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ORIGINAL RESEARCH

Effects of GLP-1RA Treatment on Long-Term Post-PCI Prognosis in T2DM Patients: A Propensity Score Matching Study

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Purpose: Data on the effect of GLP-1RA treatment on the long-term prognosis of patients with diabetes after percutaneous coronary intervention (PCI) are scant. The purpose of this study was to evaluate the effect of GLP-1RA treatment on the long-term prognosis in T2DM patients after PCI.

Patients and Methods: Data on T2DM patients who underwent PCI from January 2019 to December 2020 were retrospectively analyzed. Clinical data and the use of hypoglycaemic drugs were collected. Patients were divided into 2 groups based on whether they were treated with GLP-1RAs: the control group and the GLP-1RA group. PSM was used to match the control group at a 1:1 ratio. Survival curve and univariate and multivariate Cox regression analyses were used to compare the effects of GLP-1RA treatment on prognosis.

Results: A total of 981 patients were enrolled, and 277 pairs (554 patients) were matched with propensity scores. The balance between two groups improved after PSM ($P>0.05$). Compared with the control group, patients in the GLP-1RA group had lower TC, LDL-C, and HbA1c levels ($P<0.05$). After 24 months of follow-up, a total of 93 patients experienced adverse cardiovascular events. The survival curve revealed that the event-free survival rate in the GLP-1RA group was greater than that in the control group (log rank $P=0.012$). Univariate and multivariate Cox regression analyses revealed that BMI (HR: 1.055, 95% CI=1.007–1.105), HDL-C levels (HR: 0.236, 95% CI=0.095–0.583) and GLP-1RA use (HR: 0.617, 95% CI=0.403–0.943) were independent influencing factors of post-PCI major adverse cardiovascular event (MACE) risk in T2DM patients ($P<0.05$).

Conclusion: GLP-1RA treatment demonstrates cardiovascular benefits in T2DM patients following PCI, effectively reducing the risk of MACE, and enhancing long-term prognosis.

Keywords: GLP-1 receptor agonist, percutaneous coronary intervention, long-term prognosis, ischemic heart disease

Introduction

Type 2 diabetes mellitus (T2DM) patients often experience microvascular and macrovascular complications. The cardiovascular mortality rate of diabetes patients is three times greater than that of nondiabetic patients, and the risk of all-cause death is two times greater than that of nondiabetic patients.[1] Glucagon-like peptide-1 (GLP-1) is an essential glucagon-related hormone that has a nutritional effect on β cells. GLP-1 can promote insulin biosynthesis and gene expression, which may alter the natural course of T2DM.[2] An increasing number of studies have shown that GLP-1 can improve endothelial function and has a direct protective effect on the vascular system.[3] The use of GLP-1 receptor

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agonists (GLP-1RAs) as a hypoglycaemic drug in the treatment of T2DM has been shown to reduce the incidence of cardiovascular outcomes in patients with T2DM. Other societies, such as the American Diabetes Association, recommend that GLP-1RAs be used to treat high-risk patients with cardiovascular disease (CVD).

Current evidence on GLP-1RA cardiovascular benefits in T2DM patients post-PCI remains inconsistent and limited by key knowledge gaps. While meta-analyses confirm the safety of GLP-1RAs, their efficacy in reducing major adverse cardiovascular events (MACEs) varies significantly across studies. Some report neutral effects on MACE incidence or mortality compared to controls, while others suggest class-wide cardio protection; this discrepancy may stem from differences in specific GLP-1RA agents, patient populations, or follow-up durations.[4–6]

Critically, most trials focused on broad T2DM cohorts or heart failure subgroups, with scarce data specifically addressing PCI-treated patients—a high-risk population where ischemic heart disease prevalence is elevated.[7] Short-term PCI outcomes in T2DM are well-documented: these patients face higher complication rates and mortality than nondiabetic counterparts,[8–11] and PCI is often preferred for revascularization in noncomplex disease due to its minimally invasive nature. However, long-term risks (including death, MI, and unplanned revascularization) remain substantially increased in diabetic PCI cohorts beyond the peri-procedural period. Despite this, rigorous evidence evaluating GLP-1RA's longitudinal impact (>12 months) on MACEs exclusively in post-PCI T2DM populations is notably lacking, leaving a critical gap in guiding secondary prevention strategies.

Due to their demonstrated cardiovascular benefits, current clinical guidelines recommend GLP-1RAs for use in T2DM patients at high cardiovascular risk. However, a significant evidence gap persists regarding their application specifically in high-risk patients undergoing PCI, translating these robust findings directly to the immediate post-PCI period requires careful consideration. While cohorts within cardiovascular outcomes trials (CVOTs) included patients with prior revascularization.[12] These studies were not designed or powered to evaluate outcomes specifically in the immediate post-PCI setting. Crucially, the proportion of patients enrolled in these CVOTs during the high-risk immediate post-PCI phase was minimal or undefined. The enrolled patients with "prior revascularization" largely represented a stable, chronic ASCVD population, not one in the throes of acute vascular injury, heightened inflammation, and complex antithrombotic regimens characteristic of the post-PCI state. The unique pathophysiological milieu following PCI—characterized by vascular injury, platelet activation, and the requirement for concomitant antiplatelet therapy—may potentially modify the effects of GLP-1RAs. Furthermore, the complex interplay between GLP-1RAs and the mandatory dual antiplatelet therapy (DAPT) following PCI remains largely unexplored in dedicated clinical trials. Potential interactions affecting drug efficacy, safety (eg, bleeding risk), or pleiotropic effects in this specific context are unknown. Therefore, a critical evidence gap exists regarding the efficacy and safety profile of GLP-1RAs when initiated specifically for T2DM patients in the high-risk period immediately following PCI. Therefore, this study aims to evaluate the impact of GLP-1RAs on the long-term prognosis of diabetic patients following PCI, providing a theoretical basis for the prevention and treatment of ischemic heart disease in this population and ultimately improving outcomes.

Materials and Methods

Study Design and Subjects

This single-center, retrospective cohort study was conducted at the First Affiliated Hospital of Xinjiang Medical University, a major tertiary care hospital and regional cardiovascular referral center in Urumqi, Xinjiang Uygur Autonomous Region, China. A total of 1216 T2DM patients underwent PCI at this institution between January 2019 to December 2020. After applying exclusion criteria, 1050 patients were initially screened for eligibility (Figure 1). The inclusion criteria required a documented diagnosis of T2DM based on American Diabetes Association (ADA) standards: random plasma glucose ≥ 11.1 mmol/L, fasting plasma glucose ≥ 7.0 mmol/L, and/or 2-hour plasma glucose ≥ 11.1 mmol/L during oral glucose tolerance test, or ongoing glucose-lowering therapy for previously diagnosed T2DM. Exclusion criteria were: History of coronary artery bypass grafting (CABG); severe structural heart disease; refractory end-stage heart failure; severe hepatic or renal dysfunction; type 1 diabetes mellitus; active malignancy or acute systemic infection; patient with end stage cancer; Incomplete medical records; GLP-1RA use initiated >30 days post-PCI or discontinued within 90 days of initiation. This study complies with the Helsinki Declaration and was approved by the

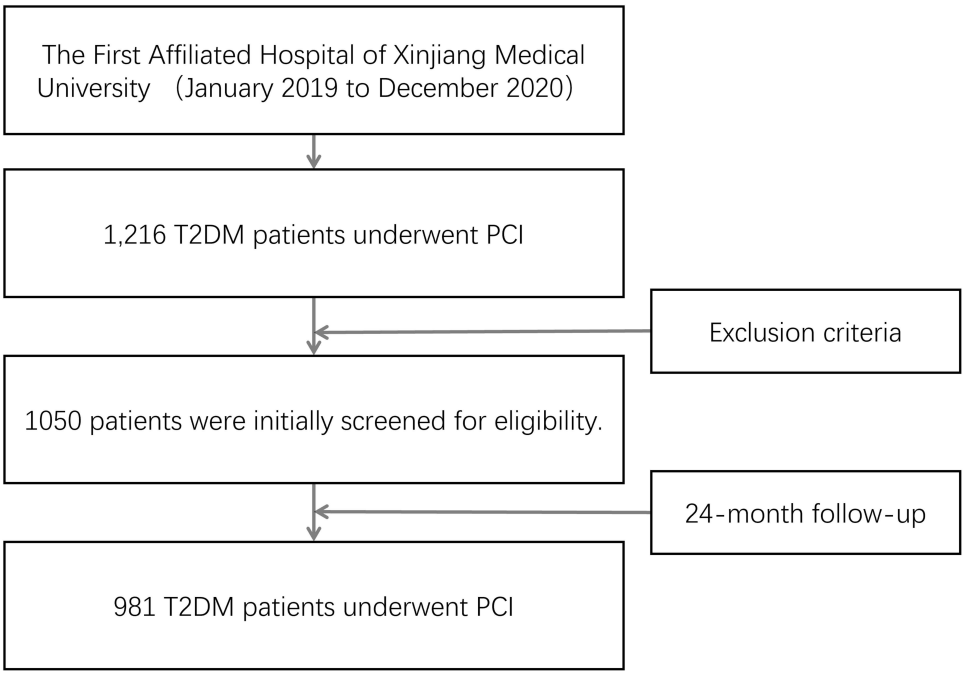

Figure 1 Research Flowchart.

Ethics Committee of the First Affiliated Hospital of Xinjiang Medical University (K202001-011). All the participants provided written informed consent.

Clinical and Biochemical Variables

Demographic data, medical history, laboratory results, and medication use were extracted by trained personnel via electronic medical records. Covariate definitions adhered to current guidelines: Hypertension: Systolic blood pressure (SBP) ≥140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg (mean of ≥2 seated measurements per visit on ≥2 visits), or documented diagnosis with ongoing antihypertensive therapy. Smoking status: Current smoker (≥1 cigarette/day in past 30 days); former smoker (quit >6 months prior); never smoker. Acute myocardial infarction (MI): Documented diagnosis meeting Fourth Universal Definition criteria (cardiac troponin elevation >99th percentile upper reference limit with ischemic symptoms/ECG changes/imaging evidence). LVEF: Measured by transthoracic echocardiography within 24h of admission using Simpson's biplane method.

Follow-Up and Endpoint Definition

Patients were followed regularly for 24 months after discharge through outpatient visits, telephone interviews, or review of the electronic medical records system. The primary endpoint was Major Adverse Cardiovascular Events (MACEs), defined as a composite of: (1) cardiac death (including death due to acute myocardial infarction, heart failure, fatal arrhythmia, or sudden cardiac death); (2) unplanned revascularization (either percutaneous or surgical, not part of the initial PCI procedure plan); and (3) hospitalization for cardiac causes (including unstable angina, acute myocardial infarction, heart failure exacerbation, or arrhythmia requiring admission).

GLP-1RA Exposure

1. Inclusion criteria for GLP-1RA group: Initiation of specific GLP-1RAs within 30 days post-PCI. Minimum treatment duration of 90 consecutive days. Agents included: liraglutide, dulaglutide, or semaglutide. 2. Verification: Exposure was confirmed via electronic prescription records and ≥2 consecutive pharmacy dispensations. 3. Dosing: Agents were administered at standard doses with no protocol-mandated dose adjustment.

Statistical Methods

Statistical analyses were performed using SPSS software (version 22.0, IBM Corp., Armonk, NY, USA). To minimize selection bias and balance baseline characteristics between the GLP-1RA group (n=277 before matching) and the control group (n=704 before matching), propensity score matching (PSM) was employed. Propensity scores were calculated using logistic regression including relevant covariates (age, sex, smoking, hypertension, MI, BMI, LVEF). Patients were matched 1:1 using greedy matching with nearest neighbor algorithm without replacement with a caliper width of 0.02 standard deviations of the logit propensity score. Standardized mean differences (SMDs) were calculated for all covariates. As shown in Table 1, all variables achieved SMD < 0.25 after matching, indicating adequate balance between groups. After PSM, both the GLP-1RA group and the control group comprised 277 patients each for the primary analysis. Continuous variables are represented by the mean ± standard deviation ($(\overline{x} \pm s)$) or median and interquartile range [M (QL, QU)], whereas categorical variables are represented by the number of cases and percentage [n (%)]. Comparisons between groups were conducted using independent samples *t*-test or Mann–Whitney *U*-test for continuous variables, and chi-square test or Fisher's exact test for categorical variables, as appropriate. Cox proportional hazards regression was performed with verification of proportional hazards (PH) assumption using Schoenfeld residuals. For variables violating PH assumption ($P<0.05$), stratified Cox regression was employed. Kaplan–Meier (KM) survival curves were drawn, and the event-free survival rates of the different groups were compared. Univariate and multivariate Cox regression analyses were used to clarify the relationship between GLP-1RA treatment and the occurrence of cardiovascular events.

Results

Comparison of Data Before and After PSM in Each Group

Initially, 1050 patients were screened for eligibility. After applying the inclusion and exclusion criteria, a total of 981 subjects (93.4% follow-up rate) completed the 24-month follow-up, with an average age of 62 ± 10 years, including 834 males and 147 females. All patients presenting with acute myocardial infarction underwent emergency PCI during index hospitalization. A total of 704 diabetes patients in the control group did not receive GLP-1RAs. A total of 277 patients were treated with GLP-1RAs. Before PSM, there were statistically significant differences ($P<0.05$) in sex, age, and BMI between the control group and the GLP-1RA group. After PSM, the matched cohort comprised 554 patients (277 pairs), with no statistically significant differences ($P>0.05$) in sex, age, BMI, smoking history, hypertension, myocardial infarction, or LVEF, indicating improved balance (Table 1). Although PSM did not reduce the SMD of LVEF (0.25 before and after matching), this was expected because pre-matching group difference was nonsignificant ($P=0.729$). Among the 554 matched patients, 93 experienced MACEs during follow-up, including: Cardiac death: 18 cases (19.4%). Unplanned revascularization: 14 cases (15.1%). Hospitalization for cardiac causes: 64 cases (68.8%).

Table 1 Comparison of the Baseline Data of Patients Before and After PSM Between the Two Groups [$\overline{x} \pm s$, n (%)]

	Before PSM		*SMD*	*P*	After PSM		*SMD*	*P*
	Control Group (n=704)	GLP-1RA Group (n=277)			Control Group (n=277)	GLP-1RA Group (n=277)		
Age (years)	61±9	65±11	0.398	<0.001	65±10	65±11	0.000	0.755
Male	633 (89.9)	201 (72.6)	0.454	<0.001	219 (79.1)	201 (72.6)	0.152	0.074
Smoking	242 (34.4)	111 (40.1)	0.118	0.094	103 (37.2)	111 (40.1)	0.060	0.485
Hypertension	437 (62.1)	188 (67.9)	0.122	0.071	189 (68.2)	188 (67.9)	0.006	0.927
AMI	172 (24.4)	56 (20.2)	0.101	0.159	51 (18.4)	56 (20.2)	0.046	0.590
BMI, kg/m^2	26.5±3.9	26.1±4.5	0.095	0.035	26.3±4.6	26.1±4.5	0.044	0.215
LVEF, %	37±4	36±4	0.250	0.729	37±4	36±4	0.250	0.312

Abbreviations: AMI, Acute Myocardial Infarction; BMI, Body mass index; LVEF, Left ventricular ejection fraction.

Comparison of Test Results Between the Two Groups of Patients

The differences in test indicators between the two groups of patients were compared after PSM. Compared with those in the control group, patients in the GLP-1RA group had lower levels of total cholesterol (TC) (P=0.016), lower levels of low-density lipoprotein cholesterol (LDL-C) (P=0.002), and lower levels of glycosylated haemoglobin (HbA1c) (P=0.004). There was no significant difference in blood glucose, triglyceride (TG), or high-density lipoprotein cholesterol (HDL-C) levels between the two groups (P>0.05) (Table 2).

Comparison of Diabetes Drugs Between the Two Groups

Considering that patients may receive different diabetes drugs at the same time, in this study, the use of diabetes drugs was compared between the two groups, and the results revealed that there was no significant difference in the use of metformin, α-glucosidase inhibitors, insulin secretagogues, insulin or other hypoglycaemic drugs between the two groups (Table 3).

Survival analysis Cox regression covariates were selected based on clinical relevance. Initial multivariate Cox regression identified GLP-1 receptor agonist therapy as a significant protective factor against MACEs (HR=0.617, 95% CI: 0.403–0.943, P=0.026) (Table 4). However, Schoenfeld residuals testing revealed non-proportional hazards for GLP-1RA (χ^2=4.05, P=0.044), indicating its protective effect varied over time (Supplementary Table 1). To address this violation while validating other predictors, we performed stratified Cox regression with GLP-1RA as the stratification factor. This analysis confirmed: Higher body mass index (BMI) remained an independent risk factor (HR=1.052, 95% CI: 1.005–1.101, P=0.031). High-density lipoprotein cholesterol (HDL-C) was a robust protective factor (HR=0.253, 95% CI: 0.105–0.609, P=0.002). Hypertension emerged as a significant risk predictor (HR=2.852, 95% CI: 1.233–6.594, P=0.014) (Table 5). Critically, the Kaplan-Meier curve (Figure 2) demonstrated sustained survival benefit with GLP-1RA therapy throughout the 24-month follow-up (log-rank P=0.012), affirming its clinical importance despite the time-varying effect magnitude.

Table 2 Comparison of Test Results Between the Two Groups [M (Q_L, Q_U)]

	Control Group	GLP-1RA Group	*P*
Blood glucose	8.11 (5.93, 11.78)	7.64 (5.82, 11.17)	0.428
TG (mmol/L)	1.28 (0.97, 1.74)	1.28 (0.92, 1.84)	0.817
TC (mmol/L)	3.48 (2.84, 4.21)	3.32 (2.69, 3.98)	0.016
HDL-C (mmol/L)	0.86 (0.70, 1.07)	0.90 (0.71, 1.10)	0.398
LDL-C (mmol/L)	2.22 (1.75, 2.92)	2.07 (1.54, 2.55)	0.002
HbA1c (%)	8.3 (7.3, 9.5)	7.9 (6.8, 9.2)	0.004

Abbreviations: BG, Blood glucose; TG, Triglyceride; TC, Total cholesterol; HDL-C, High-density lipoprotein cholesterol; LDL-C, Low-density lipoprotein cholesterol; HbA1c, Glycosylated haemoglobin.

Table 3 Comparison of Diabetes Drugs Between the Two Groups [n (%)]

	Control Group	GLP-1RA Group	*P*
Metformin	93 (33.6)	92 (33.2)	0.928
α-glucosidase inhibitor	129 (46.6)	115 (41.5)	0.231
Insulin secretagogue	46 (16.6)	32 (11.6)	0.087
Insulin	200 (72.2)	190 (68.6)	0.352
Others	44 (15.9)	41 (14.8)	0.724

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Table 4 Univariate and Multivariate Cox Regression Analyses

	Univariate Cox Regression Analysis	*P*	Multivariate Cox Regression Analysis	*P*
	HR (95% CI)		HR (95% CI)	
Sex	1.733 (0.997–3.011)	0.051	1.592 (0.900–2.815)	0.110
Age	1.001 (0.992–1.021)	0.913	1.017 (0.995–1.039)	0.126
Smoking	0.744 (0.482–1.149)	0.182	0.652 (0.402–1.055)	0.081
Hypertension	2.439 (1.323–4.179)	0.001	2.363 (0.979–5.704)	0.056
AMI	0.478 (0.248–0.921)	0.027	0.848 (0.282–2.545)	0.768
BMI	1.053 (1.008–1.100)	0.019	1.055 (1.007–1.105)	0.024
LVEF	0.985 (0.965–1.005)	0.145	0.980 (0.959–1.001)	0.067
HDL-C	0.242 (0.105–0.554)	0.001	0.236 (0.095–0.583)	0.002
LDL-C	0.945 (0.755–1.183)	0.620	1.060 (0.848–1.325)	0.610
HbA1C	1.095 (0.987–1.215)	0.088	1.074 (0.960–1.201)	0.211
GLP-1RA	0.587 (0.386–0.894)	0.013	0.617 (0.403–0.943)	0.026

Abbreviations: AMI, Acute Myocardial Infarction; BMI, Body mass index; LVEF, Left ventricular ejection fraction; HDL-C, High-density lipoprotein cholesterol; LDL-C, Low-density lipoprotein cholesterol; HbA1c, Glycosylated haemoglobin.

Table 5 Hierarchical COX Regression Model

	HR (95% CI)	*P*
Sex	1.464 (0.779–2.749)	0.236
Age	1.017 (0.995–1.039)	0.124
Smoking	1.313 (0.823–2.095)	0.253
Hypertension	2.852 (1.233–6.594)	0.014
AMI	1.181 (0.427–3.266)	0.748
BMI	1.052 (1.005–1.101)	0.031
LVEF	0.982 (0.961–1.003)	0.093
HDL-C	0.253 (0.105–0.609)	0.002
LDL-C	1.030 (0.821–1.291)	0.800
HbA1C	1.093 (0.982, 1.216)	0.104

Abbreviations: AMI, Acute Myocardial Infarction; BMI, Body mass index; LVEF, Left ventricular ejection fraction; HDL-C, High-density lipoprotein cholesterol; LDL-C, Low-density lipoprotein cholesterol; HbA1c, Glycosylated haemoglobin.

Discussion

The results of this study indicate that GLP-1RA treatment is associated with a decreased risk of MACEs within 24 months in T2DM patients who underwent PCI, indicating that GLP-1RA treatment helps improve cardiovascular outcomes in T2DM patients. Similar to the results of this study, some studies have also shown that GLP-1RA treatment has a positive effect on the heart and can significantly reduce the incidence of cardiovascular events in T2DM patients.

Previous studies have shown that CVDs in patients with diabetes are more complex, leading to poor clinical prognosis.[13] A study by Gyldenkerne et al[14] revealed that the risk of myocardial infarction and all-cause death in diabetes patients with coronary artery disease is much greater than that in patients with coronary artery disease without diabetes. Among the patients who received PCI revascularization, 40% had diabetes.[15] Unplanned readmission after PCI is common, with up to 16% of PCI patients readmitted within 30 days after surgery.[16] Compared with nondiabetic patients, diabetes patients have a greater risk of MACEs after PCI. Diabetes status is an independent predictor of readmission after PCI. The interaction between CVD and diabetes increases the risk of complications. Previous studies

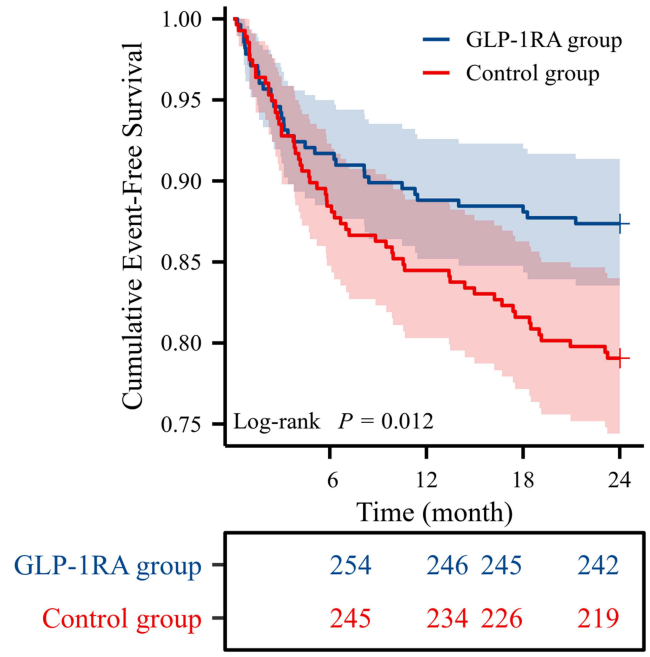

Figure 2 Comparison of the survival curves of patients in the two groups.

have suggested that diabetes patients with complications should be treated as high-risk groups, aiming to reduce the high readmission rate of diabetes patients with CVD.[17]

GLP-1RAs are a class of drugs used to treat T2DM. They can not only improve hyperglycaemia in diabetes patients but also directly affect important risk factors for other CVDs, such as hypertension, dyslipidaemia and obesity.[18] Previous studies have shown that GLP-1RA treatment has a significant effect on the incidence of cardiovascular death in T2DM patients; improves redox status and mitochondrial respiration; and reduces the interaction between leukocytes and the endothelium, inflammation, and carotid intima-media thickness in T2DM patients, thereby potentially reducing the risk of developing atherosclerosis and CVD.[19] The LEADER trial showed that adding liraglutide to standard treatment for T2DM can reduce the risk of cardiovascular death, myocardial infarction, or nonfatal stroke by 13%.[20] Bethel et al[21] compared GLP-1RAs and placebo in 33457 patients with diabetes. The results revealed that MACEs were significantly reduced by 10%, cardiovascular mortality was significantly reduced by 13%, and total mortality was significantly reduced by 12%. However, no impact on stroke, myocardial infarction, or heart failure hospitalization was observed. Liraglutide can reduce infarct size and improve cardiac function in diabetic mice.[22] Similar studies may help explain why GLP-1RA treatment may reduce the incidence of adverse endpoint events after PCI in diabetes patients.

Landmark trials such as LEADER and SUSTAIN-6 demonstrated the cardioprotective effects of glucagon-like peptide-1 receptor agonists (GLP-1RAs) in patients with type 2 diabetes mellitus (T2DM). These studies established that GLP-1RAs confer significant cardiovascular benefits beyond glycemic control.[23] Mechanistically, emerging evidence suggests these benefits may be partially mediated through weight reduction and blood pressure lowering effects,[24] alongside proven reductions in atherosclerotic cardiovascular events, particularly ischemic stroke.[25]

Crucially, however, post-percutaneous coronary intervention (PCI) subgroups were seldom analyzed separately in major trials. The EXSCEL trial—a global, multicenter, randomized, placebo-controlled study—evaluated once-weekly exenatide in 14,752 T2DM patients, including 1621 (11%) with prior PCI. While the trial reported a neutral impact on major adverse cardiovascular events (MACE) overall,[26] subgroup-specific outcomes for PCI patients remained unpublished. This contrasts with positive findings from other GLP-1RA trials.[27] Notably, exenatide showed a non-significant trend toward reduced all-cause mortality.[28] The neutral MACE outcomes in PCI patients may reflect their complex pathophysiology, often involving multivessel disease which elevates cardiovascular risk.[29]

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Previous studies have shown that GLP-1RA treatment can effectively reduce several metabolic risk factors, including HbA1c levels, body weight, and blood glucose.[30] GLP-1RAs typically lead to decreased appetite and food intake, resulting in weight loss. Moreover, GLP-1 can dramatically reduce the concentration of nonesterified fatty acids by stimulating insulin and inhibiting glucagon secretion, especially in patients with T2DM and hyperglycaemia. In clinical trials, GLP-1RA treatment has been shown to reduce TG concentrations and increase HDL-C concentrations.[31] In addition, a sustained decrease in the LDL-C concentration was observed with GLP-1RA treatment, particularly compared with insulin therapy. In a rodent model of ischemia–reperfusion injury and diabetic cardiomyopathy, natural GLP-1 and GLP-1 receptor agonists enhance the uptake and utilization of glucose in the heart, which is related to the energy conversion from fatty acid to glucose oxidation.[32] In this study, compared with those in the control group, patients in the GLP-1RA group presented significant reductions in TC and LDL-C levels, while there were no significant differences in TG and HDL-C levels. GLP-1RA treatment can significantly reduce fasting blood glucose levels (with an average reduction of up to 50 mg/dL) and lower HbA1c levels by 0.5% to 1.3%. Similar to the above research results, in this study, the HbA1c of the GLP-1RA group was significantly lower than that of the control group, but there was no significant difference in blood glucose levels. This study provides compelling evidence that GLP-1RA therapy significantly improves cardiovascular outcomes in diabetic patients after PCI. Our initial multivariate Cox model - adjusted for key confounders including BMI, lipid profiles, and cardiac function - already demonstrated a 38.3% relative risk reduction with GLP-1RAs. While PH violation necessitated methodological adjustments, this actually enriches our understanding of GLP-1RA's temporal dynamics. The concordance between KM curves (unadjusted) and Cox models (adjusted) reinforces result validity.

The results of this study indicate that GLP-1RA treatment is associated with a decreased risk of MACEs within 24 months in T2DM patients who underwent PCI, suggesting potential cardiovascular benefits in this high-risk population. This finding aligns with mechanistic insights from prior trials but crucially extends evidence to the understudied PCI cohort. Collectively, GLP-1RAs exhibit potential for risk reduction in PCI patients, particularly in combination therapies. Nevertheless, inconsistent evidence underscores the need for rigorously designed trials to validate their cardioprotective efficacy across diverse clinical scenarios. Future studies should focus on optimizing treatment strategies to maximize cardiovascular benefits.

Beyond the acknowledged single-center design and sample size constraints, this study has additional limitations: 1) Lack of detailed GLP-1RA exposure data (dose, treatment duration, adherence) limits assessment of a dose-response relationship. This is critical given CVOTs show sustained benefit requires long-term use. 2) Despite PSM balancing measured covariates, unmeasured confounders (eg, socioeconomic status, medication adherence, residual angiographic complexity) may persist. 3) Generalizability to non-Asian populations or non-diabetic PCI patients remains uncertain, as GLP-1RA mechanisms may partly depend on gluco-metabolic effects. Further multicenter studies with larger samples, detailed drug exposure recording, and inclusion of diverse populations are warranted.

Conclusion

The present findings suggest that among T2DM patients receiving PCI treatment, patients receiving GLP-1RAs have lower levels of TC, LDL-C, and HbA1c and significantly improved survival probability, which indicates that GLP-1RA treatment is helpful for improving the cardiovascular outcome of T2DM patients. This study lays a theoretical foundation for the prevention, treatment, and prognosis of clinical diabetes patients with ischemic heart disease.

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Disclosure

The authors report no conflicts of interest in this work.

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