Am J Transl Res 2025;17(3):2210-2220
www.ajtr.org /ISSN:1943-8141/AJTR0161784

Original Article

Age-related differences in coronary artery lesions and short-term prognosis in acute coronary syndrome patients

Qiaoxi Hu[1,2,3], Jingyuan Jiang[1,2,3], Yan Liang[1,2,3], Bingfan Hu[1,2,3], Yongli Gao[1,2,3]

[1]Department of Emergency Medicine, West China Hospital, Sichuan University/West China School of Nursing, Sichuan University, Chengdu 610041, Sichuan, China; [2]Disaster Medical Center, Sichuan University, Chengdu 610041, Sichuan, China; [3]Nursing Key Laboratory of Sichuan Province, Chengdu 610041, Sichuan, China

Received November 6, 2024; Accepted February 24, 2025; Epub March 15, 2025; Published March 30, 2025

Abstract: Objective: To explore age-related differences in coronary artery lesions, lesion characteristics, and short-term prognosis in acute coronary syndrome (ACS) patients. Methods: A retrospective analysis was conducted on 198 ACS patients (February 2019-January 2024). Patients were grouped by age: < 40 years (low-age), 40-60 years (middle-age), and > 60 years (high-age). We compared clinical data, coronary angiography results, lesion characteristics, and short-term major adverse cardiac event (MACE) occurrence across the groups. Pearson or Spearman correlation was used to assess relationships, and ROC curves were employed to evaluate the predictive ability for MACE. Results: The high-age group had significantly higher Gensini scoring and Global Registry of Acute Coronary Events (GRACE) scores (both $P < 0.001$), more diseased branches, and a higher proportion of non-calcified plaques. MACE incidence was highest in the high-age group. Age correlated positively with hypertension, hyperlipidemia, triglycerides, Gensini score, GRACE score, and the number of diseased branches, and negatively with hemoglobin levels (all $P < 0.05$). Age showed the strongest predictive ability for short-term MACE (AUC: 0.673, sensitivity: 71.0%). Conclusion: Elderly ACS patients exhibit more severe coronary lesions and a higher incidence of MACE. Age is a significant predictor of short-term MACE and correlates with various clinical and angiographic indicators.

Keywords: Acute coronary syndrome, age, degree of coronary artery lesions, characteristics of coronary artery, short-term prognosis

Introduction

Acute coronary syndrome (ACS), which includes acute myocardial infarction and unstable angina pectoris, is a leading cause of adverse cardiovascular events and death [1]. In recent years, ACS prevalence has steadily increased, posing a significant threat to patients' health and quality of life [2]. ACS typically arises from the instability of atherosclerotic plaques in the coronary arteries, leading to plaque rupture, thrombosis, and acute coronary obstruction, resulting in myocardial ischemia, hypoxia, and even necrosis [3].

Age is a crucial clinical factor influencing the characteristics and prognosis of ACS [4]. Studies have highlighted age-related differences in the pathogenesis, clinical presentation, and treatment response of ACS patients. Recent research confirms that younger patients, influenced by lifestyle factors and genetics, often experience ACS due to coronary artery spasm and inflammation, with relatively mild lesions but severe cardiovascular events [5-7]. In contrast, older patients frequently have comorbid conditions like hypertension, diabetes, and hyperlipidemia, which accelerate coronary atherosclerosis and lead to more severe coronary lesions, often involving multi-vessel and complex lesions with unstable plaque characteristics [8].

However, existing research on the degree of coronary artery, lesion characteristics, and short-term prognosis in ACS patients across different age groups have limitations. Many studies have small sample sizes, potentially limiting their representativeness, and often use single research methods, reducing the comprehen-

https://doi.org/10.62347/TYYQ6633

siveness of findings [9]. Moreover, few studies integrate multiple data sources to provide a holistic view of the disease, leading to inconsistent results and limited insight into the real clinical situation.

This retrospective study aims to fill these gaps with several innovations. First, by analyzing a relatively large cohort of 198 ACS patients, we offer a more representative picture of ACS across age groups, minimizing the biases of small sample studies. Second, our multi-faceted approach combines clinical data, detailed angiographic results, and long-term follow-up data, providing a comprehensive understanding of the relationships between age, coronary artery lesions, and prognosis. Furthermore, this study explores the interactions between factors like comorbidities, lifestyle, and genetics with age, offering new insights into how these factors influence coronary lesions and short-term outcomes. These interactions have not been fully addressed in previous research.

Ultimately, this study seeks to better understand age-related differences in coronary artery lesions, lesion characteristics, and short-term prognosis in ACS patients. Our findings aim to support personalized treatment strategies, improve prognosis assessments, and provide comprehensive guidance for ACS diagnosis and management, ultimately enhancing patient outcomes and quality of life.

Materials and methods

Research subjects

This retrospective study analyzed 198 patients with ACS who were admitted to West China Hospital, Sichuan University, between February 2019 and January 2024.

Inclusion Criteria: (1) Diagnosis of ACS according to established criteria [10]. (2) Aged 18 years or older. (3) Underwent either coronary artery bypass grafting (CABG) or percutaneous coronary intervention (PCI).

Exclusion Criteria: (1) Patients with cor pulmonale, congenital heart disease, pulmonary embolism, or acute myocardial infarction. (2) Severe hepatic or renal insufficiency or other systemic diseases that could affect study results. (3) Previous history of CABG or other cardiac surgeries. (4) Incomplete clinical data that hinder effective analysis.

Grouping

Patients were categorized by age: Low-age group: < 40 years, consisting of 39 patients (20% of total). Middle-age group: 40-60 years, consisting of 77 patients (39% of total). High-age group: > 60 years, consisting of 82 patients (41% of total).

This study was approved by the Medical Ethics Committee of West China Hospital, Sichuan University.

The distribution of patients in each age group was compared to the general population prevalence of ACS. The χ^2 test for goodness of fit showed no significant difference between observed and expected distributions in each group:

Low-age group: $\chi^2 = 2.904$, df = 1, $P > 0.05$, indicating a representative sample. Middle-age group: $\chi^2 = 0.874$, df = 1, $P > 0.05$, confirming representativeness. High-age group: $\chi^2 = 1.360$, df = 1, $P > 0.05$, also confirming representativeness.

Collection of clinical data

Patient data were collected from electronic medical records or paper files. The following basic information was gathered:

Demographic Data: Gender, body mass index (BMI), history of cerebrovascular diseases, prior myocardial infarction, family history of coronary heart disease, hypertension, hyperlipidemia, diabetes, smoking history, and family history of ACS.

Laboratory Examination Data: The following laboratory values at admission were collected for each patient: Systolic blood pressure (SBP), diastolic blood pressure (DBP), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), total cholesterol (TC), triglycerides (TG), fasting blood glucose (FBG), creatinine (CRE) and hemoglobin (Hb).

Evaluation indicators for lesions

The Gensini scoring method and the ACS Ischemia Global Registry of Acute Coronary Ev-

ents (GRACE) scoring system were used to assess the degree of coronary artery lesions.

Gensini Scoring Method [11]: The most stenotic location of each lesion was the main scoring point. Scores were assigned as follows:

Occlusion: 32 points; 99% stenosis: 16 points; 90% stenosis: 8 points; 75% stenosis: 4 points; 50% stenosis: 2 points; 25% stenosis: 1 point.

For the lesion location, the scoring was as follows:

Circumflex branch, right coronary branch, or left anterior descending (LAD) branch: 1 point; Middle segment of LAD: 1.5 points; Proximal segment of circumflex or LAD: 2.5 points; Left main trunk: 5 points; Other branches: 0.5 points.

The total score was calculated by multiplying the stenosis degree score by the lesion location score, with a higher score indicating more severe stenosis.

GRACE Scoring System [12]: The GRACE score ranges from 1 to 296, with a higher score indicating a higher risk of adverse events.

Coronary angiography data

Coronary artery characteristics were evaluated based on the number of diseased branches, types of lesions, and plaque characteristics. The coronary CT angiography data were used to record the number of diseased branches and lesion types, including in-stent restenosis, chronic total occlusion, proximal LAD lesions, and ostial lesions.

Plaque Characterization: Plaque CT values were measured on transverse thin-slice images from coronary CT angiography.

Calcified plaques: CT value > 120; Non-calcified plaques: CT value between 50 and 120; Mixed plaques: Containing both calcified and non-calcified areas.

Follow-up and prognosis evaluation

Follow-up data were collected by telephone, outpatient visits, or re-hospitalization records from the hospital information system. Follow-up started from the time of ACS diagnosis and discharge, continuing for six months. Short-term prognosis was evaluated based on the occurrence of major adverse cardiovascular events (MACE), including:

Recurrent myocardial infarction; Unstable angina pectoris; Severe cardiac arrhythmias (e.g., sustained ventricular tachycardia, ventricular fibrillation); Hospitalization for heart failure; Cardiogenic death.

Statistical analysis

Data analysis was performed using SPSS 23.0 software. Continuous variables were first tested for normality. Variables conforming to normal distribution were expressed as mean ± standard deviation, and comparisons among groups were performed using analysis of variance (ANOVA). For categorical variables, frequencies and percentages were used, and comparisons between groups were made using the χ^2 test or exact test. Pearson correlation was used for normally distributed continuous data, and Spearman rank correlation was applied for categorical data.

Receiver operating characteristic (ROC) curves were used to assess the predictive ability of indicators for short-term MACE occurrence, with predictive strength represented by the area under the curve (AUC). Binary logistic regression was used to identify factors influencing the short-term occurrence of MACE. A *P*-value < 0.05 was considered significant, with all tests being two-sided.

Results

Comparison of basic characteristics of patients

There were no significant differences in the distributions of gender, history of myocardial infarction, family history of coronary heart disease, diabetes, smoking history, or ACS family history among the low-age, middle-age, and high-age groups (all P > 0.05). However, the proportion of patients in the high-age group with a body mass index (BMI) > 24 kg/m^2, a history of cerebrovascular diseases, combined hypertension, and combined hyperlipidemia was higher than in the low-age and middle-age groups (all P < 0.05) (**Table 1**).

Table 1. Comparison of basic characteristics

Essential characteristic	Low-age group (n = 39)	Middle-age group (n = 77)	High-age group (n = 82)	χ^2	*P*
Gender (Man/Woman)	26/13	64/13	61/21	4.141	0.126
BMI				15.536	0.004
< 18.5 kg/m^2	6	13	14		
18.5-23.9 kg/m^2	14	30	11		
> 24 kg/m^2	19	34	57[a,b]		
History of cerebrovascular diseases (yeas/no)	3/36	5/72	21/61	13.475	0.002
History of old myocardial infarction (yeas/no)	7/32	15/62	19/63	0.554	0.758
Family history of coronary heart disease (yeas/no)	11/28	17/60	16/66	1.157	0.561
Combined hypertension (yeas/no)	8/31	12/65[a]	49/33[a,b]	38.522	< 0.001
Combined hyperlipidemia (yeas/no)	17/22	32/45[a]	65/17[a,b]	27.008	< 0.001
Combined diabetes (yeas/no)	6/33	7/70	18/64	4.976	0.083
Smoking history (yeas/no)	16/23	23/54	20/62	3.497	0.174
ACS family history (yeas/no)	8/31	19/58	19/63	0.252	0.882

Note: [a]: Compared with the low-age group, [b]: Compared with the middle-age group, the *P* value was less than 0.05. BMI: body mass index, ACS: acute coronary syndrome.

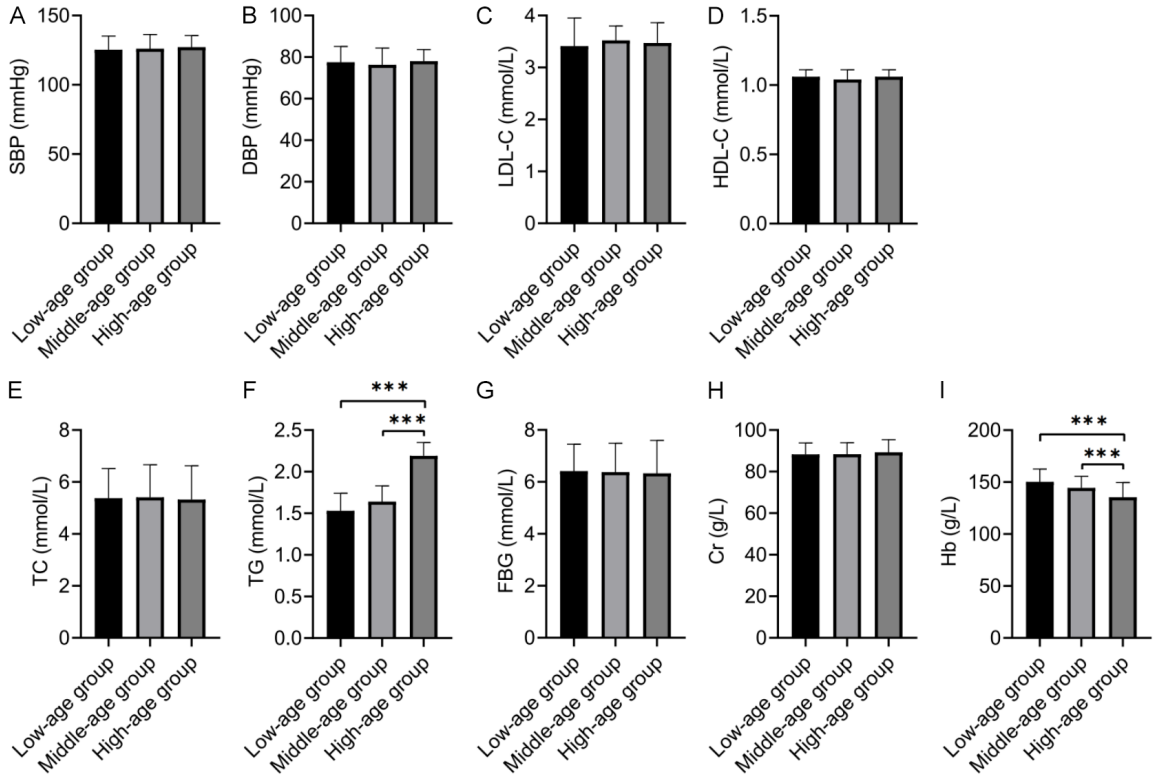

Figure 1. Laboratory indicators of patients in different age groups. Note: (A) Systolic blood pressure (SBP); (B) Diastolic blood pressure (DBP); (C) Low-density lipoprotein cholesterol (LDL-C); (D) High-density lipoprotein cholesterol (HDL-C); (E) Total cholesterol (TC); (F) Triglycerides (TG); (G) Fasting blood glucose (FBG); (H) Creatinine (Cr); (I) Hemoglobin (Hb). ***P < 0.001.

Comparison of laboratory indicators

Significant differences were observed in the levels of TG and Hb among the age groups (F = 253.300 and 20.490, respectively; both P < 0.001). The TG level was higher in the high-age group than in the low-age and middle-age groups, while the Hb level was lower in the high-age group compared to the other two groups (both P < 0.005) (**Figure 1**).

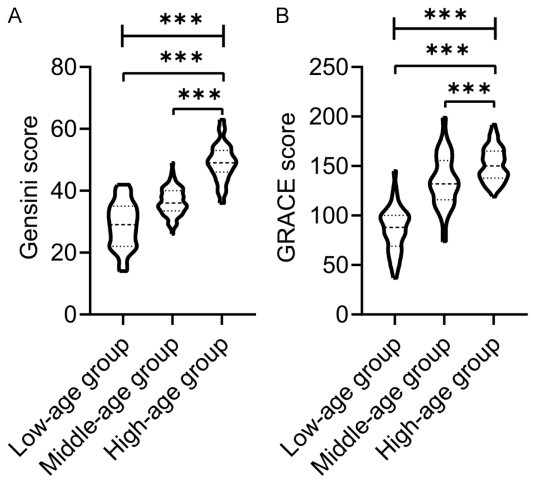

Figure 2. Gensini and GRACE scores among ACS patients of different ages. Note: GRACE: Global Registry of Acute Coronary Events, ACS: acute coronary syndrome. ***$P < 0.001$.

Comparison of degree of coronary artery lesions

The Gensini scores for the low-age, middle-age, and high-age groups were (29.36 ± 5.73), (36.12 ± 4.83), and (48.52 ± 6.62) points, respectively. The corresponding GRACE scores were (89.21 ± 19.34), (136.03 ± 22.58), and (152.19 ± 18.37) points. Statistically significant differences were found in both Gensini and GRACE scores across the age groups ($F = 188.800, 116.300$; both $P < 0.001$). The Gensini and GRACE scores were higher in the high-age group compared to the low-age and middle-age groups (both $P < 0.001$) (**Figure 2**).

Comparison of characteristics of coronary arteries

Statistically significant differences were observed in the number of diseased branches, proportion of calcified plaques, and proportion of non-calcified plaques among the three age groups (all $P < 0.05$). The high-age group had a higher number of diseased branches and a higher proportion of non-calcified plaques compared to the low-age and middle-age groups. In contrast, the proportion of calcified plaques in the high-age group was lower than in the other two groups (all $P < 0.05$) (**Table 2**).

Comparison of incidence of MACE

Significant differences in the incidence of MACE were observed among the three age groups ($P < 0.05$). The incidence of MACE was higher in the high-age group compared to the low-age and middle-age groups (both $P < 0.05$) (**Table 3**).

Correlation analysis

Variables that showed significant differences among the three groups were included in a correlation analysis with age. The results revealed significant linear relationships between age and factors such as BMI, history of cerebrovascular diseases, combined hypertension, combined hyperlipidemia, TG, Hb, Gensini score, GRACE score, number of diseased branches, non-calcified plaques, and calcified plaques ($P < 0.05$). Specifically, age was significantly positively correlated with combined hypertension, combined hyperlipidemia, TG, Gensini score, GRACE score, and number of diseased branches, while it was significantly negatively correlated with Hb (all with $r > 0.3$) (**Table 4**).

Predictive capacity of age and other indicators regarding the recent occurrence of MACE

The occurrence of MACE in ACS patients was considered the outcome variable, with age and other relevant indicators as predictor variables. An ROC curve analysis was performed (**Figure 3**). The results showed that age, concomitant hypertension, TG, Gensini score, and GRACE score all had predictive value for the short-term occurrence of MACE in ACS patients (all $P < 0.05$). Among these, age had the highest predictive capacity, with an AUC of 0.673 (95% CI: 0.577-0.768) and a sensitivity of 71.0%. The Gensini score also demonstrated strong predictive ability, with an AUC of 0.662 (95% CI: 0.562-0.762) and a sensitivity of 77.4% (**Table 5**).

Binary logistic regression analysis of the influencing factors for the recent occurrence of MACE

Taking whether MACE occurred recently in ACS patients as the dependent variable, and age, combined hypertension, TG, Gensini score, and GRACE score as independent variables, a binary logistic regression analysis was conducted. The results showed that combined hypertension was an independent risk factor for the short-term occurrence of MACE in ACS patients ($P < 0.05$) (**Table 6**).

Table 2. Comparison of characteristics of coronary arteries

Essential characteristic	Number of diseased branches	Lesion types				Plaque characteristics			
		In-stent restenosis lesions	In-stent restenosis lesions	Proximal left anterior descending branch lesions	Ostial lesions	Number of plaques	Calcified plaques	Mixed plaques	Non-calcified plaques
Low-age group (n = 39)	1.54 ± 0.33	2	8	19	3	87	35	22	30
Middle-age group (n = 77)	1.85 ± 0.36[a]	4	13	23	7	144	53[a]	33	58[a]
High-age group (n = 82)	2.34 ± 0.71[a,b]	5	17	28	9	166	41[a,b]	45	80[a,b]
F/χ^2	34.200	0.078	0.434	4.113	0.369	-	20.998	2.973	21.443
P	< 0.001	0.962	0.805	0.128	0.831	-	< 0.001	0.226	< 0.001

Note: [a]: Compared with the low-age group, [b]: Compared with the middle-age group, the *P* value was less than 0.05.

Table 3. Comparison of incidence of MACE

Group	Recurrent myocardial infarction	Unstable angina pectoris	Severe cardiac arrhythmias	Hospitalization due to heart failure	Cardiogenic death	Total occurrence of MACE
Low-age group (n = 39)	0	0	0	2	0	2
Middle-age group (n = 77)	2	1	2	3	1	9
High-age group (n = 82)	2	2	6	7	3	20[a,b]
χ^2						8.928
P						0.012

Note: [a]: Compared with the low-age group, [b]: Compared with the middle-age group, the *P* value was less than 0.05. MACE: major adverse cardiovascular events.

Table 4. Correlation analysis

Variable	Statistic	BMI	History of cerebrovascular diseases	Combined hypertension	Combined hyperlipidemia	TG	Hb	Gensini scores	GRACE scores	Number of diseased branches	Number of diseased branches	Non-calcified plaques
Age	r	0.149	0.259	0.405	0.337	0.709	0.362	0.747	0.651	0.499	0.273	0.270
	P	0.036	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Note: BMI: body mass index, TG: triglyceride, Hb: hemoglobin, GRACE: Global Registry of Acute Coronary Events.

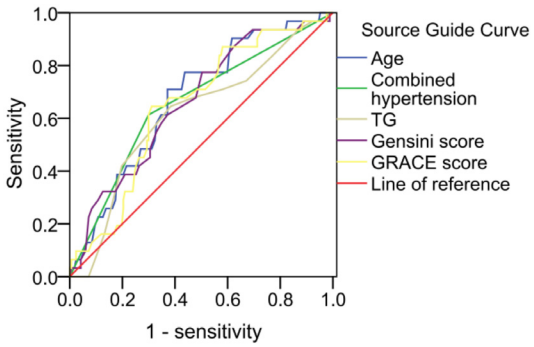

Figure 3. ROC curve analysis of age and other indicators for the recent occurrence of major adverse cardiovascular events (MACE) in acute coronary syndrome (ACS) patients.

Discussion

Acute coronary syndrome (ACS) is a clinical syndrome caused by acute myocardial ischemia and represents a significant threat to patient life and health. The degree and characteristics of coronary artery lesions, as well as short-term prognosis, can vary considerably among ACS patients of different ages. Understanding these differences is critical for optimizing clinical treatment strategies and improving patient outcomes.

This study found that the high-age group had a higher proportion of patients with aBMI > 24 kg/m^2, a history of cerebrovascular disease, combined hypertension, and combined hyperlipidemia compared to the low-age and middle-age groups. As people age, their metabolic rate typically decreases, often coupled with reduced physical activity and increased fat accumulation, which can lead to a higher BMI. Additionally, vascular aging and endothelial dysfunction increase the likelihood of hypertension and hyperlipidemia in elderly patients. Furthermore, a history of cerebrovascular diseases and coronary artery lesions often share common pathological mechanisms, such as atherosclerosis, making these risk factors more prevalent in older populations.

The high-age group also exhibited TG levels and lower Hb levels than the low-age and middle-age groups. Elevated TG levels can contribute to lipid deposition on vascular walls, accelerating atherosclerosis and adversely affecting coronary artery health. On the other hand, factors like diminished hematopoietic function and insufficient nutritional intake in elderly patients often result in lower Hb levels. Anemia can exacerbate cardiac burden and impair oxygen delivery to the myocardium, further affecting coronary artery lesions and prognosis [13, 14]. Previous studies have similarly highlighted the age-related differences in traditional risk factors such as hypertension and hyperlipidemia [15].

In the high-age group, both the Gensini and GRACE scores were higher than those of the low-age and middle-age groups. Additionally, the number of diseased branches and the proportion of non-calcified plaques were also higher in the high-age group, whereas the proportion of calcified plaques was lower compared to the other two age groups. The Gensini score and GRACE score are key indicators for evaluating the severity of coronary artery lesions and patient prognosis. Higher scores indicate more severe lesions and a less favorable prognosis. Non-calcified plaques are unstable and prone to rupture, which can trigger thrombosis and lead to the onset of ACS. The higher proportion of non-calcified plaques in the high-age group suggests increased instability in coronary artery lesions [16, 17].

Regarding coronary artery characteristics, Tu et al. [18] also found that elderly patients had higher proportions of multi-vessel and complex lesions, which aligns with our findings. However, differences in lesion types and distribution may exist due to population heterogeneity. For example, Gaba et al. [19] reported that patients in some regions had a higher propensity for left main trunk lesions, although this was not notably observed in our study. This discrepancy may be attributed to regional variations in the populations studied.

Additionally, we found that the incidence of MACE was higher in the high-age group compared to the low-age and middle-age groups. This is likely related to factors such as the decline in physical function, the presence of multiple comorbidities, more severe coronary artery lesions, and decreased cardiac compensatory capacity in elderly patients. Once ACS occurs, older individuals are less able to tolerate adverse conditions such as cardiac ischemia, making them more vulnerable to severe cardiovascular events and poor prognoses [20]. Anthony et al. [21] also demonstrated that

Table 5. Predictive abilities of age and other indicators for the recent occurrence of MACE in ACS patients

Test variable	AUC (95% CI)	SE	*P*	Sensitivity (%)	Specificity (%)	Optimal Cut-off Value
Age	0.673 (0.577-0.768)	0.049	0.002	71.0	62.9	59.5
BMI	0.536 (0.421-0.651)	0.059	0.527			
History of cerebrovascular diseases	0.566 (0.45-0.682)	0.059	0.242			
Combined hypertension	0.657 (0.549-0.764)	0.055	0.006	61.3	70.1	-
Combined hyperlipidemia	0.560 (0.452-0.668)	0.055	0.287			
TG	0.615 (0.506-0.724)	0.056	0.043	64.5	61.7	2.0
Hb	0.525 (0.409-0.641)	0.059	0.659			
Gensini scores	0.662 (0.562-0.762)	0.051	0.004	77.4	49.7	38.5
GRACE scores	0.649 (0.551-0.747)	0.050	0.009	64.5	68.9	144.5
Number of diseased branches	0.531 (0.43-0.633)	0.052	0.582			
Number of diseased branches	0.477 (0.365-0.589)	0.057	0.686			
Non-calcified plaques	0.590 (0.493-0.687)	0.050	0.113			

Note: BMI: body mass index, TG: triglyceride, Hb: hemoglobin, GRACE: Global Registry of Acute Coronary Events, MACE: major adverse cardiovascular events, ACS: acute coronary syndrome, AUC: area under the curve, SE: standard error.

Table 6. Binary logistic regression analysis of the factors influencing the recent occurrence of MACE in ACS patients

Independent variable	B	SE	Wals	*P*	OR (95% CI)
Age	0.018	0.023	0.634	0.426	1.018 (0.974-1.064)
Combined hypertension	1.108	0.461	5.776	0.016	3.028 (1.227-7.475)
TG	1.032	0.944	1.195	0.274	0.356 (0.056-2.267)
Combined hypertension	0.024	0.034	0.488	0.485	1.024 (0.958-1.094)
Combined hypertension	0.012	0.009	1.640	0.200	1.012 (0.994-1.030)

Note: TG: triglyceride, Hb: hemoglobin, MACE: major adverse cardiovascular events, ACS: acute coronary syndrome, SE: standard error, ROC: receiver operator characteristic curve.

the incidence of adverse cardiovascular events was significantly higher in elderly ACS patients than in younger patients. However, age stratification and the specifics of prognosis evaluation may vary between studies. This study further delineates these differences by employing more detailed age groupings. Several studies [22, 23] have also confirmed that ACS patients of different ages exhibit significantly distinct outcomes, consistent with our findings.

We hypothesize that the influence of age on ACS is a result of multiple factors:

(I) Mechanism of Atherosclerosis Progression: Age is a key risk factor for atherosclerosis. As age increases, the functionality of vascular endothelial cells declines, the secretion of vasodilatory factors like nitric oxide decreases, and the elasticity of the vascular walls diminishes. This facilitates lipid deposition on the vascular wall, contributing to the formation of atherosclerotic plaques. Elderly patients are also chronically exposed to risk factors such as hypertension and hyperlipidemia, which further accelerate atherosclerosis, leading to more severe coronary artery stenosis and a higher risk of ACS [24, 25].

(II) Inflammatory Response Mechanism: Inflammation plays a crucial role in the initiation and progression of both atherosclerosis and ACS. Elderly patients often have weakened immune functions and may experience a more pronounced chronic inflammatory state. Inflammatory cells such as monocytes and macrophages infiltrate the vascular wall, releasing inflammatory mediators that promote the formation, progression, and destabilization of atherosclerotic plaques. These inflammatory factors also activate platelets, increasing the risk of thrombosis and contributing to the development of ACS [26].

(III) Platelet Activity and Coagulation Mechanism: The impaired endothelial function in elderly patients reduces the threshold for platelet activation and aggregation, increasing platelet activity. Upon rupture of atherosclerotic plaques, platelets are more likely to aggregate at the site, forming a thrombus that can block coronary arteries and trigger severe cardiovascular events like acute myocardial infarction. Additionally, the coagulation factors in elderly patients may undergo changes, leading to a hypercoagulable state and further elevating the risk of thrombosis [27].

However, this study has several limitations. First, the sample size was relatively small, including only 198 ACS patients, which may limit the generalizability of the results. It might not capture all possible scenarios across different age groups of ACS patients, potentially leading to gaps in representativeness. The study's retrospective design relies on existing medical records, which may contain incomplete or inaccurate data, impacting the results. Furthermore, the study could not control for variables in the same way as a prospective study, limiting the ability to draw firm conclusions. While this study analyzed age-related indicators, it did not fully explore other important factors, such as regional differences, which could influence the severity of coronary artery lesions and short-term prognosis. Therefore, some variables essential to the results may have been overlooked, affecting the study's comprehensiveness and accuracy.

In conclusion, through the analysis of coronary artery lesion severity, characteristics, and short-term prognosis in ACS patients of different ages, this study identified significant differences across age groups in terms of risk factors, laboratory indicators, lesion severity, and prognosis. The findings suggest that in the high-age group, coronary artery lesions are more severe, the number of diseased branches is greater, and the incidence of MACE is higher. Age was closely related to several clinical indicators, with its predictive ability for the occurrence of recent MACE in ACS patients standing out. Compared to previous studies, our results show both similarities and differences, likely influenced by factors such as population differences and research methods. Future multi-center, large-sample studies are needed to further explore the characteristics and prognosis of ACS patients across different age groups, providing a more accurate foundation for clinical treatment.

Disclosure of conflict of interest

None.

Address correspondence to: Yongli Gao, Department of Emergency Medicine, West China Hospital, Sichuan University, No. 37 Guoxue Lane, Wuhou District, Chengdu 610041, Sichuan, China. Tel: +86-028-85423712; E-mail: gaoyongli0320@163.com

References

[1] Siagian SN, Christianto C, Angellia P and Holiyono HI. The risk factors of acute coronary syndrome in young women: a systematic review and meta-analysis. Curr Cardiol Rev 2023; 19: e161122210969.

[2] Simoni AH, Frydenlund J, Kragholm KH, Bøggild H, Jensen SE and Johnsen SP. Socioeconomic inequity in incidence, outcomes and care for acute coronary syndrome: a systematic review. Int J Cardiol 2022; 356: 19-29.

[3] Iida K, Hiro T, Fukamachi D, Sudo M, Nishida T, Akutsu N, Murata N, Kogo T, Kojima K, Mineki T, Tamaki T, Migita S, Morikawa T and Okumura Y. Three-dimensional fluid dynamical features of coronary plaque rupture provoking acute coronary syndrome. J Atheroscler Thromb 2022; 29: 464-473.

[4] Damluji AA, Forman DE, Wang TY, Chikwe J, Kunadian V, Rich MW, Young BA, Page RL 2nd, DeVon HA and Alexander KP; American Heart Association Cardiovascular Disease in Older Populations Committee of the Council on Clinical Cardiology and Council on Cardiovascular and Stroke Nursing; Council on Cardiovascular Radiology and Intervention; and Council on Lifestyle and Cardiometabolic Health. Management of acute coronary syndrome in the older adult population: a scientific statement from the American Heart Association. Circulation 2023; 147: e32-e62.

[5] Demirci D, Ersan Demirci D, Chi G and Gibson CM. The relationship between the age of first acute coronary syndrome episode and internal migration. Turk Kardiyol Dern Ars 2023; 51: 250-255.

[6] Suzuki K, Niida T, Yuki H, Kinoshita D, Fujimoto D, Lee H, McNulty I, Takano M, Nakamura S, Kakuta T, Mizuno K and Jang IK. Coronary plaque characteristics and underlying mechanism of acute coronary syndromes in different age groups of patients with diabetes. J Am Heart Assoc 2023; 12: e031474.

[7] Haskiah F, Erez D and Khaskia A. Familial hypercholesterolemia among young adults with acute coronary syndrome. Am J Cardiol 2023; 186: 189-195.
[8] Tian P, Liu Y, Wang J, Xing L, Huang X, Fu C, Yuan C and Liu P. Correlation of neck circumference, coronary calcification severity and cardiovascular events in Chinese elderly patients with acute coronary syndromes. Atherosclerosis 2024; 394: 117242.
[9] Taylan G, Kaya Ç, Özbek M, Kurt F, Kaçmaz Y, Akkaya F, Kahraman F and Yılmaz AS. Short-term prognosis of elderly patients admitted to the coronary care unit: a subgroup analysis of the MORCOR-TURK (mortality and morbidity in coronary care units in Türkiye) trial. Turk Kardiyol Dern Ars 2024; 52: 411-419.
[10] Bhatt DL, Lopes RD and Harrington RA. Diagnosis and treatment of acute coronary syndromes: a review. JAMA 2022; 327: 662-675.
[11] Zhang F, Li W, Zhang Y, Wang D, Li J, Li C and He L. lncRNA TPRG1-AS1 screened the onset of acute coronary syndromes and predicted severity and the occurrence of MACE during patients' hospitalization. J Inflamm Res 2023; 16: 5385-5391.
[12] Kabiri A, Gharin P, Forouzannia SA, Ahmadzadeh K, Miri R and Yousefifard M. HEART versus GRACE score in predicting the outcomes of patients with acute coronary syndrome; a systematic review and meta-analysis. Arch Acad Emerg Med 2023; 11: e50.
[13] Yuan W, Shao Y, Zhao D and Zhang B. Correlation analysis of lipid accumulation index, triglyceride-glucose index and H-type hypertension and coronary artery disease. PeerJ 2023; 11: e16069.
[14] Song F, Zhou Y, Zhang K, Liang YF, He X and Li L. The role of the plasma glycosylated hemoglobin A1c/Apolipoprotein A-I ratio in predicting cardiovascular outcomes in acute coronary syndrome. Nutr Metab Cardiovasc Dis 2021; 31: 570-578.
[15] Lee K, Kang J, Park KW, Park TH, Kim BS, Lim SW, Cho YH, Jeon DW, Kim SH, Yang HM, Kang HJ, Han JK, Shin ES, Koo BK and Kim HS. Impact of age on antiplatelet monotherapy in the chronic maintenance period after percutaneous coronary intervention: a post hoc analysis from the HOST-EXAM extended study. Can J Cardiol 2024; 40: 43-52.
[16] Suzuki W, Ohashi H, Ando H, Nakano Y, Takashima H, Fujimoto M, Sawada H, Goto R, Suzuki A, Sakurai S and Amano T. Tissue characteristics of residual lesion in patients with acute coronary syndrome caused by plaque rupture versus plaque erosion: a single-center, retrospective, observational study. Nagoya J Med Sci 2024; 86: 189-200.
[17] Poldervaart JM, Langedijk M, Backus BE, Dekker IMC, Six AJ, Doevendans PA, Hoes AW and Reitsma JB. Comparison of the GRACE, HEART and TIMI score to predict major adverse cardiac events in chest pain patients at the emergency department. Int J Cardiol 2017; 227: 656-661.
[18] Tu ZH, Bai K, Pu Y and Ma F. Analysis of coronary artery lesions degree, characteristics of coronary arteries and recent prognosis in patients with acute coronary syndrome of different ages. Int J Clin Exp Med 2024; 23: 1369-1372.
[19] Gaba P, Christiansen EH, Nielsen PH, Murphy SA, O'Gara PT, Smith PK, Serruys PW, Kappetein AP, Park SJ, Park DW, Stone GW, Sabik JF, Sabatine MS, Holm NR and Bergmark BA. Percutaneous coronary intervention vs coronary artery bypass graft surgery for left main disease in patients with and without acute coronary syndromes: a pooled analysis of 4 randomized clinical trials. JAMA Cardiol 2023; 8: 631-639.
[20] Ratcovich H, Joshi FR, Palm P, Færch J, Bang LE, Tilsted HH, Sadjadieh G, Engstrøm T and Holmvang L. Prevalence and impact of frailty in patients ≥70 years old with acute coronary syndrome referred for coronary angiography. Cardiology 2024; 149: 1-13.
[21] Anthony N, Hassan A, Ghani U, Rahim O, Ghulam M, James N, Ashfaq Z, Ali S and Siddiqui A. Age-related patterns of symptoms and risk factors in acute coronary syndrome (ACS): a Study Based on Cardiology Patients' Records at Rehman Medical Institute, Peshawar. Cureus 2024; 16: e58426.
[22] Wang J, Huang X, Fu C, Sheng Q and Liu P. Association between triglyceride glucose index, coronary artery calcification and multivessel coronary disease in Chinese patients with acute coronary syndrome. Cardiovasc Diabetol 2022; 21: 187.
[23] Kazem N, Hofer F, Koller L, Hammer A, Hofbauer TM, Hengstenberg C, Niessner A and Sulzgruber P. The age-specific prognostic impact of the platelet-to-lymphocyte ratio on long-term outcome after acute coronary syndrome. Eur Heart J Open 2021; 2: oeab031.
[24] Jamil S, Jamil G, Mesameh H, Qureshi A, Al-Kaabi J, Sharma C, Aziz F, Al-Shamsi AR and Yasin J. Risk factor comparison in young patients presenting with acute coronary syndrome with atherosclerotic coronary artery disease vs. angiographically normal coronaries. Int J Med Sci 2021; 18: 3526-3532.

[25] Li Z, Tang Z, Wang Y, Liu Z, Wang S, Wang Y, Wang G, Wang Y and Guo J. Impact of prediabetes and duration of diabetes on radial artery atherosclerosis in acute coronary syndrome patients: an optical coherence tomography study. Diab Vasc Dis Res 2022; 19: 14791641221078108.

[26] Eggers KM, Batra G, Lindahl B, Ghukasyan Lakic T, Lindbäck J, Budaj A, Cornel JH, Giannitsis E, Katus HA, Storey RF, Becker RC, Siegbahn A and Wallentin L. Temporal biomarker concentration patterns during the early course of acute coronary syndrome. Clin Chem Lab Med 2024; 62: 1167-1176.

[27] Wang C, Jiang D, Ge H, Ning J, Li X, Liao M and Xiao X. Preparation of an anticoagulant polyethersulfone membrane by immobilizing FXa inhibitors with a polydopamine coating. J Biomater Sci Polym Ed 2024; 35: 2469-2483.