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Analysis of risk factors for adverse events associated with cardiogenic syncope due to coronary artery disease in the elderly

Yangyang Liang[1], Xinping Li[1*], Shuguang Chen[2], Qiaoying Cha[1] and LiYa Yang[3]

Abstract

Objective To analyze risk factors for adverse events associated with syncope due to coronary artery disease (CAD) in the elderly.

Methods Two hundred eight patients with CAD who were hospitalized for cardiogenic syncope in our hospital from September 2022 to September 2023 were included in this study. Based on the follow-up results, 208 patients with cardiogenic syncope due to geriatric coronary artery disease were classified into the no-adverse group ($n=171$), and the adverse group ($n=37$), and the risk factors for the occurrence of adverse events in cardiogenic syncope in both groups were analyzed.

Results The age differences, history of heart failure, cardiac troponin I (hs-TnT) level, N-terminal B-type natriuretic peptide proteins (NT-proBNP) level, heart rate, left ventricular ejection fraction (LVEF), and QTC abnormality between the two groups were statistically significant ($P<0.05$). The COX multifactorial regression analysis revealed that hs-TnT, NT-proBNP, QTC abnormality prolongation and LVEF were all identified as risk factors for poor prognosis in elderly CAD patients ($P<0.05$). proBNP, abnormal prolongation of QTC, and LVEF were identified as risk factors for cardiogenic syncope in elderly CAD patients, leading to a poor prognosis ($P<0.05$). ROC curve analysis demonstrated that combining hs-TnT, NT-proBNP, QTC, and LVEF tests resulted in higher diagnostic accuracy than a single test alone, significantly improving the diagnostic accuracy ($P<0.05$).

Conclusion High hs-TnT and NT-proBNP levels, abnormally prolonged QTC, and LVEF > 50% are risk factors for cardiogenic syncope leading to adverse events in elderly CAD patients.

The clinical Trial Number of this study is CLTR202356423, and it was registered in 2023.

Keywords Prognosis, Cardiogenic syncope, Risk factors, Adult Coronary artery disease

Introduction

Syncope is a frequently observed medical condition characterized by a temporary loss of consciousness caused by insufficient blood flow to the brain. It can be caused by various conditions, ranging from harmless to potentially fatal diseases. This wide range of potential causes makes it challenging to assess the risk for patients experiencing syncope. By utilizing standardized diagnostic approaches, it is possible to ascertain the underlying cause in most patients. The clinical management of

*Correspondence:
Xinping Li
13932058833@163.com
[1] Department of Cardiology, First Hospital of Handan City, Handan, Hebei Province, China
[2] Xinhua Hospital, Guan County, Handan City, Hebei, China
[3] Department of Surgery, First Hospital of Handan City, Handan, Hebei Province, China

syncope can be quite challenging, and healthcare providers and patients are apprehensive about the possibility of future adverse clinical events [1], such as cardiac arrest. Cardiogenic syncope refers to syncope that occurs due to bradycardia, tachycardia, or hypotension caused by a low cardiac index, obstruction of blood flow, vasodilatation, or acute vascular entrapment [2]. According to the 2017 ACC/AHA/HRS guidelines, syncope is caused by neurally mediated syncope in 16.8% of cases and cardiac syncope in 52.2% of cases, making cardiac syncope the second most frequent cause of syncope [3]. The outcome of syncope varies significantly based on the underlying cause. Prior research has indicated [4] that individuals experiencing syncope due to a cardiac cause are at a greater risk of being hospitalized and dying compared to those with non-cardiac syncope.

Additionally, individuals with syncope are more prone to experiencing cardiac arrest and subsequent sudden cardiac death if they have heart failure with reduced left ventricular function, hypertrophic cardiomyopathy, or primary electrical disease. Coronary artery disease (CAD) is the main reason for heart attacks and the most frequent cause of cardiac arrest. However, there is a significant lack of information regarding the risk of sudden cardiac death related to syncope in the broader range of patients with heart disease. Therefore, this study aims to examine the clinical risk factors for adverse events of syncope caused by annual coronary artery disease. The study is conducted at a single center to enhance the risk stratification for sudden cardiac death in elderly CAD patients who experience cardiogenic syncope.

Information and methods

General information

This prospective, single-center cohort study enrolled 208 CAD patients admitted to our institution due to cardiogenic syncope between September 2022 and September 2023. The study adhered to the principles outlined in the Declaration of Helsinki and received approval from the relevant ethical committees, e.g., Xu Wen, Nursing, Department of Cardiology, the First Hospital of Handan City, Hebei Province, and Lan Yuntian, Nursing, Department of Cardiology, the Second Hospital of Zhengzhou City, Henan Province. Before participating, all patients gave their informed consent.

Inclusion criteria and exclusion criteria

The inclusion criteria consisted of patients with CAD who were 18 years of age or older and were hospitalized for cardiogenic syncope. Syncope is a temporary loss of consciousness caused by inadequate blood flow to the brain. It is characterized by sudden onset, brief duration, and spontaneous full recovery. to diagnose the cause of syncope, a comprehensive evaluation was performed, including clinical history, physical examination, ECG, and biomarkers. In cases where myocardial ischemia was suspected, the STEMI guidelines were used to assess the likelihood of acute coronary events as a contributing factor. However, the STEMI guidelines were part of a broader diagnostic process, and other potential causes of syncope were ruled out through additional clinical assessments and diagnostic tests. To obtain a conclusive diagnosis of the cause of syncope, see the Guidelines for ST-segment Elevation Myocardial Infarction [5]. Confirmed CAD is defined as a significant coronary artery having a $\geq$ 50% narrowing or a history of myocardial infarction or coronary artery revascularization. (2) Comprehensive clinical information. The exclusion criteria included the following: (1) confusion caused by factors such as poisoning, seizure, stroke, transient ischemic attack, head trauma, or metabolic disorders like hypoglycemia, as well as presyncope that did not lead to complete loss of consciousness; (2) new or worsening confusion; (3) patients unable to participate in the screening for the cause of syncope; (4) pregnant or breastfeeding patients; and (5) patients with a history of drug or alcohol abuse.

Data acquisition

All patients underwent a comprehensive evaluation, which included a thorough assessment of their medical history (including conditions such as hypertension and diabetes), general information (such as age, sex, and blood pressure), cardiac biomarker tests (specifically cardiac troponin I and N-terminal B-type natriuretic peptide proteins), markers related to metabolism (such as triglyceride, cholesterol, creatinine, and alanine aminotransferase), a 12-lead electrocardiogram (precisely measuring QTC), echocardiography (specifically assessing left ventricular ejection fraction), coronary CTA, and chest CT. The results of these evaluations were documented. Cardiac electrophysiology and coronary angiography are conducted when needed. The Evaluation of Syncope Study Guidelines (EGSYS) incorporated five predictors for syncope: abnormal electrocardiogram and/or cardiac disease (3 points), presyncope palpitations (4 points), syncope during exertion (3 points) or while in a supine position (2 points), autonomic symptoms (−1 point), and predisposing and/or precipitating factors (−1). Cardiogenic syncope is determined by a score of ≥ 3 on the European Syncope Guidelines Evaluation Study (EGSYS) scale [6].

Follow up

All patients were followed up by outpatient follow-up and telephone after discharge. The primary outcome measure was the occurrence of adverse events within

1 year following an episode of cardiogenic syncope. These adverse events included all-cause mortality, recurrent syncope, and readmission for cardiogenic diseases such as severe structural heart disease, aortic coarctation, acute pulmonary embolism, severe pulmonary hypertension, cardiac interventions, and cardiac surgery. Participants were categorized into two groups: a no-adverse group and an adverse group, based on the presence or absence of adverse events and their impact on prognosis.

Statistical processing

The statistical analysis was conducted using SPSS 22.0 software. The measurement data were represented as the mean value plus or minus the standard deviation (x ± s). The independent t-test was used to compare the means between groups. The count data were converted into rates, and the rates were compared using the chi-square test. The study utilized univariate analysis and multivariate COX proportional risk models to examine the variables linked to the prognosis of cardiogenic syncope. Receiver Operating Characteristic (ROC) analysis was conducted on variables discovered using multivariate Cox analysis to evaluate the diagnostic precision of prognosis for cardiogenic syncope. A *P*-value less than 0.05 was deemed to be statistically significant.

Results

General information analysis

According to the follow-up results, 37 patients experienced adverse events during the mean follow-up time (369.20 ±172) days, and the other 171 CAD patients did not experience any adverse events. The differences between the two groups were significant when comparing the patients in terms of age, history of heart failure, hs-TnT levels, NT-proBNP levels, heart rate, LVEF, and QTC abnormalities ($P < 0.05$), while the differences were not significant when compared in other aspects ($P > 0.05$), as shown in Table 1.

Cox regression analysis

To identify independent risk factors associated with adverse outcomes in elderly CAD patients with cardiogenic syncope, we first conducted univariate Cox proportional hazards analyses for the following clinical and demographic variables: age, sex, heart failure history, hypertension, diabetes, systolic blood pressure, heart rate, hs-TnT, NT-proBNP, D-dimer, CK, CK-MB, creatinine, ALT, AST, hemoglobin, hematocrit, LVEF, total cholesterol (TC), triglycerides (TG), and QTc (> 450 ms). Variables achieving statistical significance ($p < 0.05$) in univariate analysis were then included in the multivariate Cox regression model.

Table 1 Comparison of general information of the two groups of patients

Variable	No adverse group ($n = 171$)	Adverse group ($n = 37$)	t	*P*
Age(years)	66.75 ± 9.93	71.74 ± 9.06	2.813	0.005
Sex (m/f)	92 (53.80)/79 (46.20)	26 (70.27)/11 (29.73)	3.361	0.067
Systolic blood pressure (mmHg)	139.41 ± 15.41	143.95 ± 16.77	1.599	0.111
Heart rate (beats/min)	70.74 ± 16.79	77.41 ± 15.82	2.191	0.030
Heart failure	99 (57.89)	31 (83.78)	8.699	0.003
Diabetes	35 (20.47)	8 (21.62)	0.025	0.875
High blood pressure	47 (27.49)	9 (24.32)	0.155	0.694
hs-TnT (ug/L)	30.98 ± 4.51	35.61 ± 6.71	5.143	< 0.001
NT-proBNP (ng/L)	245.81 ± 73.96	312.93 ± 88.67	4.824	< 0.001
D -dimer (ng/mL)	596.94 ± 141.01	643.59 ± 157.10	1.787	0.075
CK (U/L)	12.1 (7.4, 18.2)	13.5 (8.8, 23.8)	1.634	0.096
CK-MB (U/L)	10.7 (5.2, 15.6)	11.2 (6.3, 16.9)	1.212	0.147
Creatinine (umol/L)	67.89 ± 6.36	69.15 ± 7.33	1.063	0.289
ALT (U/L)	34.36 ± 8.12	35.39 ± 6.78	0.719	0.473
AST (U/L)	19.57 ± 4.12	21.01 ± 5.35	1.822	0.070
Hemoglobin (g/L)	135.36 ± 14.41	131.95 ± 15.63	1.285	0.200
Hematocrit value (%)	38.99 ± 2.61	38.12 ± 2.04	1.904	0.058
LVEF (%)	47.52 ± 3.60	68.71 ± 3.92	1.794	0.074
TC (mmol/L)	4.74 ± 0.69	4.91 ± 1.24	1.153	0.250
TG (mmol/L)	2.51 ± 1.03	2.73 ± 1.09	1.166	0.245
QTC > 450 ms	100 (58.48)	29 (78.38)	5.113	0.024

Table 2 presents the results of the multivariate Cox proportional hazards analysis. The findings indicate that hs-TnT, NT-proBNP, QTc prolongation (> 450 ms), and LVEF were independent predictors of poor prognosis ($p < 0.05$). In the final model, each of these factors showed a statistically significant association with an increased hazard of adverse events during follow-up.

Predictive value of adverse events in patients with syncope

The ROC curves showed that the combined diagnostic AUC of hs-TnT, NT-proBNP, QTC, and LVEF was higher than that of the single test, which could significantly improve the diagnostic accuracy, as shown in Table 3 and Fig. 1.

A comparative analysis was conducted between patients with and without adverse events to identify potential predictors of poor prognosis in coronary artery disease (CAD) patients with cardiogenic syncope demonstrated in Fig. 2. Several parameters like age, diabetes and hypertension, Heart Rate, QT Extension and QTc > 450 ms, Left Ventricular Ejection Fraction (LVEF) and NT-proBNP, High-Sensitivity Troponin T (hs-TnT), Sex Distribution and Systolic Blood Pressure.

Age; Patients in the adverse event group were significantly older than those in the no-adverse event group (71.74 vs. 66.75 years, t = 2.813, $P = 0.005$). Diabetes and Hypertension; The prevalence of diabetes was comparable between the two groups (21.62% vs. 20.47%, $P = 0.875$). Similarly, no significant difference was observed in the incidence of high blood pressure (24.32% vs. 27.49%, $P = 0.694$). Heart Failure; A significantly higher proportion of patients in the adverse group had a history of heart failure compared to the no-adverse group (83.78% vs. 57.89%, $P = 0.003$), indicating its strong association with adverse outcomes. Heart Rate; The mean heart rate was significantly higher in the adverse event group (77.41 vs. 70.74 beats/min, t = 2.191, $P = 0.03$), suggesting a potential prognostic role in risk stratification. QT Extension and QTc > 450 ms; QT extension showed high accuracy (78.54%) in predicting adverse events, with sensitivity and specificity values of 73.2% and 79.7%, respectively ($P = 0.051$). However, QTc > 450 ms data were not available for statistical comparison. Left Ventricular Ejection Fraction (LVEF) and NT-proBNP: The AUC values for LVEF and NT-proBNP were 0.758 and 0.656, respectively, indicating their potential as predictive markers. The sensitivity, specificity, and accuracy of NT-proBNP in predicting adverse outcomes were 70.7%, 59.3%, and 61.33%, respectively ($P = 0.013$). High-Sensitivity Troponin T (hs-TnT); The mean hs-TnT level was significantly higher in the adverse group compared to the no-adverse group (35.61 vs. 30.98 μg/L, t = 5.143, $P < 0.001$). ROC analysis showed

Table 2 Multivariate cox proportional hazards analysis of risk factors for poor prognosis in elderly CAD patients with cardiogenic syncope

Variable	Regression Coefficient	Standard Error	Wald	*p*-value	HR	95% CI
Pulse rate	0.243	0.343	0.423	0.515	1.275	0.613–2.649
Age	1.051	0.591	3.169	0.075	2.862	0.899–9.107
Heart failure	0.11	0.483	0.052	0.819	1.117	0.433–2.877
hs-TnT	0.053	0.024	4.735	0.03	1.055	1.005–1.106
NT-proBNP	0.404	0.144	7.907	0.005	1.497	1.130–1.984
QTc > 450 ms	1.561	0.37	17.83	< 0.001	4.766	2.309–9.838
LVEF	0.094	0.04	5.62	0.018	1.098	1.016–1.187

Variables included in the final model were those with $p < 0.05$ in the univariate analysis

HR Hazard ratio

Table 3 Efficacy of hs-TnT, NT-proBNP, Abnormal QTC Prolongation, and LVEF in predicting the occurrence of cardiogenic syncope resulting in a poor prognosis in elderly CAD patients

Variable	AUC	Standard error	*P*	Sensitivity	Specificity	Accuracy
hs-TnT	0.688	0.055	0.001	51.20	84.70	78.74
NT-proBNP	0.656	0.055	0.013	70.70	59.30	61.33
QT Extension	0.764	0.051	0.000	73.20	79.70	78.54
LVEF	0.758	0.049	0.000	65.90	76.30	74.45
Joint test	0.878	0.035	0.000	68.3	94.90	90.17

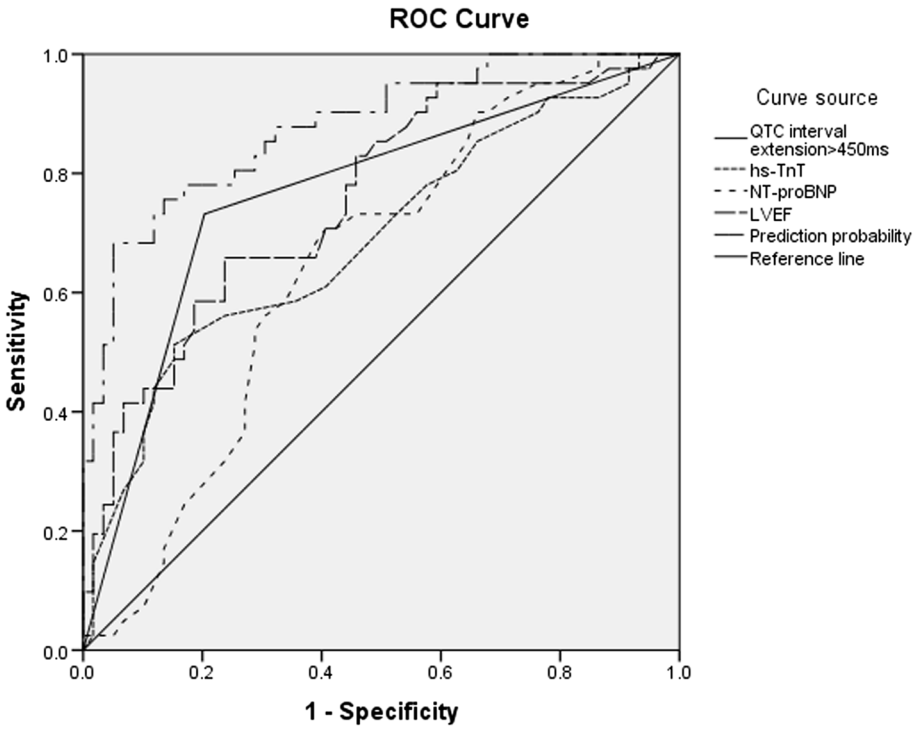

Fig. 1 ROC curve analysis graph

that hs-TnT had an AUC of 0.688 ($P = 0.001$), with a sensitivity of 51.2% and specificity of 84.7%, achieving an accuracy of 78.74%. Sex Distribution; Males comprised a larger proportion of patients in both groups, with a higher prevalence in the adverse event group (70.27% vs. 53.80%). However, this difference did not reach statistical significance ($P = 0.067$). Systolic Blood Pressure; No significant difference was found in systolic blood pressure between the two groups (143.95 vs. 139.41 mmHg, $P = 0.111$). Overall Predictive Performance; The joint test, incorporating multiple parameters, demonstrated strong predictive ability with an AUC of 0.878, a sensitivity of 68.3%, a specificity of 94.9%, and an overall accuracy of 90.17%. These findings highlight the significance of heart failure, heart rate, QT extension, NT-proBNP, and hs-TnT as potential predictors of adverse outcomes in CAD patients with cardiogenic syncope.

Discussion

Syncope is an important public health problem, often incapacitating the patient and may be the only warning before sudden cardiac death. Cardiac syncope is mainly caused by cardiac disease. The diagnosis of cardiac causes of syncope has important prognostic significance. Research comparing mortality rates after syncope based on potential processes consistently demonstrates [7] that individuals with cardiac reasons have a greater mortality rate compared to those with non-cardiac causes. A study with 433 patients [8] and a follow-up period of over 60 months found that patients with cardiac reasons had a mortality rate of 50%, whereas patients with non-cardiac or unexplained causes had mortality rates of 31% and 24%, respectively. Coronary artery disease is a common heart disease in which atherosclerosis occurs in the coronary arteries, causing narrowing of the coronary arterial lumens, which leads to ischemia in the myocardium, and in elderly patients due to senility and frailty. Older patients are a group with a high occurrence of coronary artery disease due to the process of aging, frailty, and having several health conditions. However, it is uncertain if fainting in all older patients with coronary artery disease is linked to a negative outlook. Hence, the objective of this research is to examine the characteristics that increase the likelihood of an adverse outcome in older patients with coronary artery disease who have syncope. The goal is to promptly identify high-risk individuals and provide appropriate treatment in order to mitigate the potential effects of life-threatening situations.

The study's findings revealed that patients in the poor prognosis group were characterized by advanced age, concomitant heart failure disease, elevated levels of hs-TnT and NT-proBNP, LVEF more than 50%, and abnormally prolonged QTCs, as compared to the good prognosis group [9]. When analyzing the reasons for this,

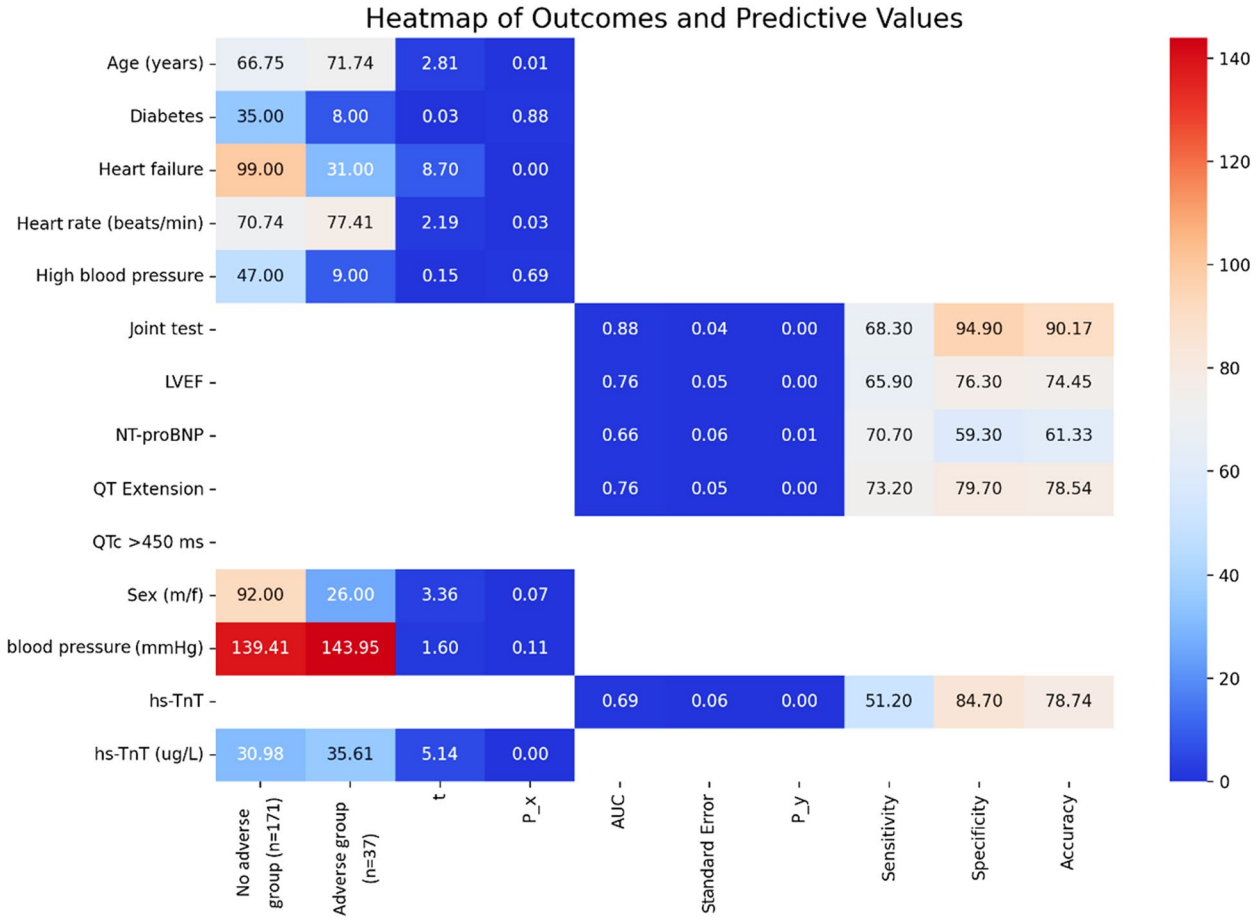

Fig. 2 Comparison of clinical and biochemical parameters between adverse and No adverse outcome groups in CAD patients with cardiogenic syncope

the increased risk of cardiogenic syncope and the ensuing adverse severe events in the elderly is paralleled by the inevitable progression with age to potentially of severe structural heart disease is parallel. In individuals with heart failure and decreased left ventricular systolic function, syncope is linked to a higher likelihood of sudden death, regardless of the cause of syncope. However, this study shows that the connection between syncope and unfavorable prognosis is specifically related to a prior history of comorbid heart failure in patients with coronary heart disease (CHD). To provide clarity, patients with LVEF greater than 50% and poor prognosis were not necessarily considered"normal."Instead, these patients could have been experiencing a specific clinical condition, such as heart failure with preserved ejection fraction (HFpEF), which is characterized by a normal or near-normal LVEF but impaired diastolic function, leading to a poor prognosis. HFpEF is a recognized syndrome that can result in adverse clinical outcomes despite normal systolic function.Therefore, to better contextualize these findings, the patients with LVEF >50% and poor prognosis may have had HFpEF or another clinical syndrome contributing to the adverse outcomes. CTnI and NT-proBNP are frequently employed for diagnosing and evaluating the prognosis of heart failure disease [10]. Consequently, they tend to be elevated in the adverse group. This study is the first to establish a link between cardiac syncope and an unfavorable prognosis.

The current study has shown, for the first time, that the link between syncope and negative prognosis is not influenced by left ventricular (LV) systolic function. However, it was observed that patients in the poor prognosis group had a higher LV ejection fraction, which aligns with previous research indicating that sudden cardiac arrest (SCA) events are more frequent in patients with LV ejection fraction greater than 50% [11]. Previous research conducted a small case–control study [12] and found that QTc prolongation was identified as a predictor for the occurrence of sudden cardiac death (SCD) in patients with coronary heart

disease (CHD). The study also revealed that the risk of SCD doubled when QTc abnormalities were prolonged, which aligns with the current study's findings. The results of this study indicate that there was a two-fold increase in ECG abnormalities among the group of individuals with low socioeconomic status.

The COX multifactorial analysis revealed that elevated levels of cTnI, QTc anomalies, and LEVF > 50% were separately linked to the prognosis of mortality resulting from syncope. The biomarkers cTnI and NT-proBNP were previously studied to determine the existence and severity of cardiac disease, as well as to assess the risk of adverse events in syncope patients. These biomarkers have also been suggested as a means of identifying syncope patients who are at risk for negative outcomes [13, 14]. Probst MA et al. [15] found that high-sensitivity cardiac troponin T and NT-proBNP showed a high level of sensitivity in effectively ruling out death and significant cardiac outcomes in older persons experiencing syncope caused by cardiac issues. Gibson TA et al. [13] Elevated troponin (LR + 2.49, 95% CI [1.36, 4.10]), B-type natriuretic peptide (LR + 2.19, 95% CI [1.15, 5.42]) were all risk factors for poor syncope prognosis, which is generally consistent with the present study, and CHD patients with LEVF > 50% had a significantly increased risk of poor prognosis for cardiogenic syncope, which is consistent with the Aro AL et al. [16] study (LR + 3.1, 95% CI [1.68, 5.79]), which is generally consistent with the present study, and these findings may be useful in improving the risk stratification process in SCA patients with preserved LVEF. Nevertheless, the existing guidelines lack a specific approach for categorizing the risk of this significant minority. Patients with coronary artery disease and syncope are a distinct group, and it is important to investigate the potential relevance of syncope as a clinical risk signal in patients with intact LVEF and coronary artery disease. There is a clear connection between QTc prolongation and sudden cardiac arrest (SCA) in older patients with coronary heart disease (CHD) who have syncope. This shows that including QTc intervals in risk assessment algorithms could be helpful and that prolonged QT intervals may indicate an underlying heart condition. ROC curve analysis demonstrated that the diagnostic accuracy was enhanced by combining hs-TnT, NT-proBNP, QTC prolongation, and LVEF. However as a limitaions, additional validation is required to confirm the inclusion of these indicators in risk stratification. This validation should involve several centers, a bigger sample size, potential confounding factors and a longer follow-up period{9}.

Conclusion

This study found that elevated levels of hs-TnT and NT-proBNP, along with abnormally prolonged QTc and LVEF > 50%, were associated with adverse parameters such as increased heart rate, advanced age, history of heart failure, were linked to the occurrence and recurrence of cardiogenic syncope in elderly CAD patients. These factors may serve as specific risk factors for clinical judgment and should be considered when developing future risk prediction tools for serious clinical events following syncopal emergency room visits.

Abbreviations

ACC	American College of Cardiology
AHA	American Heart Association
HRS	Heart Rhythm Society
AUC	Area Under the Curve
CAD	Coronary Artery Disease
CHD	Coronary Heart Disease
CI	Confidence Interval
CLTR	Clinical Trial Registration
COX	Cox Proportional Hazard Model
CTA	Computed Tomography Angiography
CT	Computed Tomography
CTnI	Cardiac Troponin I
ECG	Electrocardiogram
EGSYS	Evaluation of Syncope Study Guidelines
hs-TnT	High-Sensitivity Troponin T
LR +	Likelihood Ratio Positive
LVEF	Left Ventricular Ejection Fraction
NT-proBNP	N-terminal pro B-type Natriuretic Peptide
OR	Odds Ratio
P	*P*-value
QTC	QT Interval Corrected for Heart Rate
QTc	Corrected QT Interval
ROC	Receiver Operating Characteristic
SCA	Sudden Cardiac Arrest
SCD	Sudden Cardiac Death
STEMI	ST-segment Elevation Myocardial Infarction
SPSS	Statistical Package for the Social Sciences

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Clinical Trial

Clinical Trial Number: CLTR-2023-56423.
Trial Title: Risk Factors Analysis for Adverse Events Related to Cardiac Syncope in Elderly Patients with Coronary Artery Disease.
Objective: The study aims to identify and assess the risk factors associated with adverse events following cardiac syncope in elderly patients with coronary artery disease, with the goal of providing a basis for clinical interventions and preventative strategies.
Design: Prospective cohort study.
Sample Size: An estimated minimum of 200 elderly patients with coronary artery disease will be included.
Inclusion Criteria: Elderly patients (aged 65 years and above) diagnosed with coronary artery disease (CAD), confirmed by angiography or non-invasive testing.
Patients who have experienced at least one episode of syncope, including cardiogenic syncope, within the last 12 months.
Patients who have given informed consent for participation in the study.
Exclusion Criteria:
Patients with a history of non-cardiogenic syncope (e.g., vasovagal, orthostatic hypotension).

Patients with active cancer, severe comorbidities (e.g., end-stage renal disease), or terminal illnesses. Patients unable to provide informed consent due to cognitive impairments or language barriers.
Primary Endpoint: Adverse cardiac events after cardiac syncope, such as cardiac arrest, myocardial infarction, recurrent syncope, etc.
Secondary Endpoint: Non-fatal adverse events related to syncope, such as fractures due to falls, brain injuries [17–20], etc.
Data Collection: Data will be collected through electronic medical record review, patient interviews, physical examinations, and laboratory tests.
Statistical Analysis: Descriptive statistics, univariate, and multivariate regression analysis methods will be used to evaluate the association between various risk factors and the occurrence of adverse events.
Anticipated Results: Identification of key risk factors associated with increased risk of adverse event occurrence in elderly patients with coronary artery disease experiencing cardiac syncope, providing a scientific basis for targeted prevention measures.
Ethics Approval: The clinical trial requires approval from the relevant ethics committee and ensures that all participants have signed an informed consent form.
Trial Registration: Register on the National Clinical Trials Registry or other internationally recognized clinical trial registration platforms (No.1435639189) on June,18, 2024.
Note: The study adhered to the principles outlined in the Declaration of Helsinki and received approval from the relevant ethical committees, e.g., Xu Wen, Nursing, Department of Cardiology, the First Hospital of Handan City, Hebei Province, and Lan Yuntian, Nursing, Department of Cardiology, the Second Hospital of Zhengzhou City, Henan Province.

Authors' contributions

Yangyang Liang, Shuguang Chen, Qiaoying Cha, LiYa Yang: Designed the study, performed data analysis, and contributed to drafting and revising the manuscript. Collected and organized the data, conducted statistical analysis, Provided clinical expertise, interpreted the results, and assisted in manuscript preparation. Xinping Li: Supervised the study, provided guidance on methodology, and reviewed the final manuscript for important intellectual content.

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Data availability

The datasets generated and analyzed during the current study are not publicly available due to ethical restrictions and patient confidentiality but are available from the corresponding author upon reasonable request and with permission from the relevant ethics committee.

Declarations

Ethics approval and consent to participate

The study received ethical approval under the ethics approval number 2024-k-59, granted by the Clinical Research Ethics Committee of Handan First Hospital. The project was reviewed and approved via the committee's fast-track process. Informed consent was obtained from all individual participants included in the study prior to their participation.
This study was conducted in accordance with the principles outlined in the Declaration of Helsinki and its subsequent amendments.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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