RESEARCH ARTICLE / *Araştırma Makalesi*

Evaluation of Intra-hospital and Long-term Mortality in Patients Presenting with ST-segment Elevation Myocardial Infarction: A Tertiary Cardiology Center Experience

ST Segment Yükselmeli Miyokard İnfarktüsü ile Başvuran Hastalarda Hastane İçi ve Uzun Dönem Mortalitenin Değerlendirilmesi: Üçüncü Basamak Kardiyoloji Merkezi Deneyimi

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Geliş Tarihi / Received : **10.08.2020** Kabul Tarihi / Accepted : **17.09.2020**

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(Sakarya Tıp Dergisi / ***Sakarya Med J*** **2020, 10(4):600-607) DOI: 10.31832/smj.778996**

Abstract

Objective — Ischemic heart disease remains the leading cause of death. Not only strategies of health care providers but also population characteristics are also important to extend life expectancy in patients with cardiovascular disease. Thus clinical studies including national cohort of patients provide important insights into the real-life health care. We aimed to assess intra-hospital and long-term outcomes in patients with ST-elevation myocardial infarction (STEMI).

Materials and Methods — A total of 178 STEMI patients treated with primary percutaneous coronary intervention (PCI), who were documented to be death or responded the telephone interview, were included into the analyses. These patients were divided into three groups according to age (Group-1: <35 years, Group-2: ≥35-60 years, and Group-3: ≥ 60 years). Mortality and nonfatal cardiovascular complications were compared in three groups.

Results — Median period of follow-up was 95 months. At the intra-hospital period, re-myocardial infarction was occurred in 4 patients while death was seen in 4. During the long term follow-up, re-myocardial infarction was occurred in 30 patients. Incidence of re-myocardial infarction did not differ among the groups. Long-term mortality among study patients was found to be 27.5 % (n=49). The mortality rates between the groups were significantly different (13.3% for group-1, 16.8% for group-2, 53.5% for group-3, respectively) (p <0.001)

Conclusion — In conclusion, the present study is an evaluation of intra-hospital and long-term outcomes in patients presented with STEMI and treated with primary PCI. Over the 95 months follow-up, all cause mortality was found to be 27.5% in those.

Keywords — Mortality; Percutaneous Coronary Intervention; ST Elevation Myocardial Infarction

Öz

Amaç — *İskemik kalp hastalığı tüm dünyada önde gelen bir ölüm sebebidir ve kardiyovasküler hastalığı olan hastalarda yaşam beklentisini uzatmak için sadece sağlık hizmeti sağlayıcılarının stratejileri değil, toplum özellikleri de önem arz etmektedir. Bu nedenle, ilgilenilen toplum özelliklerini yansıtan, ulusal, klinik çalışmalar gerçek yaşam sağlık hizmetleri hakkında önemli bilgiler vermektedir. Biz bu çalışma ile üçüncü basamak kardiyoloji merkezimize başvuran ST elevasyonlu miyokart enfarktüsü (STEMI) hastalarında hastane içi ve uzun dönem sonuçlarımızı değerlendirmeyi amaçladık.*

Gereç ve Yöntemler — *Primer perkütan koroner girişim (PCI) ile tedavi edilen ve telefon ile yaptığımız sorgulamalara cevap veren veya takiplerinde vefat ettiği belgelenen toplam 178 STEMI hastası analizlere dâhil edildi. Bu hastalar yaşa göre üç gruba ayrıldı (Grup-1: <35 yaş, Grup-2: ≥35-60 yaş ve Grup-3: ≥ 60 yaş). Bu üç grup hastanın takiplerindeki ölüm ve ölümcül olmayan kardiyovasküler istenmeyen olaylar mukayese edildi. Hayatta kalma eğrileri Kaplan-Meier yöntemi ile oluşturuldu.*

Bulgular — *Çalışmamızda medyan takip süresi 95 aydı. Hastane içi dönemde, 4 hastada yeniden miyokart enfarktüsü ve 4 hastada ölüm görüldü. Uzun süreli takipte ise 30 hastada yeniden miyokart enfarktüsü izlendi. Tekrar miyokart enfarktüsü sıklığında gruplar arasında farklılık görülmedi. Çalışmaya dâhil edilen hastalarda uzun süreli mortalite % 27,5 olarak bulundu (n = 49). Gruplar arasındaki mortalite oranlarının anlamlı derecede farklı olduğu tespit edildi (sırasıyla; Grup-1 için % 13,3, Grup-2 için % 16,8, Grup-3 için % 53,5) (p <0.001).*

Sonuç — *STEMI ile başvuran ve primer PCI ile tedavi edilen hastalarda hastane içi ve uzun dönem sonuçlarının değerlendirildiği çalışmamızda 95 aylık takipte, tüm nedenlere bağlı mortalite % 27,5 olarak bulunmuştur.*

Anahtar Kelimeler — *miyokardiyal infarktüs; perkütan koroner girişim; ölüm oranı*

INTRODUCTION

Even tough a series of randomized, multicentre trials have proven that new treatment approaches of myocardial infarction resulted in improved survival and lower morbidity, ischemic heart disease has remained the leading cause of death during the past decade.[1,2] Because of the importance, societies regularly publish guidelines to standardize the treatment and to update clinicians. Nonetheless, the adoption of recommendations in clinical practice varies between and inside of countries.[3] As examples, primary PCI which is the most effective procedure for decreasing the mortality of myocardial infarction patients is applied in higher rates (75–94%) in Japan comparing with the western countries (5.5–49.6%).[4] Moreover, there is a considerable difference in treatment application strategies between the hospitals even in the same country.[3,4] On the other hand, not only strategies of health care providers but also population characteristics are also important to achieve a success of extending life expectancy in patients with cardiovascular disease.[5] A randomized clinical trial certainly reveals the efficacy or safety of a treatment modality in a selected target population however the real world data could be different. Thus clinical registries including the national cohort of patients provide important insights into the real-life health care.

The purpose of the present study was to describe long-term outcomes in patients with STEMI admitted to our hospital which is a tertiary referral hospital. Additionally, the study intended to analyze if and how much the changes in patient characteristics, laboratory parameters and aging contributed to the changes in major adverse cardiac events.

MATERIALS and METHODS

Study Population

All cases, admitted to our hospital with the diagnosis of STEMI and underwent PCI between January 2011 and August 2014, were retrospectively collected for the present longitudinal descriptive study. The study protocol was approved by the Haydarpasa Numune Education and Research Hospital Ethics Committee (Date: 20/04/2020; Reference Number: 2020/KK/59). Patients who had previously undergone heart surgery, including coronary artery bypass grafting or prosthetic valve replacement, and with a prior diagnosis of; heart failure (left ventricular ejection fraction< 40%), stroke, cancer, end-stage renal failure, chronic inflammatory diseases were excluded. However patients who had previously undergone PCI were included. Because, we intended to offer a framework for the exploration of the real life clinical data. Additionally, patients who had insufficient data (e.g. telephone number, patient card, laboratory parameters) were excluded. Finally 204 patients were found to be eligible. At this stage all eligible patients were scanned on the internet database of Turkish Ministry of Health if they died. 49 patients were seen to have died, and their study cards were filled. Finally 155 patients, eligible for the interview, were telephoned. A maximum of three attempts were made to reach patients. At this time, some additional patients who refused or did not respond the interview and had a wrong or disconnected number were found to be ineligible. Interviews were completed in 129 patients.

Data with respect to demographic and clinical characteristics and laboratory parameters were collected from the medical records. The definition of hypertension was specified as a systolic pressure ≥140 mmHg and/or a diastolic pressure ≥ 90 mmHg or if the participant was taking an antihypertensive medication.[6] Diabetes mellitus was determined as a fasting glucose level >126 mg/dl and/or if the patient was taking an anti-diabetic medication.[7] Participants who were recorded as smoker at the patient card were classified as smokers. Hyperlipidemia was defined as taking a lipid-lowering therapy. Chronic kidney disease (CKD) was defined as a glomerular filtration rate (GFR) <60 mL/min/1.73 m2 for 3 months or more.[8] A history of CAD was determined as the existence of prior acute coronary syndrome, percutaneous or surgical coronary revascularization, and/or at least one attested coronary stenosis ≥50% luminal diameter on angiography.[9]

Laboratory Parameters and Results of the Angiograms

The results of the laboratory parameters were obtained using the electronic database of the hospital. According to our hospital protocol, blood samples were drawn from an antecubital vein using vacuum collection devices at the time of admission to the emergency service. Hematological parameters were obtained using a Coulter LH 780 Hematology Analyzer (Beckman Coulter Ireland Inc, Mervue, Galway, Ireland). Lipid levels including total cholesterol, HDL-C and triglyceride levels were enzymatically measured (Architec c-Systems, Abbott, USA) while LDL-C levels were obtained with Friedewald formula.[10] Hs-CRP measurements were conducted using the turbidimetric method by a Cobas Integra analyzer (Roche Diagnostics, Turkey).

Angiographic data with respect to primary PCI was conducted from the cardiac catheterization laboratory records. Angiographic culprit lesion was defined as the lesion with the most severe stenosis that treated with initial primary PCI. Echocardiographic data related to index hospitalization was conducted from the database of the hospital.

Telephone Interview Procedures

One member of the research team conducted interviews between May and June 2020. A semi-structured interview guide was utilized, which included primary questions related to patients follow up period. The patients were asked if they experienced any re-hospitalization with respect to acute coronary syndrome or stroke after index hospitalization. They were also asked if they underwent coronary angiography after index hospitalization. Each patient was interviewed only once. Interviews generally ranged from 3 to 6 minutes. The telephone interview was the only contact with recruited patients after the index hospitalization.

Statistical Aanalysis

The SPSS 22.0 (IBM Corporation, Armonk, New York, USA) was used for statistical analysis. Categorical variables were demonstrated as number and percentage. All quantitative data were expressed as mean ± SD unless otherwise stated. The Shapiro-Wilk test was applied to determine the normal distributions of datasets. The results were analyzed by one-way ANOVA for multiple comparisons. Survival curves of all-cause death were displayed using Kaplan–Meier curves and compared with log-rank tests. A P-value <.05 was considered statistically significant.

RESULTS

A total of 178 patients who were documented to be death or responded the telephone interview were included into the analyses. These patients were divided into three groups according to age: Group-1 consisted of patients who were younger than 35 years old, Group-2 consisted of patients who were between 35–60 years old, and Group-3 consisted of patients who were older than 60 years old. The mean age was 30.87±3.15 years for the Group-1, 46.88±7.99 years for the Group-2, and 68.75±8.24 years for the Group-3. 40 patients (88.8%) were male in the Group-1, 64 patients (83.1%) were male in the Group-2 and 38 patients (67.8%) were male in the Group-3. Comparison of basal characteristics of the groups was presented in Table 1. Although proportion of male patients was similar for group-1 (88.8%) versus group-2 (83.1%), male dominance was found to decrease with aging. The proportion of male (67.8%) was significantly less in the group-3 compared with the other groups (p=0.020). Co-morbid conditions were tended to be more frequent with aging. Group-3 patients were more likely to have a prior history of CAD, hypertension and diabetes mellitus on presentation compared with the other groups (p=0.02, p<0.001, p=0.013, respectively). The incidence of smoking, family history of CAD, hyperlipidemia and CKD was similar in all groups.

Comparison of the initial laboratory parameters between the groups was shown in Table 2. Patients with older age were more likely to have high Blood urea nitrogen (BUN) levels and high C-reactive protein levels. In contrast, younger patients were more likely to have high white blood cell count, high hemoglobin levels and high hematocrit

percentage (all p values <0.05). The mean serum low –density lipoprotein (LDL) levels progressively decreased from group-1 to 3, from 134±51mg/dl in group-1 to 114±31 mg/dl in group-3. There was a significant difference in mean LDL levels between group-1 and group-3 (p=0.042). There were also significant differences with respect to mean platelet volumes (MPV). The mean MPV was significantly lower in group-1 (8.56±0.82) as compared to the group-2 (9.04±1.06) and to the group-3 (8.89±0.99) (p=0.031 and p=0.040, respectively).

On the other hand, there were not any significant differences between the groups with respect to ejection fraction obtained at the day of discharge (p=0.272).

Comparison of the baseline clinical features and long term outcomes of patients with respect to groups was shown in Table 3. Localization of infarction and culprit artery characteristics did not differ among the groups. Similarly, intra-hospital complication rates including re-myocardial infarction, mitral regurgitation, stroke, and death, were not different among the groups.

Patients, safely discharged after the index hospitalization, were followed up 95 months. There was a significant difference in mean follow-up periods between group-2 (88±29 months) and group-3 (68±44 months) (p=0.003).

Among the 178 study patients, at the intra-hospital period, re-myocardial infarction was occurred in 4 patients while death was seen in 4. During the long term follow-up, re-myocardial infarction was occurred in 30 patients. Incidence of re-myocardial infarction did not differ among the groups. Additionally, during the long-term follow-up, there were 2 cases of stroke among all patients. Long-term mortality among study patients was found to be 27.5 % (n=49). It was seen that patients with younger age were more likely to survive. The mortality rates between the groups were significantly different (13.3% for group-1, 16.8% for group-2, 53.5% for group-3, respectively) (p <0.001). Kaplan–Meier curves for cumulative survival in study patients were shown in Figure 1.

Table 1. Baseline characteristics of patients with ST-elevation myocardial infarction according to age groups

Parameters	**Group-1 (<35) n=45**	**Group-2 (≥35-60) n=77**	**Group 3 (≥60) n=56**	**Overall P value**
Age (mean ± SD.)	30.87±3.15	46.88±7.99	68.75±8.24	**<0.001**
Males, n (%)	40 (88.8%)	64 (83.1%)	38(67.8%)	**0.020**
Family History of CAD, n (%)	12 (26.6%)	14(18.1%)	10 (17.8%)	0.460
Smoking, n (%)	23 (51.1%)	46 (59.7%)	30 (53.5%)	0.608
Hypertension, n (%)	7 (15.5%)	28 (36.3%)	35 (62.5%)	**<0.001**
History of CAD, n (%)	2 (4.4%)	9 (11.6%)	16 (28.6%)	**0.002**
Diabetes mellitus, n (%)	3 (6.6%)	16 (20.7%)	17 (30.3%)	**0.013**
Hyperlipidemia, n (%)	6 (13.3%)	12 (15.5%)	3 (5.3%)	0.183
Chronic Kidney Disease, n (%)	1 (2.2%)	1 (1.2%)	4 (7.1%)	0.162

Data are mean ± SD. CAD: Coronary Artery Disease

Table 2. Laboratory parameters of patients with ST-elevation myocardial infarction according to age groups				
Parameters	**Group-1 (<35) n=45**	**Group-2 (≥35-60) n=77**	**Group 3 (≥60) n=56**	**Overall P value**
Glucose (mg/dl)	138±72	159±92	157±74	0.339
Blood urea nitrogen (BUN) (mg/dl)	16±13	16±6	22±11	**0.002**
Creatinine (mg/dl)	1.07±0.80	0.94±0.44	1.17±0.83	0.292
Low-density lipoprotein (mg/dl)	134±51	123±43	114±31	0.054
High-density lipoprotein (mg/dl)	34±8	34±9	38±14	0.073
C-reactive protein (mg/L)	6.96±1.70	16.04±2.10	35.47±8.20	**0.040**
White blood cells (x 109/L)	14.70±5.39	13.12±4.19	11.21±3.14	**<0.001**
Hemoglobine (g/L)	14.63±1.54	14.17±1.62	13.35±1.72	**<0.001**
Hematocrit (%)	43.27±4.74	41.50±4.67	39.06±4.91	**<0.001**
Platelet (x 109/L)	246±60	262±77	244±71	0.304
Red blood cell distribution width (RDW) (%)	13.64±1.45	13.38±1.38	13.97±1.93	0.109
Mean platelet volume (MPV) (fL)	8.56±0.82	9.04±1.06	8.89±0.99	**0.040**
Ejection Fraction (%)	48±9	47±12	45±10	0.272
Data are mean ± SD.				

Table 3. Baseline clinical features and long term outcomes of patients with ST-elevation myocardial infarction according to age groups				
Parameters	**Group-1 (<35) n=45**	**Group-2 (≥35-60) n=77**	**Group 3 (≥60) n=56**	**Overall P value**
Localization of infarction				
Anterior AMI	33 (73.3%)	45 (58.4%)	33 (58.9%)	0.213
Inferior AMI	7 (15.5%)	18 (23.3%)	16 (28.5%)	0.302
Lateral AMI	5 (11.1%)	14 (18.1%)	6 (10.7%)	0.382
Culprit lesion (artery)				
Left anterior descending	33 (73.3%)	45 (58.4%)	33(58.9%)	**0.358**
Circumflex	6 (13.3%)	12 (15.5%)	7(12.5%)	
Right coronary	6 (13.3%)	20 (25.9%)	15(26.7%)	
Intra hospital complication				
Re-myocardial infarction	1(2.2%)	2 (2.6%)	1(1.7%)	0.952
Mitral regurgitation	2 (4%)	4(5%)	4(7%)	**0.823**
Stroke	0	0	1(1.7%)	0.334
Death	1(2.2%)	0	3(5.3%)	0.120
Long term follow-up				
Follow-up time (months)	80±23	88±29	68±44	0.003*
Re-mycardial infarction	8 (17.7%)	12 (15.5%)	10 (17.8%)	0.925
Stroke	0	1 (1.3%)	1 (1.7%)	0.686
Death	6 (13.3%)	13 (16.8%)	30 (53.5%)	<0.001
Data are presented as percentage (%) * Refers to p value of comparison of Group-2 and Group-3. AMI: Acute Myocardial Infarction				

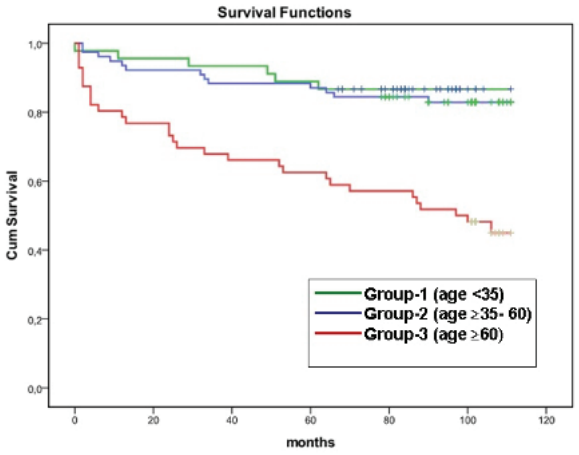

Figure 1: Kaplan–Meier curves for cumulative survival with respect to age groups in ST-elevation myocardial infarction patients who underwent primary percutaneous coronary intervention

DISCUSSION

The present investigation was an evaluation of patient characteristics, laboratory parameters, and short- and long-term outcomes in patients presented with STEMI and treated with primary PCI in a tertiary cardiology center. The main results of the present study were as follows: 1) over the 95 months follow-up, all cause mortality was found to be 27.5% in our study population; 2) patients with younger age were more likely to survive; 3) 79.7% of the study population consisted of males, male dominance was found to decrease with aging; 4) co-morbid conditions were tended to be more frequent with aging; 5) younger patients were more likely to have a high level of leukocytes, and LDL; 6) a considerable proportion of study patients experienced anterior wall infarction while most common (62.3 %) culprit lesion was found to be LAD; 7) intra-hospital complication rates were relatively low (7.3%) and there was no age or sex-specific difference in those.

Worldwide, ischemic heart disease is the single most common cause of death.[1,2] Several recent studies in the western-world have highlighted a decline in acute and long-term mortality following STEMI in association with broader use of current therapies including primary PCI, and modern antithrombotic therapy.[11,12] Despite that, mortality remains substantial; the intra-hospital mortality of unselected patients with STEMI in the European countries ranges from 4 to 12%.[13] A median period of 39 months mortality among STEMI patients in a sub-Saharan Africa population is found to be 10.4%.[14] However, to date, there is a little evidence of long-term outcomes in patients with STEMI in Turkey. The present study is the unique report on STEMI patients from a nationally representative cohort. Our study has reported a lower intra-hospital mortality rate in patients with STEMI underwent primary PCI (7.3%). It seems to be underestimated because of our study design. We excluded patients who did not receive primary PCI therapy. Patients who had previously undergone heart surgery and with a prior diagnosis of heart failure were also excluded. It is plausible to assume that a decision to prefer medical treatment for acute coronary syndrome might be given for STEMI patients with advanced age or whom chest pain relieved at the time of admission.[15] Additionally, in a previous registry including patients with STEMI, it was reported that the proportion of patients with a prior diagnose of heart failure at the time of admission was 15%, while the proportion of patients with previous bypass surgery was 5%.1 Thus, design of our study might explain the lower incidence of intra-hospital mortality. On the other hand, in a prior study in which mean age of the recruited patients were 64 years, the survival rates at 5 and 10 years after presentation with acute myocardial infarction were revealed to be 66.7%, and 42.4%, respectively.[16] However in our study survival rate at 95 months after STEMI has reported to be 72.5 %.

The possible explanations for this relatively high survival rate are: I) median age of the current study patients was 50. Indisputably, age has been one of the most important predictor of death following STEMI.[17] Moreover a rising gradient in mortality has been apparent after seventh decade,[18] II) the present study excluded the patients with heart failure and previous cardiac surgery that they would

shorten the survival rate, III) it is proven that delay in door to-balloon time is a major contributor to mortality associated with STEMI.[19] In this context, the present study was carried out in a single tertiary cardiology center where unacceptable delays in door to-balloon time are not usual, and that might have a contribution to high survival rate.

Inflammation is one of the main factors causing coronary artery disease. The intensity of the inflammatory response and hemodynamic consequence in acute myocardial infarction leads to a high level of leukocytes, C-reactive protein and also MPV.[20] Many studies have revealed that leukocytosis is related to an increased cardiovascular mortality rate. Moreover, leukocytosis, high levels of C-reactive protein and MPV, proved to be of prognostic value when evaluating adverse clinical outcomes.[21-24] In the present study, patients with younger age who have a relatively high survival rate comparing with older patients were more likely to have a low level of C-reactive protein and MPV which is coherent with previous observations. But, in contrast to prior findings younger patients were more likely to have a high white blood cell count. However, in the present study, we did not assess the effects of those parameters on survival rate by a regression model. Prospective settings addressing this issue in a national cohort should be considered.

Our study has several limitations. First, the quality of the individual data items is less good than in clinical trials or well-conducted observational studies. As an observational study, causality between the changes in treatment strategies and outcomes cannot be fully explained. Second, the present work is a single-center analysis; therefore, the generalisability of these findings is limited. Third, we did not evaluate the variability in long term medical therapy, adherence to therapy, and habit of cigarette smoking of recruited patients those could affect the outcome. Fourth, we did not measure the effects of patient characteristics and laboratory parameters on short- and long-term outcome by a regression model. Finally, we cannot exclude the possibility of unmeasured confounding factors.

In conclusion, the present study is an evaluation of intra-hospital and long-term outcomes in patients presented with STEMI and treated with primary PCI in a tertiary cardiology center. Over the 95 months follow-up, all cause mortality was found to be 27.5% in those.

Acknowledge

This study protocol was approved by the Haydarpasa Numune Education and Research Hospital Ethics Committee (Date: 20/04/2020; Reference Number: 2020/KK/59)

Conflict of interest: None

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