



ISSN: 2277- 7695

TPI 2016; 5(6): 118-120

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www.thepharmajournal.com

Received: 19-04-2016

Accepted: 20-05-2016

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## Features of coronary lesions in patients with heart failure after myocardial infarction

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### Abstract

This article covers the results of study of coronary bed state in patients with acute myocardial infarction (MI) according to coronary angiography data. Examinations showed that a single-vessel disease of coronary branches occurred more often than a multivessel one. Right coronary artery (RCA) and left anterior descending artery (LAD) diseases were registered most often out of three main coronary arteries. RCA narrowing occurred more often in case of the single-vessel disease than in the multivessel one. Left main coronary artery trunk (LMT) narrowing was found significantly rarer. TIMI flow 3 was found significantly more often after percutaneous coronary intervention (PCI). An average length of implanted stents was  $(23.2\pm 3.1)$  mm, an average diameter was  $(2.84\pm 0.28)$  mm, an average balloon inflation pressure was  $(14.0\pm 0.67)$  atm. According to Syntax Score evaluation examined patients got  $(21\pm 1.23)$  points. These signs have favorable prognosis.

**Keywords:** percutaneous coronary intervention; Syntax Score; coronary artery; heart failure.

### 1. Introduction

According to American Heart Association (AHA), coronary artery disease (CAD) is the most common cause of death and constitutes 52% in the structure of mortality from cardiovascular diseases (CVD) [1]. The main causes of mortality in case of CAD are primarily acute myocardial infarction and sudden cardiac death. CAD is of great concern in reduction of patients' lifespan and quality of life in structure of cardiovascular disease [4]. Coronary angiography is the gold standard for CAD diagnosis as it allows investigating the state of the coronary arteries (CA), determining qualitative and quantitative characteristics of the affected segments, evaluating coronary blood flow state and choosing the correct treatment approach. The level, location and number of CA lesions have a prognostic value as they determine the severity of myocardial injury. Left main coronary artery trunk injury and multivessel disease are the most dangerous. Anterior interventricular branch lesion, especially in the proximal area, is the most unfavorable among the lesions of three main coronary branches [6].

Blood flow restoration rate in case of occlusive disease of infarct related coronary artery (IRCA) has been proved to be the main factor that determines MI final extension. This determines treatment approach in case of full coronary occlusive disease, namely achievement of early and sustained reperfusion of occlusal artery [5]. This will allow preserving myocardium or reducing the expansion of necrosis area and preventing the development of chronic heart failure (CHF) myocardial electrical instability as evidenced in numerous randomized controlled clinical investigations (DANAMI-2, PRAGUE-2, SIAM-III) [2, 3, 7].

The aim of our research was to analyze coronary bed lesions in patients with acute myocardial infarction.

### 2. Methods

The research was conducted at Ivano-Frankivsk Regional Clinical Cardiology Dispensary. 160 patients with postinfarction atherosclerosis were examined. The patients were divided into three groups. Group I consisted of 72 patients with CHF who had had MI with revascularization performed by IRCA BMS stenting during acute period. Group II included 66 patients with CHF who had had MI without reperfusion during acute period. Group III consisted of 22 patients who had had MI with performed stenting without CHF. The groups were compared by age and sex. Persons with severe concomitant diseases of respiratory system, digestive system, kidneys, and those with oncology diseases were excluded from the research. CHF diagnosis was made in accordance with the recommendations of Ukrainian Association of Cardiology of the diagnosis and treatment of chronic heart failure (2012). Compulsory criterion for patients' inclusion in the research was their signing of informed consent.

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In order to meet a goal objective, cross-sectional study of diagnostic coronary angiography protocols was performed to the patients during MI acute period. Patients with steady forms of coronary heart disease were not included into the sample. Coronary angiography was conducted at Ivano-Frankivsk Central City Hospital using angiographic system Infinix manufactured by Toshiba. Coronary artery constriction more than 50% was considered hemodynamically relevant lesion. Statistical processing of the results was conducted using a computer program STATISTIKA-7 and statistical function program "Microsoft Excel" on personal computer with the use of variation-statistical method of analysis. Fisher's exact test

was applied to compare the reliability between research groups regarding occurrence of clinical symptoms and physical changes. Differences were considered reliable at  $p < 0.05$ .

### 3. Results

Baseline risk of death was determined according to TIMI RISK SCORE scale: presence of independent predictors was assessed in grades; the total was correlated with the risk score; death probability was estimated in percentage terms. Characteristics of predictors depending on the treatment approach are presented in Table 1.

**Table 1.1:** Frequency of death risk predictors in examined patients according to TIMI Risk Score

Risk predictors	Patients with CHF after old MI with stenting (n=72)		Patients with CHF after old MI without stenting (n=66)		Patients with stenting without CHF (n=22)	
	abs.	%	abs.	%	abs.	%
Age, over 65	27	37.5	29	43.9	6	27.3
Arterial hypertension, diabetes mellitus, CAD	53	73.6	42	63.6	8	36.4
↑ST in V2-V5, left bundle-branch block	8	11.1	6	9.1	-	-
Killip II-IV	52	72.2	45	68.2	2	9.1
heart rate >100 bpm	12	16.7	9	13.6	5	22.7
BP <100 mm Hg	10	13.9	11	16.7	6	27.3
Body weight < 67 kg	13	18.1	12	18.2	10	45.5
No reperfusion therapy in the first 4 hours	46	63.9	66	100	12	54.6

Note: Percentage of the total number of persons in the group is indicated.

Analyzing protocols of coronarographic study of patients suffering from CHF with postinfarction atherosclerosis lesion of LCA trunk was observed in 1.4% of cases, AIVA was detected in 23 (31.9%) individuals, circumflex artery (CA) – in 10 (13.9) persons. Occlusion of LCA intermediate branch (IB) occurred in 4 (5.6%) individuals. RCA was affected in 29 (40.3%) patients, RCA posterior interventricular branch (PIV)

was injured in 5 (6.9%) individuals. TIMI flow 3 was diagnosed in 69 (95.8%) patients after percutaneous coronary intervention, TIMI flow 2 was diagnosed in 2 (2.8%) persons while no-reflow syndrome was detected only in 1 (1.4%) person.

Risk assessment mortality, reinfarction and recurrent MI by the GRACE risk scale are presented in Table 2.

**Table 1.2:** The relative risk of death, reinfarction and recurrent myocardial infarction scale GRACE

Group	Performance Scale GRACE			
	D. %	D <sub>6</sub> . %	DM. %	DM <sub>6</sub> . %
Patients with CHF after old MI with stenting (n=72)	3.43±0.12	6.46±0.37	6.97±0.45	24.95±1.18
Patients with CHF after old MI without stenting (n=66)	9.76±0.55 $p < 0.001$	15.63±0.89 $p < 0.001$	26.85±1.54 $p < 0.001$	26.65±1.83 $p > 0.05$
Patients with stenting without CHF (n=22)	9.76±0.55 $p < 0.001$	15.63±0.89 $p < 0.001$	26.85±1.54 $p < 0.001$	26.65±1.83 $p < 0.05$

Notes: Probability performance difference compared to:

1. p - patients without heart failure,
2. p<sub>1</sub> - patients with heart failure after old myocardial infarction without stenting.

At the risk of mortality, reinfarction and recurrent MI by the GRACE risk scores, found that the risk of total mortality, reinfarction, or repeat heart attack while in the hospital (D) conducted in patients with CHF without stenting was (3.43±0.12)% 6 months (D<sub>6</sub>) - (6.46±0.34)%. The risk of death with the possibility of occurrence of reinfarction during the hospital stay (DM) was (6.97±0.45)%, and death or reinfarction at 6 months (DM<sub>6</sub>) - (21.23±1.18)%. In patients with CHF after old MI revascularization risk of mortality, reinfarction and recurrent MI was (6.23±0.35)% ( $p < 0.001$ ) D<sub>6</sub> - (6.46±0.34)% ( $p < 0.001$ ), DM equal (15.76±0.67)% ( $p < 0.001$ ), DM<sub>6</sub> - (25.31±1.43)% ( $p < 0.05$ ), which is significantly higher compared with those of people without CHF. In patients

without reperfusion held endpoints made: D - (9.76±0.55)%, D<sub>6</sub> - (15.63±0.89)%, DM - (26.85±1.54)%, and DM<sub>6</sub> - (26.65±1.83)%. Consequently, the risk of death in patients with CHF without MI transferred is held revascularization was significantly higher than in those with and conducted stenting in patients without CHF.

Stents <18 mm in length were applied in 35 (48.6%) patients, 18-23 mm stents were used in 27 (37.5%) individuals, stents >23 mm in length were implanted in 10 (13.9%) patients. The average length of the stents constituted (23.2±3.1) mm.

Stents 2.5 mm in diameter were implanted in 26 (36.1%) patients. Stents 2.75 mm in diameter were applied in 29.2% of patients. 15 (20.8%) individuals were implanted stents 3.0 mm

in diameter. Stents 3.5 mm in diameter were applied in 10 (13.9%) persons. The average diameter of implanted stents constituted (2.84±0.28) mm. The average pressure of balloon inflating was (14.0±0.67) atm.

Type A stenosis was detected in 27 (37.5%) patients. Type B1 was observed in 25 (34.7%) individuals. Type B2 stenosis was peculiar to 15 (20.8%) patients. Type C of CA stenosis was detected in 5 (6.9%) patients.

According to Syntax Score the assessment constituted (21.0±1.23) scores in the examined patients.

**Table 1.3:** The incidence of coronary arteries constriction in patients with acute myocardial infarction

Coronary arteries	Single-vessel disease (n=44)		Multivessel disease (n=28)		P
	n	%	n	%	
RCA	23	52.3	22	33.3	<0.05
LCA	0	0	1	1.5	>0.05
AIVA	14	31.8	24	36.4	>0.05
CA	7	15.9	19	28.8	>0.05

**Notes:** 1. The per cent of the total number of patients in the group is indicated.

2. p – probability of difference between the group of patients with single-vessel disease and patients with multivessel disease of coronary arteries.

Analyzing protocols of coronarographic study of patients, single-vessel disease RCA lesion was detected in 52.3% of patients while AIVA lesion was diagnosed in 31.8% of cases, CA occurred in 15.9% of cases.

Multivessel disease was detected in 28 patients. Two-vessel disease was found in 14 (50.0%) individuals, three-vessel disease occurred in 13 (46.2%) patients, and two-vessel disease and LCA trunk lesion was observed in 1 (3.6%) patient. According to statistical estimation two-vessel disease and three-vessel disease of the main branches (RCA, AIVA, CA) occurred reliably more often than the lesion of two vessels and the lesion of two vessels and LCA trunk ( $p<0.001$ ). Generally, 66 vessels were significantly constricted in 28 patients with multivessel disease. The study of CA specific gravity detected that hemodynamically relevant RCA constriction occurred more often in case of multivessel disease and constituted 33.3% (n=22) of cases, AIVA constriction was observed in 36.4% (n=24) of cases, CA constriction was detected in 28.8% (n=19) of cases. These constrictions occurred more often than constriction of LCA trunk which is prognostically unfavorable, dangerous and controversial concerning treatment approach. Having compared the incidence of main coronary arteries constriction (Table 2), RCA was found to occur significantly more often in case of single-vessel disease than in multivessel disease.

**4. Conclusions**

According to coronarography study, the lesion of one of main CA was observed significantly more often than multivessel disease in patients with CHF after old MI. Two-vessel and three-vessel constriction of main coronary branches without LCA trunk lesion was proved to occur more often in patients with CHF after old MI in case of multivessel disease. Reperfusion therapy by IRCA BMS stenting improves the course of postinfarction cardiosclerosis and therefore should be a priority approach to treatment of patients with acute myocardial infarction.

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