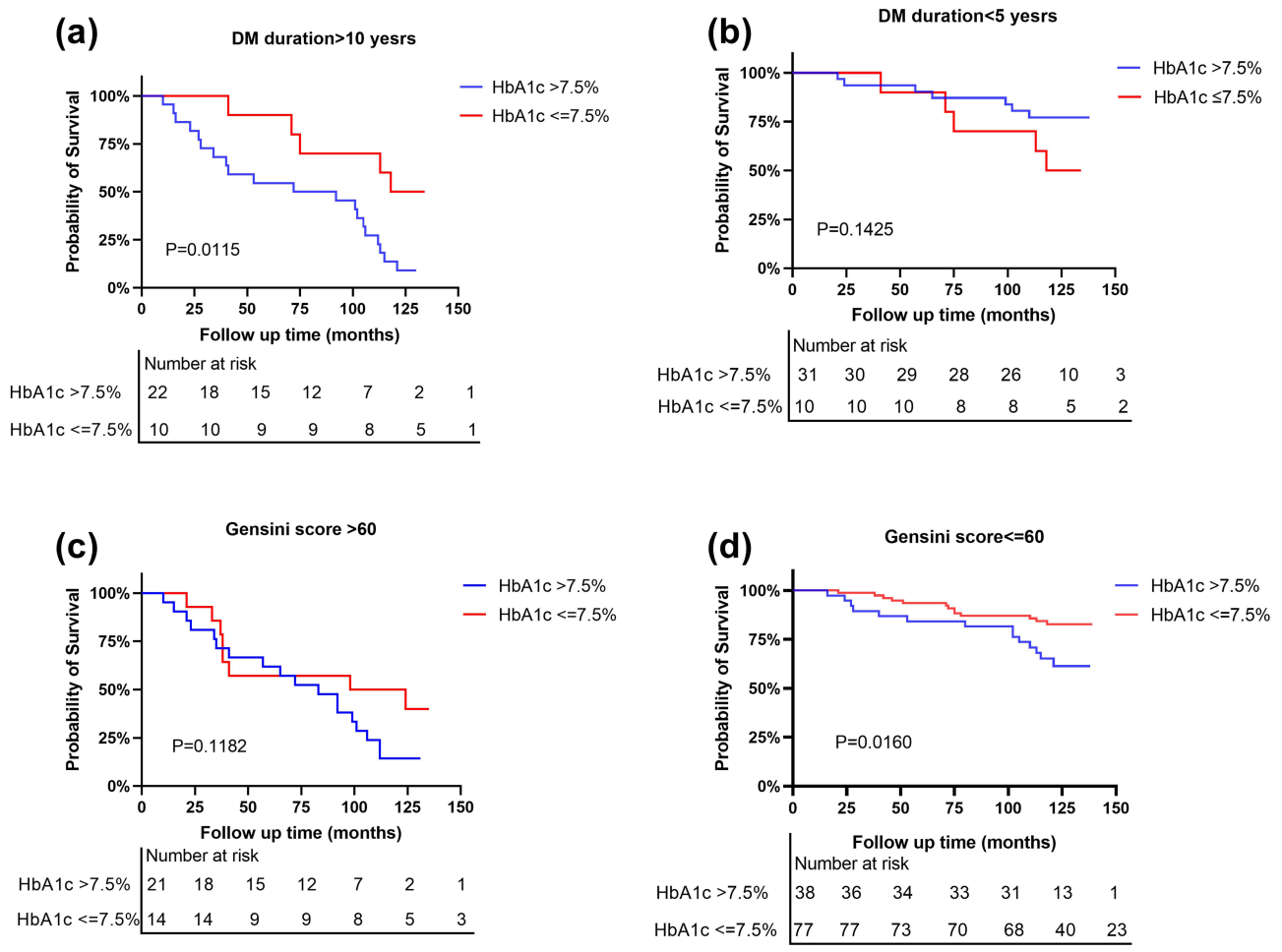

Figure 2 All-cause mortality risk factors and Survival Analysis. (**a**) The survival curve of DM duration>10 years group according to the level of HbA1c. (**b**) The survival curve of DM duration< 5 years group according to the level of HbA1c. (**c**) The survival curve of Gensini score>60 group according to the level of HbA1c. (**d**) The survival curve of Gensini score≤60 group according to the level of HbA1c.

significant difference between the two groups with a diabetic duration of <5 years (p = 0.1340, Figure 3b). Figures 3c and d show that higher mortality rates were observed in patients with HbA1c of >7.5% and Gensini score of >60 points or ≤60 points (p = 0.0154, p = 0.0104).

Table 4 Cox Survival Analysis of Cardiovascular Death

	Univariate Analysis		Multivariable Analysis	
	HR (95% CI)	***P*-value**	**HR (95% CI)**	***P*-value**
Age (years)	1.141(1.09–1.19)	<0.001	1.10 (1.05–1.15)	<0.001
HbA1c (%)	1.29 (1.14–1.46)	<0.001	1.36 (1.16–1.58)	<0.001
DD (years)	1.09 (1.06–1.13)	<0.001	1.06 (1.00–1.10)	0.048
Fasting glucose (mmol/L)	1.15 (1.07–1.24)	0.002	-	-
Gensini score	1.02 (1.02–1.03)	<0.001	1.02 (1.01–1.03)	<0.001
MI or PCI, n (%)	3.50 (1.89–6.49)	<0.001	-	-
DBIL (umol/L)	1.12 (1.03–1.22)	0.008	1.12 (1.04–1.23)	0.003
Serum albumin (g/dL)	0.91(0.86–0.97)	0.002	-	

(*Continued*)

Table 4 (Continued).

	Univariate Analysis		Multivariable Analysis	
	HR (95% CI)	***P*-value**	**HR (95% CI)**	***P*-value**
Serum total protein (g/dL)	0.93 (0.88–0.98)	0.006	0.89 (0.83–0.95)	0.001
Hgb (g/dL)	0.98 (0.97–0.10)	0.042	-	-
HCT (%)	0.95 (0.92–0.98)	0.003	-	

Abbreviations: HbA1c, glycosylated hemoglobin; DD, Diabetic duration; MI, myocardial infarction; PCI, percutaneous coronary intervention; DBIL, direct bilirubin; Hgb, hemoglobin; HCT, hematokrit.

Discussion

In this retrospective analysis with a 10-year follow-up, in the population with a diabetes course of >10 years, the risk of cardiovascular and all-cause death was substantially lower in the intensive group (HbA1c ≤7.5%) than in the relaxed glycaemic group (HbA1c >7.5%). Our finding that intensive glycaemic control reduced cardiovascular mortality across all stenosis levels (Gensini >60 and ≤60) but improved all-cause survival only in milder stenosis aligns with the 'vascular vulnerability' hypothesis. In advanced atherosclerosis (Gensini >60), plaques exhibit thin fibrous caps, necrotic cores and macrophage infiltration. This observation indicates that in patients with highly narrowed coronary arteries, solely focusing on blood glucose control may not be sufficient to improve prognosis comprehensively; it may be necessary

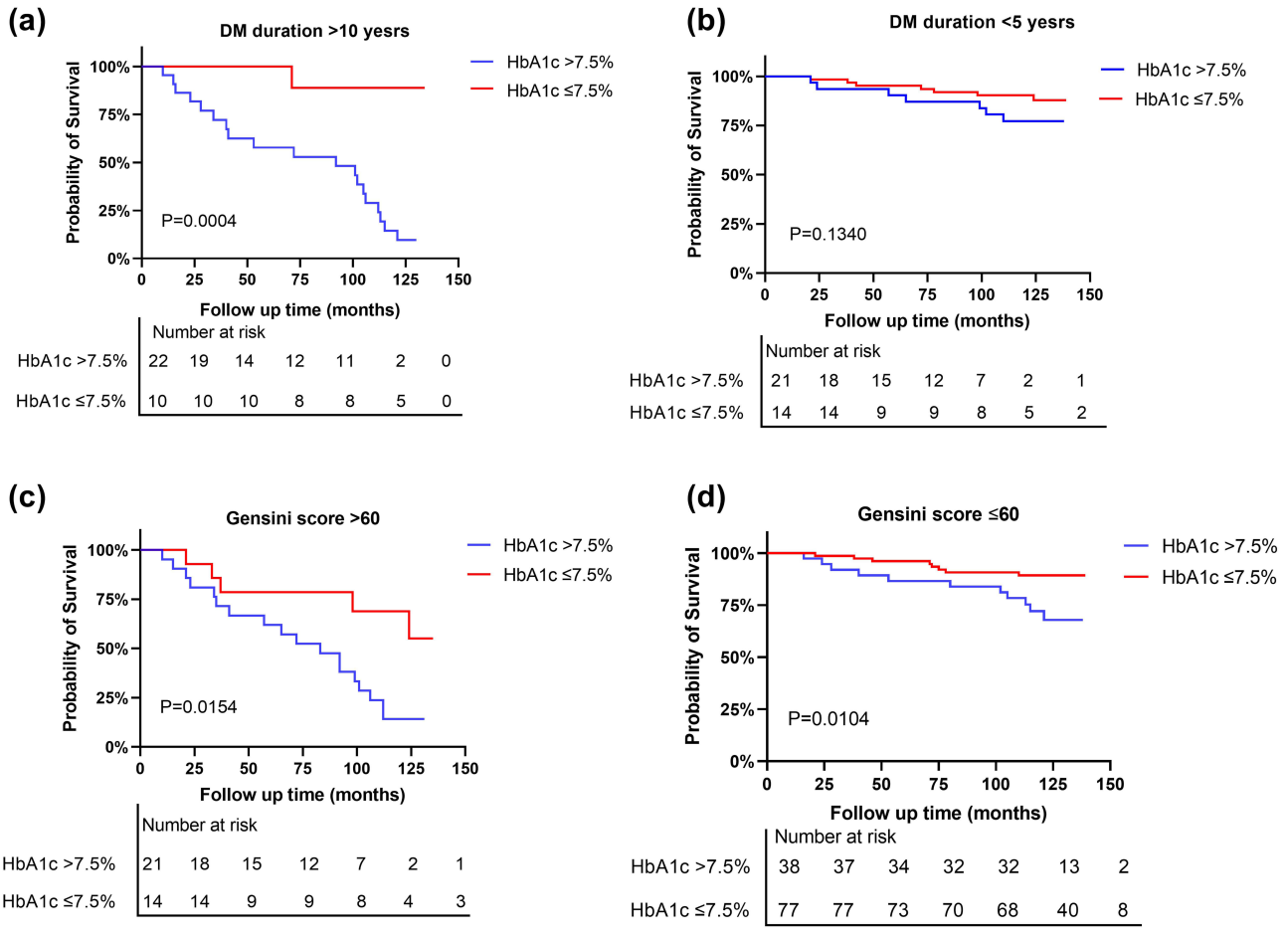

Figure 3 Cardiovascular mortality risk factors and Survival Analysis. (**a**) The survival curve of DM duration>10 years group according to the level of HbA1c. (**b**) The survival curve of DM duration< 5 years group according to the level of HbA1c. (**c**) The survival curve of Gensini score>60 group according to the level of HbA1c. (**d**) The survival curve of Gensini score≤60 group according to the level of HbA1c.

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to consider other risk factors, such as blood pressure and lipid levels, and their management. Here, aggressive HbA1c-lowering may fail to reverse structural instability, and hypoglycaemia episodes could trigger catecholamine surges, plaque rupture and fatal arrhythmias.[19] Conversely, in early-stage CAD (Gensini ≤60), glucose control mitigates endothelial nitric oxide synthase uncoupling, suppresses AGE-RAGE signalling and stabilises plaque phenotype.[20] Furthermore, this observation also indicates that in more advanced stages of the disease process, the potential benefit of blood glucose control on overall survival may be somewhat limited, underscoring the need for a more comprehensive treatment approach in clinical practice.

In our study, we also found that the Gensini score was independently associated with mortality in patients with T2DM and CCS. More recently, a retrospective cohort study showed that patients with high Gensini scores had higher event rates for all-cause mortality than those with low Gensini scores.[18] Severe stenosis (Gensini >60) reflects advanced atherosclerosis, where plaque instability and ischaemia-reperfusion injury amplify systemic inflammation. Reynolds et al[21] have reported that the Gensini score was a highly important predictor of all-cause and cardiac mortality in patients with CAD. Our study results reaffirmed that the Gensini score was an important predictor of a worse prognosis for patients with stable CAD.

Our finding is consistent with previous studies that age is a well-known risk factor for all-cause and CAD mortality; older patients had higher prevalence rates than younger patients.[22] Another study has also shown that the rate of mortality significantly increased with diabetes duration.[23] For individuals with T2DM, advancing age often complicates the disease course, as prolonged hyperglycaemia leads to cumulative vascular damage, increasing the risk of CVD. Elderly patients are more prone to developing multiple complications such as hypertension, dyslipidaemia and renal insufficiency, all of which further exacerbate the progression of CVD. Consequently, elderly individuals with T2DM face a relatively higher risk of cardiovascular mortality.

To the best of our knowledge, this is the first study that evaluated the associations of creatinine with total and cardiovascular mortality in the T2DM and CAD population. A retrospective cohort study has shown that a small creatinine increase had a high HR for all-cause mortality (HR 1.577, CI 1.329–1.871) in patients with CVD.[24] Previous studies have shown that patients with DM usually have higher serum creatinine and could develop chronic kidney disease.[25,26] The results of this study also demonstrate that creatinine levels are independently associated with all-cause mortality in individuals with T2DM and CAD.

Our study found that in T2DM with CCS, a higher DBIL level, rather than TBIL or IBIL, was positively associated with cardiovascular mortality. Elevated DBIL may indicate impaired hepatic conjugation capacity, linked to oxidative stress and endothelial dysfunction in T2DM. The association between serum bilirubin and T2DM with CAD has been reported in several studies, although the results are inconsistent. Serum bilirubin is a potent endogenous antioxidant and has been identified as a cardiovascular risk in cohort studies,[27] although the relation to T2DM and CAD remains unclear. The serum TBIL, which is the sum of the DBIL and IBIL, was the primary focus of previous studies. The meta-analysis reported that TBIL had an inverse association with adverse metabolic outcomes and confirmed a protective role of bilirubin in vascular disease outcomes, such as CAD.[28] In contrast, the Dongfeng–Tongji cohort study reported that DBIL concentrations were positively associated with the risk of incident T2DM in middle-aged and elderly adults,[29] which was consistent with our results. The controversy in the studies may be due to both genetics and the environment. Additionally, in our study, we found that serum total protein was a protective factor for cardiovascular mortality in T2DM with CCS.

In our study, we also first proposed the glycaemic control strategy using the duration of diabetes and the degree of coronary stenosis. In the ADA guidelines, glycaemic targets are suggested by the number and severity of comorbidities.[30] Previous studies have reported that prolonged exposure to hyperglycaemia coupled with several cardiovascular risk factors raises mortality in patients with long-duration diabetes.[31] We found that long diabetes duration (≥10 years) and strict glycaemic control (≤7.5%) were associated with an decreased risk of death (Figures 2a and 3a). However, for individuals with short diabetes duration (<5 years), good glycaemic control did not further decrease the risk of death. In this study, we also found that severe coronary stenosis (Gensini score >60) and strict glycaemic control were associated with decreased risk of cardiovascular mortality but not all-cause mortality (Figures 2c and 3c), whereas tight glycaemic control further reduced the risk of death among patients with milder coronary stenoses (Gensini score ≤60). According to

prior research, targets for glycaemic control should be tailored to each person's fragility or functional dependency and life expectancy.[32,33] The present study extends prior research by demonstrating that glycaemic control should consider not only the diabetic duration but also the severity of CAD.

This study has several strengths and limitations. It is the first retrospective study that focuses on mortality and glycaemic control based on coronary stenosis and diabetes duration among Chinese people with long-term follow-up (10 years). The following are some of the current study's flaws: (1) This is a single-centre retrospective study, and the sample size is relatively small. Further large clinical studies are required to validate our findings; (2) the fluctuating relationship over time between HbA1c levels and all-cause mortality was not examined – HbA1c values at various time points would more accurately reflect the risk of mortality because HbA1c fluctuates throughout time. Also, we were unable to obtain complete baseline HbA1c data, glycemic variability or trajectories (for example, patients improving from high to low HbA1c or vice versa) or perform a correlation analysis between baseline HbA1c and the Gensini score due to incomplete longitudinal data in this retrospective cohort. These limitations highlight the need for future prospective, multi-centre studies with more comprehensive data collection to further explore these relationships; (3) the major goal of this experiment was to determine whether there was a link between a single baseline measurement of exposures and variables and mortality. We did not examine how risk factors or therapies changed over time; thus, we were unable to draw any inferences about the association between longitudinal risk factor control and clinical outcomes; (4) limitations are imposed by the retrospective character of this research, particularly the significant number of patients who were eliminated due to incomplete data. Therefore, our results should be interpreted with caution and need to be further verified by a prospective, multicentre study.

In conclusion, our study examined risk factors for all-cause and cardiovascular mortality in patients with coronary heart disease and diabetes. The individual's frailty, life expectancy, diabetes duration and coronary stenosis should be considered in the decision of glycaemic control.

Ethics Statement

Registry and the registration no. of the study/trial: X2Y202352, on 2022/05/02.

Approval of the research protocol: The protocol for this research project was approved by the Ethics Committee of the Second Affiliated Hospital of Xi'an Medical University. All available data were completely anonymous with no personal information.

Informed Consent

The participants were telephoned with their consent and informed of the purpose of the study. The verbal consent was recorded by audio recording. The reasons are as follows: 1. This study is a retrospective study and all data are anonymized during the analysis process, which does not involve the privacy of patients; 2. This study has a long time span and retrospective analysis of hospitalized patients 10 years ago. Some patients died or were unable to sign informed consent due to complications during the follow-up. All specimens involving participants were approved by the Ethics Committee of the Institutional Review Board of The Second Affiliated Hospital of Xi'an Medical University (No. X2Y202352).

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Disclosure

The authors declared no conflicts of interest concerning the authorship or publication of this article.

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