# Early Versus Late Primary Percutaneous Coronary Angioplasty in Patients with Acutemyocardial Infarction and Single Vessel Coronary Disease – Factors for Overall Patients Survival Rate

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**Abstract:** *Primary percutaneous coronary intervention (PPCI) is a preferred strategy for reperfusion of the coronary artery, under ST-elevation myocardial infarction /STEMI/ conditions, if it can be done quickly by an experienced operator. Improving the left ventricular function predicts a better short-term and long-term prognosis. The aim of the study was to assess the success of primary angioplasty, depending on the time from the onset of symptoms to the use of interventrial treatment in patients with STEMI and single coronary artery disease with respect to blood flow recovery in the target artery, left ventricle systolic function, early and late major adverse cardiac events /MACE/. In the present study, 178 patients with an average age of 59.79 ± 13.29 years in the range 32-95 years were enrolled. 128 (71.9%) of them are male and 50 (28.1%) female patients. The population surveyed are patients from "St. Ekaterina" University Hospital - Sofia. The voluntary participation of all persons under examination is certified by written informed consent. The data is entered and processed with the IBM SPSS Statistics 23.0 statistical package. Patients aged 62 years or older have an 8 times higher risk of lethal outcome than younger patients; women have a 3.3 times higher risk of fatal outcome than men. The presence of chronic kidney disease increases the lethal risk by about 5.7 times; The greatest impact on survival is cardiogenic shock, which is associated with an 18 times higher mortality risk; Access via a.femoralis is associated with a 4.8 times higher risk of death than a. radialis; In our study, age, gender, presence of chronic kidney disease, dyslipidemia, atrial fibrillation, arterial access to the intervention are defined as the main prognostic factors for patient survival. Late reperfusion may increase survival benefits, especially in elderly patients.*

**Keywords:** Primary percutaneous coronary intervention, ST-elevation myocardial infarction, Left ventricle (LV) remodelling

## 1. Introduction

Cardiovascular diseases (CVDs) are a leading cause of death in economically developed and many developing countries in the world and ischemic disease of the heart (IDH) is in the basis of half of the deaths in CVDs. [1] Patients with acute chest pain account for a great percentage of emergency hospitalizations in Europe. Regardless of the new possibilities for diagnostic and treatment, the frequency of death, myocardial infarct (MI) and rehospitalisation in patients with acute coronary syndrome (ACS) remain high. The occurring serious morphological and functional changes in the affected necrotic parts of the myocardium during acute myocardial infarct, and in the surrounding ischemic regions determine the patient outcome immediately after the occlusion of the coronary vessel occur and for a longer period of time. Early reperfusion of the infarct –related artery improve survival rate of patients. Primary percutaneous coronary intervention /PPCI/ is recommended strategy for coronary artery reperfusion in AMI, in case of possibility to be performed quickly by an experienced operator. [2,3] Left ventricle (LV) remodelling occurs immediately after the incident (up to 72 hours) and later after the first week and months. For the recovery of great importance is presence of viable myocardium especially after reperfusion treatment in and surrounding the infarct zone. Left ventricle remodelling as well as the presence or absence of viable myocardium in and surrounding the infarct zone have great prognostic value for the patients after acute myocardial infarction /AMI/. Global, and most importantly regional systolic and diastolic LV function predicts better short term and long term prognosis. That is why of first and foremost importance for the patients with AMI is evaluation of presence of viable myocardium at any moment of the evolution of the disease. The aim of the current work is to evaluate the advantages and disadvantages of primary percutaneous coronary intervention in patients with acute myocardial infaction with single vessel coronary disease – before and after 12 hours from the onset of chest pain. Evaluation of success of primary angioplasty depending on time interval between onset of symptoms and interventional treatment in patients with AMI with ST-T elevation and single coronary disease in regards to blood flow recovery in the infarct-related artery, LV systolic function, early and late MACE.

## 2. Materials and Methods

In the current study 178 consecutive patients with mean age 59,79±13,29 age ranging from 32 to 95 years old are included. Patient inclusion is prospective. The patient population, subject of the study, are patients of University hospital "Saint Ekaterina" in Sofia. Informed constant for voluntary participation in the study was obtained from all examined patients.

**Inclusion criteria**
1 Increase of heart biomarkers (preferably troponin – Tn) with at least one value above the 99th percentile for normal referent population range and with at least one of the following signs of ischaemia:
1) Presence of chest pain with a duration of more than 20 minutes;

2) ECG criteria for ischemia with lack of signs of left bundle block and left ventricular hypertrophy. ECG signs of ST-elevation – defined as elevation of point J in two contiguous leads, at least 0.2mV in male and 0.15 mV in female for V2-V3 leads and at least 0.1 mV for the remaining leads. ST depression should be at least 0.05 mV in two contiguous leads. T-wave inversion is considered significant when there is at least 0.1 mV in two contiguous leads with prominent R-wave or R\S ratio >1;

3) appearance of pathologic Q-wave in the ECG;

4) new left bundle block;

### Exclusion criteria

1) Other forms of ischemic heart disease, different of acute myocardial infarction with ST-T elevation /STEMI/ - stable and instable stenocardia, silent ischaemiaq ischemic cardiomyopathy, Prinzmetal angina, acute myocardial infarction without evevation of the ST-T segment.

2) Acute myocardial infarct with ST-T elevation in two or multi vessel coronary disease;

3) Noncompliance or refusal to sign informed consent for coronary angiography and PPCI, as well as refusal for long term follow up.

## 3. Statistical Analyze

The data are imported and analysed with statistical software , IBM SPSS Statistics 23.0. For significance level, in which zero hypothesis is rejected, was accepted $p<0.05$. Descriptive analysis, analysis of variance, graphic analysis, alternative analysis, Fisher's exact test and chi-squared test, Kolmogorov-Smirnov and Shapiro-Wilk non-parametric tests, Student's t-test, Mann-Whitney U test, binary logistic regression, repeated measures ANOVA, Log Rank, Breslow и Tarone-Ware tests, ROC curves were applied

## 4. Results

The study encompasses 178 consecutive patients with mean age 59.79±13.29 age ranging from 32 to 95 years old. 128 (71.9%) of them are male and 50 (28.1%) female patients. The vastest age group (38 patients) is in the male population between 50 and 59 years old, followed by 60-69 years with 32 patients and the smallest group (5 patients) – age between 80-89 years. In the age group 90-99 years old there are no male patients. In the female patient population the vastest group (15 patients ) are in the age group 70-79 years old followed by the age group between 60 and 69 with 13 patients and the smallest group – one patient in the age group 30-30 years.

The two groups are statistically equal regarding the confounding factors gender and age /table1

**Table 1:** Comparative analyse of the assessed groups in respect the criteria gender and age

| Criteria | Revascularized within12 hours (n=112) | | Revascularized after 12 hours (n=66) | | P |
|---|---|---|---|---|---|
| | n | % | n | % | 0.060 |
| **Gender** | | | | | 0.060 |
| male | 75 | 67.0 | 53 | 80.3 | |
| female | 37 | 33.0 | 13 | 19.7 | |
| **Age** | $\overline{X}$ | SD | $\overline{X}$ | SD | |
| (years) | 60.85 | 13.34 | 58.00 | 13.11 | 0.168 |

Mean time of follow up is 11.30±2.53 moths in the interval 0 to 12 months, and overall mean survival rate is 11.36±0.19 months in the interval 0 to 12 months.

In table 2 is presented the survival rate of the studied group calculated by Kaplan Meier estimator. More characteristic points in it are the following:

- Out of 177 patients followed up for overall survival rate, 18 (10.8%) died from the studied disease;
- The highest mortality rate is observed in the time period 0-6 moths – 13 of the case or 72.2% from the overall number of exituslethalis (18 patients) during the follow up;
- Second place in mortality is observed in the period between $6^{th}$ and $12^{th}$ monthq when 5 (28.2%) of the exitus took place;
- The minimal overall survival rate registered is 0 months (exitus in the hospital) and maximal – 12 month (one year);
- One month survival rate is 96.6%, six-month survival rate is 92.6%, and one year survival rate – 89.9%.

**Table 2:** Overall survival rate by Caplan Meier

| Time (month.) | Cumulative probability | Number exitus | Cumulative number exitus | Number of dropped | Number of remaining |
|---|---|---|---|---|---|
| 0 | 0.972 | 5 | 5 | 0 | 172 |
| 1 | 0.966 | 1 | 6 | 1 | 170 |
| 6 | 0.926 | 7 | 13 | 0 | 163 |
| 12 | 0.898 | 5 | 18 | 158 | 0 |

On individual basis it is obviated that:

1) Patients aged 62 and more have about 8 times higher risk for lethal outcome compared to younger patients;

2) As compared to males, females have about 3.3 time higher risk of lethal outcome;

3) Presence of chronic kidney disease increases the risk of lethal outcome about 5,7 times;

4) Dyslipidaemia increases the risk of lethal outcome about 5,6 times;

5) The greatest impact on survival rate has cardiogenic shock which is associates with 18 times higher risk of lethal outcome;

6) Atrial fibrillation, as opposed to sinus rhythm, increases lethality about 6.5 times and pacemaker rhythm about 11 times;

7) Vessel approach through a.femoralis is associated with 4.8 times higher risk of death as compared to vessel approach through a. radialis used;

8) Use of antiaggragantPlavix® compared to Brilique® is associated with 3.6 higher risk of lethal outcome.

## 5. Discussion

Our study is based on observations on patients who underwent early revascularization of infarct –related artery, and who missed the optimal time for revascularization according the current guidelines. Higher risk of lethal outcome is observed in patients above 62 years old. Moreover, this confirms the fact that advanced aged is associated with delay of the patients. The greatest impact on survival rate has the cardiogenic shock, which is associated with 18 times higher risk of mortality. Presence of chronic kidney disease increases the risk of lethal outcome about 5.7 times among the studied population. In respect to the gender characteristic in females there is evidence of higher risk of mortality as compared to males. This study is the first in Bulgaria that deals with the problem of delayed early revascularization in patients with acute myocardial infarction and single coronary vessel disease.

Multiple studies show that time is one the major factors for preserving regional kinetic of the left ventricle, left ventricular remodelling left ventricular function and survival rate of patients. The relation in this case is straightforward. In the basis of our study we aim at proving that the strategy for late PPCI prevents from left ventricle remodelling, preserves left ventricular pump function, reduces the frequency of MACE, the cardiovascular death and the repeated hospitalizations in connection to heart failure. Several studies have already shown the relation of mortality and the time period of delay of treatment and the horizontal relation between time to reperfusion and morality.[4,5] High risk patients are prone to present early while those who appear late have already survived the early hours ,i.e. the period in which they are exposed to highest mortality rate. This so called survivor –cohort effect is supported by Löwel et al.[6] Moreover, the fact that the time of onset of initial symptoms does not necessarily corresponds to the time of coronary artery occlusion should be taken into account. In many cases the exact beginning of ACS cannot be defined because it is based on subjective patients complains and the ACS may be preceded by heart rhythm and conduction disorders and /or nonstable angina. In early reperfusion and recanalization of the coronary artery, greater part of viable myocardium is preserved. In later hospitalization of patients there is generally a great part of the myocardium is at risk. The residual blood flow in the infarct – related vessel can be increased in up to 50% [7,8]. The residual antegrade blood flow ensures low rate of perfusion of the stunned and hibernating myocardium and increased time for salvage and preserving the myocardium for a couple of days more. [9,10] Sim et al. evaluate the efficacy of primary PCI in 2 344 patients with STEMI presenting from 12 to 72 hour after the onsen of symptoms and find out that PCI is associated with significantly higher patients' improvement in the 12 month clinical follow up.[11] Our study reveals that great part of the patients present later from onset of pain / stenocardial/ symptoms.

The open artery hypothesis proves that late revascularization of totally occluded IRA has beneficial effect on left ventricle remodelling, salvage of myocardium and long-term results for the patients. [12,13.] Recent clinical data show that the myocardium might be salvaged after 12 hours even when IRA is totally colluded.[14] It is proven that late reperfusion can stop the ischemic apoptotic cascade and their consequences [15] and to prevent reducing the capillary density.[16] Furthermore, ischemia itself stimulates the formation of collateral circulation.[17] In certain pathological conditions in patients such as anaemia, smoking, hyperkinetic heart, COPD, the affected myocardium is preconditioned which increases its resistance to ischaemia.[18] These factors prolong the resistance and the viability of the affected myocardium. That is why late recanalization patients might benefit from reperfusion of myocardium.[19] Analyses of several studies showed that late PCI may improve function and LV remodelling and to decrease the frequency of cardio-vascular incidents.[20] Our results confirm that indeed late PCI has prevented unfavourable LV remodelling and deterioration of contractile function of the ventricle and has improved the clinical outcome and results in patients presenting late for revascularization.

## 6. Conclusion

Performing late reperfusion of the infarct –related artery in AMI is relatable possible and safe in routine practice. In our study as main prognostic factors for patient's survival are defined age, gender, presence of chronic kidney disease, dyslipidaemia, atrial fibrillation and arterial approach for performing the intervention. Late reperfusion may increase the benefits for survival especially in elderly patients.

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