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The Mean Corrected TIMI Frame Count Could Predict Major Adverse Cardiovascular Events in Patients with Coronary Slow-Flow Phenomenon

Ortalama Düzeltilmiş TIMI Kare Sayısı Koroner Yavaş Akım Fenomeni Olan Hastalarda İstenmeyen Majör Kardiyovasküler Olayları Öngördürebilir

ORIGINAL ARTICLE
KLİNİK ÇALIŞMA

Abstract

Objective: The aim of the present study was to investigate the association between the mean corrected thrombolysis in myocardial frame count and major adverse cardiovascular events in patients with the coronary slow-flow phenomenon.

Methods: A total of 98 patients with coronary slow-flow phenomenon who met inclusion criteria from 2015 to 2020 were retrospectively included in the analysis. The patients were ranked according to their mean corrected thrombolysis in myocardial frame count values and were divided into quartiles based on those. Group 1 consisted of patients who had a mean corrected thrombolysis in myocardial frame count value >36.68 (third quartile), while group 2 consisted of patients who had a mean corrected thrombolysis in myocardial frame count value ≤36.68 (first quartile+second quartile). Mortality and non-fatal cardiovascular complications were compared between the groups.

Results: Mean follow-up duration was 3.93 ± 1.50 years. Recurrent chest pain and major adverse cardiovascular events increased in group 1 compared to group 2 ($P \leq .001$, $P \leq .001$, respectively). Hypertension (odds ratio 2.627, $P = .033$), hyperlipidemia (odds ratio 2.469, $P = .028$) and mean corrected thrombolysis in myocardial frame count (odds ratio 1.106, $P = .002$) were independent predictors of recurrent chest pain according to Cox regression analysis. Although older age (odds ratio 1.125, $P = .011$), hypertension (odds ratio 6.081, $P = .026$), hyperlipidemia (odds ratio 12.308, $P = 0.019$), and mean corrected thrombolysis in myocardial frame count (odds ratio 1.476, $P = .001$) were found to be significantly related with major adverse cardiovascular events in patients with coronary slow-flow phenomenon, only mean corrected thrombolysis in myocardial frame count (odds ratio 1.161, $P = .021$) was an independent predictor of major adverse cardiovascular events in Cox regression analysis.

Conclusion: Higher mean corrected thrombolysis in myocardial frame count could predict major adverse cardiovascular events in patients with the coronary slow-flow phenomenon.

Keywords: Coronary slow flow, major adverse cardiovascular events, mean corrected TIMI frame count

ÖZET

Amaç: Bu çalışmanın amacı, koroner yavaş akım fenomeni olan hastalarda ortalama düzeltilmiş TIMI kare sayısı ile majör istenmeyen kardiyovasküler olaylar arasındaki ilişkiyi araştırmaktı.

Yöntemler: 2015-2020 yılları arasında dahil edilme kriterlerini karşılayan koroner yavaş akım fenomenine sahip toplam 98 hasta retrospektif olarak analizlere dahil edildi. Hastalar ortalama düzeltilmiş TIMI kare sayısı değerlerine göre sıralandı ve bunlara göre çeyreklere ayrıldı. Grup-1 ortalama düzeltilmiş TIMI kare sayısı değeri >36,68 (üçüncü çeyrek) olan hastalardan, grup-2 ise ortalama düzeltilmiş TIMI kare sayısı değeri ≤36,68 (birinci çeyrek+ikinci çeyrek) olan hastalardan oluşturuldu. Gruplar arasında mortalite ve fatal olmayan kardiyovasküler olaylar karşılaştırıldı.

Bulgular: Ortalama takip süresi 3,93 ± 1,50 yıldı. Grup-1'de Grup-2'ye kıyasla tekrarlayan göğüs ağrısı ve majör istenmeyen kardiyovasküler olaylar artmıştı (sırasıyla, $P \leq ,001$, $P \leq ,001$). Cox regresyon analizine göre hipertansiyon (Odds oranı (OR) 2,627. $P = ,033$), hiperlipidemi (OR 2,469, $P = ,028$), ve ortalama düzeltilmiş TIMI kare sayısı (OR 1,106, $P = ,002$) tekrarlayan göğüs ağrısının bağımsız öngördürücüleriydi. İleri yaş (OR 1,125, $P = ,011$), hipertansiyon (OR 6,081, $P = ,026$), hiperlipidemi (OR 12,308, $P = ,019$) ve ortalama düzeltilmiş TIMI kare sayısı

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(OR 1,476, *P* = ,001), koroner yavaş akım fenomenine sahip hastalarda majör istenmeyen kardiyovasküler olaylar ile anlamlı olarak ilişkili bulunmasına rağmen, ortalama CTFC (OR 1,161, *P* = ,021), Cox regresyon analizinde majör istenmeyen kardiyovasküler olayların bağımsız öngördürücüsüydü.

Sonuç: Daha yüksek ortalama düzeltilmiş TIMI kare sayısı, koroner yavaş akım fenomenine sahip hastalarda majör istenmeyen kardiyovasküler olayları öngördürebilir.

Anahtar Kelimeler: Ortalama düzeltilmiş TIMI kare sayısı, koroner yavaş akım, majör istenmeyen kardiyovasküler olaylar

Coronary slow flow phenomenon (CSFP) is characterized by delayed distal vessel opacification in the absence of significant epicardial coronary artery disease during coronary angiography. The pathogenesis of CSFP includes small vessel dysfunction, endothelial dysfunction, subclinical atherosclerosis, and genetic factors.[1-5] However, this phenomenon is shown to be associated with clinical manifestations of myocardial ischemia, life-threatening arrhythmias, sudden cardiac death, and recurrent acute coronary syndromes.[6-9] The risk factors of CSFP have been reported in many studies. However, there is a limited number of studies on the cardiac prognosis of patients with coronary slow flow (CSF).

Mean corrected thrombolysis in myocardial (TIMI) frame count (CTFC) method has been used to evaluate coronary flow in previous studies. Mean CTFC is simple, reproducible, and objective.[10,11] Although mean CTFC, a quantitative index of coronary flow, has been widely used in the diagnosis and in the assessment of CSFP, it has not been studied for predicting long-term clinical follow-up in patients with CSFP. Thus, in the present study, we aimed to investigate the role of mean CTFC in predicting major adverse cardiovascular events (MACE) in patients with CSFP.

Methods

All cases diagnosed with CSF were retrospectively collected between February 2015 and 2020 September. Exclusion criteria were as follows moderate or severe valvular heart disease, prosthetic heart valves, atrial fibrillation, cardiomyopathies, congenital heart disease, previous history of coronary artery disease (acute coronary syndrome or diameter stenosis of ≥20% in a coronary artery), coronary artery ectasia, acute or chronic hepatic and renal failure (estimated glomerular filtration rate <60 mL/min/1.73 m^2) chronic obstructive pulmonary disease, hypothyroidism, hyperthyroidism, and reduced left ventricular ejection fraction (<55%). Additionally, patients whose follow-up data could not be reached from follow-up visits, national clinical records, or telephone visits were found to be ineligible. Finally, 98 out of 135 patients were included in the study.

ABBREVIATIONS

AUC	Area under curve
CSF	Coronary slow flow
CSFP	Coronary slow flow phenomenon
CTFC	Corrected thrombolysis frame count
LAD	Left anterior descending artery
MACE	Major adverse cardiovascular events
MI	Myocardial infarction
PACS	Picture archiving and communication systems
RCA	Right coronary artery
ROC	Receiver-operating characteristic
SD	Standard deviation
TFCs	Thrombolysis in myocardial frame counts
TIMI	Thrombolysis in myocardial
USAP	Unstable angina pectoris
VT	Ventricular tachycardia

The study protocol was approved by the local ethics committee and conducted in accordance with the ethical principles of the Declaration of Helsinki. Ethics committee for this study was received from the Haydarpaşa Numune Training and Research Hospital Ethics Committee (Date-Number: 2021/KK/198). Informed consent was obtained from all individual participants included in the study.

TIMI Frame Count and Definition of Slow Coronary Flow

One member of the research team, an interventional cardiologist who was blinded to the patients examined the coronary angiographic records of the patients from our clinical center picture archiving and communication systems system (PACS). Thrombolysis in myocardial frame counts (TFCs) were counted according to the criteria for each coronary artery, as described by Gibson et al.[11] The TIMI frame count reflects the number of cine frames required for contrast to first reach standardized distal coronary landmarks in a coronary artery.[12] Additionally, the term CTFC, the frame count number after adjustment for vessel length, has been described to compensate for the longer length of the left anterior descending artery (LAD) compared with the circumflex and right coronary arteries.[10,11] The TFC for the LAD was divided by 1.7 to obtain the CTFC. Because the normal frame counts for the LAD artery were 1.7 times greater than the mean for the LCx and right coronary artery (RCA), CTFC > 27 frames were accepted CSF. The mean corrected TFC was further calculated by averaging the sum of the corrected TFCs for each coronary artery.[11] Subjects with a corrected TFC greater than 2 standard deviations (SD) above the normal range were considered to have CSFP.

Follow-up and Outcome

Follow-up data obtained by the members of the research team were based on follow-up visits, national clinical records, or telephone interviews. Major adverse clinical events (MACE): cardiovascular death, non-fatal myocardial infarction (MI), coronary revascularization, unstable angina pectoris (USAP), and non-fatal stroke and arrhythmias [sustained ventricular tachycardia (VT)] were investigated. Clinical symptoms and long-term medications after hospital discharge were also interrogated.

Statistical Analysis

Continuous variables were expressed as mean ± SD, while categorical variables were expressed as percentages. Kolmogorov–Smirnov test was used to evaluate the normal distribution. Then, the Student's *t*-test was used to compare normally distributed data between 2 groups. The chi-square test or Fisher's exact test was used for categorical variables according to the distribution of the numbers in the cells. Cox regression analysis was performed for estimating the predictors of MACE and recurrent chest pain and receiver-operating characteristic (ROC) curve was used to analyze the prognostic value of mean TFC for MACE and recurrent chest pain in CSFP. Kappa values (κ statistic) were used for

the consistency evaluation between 2 members of the research team. Statistical Package for the Social Sciences software version 22.0 (IBM Corp., Armonk, NY, USA) was used for statistical analysis. A *P*-value of <.05 was considered statistically significant.

Results

A total of 98 patients who were documented to have CSF and responded to the telephone interview were included in the analysis. The baseline characteristics are shown in Table 1.

The patients were ranked according to their mean CTFC values and were divided into quartiles based on those. To assess the relationship between CTFC and MACE, 2 groups were created. Group 1 consisted of patients who had a mean CTFC value >36.68 (third quartile), while group 2 consisted of patients who had a mean CTFC value ≤36.68 (first quartile+second quartile). Age, gender, body mass index, diabetes mellitus, and hyperlipidemia were similar between the groups (*P*=.064, *P*=.391, *P*=.264, *P*=.552, *P*=.347, *P*=.136, respectively) (Table 2). Otherwise, hypertension, undergoing coronary angiography, recurrent chest pain, and MACE were significantly higher in group 1 compared to group 2 (*P*=.026, *P*=.006, *P* ≤ .001, *P* < .001, respectively) (Table 2). When the MACE were compared between the groups, CV death and MI were significantly higher in group 1 compared to group 2 (*P* ≤ .001, *P*=.013, respectively). On the other hand, USAP, stroke, and arrhythmia were similar between the groups (*P* = 0.148, *P* = 0.245, *P* = 0.245, respectively). No revascularization was observed in both groups as well (Table 2).

The follow-up duration, between the index angiography and telephone interview/follow-up visits, was 3.93 ± 1.50 years. During this period, 4 patients (4.1%) died. Three of those were found to be associated with cardiac reasons. However, 1 patient passed away because of breast cancer.

Table 1. Baseline Characteristics of the Patients

Parameters	Patients (n=98)
Age (years)	56.3 ± 9.0
Gender (male)	58 (59.2)
BMI (kg/m²)	27.01 ± 3.18
Hypertension, n (%)	46 (46.9)
Diabetes mellitus, n (%)	28 (28.6)
Hyperlipidemia, n (%)	49 (50)
P/C smoking, n (%)	29 (29.6)
SBP (mm Hg)	134.0 ± 9.88
DBP (mm Hg)	83.66 ± 5.80
Medication	
ASA, n (%)	95 (96.9)
Beta blocker, n (%)	87 (88.8)
Ca-ch blockers, n (%)	21 (21.4)
ACEI/ARB, n (%)	17 (17.3)
Statins, n (%)	93 (94.9)
Angiographic features of CSF	
Only in one coronary artery, n (%)	24 (24.5)
LAD, n (%)	5 (5.1)
CX, n (%)	6 (6.1)
RCA, n (%)	13 (13.3)
In 2 coronary arteries, n (%)	41 (41.8)
LAD and CX, n (%)	21 (21.4)
LAD and RCA, n (%)	11 (11.2%)
RCA and CX, n (%)	9 (9.2%)
In 3 coronary arteries, n (%)	33 (33.7%)

Data were presented as n (%) or mean ± standard deviation.
BMI, body mass index; P/C, previous or current; ASA, acetylsalicylic acid; Ca-ch, calcium channel; ACE/ARBI, angiotensin-converting enzyme/angiotensin receptor blocker, CSF, coronary slow flow; LAD, left anterior descending artery; Cx, cirfumflex artery; RCA, right coronary artery.

Table 2. Baseline Characteristics and Long-Term Outcomes of Patients with CSFP According to Groups

	Group 1	Group 2	
Variables	Mean CTFC >36.68 (n=24)	Mean CTFC ≤ 36.68 (n=74)	*P*
Age (years)	59.37 ± 7.56	55.43 ± 9.33	.064
Gender (male)	16 (66.7)	42 (56.8)	.391
BMI (kg/m²)	27.64 ± 2.91	26.80 ± 3.25	.264
Hypertension, n (%)	16 (66.7)	30 (40.5)	.026
DM, n (%)	8 (33.3)	20 (20.7)	.552
Hyperlipidemia, n (%)	14 (58.3)	35 (47.3)	.347
P/C smoking, n (%)	10 (41.7)	19 (25.7)	.136
Long-term outcomes			
Undergoing CA, n (%)	5 (25)	3 (4.1)	.006
Recurrent chest pain, n (%)	17 (70.8)	13 (17.6)	<.001
MACE, n (%)	10 (41.7)	1 (1.4)	<.001
CV deaths, n (%)	3 (12.5)	0 (0)	<.001
MI, n (%)	3 (12.5)	0 (0)	.013
USAP, n (%)	2 (8.3)	1 (1.4)	.148
Stroke, n (%)	1 (4.2)	0 (0)	.245
Revascularization, n (%)	0 (0)	0 (0)	NA
Arrhythmia, n (%)	1.(4.2)	0 (0)	.245
Drug treatment			
ASA, n (%)	23 (95.8)	72 (97.3)	1
Beta-blockers, n (%)	21 (87.5)	66 (89.2)	1
Ca ch blockers, n (%)	8 (33.3)	13 (17.6)	.102
ACE/ARB, n (%)	5 (20.8)	12 (16.2)	.757
Statins, n (%)	22 (91.7)	71 (95.9)	.593

Data were presented as n (%) or mean ± standard deviation.
BMI, body mass index; DM, diabetes mellitus; P/C, previous or current; CA. coronary angiography; MACE was defined as the composite of CV death, myocardial infarction, coronary revascularization, stroke arrhythmia; MACE, major adverse cardiac events; CV, cardiovascular; MI, myocardial infarction; USAP, unstable angına pectoris; NA, not available; ASA, acetylsalicylic acid; Ca ch, calcium channel; ACEI/ARB, angiotensin-converting enzyme/angiotensin receptor blocker.

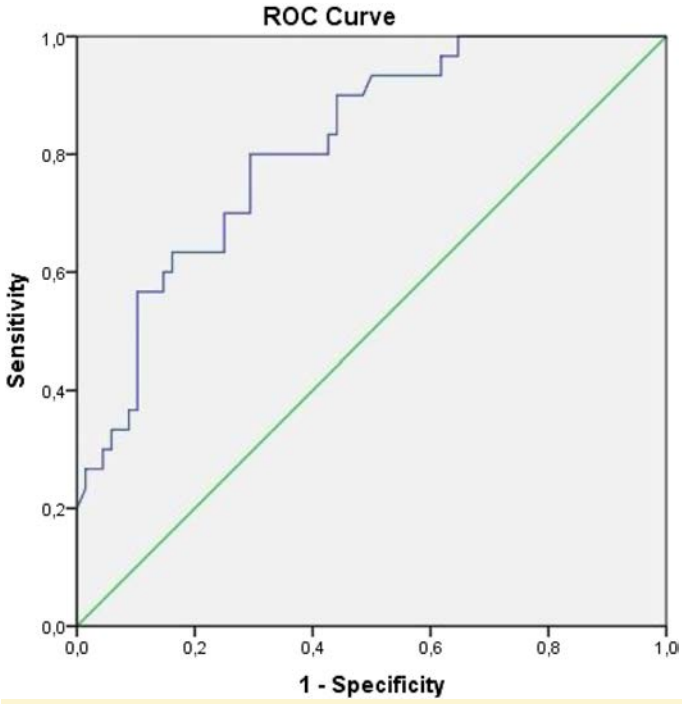

Figure 1. The receiver-operating characteristic curve of mean CTFC for predicting recurrent chest pain in patients CSFP. CTFC, corrected thrombolysis in myocardial infarction frame count; CSFP, coronary slow-flow phenomenon.

On the other hand, during the follow-up, 30 patients (30.6%) visited our cardiology outpatient department due to recurrent chest pain while on medication. Eight patients (8.2%) underwent coronary angiography during the follow-up. There was no significant difference in terms of drug treatment between the groups (all $P > .05$) (Table 2). The persistence of CSFP was observed in all of those. The effects of multiple variables on the recurrent chest pain were analyzed with univariate and multivariate Cox regression analyses. Hypertension (odds ratio (OR) 6.429, 95% CI: 2.403-17.197 $P < .001$), hyperlipidemia (OR 5.308, 95% CI: 1.998-14.103, $P = .001$), and mean CTFC (OR 1.284, 95% CI: 1.148-1.436, $P < .001$) were found to be predictors of recurrent chest pain according to univariate analysis. Moreover, hypertension (OR 2.627, 95% CI: 1.081-6.381, $P = .033$), hyperlipidemia (OR 2.469, 95% CI: 1.025-5.946, $P = .028$), and mean CTFC (OR 1.106, 95% CI: 1.037-1.179, $P = .002$) were also independent predictors of recurrent chest pain according to multivariate Cox regression analysis. The ROC curve of CTFC for predicting recurrent chest pain is demonstrated in Figure 1. Mean CTFC 34.17 had 70% sensitivity and 75% specificity in predicting recurrent chest pain in patients with CSFP [area under curve (AUC) 0.814 with 95% CI (0.727-0.901)].

The effects of multiple variables on the MACE were analyzed with univariate and multivariate Cox regression analyses (Table 3). According to univariate analysis, age (OR 1.125, 95% CI: 1.027-1.1232, $P = .011$), hypertension (OR 6.081, 95% CI: 1.240-29.821, $P = .026$), hyperlipidemia (OR 12.308, 95% CI: 1.509-100.336, $P = 0.019$), and mean CTFC (OR 1.476, 95% CI: 1.199-1.155 and $P = 0.001$) were found to be significantly related with MACE. Otherwise, only mean CTFC (OR 1.161, 95% CI: 1.022-1.317 and $P = .021$) was an independent predictor of MACE in multivariate Cox regression analysis.

The ROC curve of CTFC for predicting MACE is demonstrated in Figure 2. Mean CTFC 38.45 had 81.8% sensitivity and 88.5% specificity in predicting MACE in patients with CSFP [(AUC) 0.889 with 95% CI (0.772-1.000)].

Agreement in Evaluating Whether It Is Normal Flow or Slow Flow (Using CTFC) Between 2 Independent Observers

The coronary flow results whether normal flow (CTFC ≤ 27 frames) or slow flow (CSFP, CTFC > 27 frames) were evaluated by 2 members

Table 3. The Predictors of Major Adverse Cardiac Events in Coronary Slow-Flow Patients

	Univariate Analysis			Multivariate Analysis		
Variables	**OR**	**95% CI**	***P***	**OR**	**95% CI**	***P***
Age	1.125	(1.027-1.1232)	.011	1.073	(0.965-1.194)	.195
Gender	0.808	(0.229-2.853)	.740			
BMI	0.912	(0.763-1.090)	.311			
Hypertension	6.081	(1.240-29.821)	.026	1.942	(0.349-10.815)	.449
DM	3.545	(0.984-12.771)	.053			
Hyperlipidemia	12.308	(1.509-100.336)	.019	4.500	(0.512-39.586)	.175
P/C smoker	2.187	(0.610-7.841)	.229			
Mean CTFC	1.476	(1.199-1.155)	.001	1.161	(1.022-1.317)	.021
ASA	0.235	(0.020-2.833)	.254			
Beta-blockers	0.270	(0.059-1.226)	.090			
Ca ch blockers	2.353	(0.617-8.967)	.210			
ACEI/ARB	3.253	(0.833-12.706)	.090			
Statins	0.532	(0.049-4.747)	.532			

OR, odds ratio; BMI, body mass index; DM, diabetes mellitus; P/C, previous or current; CTFC, corrected thrombolysis in myocardial infarction frame count; ASA, acetylsalicylic acid; Ca ch, calcium channel; ACEI/ARB, angiotensin-converting enzyme/angiotensin receptor blocker.

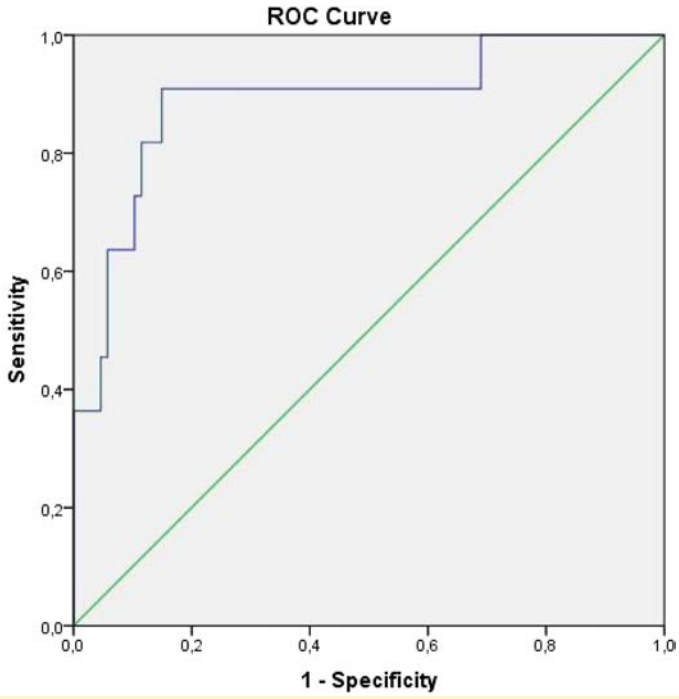

Figure 2. The receiver-operating characteristic curve of mean CTFC for predicting MACE in patients CSFP. CTFC, corrected thrombolysis in myocardial infarction frame count; MACE, major adverse cardiovascular events; CSFP, coronary slow-flow phenomenon.

of the research team who were blinded to the patients data. And the rates of agreement between 2 members of the research team were also assessed with the use of κ statistics. The value $\kappa > 0.80$ indicates excellent agreement between 2 independent observers; however, value <0.40 indicates poor agreement. The value $\kappa > 0.70$ indicates good agreement between independent observers as well. The agreement of the coronary flow results was good for LAD, with a 93% rate of agreement between 2 observers ($\kappa = 0.77 \pm 0.05$). While, the agreement rate of the coronary flow results was moderate (91.2%) for LCx ($\kappa = 0.68 \pm 0.05$). The agreement rate of the coronary flow results was also good for RCA 92.3% ($\kappa = 0.74 \pm 0.05$).

The effect size (Cohen's d) and power value (1 cohen's d ß) for CTFC, compared between group 1 and group 2, were calculated using G* Power software (version 3.1.9.2) The alpha level used for this analysis was <0.05. The effect size and power value were 0.488 and 0.920, respectively, for CTFC. The minimum sample size to evaluate properly the change of CTFC was found to be 20.

Discussion

In the present study, we demonstrated that mean CTFC was independently associated with recurrent chest pain and MACE in patients with CSFP. Moreover, CV deaths and MI from components of MACE significantly increased in patient with higher mean CTFC (group 1). Otherwise, USAP, stroke, and arrhythmia were similar between the groups and no revascularization was observed in both groups.

As previously mentioned, there are limited numbers of studies investigating long-term outcomes of patients with CSFP. Some studies found that CSFP has been associated with favorable long-term prognosis,[13,14] whereas the others showed that CSFP has been related to a worse long-term prognosis.[15] However, CTFC method was introduced by Gibson et al[11] to diagnose CSFP as a reproducible, quantitative, and relatively objective method.

Previous studies found that mean CTFC was significantly higher in patients with CSF compared to patients with normal coronary artery.[16,17] In addition, Kemaloğlu Öz et al[16] showed that there were moderate and positive correlations between mean TFC and left and right ventricular strains in patients with CSF. But both studies did not evaluate the cardiac prognosis of patients with CSF. The present study revealed that patients with higher mean CTFC (mean TFC > 38.45) had increased MACE and MACE significantly increased in group 1 compared to group 2 in our study (Table 2). A reduced coronary flow rate may increase platelet aggregation. Thus, CV deaths and MI can increase. Mean CTFC was the only independent predictor of MACE in patients with CSFP as well (Table 2), thereby suggesting that higher mean CTFC might predict patients at high risk for cardiovascular events among CSFP population. Life-threatening arrhythmias and sudden cardiac death can be seen in patients with CSF.[8,9,18] Cardiovascular death was significantly higher in group 1 compared to group 2 in our study (Table 2) and all cardiovascular deaths were related to sudden cardiac death in our study. Myocardial infarction was significantly higher in group 1 compared to group 2 but unstable angina, stroke, and arrhythmia were similar between the groups in our study. Although undergoing coronary angiography was significantly increased in group 1 compared with group 2, in our study, no revascularization was observed in both groups during follow-up (Table 2).

A previous study that used CTFC to define CSFP found that age, hypertension, and dyslipidemia were independent predictors of MACE in patients with CSFP.[18] But they did not research mean CTFC to evaluate predictors of MACE. In the present study, although age, hypertension, and hyperlipidemia seemed to be predictors of MACE in CSFP according to univariate analysis, these risk factors did not predict MACE in CSFP according to multivariate Cox regression analysis (Table 2). But just mean CTFC predicted MACE for CSFP in our study. Thus, further large cohorts need to be carried out in order to validate the predictors of MACE in CSFP.

In our study, besides predicting MACE, mean CTFC was related to recurrent chest pain. Voelker et al[19] found that continuing chest pain was more common in patients with CSF compared to patients with normal coronary artery. Our study has confirmed their study. In the present study, we found that recurrent chest pain while on medication was significantly increased in group 1 compared to group 2 in Table 2. Additionally, Cox regression analysis showed that hypertension, hyperlipidemia, and increased mean CTFC were the independent predictors for recurrent chest pain (Table 2). Thus, our findings could provide important insights into the role of mean CTFC on predicting recurrent symptoms in coronary artery disease patients.

Mean CTFC is a simple and easily applicable method for defining CSFP. In our study, mean CTFC was an independent predictor for MACE, and it can be used as a prognostic indicator in CSFP.

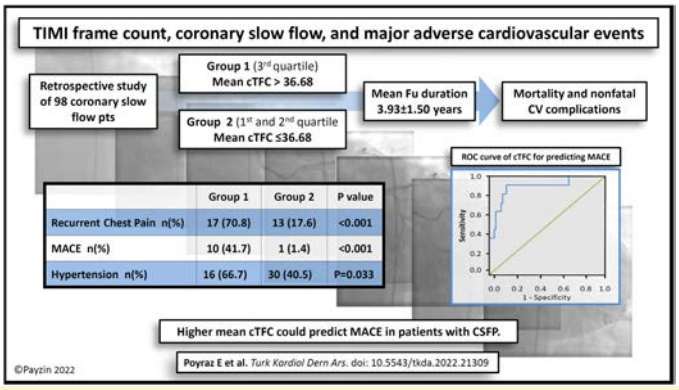

Figure 3. Visual summary of the article.

Further studies are needed to determine whether a higher mean CTFC may predict MACE.

Limitation

The main limitation of our study was the limited number of enrolled patients and the study conclusions needed confirmation with larger studies. Additionally, there was a possibility of the presence of several unmeasured confounders and intra-observer variability on the mean CTFC analysis.

Conclusion

In the present study, we found that higher mean corrected thrombolysis in myocardial frame count could predict major adverse cardiovascular events in patients with the coronary slow-flow phenomenon.

Visual summary of the article can be seen in Figure 3.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Haydarpaşa Numune Training and Research Hospital (Approval Date: 2021; Approval Number: 2021/KK/198).

Informed Consent: Written informed consent was obtained from all participants who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - E.P.; Design - G.S.; Supervision - S.T.; Materials - E.P.; Data Collection and/or Processing - A.E., L.D.A., S.Y.; Analysis and/or Interpretation - S.T.; Literature Review - A.Ö., Ö.G.; Writing - G.S.

Declaration of Interests: None of the authors have any conflict of interest that is relevant for the present study.

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