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Research Article

Factors associated with new-onset atrial fibrillation after coronary stent implantation: A single-center retrospective cohort study

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ABSTRACT

Background: New-onset atrial fibrillation is a clinically relevant complication that may occur after coronary stent implantation. Although several clinical and echocardiographic factors have been associated with post-procedural atrial fibrillation, the relationship between coronary anatomical disease burden and early new-onset atrial fibrillation remains incompletely characterized. Therefore, this study aimed to investigate the association between coronary anatomical disease burden and early new-onset atrial fibrillation in patients undergoing coronary stent implantation.

Methods: We retrospectively evaluated 450 patients who underwent coronary stent implantation between January 2018 and December 2025. Patients with a previous history of atrial fibrillation, permanent pacemaker implantation, moderate-to-severe valvular heart disease, or incomplete clinical data were excluded. Patients were monitored for the occurrence of documented new-onset atrial fibrillation during the seven-day observation period. Clinical, laboratory, echocardiographic, and angiographic characteristics were compared between patients who developed atrial fibrillation and those who did not. Coronary anatomical complexity was assessed using the SYNTAX score. Multivariable logistic regression analysis was performed to identify factors independently associated with new-onset atrial fibrillation.

Results: New-onset AF was documented in 37 patients (8.2%). Patients who developed AF were older and had larger left atrial diameter and higher SYNTAX scores than those without AF. In multivariable logistic regression analysis, increasing age (adjusted OR, 1.07; 95% CI, 1.03–1.11; $p = 0.001$), larger left atrial diameter (adjusted OR, 1.15; 95% CI, 1.07–1.24; $p < 0.001$), and higher SYNTAX score (adjusted OR, 1.09; 95% CI, 1.04–1.15; $p < 0.001$) were independently associated with new-onset AF. Given the limited number of AF events, these associations should be interpreted cautiously.

Conclusion: In this retrospective cohort of patients undergoing coronary stent implantation, older age, larger left atrial diameter, and higher SYNTAX score were independently associated with documented new-onset atrial fibrillation within seven days. These findings suggest that both atrial structural characteristics and coronary anatomical disease burden may be relevant to early post-procedural atrial fibrillation. However, the findings are exploratory and should be confirmed in larger prospective studies incorporating systematic rhythm monitoring.

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1. Introduction

Atrial fibrillation (AF) is the most common sustained cardiac arrhythmia in the adult population and is strongly associated with stroke, heart failure, and increased mortality [1]. Current epidemiological data indicate that the prevalence of AF in the general population is 1–2% and increases exponentially with age [2]. The

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prevalence of AF is higher in patients with coronary artery disease, and these two conditions frequently coexist [3].

New-onset AF after percutaneous coronary intervention (PCI) represents an important clinical problem. Population-based studies have demonstrated that this condition is associated with increased mortality [4]. In addition, AF occurring after coronary intervention has been linked to long-term major adverse cardiac events [5].

The pathophysiology of new-onset AF after coronary stent implantation is complex and multifactorial. Advanced age, structural changes of the left atrium, increased atrial pressure, and inflammatory activity are considered key components [6]. Procedure-related microvascular injury, myocardial ischemia, and reperfusion injury may also increase atrial electrical instability and facilitate arrhythmia development [7]. Moreover, the increased ischemic burden related to diffuse and complex coronary artery disease may trigger electrical remodelling in atrial tissue.

Previous studies have investigated the incidence and predictors of new-onset atrial fibrillation after primary percutaneous coronary intervention, although the contribution of individual angiographic and procedural characteristics remains incompletely defined [8].

In this context, identifying the determinants of new-onset AF after coronary stent implantation is of major importance for early risk stratification and the development of individualized follow-up strategies. The aim of this study was to evaluate the clinical and angiographic predictors of new-onset AF in a single-center cohort.

Although previous studies have identified several clinical and structural factors associated with new-onset AF after coronary intervention, the relative contribution of angiographic disease burden in conjunction with established clinical and echocardiographic characteristics remains incompletely defined [9–12]. In particular, it is unclear whether the extent of angiographic coronary disease provides additional information regarding the occurrence of new-onset AF beyond conventional risk factors and atrial structural characteristics. Therefore, the present study aimed to evaluate the clinical, echocardiographic, laboratory, and angiographic factors associated with documented new-onset AF within seven days after coronary stent implantation. By simultaneously assessing these different domains, this study seeks to provide a more comprehensive characterization of factors associated with early post-procedural AF and to identify variables that may help clinicians recognize patients who warrant closer rhythm surveillance.

2. Materials and Methods

2.1. Study design and patient selection

This single-center, retrospective cohort study included patients who underwent coronary stent implantation between January 2018 and December 2025. Medical records were reviewed retrospectively after ethics committee approval on December 10, 2025 (Approval No. 2025/12-296). Patients with a previous history of atrial fibrillation (AF), permanent pacemaker implantation, moderate-to-severe valvular heart disease, or incomplete clinical data were excluded. The final study population consisted of 450 patients.

New-onset AF was defined as a newly documented episode occurring within seven days after coronary stent implantation in patients without a documented history of AF before the index procedure. AF was identified by 12-lead electrocardiography or continuous telemetry during hospitalization. An episode was considered diagnostic of AF if it lasted at least 30 seconds and demonstrated an irregularly irregular ventricular rhythm without consistent, discernible P waves and with variable atrial activity.

The study aimed to evaluate clinical, laboratory, echocardiographic, and angiographic factors associated with documented new-onset AF within seven days after coronary stent implantation.

2.2. Data collection

Demographic data, comorbidities, laboratory findings, echocardiographic measurements, and angiographic data were obtained retrospectively from the hospital electronic medical records. Age, sex, hypertension, diabetes mellitus, chronic kidney disease, heart failure, and smoking status were recorded. Laboratory parameters included hemoglobin, creatinine, C-reactive protein, and troponin levels.

2.3. Echocardiographic assessment

All patients underwent transthoracic echocardiography before the procedure. Left ventricular ejection fraction was calculated using the Simpson method, and left atrial diameter was measured from the parasternal long-axis view.

2.4. Angiographic and interventional characteristics

Coronary angiography was performed using standard projections. The number of diseased vessels, total number of stents, total stent length, and angiographic disease severity scores were recorded. All procedures were performed by experienced interventional cardiologists. Coronary anatomical complexity was assessed using the SYNTAX score, whereas multivessel disease, number of implanted stents, and total stent length were recorded as separate angiographic and procedural characteristics. These variables were considered distinct measures of coronary disease extent and procedural complexity, although potential overlap between these measures was recognized during interpretation of the multivariable analysis.

2.5. Outcome measure

The primary endpoint was the occurrence of new-onset AF confirmed by electrocardiography or continuous monitoring within the first seven days after coronary stent implantation.

During hospitalization, all patients were monitored with continuous telemetry for at least the first 48 hours

after the procedure. In addition, daily 12-lead electrocardiograms were routinely performed, and additional ECG recordings were obtained if patients developed symptoms suggestive of arrhythmia. For patients discharged before day seven, outpatient clinical evaluation and ECG review were performed when clinically indicated.

2.6. Statistical analysis

Statistical analyses were performed using SPSS software. Continuous variables are presented as mean ± standard deviation, and categorical variables as numbers and percentages. Group comparisons were performed using the Student's *t*-test or Mann–Whitney *U* test for continuous variables and the chi-square test for categorical variables. Candidate variables for the multivariable logistic regression model were selected based on both clinical relevance and findings from the univariate analyses. Variables showing a statistically significant association with new-onset atrial fibrillation in the univariate analysis and variables considered clinically relevant based on established risk factors were considered for multivariable analysis. The final multivariable model included age, left atrial diameter, hypertension, heart failure, C-reactive protein, total stent length, multivessel disease, and angiographic disease severity score. Odds ratios (ORs) with 95% confidence intervals (CI) were calculated. A two-sided p value < 0.05 was considered statistically significant.

Because only 37 patients developed new-onset AF, the number of events available for multivariable analysis was relatively limited. Candidate variables were therefore selected on the basis of clinical relevance and findings from the univariate analyses rather than by indiscriminate inclusion of all measured variables. The multivariable results were interpreted cautiously, particularly for variables representing related aspects of coronary disease burden.

Given the relatively small number of outcome events (37 patients with new-onset AF), the multivariable logistic regression analysis was considered exploratory. Variables were selected based on clinical relevance and the results of the univariate analyses rather than including all available covariates simultaneously. The resulting odds ratios and confidence intervals were interpreted cautiously, and no claim of development or validation of a clinical prediction model was made.

3. Results

A total of 450 patients were included. New-onset AF occurred in 37 patients (8.2%) within seven days after coronary stent implantation. The mean age was 71 ± 9 years in patients who developed AF and 62 ± 11 years in those who did not (p < 0.001). The prevalence of hypertension was 78% versus 56% (p = 0.01), and heart failure was 41% versus 18% (p = 0.002), respectively. The baseline clinical, echocardiographic, and angiographic characteristics of the study population are summarized in Table 1.

Table 1. Baseline clinical, echocardiographic and angiographic characteristics.

Variable	AF (+) (n = 37)	AF (–) (n = 413)	p value
Age (years)	71 ± 9	62 ± 11	< 0.001
Hypertension, *n* (%)	29 (78)	231 (56)	0.01
Heart failure, *n* (%)	15 (41)	74 (18)	0.002
Left atrial diameter (mm)	41 ± 4	36 ± 5	< 0.001
Left ventricular ejection fraction (%)	51 ± 8	53 ± 7	0.18
C-reactive protein (mg/L)	9.2 ± 3.1	4.6 ± 2.4	< 0.001
Multivessel disease, *n* (%)	24 (65)	157 (38)	0.004
Total stent length (mm)	48 ± 16	32 ± 14	< 0.001
Number of stents	2.3 ± 0.9	1.6 ± 0.7	< 0.001
Angiographic disease severity score	24 ± 7	16 ± 6	< 0.001

Data are presented as mean ± standard deviation or number (percentage). AF: atrial fibrillation. p values were calculated using Student's *t*-test or Mann–Whitney *U* test for continuous variables and chi-square test for categorical variables.

Left atrial diameter was significantly larger in the AF group (41 ± 4 mm vs. 36 ± 5 mm, p < 0.001). Left ventricular ejection fraction was similar between groups (51 ± 8% vs. 53 ± 7%, p = 0.18). C-reactive protein levels were higher in patients with AF (9.2 ± 3.1 mg/L vs. 4.6 ± 2.4 mg/L, p < 0.001). Multivessel disease was more frequent in patients who developed AF (65% vs. 38%, p = 0.004). Total stent length was 48 ± 16 mm versus 32 ± 14 mm (p < 0.001). The mean number of stents was 2.3 ± 0.9 versus 1.6 ± 0.7 (p < 0.001). The mean SYNTAX score was significantly higher in patients who developed new-onset AF than in those who did not develop AF (24 ± 7 vs. 16 ± 6, respectively; p < 0.001). In multivariable logistic regression, advanced age (OR 1.07; 95% CI 1.03–1.11; p = 0.001), left atrial diameter (OR 1.15; 95% CI 1.07–1.24; p < 0.001), and angiographic disease severity (OR 1.09; 95% CI 1.04–1.15; p < 0.001) were independent predictors of new-onset AF. Independent predictors of new-onset AF identified in the multivariable model are shown in Table 2 and graphically illustrated in Fig. 1.

OR: odds ratio; CI: confidence interval. Variables included in the multivariable model were age, left atrial diameter, angiographic disease severity score, hypertension, heart failure, C-reactive protein, total stent length, and multivessel disease. A p value < 0.05 was considered statistically significant.

Table 2. Multivariable logistic regression analysis for new-onset atrial fibrillation.

Variable	Odds ratio (OR)	95% confidence interval	*p* value
Age (per year)	1.07	1.03–1.11	0.001
Left atrial diameter (per mm)	1.15	1.07–1.24	< 0.001
SYNTAX score	1.09	1.04–1.15	< 0.001

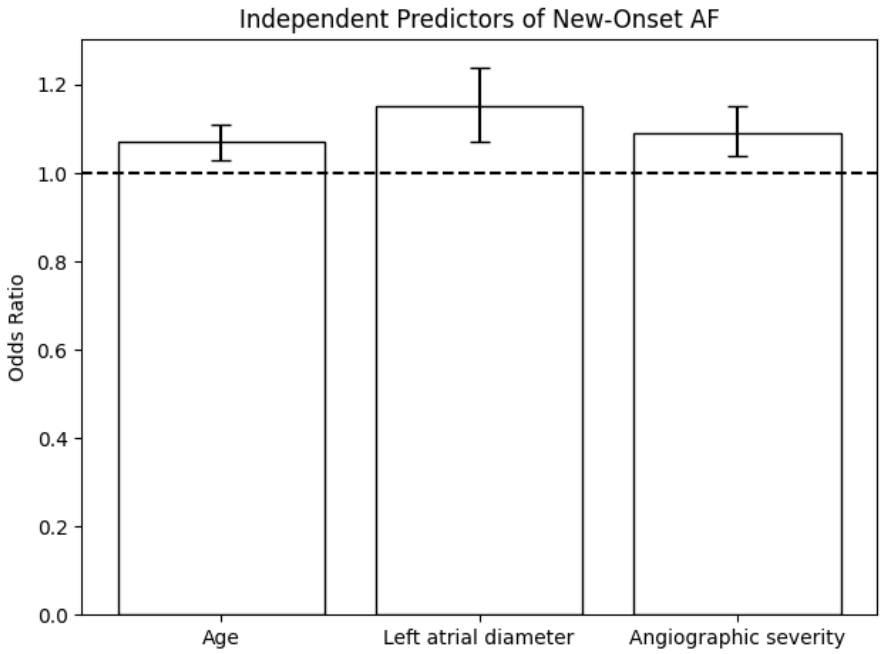

Fig. 1. Factors independently associated with new-onset atrial fibrillation.
(Bars represent odds ratios; error bars indicate 95% confidence intervals. The dashed horizontal line indicates OR = 1.)

4. Discussion

In this single-center retrospective study, the incidence of new-onset AF within seven days after coronary stent implantation was 8.2%. Previous studies have reported rates ranging from 5% to 12% [13]. These differences may be explained by variations in patient characteristics, follow-up duration, and definitions of AF.

Age was independently associated with new-onset atrial fibrillation in the multivariable analysis. Multicenter analyses in patients with ST-elevation myocardial infarction have also shown that age is one of the most important predictors of new-onset AF [14]. Age-related atrial fibrosis, conduction slowing, and electrical heterogeneity create a substrate for arrhythmogenesis.

Left atrial diameter was another independent predictor, supporting the role of atrial stretch and structural remodeling in AF pathogenesis [15]. Pre-procedural echocardiographic assessment may therefore be useful for risk stratification.

Angiographic disease severity was independently associated with new-onset AF, suggesting that increased ischemic burden and complex coronary anatomy may promote atrial electrical instability. New-onset AF after primary PCI has been linked to multivessel disease and high-risk lesions [16]. The independent association between SYNTAX score and new-onset AF is a potentially important finding of the present study. The SYNTAX score reflects the anatomical extent and complexity of coronary artery disease and may therefore serve as an indirect marker of overall coronary atherosclerotic burden. More extensive and complex coronary disease may be associated with a greater ischemic burden, systemic inflammation, endothelial dysfunction, and adverse ventricular or atrial remodeling, all of which may facilitate the development of atrial arrhythmias. However, given the observational nature of our study, this association should not be interpreted as evidence of a direct causal relationship.

The relatively small number of patients who developed new-onset AF (n = 37) represents an important limitation of the multivariable analysis. Although several clinically relevant variables were considered, the number of outcome events was limited relative to the number of candidate covariates. Consequently, model overfitting and instability of the estimated associations cannot be completely excluded. The multivariable findings should therefore be considered exploratory and hypothesis-generating rather than definitive estimates of independent predictive effects. Larger prospective studies with adequate numbers of AF events are required to confirm these associations and to determine whether they provide incremental value for clinical risk stratification. With 37 AF events and eight covariates included in the multivariable model, the events-per-variable ratio was relatively low. Therefore, the possibility of overfitting and imprecision of the regression coefficients should be acknowledged when interpreting the observed associations.

The association between larger left atrial diameter and new-onset AF is biologically plausible and is consistent with previous clinical observations. In a cohort of 1,603 patients with STEMI undergoing primary PCI, new-onset AF occurred in 6.1% of patients, and left atrial diameter was identified as an independent factor associated with AF. These findings support the concept that pre-existing atrial structural remodeling may contribute to susceptibility to AF during the acute or early post-interventional period. Our findings extend this observation to a broader population of patients undergoing coronary stent implantation [17].

Our findings are broadly consistent with more recent studies evaluating new-onset AF after PCI. In a contemporary cohort of patients undergoing PCI for acute myocardial infarction, increasing age and larger left atrial diameter were independently associated with new-onset AF, while the type of PCI was also associated with AF risk. These findings support the importance of age and atrial structural remodeling as clinically relevant determinants of post-PCI AF [18].

Our study extends these observations by evaluating clinical, echocardiographic, and angiographic characteristics together in a broader cohort of patients undergoing coronary stent implantation. In particular, the independent association between angiographic disease severity and new-onset AF suggests that the extent of coronary atherosclerotic burden may provide additional information beyond conventional clinical and echocardiographic variables. This association should nevertheless be interpreted cautiously, as angiographic disease severity may partly reflect overall ischemic and procedural complexity rather than a direct causal mechanism.

From a practical standpoint, early identification of patients at high risk for new-onset atrial fibrillation may allow closer rhythm surveillance, optimization of volume status, stricter control of blood pressure, and consideration of tailored antithrombotic strategies. Such an approach may potentially reduce arrhythmia-related complications and improve short- and long-term outcomes after coronary intervention.

The independent association between the SYNTAX score and new-onset AF should be interpreted with caution. Several angiographic and procedural variables, including SYNTAX score, multivessel disease, number of stents, and total stent length, may be interrelated and may partly represent the same underlying construct of coronary disease burden. In addition, only 37 patients developed new-onset AF, resulting in a relatively limited number of outcome events for multivariable modeling. Therefore, residual confounding, model instability, and potential overfitting cannot be completely excluded. The present findings should consequently be regarded as hypothesis-generating rather than as a validated prediction model.

Future prospective studies with larger sample sizes and a greater number of AF events should evaluate whether angiographic disease complexity provides incremental prognostic information beyond established clinical and echocardiographic risk factors.

This study has several limitations. First, its retrospective, single-center design limits the generalizability of the findings and precludes conclusions regarding causality. Second, the relatively small number of patients who developed new-onset AF (n = 37) limited the number of outcome events available for multivariable analysis. With eight covariates considered in the final model, the events-per-variable ratio was relatively low; therefore, model instability and potential overfitting cannot be completely excluded. The multivariable findings should consequently be interpreted as exploratory and hypothesis-generating rather than as a validated prediction model. Third, rhythm surveillance was not uniform throughout the entire seven-day observation period. Continuous telemetry was routinely performed for at least the first 48 hours during hospitalization, whereas post-discharge rhythm assessment was clinically driven. Consequently, asymptomatic episodes of AF occurring after hospital discharge may have remained undetected, potentially resulting in an underestimation of the incidence of documented new-onset AF. In addition, previously unrecognized paroxysmal AF could not be completely excluded because systematic prolonged ambulatory rhythm monitoring before or after the index procedure was not performed. Fourth, several angiographic and procedural variables, including SYNTAX score, multivessel disease, number of stents, and total stent length, may represent overlapping aspects of coronary disease burden and procedural complexity. Although these variables were considered separately in the analysis, residual interrelationships among them may have influenced the estimated associations. Therefore, the independent association between SYNTAX score and new-onset AF should be interpreted cautiously. Finally, because the study focused on clinically documented AF during the defined observation period, the findings should not be interpreted as representing the complete burden of post-PCI atrial arrhythmia. Prospective multicenter studies incorporating systematic and prolonged rhythm monitoring, larger sample sizes, and appropriately powered multivariable or prediction analyses are needed to validate these findings.

5. Conclusions

In patients undergoing coronary stent implantation, older age, larger left atrial diameter, and higher SYNTAX score were independently associated with documented new-onset AF within seven days of the procedure. These findings suggest that early post-procedural AF may be related to both pre-existing atrial structural substrate and the extent of coronary anatomical disease. However, given the retrospective single-center design, the limited number of AF events, the potential overlap among measures of coronary disease burden, and the possibility of undetected asymptomatic AF after hospital discharge, these findings should be considered exploratory rather than definitive. Larger prospective studies with systematic prolonged rhythm monitoring are warranted to determine whether these factors provide clinically meaningful incremental information for identifying patients at increased risk of post-PCI AF.

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Conflict of Interest

The author declares no potential conflicts of interest with respect to the research, authorship, and/or publication of this manuscript.

Data Availability

The datasets generated and/or analyzed during the current study are not publicly available but are available from the corresponding author upon reasonable request.

AI Assistance

No AI-based tools were used in the preparation of this manuscript.

Ethics Approval and Consent to Participate

This study was approved by the ethics committee of Erzurum Faculty of Medicine, University of Health Sciences, Türkiye (Approval Number: 2025/12-296; Date: 10.12.2025). Written informed consent was obtained from all participants. All procedures were conducted in accordance with relevant guidelines and regulations.

Author Contributions

Esma Selva Ateş Ceyhun: *conceptualization, data curation, formal analysis, investigation, methodology, project administration, resources, supervision, validation, visualization, writing – original draft, writing – review & editing.*

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