EURASIAN JOURNAL OF EMERGENCY MEDICINE
Original Article
DOI: 10.4274/eajem.galenos.2019.86158
Eurasian J Emerg Med. 2019;18(3): 128-36

Factors Affecting Prognosis Based on Right Coronary Artery Pathologies

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Abstract

Aim: Blood glucose levels, cardiac troponin (cTn) values within the first 12 hours, ejection fraction (EF), bundle branch block and Gensini scores of patients who were admitted to the emergency department for acute inferior myocardial infarction (AIMI) were compared based on the bundle branch of the occluded right coronary artery (RCA) with regard to prognosis.

Materials and Methods: The data of the study were acquired through retrospective review of 212 patients with AIMI (48 women, 164 men; median age=64 years) who applied to the emergency department due to chest pain and who were hospitalized in cardiology clinic between January 2012 and December 2015. The patients were divided into five RCA groups based on the angiography results. The level of mortality and three-vessel disease (TVD) were compared based on age, gender, blood glucose, EF, Gensini score (GS), cTn, bundle branch block, type of myocardial infarction and percentage of the occluded vein.

Results: Major percentage of the occluded vein, cTn, high-density lipoproteins, blood glucose, GS, and EF were statistically significant. The most frequent complication that occurred after acute myocardial infarction was ischemic heart failure (IHF) and it was mostly seen in RCA. Mortality, ventricular tachycardia (VT) and acute pulmonary edema (APE) were seen in acute ST-elevated MI that was close to circumflex artery (Cx) and lateral region. Cardiac tamponade or pericardial effusion was more frequent in mid-RCA. IHF, VT, atrioventricular complete block and APE were common in female patients. Male patients had only higher levels of cardiac tamponade and/or pericardial effusion ($p<0.05$). Mortality rate was 31.3% (n=15) in female patients and 11.6% (n=19) in male patients. Mortality and right bundle branch block were most common in acute inferoposterior myocardial infarction and IHF AIMI, as well as left bundle branch block was most common in inferolateral MI. TVD was more common in infarctions close to Cx, as well as most frequently in RCA when it was compared with the major occluded vein.

Conclusion: Diagnosing an acute coronary syndrome and determining its characteristics based on RCA and the involved segment might be a predictive vision for rapidly predicting complications in TVD and mortality.

Keywords: Right coronary artery, emergency department, acute myocardial infarction, mortality, three-vessel disease

Introduction

Myocardial infarction (MI) is one of the major causes of death in our country and in the world today and is described as "myocardial cell death depending on extended ischemia due to occlusion of the veins which feed the heart". There are two main coronary arteries that feed the heart: left main coronary artery (LCA) and right main coronary artery (RCA). While LCA predominantly feeds the anterior side of the heart and the left ventricle that has the actual function of pumping, RCA predominantly feeds the right ventricle and right atrium of the heart as well as the sinoatrial nodes. Both coronary arteries have a vital function for human life and the branches separating from these arteries may vary from person to person (1,2).

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Cite this article as: Coşkun A, Korkmaz İ, Eren ŞH. Factors Affecting Prognosis Based on Right Coronary Artery Pathologies. Eurasian J Emerg Med. 2019;18(3):128-36.

Received: 22.02.2019
Accepted: 02.05.2019

RCA originates from its own ostium in the right coronary sinus and proceeds through the right atrioventricular (AV) orifice. RCA has several branches and the first of these branches is called as conus artery. This artery feeds the outflow tract of the right ventricle. The second sub-branch is the sinoatrial node artery that feeds the sinoatrial node. The right ventricular (RV) branch arises after this artery and the RCA segment which proceeds until this branch is called "proximal RCA". The "middle RCA" segment is the segment between the RV branch that feeds the right ventricle and acute marginal artery originating from the RCA. RCA segment following acute marginal artery branch is called "distal RCA" and this segment is divided into two parts as posterior descending artery (PDA) and posterolateral branch (PLB). PDA originates from the distal RCA in 80-85% of all subjects (3,4) and right predominance is mentioned in these individuals. PDA originates from the left circumflex coronary artery in remaining individuals and left predominance is mentioned in these individuals. While PDA feeds the posterior interventricular septum, PLB feeds the inferior left ventricle. RCA branches are schematically shown in Figure 1. Sohrabi et al. (5) detected RCA occlusion in 64.7% of acute inferior myocardial infarction (AIMI) cases in their study. Waldo et al. (6) detected RCA involvement in 467 of 824 cases diagnosed with isolated posterior MI (PMI).

We aimed to determine whether there was a relationship between the occluded segments and gender, age, ejection fraction (EF), blood glucose, Gensini score (GS), the first three measured cardiac troponin (cTn) levels, mortality, three-vessel disease (TVD) as well as bundle branch parameters in MI cases which progresses depending on occlusion of RCA, which is one of the main veins feeding the heart, or not in our study. Moreover, we determined the type of MI that progressed based on the occluded segment and its complications.

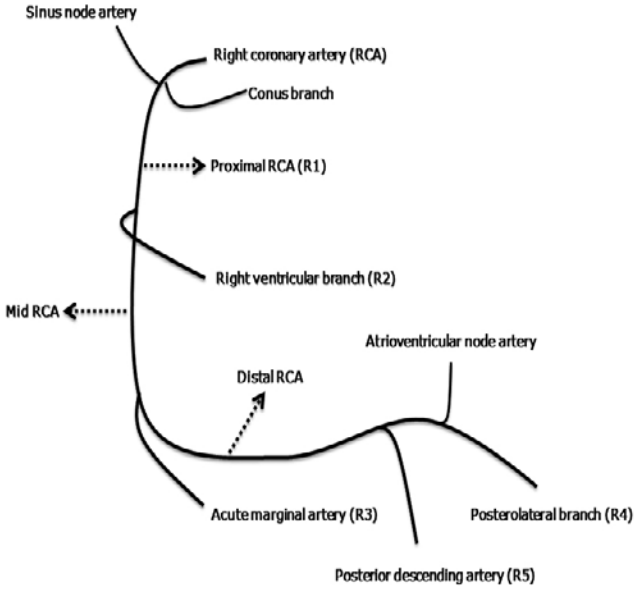

Figure 1. Schematic view of right coronary artery and its branches

RCA: Right coronary artery

Materials and Methods

Study Design and Population

Two hundred and twelve (48 women, 164 men; median age=64.56±8.88 years; range 45-77 years) patients, who applied to the emergency department due to chest pain and who were hospitalized to the cardiology clinic with a diagnosis of MI depending on occlusion in RCA and its branches between January 2012 and December 2015, were included in the study. Patients who had prostate cancer, pulmonary emboli and chronic liver diseases; who did not undergo blood transfusion; who had chronic kidney disease and new cerebrovascular disease; who did not have complete blood count, biochemistry, cTn, electrocardiography (ECG), echocardiography, lipid profile, risk factors, blood glucose, and angiography results were excluded from the study. Age, gender, ECG, coronary angiography reports, EF, blood glucose level on admission, lipid profiles, first three measured troponin I levels and bundle branch block (BBB) of these patients were retrospectively examined through the hospital automation system. Moreover, presence of diabetes, smoking, and hypertension was examined and recorded. cTn level on admission was classified as cTn 1, and cTn 2 for 6th hour and cTn 3 for 12th hour.

Mortality of all cases was obtained after 60 months follow-up. These results were decided by contacting the hospital automation system and/or the patients and their relatives by phone.

Patients who had chest pain and/or discomfort lasting at least 30 minutes and had ECG with STEMI in accordance with 2013 ACCF/AHA guidelines were included in the study (7). UA/NSTEMI was defined in accordance with the criteria of AHA/ACC Guideline for the Management of Patients With NSTE-ACS, 2014. All patients were checked by Transthoracic Echocardiography (TTE) (Philips Epiq 7, Philips Ultrasound, WA, USA) to see if they had focal wall motion abnormalities or not.

Written informed consent was obtained from all patients and the study was approved by the Ethical Committee Cumhuriyet University. number: 2018-01-26.

Cardiac Biomarker Analysis

Venous blood samples were obtained from the antecubital veins of patients in order to measure serum levels of Troponin I. Elecsys Troponin I STAT assay, cobas e 411 and Hitachi Roche analyzers were used to measure Troponin I levels. Troponin levels of patients were measured at admission, 6th and 12th hour.

Angiographic Analysis

Angiographic evaluations were performed by two experienced cardiologists who were blinded to the study. Discrepancies were resolved by consensus. Angiography was performed in all patients. As a result of the angiography, GS was calculated according to the system and vessel structure. The extent and severity of coronary artery disease (CAD) were assessed through GS (8).

Gensini Scoring System

GS was calculated by multiplying the severity coefficient, which was assigned to each coronary stenosis based on the degree of luminal narrowing (reductions of 25%, 50%, 75% 90%, 99%, and complete occlusion were respectively given Gensini scores of 1, 2, 4, 8, 16, and 32) through the coefficient identified based on the functional importance of the myocardial area supplied by that segment: LCA, 5; the proximal segment of the left anterior descending coronary artery (ADA), 2.5; the mid segment of the left ADA, 1.5; the apical segment of the left ADA, 1; the first diagonal branch, 1; the second diagonal branch, 0.5; the proximal segment of the circumflex artery (Cx), 2.5 (if RCA dominancy exist 3.5); the distal segment of the Cx, 1 (if dominant, 2); the obtuse marginal branch, 1; the PLB, 0.5; the proximal segment of the RCA, 1; the mid segment of the RCA, 1; the distal segment of the RCA, 1; and the PDA, 1 (8).

Statistical Analysis

The data obtained from this study were analyzed via SPSS 20 software package. Shapiro-Wilk test was used as test of normality. Mann-Whitney U and Kruskal Wallis tests were used to compare non-normally distributed variables between groups. Post-Hoc multiple comparison test was used in case of significant differences in Kruskal Wallis test. Two-way ANOVA was used in the analysis of multiple dependent variables with normal distribution. Multiple comparison tests were used in case where there were no significant differences. Chi-Square analysis was used to examine the relationships between the groups in terms of nominal variables. Spearman's correlation was used for the correlation of values. $P<0.05$ was considered statistically significant.

Results

The mean occlusion rate was 83.97±14.37 percent. Mean cTn 1 was 3.08±3.43 mg/dL, cTn 2 was 8.06±9.72 mg/dL and cTn 3 was 18.21±16.29 mg/dL. Mean triglyceride (TG) level was 151.91±70.05 mg/dL, cholesterol was 198.48±72.54 mg/dL, high-density lipoprotein (HDL) was 35.6±7.98 mg/dL, low-density lipoprotein (LDL) was 122.20±81.00 mg/dL, very low-density lipoprotein (VLDL) was 33.19±18.45 mg/dL and blood glucose level was 139.60±62.99 mg/dL. Gensini score was 67.45±50.32 points and EF was 46.67±13.13. TG, LDL, and VLDL were not statistically significant; but the percentage of the occluded vein, cTn 1, HDL, blood glucose, GS, and EF were statistically significant (Table 1).

The most common complication after MI was ischemic heart failure (IHF) when the analysis was conducted based on the structure of the occluded vein as well as it was seen in RCA. Mortality, ventricular tachycardia (VT) and acute pulmonary edema (APE) were especially seen in ST-elevated MI (STEMI) close to Cx and lateral region. Cardiac tamponade and pericardial effusion were seen more frequently in mid-RCA. Although diabetes was not significant, other values were found to be significant based on the structure of the occluded vein (Table 2).

IHF, VT, AV complete block and APE were more frequent in female patients, whereas only cardiac tamponade or pericardial effusion was more frequent in male patients when complication analysis based on gender was conducted. Mortality was 31.3% (n=15) in female patients and 11.6% (n=19) in male patients. Mortality, complications, TVD and BBBs were significantly different based on gender (Table 3).

Mortality and right BBB were most commonly seen in acute inferoposterior MI (IPMI) and IHF AIMI, as well as left BBB, was seen most frequently in inferolateral MI (ILMI) when they were examined based on the type of acute MI. TVD was seen more frequently in infarctions close to Cx and most frequently in RCA regarding the occluded major vein. MI types were found statistically significant in terms of EF and age (Table 4).

Discussion

In the literature review, we could not find any studies related to RCA with emergency department admission, AIMI which involved the bundle branches of RCA and frequent accompanying posterior MI (PMI), IPMI, ILMI in CAD as well as EF, Gensini score, BBBs, TVD and mortality in the right ventricle MIs (RVMI). We conducted our study in order to determine prognostic results regarding the affected vein segment in MI which progresses depending on RCA occlusion.

Infarctions that occur due to the interruption of blood flow in RCA are more associated with ST-segment changes in leads I, II, III, aVF and aVL on ECG. ST-segment elevation in lead III derivation is higher than the ST-segment elevation in lead II in RCA occlusion. It is stated that the probability of a lesion in RCA increases significantly when ST-segment depression in aVL derivation is higher than ST-segment in lead I in addition to these criteria (9-11).

Seventy-seven point four percent (n=164) of our patients were male, 22.6% (n=48) were female and the mean age was 64 years.

Male gender is considered as an independent risk factor in several studies. Sixty percent of CADs are seen in male individuals. Atherosclerotic heart diseases start 10-20 years earlier in male individuals and its frequency is 3-6 times higher than in female individuals (6). Our study is consistent with the literature in this aspect.

Wellens et al. (12) have stated that AIMI occurs due to a sudden interruption of blood flow of myocardium fed by RCA or Cx. RCA lesions are the major cause in AIMIs. RCA extends into the right atrium and ventricle and reaches the septum; it then transmits blood into the posterior and inferior part of the left ventricle and ends. Structures such as sinus node regulate the cardiac rhythm and they are mostly supplied by RCA. RCA is dominant in 60-70% of people. Our study was similar to the available studies and the occluded major vein was RCA. The presence of RCA lesions in inferior, posterior and IPMI was 64.9%, 50% and 48.1%, respectively. RCA lesion was also seen in ILMI with an equal rate of 31% with R4. RVMI was observed in two cases, one of which was RCA and the other of which was R5.

Gül et al. (13) stated that the lesion was mostly in RCA in cases with concurrent AIMI and right ventricle infarction. RCA lesions cause the most cases of AIMIs where infarction spreads to the right ventricle and posterior regions. Cx remains at the forefront in cases with only posterior wall infarction accompanying inferior infarction. ECG was used for diagnosis in our study. STEMI in ECG was divided into groups as inferior, posterior, right ventricle, inferoposterior and inferolateral MI. The structure of the occluded major vein was determined based on the occlusion in angiography. AIMI, posterior and inferoposterior MIs were seen in R2 and R3, particularly RCA; inferolateral MIs were detected more in R4, R5 and Cx in our study. It was seen that complications, TV CAD, and mortality increased when involvement extended towards Cx. Therefore, we detected that GS that indicates the frequency of CAD increased, EF decreased and prognosis worsened.

Table 1. Baseline characteristics of study patients

	All patients	Patients with					p
		R1	R2	R3	R4	R5	
Baseline characteristics							
Age, mean ± SD, years	64.56±8.87	62.55±9.10	61.46±9.84	63.1±7.46	70.4±5.61	69.4±5.06	**0.001**
Gender, Male/Female	164/48	105/13	17/7	6/4	20/15	16/9	**0.001**
Laboratory findings							
TG (mg/dL)	151.91±70.06	159.78±77.64	148.33±56.32	136.9±46.44	143.11±67.2	136.48±52.37	0.440
CHOL (mg/dL)	198.48±72.54	197.34±67.85	210.54±79.96	230.1±112.17	201.76±76.83	174.88±58.72	0.257
HDL (mg/dL)	35.60±7.98	34.90±7.81	35.79±8.05	32.6±7.9	36.85±7.48	38.16±9.06	0.218
LDL (mg/dL)	122.20±81.01	128.22±102.00	104.16±36.56	135.2±56.15	122.97±42.5	104.8±32.47	0.519
VLDL (mg/dL)	33.19±18.45	33.91±17.51	29.29±11.00	35.8±19.71	35.02±25.58	29.88±16.53	0.630
LVEF (%)	46.78±14.27	50.77±11.21	50.91±10.99	45.00±12.24	37.45±12.94	36.88±13.04	**0.001**
GS	67.45±50.32	53.16±44.96	74.33±57.85	91.2±56.93	86.82±50.31	91.68±44.23	**0.001**
cTn 1 (ng/mL)	3.08±3.43	2.71±1.79	2.46±1.91	2.82±3.06	3.61±3.37	4.74±7.7	**0.001**
cTn 2	8.06±9.72	7.10±6.24	6.55±4.98	9.48±.25	8.88±8.74	12.36±21.02	**0.008**
cTn 3	18.21±16.21	16.71±13.78	17.94±14.37	19.61±15.98	20.44±20.29	21.86±22.29	**0.001**
Glucose (mg/dL)	139.60±62.99	133.07±51.69	155.25±87.44	193.6±119.17	137.42±60.35	136.84±48.59	**0.036**
BPV (%)	83.96±14.37	79.46±14.59	78.79±15.65	85.80±11.48	94.2±6.21	95.12±5.23	**0.001**
Mortality	34	13	2	2	10	**7**	**0.038**
TVD	111	**44**	**15**	**7**	**24**	**21**	**0.001**
Inferior MI	131	85	18	3	13	12	
Posterior MI	14	7	2	0	4	1	
Inferoposterior MI	27	13	1	4	6	3	**0.004**
Inferolateral MI	38	12	3	3	12	8	
Right ventricular MI	2	1	**0**	**0**	**0**	**1**	

R1: Proximal right coronary artery, R2: Right ventricular branch, R3: Acute marginal artery, R4: Posterolateral branch, R5: Posterior descending artery, SD: Standard deviation, TG: Triglycerides, CHOL: Cholesterol, HDL: High-density lipoprotein, LDL: Low-density lipoprotein, VLDL: Very-low-density lipoprotein, LVEF: Left ventricular ejection fraction, GS: Gensini score, cTn: Troponin, BVP: Blocked vessel percentage, TVD: Three-vessel disease, MI: Myocardial infarction, $p<0.05$

Table 2. Comparison of variables according to the underlying major vessel structure

Right coronary artery								
		R1 n (%)	R2 n (%)	R3 n (%)	R4 n (%)	R5 n (%)	χ^2	p-value
Complication	No	54 (45.8)	14 (58.3)	2 (20)	8 (22.9)	7 (28)	63.75	0.001
	IHF	37 (31.4)	5 (20.8)	2 (20)	3 (8.6)	5 (20)		
	VT	2 (1.7)	0 (0)	0 (0)	5 (14.3)	3 (12)		
	CT/E	7 (5.9)	3 (12.5)	0 (0)	4 (11.4)	1 (4)		
	AV Blocs	13 (11)	1 (4.2)	4 (40)	5 (14.3)	1 (4)		
	APE	5 (4.2)	1 (4.2)	2 (20)	10 (28.6)	8 (32)		
Mortality	No	105 (89)	22 (91.7)	8 (80)	25 (71.4)	18 (72)	10.12	0.038
	Yes	13 (11)	2 (8.3)	2 (20)	10 (28.6)	7 (28)		
BB	No	79 (66.9)	17 (70.8)	5 (50)	21 (60)	17 (68)	22.47	0.004
	RBBB	32 (27.1)	6 (25)	3 (30)	19 (54.3)	2 (8)		
	LBBB	7 (5.9)	1 (4.2)	2 (20)	16 (45.7)	6 (24)		
AF	No	97 (82.2)	16 (66.7)	8 (80)	11 (31.4)	18 (72)	12.40	0.016
	Yes	21 (17.8)	8 (33.3)	2 (20)	24 (68.6)	7 (28)		
TVD	No	74 (62.7)	9 (37.5)	3 (30)	4 (11.4)	4 (16)	26.70	0.001
	Yes	44 (37.3)	15 (62.5)	7 (70)	31 (88.6)	21 (84)		
HT	No	45 (38.1)	10 (41.7)	3 (30)	18 (51.4)	1 (4)	19.17	0.001
	Yes	73 (61.9)	14 (58.3)	7 (70)	31 (88.6)	24 (96)		
DM	No	66 (55.9)	13 (54.3)	3 (30)	18 (51.4)	14 (56)	2.62	0.623
	Yes	52 (44.1)	11 (45.2)	7 (70)	17 (48.6)	11 (44)		
Tobacco	No	46 (39)	10 (41.7)	5 (50)	27 (77.1)	19 (76)	23.45	0.001
	Yes	72 (61)	14 (58.3)	5 (50)	8 (22.9)	6 (24)		
Gender	No	13 (11)	7 (29.2)	4 (40)	15 (42.9)	9 (36)	22.12	0.001
	Yes	105 (89)	17 (70.8)	6 (60)	20 (57.1)	16 (64)		

IHF: Ischemic heart failure, VT: Ventricular tachycardia, CT/E: Cardiac tamponade/effusion, AV: Atriventricular, APE: Acute pulmonary edema, RBBB: Right branch block, LBBB: Left branch block, BB: Branch block, AF: Atrial fibrillation, HT: Hypertension, DM: Diabetes mellitus, %: percent, χ^2: Chi-square, $p<0.05$

In addition to the diagnosis of CAD, cTns are valuable in determining prognosis and planning treatment. Çelebi et al. (14) stated that cTns were highly sensitive and specific indicators of damage in the myocardium. CAPTURE study reported that the risk of 6-month MI with or without death was 23.9% in patients with cTn-T level >0.1 g/L and 7.5% in patients with cTn-T level <0.1 g/L (15). Moreover, approximately 50% of patients with heart failure may have high levels of cTn during both acute and chronic compensation period (16-18). In our study, among the cTn values taken within the first 12 hours, cTn-1 was 3.08±3.43 mg/dL, cTn-2 was 8.06±9.72 mg/dL and cTn-3 was 18.21±16.29 mg/dL. The high levels of cTn values on admission were prognostic in terms of mortality. Moreover, high levels of cTn values increased the frequency of CAD based on the size of the ischemic region as well as the percentage and number of the occluded vein. Thus; decrease in EF is associated with GS, accompanying TVD and increased mortality. cTn correlation was towards negative analysis. cTns provide important information about both the diagnosis and the course of treatment. High cTn level is an important indicator of coronary ischemia, but it should be considered that cTn may increase in different clinical cases and should not be always interpreted in favor of coronary ischemia.

Gensini scoring system of Quadros et al. (19) is a method used in the evaluation of CAD frequency. GS, which is examined with regard to CAD frequency and lesion severity, is a quantitative numerical method when used in conjunction with the analysis conducted through simple catheter calibration that reveals this relationship. While patients with GS below 20 are classified as mild CAD, patients with GS ≥20 are classified as severe CAD (8,20). Gensini score was used in our study for this purpose. A significant difference was detected when the GS and its EFs were compared based on the types of acute MI. It was seen that the more the number of the involved coronary arteries, the more GS increased as well as that EF significantly decreased in association with the increased score based on the involved heart region. Gensini

Table 3. Comparison of variables according to gender

		Female n (%)	Male n (%)	χ^2	p-value
Complication	**No**	9 (18.8)	76 (46.3)	**17.01**	**0.004**
	IHF	14 (29.2)	38 (23.2)		
	VT	4 (8.3)	6 (3.7)		
	CT/E	3 (6.3)	12 (7.3)		
	AV blocs	11 (22.9)	13 (7.9)		
	APE	7 (14.6)	19 (11.6)		
Mortality	**No**	33 (68.8)	145 (88.4)	**10.66**	**0.001**
	Yes	15 (31.3)	19 (11.6)		
BB	**No**	29 (60.4)	110 (67.1)	**10.06**	**0.007**
	RBBB	7 (14.6)	40 (24.4)		
	LBBB	12 (25)	14 (8.5)		
AF	**No**	28 (58.3)	130 (79.3)	**8.57**	**0.003**
	Yes	20 (41.7)	34 (20.7)		
TVD	**No**	3 (6.3)	98 (59.8)	**42.62**	**0.001**
	Yes	45 (93.8)	66 (40.2)		
HT	**No**	7 (14.6)	56 (34.1)	**6.80**	**0.009**
	Yes	41 (85.4)	108 (65.9)		
DM	**No**	34 (70.8)	80 (48.8)	**7.26**	**0.007**
	Yes	14 (29.2)	84 (51.2)		
Tobacco	**No**	37 (77.1)	70 (42.7)	**17.57**	**0.001**
	Yes	11 (22.9)	94 (57.3)		

IHF: Ischemic heart failure, VT: Ventricular tachycardia, CT/E: Cardiac tamponade/effusion, AV: Atrioventricular, APE: Acute pulmonary edema, RBBB: Right branch block, LBBB: Left branch block, BB: Branch block, AF: Atrial fibrillation, HT: Hypertension, DM: Diabetes mellitus, %: percent, χ^2: Chi-square, $p<0.05$

score did not increase in AMI, was highest in bundle branches of RCA, and the highest increase was in R4 bundle branch. It is considered that higher levels of GS in posterior and lateral are associated with Cx.

When the literature is examined, it is seen that several studies have been carried out on BBBs. To the best of our knowledge, no analysis based on the bundle branches of RCA has been conducted as in our study. Right BBB was seen most frequently in distal RCA (R3) at a rate of 30% and left BBB was detected in the posterolateral bundle branch of RCA (R4) at a rate of 28.6%. Braunwald et al. (21) stated that new-onset right BBB led to an increase in cardiovascular mortality due to frequent prevalence of CAD and IHF. When RBBB occurs in presence of cardiac the disease, it causes disease to progress. Braunwald et al. (22) stated that the presence of left BBB caused increased spread of disease, decreased ventricular function and decreased survival among the patients with CAD. In our study, right BBB was more common in men and left BBB was more common in women. In a similar study, Hesse et al. (23) found that right BBB was more common in older men and light BBB was more common in older women. In our study, right BBB was mostly seen in IPMI at a rate of 63% and left BBB was mostly seen in ILMI at a rate of 39.5%. IHF was the most common complication in both right and left BBBs and seen in the proximal shade of RCA. AV complete block was prominent in the middle and distal parts of RCA, and VT and APE were more common when Cx was included or approached laterally. In total, mortality was mostly seen in left BBB at a rate of 46.2%. However, it was interesting that mortality in both BBBs was highest in PDA of RCA. It is likely that it is close to Cx or Cx is included in the process. TVD, GS and mortality increased when TVD proceeded laterally. In case of diabetes and smoking, hypertension, which is one of the risk factors, was more frequently together with left and right BBBs. We think that conditions affecting lungs such as smoking and chronic lung diseases affect ventricle more and cause an increase in right BBB.

Mean EF was 46 in our study. EFs of the patients decreased in inferior MI and to a lesser extent in anterior MI. EFs of the patients with lesions in Cx were affected more based on the data of our study. The greater the rate of occlusion, the greater the mortality and CAD frequency in our study. CAD frequency and EF showed

Table 4. Comparison of variables according to myocardial infarction

Myocardial infarction		IMI n (%)	PMI n (%)	IPMI n (%)	ILMI n (%)	RVMI n (%)	χ^2	p-value
Complication	No	79 (60.3)	1 (7.1)	2 (7.4)	3 (7.9)	0 (0)	36.9	0.001
	IHF	48 (36.6)	1 (7.1)	1 (3.7)	2 (5.3)	0 (0)		
	VT	3 (2.3)	0 (0)	1 (3.7)	6 (15.8)	0 (0)		
	CT/E	0 (0)	12 (85.7)	1 (3.7)	2 (5.3)	0 (0)		
	AV blocs	1 (0.8)	0 (0)	18 (66.7)	5 (13.2)	0 (0)		
	APE	0 (0)	0 (0)	4 (14.8)	20 (52.6)	2 (100)		
Mortality	No	128 (97.7)	11 (78.6)	14 (51.9)	23 (60.5)	2 (100)	55.24	0.001
	Yes	3 (2.3)	3 (21.4)	13 (48.1)	15 (39.5)	0 (0)		
BB	No	101 (77.1)	11 (78.6)	7 (25.9)	18 (47.4)	2 (100)	64.15	0.001
	RBBB	23 (17.6)	2 (14.3)	17 (63)	5 (13.2)	0 (0)		
	LBBB	7 (5.3)	1 (7.1)	3 (11.1)	15 (39.5)	0 (0)		
AF	No	109 (83.2)	9 (64.3)	19 (70.4)	20 (52.6)	0 (0)	16.44	0.002
	Yes	22 (16.8)	5 (35.7)	8 (29.6)	18 (47.4)	0 (0)		
TVD	No	71 (54.2)	8 (57.1)	9 (33.3)	13 (34.2)	0 (0)	9.55	0.049
	Yes	60 (45.8)	6 (42.9)	18 (66.7)	25 (65.8)	2 (100)		
HT	No	52 (39.7)	2 (14.3)	4 (14.8)	5 (13.2)	0 (0)	16.54	0.002
	Yes	79 (60.3)	12 (85.7)	23 (85.2)	33 (86.8)	2 (100)		
DM	No	72 (55)	11 (78.6)	12 (44.4)	18 (47.4)	1 (50)	5.12	0.275
	Yes	59 (45)	3 (21.4)	15 (55.6)	20 (52.6)	1 (50)		
Tobacco	No	52 (39.7)	9 (64.3)	20 (74.1)	25 (65.8)	1 (50)	16.74	0.002
	No	79 (60.3)	5 (35.7)	7 (25.9)	13 (34.2)	1 (50)		
Gender	F	25 (19.1)	3 (21.4)	9 (33.3)	11 (28.9)	0 (0)	4.17	0.384
	M	106 (80.9)	11 (78.6)	18 (66.7)	27 (71.1)	2 (100)		
MBV	R1	85 (64.9)	7 (50)	13 (48.1)	12 (31.6)	1 (50)	35.20	0.004
	R2	18 (13.7)	2 (14.3)	1 (3.7)	3 (7.9)	0 (0)		
	R3	3 (2.3)	0 (0)	4 (14.8)	3 (7.9)	0 (0)		
	R4	13 (9.9)	4 (28.6)	6 (22.2)	12 (31.6)	1 (50)		
	R5	12 (9.2)	1 (7.1)	3 (11.19)	8 (21.1)	1 (50)		

IHF: Ischemic heart failure, VT: Ventricular tachycardia, CT/E: Cardiac tamponade/effusion, APE: Acute pulmonary edema, RBBB: Right branch block, LBBB: Left branch block, BB: Branch block, AF: Atrial fibrillation, HT: Hypertension, DM: Diabetes mellitus, MBV: Major bloced vessel, IMI: Inferior MI, PMI: Posterior MI, IPMI: Infero-posterior MI, ILMI: Infero-lateral MI, RVMI: Right ventricular MI , F: Female, M: Male %: percent, χ^2: Chi-square, $p<0.05$

negative correlation, and the most frequent complication, IHF, increased after AMI. EF was 50.77±11.21 in RCA, 50.91±10.91 in R2, 45±12.24 in R3, 37.45±12.94 in R4, and 36.88±13.04 in R5. As seen in the EF, it was observed that the more the involvement of the heart towards left, the more the decrease in EF. EF was mostly deteriorated in R5. We think that it is caused by the fact that Cx accompanies ILMI. The right ventricle involvement was mostly seen in the proximal RCA. Masci et al. (24) observed that the early damage in the right ventricle was associated with the ischemia occurred in proximal RCA at a higher level than the middle and distal RCA. Rallidis et al. (25) stated that the lesion of proximal RCA affected RV function more than distal RCA. IHF, which is one of the complications occurring after AMI, was mostly in RCA lesions at a rate of 31.4% in our study. Cardiac tamponade and pericardial effusion were detected in middle-RCA. Acute lung edema was most frequently seen in PDA (R5) at a rate of 32%. IHF and lung edema were more common in female individuals at the rates of 29.2% and 14.6%, respectively. Cardiac tamponade and/or pericardial effusion was seen more in male individuals at a rate of 7.3%. The reason for this can be explained through the fact that hypertension and diabetes, which are secondary risk factors, are seen more in female individuals. These two risk

factors were higher in female individuals and smoking status was higher in male individuals in our study.

The occluded major vein was posterolateral bundle branch (R4) at a rate of 28.6% when the mortality analysis was conducted based on bundle branches of RCA. Whereas Lin et al. (26) found that the mortality in RCA lesions was higher than proximal and distal RCA (25.9%, 1.7%, 24.1%, respectively). The mortality rate 31.3% in female individuals and mostly detected in acute IPMI at a rate of 48.1%. Movement disorder in anterior and inferior walls, which were common in our patients with BBBs, and aneurysms in interventricular septum supported the fact that these patients had common vein disease. TVD and mortality were most frequently seen in bundle branches of RCA close to Cx, where GS was high in distal RCA, where EF was low.

The fact that cases with MI which progresses due to RCA occlusion are correlated with the lesion region may be a predictive foresight in order to predict the RCA and its bundle branches, since it gradually increases the complications based on the number of the occluded coronary arteries, TVD and mortality. It may be more important to describe CAD with poor prognosis criteria instead of potentially absolute values.

The biggest limitation of our study was its retrospective nature. Moreover, the difficulty in reaching laboratory results and detection of risk factors through calling patients one by one were other reasons of limitation. We believe that our study may be beneficial if it is supported by new prospective data when the limitation in health expenses in the recent periods of time is taken into consideration.

Conclusion

Early prediction of the occlusion level of RCA and its bundle branches, the cTn-dependent or independent complications after AMI may be a predictive foresight to indicate TVD and mortality prognosis.

Ethics

Ethics Committee Approval: Cumhuriyet University approval number: 2018-01-26.

Informed Consent: Informed consent was obtained.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: A.C., İ.K., Concept: A.C., Design: A.C., Ş.H.E., Data Collection or Processing: A.C., Analysis or Interpretation: A.C., İ.K., Literature Search: A.C., İ.K., Writing: A.C., Ş.H.E.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study received no financial support.

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