ORIGINAL RESEARCH

Assessing the Clinical Impact of Percutaneous Coronary Intervention in Patients with Acute Myocardial Infarction

Lin Cao, MM; Xiaojuan Yu, MM; Minmin Zhang, BD; Yebao Wang, MM; Jun Wang, PhD

ABSTRACT

Background • Percutaneous coronary intervention (PCI) has emerged as a pivotal intervention in reducing mortality among ST-segment elevation myocardial infarction (STEMI) patients.

Objective • This study aimed to evaluate the clinical effectiveness of PCI in the management of acute myocardial infarction (AMI).

Design • A retrospective study design was adopted.

Setting • The study was conducted at the Affiliated Taizhou People's Hospital of Nanjing Medical University.

Participants • A total of 126 AMI patients were selected and categorized into two groups based on their treatment regimen: the study group (n=76) underwent PCI, while the control group (n=50) received standard drug therapy.

Interventions • The control group was managed with conventional drug treatment, while the study group underwent PCI.

Primary Outcome Measures • The primary outcome measures included (1) N-terminal pro-B-type natriuretic peptide levels, (2) cardiac function, (3) total clinical effectiveness, (4) incidence of adverse cardiovascular events, and (5) quality of life.

Results • After treatment, both groups exhibited a reduction in N-terminal pro-B-type natriuretic peptide levels, with a more significant decrease observed in the study group compared to the control group ($P < .05$). Post-treatment left ventricular end-diastolic and end-systolic volumes decreased, while left ventricular ejection fraction increased in both groups. The study group exhibited more substantial improvements in these parameters compared to the control group ($P < .05$). The study group also demonstrated a higher total clinical effectiveness rate ($\chi^2 = 9.95$, $P < 0.05$) and a lower incidence of adverse cardiovascular events during follow-up ($P < .05$). Additionally, both groups reported an increase in quality-of-life scores, with the study group experiencing a more significant improvement ($P < .05$).

Conclusions • This study suggests that PCI, when applied in the clinical management of AMI patients, can significantly reduce N-terminal pro-B-type natriuretic peptide levels, enhance cardiac function, lower the occurrence of cardiovascular adverse events, and improve patients' overall quality of life. (*Altern Ther Health Med.* 2024;30(6):229-233).

Lin Cao, MM; Xiaojuan Yu, MM; Minmin Zhang, BD; Jun Wang, MM; Department of Emergency, The Affiliated Taizhou People's Hospital of Nanjing Medical University, Taizhou, Jiangsu, China. **Yebao Wang, PhD,** Department of Cardiovascular Medicine, The Affiliated Taizhou People's Hospital of Nanjing Medical University, Taizhou, Jiangsu, China.

Corresponding author: Jun Wang, PhD
E-mail: 15061008998@163.com

INTRODUCTION

Acute myocardial infarction (AMI), the most severe form of coronary syndrome, arises in patients experiencing myocardial ischemia or necrosis within the region perfused by the afflicted blood vessel.[1,2] AMI represents the leading cause of mortality among elderly patients diagnosed with acute coronary syndrome.[3] AMI is characterized by severe and prolonged chest pain, ECG changes, elevated cardiac biomarkers, and other symptoms, with a high emphasis on timely intervention for better outcomes. Risk factors include a history of heart disease, smoking, hypertension, diabetes, high cholesterol, and a family history of heart disease.[4]

Certain lifestyle aspects also act as risk factors for AMI, encompassing overwork, emotional stress, excessive food consumption, exposure to cold, constipation, and smoking, as well as heavy alcohol consumption.[5] The demographic shift towards an aging population, coupled with social and economic progress in China, has contributed to an increasing incidence of AMI. This demographic shift has led to an annual rise in the incidence of AMI in recent years, posing a significant threat to both the physical and mental well-being of the population.[6]

The clinical management of AMI prioritizes the swift restoration of myocardial blood perfusion, minimizing myocardial ischemia duration, mitigating the expansion of the infarcted area, limiting the extent of myocardial ischemia, and preserving cardiac function.[7,8] In the past, conventional drug therapies were frequently employed in clinical practice, yet they resulted in unsatisfactory therapeutic outcomes.[9]

Currently, percutaneous coronary intervention (PCI) is a commonly employed clinical approach for AMI.[10] This procedure involves the insertion of balloon catheters into the affected arteries, effectively restoring coronary blood flow, addressing artery obstructions and stenosis, and ameliorating myocardial ischemia. PCI is distinguished by its high vascular patency rates, low recurrence and complication rates, minimal invasiveness, and rapid patient recovery.[11] Furthermore, research has shown that PCI reduces the composite endpoint of death or AMI rehospitalization and lowers cardiac mortality.[12]

This paper presents an analysis of the clinical effectiveness of PCI in AMI patients. This study aims to provide insights into the potential benefits of PCI in improving patient outcomes and reducing cardiac mortality in individuals suffering from AMI.

MATERIALS AND METHODS

Study Design

This study utilized a retrospective design, examining the clinical outcomes of AMI patients treated with PCI compared to those receiving conventional drug therapy. Patient data collected from January 2017 to December 2020 were analyzed to assess the efficacy of PCI in improving AMI management. They were categorized into two groups: the study group (SG, n=76) and the control group (CG, n=50), based on their treatment modality.

Inclusion and Exclusion Criteria

Inclusion criteria were as follows: (1) Patients meeting the diagnostic criteria for AMI; (2) Patients and their family members provided informed consent by signing the necessary documentation. Exclusion criteria: (1) Individuals unable to tolerate surgical and therapeutic drugs, those not compliant with medical guidance, or who fail to cooperate with the necessary examinations; (2) Pregnant and lactating women; (3) Patients with severe pulmonary infections, liver or kidney diseases, and mental disorders were excluded.

Control Group (CG) Treatment

Patients in the CG received conventional drug therapy, which consisted of the following medications: oral ticagrelor (Zhengda Tianqing Pharmaceutical Group Co., LTD.) at a dosage of 180 mg per administration, aspirin (Bayer Healthcare Co. Ltd.) at a dosage of 300 mg per administration, and atorvastatin (Pfizer Inc.) at a dosage of 20 mg per administration. This treatment regimen was administered for a duration of 6 months.

Study Group (SG) Treatment

Patients in the SG underwent PCI. Emergency coronary angiography was performed through the right radial artery. The angiographic findings revealed no stenosis in the left main branch, safe occlusion proximal to the left anterior descending branch, no significant stenosis in the left circumflex branch and blunt margin branch, 50-60% stenosis in the proximal middle section of the right coronary artery, no stenosis in the distal segment, posterior branch of the left ventricle, and posterior descending branch. The coronary artery exhibited a normal origin and a dextral dominant distribution.

Treatment Procedure. During the procedure, the catheter was guided into position using EBU35, and the sion and runthrough guide wires were individually advanced to the distal anterior descending branch. Subsequently, a 25*15 mm balloon was inserted into the 8-atm occlusive segment of the anterior descending branch for predilation. Re-examination angiography revealed a residual stenosis of 70-80% in the near middle section of the anterior descending branch. A 3.0*35 mm Infiniti drug stent was then inserted and deployed in the proximal middle segment of the anterior descending branch for a duration of 6-9 seconds. Post-stent angiography demonstrated satisfactory dilation, complete resolution of the original stenosis, absence of dissection, and a blood flow status of thrombolysis in myocardial infarction 3 (TIMI3) in the anterior descending branch.

Observation Measures

Plasma N-terminal pro-B-type natriuretic peptide (NT-proBNP) Level. The NT-proBNP levels in both groups were compared before and 6 months post-treatment. A fasting 3 ml venous blood sample was obtained in the morning, centrifuged for 10 minutes, and the plasma was isolated. The NT-proBNP levels were quantified using an enzyme-linked immunosorbent assay (ELISA) provided by Beijing Kexing Zhongwei Biological Technology Co., LTD.

Cardiac Function Assessment. Toshiba Aplion500 intelligent color Doppler ultrasound was utilized to evaluate cardiac function in both groups before and 6 months after treatment. Key parameters assessed included left ventricular end-diastolic volume (LVEDV), left ventricular end-systolic volume (LVESV), and left ventricular ejection fraction (LVEF).

Total Clinical Effectiveness Rate. The total clinical effectiveness rate in both groups was compared 6 months post-treatment, categorized as follows: (1) Obvious Effect: Myocardial ischemia symptoms essentially disappeared, and electrocardiogram (ECG) monitoring showed normal results; (2) Effective: Patients exhibited noticeable improvement in myocardial ischemia symptoms, with significantly improved ECG monitoring; (3) Ineffective: Patients experienced no significant change or even worsening of myocardial ischemia symptoms. The total effective rate was calculated as the sum of the significant effective rate and the effective rate. Total Effective Rate = Significant Effective Rate + Effective Rate

Adverse Cardiovascular Events. Occurrence of adverse cardiovascular events, including angina pectoris, heart

failure, cardiogenic death, and reinfarction, was recorded during the one-year follow-up after discharge.

Quality of Life Assessment. Physical function, social function, cognitive function, emotional function, and role function in both groups were evaluated using the 36-item short-form (SF-36) score scale before and 6 months after treatment.[13] The SF-36 score ranged from 0 to 100, with higher scores indicating a better quality of life.

Statistical Analysis

Statistical analysis was conducted using SPSS 22.0 statistical software (IBM, Armonk, NY, USA). Measurement data were presented as mean ± standard deviation ($\bar{x} \pm s$), and a *t* test was employed for between-group comparisons. Count data were expressed as percentages, and the χ^2 test was utilized for comparisons between groups. A significance level of $P < .05$ was considered statistically significant.

RESULTS

Comparison of Baseline Characteristics

The comparison of general data between both groups revealed no statistically significant differences ($P > .05$), indicating comparability, refer to Table 1

NT-proBNP Levels in Both Groups

There was no significant difference in the NT-proBNP levels between both groups prior to treatment ($P > .05$), as depicted in Figure 1. However, after treatment, the NT-proBNP levels significantly decreased in both groups ($P < .05$), with the SG (410.37±41.29) exhibiting a notably lower level in comparison to the CG (521.09±52.08) ($P < .05$). These findings collectively indicate that PCI is more effective in reducing NT-proBNP levels in AMI patients.

Cardiac Function in Both Groups

There were no significant differences in LVESV, LVEDV, and LVEF levels between both groups prior to treatment ($P > .05$), as illustrated in Figure 2. However, after treatment, LVESV and LVEDV levels demonstrated a significant reduction ($P < .05$), while LVEF levels increased in both groups ($P < .05$). Particularly, LVESV and LVEDV levels in the SG (64.52±6.51 and 115.67±11.69) showed a noteworthy decrease compared to the CG (76.23±7.64 and 127.41±12.75), while LVEF levels in the SG (63.74±6.38) exhibited a significant increase relative to the CG (53.69±5.41) ($P < .05$). These findings collectively suggest that PCI is more effective in enhancing cardiac function in AMI patients.

Total Clinical Effectiveness Rate in Both Groups

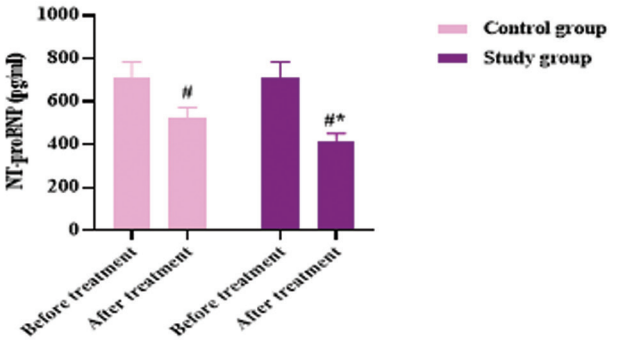
After treatment, the SG exhibited 53 patients with a notable therapeutic effect and 20 cases with effectiveness, resulting in a total effective rate of 96.05%. This rate was significantly higher than the CG, which had a total effective rate of 78.00% ($\chi^2 = 9.95$, $P < .05$), as shown in Figure 3). These findings collectively suggest that PCI had a more favorable clinical therapeutic impact on AMI patients.

Table 1. General Data of Patients in Both Groups

Index		Control Group (n = 50)	Study Group (n=76)	t/χ^2	*P* value
Gender (Male/Female)		32/18	50/26	0.04	.84
Average Age (Years)		67.38±6.32	67.35±6.28	0.03	.98
Average Time from Onset to Admission (min)		56±5	55±6	1.01	.31
Type of Infarction	Anterior or high lateral myocardial infarction	24	38	0.05	.97
	Inferior or inferior right ventricular infarction	18	26		
	Non-Q wave myocardial infarction	8	12		
Complicated Disease	Hyperlipidemia	26	41	0.15	.93
	Diabetes	24	43		
	Hypertension	25	40		
Cardiac Function Grade	Grade I	25	35	0.82	.84
	Grade II	10	18		
	Grade III	8	15		
	Grade IV	7	8		

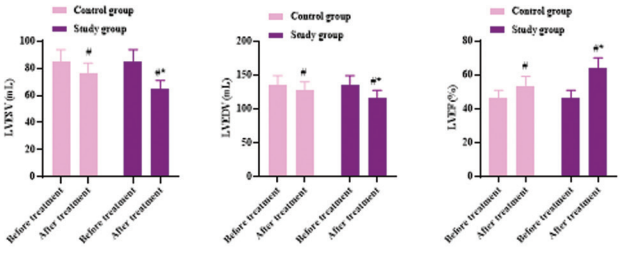
Note: Data presented as mean ± standard deviation for continuous variables and as counts for categorical variables. Type of infarction and complicated disease are presented as categorical variables, with counts provided for each category. Gender, type of infarction, and cardiac function grade were analyzed using chi-squared tests, while continuous variables, such as age and time from onset to admission, were assessed using independent *t* tests.

Figure 1. Changes in NT-proBNP Levels in Both Groups



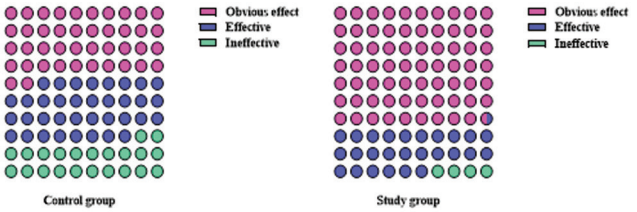
Note: Figure 1 illustrates the alterations in N-terminal pro-B-type natriuretic peptide (NT-proBNP) levels in both study groups. The symbol '#' denotes statistical significance ($P < .05$) when compared to the pre-treatment levels within the same group, while the symbol '*' signifies statistical significance ($P < .05$) when compared to the control group. NT-proBNP, a crucial cardiac biomarker, reflects changes in cardiac function and is an essential parameter for the diagnosis of acute myocardial infarction.

Figure 2. Cardiac Function Changes in Both Groups



Note: Figure 2 presents the alterations in cardiac function parameters in both study groups. The symbol '#' signifies statistical significance ($P < .05$) when compared to the pre-treatment levels within the same group, while the symbol '*' indicates statistical significance ($P < .05$) when compared to the control group. Cardiac function parameters include left ventricular ejection fraction (LVEF), left ventricular endsystolic volume (LVESV), and left ventricular enddiastolic volume (LVEDV). These parameters are pivotal indicators of cardiac performance and provide insights into myocardial function and recovery post-treatment.

Figure 3. Total Clinical Effective Rate in Both Groups



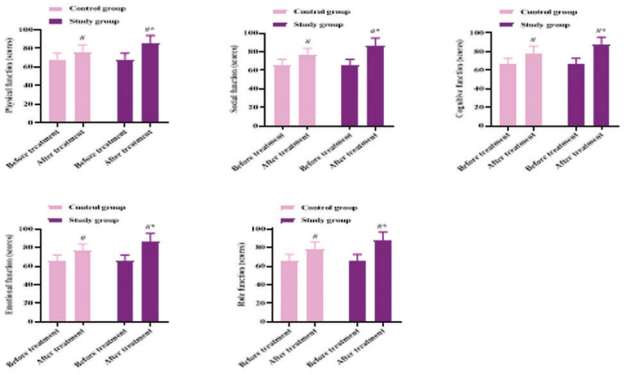
Note: Figure 3 illustrates the total clinical effective rate in both study groups, with color-coded categories representing patient outcomes. "Obvious effect" is denoted in pink, "effective" in blue, and "ineffective" in green. It reflects the combined success of interventions in improving cardiac health and quality of life.

Table 2. Adverse Cardiovascular Events in Both Groups [n (%)]

Groups	n	Angina Pectoris	Heart Failure	Cardiogenic Death	Reinfarction	Total Incidence Rate (%)
Control Group	50	4	6	5	3	18 (36.00%)
Study Group	76	3	4	2	1	10 (13.16%)
χ^2		9.10				
P value		<.05				

Note: Data presented as counts and percentages. Adverse cardiovascular events were categorized into angina pectoris, heart failure, cardiogenic death, and reinfarction. The total incidence rate represents the overall occurrence of adverse cardiovascular events.

Figure 4. SF-36 scores in Both Groups



Note: Figure 4 presents the SF-36 scores in both study groups. The symbol '#' indicates statistical significance ($P < .05$) when compared to the pre-treatment scores within the same group, while the symbol '*' signifies statistical significance ($P < .05$) when compared to the control group. SF-36, the 36-item short-form questionnaire, is a comprehensive tool used to assess various aspects of patient quality of life. This figure highlights changes in patients' well-being and quality of life after treatment.

Adverse Cardiovascular Events in Both Groups

During follow-up, the incidence of adverse cardiovascular events in the SG was 13.16%, which was significantly lower than the 36.00% observed in the CG ($P < .05$), as indicated in Table 2). These findings collectively suggest that PCI is more effective in reducing the occurrence of adverse reactions in AMI patients.

Quality of Life Scores in Both Groups

There were no differences in SF-36 scores between both groups prior to treatment ($P > .05$) refer to Figure 4. However, after treatment, SF-36 scores increased in both groups ($P < .05$), with those in the SG notably higher than the CG ($P < .05$). These findings collectively suggest that PCI is more effective in enhancing the quality of life for AMI patients.

DISCUSSION

AMI is a prevalent clinical condition, and its incidence has notably risen in recent years, with a trend toward affecting younger individuals. The disease is characterized by its severity, rapid progression, high disability rate, and fatality rate.[9-10] Delayed or inappropriate treatment may result in fatalities.[11] The primary focus of clinical management is to promptly address blood vessel occlusion, facilitating myocardial reperfusion, and minimizing the duration of myocardial ischemia.[12-15]

PCI is an innovative interventional therapy technique that builds upon percutaneous coronary angioplasty by addressing the limitations of balloon catheters. This approach includes procedures such as plaque rotatory excision aspiration, directed plaque myotomy, and coronary stent implantation.[16] In comparison to conventional drug therapy, PCI offers several advantages, including the preservation of viable myocardial function, reduction in infarct size, support for cardiac function recovery, and the provision of adequate time for subsequent treatment. Early-stage PCI can completely restore blood flow and myocardial perfusion, resulting in fewer residual stenosis vessels, significantly improved cardiac function, reduced reinfarction rates, and enhanced short- and long-term prognoses for AMI patients.[17]

NT-proBNP is a cardiac endocrine hormone primarily synthesized and secreted within the ventricular muscle.[18] Its level serves as a crucial diagnostic indicator for AMI.[19] Following AMI-induced acute myocardial ischemia, the sodium-titanium system in the myocardium rapidly activates, leading to increased BMP content. This change can effectively reflect alterations in cardiac function among patients.[20]

Furthermore, NT-proBNP possesses several noteworthy characteristics. It has a prolonged half-life, maintains consistently elevated levels, and exhibits minimal variation.[21] Additionally, NT-proBNP exerts diuretic effects, inhibits the sympathetic system, and reduces vascular tension. Ventricular remodeling, a process involving cardiomyocyte hypertrophy, apoptosis, and embryonic protein expression, is influenced by the heart's response to increased pressure. This elevated pressure leads to increased ventricular wall tension, subsequently resulting in heightened NT-proBNP secretion, conversion to BNP, promotion of nervous system excitability, and facilitation of ventricular remodeling.[22]

LVEF serves as a vital marker for ventricular ejection function and holds a distinct association with myocardial contractility. The greater the strength of myocardial contractility, the higher the output per cardiac cycle, resulting in an increased ejection fraction.[23] In this study, it was observed that after treatment, the NT-proBNP levels decreased in both groups, with the SG showing significantly lower levels compared to the CG. These findings suggest that PCI effectively achieves complete and rapid opening of the

infarct-related artery, facilitating the maximum rescue of ischemic myocardium. This process, in turn, reduces ventricular wall tension and mitigates ventricular remodeling. As a result, there is a reduction in the release of plasma NT-proBNP, a pattern consistent with previous studies.[24]

LVESV and LVEDV levels were significantly lower in the SG compared to the CG, while the LVEF level was notably higher in the SG than in the CG. The total effective rate reached 96.05% in the SG, which was significantly higher than the 78.00% rate observed in the CG, indicating that PCI effectively promotes cardiac function in AMI patients. Consistently, Malgorzata Sikora-Frac et al.[25] have also noted that PCI significantly improves left ventricular function.

In our study, the incidence of adverse cardiovascular events during follow-up was notably lower in the SG compared to the CG, underscoring the efficacy of PCI in treating AMI, in line with previous studies.[26] In general, the rationale behind this lies in the fact that compared to conventional drug treatment, PCI therapy is more effective in dilating coronary arteries, addressing coronary artery stenosis and occlusion, and expediting blood vessel recanalization and myocardial blood perfusion recovery.[27] Additionally, the post-treatment SF-36 quality of life scores in the SG were notably higher than those in the CG. This finding suggests that PCI enhances patients' quality of life and promotes early recovery, aligning with findings in prior literature.

Study Limitations

This study has certain noteworthy limitations. Firstly, it was a retrospective observational study confined to our hospital, which may introduce selection bias. Moreover, the sample size was restricted, potentially affecting the generalizability of the results. Additionally, the follow-up duration was relatively short, which could limit our understanding of long-term outcomes. To reinforce the robustness of our findings and address these limitations, future research should encompass larger, more diverse populations and more extended follow-up periods.

CONCLUSION

In conclusion, this study has highlighted significant insights into the clinical treatment of AMI. PCI emerges as a pivotal therapeutic approach, demonstrating its capacity to effectively lower NT-proBNP levels, enhance cardiac function, decrease the incidence of adverse cardiovascular events, and ultimately elevate patients' quality of life. The robust evidence presented here supports PCI as a highly recommended treatment modality for AMI patients in clinical practice. However, the careful consideration of contraindications remains paramount to ensure the efficacy and safety of treatment. This study underscores the critical need for further research to validate these findings on a larger scale and in diverse patient populations, ultimately advancing the field of AMI management.

ACKNOWLEDGEMENT

None

CONFLICT OF INTERESTS

The authors report no conflict of interest.

AVAILABILITY OF DATA AND MATERIALS

The data supporting the findings of this study are available from the corresponding author upon request, subject to reasonable conditions.

FUNDING

No funding was received.

REFERENCES

1. Reed GW, Rossi JE, Cannon CP. Acute myocardial infarction. *Lancet*. 2017;389(10065):197-210. doi:10.1016/S0140-6736(16)30677-8
2. Anderson JL, Morrow DA. Acute Myocardial Infarction. *N Engl J Med*. 2017;376(21):2053-2064. doi:10.1056/NEJMra1606915
3. Bhatt DL, Lopes RD, Harrington RA. Diagnosis and Treatment of Acute Coronary Syndromes: A Review. *JAMA*. 2022;327(7):662-675. doi:10.1001/jama.2022.0358
4. Gulati R, Behfar A, Narula J, et al. Acute Myocardial Infarction in Young Individuals. *Mayo Clin Proc*. 2020;95(1):136-156. doi:10.1016/j.mayocp.2019.05.001
5. Wereski R, Kimenai DM, Bularga A, et al. Risk factors for type 1 and type 2 myocardial infarction. *Eur Heart J*. 2022;43(2):127-135. doi:10.1093/eurheartj/ehab581
6. Damluji AA, van Diepen S, Katz JN, et al; American Heart Association Council on Clinical Cardiology; Council on Arteriosclerosis, Thrombosis and Vascular Biology; Council on Cardiovascular Surgery and Anesthesia; and Council on Cardiovascular and Stroke Nursing. Mechanical Complications of Acute Myocardial Infarction: A Scientific Statement From the American Heart Association. *Circulation*. 2021;144(2):e16-e35. doi:10.1161/CIR.0000000000000985
7. Dauerman HL, Goldberg RJ, Gore JM. Treatment options for acute myocardial infarction complicated by cardiogenic shock. *Cardiol Rev*. 2000;8(4):207-215. doi:10.1097/00045415-200008040-00006
8. Ibanez B, James S, Agewall S, et al; ESC Scientific Document Group. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation: the Task Force for the management of acute myocardial infarction in patients presenting with ST-segment elevation of the European Society of Cardiology (ESC). *Eur Heart J*. 2018;39(2):119-177. doi:10.1093/eurheartj/ehx393
9. Shah AH, Puri R, Kalra A. Management of cardiogenic shock complicating acute myocardial infarction: A review. *Clin Cardiol*. 2019;42(4):484-493. doi:10.1002/clc.23168
10. Bhatt DL. Percutaneous Coronary Intervention in 2018. *JAMA*. 2018;319(20):2127-2128. doi:10.1001/jama.2018.5281
11. Hoole SP, Bambrough P. Recent advances in percutaneous coronary intervention. *Heart*. 2020;106(18):1380-1386. doi:10.1136/heartjnl-2019-315707
12. Thrane PG, Kristensen SD, Olesen KKW, et al. 16-year follow-up of the Danish Acute Myocardial Infarction 2 (DANAMI-2) trial: primary percutaneous coronary intervention vs. fibrinolysis in ST-segment elevation myocardial infarction. *Eur Heart J*. 2020;41(7):847-854. doi:10.1093/eurheartj/ehz595
13. Bunevicius A. Reliability and validity of the SF-36 Health Survey Questionnaire in patients with brain tumors: a cross-sectional study. *Health Qual Life Outcomes*. 2017;15(1):92. doi:10.1186/s12955-017-0665-1
14. Henry TD, Tomey MI, Tamis-Holland JE, et al; American Heart Association Interventional Cardiovascular Care Committee of the Council on Clinical Cardiology; Council on Arteriosclerosis, Thrombosis and Vascular Biology; and Council on Cardiovascular and Stroke Nursing. Invasive Management of Acute Myocardial Infarction Complicated by Cardiogenic Shock: A Scientific Statement From the American Heart Association. *Circulation*. 2021;143(15):e815-e829. doi:10.1161/CIR.0000000000000959
15. Dai K, Shiode N, Nakano Y. Treatment Delays in Patients With Acute Myocardial Infarction. *Circ J*. 2022;86(4):609-610. doi:10.1253/circj.CJ-22-0033
16. Kandan SR, Johnson TW. Management of percutaneous coronary intervention complications. *Heart*. 2019;105(1):75-86. doi:10.1136/heartjnl-2017-311155
17. Banning AP, Baumbach A, Blackman D, et al. Percutaneous coronary intervention in the UK: recommendations for good practice 2015. *Heart*. 2015;101 Suppl 3(Suppl 3):1-13.
18. Cao Z, Jia Y, Zhu B. BNP and NT-proBNP as Diagnostic Biomarkers for Cardiac Dysfunction in Both Clinical and Forensic Medicine. *Int J Mol Sci*. 2019;20(8):1820. doi:10.3390/ijms20081820
19. von Lewinski D, Kolesnik E, Tripolt NJ, et al. Empagliflozin in acute myocardial infarction: the EMMY trial. *Eur Heart J*. 2022;43(41):4421-4432. doi:10.1093/eurheartj/ehac494
20. Tripolt NJ, Kolesnik E, Pferschy PN, et al; EMMY study group. Impact of EMpagliflozin on cardiac function and biomarkers of heart failure in patients with acute MYocardial infarction-The EMMY trial. *Am Heart J*. 2020;221:39-47. doi:10.1016/j.ahj.2019.12.004
21. Shen T, Yang X, Zhang Z. Positive Relationship of RDW with NT-proBNP and cTnI in Acute Myocardial Infarction Patients. *Clin Lab*. 2022;68(6). doi:10.7754/Clin.Lab.2021.210808
22. Jin L, Pan Y, Li Q, Li J, Wang Z. Elabela gene therapy promotes angiogenesis after myocardial infarction. *J Cell Mol Med*. 2021;25(17):8537-8545. doi:10.1111/jcmm.16814
23. Oprescu N, Micheu MM, Scafa-Udriste A, Popa-Fotea NM, Dorobantu M. Inflammatory markers in acute myocardial infarction and the correlation with the severity of coronary heart disease. *Ann Med*. 2021;53(1):1041-1047. doi:10.1080/07853890.2021.1916070
24. Fan H, Wang Y, Wang X, Dong X, Shao X, Yang F. Effect of Emergency Percutaneous Coronary Intervention Combined with Sacubitril and Valsartan on the Cardiac Prognosis in Patients with Acute Myocardial Infarction. *Int J Gen Med*. 2023;16:499-505. doi:10.2147/IJGM.S389216
25. Sikora-Frac M, Zaborska B, Maciejewski P, Budaj A, Bednarz B. Improvement of left ventricular function after percutaneous coronary intervention in patients with stable coronary artery disease and preserved ejection fraction: impact of diabetes mellitus. *Cardiol J*. 2021;28(6):923-931. doi:10.5603/CJ.a2019.0066
26. Park MW, Kim CJ, Kim MC, et al. A prospective, multicentre, randomised, open-label trial to compare the efficacy and safety of clopidogrel versus ticagrelor in stabilised patients with acute myocardial infarction after percutaneous coronary intervention: rationale and design of the TALOS-AMI trial. *EuroIntervention*. 2021;16(14):1170-1176. doi:10.4244/EIJ-D-20-00187
27. Cohen DJ, Van Hout B, Serruys PW, et al; Synergy between PCI with Taxus and Cardiac Surgery Investigators. Quality of life after PCI with drug-eluting stents or coronary-artery bypass surgery. *N Engl J Med*. 2011;364(11):1016-1026. doi:10.1056/NEJMoa1001508