BRITISH JOURNAL OF HOSPITAL MEDICINE

ARTICLE

Differential Impacts of Invasive Percutaneous Coronary Intervention and Conservative Strategy on Elderly Patients with Non-ST-Segment Elevation Myocardial Infarction: An Analysis of Short-Term and Long-Term Survival

Xinjian Li[1], Fadong Li[1], Yue Wang[1], Rui Meng[2], Shen Wang[1], Song Li[3], Xiaofan Wu[1,*]

[1]Department of Cardiology, Beijing Anzhen Hospital, Capital Medical University, Beijing, China
[2]Department of Geriatric, Aerospace Center Hospital, Beijing, China
[3]Department of Cardiology, Cao County People's Hospital, Heze, Shandong, China
*Correspondence: dorwuxf@163.com (Xiaofan Wu)

Abstract

Aims/Background The present study investigated the short-term and long-term outcomes of an invasive strategy in percutaneous coronary intervention (PCI) and a conservative strategy in non-ST-segment elevation myocardial infarction (NSTEMI) patients older than 80 years, with the aim to identify the strategy that is more beneficial than the other to this demographic population.
Methods A total of 139 patients from Beijing Anzhen Hospital and the Cao County People's Hospital were included in this study, comprising those aged >80 years and diagnosed with NSTEMI between 2017 and 2022. The main observation indicator was all-cause death, whereas the secondary indicators included composite endpoint events of recurrent myocardial infarction, need for urgent revascularization, recurrent angina, stroke, death, and major bleeding.
Results Among these participants, 72 patients received PCI while the rest (n = 67) received the conservative treatment. Compared to patients who received the conservative treatment, patients who received PCI had significantly lower rates of all-cause mortality during hospitalization and 30 days of follow-up.
Conclusion Our findings support that patients older than 80 years with NSTEMI can benefit from PCI compared to the conservative treatment.

Key words: outcome; non-ST-segment elevation myocardial infarction (NSTEMI); conservative strategy; percutaneous coronary intervention (PCI)

Submitted: 9 May 2024 Revised: 3 August 2024 Accepted: 5 August 2024

How to cite this article:
Li X, Li F, Wang Y, Meng R, Wang S, Li S, Wu X. Differential Impacts of Invasive Percutaneous Coronary Intervention and Conservative Strategy on Elderly Patients with Non-ST-Segment Elevation Myocardial Infarction: An Analysis of Short-Term and Long-Term Survival. Br J Hosp Med. 2024. https://doi.org/10.12968/hmed.2024.0241

Introduction

A patient's clinical outcome can be impacted by one's age, gender, educational level, distance between residence and treating hospital, choice of transportation, distinctiveness of disease symptoms, understanding of the disease, and presence of chronic cardiovascular diseases, all of which would also affect the timeliness of treatment. Delayed treatment can lead to poorer prognosis. The populations of both the world and China are experiencing rapid ageing, leading to an ever-expanding elderly population. The World Health Organization predicts that in the next two decades, the number of deaths from coronary heart disease will increase by 1–1.5

times, and individuals with an average age of 80 years are expected to live for another nine years (McKay and Mensah, 2005). Patients aged 80 years or older with non-ST-segment elevation myocardial infarction (NSTEMI) account for a large proportion of those with acute coronary syndromes (ACS) and readmissions; most are associated with frailty, a decline in cognition and function, and comorbidities.

In the last decade, many trials have shown that the treatments tested contributed to better short- and long-term outcomes (e.g., fewer deaths), a result that was mainly attributable to younger patients (median age of 65 years) and male patients (Alexander et al, 2007; Avezum et al, 2005; Brieger et al, 2004; Garg et al, 2018) recruited in these trials. However, older patients are underrepresented in most of these trials. Elderly patients over the age of 80 are also unlikely to receive invasive interventional treatments recommended by existing guidelines, because it has been estimated that they are at increased risk for major comorbidities and surgical complications (including death) compared to younger patients (Little and Johnstone, 2007). Current guidelines such as those by the European Society of Cardiology (ESC) and American Heart Association (AHA) do not provide a clear invasive strategy applicable for treating elderly patients older than 80 years with NSTEMI. Additionally, a lack of representation of patients older than 80 years in expert consensuses and large randomized controlled trials impede the efforts to delineate clear clinical benefits of these treatments for this particular age group of patients (Amsterdam et al, 2014; Hamm et al, 2011).

There have been only a few observational studies that supported utilizing an invasive strategy in octogenarians with NSTEMI in favour of using a conservative strategy (Kaura et al, 2020; Reinius et al, 2018; Sui et al, 2019; Nguyen et al, 2020). To date, only one randomized controlled trial has been published for NSTEMI patients over 80 years old, with an average follow-up of 1.53 years. This study concluded that percutaneous coronary intervention (PCI) could significantly reduce the composite endpoint events (all-cause mortality, recurrence of myocardial infarction, stroke, etc.) compared to conservative treatment strategies. Additionally, there was no statistical difference in bleeding complications between the two groups (Tegn et al, 2016). Due to the lack of clinical trials and real-world data, the best management strategy for elderly patients over 80 years of age with NSTEMI is still a subject of debate.

The main purpose of this retrospective study was to compare the short- and long-term outcomes of PCI or conservative strategies in NSTEMI patients over 80 years of age and to investigate whether PCI is more beneficial in terms of clinical outcomes than conservative treatment to this demographic population. The research was conducted in strict accordance with the ethical principles outlined in the Declaration of Helsinki.

Methods

Patients

From 2017 to 2022, 139 elderly patients with NSTEMI aged $>$80 years were recruited in Beijing Anzhen Hospital and Cao County People's Hospital, China, for this retrospective study. In this study, NSTEMI is defined in terms of the typical ischemic symptoms, i.e., elevated levels of cardiac troponin-I (cTnI) or creatine kinase-MB and no evidence of ST-segment elevation in electrocardiogram (Hamm et al, 2011). The inclusion criteria for this study were: (1) participants exhibiting characteristic electrocardiogram (ECG) abnormalities, which include ST-segment depression, transient ST-segment elevation, and T-wave changes; and (2) participants with elevated cTnI levels or a rise and subsequent fall in cTnI levels, with at least one measurement exceeding the upper limit of normal. Patients presenting with chest pain were excluded from the study if they exhibited any of the following conditions: (1) aortic dissection, (2) pulmonary embolism, (3) renal insufficiency, (4) heart failure, and (5) myocarditis. Patients were divided into two groups: the conservative treatment group and the invasive treatment group.

Procedures

The invasive strategies described in this study included coronary stent implantation or coronary balloon dilatation, while the conservative strategy was only optimal medical therapy. Coronary angiography and percutaneous revascularization were performed in compliance with the existing clinical practice guidelines and expert consensus documents created by experienced cardiologists. Aspirin (HJ20160685, Bayer Healthcare Manufacturing S.p.A., Garbagnate, Milan, Italy) and clopidogrel (HJ20171237, Sanofi Winthrop industrie, Hangzhou, China)/ticagrelor (H202170337034, AstraZeneca Pharmaceutical Co., Ltd, Wuxi, China) were used for antiplatelet treatment in the two groups (the conservative treatment group and the invasive treatment group).

Data Collection

Baseline data of patients were collected from medical records. Follow-up was conducted through phone calls, with the final follow-up being conducted on 1 January 2022. The outcomes of the current study were defined as death or adverse events that occurred prior to the scheduled telephone follow-up on 1 January 2022.

Primary and Secondary Outcomes

The primary outcomes were short- and long-term all-cause mortality. Secondary outcomes were composite endpoint events of recurrent myocardial infarction, need for urgent revascularization, recurrent angina, stroke, and major bleeding during short-term (30 days) and long-term (median = 1.3 years) follow-up. Major bleeding, including pericardial tamponade, cerebral hemorrhage, gastrointestinal bleeding (>50 g/dL fall in hemoglobin levels), or intracranial bleeding, may lead to death. Reinfarction was defined as new cardiac symptoms combined with a rise in troponin exceeding the 99th percentile of a normal population documented at the local laboratory at each participating site. Periprocedural myocardial infarction (type 4a) was defined as a rise in creatine kinase-MB or troponins to three times the 99th percentile, assuming normal biomarkers before the procedure. The need for urgent revascularization was defined as increasing angina pectoris symptoms despite optimal medical treatment with or without ECG changes, as judged by cardiologists in community hospitals. Stroke was defined as a new focal neurological deficit of vascular origin lasting more than 24 hours (Amsterdam et al, 2014; Hamm et al, 2011). Patients received follow-up for data on all-cause mortality from the admission date until death or until 1 January 2022, whichever came first. For bleeding, reinfarction, recurrent angina, and stroke, patients were followed up from the admission date until 1 January 2022.

Statistical Analysis

The data obtained from this study were analyzed using SPSS (Version 22, IBM Corp., Armonk, NY, USA) and R software (Version 4.1.3, R Foundation for Statistical Computing, Vienna, Austria). Shapiro-Wilk test was used to assess the data conformance to normal distribution. For the continuous variables, normally distributed data are expressed as mean $\pm$ standard deviation and were analyzed using a *t*-test. Data that do not conform to the normal distribution are presented as a median and interquartile range, and were analyzed using the Mann-Whitney U test. Data of categorical variables are expressed as frequencies and percentages, and were analyzed using the Chi-square test or Fisher's exact test. We also used univariate and multivariate logistic regression analyses to investigate the influencing factors of the invasive treatment group. Variables in univariate logistic regression analyses with $p < 0.1$ were included for the subsequent multivariate logistic regression analyses. The multivariate logistic regression was conducted using a forward stepwise (likelihood ratio (LR)) approach. A Kaplan-Meier curve was plotted to depict survival probability, and statistical differences were determined using the log-rank test. Univariate and multivariate Cox proportional hazards analyses were performed to examine the impact of PCI on the study's main results. Variables in the univariate Cox proportional hazards analyses with $p < 0.15$ were included in the multivariate analyses. The multivariate Cox proportional hazards analyses were conducted using a stepwise approach. The findings are presented as hazard ratios (HR) with 95% confidence intervals (CI). A two-sided significance level of 0.05 was used.

Results

A total of 139 participants were recruited, and all participants were divided into the conservative treatment group (n = 67) and the invasive treatment group (n = 72). There were significant differences between the two groups in terms of sex, systolic blood pressure, creatinine, glomerular filtration rate (GFR), global registry of acute coronary events (GRACE) score, aspirin use, low-molecular-weight heparin (LMWH) use, and participation in cardiac rehabilitation activity (Ba Duanjin). There were no significant differences in the other variables (Table 1).

In the invasive treatment group, 43 patients had triple-vessel lesions, 18 patients had two-vessel lesions, and 11 patients had single-vessel lesions. Additionally, 54 patients received either bare or drug-eluting stent implantations and 18 patients received either common balloon or drug-coated balloon dilation. Among them, 65 patients completed the operation with the radial artery approach, without manifesting any serious complications, such as arteriovenous fistula or radial artery

Table 1. Baseline and clinical characteristics of the study participants.

Characteristic	Invasive treatment group (n = 72)	Conservative treatment group (n = 67)	χ^2/Z/t	p-value
Age (years)	84.45 (82.8, 86.62)	84.6 (83.2, 87.8)	–0.58	0.564
Male	29 (40.3%)	42 (62.7%)	6.97	0.008
Weight (kg)	60 (55, 65.5)	61 (59.5, 65)	–0.13	0.897
Medical history				
MI	17 (23.6%)	18 (26.9%)	0.20	0.659
Angina	31 (43.1%)	24 (35.8%)	0.76	0.383
PCI	19 (26.4%)	16 (23.9%)	0.12	0.734
CABG	3 (4.2%)	3 (4.2%)	Fisher	>0.999
Hypertension	65 (90.3%)	53 (79.1%)	3.38	0.066
Type 2 diabetes	32 (44.4%)	36 (53.7%)	1.20	0.274
COPD	3 (4.2%)	6 (9.0%)	Fisher	0.313
Depression	3 (4.2%)	1 (2.7%)	Fisher	0.621
Stroke	28 (38.9%)	27 (40.3%)	0.03	0.865
Atrial fibrillation	14 (19.4%)	16 (23.9%)	0.40	0.525
Smoking	17 (23.6%)	26 (38.8%)	3.75	0.053
Blood pressure				
Systolic (mmHg)	133.01 ± 19.76	125.58 ± 23.05	2.04	0.043
Diastolic (mmHg)	70 (62.5, 78)	67 (60, 73.5)	–1.46	0.145
Killip class			6.55	0.088
I	33 (45.8%)	26 (38.8%)		
II	20 (27.8%)	12 (17.9%)		
III	13 (18.1%)	14 (20.9%)		
IV	6 (8.3%)	15 (22.4%)		
Ejection fraction (EF, %)	57.5 (47.75, 62)	58 (50, 60.5)	–0.11	0.916
Troponin level (TnI; ng/mL)	2.89 (1.06, 5.34)	1.85 (0.34, 6.23)	–1.07	0.285
Creatinine (mmol/L)	89.05 (71.78, 124.8)	104.3 (83.9, 144)	–2.30	0.022
GFR (mL/min per 1.73 m^2)	44.75 ± 18.46	38.24 ± 20.33	1.98	0.050
GRACE score	154.5 (140, 169)	170 (154.5, 190.5)	–3.78	<0.001
Medical treatment				
Aspirin	68 (94.4%)	56 (83.6%)	4.25	0.039
Clopidogrel	63 (87.5%)	57 (85.1%)	0.17	0.677
Ticagrelor	7 (9.7%)	5 (7.5%)	0.23	0.636
Warfarin	3 (4.2%)	1 (1.5%)	Fisher	0.621
Dabigatran or rivaroxaban	0 (0)	3 (4.5%)	Fisher	0.109
β blocker	42 (58.3%)	36 (53.7%)	0.30	0.585
Statins	71 (98.6%)	62 (92.5%)	Fisher	0.106
ACEI or ARB	25 (34.7%)	16 (23.9%)	1.96	0.161
Calcium channel blocker	17 (23.6%)	12 (17.9%)	0.68	0.409
Nitrates	57 (79.2%)	44 (65.7%)	3.18	0.074
LMWH	13 (18.1%)	24 (35.8%)	5.61	0.018
Cardiac rehabilitation (Ba Duanjin) *	65 (90.3%)	46 (68.7%)	10.09	0.001

Table 1. Continued.

Characteristic	Invasive treatment group (n = 72)	Conservative treatment group (n = 67)	$\chi^2/Z/t$	*p*-value
Coronary angiographic data				
Two-vessel disease	18 (25.0%)	NA		
One-vessel disease	11 (15.3%)	NA		
Calcification	39 (54.2%)	NA		
Revascularization therapy				
Stenting	54 (75%)	NA		
PTCA alone	18 (25%)	NA		
Vascular puncture access				
Radial access	65 (90.3%)	NA		
Femoral access	7 (9.7%)	NA		

MI, myocardial infarction; PCI, percutaneous coronary intervention; CABG, coronary artery bypass graft; COPD, chronic obstructive pulmonary disease; GFR, glomerular filtration rate; EF, ejection fraction; ACEI, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; LMWH, low-molecular-weight heparin; PTCA, percutaneous transluminal coronary angioplasty; NA, not applicable.
*Ba Duanjin is a traditional form of Chinese exercise primarily used as an early rehabilitation exercise for patients with acute myocardial infarction, and inducted as a new mode of hospital rehabilitation treatment for patients with early acute myocardial infarction.

occlusion—an indicator of the radial artery puncture route being a safe mode for elderly patients undergoing coronary interventional therapy.

During hospitalization, patients receiving the invasive treatment had significantly lower rates of the primary endpoint ((all-cause mortality of 5.6% (n = 4) in the invasive treatment group versus 19.4% (n = 13) in the treatment conservative group; HR 0.286, 95% CI 0.093–0.878, $p = 0.018$); Table 2).

During the short-term follow-up, the composite endpoint events such as reinfarction, need for urgent revascularization, recurrent angina pectoris, major bleeding, stroke, and death, occurred in 11 patients receiving the invasive treatment and in 21 patients treated with the conservative strategy (HR 0.417, $p = 0.019$). Two major bleeding events (gastrointestinal bleeding) occurred in the invasive group and two in the conservative group, all of which were related to the treatment using dual antiplatelet drugs (aspirin in combination with clopidogrel or ticagrelor) (Table 2).

During long-term follow-up, compared to the conservative strategy, the PCI treatment did not significantly reduce all-cause mortality (HR 0.764, $p = 0.471$) and composite endpoint events (HR 0.644, $p = 0.148$) (Table 2).

The Kaplan-Meier survival analyses of all-cause mortality and composite endpoint events showed that during the 30-day follow-up period, the incidence of death ($p = 0.019$) and composite outcome ($p = 0.015$) of patients in the invasive treatment group were lower than that of the conservative treatment group (Fig. 1).

During the long-term follow-up, the Kaplan-Meier survival analysis for all-cause deaths and the composite endpoint event showed no statistical difference between the invasive treatment group and the conservative treatment group (Fig. 2).

Table 2. Clinical outcomes of the participants during hospitalization, short- and long-term follow-up.

	Invasive treatment group (n = 72)	Conservative treatment group (n = 67)	Hazard ratio	*p*-value
During hospitalization				
All-cause mortality	4 (5.6%)	13 (19.4%)	0.286 (0.093–0.878)	0.018
Short-term follow-up (30 days)				
All-cause mortality	2 (2.8%)	9 (13.4%)	0.193 (0.042–0.894)	0.035
Composite endpoint events	11 (15.3%)	21 (31.3%)	0.417 (0.201–0.865)	0.019
Components of the composite endpoint				
Recurrent myocardial infarction	2 (2.8%)	3 (4.5%)	0.502 (0.084–3.015)	0.451
Recurrent angina	3 (4.2%)	7 (10.4%)	0.340 (0.088–1.320)	0.119
Stroke	2 (2.8%)	0 (0.0%)	4.546×10^8 (0.000–Inf)	0.999
Major bleeding	2 (2.8%)	2 (3.0%)	0.739 (0.104–5.253)	0.763
Cerebral hemorrhage	0 (0.0%)	1 (1.5%)	0.000 (0.000–Inf)	0.999
Gastrointestinal	2 (2.8%)	1 (1.5%)	1.462 (0.132–16.149)	0.757
Long-term follow-up (median 1.3 years)				
All-cause mortality	14 (19.4%)	15 (22.4%)	0.764 (0.368–1.588)	0.471
Composite endpoint events	20 (27.8%)	24 (35.8%)	0.644 (0.355–1.169)	0.148
Components of the composite endpoint				
Recurrent myocardial infarction	6 (8.3%)	8 (11.9%)	0.589 (0.202–1.717)	0.332
Recurrent angina	7 (9.7%)	7 (10.4%)	0.735 (0.256–2.107)	0.567
Stroke	2 (2.8%)	1 (1.5%)	1.496 (0.135–16.563)	0.743
Major bleeding	7 (9.7%)	8 (11.9%)	0.670 (0.239–1.873)	0.445
Cerebral hemorrhage	4 (5.6%)	2 (3.0%)	1.439 (0.263–7.872)	0.674
Gastrointestinal	4 (5.6%)	6 (9.0%)	0.513 (0.142–1.862)	0.310

Inf, Infimum.

In univariate survival analysis, only PCI, age and type 2 diabetes were significantly related ($p < 0.15$) to the all-cause mortality within 30 days (**Supplementary Table 1**). After adjusting for age and type 2 diabetes in multivariate survival analysis, PCI was still significantly related to all-cause mortality within 30 days (adjusted HR 0.189, 95% CI 0.041–0.875, $p = 0.033$) (**Supplementary Table 2**). The Cox proportional hazards models of PCI and other related factors of composite endpoint events indicate that only PCI, previous angina, type 2 diabetes, smoking and GRACE score were significantly related to the 30-day composite endpoint events (**Supplementary Table 1**). After adjusting for previous angina, type 2 diabetes, smoking and GRACE score for multivariate survival analysis, PCI remained significantly associated with composite endpoint events within 30 days (adjusted HR 0.469, 95% CI 0.224–0.985, $p = 0.045$) (**Supplementary Table 2**).

In the univariate Cox proportional hazards analysis of long-term follow-up data, although a few variables showed significant differences, PCI, the main study variable, did not show significant differences in all-cause mortality and composite

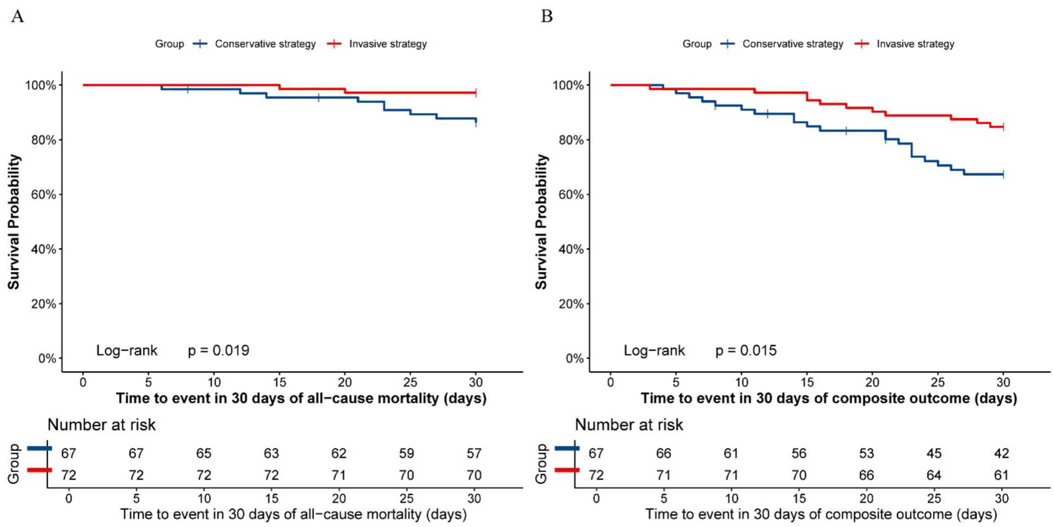

Fig. 1. Analysis of short-term follow-up results for two groups. (A) The Kaplan-Meier survival analysis of all-cause mortality during short-term follow-up (30 days) for both invasive (PCI) and conservative strategies. (B) The Kaplan-Meier survival analysis of composite outcome during short-term follow-up (30 days) for invasive (PCI) and conservative strategies.

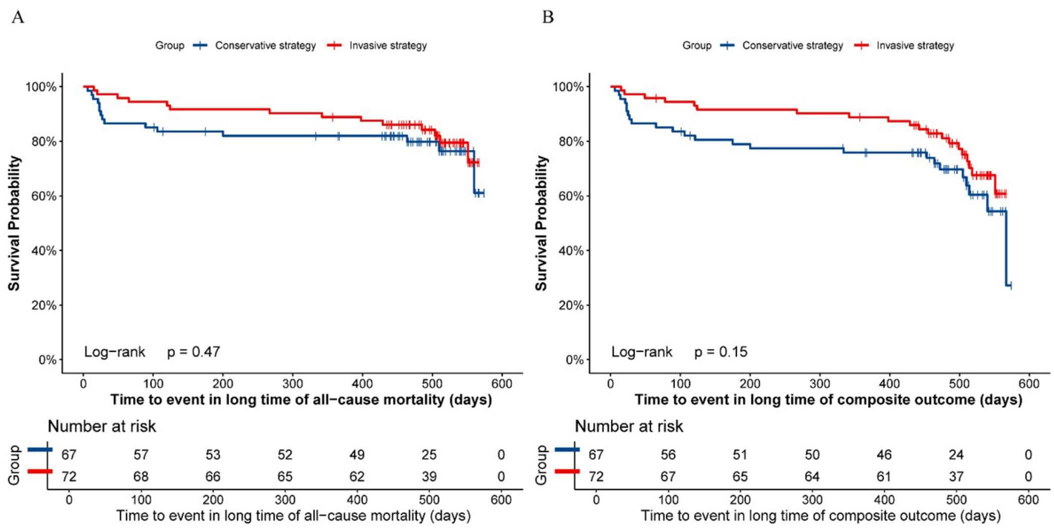

Fig. 2. Analysis of long-term follow-up results for two groups. (A) The Kaplan-Meier survival analysis of all-cause mortality during long-term follow-up (median 1.3 years) for both invasive (PCI) and conservative strategies. (B) The Kaplan-Meier survival analysis of composite outcome during long-term follow-up (median 1.3 years) for both invasive (PCI) and conservative strategies.

endpoint events ($p > 0.05$) (**Supplementary Table 3**). Therefore, the multivariate Cox proportional hazards analysis wasn't conducted.

Results of the univariate and multivariate analyses for influencing factors on PCI are shown in **Supplementary Tables 4,5**. Multivariate analysis showed that the male sex (OR = 0.422, 95% CI 0.205–0.869, p = 0.019), GRACE score (OR = 0.979, 95% CI 0.965–0.993, p = 0.004) and LMWH (OR = 0.411, 95% CI 0.179–0.942, p = 0.036) were independent protective factors of the invasive PCI strategy (**Supplementary Table 5**).

Discussion

Patients older than 80 years with NSTEMI tend to delay receiving treatments, potentially exacerbating their condition and disease prognosis. Since NSTEMI patients of this age group constitute a growing proportion of the population, developing treatment for this disease is imperative (Bach et al, 2004; Damman et al, 2012), as this particular patient group suffers from various frailties, cognitive and functional impairments, and experiences a situation where standard guidelines and expert consensus on treating the disease are basically lacking (Sui et al, 2019). It is worthy to note that the management strategies applied to treating NSTEMI in elderly patients older than 80 years are not evidence-based.

To date, only two small randomized trials (After Eighty and Italian Elderly ACS Trial) and two small subgroup analyses of randomized trials (Treat Angina with Aggrastat and Determine Cost of Therapy with an Invasive or Conservative Strategy-Thrombolysis in Myocardial Infarction (TIMI) 18 (TACTICS-TIMI 18) and FIR) had investigated if invasive treatment is superior to conservative treatment for NSTEMI in patients aged 75–80 years or older (Bach et al, 2004; Damman et al, 2012; Savonitto et al, 2012; Tegn et al, 2016). In the After Eighty study, there was a significant reduction of composite events in the invasive strategy group compared to the conservative strategy group after a median follow-up of 1.53 years. Efficacy of the invasive strategy was decreased with increasing age (after adjusting for creatinine and effect modification). There were no differences between the two groups when it came to bleeding complications (Tegn et al, 2016). According to Italian Elderly ACS study, there was a significant reduction in primary outcomes (death, myocardial infarction, stroke, and readmission due to cardiovascular causes) in the invasive strategy group compared to the conservative strategy group after one year of treatment (HR 0.43, 95% CI 0.23–0.80) (Savonitto et al, 2012). Some retrospective studies (Fuwai Hospital, Beijing, China [invasive group, n = 69; and non-invasive group, n = 121]; Thong Nhat Hospital, Ho Chi Minh City, Vietnam [invasive group, n = 42; and non-invasive group, n = 78]; SENIOR-NSTEMI [invasive group, n = 836; and non-invasive group, n = 1039]) proved that elderly NSTEMI patients could benefit more from the invasive strategy than the conservative strategy (Kaura et al, 2020; Reinius et al, 2018; Sui et al, 2019; Nguyen et al, 2020). However, the latest meta-analysis revealed that in elderly patients with NSTEMI, when compared with conservative medical therapy, revascularization therapy's ability to reduce long-term mortality is unclear (OR 0.84, 95% CI 0.66–1.06; $p = 0.15$) (Gnanenthiran et al, 2017). Given that the 95% CI of our findings is relatively wide and not precise enough, we may need to replicate the study to improve the accuracy of the confidence interval estimate.

The results of our study show that for elderly patients above 80 years of age with NSTEMI, an invasive strategy is clinically more beneficial than a conservative strategy in reducing mortality during hospitalization and during short-term follow-up (30 days). Invasive strategies were also found to be more effective in reducing composite endpoint events during short-term follow-up (30 days).

Univariate and multivariate Cox proportional hazards analyses of our study showed that the relationship between PCI and all-cause mortality during short-term follow-up (30 days) was still significant after adjusting for age and type 2 diabetes in multivariate survival analysis (adjusted HR 0.189, 95% CI 0.041–0.875, p = 0.033). The Cox proportional hazards models of PCI and other related factors regarding composite endpoint events indicate that only PCI, previous angina, type 2 diabetes, smoking and GRACE score were significantly related to the 30-day composite endpoint events. After adjusting for previous angina, type 2 diabetes, smoking and GRACE score in multivariate survival analysis, PCI remained significantly related to composite endpoint events within 30 days (adjusted HR 0.469, 95% CI 0.224–0.985, p = 0.045). In the univariate Cox proportional hazards analysis of long-term follow-up data, although a few other variables showed significant differences, PCI, being the principal variable, did not show significant differences in all-cause mortality and composite endpoint events ($p > 0.05$). Therefore, a multivariate Cox proportional hazards analysis was not implemented. However, the current Cox model encompassed a very limited number of parameters without taking into account cognitive impairment—a common medical condition among older patients. Therefore, the prognostic prediction ability of this model warrants further improvement.

Univariate and multivariate regression analyses conducted in this study unveiled that male sex (OR = 0.422, 95% CI 0.205–0.869, p = 0.019), LMWH use (OR = 0.411, 95% CI 0.179–0.942, p = 0.036) and GRACE score (OR = 0.979, 95% CI 0.965–0.993, p = 0.004) were independently influential on the invasive strategy, indicating that male sex, LMWH use and GRACE score are protective factors of the invasive strategy. According to current research, age and GRACE score are strong predictors of adverse cardiovascular events in elderly patients with acute coronary syndrome (Dos Santos Cerqueira Junior et al, 2018; Eagle et al, 2004; Granger et al, 2003; Trantalis et al, 2019).

In the present study, there was no difference in complications due to the incidence of bleeding (Valgimigli et al, 2015) between the invasive and conservative treatment groups. This lack of disparity may be partially attributed to the usage of an antithrombotic treatment by both treatment groups (Table 1) and the utilization of vascular puncture access (90.3%) in the catheter laboratory (Valgimigli et al, 2015). The results of this study support the use of invasive strategies for patients older than 80 years with NSTEMI with the aim to reduce mortality and composite endpoint events during hospitalization and short-term follow-up (30 days). However, due to the small number of people over the age of 90 enrolled in this study, the effectiveness of invasive strategy for individuals in nonagenarians remains uncertain.

Limitations

The main limitation of our study was the small sample size. Therefore, further multi-center and large-sample clinical studies are needed to support our conclusions.

Conclusion

In conclusion, our findings support that patients older than 80 years with NSTEMI can benefit from PCI treatment. Invasive strategies, such as PCI, can significantly reduce all-cause mortality and composite endpoint events within 30 days compared to a more conservative strategy. Additionally, it is worthy to highlight that PCI may not be significantly more effective than its conservative counterpart in reducing in mortality in the long term.

Key Points

- The ESC and AHA guidelines failed to provide a clear invasive strategy to treat elderly patients older than 80 years with NSTEMI.
- It is crucial to investigate whether patients over 80 years of age with NSTEMI can benefit from the invasive PCI strategy.
- Patients older than 80 years with NSTEMI represent a heterogeneous group suffering from various frailties, as well as cognitive and functional impairments.

Availability of Data and Materials

All the data of this study are included in this article.

Author Contributions

XL, SL, and SW were responsible for the study design, participant recruitment, and data collection. XL, FL, YW, and RM were responsible for the implementation of the interventions. XL, SL, SW, FL, YW, RM, and XW were involved in data analysis and interpretation. XL, SL, and XW drafted the manuscript. All authors contributed to important editorial changes of important content in the manuscript. All authors read and approved the final manuscript. All authors have participated sufficiently in the work and agreed to be accountable for all aspects of the work.

Ethics Approval and Consent to Participate

The Ethics Committee of Beijing Anzhen Hospital has approved our clinical research application (Ethical code: KS2022017). Every patient signed an Informed Consent, and if the patient lost the ability to sign, their legal representative signed the Informed Consent.

Acknowledgement

Not applicable.

Funding

This research received no external funding.

Conflict of Interest

The authors declare no conflict of interest.

Supplementary Material

Supplementary material associated with this article can be found, in the online version, at https://www.magonlinelibrary.com/doi/suppl/10.12968/hmed.2024.0241.

References

Alexander KP, Newby LK, Cannon CP, Armstrong PW, Gibler WB, Rich MW, et al. Acute coronary care in the elderly, part I: Non-ST-segment-elevation acute coronary syndromes: a scientific statement for healthcare professionals from the American Heart Association Council on Clinical Cardiology: in collaboration with the Society of Geriatric Cardiology. Circulation. 2007; 115: 2549–2569. https://doi.org/10.1161/CIRCULATIONAHA.107.182615

Amsterdam EA, Wenger NK, Brindis RG, Casey DE, Jr, Ganiats TG, Holmes DR, Jr, et al. 2014 AHA/ACC Guideline for the Management of Patients with Non-ST-Elevation Acute Coronary Syndromes: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Journal of the American College of Cardiology. 2014; 64: e139–e228. https://doi.org/10.1016/j.jacc.2014.09.017

Avezum A, Makdisse M, Spencer F, Gore JM, Fox KAA, Montalescot G, et al. Impact of age on management and outcome of acute coronary syndrome: observations from the Global Registry of Acute Coronary Events (GRACE). American Heart Journal. 2005; 149: 67–73. https://doi.org/10.1016/j.ahj.2004.06.003

Bach RG, Cannon CP, Weintraub WS, DiBattiste PM, Demopoulos LA, Anderson HV, et al. The effect of routine, early invasive management on outcome for elderly patients with non-ST-segment elevation acute coronary syndromes. Annals of Internal Medicine. 2004; 141: 186–195. https://doi.org/10.7326/0003-4819-141-3-200408030-00007

Brieger D, Eagle KA, Goodman SG, Steg PG, Budaj A, White K, et al. Acute coronary syndromes without chest pain, an underdiagnosed and undertreated high-risk group: insights from the Global Registry of Acute Coronary Events. Chest. 2004; 126: 461–469. https://doi.org/10.1378/chest.126.2.461

Damman P, Clayton T, Wallentin L, Lagerqvist B, Fox KAA, Hirsch A, et al. Effects of age on long-term outcomes after a routine invasive or selective invasive strategy in patients presenting with non-ST segment elevation acute coronary syndromes: a collaborative analysis of individual data from the FRISC II - ICTUS - RITA-3 (FIR) trials. Heart. 2012; 98: 207–213. https://doi.org/10.1136/heartjnl-2011-300453

Dos Santos Cerqueira Junior AM, Pereira LGDS, Souza TMBD, Correia VCDA, Alexandre FKB, Sodré GS, et al. Prognostic Accuracy of the GRACE Score in Octogenarians and Nonagenarians with Acute Coronary Syndromes. Arquivos Brasileiros De Cardiologia. 2018; 110: 24–29. https://doi.org/10.5935/abc.20170175

Eagle KA, Lim MJ, Dabbous OH, Pieper KS, Goldberg RJ, Van de Werf F, et al. A validated prediction model for all forms of acute coronary syndrome: estimating the risk of 6-month postdischarge death in an international registry. JAMA. 2004; 291: 2727–2733. https://doi.org/10.1001/jama.291.22.2727

Garg A, Garg L, Agarwal M, Rout A, Raheja H, Agrawal S, et al. Routine Invasive Versus Selective Invasive Strategy in Elderly Patients Older Than 75 Years With Non-ST-Segment Elevation Acute Coronary Syndrome: A Systematic Review and Meta-Analysis. Mayo Clinic Proceedings. 2018; 93: 436–444. https://doi.org/10.1016/j.mayocp.2017.11.022

Gnanenthiran SR, Kritharides L, D'Souza M, Lowe HC, Brieger DB. Revascularisation compared with initial medical therapy for non-ST-elevation acute coronary syndromes in the elderly: a meta-analysis. Heart. 2017; 103: 1962–1969. https://doi.org/10.1136/heartjnl-2017-311233

Granger CB, Goldberg RJ, Dabbous O, Pieper KS, Eagle KA, Cannon CP, et al. Predictors of hospital mortality in the global registry of acute coronary events. Archives of Internal Medicine. 2003; 163: 2345–2353. https://doi.org/10.1001/archinte.163.19.2345

Hamm CW, Bassand JP, Agewall S, Bax J, Boersma E, Bueno H, et al. 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 (ACS) in patients presenting without persistent ST-segment elevation of the European Society of Cardiology (ESC). European Heart Journal. 2011; 32: 2999–3054. https://doi.org/10.1093/eurheartj/ehr236

Kaura A, Sterne JAC, Trickey A, Abbott S, Mulla A, Glampson B, et al. Invasive versus non-invasive management of older patients with non-ST elevation myocardial infarction (SENIOR-NSTEMI): a cohort study based on routine clinical data. Lancet. 2020; 396: 623–634. https://doi.org/10.1016/S0140-6736(20)30930-2

Little M, Johnstone C. Guidelines for the management of acute coronary syndromes 2006. The Medical Journal of Australia. 2007; 187: 372. https://doi.org/10.5694/j.1326-5377.2007.tb01291.x

McKay J, Mensah GA. The atlas of heart disease and stroke. World Health Organization: Geneva. 2005.

Nguyen TV, Bui KX, Tran KD, Le D, Nguyen TN. Non-ST elevation acute coronary syndrome in patients aged 80 years or older in Vietnam: An observational study. PLoS ONE. 2020; 15: e0233272. https://doi.org/10.1371/journal.pone.0233272

Reinius P, Mellbin L, Holzmann MJ, Siddiqui AJ. Percutaneous coronary intervention versus conservative treatment for non ST-segment elevation myocardial infarction in patients above 80 years of age. International Journal of Cardiology. 2018; 267: 57–61. https://doi.org/10.1016/j.ijcard.2018.05.078

Savonitto S, Cavallini C, Petronio AS, Murena E, Antonicelli R, Sacco A, et al. Early aggressive versus initially conservative treatment in elderly patients with non-ST-segment elevation acute coronary syndrome: a randomized controlled trial. JACC. Cardiovascular Interventions. 2012; 5: 906–916. https://doi.org/10.1016/j.jcin.2012.06.008

Sui YG, Teng SY, Qian J, Wu Y, Dou KF, Tang YD, et al. Invasive versus conservative strategy in consecutive patients aged 80 years or older with non-ST-segment elevation myocardial infarction: a retrospective study in China. Journal of Geriatric Cardiology. 2019; 16: 741–748. https://doi.org/10.11909/j.issn.1671-5411.2019.10.006

Tegn N, Abdelnoor M, Aaberge L, Endresen K, Smith P, Aakhus S, et al. Invasive versus conservative strategy in patients aged 80 years or older with non-ST-elevation myocardial infarction or unstable angina pectoris (After Eighty study): an open-label randomised controlled trial. Lancet. 2016; 387: 1057–1065. https://doi.org/10.1016/S0140-6736(15)01166-6

Trantalis G, Aggeli K, Toutouzas K, Synetos A, Latsios G, Drakopoulou M, et al. The prognostic value of CHA_2DS_2-VASc and GRACE risk scores in patients with ACS. Hellenic Journal of Cardiology. 2019; 60: 305–308. https://doi.org/10.1016/j.hjc.2018.03.001

Valgimigli M, Gagnor A, Calabró P, Frigoli E, Leonardi S, Zaro T, et al. Radial versus femoral access in patients with acute coronary syndromes undergoing invasive management: a randomised multicentre trial. Lancet. 2015; 385: 2465–2476. https://doi.org/10.1016/S0140-6736(15)60292-6