ORIGINAL ARTICLE

Impact of reperfusion therapy and infarct localization on frequency of premature ventricular beats in acute myocardial infarction

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ABSTRACT

Aim To determine the impact of infarct localization and types of reperfusion therapy on the frequency of ventricular premature beats (VPBs) in patients with acute myocardial infarction (AMI) and reduced left ventricular ejection fraction (LVEF).

Methods A total of 705 patients with acute ST elevation myocardial infarction (STEMI) were divided according to the infarct localization (anteroseptal, anterolateral, inferior and posterior) and reperfusion therapy (fibrinolysis or percutaneous coronary intervention with stenting) into two groups: LVEF<45% was an experimental group and LVEF≥45% was a control group. The occurrence of VPBs<10 per hour was defined as a non-significant, and the occurrence of VPBs≥10 per hour defined as a significant.

Results In patients with fibrinolysis therapy and LVEF<45% significant number of VPBs were in anteroseptal (p=0.017*),* anterolateral (p<0.001) and posterior AMI (p<0.001), but in patients with percutaneous coronary intervention (PCI) and LVEF<45% significant number of VPBs were only in anteroseptal AMI (p=0.001) localization.

Conclusion In patients with reduced ejection fraction in AMI, treatment with PCI method has a better antiarrhythmic effect compared to fibrinolysis treatment.

Key words: fibrinolysis, percutaneous coronary intervention, ventricular arrhythmias

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INTRODUCTION

Ventricular premature beats (VPB) represent a premature ventricular contraction (1). The association between VPBs and poor patient prognosis has been well documented (2). Ventricular premature beats in the early phase of an acute myocardial infarction (AMI) are not considered in the high mortality rate (3,4). However, after the first 48 hours, VPBs are a problem with long-term prognostic significance (5).

The background might be an unsynchronized myocardial repolarization on the grounds of ischemia, lesion or myocardial necrosis (6). Patients with frequent premature ventricular contractions or certain patterns of premature ventricular contractions may be at increased risk of developing heart rhythm problems (arrhythmias) or weakening of the heart muscle (cardiomyopathy) (7-9). The difference in conduction velocity between injured and uninjured tissue can trigger re-entry or a feedback loop that is believed to be the cause of many lethal arrhythmias (10). The most serious of arrhythmias is ventricular fibrillation, an extremely fast and chaotic heart rhythm that is the leading cause of sudden cardiac death. Another life-threatening arrhythmia is ventricular tachycardia, which can cause sudden cardiac death. Rarely, when accompanied by underlying heart disease, frequent premature contractions can lead to chaotic, dangerous heart rhythms and possibly sudden cardiac death (11,12). Post-AMI VPBs, particularly if frequent (more than 10 per hour) or complex (repetitive forms, primarily nonsustained ventricular tachycardia), appear to be associated with a worse prognosis in patients with a prior AMI (10).

The relationship among reduced left ventricular ejection fraction (LVEF) and the size of affected myocardial area might be also important (13). Therefore, reperfusion therapy as a percutaneous coronary intervention (PCI) or fibrinolytic therapy should be attempted as soon as possible (14).

The impact of AMI localization on VPBs is also unclear. In general, large studies analyzed the occurrence of VPBs in the post infarction period by *anterior* or *inferior* localization but, the results are contradictory. Bluazite had more VPBs in *inferior* (15), while Stone concluded that VPBs are more frequent in *anterior* AMI (16) localization.

Our aim was to determine the impact of AMI localization and type of reperfusion therapy on the frequency of VPBs in patients with reduced LVEF.

PATIENTS AND METHODS

Patients

This retrospective research was conducted from the 2000 to 2012. Among the total of 705 patients with acute ST elevation myocardial infarction (STEMI) (the average age 62.5 years), 484 (68.7%) were males and 221 (31.3%) were females. They were hospitalized in the Coronary Unit of the General Hospital in Karlovac, Croatia.

Methods

All patients were divided according to the reperfusion therapy to patients with fibrinolysis and the PCI. According to the AMI localization, the patients were divided into four groups (*anteroseptal, anterolateral, inferior and posterior* localization). Because LVEF<50% represents a reduced value of LVEF, we established the experimental group of patients with LVEF<45% and the control group with better LVEF (≥45%). According to the number of VPBs, we established the group with less VPBs (<10 per hour) and the group with more VPBs (≥10 per hour).

The exclusion criteria were cardiomyopathy, left ventricular hypertrophy, hyperkalemia, hyperthyroidism, mitral valve prolapse, digitalis therapy, history of VPBs, and previous myocardial infarctions.

The AMI diagnostic criteria were chest pain (the first six hours). The ECG diagnosis of the ST segment elevation type of acute myocardial infarction require at least 1 mm (0.1 mV). These elevations must be present in anatomically contiguous leads (I, aVL, V3-V6 correspond to the *anterolateral* wall; V1-V4 correspond to the *anteroseptal* wall; II, III, aVF correspond to the *inferior* wall and ST-denivelation in V3-4 or R-wave enlargement in V1-V3 leads for *posterior* AMI). The cardiac enzyme troponin I was >1.00 ug/L.

Streptokinase was used as a fibrinolytic agent, and the dose was 1.5 million international units. Each patient was treated with beta-blockers, acetylsalicylic acid (ASA), angiotensin converting enzyme inhibitor, statin and in the PCI method with clopidogrel. The PCI treatment had to be with stenting.

A coronary angiogram in the PCI treatment had the criteria of post angioplasty blood flow of the TIMI grade III (17). Ventricular premature beats had been verified between the sixth and tenth day of hospitalization with a 24 hour Holter ECG monitoring. Left ventricular ejection fraction was assessed with the heart ultrasound and the Simpson biplane technique in the apical projection.

RESULTS

The study evaluated a total of 705 patients. The patients' average age was 62.4 years, 484 (68.7%) were males and 221 (31.3%) were females.

A significant number of VPBs were identified in 194 (27.4%) patients. A total of 155 (22.0%) patients had the LVEF<45%. A total of 166 (23.5%) patients had *anteroseptal*, 106 (15.0%) *anterolateral*, 159 (22.6%) inferior and 274 (38.9%) *posterior* infarct localization (Table 1).

Table 1. Distribution of myocardial infarction localization

Localization	N (%) of patients
Anteroseptal	166 (23.5)
Anterolateral	106 (15.0)
Inferior	159 (22.6)
Posterior	274 (38.9)
Total	705 (100)

There were 522 patients with fibrinolysis and 183 patients with PCI treatments (Table 2).

Table 2. Distribution of reperfusion therapy

Reperfusion therapy	N (%) of patients
Fibrinolysis	522 (74)
Percutaneous coronary intervention	183 (26)
Total	705 (100)

In the fibrinolysis and LVEF<45% group, a significant number of VPBs were in *anteroseptal* (p=0.017), *anterolateral* (p<0.001) and *posterior* localization (p<0.001) (Table 3).

Table 3. Myocardial infarction and ventricular premature beats in fibrinolysis

Localization of myocardial infarction	Ventricular premature beat/h	No (%) of patients with left ventricular ejection fraction		95% CI	p
		<45%	>45%		
Anteroseptal	<10	28 (5.4)	72 (13.8)	50.57-54.91	
	>10	18 (3.4)	18 (3.4)	44.44-52.62	0.017
Anterolateral	<10	14 (2.7)	52 (10.0)	48.28-52.78	
	>10	16 (3.1)	8 (1.5)	38.56-47.27	<0.001
Inferior	<10	12 (2.3)	88 (16.9)	56.38-59.94	
	>10	8 (1.5)	22 (4.2)	49.64-57.89	0.080
Posterior	<10	10 (1.9)	120 (23.0)	54.63-57.66	
	>10	14 (2.7)	22 (4.2)	45.76-51.80	<0.001

In the PCI treatment significant number of VPBs were in *anteroseptal* localization (p=0.001) (Table 4).

Table 4. Myocardial infarction and ventricular premature beats in percutaneous coronary intervention

Localization of myocardial infarction	Ventricular premature beat/h	No (%) of patients with left ventricular ejection fraction		95% CI	p
		<45%	>45%		
Anteroseptal	<10	2 (1.1)	20 (10.9)	50.90-59.10	
	>10	6 (3.3)	2 (1.1)	31.75-53.00	0.001
Anterolateral	<10	2 (1.1)	8 (4.4)	41.50-56.90	
	>10	4 (2.2)	2 (1.1)	26.95-57.38	0.118
Inferior	<10	4 (2.2)	14 (7.7)	49.22-62.23	
	>10	2 (1.1)	9 (4.9)	51.65-66.17	0.999
Posterior	<10	6 (3.3)	60 (32.8)	53.86-58.47	
	>10	9 (4.9)	33 (18.0)	51.65-57.88	0.071

DISCUSSION

This study established several VPBs in patients with fibrinolysis than PCI treatment in acute STEMI.

In relevant literature sources primary PCI was better than thrombolytic therapy (18). Primary PCI is more effective than thrombolytic therapy for the treatment of acute STEMI because it reduces overall short-term death (7% vs 9%), death excluding the shock (5% vs 7%), non-fatal reinfarction (3% vs 7%), stroke (1% vs 2%) and the combined endpoint of death, non-fatal reinfarction, and stroke (8% vs 14%) (19).

However, there are scarce data about VPBs in patients with fibrinolysis comparing to PCI treatment in acute STEMI. Our results can be compared with a limited number of relevant literature sources. A higher VPBs frequency in *anterior* than *inferior* infarctions (70.2 vs 58.9%) has been described by Stone (16). Breithardt described a higher frequency of tardive ventricular potentials in *anterior* AMI compared to the *inferior* AMI (20). However, Bluzaite (15) had higher occurrence in the *inferior* than *anterior* infarction. Pascale also found a significantly more VPBs in the *inferior* infarction (21). Future researches with an additional electrophysiological testing would be of interest. Although the cardiac conductive system is mainly in the septum (22), the distal area like His-Purkinje system is also a source of ectopic impulses (23).

An early spontaneous reperfusion in AMI could be a protective factor for VPBs (24,25). The impact of collateral circulation is also important. In case of collateral circulation, the infarction affec-

ted area will be smaller than the area with occluded artery (26).

Our results had the link among the residual LVEF<45% and the significant number of VPBs. These data are in correlation with results of low LVEF and several VPBs (27). Solomon demonstrated the rise in the mortality rate within 30 post-MI days in LVEF<30% (13).

Our analysis verified good results in the PCI treatment. The Croatian PCI network is very important for this process. This is important because the previous large trials such as DANAMI-2 study did not verify less VPBs in the PCI than the fibrinolysis (28).

In conclusion, the AMI cum small LVEF and PCI therapy has less VPBs than the fibrinolysis therapy. In the fibrinolysis therapy more VPBs were in *anteroseptal, anterolateral* and *posterior* localization but in the PCI treatment only in *anteroseptal* localization. In patients with reduced ejection fraction in AMI, treatment with PCI method has a better antiarrhythmic effect compared to fibrinolysis treatment. For this reason, the PCI treatment reduces the possibility of the occurrence of malignant ventricular arrhythmias and sudden death of patients.

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Competing interests: None to declare.

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Utjecaj reperfuzijske terapije i lokalizacije infarkta na učestalost ventrikulskih ekstrasistola u akutnom infarktu miokarda

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SAŽETAK

Cilj Odrediti utjecaj lokalizacije infarkta i reperfuzijske terapije na učestalost ventrikulskih ekstrasistola (VES) kod pacijenata s akutnim infarktom miokarda (AIM) i reduciranom ejekcijskom frakcijom lijevog ventrikla (EFLV).

Metode Ukupno je 705 bolesnika s akutnim infarktom miokarda i ST elevacijom (STEMI) podijeljeno prema lokalizaciji infarkta (anteroseptalni, anterolateralni, inferiorni i posteriorni) i reperfuzijskoj terapiji (fibrinoliza ili perkutana koronarna intervencija sa stentom) u dvije grupe: EFLV<45% kao ispitivana grupa, te EFLV≥45% kao kontrolna grupa. Pojava VES<10/h bila je nesignifikantna, a pojava VES≥10/h signifikantna.

Rezultati U pacijenata s fibrinolizom i EFLV<45% značajan broj VES-a bio je u anteroseptalnom (p=0,017), anterolateralnom (p<0,001) i posteriornom AIM-u (p<0,001), a u pacijenata s perkutanom koronarnom intervencijom (PCI) i EFLV<45% značajan broj VES-a bio je samo u anteroseptalnoj AIM (p=0,001) lokalizaciji.

Zaključak U pacijenata sa smanjenom ejekcijskom frakcijom u AIM-u, tretman s PCI metodom imao je bolji antiaritmički efekat u odnosu na fibrinolitički tretman.

Ključne riječi: fibrinoliza, perkutana koronarna intervencija, ventrikulska aritmija