STROBE Statement—checklist of items that should be included in reports of observational studies

	Item No.	Recommendation	Page No.	Relevant text from manuscript
Title and abstract	1	(a) Indicate the study's design with a commonly used term in the title or the abstract	1	Effect of diltiazem sustained-release capsules on cardiorenal composite outcomes in hypertensive patients with coronary heart disease: A real-world propensity score-matched study
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	1	Abstract: Background: Hypertension frequently coexists with coronary heart disease (CHD) and integrated management is essential to reduce cardiovascular and renal complications. Objectives: To evaluate the efficacy and safety of add-on sustained-release diltiazem capsules in patients with hypertension and CHD. Methods: This retrospective cohort analysis included 302 consecutive patients with CHD treated at the Affiliated Hospital of Jiangnan University between May 2021 and May 2024. Patients were divided into a control group (n=158) receiving standard guideline-directed therapy and a diltiazem group (n=144) receiving add-on diltiazem sustained-release capsules. Propensity scores were used to match and balance baseline covariates to reduce selection bias. Following matching, intergroup comparisons for baseline characteristics, occurrence of cardiorenal composite endpoints, blood pressure, heart rate (HR) control during follow-up and adverse drug reactions were conducted. Multivariate regression analysis was used to determine predictors of cardiorenal endpoint events. Results: After matching, baseline covariates were well-balanced between groups. During a median follow-up of 18 months, the cumulative incidence of cardiorenal composite endpoint events was lower in the diltiazem group than in controls (16.39% vs. 32.79%, P=0.002). Multivariate Cox analysis showed that diltiazem therapy was independently associated with a lower risk of composite outcomes (hazard ratio = 0.465, 95% CI: 0.284–0.760, P = 0.002). Patients receiving diltiazem also had a lower mean HR and higher achievement rates for HR control and combined blood pressure/HR targets (all P<0.05). The reduction in composite outcomes was primarily driven by fewer heart

				failure rehospitalizations. Drug-related adverse events were comparable between groups. Conclusion: Adding sustained-release diltiazem capsules to standard therapy is associated with a lower cardiorenal composite endpoint risk in patients with hypertension and CHD. The observed benefit was mainly driven by fewer heart failure rehospitalizations, alongwith improved control of blood pressure and heart rate. The renal findings should be considered exploratory because the number of renal events was limited.
Introduction				
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	1	Hypertension is a core driving factor in the development and progression of atherosclerosis. Persistently elevated blood pressure (BP) accelerates the process of coronary atherosclerosis through multiple mechanisms, such as hemodynamic stress, endothelial dysfunction, oxidative stress and inflammatory responses, ultimately leading to clinical events, including myocardial ischemia, angina pectoris and myocardial infarction
Objectives	3	State specific objectives, including any prespecified hypotheses	1-2	Based on real-world data, this study explored the effects of sustained-release diltiazem capsules on cardiorenal endpoints in patients with hypertension complicated by CHD, providing a rationale for optimizing clinical treatment strategies.
Methods				
Study design	4	Present key elements of study design early in the paper	2	All patients were categorized into two groups: a control group receiving standard guideline-directed therapy (n=158) and a diltiazem group receiving standard guideline-directed therapy combined with diltiazem sustained-release capsules. Treatment regimens were determined independently by attending physicians based on individual patient conditions, relevant clinical guidelines and clinical judgment; no treatment decisions were influenced by the study protocol.
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	2	Baseline characteristics, treatment regimens and follow-up data were collected from hospital electronic records, outpatient medical records and telephone interviews, with the last follow-up conducted on May 31, 2025.
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up Case-control study—Give the eligibility criteria, and the sources and	2	Baseline characteristics, treatment regimens and follow-up data were collected from hospital electronic records, outpatient medical records and telephone interviews, with

		methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants		the last follow-up conducted on May 31, 2025.
		(b) Cohort study—For matched studies, give matching criteria and number of exposed and unexposed Case-control study—For matched studies, give matching criteria and the number of controls per case	2	All patients were categorized into two groups: a control group receiving standard guideline-directed therapy (n=158) and a diltiazem group(n=144) receiving standard guideline-directed therapy combined with diltiazem sustained-release capsules. Treatment regimens were determined independently by attending physicians based on individual patient conditions, relevant clinical guidelines and clinical judgment; no treatment decisions were influenced by the study protocol.
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	3	Differences in post-propensity score matching (PSM) baseline characteristics, incidence of cardiorenal endpoint events, BP and HR control, target achievement during follow-up and drug-related adverse events were compared between the two groups. The factors influencing cardiac and renal endpoint events were analyzed.
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	3	The data were analyzed using SPSS software (v.26.0). Continuous variables with normal distribution are expressed by mean ± standard deviation ($\bar{x} \pm s$) and were compared by independent sample *t* test. Non-normally distributed data are expressed as median (interquartile range) [M(IQR)] and were analyzed using the Mann–Whitney U test. Categorical variables are represented as numbers (percentages) [n (%)] and were compared using the chi-square (χ^2) test or Fisher's exact test, depending on the situation. Multivariate Cox proportional hazard regression was performed to evaluate the correlation with the clinical results and the results were reported as hazard ratios (HRs) with 95% confidence intervals (CIs). Variables entered into multivariable Cox regression were selected based on clinical relevance, prior literature and univariable association (P <0.10), including age, diabetes, baseline eGFR, SBP, β-blocker use and coronary disease severity. Two-tailed P value < 0.05 indicates statistical significance. Covariate balance after matching was assessed using standardized mean differences (SMD), with SMD <0.10 considered

				acceptable balance. The composite endpoint was prespecified to capture the shared cardiovascular/renal risk continuum commonly observed in patients with hypertension and CHD.
Bias	9	Describe any efforts to address potential sources of bias	3	Two-tailed *P* value < 0.05 indicates statistical significance. Covariate balance after matching was assessed using standardized mean differences (SMD), with SMD <0.10 considered acceptable balance. The composite endpoint was prespecified to capture the shared cardiovascular/renal risk continuum commonly observed in patients with hypertension and CHD.
Study size	10	Explain how the study size was arrived at	/	/

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Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	/	
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	3	The data were analyzed using SPSS software (v.26.0). Continuous variables with normal distribution are expressed by mean ± standard deviation ($\bar{x} \pm s$) and were compared by independent sample t test. Non-normally distributed data are expressed as median (interquartile range) [M(IQR)] and were analyzed using the Mann–Whitney U test. Categorical variables are represented as numbers (percentages) [n (%)] and were compared using the chi-square (χ^2) test or Fisher's exact test, depending on the situation. Multivariate Cox proportional hazard regression was performed to evaluate the correlation with the clinical results and the results were reported as hazard ratios (HRs) with 95% confidence intervals (CIs). Variables entered into multivariable Cox regression were selected based on clinical relevance, prior literature and univariable association ($P < 0.10$), including age, diabetes, baseline eGFR, SBP, β-blocker use and coronary disease severity. Two-tailed P value < 0.05 indicates statistical significance. Covariate balance after matching was assessed using standardized mean differences (SMD), with SMD <0.10 considered acceptable balance. The composite endpoint was prespecified to capture the shared cardiovascular/renal risk continuum commonly observed in patients with hypertension and CHD
		(b) Describe any methods used to examine subgroups and interactions	3	The data were analyzed using SPSS software (v.26.0). Continuous variables with normal distribution are expressed by mean ± standard deviation ($\bar{x} \pm s$) and were compared by independent sample t test. Non-normally distributed data are expressed as median (interquartile range) [M(IQR)] and were analyzed using the Mann–Whitney U test. Categorical variables are represented as numbers (percentages) [n (%)] and were compared using the chi-square (χ^2) test or Fisher's exact test, depending on the situation. Multivariate Cox proportional hazard regression was performed to evaluate the correlation with the clinical results and the results were reported as hazard ratios (HRs) with 95% confidence intervals (CIs). Variables entered into multivariable Cox regression were selected based on clinical relevance, prior literature and

				univariable association (P <0.10), including age, diabetes, baseline eGFR, SBP, β-blocker use and coronary disease severity. Two-tailed P value < 0.05 indicates statistical significance. Covariate balance after matching was assessed using standardized mean differences (SMD), with SMD <0.10 considered acceptable balance. The composite endpoint was prespecified to capture the shared cardiovascular/renal risk continuum commonly observed in patients with hypertension and CHD
		(c) Explain how missing data were addressed	/	
		(d) Cohort study—If applicable, explain how loss to follow-up was addressed Case-control study—If applicable, explain how matching of cases and controls was addressed Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	/	
		(e) Describe any sensitivity analyses	/	
Results				
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	3	After PSM, 122 matched pairs were identified. The baseline characteristics were well-balanced between the two groups. All post-matching SMD were <0.10, indicating an adequate covariate balance (Table 1 and Fig. 1).
		(b) Give reasons for non-participation at each stage	3	After PSM, 122 matched pairs were identified. The baseline characteristics were well-balanced between the two groups. All post-matching SMD were <0.10, indicating an adequate covariate balance (Table 1 and Fig. 1).
		(c) Consider use of a flow diagram	3	Fig. 1
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	3	After PSM, 122 matched pairs were identified. The baseline characteristics were well-balanced between the two groups. All post-matching SMD were <0.10, indicating an adequate covariate balance (Table 1 and Fig. 1).
		(b) Indicate number of participants with missing data for each variable of interest	3	After PSM, 122 matched pairs were identified. The baseline characteristics were well-balanced between the two groups. All post-matching SMD were <0.10, indicating an adequate covariate balance (Table 1 and Fig. 1).
		(c) Cohort study—Summarise follow-up time (eg, average and total amount)	3	After PSM, 122 matched pairs were identified. The baseline characteristics were well-balanced between the two groups. All post-matching SMD were <0.10,

				indicating an adequate covariate balance (Table 1 and Fig. 1).
Outcome data	15*	Cohort study—Report numbers of outcome events or summary measures over time	3	The median follow-up duration was 18 months (interquartile range: 12–26 months). During the follow-up, 60 patients (24.59%) in the matched cohort experienced at least one cardiorenal composite endpoint event. However, the cumulative incidence was significantly lower in the diltiazem group than in the control group (16.39% vs. 32.79%, P=0.002). Kaplan–Meier analysis also demonstrated a significantly lower time-to-first composite event rate in the diltiazem group (Fig. 2 and Table 2). Among the individual endpoint components, the greatest absolute reduction was observed in the heart failure rehospitalization rate (14 vs. 4 events), followed by unstable angina (10 vs. 6 events), suggesting that the overall composite benefit was driven primarily by reduced recurrent hospitalizations
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	3	The median follow-up duration was 18 months (interquartile range: 12–26 months). During the follow-up, 60 patients (24.59%) in the matched cohort experienced at least one cardiorenal composite endpoint event. However, the cumulative incidence was significantly lower in the diltiazem group than in the control group (16.39% vs. 32.79%, P=0.002). Kaplan–Meier analysis also demonstrated a significantly lower time-to-first composite event rate in the diltiazem group (Fig. 2 and Table 2). Among the individual endpoint components, the greatest absolute reduction was observed in the heart failure rehospitalization rate (14 vs. 4 events), followed by unstable angina (10 vs. 6 events), suggesting that the overall composite benefit was driven primarily by reduced recurrent hospitalizations
		Cross-sectional study—Report numbers of outcome events or summary measures	3	The median follow-up duration was 18 months (interquartile range: 12–26 months). During the follow-up, 60 patients (24.59%) in the matched cohort experienced at least one cardiorenal composite endpoint event. However, the cumulative incidence was significantly lower in the diltiazem group than in the control group (16.39% vs. 32.79%, P=0.002). Kaplan–Meier analysis also demonstrated a significantly lower time-to-first composite event rate in the diltiazem group

				(Fig. 2 and Table 2). Among the individual endpoint components, the greatest absolute reduction was observed in the heart failure rehospitalization rate (14 vs. 4 events), followed by unstable angina (10 vs. 6 events), suggesting that the overall composite benefit was driven primarily by reduced recurrent hospitalizations
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	4	Patients in the diltiazem group maintained a low average HR and demonstrated significantly higher rates of target HR achievement and combined BP and HR control during follow-up (P<0.05) (Table 4).
		(b) Report category boundaries when continuous variables were categorized	4	The incidence of drug-related adverse reactions was compared between the two groups after matching (P>0.05) (Table 5).
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	/	/

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Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	/	/
Discussion				
Key results	18	Summarise key results with reference to study objectives	4	Long-term clinical practice has shown that hypertension and CHD often coexist and exacerbate each other, significantly increasing the risk of cardiovascular and cerebrovascular events and target organ damage. For such patients, comprehensive management of BP and HR is needed to improve patient prognosis to the greatest extent. At present, although the comprehensive management strategies recommended by clinical guidelines cover multiple interventions, such as antihypertensive, antiplatelet and lipid-lowering therapies, some patients still have suboptimal BP and HR control or recurrent myocardial ischemia, necessitating more individualized and multi-targeted pharmacotherapeutic strategies (Chen *et al*., 2022; Zafrir *et al*., 2022).
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	8	The limitations of this study include its retrospective single-center design, moderate sample size and nonrandomized treatment allocation. Although PSM was used to reduce baseline imbalance, residual confounding from unmeasured variables could not be fully ruled out. In addition, treatment selection and dose adjustment were physician-directed, which may have introduced a practice-pattern bias. Nonetheless, further multicenter prospective randomized studies are warranted to

				validate these findings.
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	8	The limitations of this study include its retrospective single-center design, moderate sample size and nonrandomized treatment allocation. Although PSM was used to reduce baseline imbalance, residual confounding from unmeasured variables could not be fully ruled out. In addition, treatment selection and dose adjustment were physician-directed, which may have introduced a practice-pattern bias. Nonetheless, further multicenter prospective randomized studies are warranted to validate these findings.
Generalisability	21	Discuss the generalisability (external validity) of the study results		Wuxi Municipal Health Commission General Project (MS201913).
Other information				
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	8	Wuxi Municipal Health Commission General Project (MS201913).

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.