ARAŞTIRMA MAKALESİ/ORIGINAL RESEARCH

DOI: 10.5505/ktd.2022.33576
Kocaeli Med J 2022;11(3)98-109

Comparison of Invasive Versus Conservative Management in Elderly Patients with Non-ST-Segment Myocardial Infarction: A Propensity Score Matching Analysis

ST-Segmenti Olmayan Miyokart Enfarktüslü Yaşlı Hastalarda Girişimsel ve Konservatif Tedavinin Karşılaştırılması: Bir Eğilim Skoru Eşleştirme Analizi

Faysal Şaylık[1], Tufan Cinar[2], Murat Selçuk[2], Tayyar Akbulut[1]
[1]Sağlık Bilimleri Üniversitesi, Van Eğitim ve Araştırma Hastanesi, Kardiyoloji Bölümü, Van, Türkiye
[2]Sağlık Bilimleri Üniversitesi, Sultan II. Abdülhamid Han Eğitim ve Araştırma Hastanesi, Kardiyoloji Bölümü, İstanbul, Türkiye

ABSTRACT

INTRODUCTION: The optimal management strategy in elderly patients with non-ST-segment elevation myocardial infarction (NSTEMI) is still debatable. We aimed to investigate the short- and long-term mortality rates of invasive and conservative management in elderly patients with NSTEMI aged over 75 years.
METHODS: A total of 448 patients (212 in the invasive group and 236 in the conservative group) were balanced with respect to risk factors using a propensity score matching (PSM) analysis. After PSM analysis, equal sized two groups of 376 patients were obtained with no selection bias. Short- and long-term mortality rates were compared between groups.
RESULTS: Patients in the conservative group had higher in-hospital (11.2 % vs 4.8 %), short-term (17.5 % to 7.5 %), and long-term mortality rates (23.3 % to 8.6 %) than patients in the invasive group. Kaplan-Meier survival curves showed significant differences of survival probabilities between groups for short- and long-term mortalities. An invasive management reduced the risk of mortality by 69.1 % when compared to conservative management.
DISCUSSION AND CONCLUSION: Invasive management had improved benefit on the mortality in elderly patients with NSTEMI aged over 75 years compared to the conservative management.
Keywords: Non-ST-segment elevation myocardial infarction, invasive, conservative, mortality

ÖZ

GİRİŞ ve AMAÇ: ST segment yükselmesi olmayan miyokart enfarktüsü (STOME) olan yaşlı hastalarda en uygun yönetim stratejisi hala tartışmalıdır. Biz bu çalışma da 75 yaş üzeri STOME'lı hastalarda girişimsel ve konservatif yaklaşımları kısa ve uzun dönem ölüm açısından karşılaştırmayı hedefledik.
YÖNTEM ve GEREÇLER: Toplamda 448 hasta (212 tanesi girişim grubunda ve 236 tanesi konservatif grupta) risk faktörleri açsından propensity skor uyum (PSU) analizi kullanılarak dengelendi. PSM analizinden sonra toplam 376 hastadan oluşan eşit sayıya sahip 2 grup seçim yanlılığı yapılmadan oluşturuldu. Bu gruplar kısa ve uzun dönem ölüm oranları açısından karşılaştırıldı.
BULGULAR: Konservatif grupta olan hastalar, invaziv grupta olan hastalara göre daha yüksek hastane içi ölüm (%11,2 vs %4,8), kısa dönem (%17.5 vs %7.5) ve uzun dönem ölüm (%23.3 vs %8.6) oranlarına sahiptiler. Kaplan-Meier yaşam eğrileri, gruplar arasında kısa dönem ve uzun dönem yaşam ihtimalleri açısından anlamlı farklılıklar olduğunu gösterdi. Girişimsel bir yaklaşım, konservatif yaklaşıma göre ölüm riskini % 69.1 oranında azaltmıştır.
TARTIŞMA ve SONUÇ: Konservatif tedaviye kıyasla, 75 yaş üstü STOME'lı yaşlı hastalarda girişimsel yönetim mortalite üzerinde fayda sağlamıştır
Anahtar Kelimeler: ST segment yükselmesi olmayan miyokart enfarktüs, girişimsel, konservatif, ölüm

Kabul Tarihi: 28.04.2022

Correspondence: Tufan Cinar, Sağlık Bilimleri Üniversitesi, Van Eğitim ve Araştırma Hastanesi, Kardiyoloji Bölümü, Van, Türkiye
E-mail: drtufancinar@gmail.com
Kocaeli Medical Journal

INTRODUCTION

Non-ST-segment elevation myocardial infarction (NSTEMI) constitutes a subgroup of patients at greater risk who need aggressive treatment early. The preferred treatment option is an early invasive approach in patients with high-risk characteristics (1, 2). Although elderly patients are defined as a high-risk group, they receive less revascularization treatments compared to younger patients (3). Unfortunately, there are several obstacles, including, advanced age, elevated creatinine levels, or severe heart failure, for choosing an invasive management in elderly NSTEMI patients. Moreover, elderly patients are more prone to complications of invasive strategy due to their fragile status and invasive angiography is often avoided because of concerns about potential risks and uncertain benefits in older individuals (4). Besides that, elderly patients had been underrepresented in most randomized controlled studies (RCTs) and the outcome data for NSTEMI patients who were above 75 years old was scarce (4). Thus, the ideal treatment option for elderly individuals with NSTEMI is still debatable. We aimed to investigate the impact of treatment options, including invasive versus conservative management, on the short- and long-mortality rates in elderly patients aged over 75 years from our local hospital records.

MATERIAL AND METHODS

Study subjects

The local ethics committee approved the study, and it was conducted in compliance with the Declaration of Helsinki. We recruited 448 consecutive patients who were diagnosed with NSTEMI and were over 75 years between January 2016 and February 2021 in this retrospective, observational study. Patients with ST-segment elevation myocardial infarction and those having missing data in the follow-up were excluded. Clinical data and the patient's medical history were all noted. The results of all laboratory tests were gathered from hospital laboratory database. The European Society of Cardiology's NSTEMI guideline was applied to treat all of the elderly NSTEMI patients (5).

Propensity score matching

Due to the study design, potential imbalances between two groups were expected. A propensity score matching (PSM) analysis was used to diminish potential bias and to achieve comparable groups. We estimated propensity scores using potential cofounders, such as age, gender, body mass index, cigarette smoking, and comorbidities that are risk factors for the mortality in NSTEMI patients. After estimation, patients were matched with a 1:1 nearest neighbor matching, with a caliper of 0.2 of the standard deviation of the logit for the propensity score with no replacement to attain balanced groups

with respect to covariates. Standardized differences were calculated to compare patient characteristics before and after PSM. An imbalance was referred to an absolute value higher than 0.20 (small-effect size).

Interventional procedure

Patients in invasive therapy group underwent invasive angiography through the femoral or radial artery, and all procedures were carried out by skilled operators using standard interventional techniques. If relevant, balloon angioplasty and/or stent implantation were performed to treat the culprit lesions, as per the guideline recommendations (5).

Definitions

NSTEMI was defined as the presence of persistent angina pectoris more than 20 minutes with an elevation of cardiac troponin I levels exceeding the upper normal limit in the setting of non-ST segment elevation on surface electrocardiogram (5). Deaths that occurred during hospital stay were referred as in-hospital mortality, and those that occurred within 30 days from the time of admission to cardiology clinic was referred as short-term mortality. Long-term mortality was defined as the deaths that occurred after 30 days of hospital admission. The data from the National Death Registry System were analyzed to estimate short- and long-term mortality. Congestive heart failure was defined as the presence of left ventricle ejection fraction (LVEF) < 40% with or without the related signs and symptoms including, dyspnea, orthopnea, paroxysmal nocturnal dyspnea, and edema. Hypertension was described based on the presence of a systolic blood pressure 140 mm Hg and/or diastolic blood pressure 90 mm Hg at least two times or using of current antihypertensive drugs. Diabetes mellitus was defined with fasting glucose 126 mg/dL or post-prandial glucose 200 mg/dL or using antidiabetic drugs. Cigarette smoking was described as patients with smoking at least six months continuously during the past year. Hyperlipidemia was described by an abnormally elevated total cholesterol level over 200 mg/dL and/or using anti-hyperlipidemic drugs. Chronic kidney disease was defined as an estimated glomerular filtration rate < 60 mL/min/1.73m2 and/or undergoing hemodialysis or peritoneal dialysis. Cerebrovascular disease was described by the presence of previous history of transient ischemic attack or cerebrovascular accident.

Statistical analysis

All statistical analyses were performed using R-software v. 3.6.3 (R statistical software, Institute for Statistics and Mathematics, Vienna, Austria). To determine normality, the Kolmogorov-Smirnov test was used. Continuous variables with a normal distribution were presented as arithmetical mean (standard deviation), whereas those without a normal

distribution were given as median (interquartile range (IQR)). Categorical variables were presented as numbers and percentages. The independent Student's t-test and Mann-Whitney U tests were used to compare continuous variables between the groups. The chi-square test or Fisher's exact test was performed to compare categorical variables, as appropriate. A multivariable Cox proportional regression analysis was used with clinically relevant risk factors to detect independent predictor of short- and long-mortality. Kaplan-Meier survival curves were used to compare treatment strategies for mortality rates. A 2-sided $p < 0.05$ was considered significant.

RESULTS

Table 1 summarizes the differences of covariables before and after PSM analysis. A total of 212 patients in invasive group and 216 patients in conservative group were matched with respect to age, gender, body-mass index (BMI), cigarette smoking status, and comorbidities. In unmatched study population, BMI was higher in the invasive group compared to the conservative group. Invasive group had more frequent cerebrovascular disease (CVD) and chronic kidney disease (CKD) than conservative group. After PSM analysis, all variables were non-significant between the groups and the balance was also adequate between groups.

There were no statistically significant differences between groups in terms of laboratory parameters and drugs usage (Table 2). In the invasive group, 17 patients (9%) had normal or non-obstructive coronary artery disease (CAD) and 111 patients (59.1%) had multivessel coronary lesions. Conservative group had higher in-hospital death rate (11.2% vs 4.8%), short-term death rate (17.5% vs 7.5%), and long-term mortality rate (23.3% to 8.6%) when compared to invasive group (Table 3) (Figure 1).

Kaplan-Meier survival curves indicated statistically significant differences of survival probabilities between groups for short- (Log-rank, $p = 0.002$) (Figure 2) and long-term mortalities (Log-rank, $p < 0.001$) (Figure 3).

Multivariable Cox proportional regression analysis results showed that the presence of congestive heart failure (CHF) was independently associated with both short- and long-term mortalities, whereas the presence of hypertension was independently associated with only long-term mortality in elderly NSTEMI patients. An invasive approach in those patients had independently reduced effect on both short- and long-term mortalities compared to conservative management (Table 4).

Table 1. The Comparison of Study Groups in terms of Risk Factors before and after a Propensity Score Matching Analysis

	Before PSM matching				After PSM matching			
	Invasive group, n =212	Conservative group, n = 236	Std. Difference	P value	Invasive group, n =188	Conservative group, n =188	Std. Difference	P value
Age, years	82.7(4.9)	83.5(6.9)	-0.147	0.856	83(5.1)	83(6.9)	-0.021	0.551
Male gender, n (%)	102(48.1)	119(50.4)	-0.046	0.694	89(47.3)	95(50.5)	-0.064	0.606
BMI, kg/m^2	23.5(2.5)	23(2.4)	0.190	0.037	23.4(2.5)	23.3(2.4)	0.025	0.804
Cigarette smoking, n (%)	136(64.2)	160(67.8)	-0.076	0.475	121(64.4)	119(63.3)	0.022	0.915
Hypertension, n (%)	152(71.7)	180(76.3)	-0.102	0.320	134(71.3)	133(70.7)	0.012	1.000
Diabetes mellitus, n (%)	32(15.1)	21(8.9)	0.173	0.059	26(13.8)	20(10.6)	0.089	0.431
COPD, n (%)	59(27.8)	55(23.3)	0.101	0.323	45(23.9)	42(22.3)	0.036	0.807
Congestive heart failure, n (%)	84(39.6)	81(34.3)	0.108	0.288	69(36.7)	67(35.6)	0.021	0.915
Cerebrovascular disease, n (%)	5(2.4)	0(0)	0.155	0.023	0(0)	0(0)	0.000	NA
Peripheral arterial disease, n (%)	13(6.1)	11(4.7)	0.061	0.631	11(5.9)	10(5.3)	0.022	1.000
Hyperlipidemia, n (%)	74(34.9)	70(29.7)	0.110	0.277	59(31.4)	67(35.6)	-0.089	0.444
Prior CAD, n (%)	109(51.4)	105(44.5)	0.139	0.171	90(47.9)	82(43.6)	0.085	0.469
Chronic kidney disease, n (%)	48(22.6)	31(13.1)	0.227	0.012	34(18.1)	30(16)	0.051	0.681

Abbreviations; PSM: propensity-score matching analysis, Std: standardized, BMI: body mass index, COPD: chronic obstructive pulmonary disease, CAD: coronary artery disease.

Table 3. Comparison of Angiography Results and Mortality Rates between the Groups

	Invasive group, (n =188)	Conservative group, (n =188)	P value
Normal or non-obstructive CAD, n (%)	17(9)	-	NA
One-vessel disease, n (%)	60(31.9)	-	NA
Multiple vessel disease, n (%)	111(59.1)	-	NA
Revascularization* n (%)		-	NA
PCI	91(53.2)	-	NA
CABG	21(12.2)	-	NA
No revascularization	59(34.6)	-	NA
Non-fatal MI, n (%)	10(5.3)	18(9.6)	0.169
In-hospital death, n (%)	9(4.8)	21(11.2)	0.036
Short-term death, n (%)	13(7.5)	29(17.5)	0.008
Long-term death*, n (%)	15(8.6)	37(23.3)	<0.001

* 334 patients

Abbreviations; CAD: coronary artery disease, PCI: percutaneous coronary intervention, CABG: coronary-artery bypass, MI: myocardial infarction.

Table 2. Comparison of Laboratory Parameters and Prior Medications between the Groups

	Invasive group, (n =188)	Conservative group, (n =188)	P value
WBC, cells x10^3/µl	10(7.4-12.1)	10.1(7-13.6)	0.587
Neutrophil, cells x10^3/µl	7.8(5.8-10.6)	7.3(4.9-10.5)	0.174
Lymphocyte, cells x10^3/µl	1.4(0.8-2.1)	1.6(0.9-2.2)	0.429
Platelet, cells x10^3/µl	216(172-256)	203(143-290)	0.236
Creatinine, mg/dL	1.1(0.9-1.4)	1.2(0.8-1.6)	0.377
LDL cholesterol, mg/dL	97(76-129)	99(73-130)	0.832
Triglyceride, mg/dL	111(73-136)	114(75-157)	0.180
HDL cholesterol, mg/dL	39(32-48)	39(30-47)	0.188
Troponin I, ng/mL	11.5(7.7-15)	12.2(7.6-14.4)	0.368
Treatment at admission, n (%)			
Aspirin	101(53.7)	110(58.5)	0.406
Clopidogrel	9(4.8)	20(10.6)	0.053
ACE inh/ARBs	118(62.8)	133(70.7)	0.125
Beta blockers,	99(52.7)	111(59)	0.253
Calcium channel blockers	47(25)	32(17)	0.076
Amiodarone	3(1.6)	2(1.1)	1.000
Anticoagulants	26(13.8)	19(10.1)	0.341
Statins	36(19.1)	49(26.1)	0.139
Diuretics	65(34.6)	72(38.3)	0.520

Abbreviations; WBC: white blood cell, LDL: low-density cholesterol, HDL: high-density cholesterol, ACE: angiotensinogen-converting enzyme, ARBs: angiotensin-receptor blockers.

Table 4. Multivariable Cox-Proportional Regression Analysis for short- and long-term Mortality

	Short-term mortality			Long-term mortality		
	HR	95% CI	P value	HR	95 % CI	P value
Male gender	0.891	0.513-1.546	0.730	0.911	0.547-1.517	0.764
Hypertension	0.969	0.539-1.741	0.929	2.352	1.214-4.561	**0.023**
Diabetes mellitus	1.757	0.826-3.738	0.232	0.644	0.263-1.574	0.396
Congestive heart failure	2.556	1.295-3.929	**0.016**	1.855	1.109-3.102	**0.049**
Hyperlipidemia	0.731	0.400-1.335	0.386	1.164	0.687-1.969	0.637
Invasive strategy	0.326	0.182-0.582	**0.001**	0.309	0.181-0.529	**<0.001**

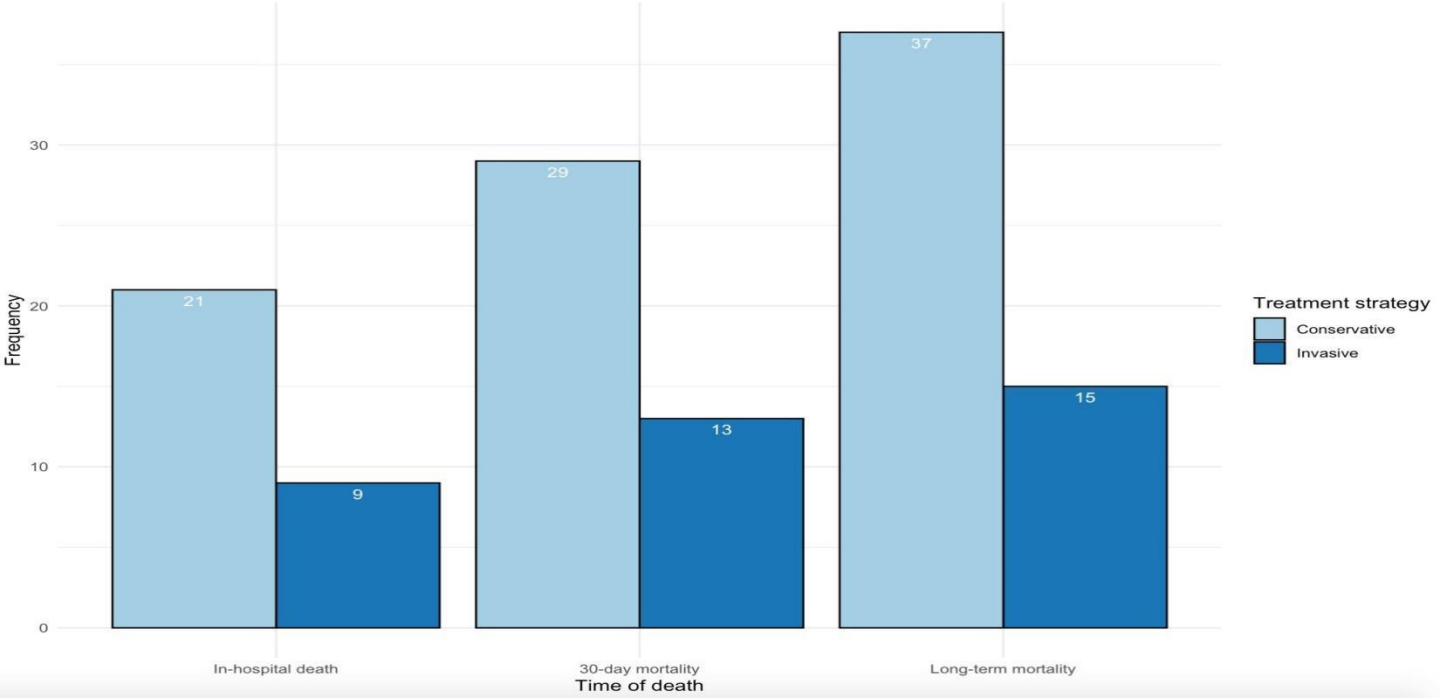

Figure 1. A box plotting showing the mortality rates of in-hospital, short- and long term for elderly elderly non-ST elevation myocardial infarction (NSTEMI) patients

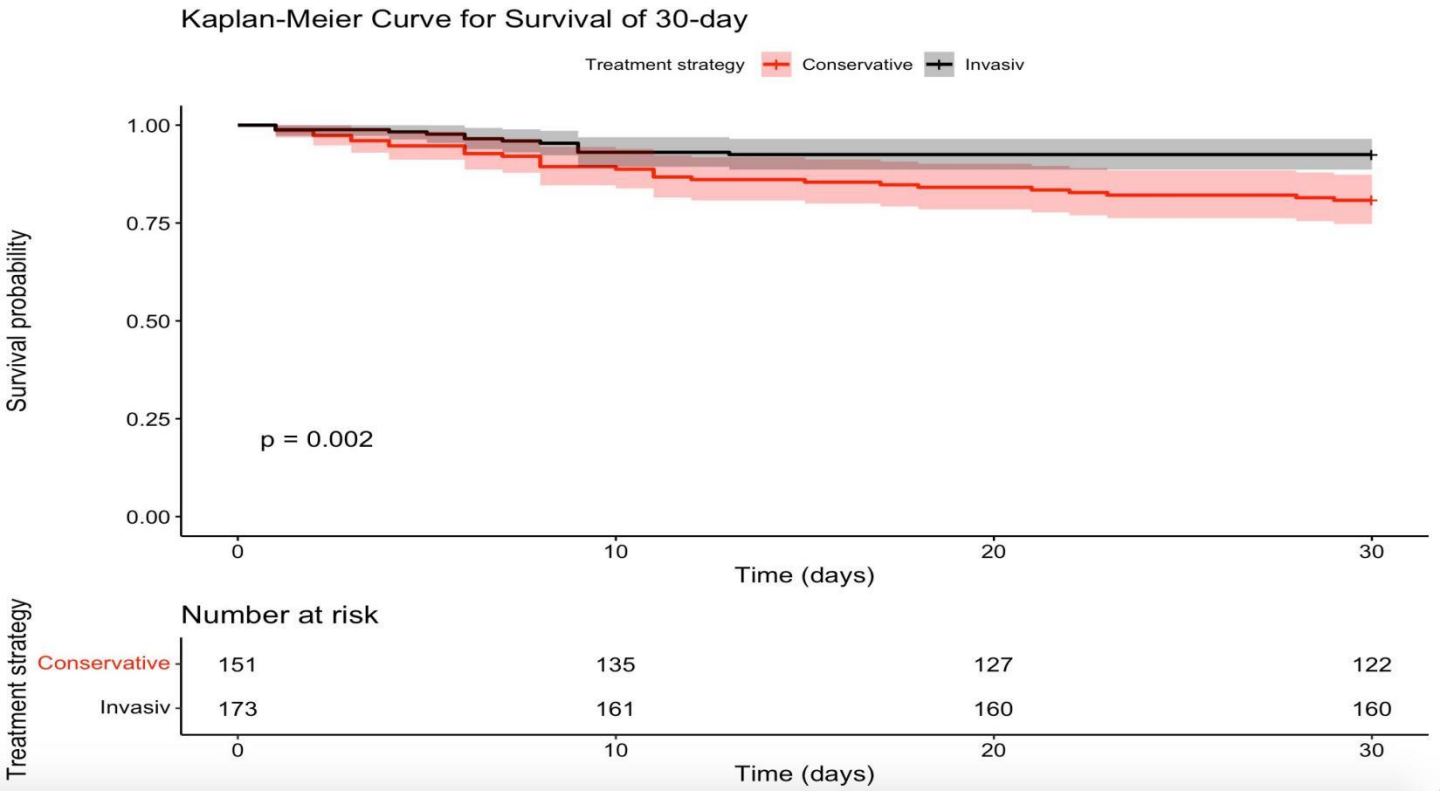

Figure 2. Short-term Kaplan Meier survival analysis of elderly non-ST elevation myocardial infarction (NSTEMI) patients

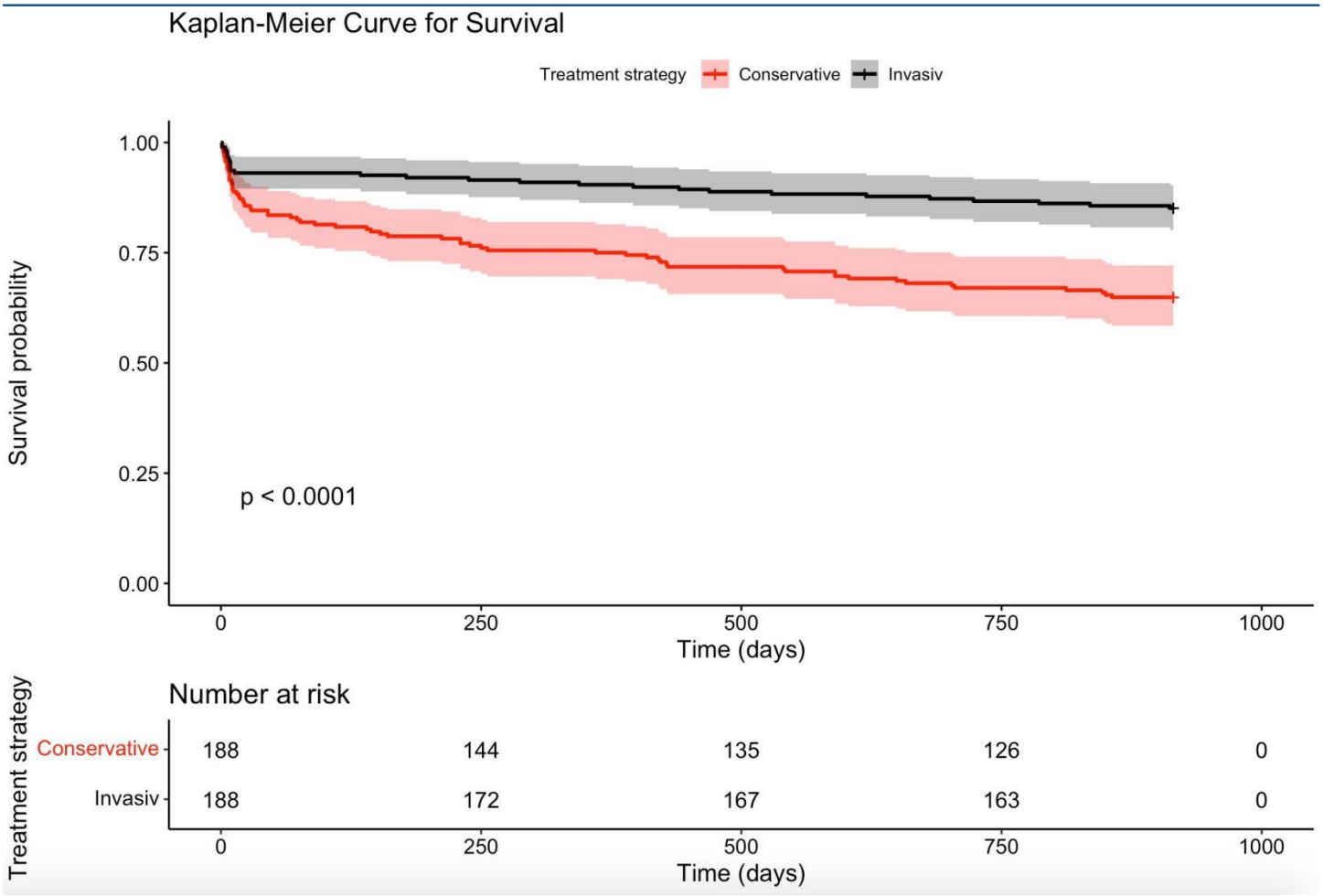

Figure 3. Long-term Kaplan Meier survival analysis of elderly non-ST elevation myocardial infarction (NSTEMI) patients.

DISCUSSION

This study showed that elderly NSTEMI patients who were treated with invasive approach had lower mortality rates compared to patients treated with conservative management. An invasive modality was independently associated with both short- and long-term mortality among those patients.

Elderly patients constitute a large subset of NSTEMI patients, and advanced age is accepted as an independent predictor of mortality in those patients (6). Nevertheless, it is recommended that invasive coronary angiography should not be avoided because of an individual's advanced age (5). Elderly patients, especially with accumulated comorbidities, have been underrepresented in most RCTs (7). The evidence from earlier RCTs pointed out that a routine invasive modality could not reduce all-cause mortality risk, while increasing the risk of periprocedural complications in elderly patients (8, 9). Because RCTs were conducted relatively in the past time period, improvements in invasive strategy, including modern drug-eluting stents, new dual antiplatelet treatment modalities,

intensive lipid lowering therapy, complete revascularization of multivessel CAD, and more frequent radial access might improve outcomes. Recent guidelines recommend a routine invasive strategy in high-risk patients with NSTEMI regardless of age (5). Several factors that can discourage cardiologists from an invasive strategy might be advanced age, chronic kidney disease, history of malignancy, diabetes mellitus, prior heart failure, and frailty (10-12). Thus, we used a propensity score matching analysis to reduce the unbalanced groups and to reduce the effects of commodities on the outcomes, especially in the conservative group. Our study represents the benefit of the decision of an invasive strategy over a conservative management on mortality in elderly NSTEMI patients.

There have been a limited and contradictory reports that have evaluated the comparisons of outcomes and mortality rates between an invasive and conservative approach in elderly NSTEMI patients. Most of them have been reported earlier than five years before improvements in therapy modalities and the results seem disconcordant with respect to mortality rates. Kvakkestad et al reported that short- and long-term mortality rates were lower in invasive group than in conservative group, and an invasive approach was an independent predictor of mortality with similar findings of our results (7). Bauer et al showed similar results in invasive group but with a trend towards more bleeding risk (3). They studied on 1,936 NSTEMI patients □75 years and reported 1-year mortality as 10.7% in invasive group versus 27.9% in conservative group as similar with this study (3)(3). A study consisted of 457 patients aged over 80 years demonstrated a 47% risk reduction with the invasive strategy for the primary end-points, including a composite of myocardial infarction, revascularization, stroke or death (13). Kolte et al. showed that an invasive management before 48 hours was related to lower rates of in-hospital mortality, but with higher rates of cardiogenic shock in elderly patients (14). Nevertheless, controversial to these studies, Sanchis et al could not demonstrated the significant effect of invasive management on long-term mortality in elderly NSTEMI patients (15). Moreover, Savonitto et a did not reach a definite conclusion for the benefit of invasive management on mortality in NSTEMI patients □75 years of age (16). In our investigation, we aimed to investigate the invasive and conservative treatment modalities in elderly NSTEMI patients with respect to mortality rates in the light of modern therapy and advanced invasive approaches. Based on results, we concluded that invasive strategy was linked to lower mortality rates compared to the conservative management.

The cause of a higher percentage of conservative group of this study population was not only due to the decision of cardiologists; but also due to the

decision of patients and the first degree relatives. Our hospital is in a rural area of Turkey, and the education levels and awareness of elderly population in our area are very low. This situation is not much different for first-degree relatives of patients. So, the decision of an invasive strategy by the patients and first-degree relatives was not made easily in our hospital and approximately half of them refuse invasive approach. However, this percentage was in accordance with the literature. In a study reported by Karen et al., the percentage of conservative group in elderly patients with NSTEMI was approximately 50% as in our study (17). Similarly, the percentage of conservative group was 48.1% of the total study population in patients aged over 75 years in a study reported by Bauer et al. (3).

Congestive heart failure was an independent predictor of both short- and long-term mortality in elderly patients with NSTEMI in this study. Morici et al. reported that elderly patients with NSTEMI who had low left ventricle ejection fraction (LVEF) had a higher hazard ratio than patients with normal LVEF, and the LVEF was an independent predictor of mortality in this study population (6). Diepen et al. investigated the effect of heart failure in elderly patients with NSTEMI and found that heart failure with reduced ejection fraction was an independent predictor of mortality as in accordance with our study (18). Hypertension was another independent predictor of long-term mortality in our study population. Lee et al. showed no association between the presence of hypertension and mortality in all aged patients with NSTEMI (19). There was a limited data presenting the association of hypertension with mortality in older NSTEMI patients in the literature. Hypertension was not found as an independent predictor of mortality in CRUSADE long-term mortality model developed by Roe et al., which was contrary to our study (20).

Limitations

The major limitation was the retrospective study nature. The small sample size and single center study were other limitations. Although we showed the superiority of the invasive management to the conservative management, we did not report the bleeding complications, contrast-induced nephropathy, transient ischemic attack, and stroke in the invasive arm of the study population. The lack of patients' medications after discharge was the another limitation. The results of our study were limited to the one geographical area. So, the results should be supported by prospective RCTs with large sample sizes. Though invasive angiography was performed on patients in the invasive treatment group via either the femoral or radial artery, there was no consistency regarding the invasive strategy. Last, owing to the study's retrospective design, we were only able to present data on all-cause

mortality.

Conclusion

This study concluded that an invasive approach had lower in-hospital, short- and long-term mortality rates when compared to conservative management in the elderly NSTEMI patients. Moreover, invasive approach was an independent predictor of mortality among these patients.

Ethics Committee Approval: Ethical approval was obtained. Clinical Research Ethics Committee (08.07.2021 date and 2021/14 number)

Authors Contributions: Concept: F.S., T.Ç., Design: T.Ç., M.S., Supervision: F.S., T.A., Resources: T.A., Materials: T.Ç., M.S., Data Collection: T.A., Analysis: F.S.,
Literature search: F.S., Writing: F.S., Review: F.S., T.Ç.,

Conflict of Interest: There is no conflict of interest.

Funding: No financial support was received.

Informed Consent: This a retrospective study.

REFERENCES

1. Bavry Anthony A, Kumbhani Dharam J, Rassi Andrew N, et al. Benefit of Early Invasive Therapy in Acute Coronary Syndromes. Journal of the American College of Cardiology. 2006 2006/10/03;48(7):1319-1325.

2. Fox Keith AA, Clayton Tim C, Damman P, et al. Long-Term Outcome of a Routine Versus Selective Invasive Strategy in Patients With Non–ST-Segment Elevation Acute Coronary Syndrome. Journal of the American College of Cardiology. 2010 2010/06/01;55(22):2435-2445.

3. Bauer T, Koeth O, Jünger C, et al. Effect of an invasive strategy on in-hospital outcome in elderly patients with non-ST-elevation myocardial infarction. European Heart Journal. 2007;28(23):2873-2878.

4. Ekerstad N, Swahn E, Janzon M, et al. Frailty Is Independently Associated With Short-Term Outcomes for Elderly Patients With Non–ST-Segment Elevation Myocardial Infarction. Circulation. 2011 2011/11/29;124(22):2397-2404.

5. Collet J-P, Thiele H, Barbato E, et al. 2020 ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation: The Task Force for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC). European Heart Journal. 2021;42(14):1289-1367.

6. Morici N, Savonitto S, Murena E, et al. Causes of Death in Patients ≥75 Years of Age With Non–ST-Segment Elevation Acute Coronary Syndrome. The American Journal of Cardiology. 2013 2013/07/01/;112(1):1-7.

7. Kvakkestad KM, Gran JM, Eritsland J, et al. Long-Term Survival after Invasive or Conservative Strategy in Elderly Patients with non-ST-Elevation Myocardial Infarction: A Prospective Cohort Study. Cardiology. 2019;144(3-4):79-89.

8. Elgendy IY, Mahmoud AN, Wen X, et al. Meta-Analysis of Randomized Trials of Long-Term All-Cause Mortality in Patients With Non–ST-Elevation Acute Coronary Syndrome Managed With Routine Invasive

Versus Selective Invasive Strategies. The American Journal of Cardiology. 2017 2017/02/15/;119(4):560-564.

9. Fanning JP, Nyong J, Scott IA, et al. Routine invasive strategies versus selective invasive strategies for unstable angina and non-ST elevation myocardial infarction in the stent era. Cochrane Database of Systematic Reviews. 2016 (5).

10. Puymirat E, Taldir G, Aissaoui N, et al. Use of Invasive Strategy in Non–ST-Segment Elevation Myocardial Infarction Is a Major Determinant of Improved Long-Term Survival. JACC: Cardiovascular Interventions. 2012 2012/09/01;5(9):893-902.

11. Bueno H, Rossello X, Pocock Stuart J, et al. In-Hospital Coronary Revascularization Rates and Post-Discharge Mortality Risk in Non–ST-Segment Elevation Acute Coronary Syndrome. Journal of the American College of Cardiology. 2019 2019/09/17;74(11):1454-1461.

12. De Luca L, Leonardi S, Cavallini C, et al. Contemporary antithrombotic strategies in patients with acute coronary syndrome admitted to cardiac care units in Italy: The EYESHOT Study. European Heart Journal Acute Cardiovascular Care. 2015;4(5):441-452.

13. Tegn N, Eek C, Abdelnoor M, et al. Patients aged 80 years or older with non-ST-elevation myocardial infarction or unstable angina pectoris randomised to an invasive versus conservative strategy: angiographic and procedural results from the After Eighty study. Open Heart. 2020;7(2):e001256.

14. Kolte D, Khera S, Palaniswamy C, et al. Early Invasive Versus Initial Conservative Treatment Strategies in Octogenarians with UA/NSTEMI. The American Journal of Medicine. 2013 2013/12/01/;126(12):1076-1083.e1071.

15. Sanchis J, Núñez E, Barrabés JA, et al. Randomized comparison between the invasive and conservative strategies in comorbid elderly patients with non-ST elevation myocardial infarction. European Journal of Internal Medicine. 2016 2016/11/01/;35:89-94.

16. Savonitto S, Cavallini C, Petronio AS, et al. Early Aggressive Versus Initially Conservative Treatment in Elderly Patients With Non–ST-Segment Elevation Acute Coronary Syndrome. JACC: Cardiovascular Interventions. 2012 2012/09/01;5(9):906-916.

17. Alexander KP, Newby LK, Bhapkar MV, et al. International variation in invasive care of the elderly with acute coronary syndromes. European Heart Journal. 2006;27(13):1558-1564.

18. van Diepen S, Chen AY, Wang TY, et al. Influence of heart failure symptoms and ejection fraction on short- and long-term outcomes for older patients with non–ST-segment elevation myocardial infarction. American Heart Journal. 2014 2014/02/01/;167(2):267-273.e261.

19. Lee D, Goodman SG, Fox KAA, et al. Prognostic significance of presenting blood pressure in non–ST-segment elevation acute coronary syndrome in relation to prior history of hypertension. American Heart Journal. 2013 2013/10/01/;166(4):716-722.

20. Roe MT, Chen AY, Thomas L, et al. Predicting long-term mortality in older patients after non–ST-segment elevation myocardial infarction: The CRUSADE long-term mortality model and risk score. American Heart Journal. 2011 2011/11/01/;162(5):875-883.e871.