An-Najah National University
Faculty of Graduate Studies

COMPARISON OF THE OUTCOMES BETWEEN PERCUTANEOUS CORONARY INTERVENTION ALONE AND PHARMACOINVASIVE CORONARY INTERVENTION AMONG ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION (STEMI) PATIENTS

By
Basel Khairy Ali Ma'ali

Supervisors
Dr. Jamal Qaddumi
Dr. Mohammad Hayek

This Thesis is Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Critical Care Nursing, Faculty of Graduate Studies, An-Najah National University, Nablus - Palestine.

2025

COMPARISON OF THE OUTCOMES BETWEEN PERCUTANEOUS CORONARY INTERVENTION ALONE AND PHARMACOINVASIVE CORONARY INTERVENTION AMONG ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION (STEMI) PATIENTS

By
Basel Khairy Ali Ma'ali

This Thesis was defended successfully on 03/02/2025 and approved by:

Dr. Jamal Qaddumi Supervisor	Signature
Dr. Mohammad Hayek Co-Supervisor	Signature
Dr. Emad Thulthain External Examiner	Signature
Dr. Ahmad Al-Aydeh Internal Examiner	Signature

Dedication

I would like to extend my deepest appreciation to Dr. Jamal Qaddumi and Dr. Mohammad Hayek for their exceptional guidance and invaluable feedback throughout my thesis work. Their expert advice was instrumental in shaping my research and bringing it to completion.

I am also profoundly grateful to the esteemed professors, doctors, and committee members who participated in my research. Their insightful contributions and feedback have significantly enhanced the quality of my work.

Furthermore, I wish to acknowledge all those who have contributed, directly or indirectly, to the development of this thesis. Their unwavering support, encouragement, and assistance have been of immense value, and I deeply appreciate their contributions. To each of them, I offer my enduring friendship, appreciation, and respect.

With immense gratitude to you all.

Acknowledgment

First and foremost, I am deeply grateful to God, the Almighty, for the countless blessings, wisdom, and opportunities that have allowed me to complete this thesis.

I owe a special debt of gratitude to Dr. Jamal Qaddumi, my supervisor, and Dr. Mohammad Hayek, my co-supervisor, for their invaluable guidance and support. Their extensive knowledge in research and the considerable time he dedicated to assisting me have been essential to the completion of my thesis. Their mentorship has been a cornerstone of my progress.

I would also like to acknowledge and thank all those who have supported me in various ways throughout my studies. Their encouragement, insights, and assistance have significantly enriched my research and made this thesis achievable.

Lastly, I extend my deepest appreciation to my parents and family. Their unwavering support and care have been a continuous source of strength and motivation. Their belief in me and encouragement throughout my academic journey have been fundamental to my success.

Declaration

I, the undersigned, declare that I submitted the thesis entitled:

COMPARISON OF THE OUTCOMES BETWEEN PERCUTANEOUS CORONARY INTERVENTION ALONE AND PHARMACOINVASIVE CORONARY INTERVENTION AMONG ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION (STEMI) PATIENTS

I declare that the work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification.

Student's Name: Basel Ma'ali

Signature: Basel Ma'ali

Date: 03/02/2025

Table of Contents

Dedication iii
Acknowledgment iv
Declaration v
Table of Contents vi
List of Tables viii
List of Figures ix
List of Appendices x
Abstract xi
Chapter One: Introduction and Literature Review 1
1.1 Background 1
1.2 Problem Statement 3
1.3 Significance of the Study 4
1.4 Aims of the Study 4
1.5 Research Questions 5
1.6 Hypotheses of the Study 6
1.7 Terms Definitions 7
1.7.1 Conceptual Definitions 7
1.7.2 Operational definitions 8
1.8 Literature Review 9
1.8.1 Introduction 9
1.8.2 Effectiveness and safety of different reperfusion strategies 9
1.8.3 Postoperative complications and acute kidney injury AKI) risk 10
1.8.4 Regional and hospital-specific comparisons of STEMI management 12
1.8.5 Summary and knowledge gap 14
Chapter Two: Methodology 16
2.1 Study Design 16
2.2 Site and Settings 16
2.3 Sample Population and Sampling 18
2.4 Inclusion and Exclusion Criteria 19
2.5 Study Tool and Protocol 19
2.6 Pilot Study 19
2.7 Data Analysis 19
2.8 Ethical Considerations 20

Chapter Three: Results 21
3.1 Introduction 21
3.1.1 Demographic data 21
3.1.2 Treatment approach and perioperative parameters 24
3.1.3 Laboratory tests and heart rate 25
3.1.4 Postoperative outcomes 29
3.3 Conclusion 33
Chapter Four: Discussion and Conclusion 34
4.1 Discussion of methods and sample characteristics of the study 34
4.2 Discussion of sample's characteristics and independent variables 37
4.3 Discussion of differences in laboratory results between study groups 40
4.4 Discussion of the postoperative complications across study groups 42
4.5 Conclusion 45
4.6 Recommendations 47
4.6.1 Recommendations for patients 47
4.6.2 Recommendations for healthcare providers 47
4.6.3 Recommendations for health institutions 48
4.7 Limitations 48
List of abbreviations 49
References 51
Appendices 61
الملخص .... ب

List of Tables

Table 1: Distribution of patients' demographic data and the differences between PCI and pharmacoinvasive groups 21

Table 2: Distribution of patients' medical and surgical histories and the differences between PCI and pharmacoinvasive groups 23

Table 3: Distribution of patients' echotomography findings and the differences between PCI and pharmacoinvasive groups 24

Table 4: Distribution of variables related to the treatment approach and perioperative parameters among the patients and between PCI and pharmacoinvasive patients 25

Table 5: Differences in preoperative laboratory tests results and heart rate between PCI and Pharmacoinvasive approaches 26

Table 6: Differences in postoperative laboratory tests results and heart rate between PCI and Pharmacoinvasive approaches 27

Table 7: Differences in preoperative-postoperative changes in laboratory tests results and heart rate between PCI and Pharmacoinvasive approaches 29

Table 8: Differences in specific postoperative complications and 30-day survival between PCI and Pharmacoinvasive approaches 30

Table 9: Differences in number of postoperative complications across patients' demographic factors 31

Table 10: D ifferences in number of postoperative complications across patients' medical factors 32

List of Figures

Figure 1: R equired sample size as calculated in G*Power 3.1 18

List of Appendices

Appendix A: Study Tool/ Abstract Sheet 61
Appendix B: I nstitutional Review Board [IRB] Form) 63
Appendix C: A pproval from Ministry of Health for Palestine Medical Complex) 64
Appendix D: Approval from An-Najah National University Hospital 65

COMPARISON OF THE OUTCOMES BETWEEN PERCUTANEOUS CORONARY INTERVENTION ALONE AND PHARMACOINVASIVE CORONARY INTERVENTION AMONG ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION (STEMI) PATIENTS

By
Basel Ma'ali
Supervisors
Dr. Jamal Qaddumi
Dr. Mohammad Hayek

Abstract

Background: Myocardial infarction is among the most diagnosed cardiological diseases in the whole world and in Palestine, and is managed mainly by invasive interventions to control or treat coronary artery occlusion, while some centers add tissue plasminogen activator to the plan in what so called pharmacoinvasive approach. The incidence of postoperative complications is inevitable, and therefore, the aim of the current study is to identify the most common complications compared between two myocardial infarction management approaches (percutaneous and pharmacoinvasive coronary interventions) in two tertiary centers in Ramallah and Nablus, and determine the most common risk factors associated with the differences between them.

Methodology: The study utilized retrospective cohort design on a randomized sample of 160 adult (30 – 75 years old) patients who were admitted to intensive care cardiology departments of Palestine Medical complex (for pharmacoinvasive approach) and An-Najah National University Hospital (for percutaneous coronary intervention approach). The researcher used a data sheet that was developed based on previous literature, and data were analyzed using software.

Results: Patients who underwent percutaneous coronary intervention ($n = 82$, 51.2%) were significantly older (mean = 59.8 ± 9.7 vs 56.2 ± 12.7) than pharmacoinvasive ($n = 78$, 48.8%). Catheter insertion site was mostly radial in percutaneous coronary intervention patients (95.1%) compared to pharmacoinvasive (15.4%), with no significant difference in MI location. Patients with percutaneous coronary intervention patients showed more significant decrease in white blood cells, low-density lipoprotein, high-density lipoprotein, triglyceride and heart rate, with more significant increase in troponin-I, and less increase in sodium, compared to pharmacoinvasive patients (p-value < 0.05)

between pre- and post-operative phases. All postoperative complications, except for upper gastrointestinal bleeding, and mortality rate were significantly higher among pharmacoinvasive patients (p-value < 0.05). Lastly, significantly more postoperative complications were found among patients with dyslipidemia, valve regurgitation and cardiac hypokinesia.

Conclusion: Patients who were treated with pharmacoinvasive approach showed higher postoperative complications and 30-day mortality rate. More research is needed in this area of cardiology management in Palestine. A prospective design is also recommended to be conducted for this topic in the future research.

Keywords: ST-elevation myocardial infarction; pharmacoinvasive; tissue plasminogen activator; complications.

Chapter One

Introduction and Literature Review

1.1 Background

Ischemic heart disease (IHD) is still one of the largest burden comorbidities that affects various levels, including individuals and health care resources. The pathophysiology of IHD is mostly determined by atherosclerotic plaque, but the recent literature emphasizes on the multifaceted mechanisms of IHD, like plaque activation and microvascular dysfunction, which requires the researchers and scientific community to adopt a broader understanding of the disease. Addressing the microvascular components in IHD, the related dysfunction is the key contributor to myocardial ischemia, and is independent of the obstructive role of plaques, therefore, it is increasingly recognized as the primary cause of angina and myocardial ischemia, and requires the shift in focus to microvascular and functional pathologies, instead of large-vessel atherosclerosis (Severino et al., 2020).

One of the leading causes of death in Palestine is acute coronary syndromes (ACS), and since the real classification of ACS is dependent on electrocardiographic presentation, i.e., the presence or absence of ST-segment elevation, there is a very broad range of clinical presentation. Once the possibility of ACS has been determined, emergency care for an acute chest discomfort must be provided using evidence-based protocols, which highlights that the assessment of ischemic and hemorrhagic risk is an important step in optimizing antithrombotic and anticoagulation treatment plans and determining the best time for revascularization (Bhatt et al., 2022).

Definition of myocardial infarction (MI)

In 2019, the European Society of Cardiology, American College of Cardiology, American Heart Association, and the World Heart Federation redefined the myocardial infarction (MI) in many definitions. At the first, MI is the presence of cardiac troponin values above the 99th percentile of the upper reference limit. Moreover, myocardial injury is defined according to the situations, including post-coronary intervention or with cardiovascular and non-cardiovascular disease. The presence of acute myocardial injury in the setting of myocardial ischemia is defined as acute MI. The presence of atherosclerotic plaque that

can lead to atherothrombotic coronary artery disease (CAD) which decrease the blood flow to the myocardium define as MI type one, while the acute myocardial injury related to imbalance between oxygen supply and demand secondary to stressors unrelated to acute coronary atherothrombosis is defines as MI type two. Other definitions of MI depend to history of patient, like heart failure (HF), accompanied by a new ischemia or electrocardiogram (ECG) change. Another definition relies on percutaneous coronary intervention (PCI)-related increase of cardiac troponin by more than 5 times, while other definition is myocardial ischemia related to stent thrombosis or MI related to restenosis, The last definition is coronary artery bypass graft (CABG) related to increase of cardiac troponin >10 times upper reference limit (Sandoval et al., 2020).

All patients who have positive cardiac troponin upper to the reference limit are defined as having ongoing myocardial damage, it can be acute, unstable or chronic. Those patients with acute damage are defined as having either acute myocardial infarction (AMI) or acute myocardial (non-ischemic) injury. The indications of having a cardiac ischemia include electrocardiographic changes, symptoms of myocardial ischemia, new loss of viable myocardium, evidence of coronary thrombus, and the context of the cTn elevation (spontaneous, peri-procedural) (Kaier et al., 2021).

Nadia and colleges in December 2017 studied cardiogenic shock (CS) that is caused after AMI, they discussed that the CS can be caused due to failure of the left ventricular (LV), and other parts of the circulatory system and diastolic function contribute to shock. They studied 4169 patients with MI and found that the incidence of CS is increased due to occurrence of early left ventricle dysfunction that led to increase the high long-term mortality (Aissaoui et al., 2018).

When one or more of the coronary arteries that provide blood to the myocardial tissues become obstructed, the result is an ST-elevation myocardial infarction (STEMI), and while plaque rupture, erosion, fissuring, or dissection that produces an obstructive thrombus is typically the cause of this sudden interruption of blood flow, factors related to dyslipidemia, diabetes mellitus, hypertension, smoking, and a family history of

coronary artery disease are the main risk factors for ST-elevation myocardial infarction (Akbar et al., 2022).

Besides the benefits, there are several side effects of PCI and alteplase for STEMI patients, including the increase in risk of bleeding and hemorrhagic stroke, acute kidney injury (AKI) for patient who treated by PCI intervention, nausea and vomiting related to alteplase given, allergy for the alteplase, … etc. (Balami et al., 2013). The aim of this study is to identify the most common complications compared between PCI and pharmacoinvasive coronary interventions among STEMI patients in two tertiary centers in Ramallah – Palestine (Palestine Medical Complex (PMC) and An-Najah National University Hospital (NNUH)) and determine the most common risk factors associated with the differences between them.

1.2 Problem Statement

According to the work experience, many of patients were admitted as case of STEMI from emergency department (ED), and are managed with thrombolytic agents as management after anticoagulant and antiplatelet medication which is taken in ED. The researcher caught attention about tPA and its side effects on the patient and which can lead to many complications that are lethal and can cause death. It was also observed that there is a scarcity in studies about the subject in Palestine and Arab countries. After reviewing several international articles about the subject, it was concluded that there is a negotiation about the best way of management for STEMI patients.

Moreover, the subject of interest was discussed with specialists in cardiology ward about tPA and catheterization for patients as plan to set new protocol of management. Many of them got IAH as an example for deferent way of management by doing catheterization for STEMI patient, and their advice was to compare between them to try for make a good and proper way for management because the cardiac catheterization can lead to many complications, including the above-mentioned incidences.

1.3 Significance of the Study

This research studies two protocols for the management of STEMI patients, and focuses on the incidence of several complications, including bleeding post tPA and AKI post PCI and ECG changes, and try to compare the effect and side and incidence of complications in two hospitals as way to decrease the complication for patient. The study can be considered a basis for future research to be conducted in Palestine, as a follow-up plan for monitoring incidence of such complications, as well as the establishment of specific guidelines that may help in directing the STEMI management to its best in different hospitals, in order to minimize complications, decrease patient's length of stay (LOS) and mortality, and increase patient's satisfaction level.

1.4 Aims of the Study

The aims to achieve the following objectives:

1. Determine the differences in demographic factors (age, gender, residency and social status) between STEMI patients who were treated with PCI and pharmacoinvasive approaches.

2. Determine the differences in past medical (DM, HTN, IHD, dyslipidemia, obesity, … etc.) and surgical (previous PCI, open heart surgeries, vascular surgeries, … etc.) histories and smoking status between STEMI patients who were treated with PCI and pharmacoinvasive approaches.

3. Determine the differences in echotomography findings (valvular disorders, cardiac muscle hypokinesia or hypertrophy, cardiomegaly and EF) between STEMI patients who were treated with PCI and pharmacoinvasive approaches.

4. Determine the differences in treatment aspects (insertion site and treatment timing) and location of MI between STEMI patients who were treated with PCI and pharmacoinvasive approaches.

5. Investigate the differences in preoperative and postoperative laboratory results (CBC, electrolytes, KFT, cardiac enzymes, lipid profile, coagulation profile, CRP, … etc.) between STEMI patients who were treated with PCI and pharmacoinvasive approaches.

6. Investigate the differences in pre-post operative changes in laboratory results between STEMI patients who were treated with PCI and pharmacoinvasive approaches.
7. Investigate the differences in postoperative incidence of specific complications (hematoma, hemorrhagic stroke, UGIB, epistaxis, hematemesis and stroke) and survival rate between STEMI patients who were treated with PCI and pharmacoinvasive approaches.
8. Investigate the differences in the number of postoperative complications across patients' demographic factors.

1.5 Research Questions

The study will try to answer the following questions:

1. Are there differences in demographic factors (age, gender, residency and social status) between STEMI patients who were treated with PCI and pharmacoinvasive approaches?
2. Are there differences in past medical (DM, HTN, IHD, dyslipidemia, obesity, … etc.) and surgical (previous PCI, open heart surgeries, vascular surgeries, … etc.) histories and smoking status between STEMI patients who were treated with PCI and pharmacoinvasive approaches?
3. Are there differences in echotomography findings (valvular disorders, cardiac muscle hypokinesia or hypertrophy, cardiomegaly and EF) between STEMI patients who were treated with PCI and pharmacoinvasive approaches?
4. Are there differences in treatment aspects (insertion site and treatment timing) and location of MI between STEMI patients who were treated with PCI and pharmacoinvasive approaches?
5. What are the differences in preoperative and postoperative laboratory results (CBC, electrolytes, KFT, cardiac enzymes, lipid profile, coagulation profile, CRP, … etc.) between STEMI patients who were treated with PCI and pharmacoinvasive approaches?

6. What are the differences in pre-post operative changes in laboratory results between STEMI patients who were treated with PCI and pharmacoinvasive approaches?
7. What are the differences in postoperative incidence of specific complications (hematoma, hemorrhagic stroke, UGIB, epistaxis, hematemesis and stroke) and survival rate between STEMI patients who were treated with PCI and pharmacoinvasive approaches?
8. What are the differences in the number of postoperative complications across patients' demographic factors?

1.6 Hypotheses of the Study

The study aims to test the following hypotheses:

H_0: There are no significant differences in demographic factors between STEMI patients who were treated with PCI and pharmacoinvasive approaches at a significance level of 0.05.

H_0: There are no significant differences in past medical and surgical histories and smoking status between STEMI patients who were treated with PCI and pharmacoinvasive approaches at a significance level of 0.05.

H_0: There are no significant differences in echotomography findings between STEMI patients who were treated with PCI and pharmacoinvasive approaches at a significance level of 0.05.

H_0: There are no significant differences in treatment aspects (insertion site and treatment timing) and location of MI between STEMI patients who were treated with PCI and pharmacoinvasive approaches at a significance level of 0.05.

H_0: There are no significant differences in preoperative and postoperative laboratory results between STEMI patients who were treated with PCI and pharmacoinvasive approaches at a significance level of 0.05.

H_0: There are no significant differences in pre-post operative changes in laboratory results between STEMI patients who were treated with PCI and pharmacoinvasive approaches at a significance level of 0.05.

H_0: There are no significant differences in postoperative incidence of specific complications and survival rate between STEMI patients who were treated with PCI and pharmacoinvasive approaches at a significance level of 0.05.

H_0: There are no significant differences in the number of postoperative complications across patients' demographic factors at a significance level of 0.05.

1.7 Terms Definitions

1.7.1 Conceptual Definitions

Tissue plasminogen activator (tPA): A medication that falls within the category of serine proteases, which are enzymes that cleave, i.e., break down, peptide links in proteins, and therefore, it is one of the key elements in the breakdown of blood clot, with the main job to catalyze the transformation of plasminogen into plasmin, which is the main enzyme that breaks up blood clots. These medications include, for example, reteplase, alteplase, and tenecteplase. tPA is indicated for the following conditions: myocardial infarction if there is a delay of more than 1 to 2 hours prior to percutaneous transluminal coronary angioplasty; pulmonary embolism in massive pulmonary embolisms, which causes severe instability due to high pressure on the heart; and ischemic stroke, which is the most common, in patients who present to the healthcare facility within 3 hours (4.5 hours in certain, eligible patients) after the onset of symptoms; in addition to thrombolysis (e.g., deep vein thrombosis). Therefore, it is very important for healthcare providers to be aware of the indications, mechanism of action, administration mechanism, adverse effects, contraindications, toxicity, and monitoring, of tPA agents, in which providers can integrate the interprofessional and multidisciplinary coordination for the optimal patient care and outcomes (Jilani & Siddiqui, 2022).

PCI: The purpose of percutaneous coronary intervention (PCI) is to increase blood flow to the ischemic region and relieve coronary artery constriction or blockage using a non-

surgical, invasive technique, in which a variety of techniques are used to accomplish, but the most popular methods are stent deployment to maintain the artery open or inflating the narrow part (Ahmad et al., 2022).

Pharmacoinvasive approach: Is conceptually defined as an alternative approach of PCI for the management of STEMI, when an immediate access to PCI is not available or feasible, and involves the administration of fibrinolytic therapy promptly after the diagnosis, which aims to restore blood flow, followed by PCI within a specific timeframe, typically within 24 hours, which addresses any remaining blockage to improve long-term outcomes (Araiza-Garaygordobil et al., 2021).

AKI: A disease defined according to the European Society of Urogenital Radiology guidelines as an increase of 25% in serum creatinine from baseline creatinine within 72 hours from contrast media administration (El-Ahmadi et al., 2019).

1.7.2 Operational definitions

PCI approach: For patients in NNUH who are primarily treated with PCI, the patient was admitted from ER as chest pain with peripheral cannula and ECG is done and seen by cardiology doctor then transfer to catheterization lab to do primary PCI, then the patient transfer to cardiac unit for monitoring hemodynamic and do ECG post catheterization and take blood sample.

Pharmacoinvasive approach: For patients in PMC who are treated primarily using the pharmacoinvasive approach, the patient was admitted from ER with chest pain as the chief complain, with peripheral cannula, set on bed and attached to cardiac monitor. Blood sample was taken as doctor requested and vital signs were taken as monitoring protocol and plan to keep blood pressure (BP) within the acceptable range for giving thrombolytic agent to decrease the risk of related complications, and do pre-intervention ECG, while if the patient complained of severe chest pain, the doctor requested to give the patient morphine according to pain score, then the doctor conducted cardiac echocardiogram for the patient before the STEMI management procedure, then the tPA was started as protocol (total dose for AMI is based on patient weight. Not to exceed 100 mg. start with 15 mg IV bolus over 1-2 minute then 0.75mg/kg IV infusion over 30 minute

(not to exceed 50 mg) and then 0.5mg/kg IV over next 60 minute (not to exceed 35mg over one hour), during that the nurse and doctor monitored the patient's hemodynamic parameters, and after one hour of tPA administration, the nurse did ECG and sent to doctor. Finally, the doctor reevaluated the patient's hemodynamic parameters and lab test, and did echocardiogram for the patient.

1.8 Literature Review

1.8.1 Introduction

The purpose of this literature review is to assess the latest and most related studies on the comparison between complications associated with two approaches of STEMI management: pharmacoinvasive and PCI. The main keywords that were used to find literature studies include: ST-elevation myocardial infarction, pharmacoinvasive, tissue plasminogen activator, complications, and were searched using PubMed, Google Scholar and ScienceDirect. The selection of articles was based on a set of criteria, including their publication date (last 5 years), and being published in rigorous journals in English version. The total number of literature articles found using the mentioned keywords exceeded 50 articles, in which they were pooled into 5 articles, while limited number of articles on this topic was found in Palestine and the Middle East region.

The management of STEMI is different from center to center, many centers use of pharmacological intervention, i.e., fibrinolytic agent for management wither the first 6 hour for the attack, other center uses of PCI intervention for the same type of patients, while others combine both in what so called pharmacoinvasive approach, and all of these interventions are useful, while having some side effects for patient. In conclusion, although it is effective for dissolving clot in the coronary artery, the time and other risk factor play an important point in management.

1.8.2 Effectiveness and safety of different reperfusion strategies

A meta-analysis was conducted by Fazel et al. (2020) in order to investigate the comparison of reperfusion strategies for STEMI, and it systematically reviewed trials to compare three strategies for management of STEMI using multivariate network meta-analysis to compare outcome between these strategies: fibrinolytic therapy alone, primary

percutaneous intervention alone, and pharmacoinvasive (fibrinolysis followed by routine early PCI within 24 hour. They collected the data from randomized controlled trials (RCTs) of patients with STEMI, presenting within 12 hours of symptom onset, and categorized the last approach as facilitated PCI when the median time interval between fibrinolysis to do PCI was led than two hour, and as pharmacoinvasive when this interval was above two hour, and they evaluated outcome of death, stroke, nonfatal reinfarction, and major type of bleeding by using multivariate network meta-analysis and Bayesian analysis. After evaluation they find that the PPCI was associated with the lowest risk of mortality and other complication like reinfarction and bleeding or stroke, when they compared with fibrinolytic therapy. The researchers explained that pharmacoinvasive approach is preferred as the next strategy after PPCI, and then fibrinolysis alone can put the patient on the high risk of bleeding and other complication. But as conclusion of study they observe that PPCI is safe and preferred for management but if not available, the pharmacoinvasive have superior to fibrinolysis alone for treatment.

1.8.3 Postoperative complications and acute kidney injury AKI) risk

Moreover, Yuan et al. (2017) conducted a study to investigate the risk factors of contrast-induced acute kidney injury (CI-AKI) in patients undergoing emergency PCI at Fuwai hospital in China from January 2013 to June 2015, including a total number of 1061 patients. They divided the patient in two group: CI-AKI and non-CI-AKI, and univariable and multivariable tests were taken, while they defined AKI as increase of serum creatinine of more than 0.5mg/dL within 3 days after exposure to contrast. The inclusion criteria were the patients who were undergoing emergency PCI and exclusion criteria were the patients who contact with contrast medium < 1 weak before procedure , patient who has allergy to iodinated contrast medium and patient who have severe heart failure and serious valvular heart disease or hemodynamic instabilityand patient who contact with nephrotoxic medicine within 2 weak before procedure and patient with severe liver disease thyroid dysfunction, malignant carcinoma or infectious disease, They found that the incidence of CI-AKI in patients undergoing emergency PCI was 22.7% by take multivariable for them like body surface area, history of MI, left ventricular ejection fraction, hemoglobin level, GFR ratio, LAD stented and diuretics use. The limitation of

this study is the lack of comparison between the patients according to their age and gender, as well as obtaining patients from a single center.

In parallel, the efficacy and safety of a pharmaco-invasive strategy with half-dose alteplase versus primary angioplasty in STEMI patients were studied by Pu et al. (2017), and included 7 centers in their randomized study, prospectively comparing all the patient aged between 18-75 years old and presented within six hour after the symptom onset. They focused on the end point of reperfusion, LV ejection fraction, infarct size, ST-segment resolution, reinfarction, heart failure, intracranial hemorrhage, major and minor bleeding. They found that pharmacoinvasive strategy with half-dose alteplase and timely PCI offers more complete epicardial and myocardial reperfusion when compared with PPCI. This study shows a strong association between this type of management for STEMI patient form many centers, while it is recommended to include more than 334 patients, as collected from 7 centers, in order to decrease bias.

More specifically, Kanic et al. (2019) focused on studying AKI in patients with MI undergoing PCI using radial (RA) versus femoral access (FA), and selected the patients from 2011-2016 in a retrospective method from a single center. They divided the patient as a two group: group A: radial access versus group B: femoral access. They found that the number of group A is lower than group B, and the incidence of AKI after PCI from RA or FA is similar in each group, The incidence of AKI is actually increased by many factors like bleeding, heart failure, age $\geq$ 70 years, renal dysfunction, and the contrast volume/GFR ratio predicted AKI in both cohorts. Additionally, diabetes, contrast volume, and hypertension were also involved in the relationship. This study shows the weak relationship between the site insertions of catheter to AKI for MI patient.

The previous phenomenon was also studied by El-Ahmadi et al. (2019), who utilized a retrospective cohort study including 4239 patients in Eastern Danish Heart Registry, where consecutive patients undergoing primary PCI due to STEMI were selected from November 1st, 2009 to December 31st, 2014, 4002 is available creatinine measurement, the AKI occurred in 765 (19.1%) with several factors involved in the development of AKI: age, symptom onset to procedure, peak value of troponin T, female sex and contrast

volume to GFR ratio. They found the most important relationship between PCI intervention as treatment of STEMI and incidence of AKI and mortality from AKI post intervention on the other hand the sample was from single center that can lead to limit the study they take just two blood sample for kidney function test Thus, patients dying very early after admission were not included in the study. And the STEMI patient can be treated by other intervention, and the sample was observational without focusing to ventricular state for the patient, Finally, retrospective studies are susceptible to the issue of missing data, so too in this study, which introduces the risk of selection bias.

1.8.4 Regional and hospital-specific comparisons of STEMI management

In a Canadian study that was conducted at the University of Ottawa Heart Institute on a sample of 236 pharmacoinvasive and 980 primary PCI patients, the researchers aimed to compare the safety and efficacy of both approaches for STEMI patients in the context of real-world system. Patients were not significantly different in most of their demographic and health-related factors, except for smoking status, which was higher among pharmacoinvasive patients. The findings related to critical time intervals showed that primary PCI patients significantly had higher median time from onset to hospital arrival (92 vs. 97 minutes), while having significantly lower time from hospital arrival to arrival to catheterization laboratory (76 vs 281 minutes), and to first balloon (95 vs. 305 minutes), and from onset to first balloon (204 vs. 415 minutes). The primary PCI patients also significantly had higher percentage of femoral catheterization access use (83.9% vs 45.4%). The in-hospital clinical outcomes were mostly insignificantly different between patients of both approaches, including bleeding (8.1% vs 6.0%), length of stay (median = 4 days for both groups), and in major composites of mortality rate (5.4% vs 4.2%), reinfarction (1.1% vs 0.8%) and stroke (1.1% vs 2.5%), while hemorrhagic stroke had an incidence of 1.3% among pharmacoinvasive, compared to 0% among PCI group. The study concluded similarities in rates of major composites, but more bleeding within pharmacoinvasive approach (Rashid et al., 2016).

In Kuwait, a nationwide study examined 936 STEMI patients from what is known as REPERFUSE Kuwait registry, where the strategies of PCI and pharmacoinvasive are compared for several outcomes. Patients in both groups were not significantly different

in most of demographic and health-related factors, except for heart rate (mean = 83.1 vs 79.3 bpm), creatinine (mean = 1.0 vs 0.9 mg/dL) and previous stroke (3.1% vs 0.3%), respectively. The study found that PCI patients significantly have less time from hospital arrival to ECG (median = 5 vs 12 minutes), and from onset to catheterization lab (3.3 vs 19 hours). Also, radial access site was preferred among pharmacoinvasive patients, with significantly higher incidence of access site hematoma among PCI patients (1.9% vs 0.0%). Most of in-hospital outcomes were not significantly different between both groups, including death (1.7% vs 1.0%), reinfarction (1.1% each), stroke (0.3% vs 0.0%), congestive heart failure (CHF, 1.7% vs 0.4%) and bleeding (2.0% vs 1.4%). The researchers concluded comparable outcomes between patients who were treated with primary PCI and pharmacoinvasive approaches, and therefore the real-world data support the use of pharmacoinvasive approach when primary PCI is not available or cannot be achieved in timely manner (Zubaid et al., 2020).

An Egyptian study went further on the comparison between primary PCI and pharmacoinvasive approaches, and aimed to compare patients who were randomized into 4 groups, where the first group included patients who underwent primary PCI in a capable center, compared to the second group who were transferred to PCI center if it wasn't available at the hospital, while the third group included patients who were treated with pharmacoinvasive strategy, where streptokinase was administered followed by PCI within 3 to 24 hours, and the fourth group included patients who were treated with fibrinolytics followed by ischemia driven PCI. Patients had similar, insignificantly different demographic and health-related factors, which shows the advantages of using randomization in such studies. The main results showed significantly higher infarction size among patients in the fourth group (mean = 497,770 mm^3) compared to the first three groups (mean = 28,391 vs. 28,553 vs. 27,580 mm^3, respectively, p-value = 0.029), as well as lower mean EF (mean = 43.5%) compared to the other three groups (mean = 50.3% vs. 53.1% vs. 50.9%, respectively), with no significant differences in microvascular obstruction (MVO) (p-value = 0.156) as shown in 3-day postoperative cardiac MRI. The study concluded the similarity of pharmacoinvasive approach in terms of postoperative infarction size, MVO and EF, compared to primary PCI approach, while the use of

fibrinolytics followed by ischemia driven PCI has inferior results as shown in the postoperative complications. Focusing on the differences between PCI and pharmacoinvasive approaches, both were insignificantly different in postoperative peak serum CK (mean = 2224 vs. 2353) (Helal et al., 2018).

1.8.5 Summary and knowledge gap

The literature review chapter extensively compared between the main targeted STEMI management approaches, where the primary PCI showed superiority in lower incidence of postoperative complications, such as reinfarction, stroke and major bleeding, while the pharmacoinvasive approach showed better outcomes compared to fibrinolysis use alone (Rashid et al., 2016; Zubaid et al., 2020). The most common postoperative complication was shown to be AKI, mostly resulted from contrast volume, renal dysfunction, diabetes and hypertension, with no impact of catheterization site (El-Ahmadi et al., 2019; Kanic et al., 2019; Yuan et al., 2017).

While several studies in Canada, Kuwait, Egypt and China have examined several independent variables, such as time-to-treatment times, infarct size, ejection fraction and in-hospital outcomes, the main results did not show significant differences in major clinical outcomes between the two approaches, with pharmacoinvasive approach to remain a viable alternative when PCI is not available or accessible, especially in the real-world clinical settings (Zubaid et al., 2020; Helal et al., 2018; Rashid et al., 2016).

While extensive research is available in the topic of the study, several gaps still remain, like the limited research in the Middle East and Palestine, where most studies were conducted in North America, Europe and East Asia, which may be caused by healthcare systems constraints, patient demographics and underexploring of time-to-treatment in Palestine. Also, more studies are needed to cover and analyze the long-term complications associated with the two approaches, including arrhythmias, heart failure and hemorrhagic strokes.

In addition, more research is needed to evaluate how hospital-specific protocols can affect complications and laboratory findings, because the existing research addresses that such factors influence the postoperative changes, without explicit investigation of them.

Lastly, the existing research mostly focuses on the short-term complications that shows the differences in outcomes within several days or weeks, with limited investigation of long-term cardiovascular health, mortality rates and quality of life.

Chapter Two
Methodology

This chapter provides the methodological aspects of the study that is were applied to collect and analyze data related to the differences in selected complications between PCI and pharmacoinvasive approaches in the management of STEMI patients, as well as the design and setting, and the selection of patients, from sampling technique and sample size, alongside the ethical consideration to ensure committing with ethical committee's standards.

2.1 Study Design

The study implemented the retrospective cohort quantitative descriptive design, in which the researcher retrospectively collected the data related to the study aim from their electronic files, and divided them according to the exposure to STEMI management: pharmacoinvasive and PCI, and then collected the desired data using a specific data sheet for the study variables.

Several advantages were considered when conducting a retrospective cohort study, including its suitability for studying multiple outcomes, and is relatively time and cost effectiveness, as both the exposures and outcomes have already occurred. On the other hand, some disadvantages should be taken in consideration in order to avoid bias, including the absence of control over exposure or outcomes by the researcher, as well as the difficulty to compare exposed and non-exposed groups, which is not found in the current study, as it compares between two specific exposures, and there is no need to retrospectively collect a sample with no exposure at all (Hyde, 2004).

2.2 Site and Settings

The study was conducted in two tertiary hospitals in West Bank – Palestine: Palestine Medical Complex (PMC) in Ramallah, and An-Najah National University Hospital (NNUH) in Nablus. Both hospitals contain a well-known reputational cardiology department, receiving tens of STEMI patients each week, and are managed using a specific protocol. Also, both hospitals have electronic medical records (EMRs), which facilitates the retrospective approach of gathering previous data. On the other hand, the researcher was limited to be able to collect data from these two hospitals due to some

limitations, including consequences of the sociopolitical situation in Palestine, limiting the transportation ability, as the researcher needed to go to each hospital multiple times to manually collect data from EMRs, and required the help of a trained specialized nurse from NNUH to facilitate data collection.

Palestine Medical Complex (PMC) is a governmental hospital that contains six qualified building that are specialized in specific medical areas, which are Ramallah Public Hospital, Al-Sheikh Zayed Hospital, National Center for Blood Diseases- Hippocrates, Bahrain pediatrics Hospital, and Kuwaiti Specialized Surgery Hospital, as well as Hemodialysis Center. It includes more than 250 beds, which provides a wide range of services, including neonatal care, maternity care, internal medicine, pediatrics, general surgery, and cardiovascular surgery. Currently, extensions are being built for Bahrain Hospital to include pediatric catheterization and open-heart surgery departments, as well as for the hemodialysis center to cover more patients (currently around 200 patients per week).

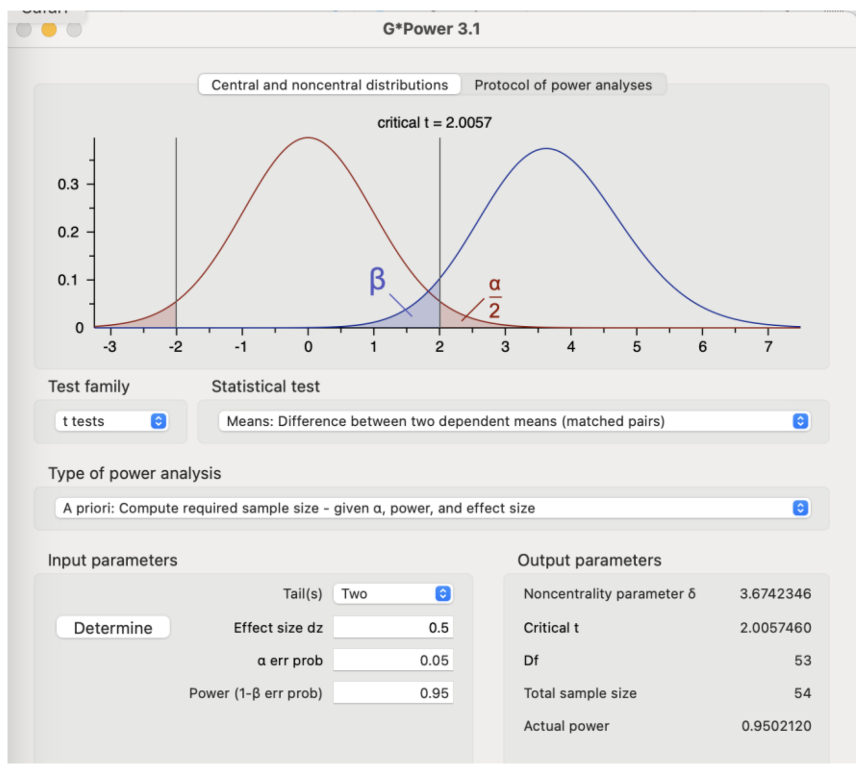
An-Najah National University Hospital (NNUH) is a prominent tertiary hospital located in Nablus, Palestine, and was established in 2013 as part of An-Najah National University’s commitment to advancing healthcare and medical education in the region, and is affiliated with An-Najah National University’s Faculty of Medicine and Health Sciences, which plays a vital role in the education and training of future medical professionals, serving as a critical healthcare provider in the West Bank, offering a wide range of specialized medical services. The hospital has a capacity of over 200 beds, with the potential for expansion to contain more patients as needed, and is equipped with modern medical technology and facilities that meet international standards, making it a leading healthcare provider in the region. The establishment and operation of the Cardiology and Cardiac Surgery departments at An-Najah National University Hospital are among its most significant achievements. The cardiology department services include non-invasive diagnostics, such as echocardiography, stress testing, and Holter monitoring, as well as invasive procedures like cardiac catheterization and angiography, while the cardiac surgery department provides a wide range of cardiac surgeries, including coronary artery bypass grafting (CABG), valve repair and replacement, and congenital heart defect correction.

2.3 Sample Population and Sampling

The study population included all adult STEMI patients who were admitted in the cardiology departments of the mentioned settings, regardless to their gender, educational levels, residency, … etc. On the other hand, the required sample size was calculated using G*Power software version 3.1, using the t-test family, and the differences between two dependent means (matched pairs) statistical test. Choosing a two-tailed parameter, with effect size of 0.5, error probability for α of 0.05 and power of 0.95, the calculated size was 54 patients for each group, resulting in a recommended sample of 108, as shown in the following figure, and the researcher will add 10% (11 patients) to get an overall of 119 patients to overcome any missing data or bias. The researcher was able to recruit a total of 160 patients (82 from NNUH and 78 from PMC).

Figure 1

*Required sample size as calculated in G*Power 3.1*



The researcher used simple randomized sampling technique, in which the researcher collected the patients who were admitted during the study period from both hospitals' EMRs, and then randomly chose the required sample from each list, by assigning a serial number to each patient, and then divide the total number of patients on the sample size, which gives a value (x) of which the researcher choose each x of the list.

2.4 Inclusion and Exclusion Criteria

Adult patients (aged between 30 and 75 years old) who were diagnosed with STEMI, and presented and managed in the mentioned hospitals during the study period were included in the study, while patients who were managed by tPA only rather than pharmacoinvasive or PCI, pregnant women, diagnosed with any mental illness, had a history of bleeding within the last 6 months, and patient who were referred to NNUH or PMC from other hospitals were excluded from the study.

2.5 Study Tool and Protocol

The data were collected by an abstract sheet (Appendix A) which was developed according to literature review and from the specialist doctor's experience. The sheet mainly included sections related to sociodemographic data, parameters related to the two approaches, in term of catheter insertion site and timing of procedure, followed by the preoperative and postoperative results of laboratory tests, postoperative complications and 30-day survival.

An external, content validity was used to validate the study tool, where the abstract sheet was reviewed by 5 experts in the field of the study, including two faculty doctors (acquiring PhD degrees in Critical Care Nursing), two experienced senior cardiac care unit nurses, and one cardiology specialist, which resulted in several adjustments to reach the final version of the used data sheet.

The data was collected by the researcher and a trained nurse in both hospitals, which facilitated data collection and shortened the required period.

2.6 Pilot Study

A total of 18 cases (around 10%) were piloted and dived them to two group (9 patients managed by pharmacoinvasive and 9 patients treated by primary PCI) to explore the appropriateness of the study instrument and help the researcher for training for data collection, which has helped to increase the validity and reliability for the research.

2.7 Data Analysis

For the purpose of data analysis, IBM Statistical Package for Social Sciences (SPSS) software v25.0 on Windows OS was used to produce descriptive and analytical results

regarding the participants' data. Descriptive statistics include the observation of frequencies and percentages of patients' sociodemographic data and variables related to pharmacoinvasive and PCI approaches, as well as postoperative complications and survival, and the mean and standard deviation (SD) of the preoperative and postoperative laboratory results.

A normality test was conducted to determine the distribution of the sample, that helped in determining the suitable analytical test (parametric vs non-parametric), which showed that the data was normally distributed, and therefore, parametric tests were used. Analytical results included the investigation of the relationship between study's independent and dependent variables, using the suitable statistical tests according to variables' types, where Chi-square test was used to investigate the relationship between categorical sociodemographic factors and medical and surgical history parameters (as independent variables) and the treatment approach incidence of complications (as dependent variables), while independent samples t-test was used to investigate the differences in preoperative and postoperative and pre-post changes in laboratory results across the treatment approaches and the dichotomous demographic factors, while one-way ANOVA was used for the differences across the non-dichotomous factors, with a cut point of 0.05 for p-value.

2.8 Ethical Considerations

First, the permission was granted from the Institutional Review Board (IRB) at An-Najah National University in order to take the permission to start data collection. Following that, a facilitation paper was granted from the Palestinian Ministry of Health to collect data from PMC, while facilitation paper was separately granted from NNUH, using the provided online form.

Moreover, confidentiality and anonymity of the collected data were granted, which included gathering no patient name, and only numbering them in a sequential series for data analysis purpose. Also, the request from the hospitals included the permission to use patients' data for the research purposes and by the researcher and trained personnel only.

Chapter Three
Results

3.1 Introduction

This chapter is dedicated to review the descriptive and analytical results of the current study, including frequencies and percentages of the categorical variables and means and standard deviations for the scale variables, with the investigation of the relationship between study's independent and dependent variables using the suitable analytical tests to achieve study's objectives and test its hypotheses.

3.1.1 Demographic data

The demographic factors for all the patients (n = 160) and their differences between patients with PCI (n = 82, 51.2%) and pharmacoinvasive (n = 78, 48.8%) are shown in the Table 1. The mean age of all patients was 58.0 ± 11.4 years old, ranging from 25 to 75 years old, which was significantly higher among the patients who underwent PCI (mean = 59.8 ± 9.7) than pharmacoinvasive (mean = 56.2 ± 12.7, t = 2.000, p-value = 0.047). Moreover, more than half of the patients 51.9% lived in urban areas, which was significantly higher among patients who underwent PCI 57.3% than pharmacoinvasive (46.2%, X^2 = 6.127, p-value = 0.047). On the other hand, most of the patients were male 1.3% and married 86.2%, in which gender and marital status did not differ significantly between the patients of both approaches.

Table 1

Distribution of patients' demographic data and the differences between PCI and pharmacoinvasive groups

Variables	Values	Overall		PCI		Pharmacoinvasive		Test result	p-value
		F	%	F	%	F	%		
Age (mean ± SD)		58.0 ± 11.4		59.8 ± 9.7		56.2 ± 12.7		2.000	0.047
Gender	Male	130	81.3%	64	78.0%	66	84.6%	1.131	0.287
	Female	30	18.8%	18	22.0%	12	15.4%		
Residency	City	83	51.9%	47	57.3%	36	46.2%	6.127	0.047
	Rural	57	35.6%	22	26.8%	35	44.9%		
	Camp	20	12.5%	13	15.9%	7	9.0%		
Social status	Single	9	5.7%	4	4.9%	5	6.4%	0.754	0.686
	Married	137	86.2%	69	85.2%	68	87.2%		
	Others	13	8.2%	8	9.9%	5	6.4%		

F = frequency, PCI = Percutaneous coronary intervention, SD = standard deviation.

Regarding past medical history (PMHx), patients of both approaches were significantly different in their dyslipidemia and obesity histories, where dyslipidemia was found among 13.8% of the patients, which was significantly higher among pharmacoinvasive 25.6% than PCI patients (2.4%, X^2 = 18.146, p-value < 0.001), while obesity was found among 13.8% of the patients, which was significantly higher among pharmacoinvasive 23.1% than PCI patients (4.9%, X^2 = 11.164, p-value = 0.001). On the other hand, the prevalence of the rest of the included histories was not significantly different between patients of both groups (p-value > 0.05), including DM 46.3%, HTN (54.4%), IHD 35.0% and other histories 16.3%.

In terms of the past surgical history (PSHx), previous PCI was done by 35.0% of the patients, while 5.0% of them had a previous open heart surgery, and 1.3% had a previous vascular surgery, which all did not significantly differ between PCI and pharmacoinvasive patients (p-value > 0.05), while having history of other surgeries was significantly higher among pharmacoinvasive 37.2% than PCI patients (2.4%, X^2 = 30.885, p-value < 0.001). Moreover, 61.3% of all patients were current smokers, which was not significantly different between both study groups (p-value = 0.067).

Table 2

Distribution of patients' medical and surgical histories and the differences between PCI and pharmacoinvasive groups

Variables	Values	Overall		PCI		Pharmacoinvasive		Test result	p-value
		F	%	F	%	F	%		
Past medical history									
DM	No	86	53.8%	49	59.8%	37	47.4%	2.441	0.118
	Yes	74	46.3%	33	40.2%	41	52.6%		
HTN	No	73	45.6%	38	46.3%	35	44.9%	0.035	0.852
	Yes	87	54.4%	44	53.7%	43	55.1%		
IHD	No	104	65.0%	56	68.3%	48	61.5%	0.802	0.371
	Yes	56	35.0%	26	31.7%	30	38.5%		
Dyslipidemia	No	138	86.3%	80	97.6%	58	74.4%	18.146	< 0.001
	Yes	22	13.8%	2	2.4%	20	25.6%		
Obesity	No	138	86.3%	78	95.1%	60	76.9%	11.164	0.001
	Yes	22	13.8%	4	4.9%	18	23.1%		
Others	No	134	83.8%	69	84.1%	65	83.3%	0.019	0.989
	Yes	26	16.3%	13	15.9%	13	16.7%		
Past surgical history									
PCI	No	104	65.0%	54	65.9%	50	64.1%	0.054	0.816
	Yes	56	35.0%	28	34.1%	28	35.9%		
Open heart surgery	No	152	95.0%	78	95.1%	74	94.9%	0.005	0.942
	Yes	8	5.0%	4	4.9%	4	5.1%		
Vascular surgery	No	158	98.8%	81	98.8%	77	98.7%	0.001	0.972
	Yes	2	1.3%	1	1.2%	1	1.3%		
Others	No	129	80.6%	80	97.6%	49	62.8%	30.885	< 0.001
	Yes	31	19.4%	2	2.4%	29	37.2%		
Smoking status	Current	98	61.3%	57	69.5%	41	52.6%	5.396	0.067
	Previous	12	7.5%	6	7.3%	6	7.7%		
	Never	50	31.3%	19	23.2%	31	39.7%		

F = frequency, PCI = Percutaneous coronary intervention, HTN = hypertension, DM = diabetes mellitus, IHD = ischemic heart disease.

For the echotomography findings, 4.4% of the patients had valve stenosis, which was significantly higher among pharmacoinvasive patients (9.0%) than PCI patients (0.0%, $X^2 = 7.696$, p-value = 0.006), while 28.1% of the patients had valve regurgitation, which was also significantly higher among pharmacoinvasive patients (52.6%) than PCI patients (4.9%, $X^2 = 44.968$, p-value < 0.001), as well as cardiac muscle hypokinesia, which was found among 41.3% of the patients, and was significantly higher among

pharmacoinvasive patients (51.3%) than PCI patients (31.7%, X^2 = 6.320, p-value = 0.012). On the other hand, other findings were not significantly different between both groups, including the prevalence of ventricular hypertrophy (13.8%) and cardiomegaly (2.5%), while the overall mean ejection fraction (EF) was 45.1 ± 10.4, and was significantly lower among PCI patients (mean = 43.4 ± 11.3) than pharmacoinvasive patients (mean = 47.0 ± 9.3, t = -2.277, p-value = 0.024).

Table 3

Distribution of patients' echotomography findings and the differences between PCI and pharmacoinvasive groups

Tomography findings	Values	Overall		PCI		Pharmacoinvasive		Test result	p-value
		F	%	F	%	F	%		
Valve stenosis	No	153	95.6%	82	100.0%	71	91.0%	7.696	0.006
	Yes	7	4.4%	0	0.0%	7	9.0%		
Valve regurgitation	No	115	71.9%	78	95.1%	37	47.4%	44.968	< 0.001
	Yes	45	28.1%	4	4.9%	41	52.6%		
Cardiac muscle hypokinesia	No	94	58.8%	56	68.3%	38	48.7%	6.320	0.012
	Yes	66	41.3%	26	31.7%	40	51.3%		
Ventricular hypertrophy	No	138	86.3%	72	87.8%	66	84.6%	0.343	0.558
	Yes	22	13.8%	10	12.2%	12	15.4%		
Cardiomegaly	No	156	97.5%	80	97.6%	76	97.4%	0.003	0.960
	Yes	4	2.5%	2	2.4%	2	2.6%		
EF (mean ± SD)		45.1 ± 10.4		43.4 ± 11.3		47.0 ± 9.3		-2.277	0.024

F = frequency, PCI = Percutaneous coronary intervention, SD = standard deviation, EF = ejection fraction

3.1.2 Treatment approach and perioperative parameters

The preferred catheter insertion approach was more in the radial artery (56.3%), which was also significantly preferred higher among PCI 95.1% than pharmacoinvasive patients (15.4%, X^2 = 103.279, p-value < 0.001). Also, more than half of the patients conducted the procedure at the day of admission 54.4%, which significantly differed between both groups, where 97.6% of the PCI patients conducted the procedure at the day of admission, while 30.8% and 48.7% of the pharmacoinvasive patients conducted it at the first and second day of admission, respectively (X^2 = 126.494, p-value < 0.001).

The locations of MI among the patients were 50.0% inferior, 12.5% septal, 34.4% anterior, 6.3% posterior and 13.1% lateral, taking into account that the patients may have

MI in more than one location at the same time, while they were not significantly different between both study groups (p-value > 0.05).

Table 4

Distribution of variables related to the treatment approach and perioperative parameters among the patients and between PCI and pharmacoinvasive patients

Variables	Values	Overall		PCI		Pharmacoinvasive		Test result	p-value
		F	%	F	%	F	%		
Catheter insertion approach	Radial	90	56.3%	78	95.1%	12	15.4%	103.279	< 0.001
	Femoral	70	43.8%	4	4.9%	66	84.6%		
When was the intervention done?	Admission day	87	54.4%	80	97.6%	7	9.0%	126.494	< 0.001
	1st day	25	15.6%	1	1.2%	24	30.8%		
	2nd day	39	24.4%	1	1.2%	38	48.7%		
	3rd day	4	2.5%	0	0.0%	4	5.1%		
	Others	5	3.1%	0	0.0%	5	6.4%		
Location of MI									
Inferior MI	No	80	50.0%	39	47.6%	41	52.6%	0.400	0.527
	Yes	80	50.0%	43	52.4%	37	47.4%		
Septal MI	No	140	87.5%	72	87.8%	68	87.2%	0.014	0.905
	Yes	20	12.5%	10	12.2%	10	12.8%		
Anterior MI	No	105	65.6%	54	65.9%	51	65.4%	0.004	0.950
	Yes	55	34.4%	28	34.1%	27	34.6%		
Posterior MI	No	150	93.8%	78	95.1%	72	92.3%	0.540	0.462
	Yes	10	6.3%	4	4.9%	6	7.7%		
Lateral MI	No	139	86.9%	73	89.0%	66	84.6%	0.682	0.409
	Yes	21	13.1%	9	11.0%	12	15.4%		

Note: F = frequency, PCI = Percutaneous coronary intervention, MI = myocardial infarction.

3.1.3 Laboratory tests and heart rate

Some of the preoperative laboratory tests showed significantly different mean results between PCI and pharmacoinvasive patients, including WBCs (overall mean = 10.53, 12.45 vs 8.51, t = 5.474, p-value < 0.001), sodium (overall mean = 137.61, 136.74 vs 138.52, t = -2.650, p-value = 0.012), troponin-I (overall mean = 514.17, 973,56 vs 69.06, t = 1.995, p-value = 0.049), triglyceride (overall mean = 188.00, 124.96 vs 200.93, t = -2.387, p-value 0.019), INR (overall mean = 1.08, 1.13 vs 1.03, t = 2.531, p-value = 0.013), CRP (overall mean = 30.64, 123.93 vs 16.29, t = 2.321, p-value = 0.040) and heart rate (overall mean = 86.66, 93.07 vs 79.92, t = 5.363, p-value < 0.001), respectively, while

the rest of the preoperative laboratory tests showed insignificant differences in their mean results between both groups (p-value > 0.05).

Table 5

Differences in preoperative laboratory tests results and heart rate between PCI and Pharmacoinvasive approaches

Test name	Overall		PCI		Pharmacoinvasive		t	p-value
	Mean	SD	Mean	SD	Mean	SD		
Hemoglobin	14.23	1.96	14.10	1.81	14.36	2.11	-0.818	0.414
WBCs	10.53	4.99	12.45	5.49	8.51	3.42	5.474	<0.001
Platelets	265.92	82.90	274.61	85.76	256.79	79.30	1.362	0.175
BUN	20.96	15.64	19.74	12.70	22.22	18.17	-0.999	0.319
Creatinine	1.84	6.52	1.39	1.83	2.31	9.16	-0.886	0.377
Potassium	4.05	0.64	4.12	0.69	3.98	0.57	1.363	0.175
Sodium	137.61	4.42	136.74	3.39	138.52	5.16	-2.650	0.012
Calcium	9.02	0.64	8.79	0.67	9.05	0.64	-1.173	0.244
Troponin-I	514.17	2846.07	937.56	3921.71	69.06	394.76	1.995	0.049
CK-MB	76.69	104.12	23.00	0.00	77.97	105.04	-0.517	0.608
CK-total	778.76	1366.70	957.00	1107.33	772.51	1382.58	0.186	0.853
RBS	174.28	90.28	167.78	79.91	181.11	100.10	-0.928	0.355
LDL	119.45	43.23	113.95	45.92	120.58	42.88	-0.557	0.579
HDL	46.47	26.86	37.91	17.91	48.23	28.12	-1.879	0.069
Triglyceride	188.00	118.89	124.96	85.43	200.93	121.06	-2.387	0.019
PT	15.25	5.07	14.74	2.85	15.78	6.60	-1.287	0.201
PTT	43.19	25.82	46.05	31.48	40.19	17.80	1.461	0.147
INR	1.08	0.25	1.13	0.17	1.03	0.30	2.531	0.013
CRP	30.64	72.36	123.93	160.25	16.29	28.62	2.321	0.040
Heart rate	86.66	16.80	93.07	15.94	79.92	15.02	5.363	<0.001

Note: F = frequency, PCI = Percutaneous coronary intervention, SD = standard deviation, WBC = white blood cells, BUN = blood urea nitrogen, CK = creatine kinase, RBS = random blood sugar, LDL = low-density lipoprotein, HLD = high=density lipoprotein, PT = prothrombin time, PTT = partial thromboplastin time, INR = international normalized ratio, CRP = c-reactive protein.

For the postoperative laboratory tests, more results showed significant differences between the study groups, including WBCs (overall mean = 9.75, 11.05 vs 8.58, t = 3.952, p-value < 0.001), sodium (overall mean = 138.75, 136.82 vs 140.67, t = -5.584, p-value < 0.001), troponin-I (overall mean = 1681.29, 3244.10 vs 38.33, t = 5.094, p-value < 0.001), LDL (overall mean = 94.95, 19.77 vs 110.37, t = -7.917, p-value < 0.001), HDL

(overall mean = 42.49, 6.81 vs 49.81, t = -5.441, p-value < 0.001), PTT (overall mean = 49.50, 57.83 vs 41.80, t = 3.845, p-value < 0.001), INR (overall mean = 1.09, 1.18 vs 1.06, t = 2.086, p-value = 0.039), CRP (overall mean = 33.93, 126.22 vs 16.19, t = 3.050, p-value = 0.008) and heart rate (overall mean = 79.55, 82.13 vs 76.83, t = 2.669, p-value = 0.008), respectively, while the rest of postoperative laboratory tests did not show significant differences in their mean results between both groups.

Table 6

Differences in postoperative laboratory tests results and heart rate between PCI and Pharmacoinvasive approaches

Test name	Overall		PCI		Pharmacoinvasive		t	p-value
	Mean	SD	Mean	SD	Mean	SD		
Hemoglobin	13.61	2.06	13.45	1.95	13.76	2.16	-0.935	0.351
WBCs	9.75	3.99	11.05	4.05	8.58	3.57	3.952	<0.001
Platelets	268.53	164.91	258.10	81.28	277.90	214.04	-0.728	0.468
BUN	21.58	17.08	19.80	12.19	23.14	20.36	-1.181	0.239
Creatinine	1.79	5.69	1.21	1.14	2.34	7.88	-1.254	0.214
Potassium	4.12	0.58	4.14	0.56	4.09	0.59	0.519	0.605
Sodium	138.75	4.71	136.82	3.12	140.67	5.24	-5.584	<0.001
Calcium	9.12	0.67	9.22	0.53	9.11	0.68	0.412	0.682
Troponin-I	1681.29	4373.56	3244.10	5695.18	38.33	206.99	5.094	<0.001
CK-MB	50.64	51.30	20.00	.	51.37	51.70	-0.600	0.552
CK-total	504.97	963.04	297.00	179.61	512.26	978.97	-0.308	0.759
RBS	154.68	62.87	153.21	50.94	156.22	73.68	-0.299	0.765
LDL	94.95	53.78	19.77	43.40	110.37	41.36	-7.917	<0.001
HDL	42.49	32.93	6.81	19.26	49.81	30.31	-5.441	<0.001
Triglyceride	160.09	154.36	34.66	66.09	185.82	154.88	-3.820	<0.001
PT	16.12	7.34	15.62	2.66	16.31	8.46	-0.426	0.671
PTT	49.50	26.34	57.83	29.24	41.80	20.70	3.845	<0.001
INR	1.09	0.26	1.18	0.16	1.06	0.28	2.086	0.039
CRP	33.93	74.16	126.22	138.98	16.19	32.89	3.050	0.008
Heart rate	79.55	12.80	82.13	13.04	76.83	12.02	2.669	0.008

Note: F = frequency, PCI = Percutaneous coronary intervention, SD = standard deviation, WBC = white blood cells, BUN = blood urea nitrogen, CK = creatine kinase, RBS = random blood sugar, LDL = low-density lipoprotein, HLD = high=density lipoprotein, PT = prothrombin time, PTT = partial thromboplastin time, INR = international normalized ratio, CRP = c-reactive protein.

The changes from preoperative to postoperative laboratory tests' results were also investigated and some had shown significant differences in mean results changes between both study groups. For example, the mean decrease in WBCs was 0.77, which significantly decreased more in PCI patients (mean decrease = 1.71) than pharmacoinvasive patients (mean increase = 0.07, t = -3.228, p-value = 0.002). Also, the mean the mean increase in sodium was 1.14, which was lower in PCI patients (mean increase = 0.13) than pharmacoinvasive patients (mean increase = 2.16, t = -3.349, p-value = 0.001). The mean increase in troponin-I was 1167.12, which was significantly higher in PCI patients (mean increase = 2306.54) than pharmacoinvasive patients (mean decrease = 30.74, t = 3.806, p-value < 0.001).

For the lipid profile, the mean decrease in LDL was 24.51, which was significantly higher among PCI patients (mean decrease = 94.18) than pharmacoinvasive patients (mean decrease = 10.21, t = 4.642, p-value < 0.001), with a mean decrease in HDL by 3.98, which was more among PCI patients (mean decrease = 31.09) than pharmacoinvasive patients (mean increase = 1.58, t = -6.380, p-value < 0.001), and a mean decrease in triglyceride by 27.91, which was significantly more among PCI patients (mean decrease = 90.29) than pharmacoinvasive patients (mean decrease = 15.11, t = -2.074, p-value = 0.041). Lastly, the mean decrease in heart rate was 7.11, which was significantly higher in PCI group (mean decrease = 10.94) than pharmacoinvasive patients (mean decrease = 3.09, t = -4.044, p-value < 0.001). On the other hand, the rest of the tests did not show significant differences in their pre-post changes between PCI and pharmacoinvasive patients (p-value > 0.05).

Table 7

Differences in preoperative-postoperative changes in laboratory tests results and heart rate between PCI and Pharmacoinvasive approaches

Test name	Overall		PCI		Pharmacoinvasive		t	p-value
	Mean diff.	SD	Mean diff.	SD	Mean diff.	SD		
Hemoglobin	-0.57	0.87	-0.55	0.91	-0.59	0.83	0.308	0.759
WBCs	-0.77	3.32	-1.71	4.30	0.07	1.72	-3.228	0.002
Platelets	1.32	154.88	-20.73	46.65	21.10	207.38	-1.650	0.101
BUN	0.19	8.17	-0.64	9.80	0.91	6.42	-1.146	0.254
Creatinine	-0.03	1.35	-0.10	0.70	0.04	1.77	-0.636	0.526
Potassium	0.07	0.50	0.02	0.60	0.11	0.36	-1.130	0.261
Sodium	1.14	3.91	0.13	2.95	2.16	4.46	-3.349	0.001
Calcium	0.10	0.54	0.28	0.52	0.08	0.54	0.855	0.395
Troponin-I	1167.12	4138.32	2306.54	5557.51	-30.74	192.21	3.806	<0.001
CK-MB	-26.05	71.76	-3.00	.	-26.60	72.53	0.322	0.749
CK-total	-273.80	561.06	-660.00	927.72	-260.25	552.40	-0.990	0.326
RBS	-19.60	57.60	-14.57	56.94	-24.89	58.18	1.133	0.259
LDL	-24.51	50.70	-94.18	71.05	-10.21	30.10	-4.642	<0.001
HDL	-3.98	17.20	-31.09	20.01	1.58	9.76	-6.380	<0.001
Triglyceride	-27.91	134.42	-90.29	124.97	-15.11	133.44	-2.074	0.041
PT	0.29	3.86	-0.34	1.37	0.52	4.43	-1.535	0.128
PTT	5.44	32.26	9.59	43.23	1.62	16.13	1.472	0.144
INR	0.02	0.16	-0.01	0.11	0.03	0.18	-0.934	0.352
CRP	1.68	30.68	19.13	89.80	-0.10	16.46	0.605	0.564
Heart rate	-7.11	12.85	-10.94	12.23	-3.09	12.32	-4.044	<0.001

Note: F = frequency, PCI = Percutaneous coronary intervention, SD = standard deviation, WBC = white blood cells, BUN = blood urea nitrogen, CK = creatine kinase, RBS = random blood sugar, LDL = low-density lipoprotein, HLD = high=density lipoprotein, PT = prothrombin time, PTT = partial thromboplastin time, INR = international normalized ratio, CRP = c-reactive protein.

3.1.4 Postoperative outcomes

Almost all postoperative complications showed significant differences between both groups. For example, the overall prevalence of postoperative insertion site hematoma was 36.9%, which was significantly higher among pharmacoinvasive patients (53.8%) than PCI patients (20.7%, $X^2 = 18.832$, p-value < 0.001). The rest of the complications also showed significantly higher prevalence among pharmacoinvasive than PCI patients, including hemorrhagic stroke (overall prevalence = 4.4%, 9.0% vs 0.0%, $X^2 = 7.696$, p-value = 0.006), epistaxis (overall prevalence = 9.4%, 19.2% vs 0.0%, $X^2 = 17.401$, p-

value < 0.001), hematemesis (overall prevalence = 3.1%, 6.4% vs 0.0%, $X^2 = 5.426$, p-value = 0.020) and stroke (overall prevalence = 2.5%, 5.1% vs 0.0%, $X^2 = 4.313$, p-value = 0.038), with a significant difference in the overall number of postoperative complications between both groups, where 79.3% of PCI patients did not have any postoperative complication, compared to only 33.3% among pharmacoinvasive patients, while 20.5% of pharmacoinvasive patients had more than one complication, compared to 0.0% among PCI patients ($X^2 = 39.450$, p-value < 0.001). Lastly, the overall 30-day survival rate was 93.1%, which was significantly lower among pharmacoinvasive patients 87.2% than PCI patients (98.8%, $X^2 = 8.403$, p-value = 0.004).

Table 8

Differences in specific postoperative complications and 30-day survival between PCI and Pharmacoinvasive approaches

Variables	Values	Overall		PCI		Pharmacoinvasive		Test result	p-value
		F	%	F	%	F	%		
Insertion site hematoma	No	101	63.1%	65	79.3%	36	46.2%	18.832	<0.001
	Yes	59	36.9%	17	20.7%	42	53.8%		
Hemorrhagic stroke	No	153	95.6%	82	100.0%	71	91.0%	7.696	0.006
	Yes	7	4.4%	0	0.0%	7	9.0%		
Upper GI bleeding	No	157	98.1%	82	100.0%	75	96.2%	3.213	0.073
	Yes	3	1.9%	0	0.0%	3	3.8%		
Epistaxis	No	145	90.6%	82	100.0%	63	80.8%	17.401	<0.001
	Yes	15	9.4%	0	0.0%	15	19.2%		
Hematemesis	No	155	96.9%	82	100.0%	73	93.6%	5.426	0.020
	Yes	5	3.1%	0	0.0%	5	6.4%		
Stroke	No	156	97.5%	82	100.0%	74	94.9%	4.313	0.038
	Yes	4	2.5%	0	0.0%	4	5.1%		
Number of complications	Zero	91	56.9%	65	79.3%	26	33.3%	39.450	<0.001
	One	53	33.1%	17	20.7%	36	46.2%		
	> one	16	10.0%	0	0.0%	16	20.5%		
Patient's survival	Died	11	6.9%	1	1.2%	10	12.8%	8.403	0.004
	Survived	149	93.1%	81	98.8%	68	87.2%		

Note: F = frequency, PCI = Percutaneous coronary intervention, GI = gastrointestinal tract.

The number of postoperative complications were also compared among all patients across the demographic factors (as shown in Table 9), which showed that none of the demographic factors were significantly associated with differences in them (p-value > 0.05).

Table 9

Differences in number of postoperative complications across patients' demographic factors

Factor	Values	None		One		> one		X^2	p-value
		F	%	F	%	F	%		
Age	< 40 YO	5	50.0%	3	30.0%	2	20.0%	3.597	0.731
	40-49 YO	16	61.5%	9	34.6%	1	3.8%		
	50-59 YO	30	62.5%	13	27.1%	5	10.4%		
	>= 60 YO	40	52.6%	28	36.8%	8	10.5%		
Gender	Male	76	58.5%	39	30.0%	15	11.5%	3.992	0.136
	Female	15	50.0%	14	46.7%	1	3.3%		
Residency	City	49	59.0%	26	31.3%	8	9.6%	1.259	0.868
	Rural	30	52.6%	20	35.1%	7	12.3%		
	Camp	12	60.0%	7	35.0%	1	5.0%		
Social status	Single	7	77.8%	2	22.2%	0	0.0%	4.315	0.365
	Married	76	55.5%	45	32.8%	16	11.7%		
	Others	7	53.8%	6	46.2%	0	0.0%		

Note: F = frequency, X^2 = Chi-square test value, YO = years old.

The relationships between the medical factors (medical and surgical histories and echotomography factors) are also tested and shown in Table 10, where it shows that 17.8% of the non-hypertensive patients had more than one complication, compared to 3.4% among hypertensive patients (X^2 = 9.617, p-value = 0.008). On the other hand, 18.2% of patients with dyslipidemia had more than one complication, compared to 8.7% among patients without dyslipidemia (X^2 = 6.716, p-value = 0.035).

Also, there was a significantly higher percentage of ad more than one complication among patients with than without valve regurgitation (22.2% vs 5.2%, respectively, X^2 = 17.875, p-value < 0.001), which also applies among patients with cardiac muscle hypokinesia (18.2% vs 4.3%, respectively, X^2 = 9.559, p-value = 0.008). The rest of the factors did not significantly associate with differences in the number of postoperative complications (p-value > 0.05).

Table 10

Differences in number of postoperative complications across patients' medical factors

Factor	Values	None		One		> one		X^2	p-value
		F	%	F	%	F	%		
DM	No	50	58.1%	25	29.1%	11	12.8%	2.424	0.298
	Yes	41	55.4%	28	37.8%	5	6.8%		
HTN	No	40	54.8%	20	27.4%	13	17.8%	9.617	0.008
	Yes	51	58.6%	33	37.9%	3	3.4%		
IHD	No	57	54.8%	38	36.5%	9	8.7%	1.807	0.405
	Yes	34	60.7%	15	26.8%	7	12.5%		
Dyslipidemia	No	84	60.9%	42	30.4%	12	8.7%	6.716	0.035
	Yes	7	31.8%	11	50.0%	4	18.2%		
Obesity	No	83	60.1%	43	31.2%	12	8.7%	4.765	0.092
	Yes	8	36.4%	10	45.5%	4	18.2%		
Others	No	74	55.2%	47	35.1%	13	9.7%	1.415	0.493
	Yes	17	65.4%	6	23.1%	3	11.5%		
PCI	No	59	56.7%	35	33.7%	10	9.6%	0.070	0.966
	Yes	32	57.1%	18	32.1%	6	10.7%		
Open heart surgery	No	88	57.9%	49	32.2%	15	9.9%	1.332	0.514
	Yes	3	37.5%	4	50.0%	1	12.5%		
Vascular surgery	No	90	57.0%	53	33.5%	15	9.5%	3.928	0.140
	Yes	1	50.0%	0	0.0%	1	50.0%		
Others	No	84	65.1%	33	25.6%	12	9.3%	19.713	<0.001
	Yes	7	22.6%	20	64.5%	4	12.9%		
Smoking status	Current	61	62.2%	26	26.5%	11	11.2%	5.288	0.259
	Previous	5	41.7%	6	50.0%	1	8.3%		
	Never	25	50.0%	21	42.0%	4	8.0%		
Valve stenosis	No	88	57.5%	51	33.3%	14	9.2%	2.283	0.244
	Yes	3	42.9%	2	28.6%	2	28.6%		
Valve regurgitation	No	76	66.1%	33	28.7%	6	5.2%	17.875	<0.001
	Yes	15	33.3%	20	44.4%	10	22.2%		
Cardiac hypokinesia	No	60	63.8%	30	31.9%	4	4.3%	9.559	0.008
	Yes	31	47.0%	23	34.8%	12	18.2%		
Ventricular hypertrophy	No	82	59.4%	44	31.9%	12	8.7%	3.317	0.190
	Yes	9	40.9%	9	40.9%	4	18.2%		
Cardiomegaly	No	89	57.1%	52	33.3%	15	9.6%	1.039	0.595
	Yes	2	50.0%	1	25.0%	1	25.0%		
EF reduction	Normal	43	58.9%	24	32.9%	6	8.2%	5.770	0.449
	Mild	29	55.8%	15	28.8%	8	15.4%		
	Moderate	6	50.0%	4	33.3%	2	16.7%		
	Severe	13	56.5%	10	43.5%	0	0.0%		

Note: F = frequency, X^2 = Chi-square test value, PCI = Percutaneous coronary intervention, HTN = hypertension, DM = diabetes mellitus, IHD = ischemic heart disease, EF = ejection fraction.

3.3 Conclusion

Patients who underwent PCI had higher mean age, more urban residency, more dyslipidemia, less obesity, lower valve stenosis and regurgitation, cardiac muscle hypokinesia and lower mean EF, than pharmacoinvasive patients. Also, PCI patients significantly had more radial insertion approach and admission-day procedure, than pharmacoinvasive patients, with no significant differences in locations of MI.

Regarding pre-post laboratory results changes, study groups had significant differences in WBCs, sodium, troponin-I, LDL, HDL, triglyceride and heart rate. On the other hand, all postoperative complications were significantly higher among pharmacoinvasive patients, including insertion site hematoma, hemorrhagic stroke, epistaxis, hematemesis, stroke and the number of complications, with significantly lower survival rate.

Chapter Four
Discussion and Conclusion

The following chapter focuses on discussing the current study results by comparing them with previous studies and trying to provide interpretations to the findings and relationships that were previously shown. Also, the following chapter will provide a comprehensive conclusion of the study, as well as a list of recommendations that are based on what have been discussed, in addition to several limitations that faced the researcher during the study process.

4.1 Discussion of methods and sample characteristics of the study

The current study was conducted with the use of a retrospective design, which is known for its advantages related to being valuable when time is limited, as it allows for the analysis of pre-existing data, and useful for generating hypotheses that can be later tested in the prospective design, and therefore giving valid and meaningful results if designed carefully (Abbott et al., 2016; Ciulla & Vivona, 2019; Talari & Goyal, 2020), and while it is limited by being less rigorous than prospective design, the study design is suitable for the current low-resource setting, and that the settings (Palestine Medical Complex and An-Najah National University Hospital) perform the targeted procedure (i.e., PCI) in a single approach each, which means that the researcher was obligated to gather data from both of them in spite of the time and transportation limitations related to the current geopolitical situation. What helped in the data collection process is referring to electronic medical records (EMRs) of both hospitals, which practical and resource-efficient in clinical research, and is particularly advantageous in retrospective design, which reduces costs and time required for data collection and helps in avoiding the manual chart reviews (Barick et al., 2018). As EMRs helps in identifying eligible patients during the data collection, with the help of Health Information System (HIS) technicians in each hospital, and therefore allowing for extraction of data in an easier and more accurate way (Ford et al., 2016), taking into account that each hospital uses a different HIS program and separate database.

The settings of the study included Palestine Medical Complex (PMC), known for being the largest hospital in the West Bank – Palestine, located in Ramallah city, a highly active

city in the economic and social ways, and was chosen for the recruitment of patients who underwent pharmacoinvasive approach, while the second setting was An-Najah National University Hospital (NNUH), a leading tertiary hospital known for being a university teaching hospital that granted the Joint Commission International Accreditation (JCIA) in 2020, and was chosen for the recruitment of patients who underwent the PCI-only approach. The inclusion of hospitals with higher levels of clinical research activity that provide better patient care is associated with gathering of better patient information, as well as a maintained focus on both clinical care and research (Jonker et al., 2020). The inclusion of such settings also supported the ability to recruit patients with a wider diversity of complex procedures compared to smaller ones, and provides rich data for research and helps in improving the prediction of surgical outcomes and resource management (Dexter et al., 2017). The results from the mentioned hospitals can also be generalized to other hospitals who use the same approaches and can be used to develop new treatments and enhance the quality of research.

In terms of the sample size, the study included a total of 160 patients, who were almost similarly divided into the two study groups. The determination of a proper sample size in pretest-posttest design is important, where small sample sizes can be related to limited power to detect the significance effects, and therefore, larger sample sizes are recommended in non-interventional studies (Buluş, 2021). In the current study, the sample size is fairly appropriate, and therefore, careful analysis of the data was needed, which was supported by the use of paired measurements (as in paired-samples t-test). Moreover, the study researcher determined the recommended sample size prior to the actual data collection, while most of the retrospective studies are conducted with the available data, and the main limitation related to such issue is about the information bias, as in incomplete data or unbalanced groups, which were overcome in the current study through careful selection of study sample (Das et al., 2016; Miciak et al., 2016).

The eligibility criteria that were chosen in the current study are also chosen to be suitable for the Palestinian population and the general cardiology research, which were also consistent with similar studies focusing on STEMI management and PCI or pharmacoinvasive strategies. For example, the inclusion of patients between 30 and 75

years indicates the inclusion of middle-aged and older adults, which reflects a high prevalence of STEMI in these age groups, and was similar to the inclusion of a previous study, where Victor et al. (2014) recruited patients between 18 and 75 years of age presenting within 12 hours of symptoms onset in their ST-Elevation Myocardial Infarction Pilot Project–Acute Myocardial Infarction (STEPP-AMI) study. Also, the exclusion of patients with history of bleeding or mental illnesses was common in STEMI studies, where bleeding risk is a significant concern related to reperfusion therapy (Han et al., 2013). To align with patient safety concerns, the current study also excluded pregnant patients. The exclusion of tPA-only patients also adheres with the recommendations related to ensuring homogeneity in treatment modalities that are compared (Capranzano et al., 2013). Lastly, the exclusion of referred patient from other hospitals helped in reducing potential biases related to differences in pre-hospital management and timing of interventions, and was consistent with a previous study called Strategic Reperfusion Early After Myocardial Infarction 2 (STREAM-2) study (Armstrong et al., 2020).

The data were collected using an abstract sheet that was developed by the researcher based on literature review and experts' opinion and review. The use of structured form, as in abstract sheet, for data collection is recommended as it helps in improving the consistency and reliability of the collected data, especially in clinical data of retrospective studies, while unstructured data are challenged by the need for more rigorous validation process to enhance its quality (Kamran et al., 2022). Also, the use of validation process through the experts' review is supported by improving data reliability and reduction of bias in retrospective studies, especially when collecting data related to clinical outcomes (Staffa & Zurakowski, 2018). The increased reliability of data is also supported by the use of validated abstract sheet when collection data in multisite studies, as it increases interrater agreement, which was also applied in the current study by validating the tool from experts in both settings, and the implementation of piloting study to get comprehensive feedback from the researcher about the process of data collection (Polnaszek et al., 2016). Data accuracy and efficiency is also supported by the use of

abstract sheet when collecting data from EMRs, and supports the importance of experts' role in designing and validating the tool for systematic data collection (Li et al., 2019).

4.2 Discussion of sample's characteristics and independent variables

The current study showed that the mean age of patients undergoing PCI-only approach was significantly higher than who underwent pharmacoinvasive approach, with a mean age of 58.0 ± 11.4 years old, that was similar to a previous study of (Robles-Ledesma et al., 2023), who reported a mean age of 58.3 ± 10.0 years old among the included STEMI patients, while it was slightly higher than the STEPP-AMI study of Victor et al. (2014). The age differences between both study groups is mostly related to clinicians' preferences to use PCI as a primary strategy in older patients, who are often considered to have higher risks of complications due to age-related comorbidities, in which direct revascularization is preferred, and aligns with the recommendations of Auffret et al. (2020), where older patients tend to undergo PCI more frequently because of better outcomes in terms of complications reduction like heart failure and mortality compared to thrombolysis, making it a safer approach.

An interesting result was related to the significant difference in residency between study groups, where pharmacoinvasive patients tended to be more from rural areas, and PCI patients tended to be residing in urban areas. This aligns with previous studies, which showed that it is more related to shorter symptom-to-door period among patients who reside in urban areas, making the cardiologist prefer the PCI only approach for them and therefore benefitting from a faster revascularization (Clifford et al., 2020; Shavadia et al., 2013), as the timing is important in such cases, in addition to the fact that rural areas, as in Palestine, lack the initial management needed for STEMI patients, which is PCI, and therefore, a thrombolysis management starts before transferring the patient to the major cardiology center, making pharmacoinvasive approach more feasible in these circumstances (Larson et al., 2012). The American College of Cardiology (ACC) and European Society of Cardiology (ESC) recommends a 90-minute onset-to-treatment period, using the PCI as the first-line treatment to benefit STEMI patients, as it improved their outcomes (Gershlick et al., 2015), while when this period is prolonged, the patient

is at risk of having prolonged ischemia-related myocardial damage, where immediate thrombolysis followed by PCI is preferred (Mishra & Verma, 2013).

There were no significant differences in the prevalence of DM, HTN or IHD between patients who underwent PCI or pharmacoinvasive approaches (p-value > 0.05). Such findings were similar to the findings found in previous studies, including Victor et al. (2014). Also, a previous study (Khan et al., 2023) found a prevalence of 56% for HTN and 24% for DM in their sample of STEMI patients who underwent thrombolysis management, compared to 55.1% and 52.6%, respectively, in the current study, showing similar HTN and higher DM prevalence, while they were not significantly different that PCI approach in both studies. Previous studies also showed that such insignificant differences in DM and HTN between STEMI management groups is related to the fact that management choice depends on logistics, symptom-to-door period and availability of PCI facilities (Balzi et al., 2006; Gour et al., 2020), and that such comorbidities are common risk factors for developing STEMI, and related to the choice of treatment.

On the other hand, the current study showed higher prevalences of dyslipidemia and obesity among patients undergoing PCI (97.6% and 95.1%, respectively) than pharmacoinvasive approach (74.4% and 76.9%, respectively). As dyslipidemia is more related to the formation of atherosclerosis, a previous study agreed with these findings, as patients with such a risk factor commonly have more severe coronary artery disease (CAD) that requires mechanical revascularization (Ferrières et al., 2018), and that PCI is often more chosen when the patients have more advanced or multi-vessel diseases (Khan et al., 2023). For diabetes, similar findings were found in previous literature (Endo et al., 2018; Ye et al., 2023), who stated that diabetic patients often present with more advanced stages of STEMI, due to the risk of more severe CAD, which calls for PCI, and that they receive more aggressive management and closer monitoring, therefore showing better outcomes, in spite of their findings that DM is more related to develop acute kidney injury (AKI) during PCI.

Similar to the previous interpretations, the choice of STEMI management is not commonly affected by the previous revascularization procedures that the patients

underwent in the past, which was presented in the current study by the absence of significant differences in the prevalence of previous PCI, open heart surgeries or vascular surgeries between both study groups (p-value > 0.05), which aligned with previous studies (Kvakkestad et al., 2022; Zubaid et al., 2020), who also supported the idea related to the preference of STEMI management according to the symptom-to-door period and facility capabilities. Therefore, a conclusion can be made here related to the eligibility of STEMI patients to either management approaches regardless of the previous revascularization history. When speaking about smoking history, it is associated with what is known as “smoking paradox”, where smokers showed better short-term outcomes after being treated from STEMI, mostly related to their younger age and fewer comorbidities, than non-smokers, while long-term outcomes were worse among them (Siddiqui et al., 2022), which is not similar to the findings of the current study related to the absence of significant differences in number of postoperative complications according to smoking status. On the other hand, a previous study agreed with the findings related to absence of differences in smoking history between both study groups, where it was interpreted by the fact that smoking is a common risk factor for developing CAD, and is not related to the choice between PCI and pharmacoinvasive approaches (Redfors et al., 2020).

The current study also found significantly lower prevalence of valve stenosis and regurgitation and cardiac muscle hypokinesia in PCI patients. These findings were also similar to previous studies. For example, Grayburn et al. (2019) and Freitas-Ferraz et al. (2020) stated that the lower prevalence of valvular issues in PCI patients is more related to the fact that such disorders can complicate the outcomes of PCI approach, due to having more common worse left ventricular function, which makes them less candidates for PCI, and therefore, other revascularization approaches are suggested in such cases. Similarly, patients who have cardiac muscle hypokinesia tend to have worse left ventricular function, which calls for the choice of pharmacoinvasive approach, especially if the initial management can reduce the ischemic burden before continuing to PCI (Huang et al., 2022). Lastly, the presence of ventricular hypertrophy was found to be similar in both groups as it was more related to chronic consequences of CAD risk factors, such as HTN,

and therefore, not often related to the choice of STEMI treatment approaches (Montalto et al., 2019). As patients with more reduced EF are in need for more urgent STEMI intervention, i.e., PCI, previous literature also supports the findings of the current study related to the significantly lower mean EF among PCI (43.4 ± 11.3) compared to pharmacoinvasive patients (47.0 ± 9.2), where lower EF indicates more severe myocardial damage or a higher ischemic burden, calling for mechanical revascularization that results in better outcomes (Palmer et al., 2018; Robles-Ledesma et al., 2023).

Previous studies also agreed with the findings of the current study in terms of the preference of radial over femoral approach of insertion among PCI patients, which was shown to have less bleeding and vascular complications, as stated in the Safety and Efficacy of Femoral Access versus Radial Access in ST-Segment Elevation Myocardial Infarction (SAFARI-STEMI) study by Bajraktari et al. (2021), and was supported by Arboine et al. (2018), who stated that radial approach among PCI patients reduces what is known as the mortality and major adverse cardiovascular events (MACE). Due to ease of access and operator's familiarity, the femoral insertion approach is more preferred among STEMIM patients treated with pharmacoinvasive approach, where it rescues post-PCI thrombolysis, as well as the need for larger catheter size in cases of STEMI that present with hemodynamic instability, heart failure or higher risk features, that may call the need for intra-aortic balloon pump (IABP) support (Jin et al., 2021).

4.3 Discussion of differences in laboratory results between study groups

In the preoperative phase, patients who were treated with PCI presented with significantly higher mean of white blood cells (WBC) count and C-Reactive protein (mean = 12.45 ± 5.49 and 123.93 ± 160.25, respectively) than pharmacoinvasive approach (mean = 8.51 ± 3.42 and 16.29 ± 28.62, respectively), which can be interpreted by the findings of several previous studies related to the fact that more severe presentation of STEMI patients is associated with more inflammatory responses and worse left ventricular function, and therefore requiring more urgent mechanical revascularization approach (Claessen et al., 2021; Purayil et al., 2020; Tuxun et al., 2020). Similarly, patients with worse presentation and higher biomarkers (as indicated by the significantly higher preoperative troponin-I in the current study among PCI than pharmacoinvasive patients) indicates more severe case

of STEMI and larger infarct size, calling form more urgent intervention, sue the need for faster revascularization (Kabil et al., 2020; Shavadia et al., 2019).

Patients who underwent PCI significantly showed a decrease in WBCs (mean difference = -1.71 ± 4.30) compared to pharmacoinvasive group (mean difference = 0.07 ± 1.72). This finding was interpreted by previous studies in that PCI approach with such decrease in WBCs often reflects more stabilization of the acute inflammatory state and better control of systemic inflammation, due to the direct revascularization and ischemia reduction of PCI approach, as found in the GLOBAL LEADERS trial by Ono et al. (2020) and Boukhris et al. (2022). The interpretation is also supported by the SCALIM registry of STEMI patients, which showed that patients undergoing pharmacoinvasive approach show gradual reduction in WBCs count due to the delayed PCI after initiating thrombolysis, thus it is more related to differences in timing and completeness of reperfusion between both approaches (Roule et al., 2020). The same applies to the significant reduction of troponin-I, which was more in PCI than pharmacoinvasive patients, reflecting more stabilization of the postoperative status, and is interpreted be the significant decrease in burden and increased vascularization provided by PCI (Permatasari et al., 2020; Shavadia et al., 2019; Zhang & Ding, 2021).

Previous studies also support the interpretation of the significantly more reduction in lipid profile laboratory results among PCI than pharmacoinvasive patients, where it indicates a better stabilization of lipid levels, due to rapid restoration of blood flow and improved myocardial perfusion, where it enhances lipid metabolism and promotes faster recovery (Mehta et al., 2022; Stepura et al., 2019). The significantly higher reduction in lipid profile among PCI patients can also be interpreted by the lipid paradox among STEMI patients as shown by Sia et al. (2020), who stated that higher preoperative lipid profile calls for more urgent mechanical revascularization using PCI, which results in more favorable reduction. The same was also noticed in regard to heart rate, which was significantly higher among PCI patients and showed more reduction in the postoperative phase. More reduction indicates more effective reperfusion due to rapid reperfusion and restoration of blood flow (Naji et al., 2021), while another study stated that heart rate

reduction reflects the success of reperfusion procedure, indicating the reduction in ischemia burden and myocardial workload (Jamal et al., 2022).

4.4 Discussion of the postoperative complications across study groups

In the current study, almost all postoperative complications were significantly higher in their incidence among patients who underwent pharmacoinvasive than PCI approach, taking into account that they were bleeding-related complications, like insertion site hematoma, hemorrhagic stroke, epistaxis, and hematemesis. Such phenomena are interpreted by the fact that initial thrombolysis therapy in the pharmacoinvasive approach increases bleeding risks, and that bleeding risks also increase with the periprocedural use of anticoagulants and antiplatelet agents, such as dual antiplatelet therapy (DAPT), which exacerbates the risk of bleeding, as stated in the nationwide prospective registry of Kuwait in Zubaid et al. (2020), in addition to the increased bleeding risk in pharmacoinvasive patients with older ages, such as the increased risk of intracranial hemorrhage and other bleeding events after receiving the full dose of thrombolysis, as mentioned in the STREAM-2 study of (Armstrong et al., 2020).

Focusing on the incidence of insertion site hematoma, several studies have interpreted this phenomenon, such as Ashmawy et al. (2019), who stated that it increases with the use of femoral access route, which is more frequently used in pharmacoinvasive approaches, that is related to femoral artery being larger and located deeper than radial artery, while it is also selected for previously mentioned reasons. Another recent study mentioned that the incidence of insertion site hematoma was 2.3% vs 0.23% among pharmacoinvasive vs PCI patients, respectively (Rana et al., 2021), compared to 53.85 vs 20.7% in the current study. The use of vascular closure devices in femoral catheterization was found to not fully eliminate the bleeding risks, especially when combined with antithrombotic therapy, as in thrombolysis and DAPT therapy (D'Ascenzo et al., 2018). In addition, Khalfallah et al. (2018) stated that such bleeding complications increase when the PCI is performed early after thrombolysis initiation (within 3 to 12 hours), due to the prolonged effect of thrombolysis agents, highlighting the importance of timing of PCI after thrombolysis, while Li et al. (2018) highlighted the correlation between age and insertion site hematoma, because pharmacoinvasive approach is more used among

patients with more critical conditions, who are mostly older in age and having more comorbidities.

Other studies, like Rashid et al. (2019) emphasized the risk of higher anticoagulants and antiplatelets therapy load on the risk of stroke after STEMI interventions, in spite of the importance of such treatment in the prevention of thrombosis. Also, Alex et al. (2018) highlighted the risk of delayed definitive PCI after thrombolysis, which may result in incomplete reperfusion or current ischemia, therefore increasing the likelihood of thromboembolic events like stroke, which was also found to be higher among pharmacoinvasive patients in the current study, while Pr and George (2018) emphasized the age role in stroke complications, which was found to be higher among pharmacoinvasive patients, who are more commonly older, having more comorbidities, and who have hypertension and atrial fibrillation, that are more found among critically ill patients requiring the pharmacoinvasive approach. Focusing on the age factor, the current study found insignificant differences in the number of postoperative complications across age groups, while they were higher among patients with HTN.

The current study found that the number of postoperative complications among patients after undergoing STEMI management is significantly higher among patients with dyslipidemia, which can be interpreted under the findings of previous studies of the link between lipid abnormalities and increased risk of complications following any medical or surgical interventions. For example, Son et al. (2023) and Som et al. (2023) mentioned the link between dyslipidemia and increased inflammatory markers and antioxidative stress, impairing wound healing and contributing to higher risks of postoperative complications, such as infections, hematoma and cardiovascular events, while Gazzaz et al. (2020) stated that dyslipidemia is strongly associated with endothelial dysfunction that increases the risk of atherosclerosis formation and thromboembolic events and bleeding complications, in addition to Liu et al. (2022), who stated that dyslipidemia is often found in coexistence with other comorbidities, such as HTN and DM, which further increases the risk of postoperative complications.

In the light of what have been discussed earlier, as well as what previous literature included, they agree with the current study finding related to the significantly higher mortality rate among patients who underwent pharmacoinvasive approach compared to PCI. For example, Alex et al. (2018) and Shavadia et al. (2019) stated that mortality rate among STEMI patients is related to the timeliness and completeness of reperfusion, that is faster achieved through PCI, which is also included in the discussion of significant improvement in laboratory results among them, as they reflected better control of myocardial inflammation and injury. Moreover, lower mortality rate among PCI patients is highly linked to the findings related to fewer number of postoperative complications among them (Rashid et al., 2019), in addition to the impact of dyslipidemia in combination with other comorbidities (Liu et al., 2022).

The previous study of Rashid et al. (2016) found similarities in major composites that they have studies, including mortality, reinfarction and stroke, which was the complete opposite of what is found in the current study, where pharmacoinvasive patients significantly had higher mortality rate and stroke events, while the current study did not investigate for the incidence of postoperative re-infarction, and is recommended to be applied in the future studies in Palestine. On the other hand, both studies agreed on significantly higher incidence of postoperative hemorrhagic stroke among patients who were treated with the pharmacoinvasive approach. The primary differences in both studies can interpret the variations in their findings, including that the previous study was conducted in a specialized, university-affiliated hospital, compared to a two-setting design in the current study, where the PCI center was a university-affiliated hospital, compared to a governmental health institute for pharmacoinvasive approach. The previous study also stated that patients who are admitted to their hospital are within 90 kilometers of radius, which also highlights the differences in transportations capabilities between Palestine and Canada, caused by presence of many barriers in Palestine, like checkpoints and political restrains by the Israeli military, even between adjacent villages, which all connect to the variations in onset-to-arrival, onset-to-catheterization laboratory and onset-to-balloon time intervals. The patients were also different in some characteristics, like the significant differences in smoking status in the previous study,

and in age in the current study. It is highly recommended to focus on clinical time intervals in future studies that are applied in Palestine among STEMI patients, which requires prospective rather than retrospective design, sue to lack of related detailed information in the patients' databases.

Focusing on the comparison between the current study and the previous study of Zubaid et al. (2020), the previous study found no significant difference in almost all of the postoperative in-hospital outcomes that were included in the current study also. Although both studies implemented the retrospective design from patients' databases, the differences in findings can be related to methodological variations, including that the REPERFUSE Kuwait registry includes detailed information about the included patients from larger number of hospitals, and is supported by governmental funding, as well as unifying the data collection method, while the current study included data from two hospitals only. Also, it is worth mentioning the same idea that was discussed before related to shorter arrival time to hospitals in other countries, where transportation capabilities are higher. Patients in both studies also had several differences in their demographic factors, including non-significant differences in age in previous study, which is the opposite in the current study, while the current study had patients with significantly different characteristics in dyslipidemia, obesity, and several echotomography findings, which were absent, or not studied, in the previous study, while both studies have patients with different baseline heart rate between both groups.

4.5 Conclusion

The current study was conducted with the main aim to investigate the differences in postoperative laboratory results and specific complications among STEMI patients who were treated with either PCI or pharmacoinvasive approaches in two tertiary health institutions in West Bank – Palestine. The data collection was done using an abstract sheet that was developed by the researcher based on previous literature and experts' opinions, and randomly recruited patients from the EMRs of selected hospitals.

Patients who were treated with pharmacoinvasive approach significantly had younger age (mean = 59.8 vs 56.2) and living more in rural areas compared to PCI group of patients.

Also, they significantly had higher prevalences of dyslipidemia (25.6% vs 2.4%), but lower obesity (76.9% vs 95.1%), while having higher percentages of valve stenosis (9.0% vs 0.0%), valve regurgitation (52.6% vs 4.9%) and cardiac muscle hypokinesia (51.3% vs 31.7%), but higher mean EF (47.0 vs 43.4) than PCI group of patients. Femoral catheter insertion site (84.6% vs 4.9%) was preferred among pharmacoinvasive patients, with 48.7% of them performing the catheterization intervention on the second day of admission, compared to 97.6% on the admission day for PCI group of patients.

Several laboratory tests showed significantly different results in the pre- and post-operative phases, with PCI group of patients significantly showing more decrease in WBCs (mean difference = -1.71 vs 0.07, p-value = 0.002), elevation in troponin-I (mean difference = 2306.54 vs -30.74, p-value < 0.001), decrease in LDL (mean difference = -94.18 vs -10.21, p-value < 0.001), HDL (men difference = -31.09 vs 1.58, p-value < 0.001) and triglyceride (mean difference = -90.29 vs -15.11, p-value = 0.041), as well as more heart rate resting (mean difference = -10.94 vs -3.09, p-value < 0.001), compared to pharmacoinvasive group of patients.

Almost all postoperative complications were significantly higher in incidence among patients who were treated with pharmacoinvasive than PCI approach, including insertion site hematoma (53.8% vs 20.7%, p-value < 0.001), hemorrhagic stroke (9.0% vs 0.0%, p-value = 0.006), epistaxis (19.2% vs 0.0%, p-value < 0.001), hematemesis (6.4% vs 0.0%, p-value = 0.020) and stroke (5.1% vs 0.0%, p-value = 0.038), as well as higher mortality rate (12.8% vs 1.2%, p-value = 0.004).

Several studies that were published in peer-reviewed journals that investigated similar topics in cardiology and management of STEMI patients showed similar results and had interpreted the significance of differences in postoperative complications and laboratory results changes between patients who were treated with pharmacoinvasive and PCI approaches. More studies are needed to be conducted in Palestine to cover more health institutions and larger samples, with preferring the use of prospective design.

4.6 Recommendations

Based on the discussion of the study results, the researcher recommends the following:

4.6.1 Recommendations for patients

1. Encourage lifestyle modifications and adopt heart-healthy lifestyle to address and control dyslipidemia and other comorbidities, which may include dietary modifications, regular exercise and weight management, in addition to frequent monitoring of lipid profile.
2. Educate the patients on the importance of prescribed medication adherence to lower the risk of postoperative complications and improve survival, like antiplatelet agents, statins and other cardiovascular drugs.
3. Increase the community and patients of concern about the recognition of signs and symptoms of STEMI, in addition to the importance of early medical attention to reduce treatment delays.

4.6.2 Recommendations for healthcare providers

1. As the survival rate is lower and the incidence of postoperative complications is higher among patients with pharmacoinvasive approach, healthcare providers are recommended to perform primary PCI whenever feasible, especially when symptom-to-door time is short, which is also supported by the optimization of hospital protocols to ensure rapid activation of catheterization lab and the minimization of door-to-balloon time.
2. As the risk of postoperative insertion site hematoma is higher among pharmacoinvasive patients and femoral insertion site, HCPs are also recommended to adopt the radial insertion site when possible.
3. Encourage the initiation or intensifying of lipid-lowering agents for patients with risk of CAD and its complications, including the early and aggressive statin therapy, as dyslipidemia was found to be associated with increased number of postoperative complications.

4. It is also recommended to closely monitor inflammatory markers, such as the changes in WBCs and troponin-I levels, because they guide the effectiveness of reperfusion and guide post-STEMI management.

4.6.3 Recommendations for health institutions

1. Increase the availability and access to primary PCI-capable facilities to reduce the reliance on pahramcoinvasive approach, which can be done through expansion of cateheterization lab capabilities, staffing and increased support to accomomdate more patients who require primary PCI.
2. Establish the speical protocols that are implemented on STEMI patients with higher risks due to comorbidities, like dyslipidemia, HTN And DM, which should also include improved monitoring, early use of anti-lipid therapies and bleeding risk management.

4.7 Limitations

The study was also limited by the following factors:

1. The use of retrospective design and collecting data from EMRs, which may have increased the selection bias and information bias, and was overcome by using simple randomization sampling method.
2. The differences in clinical practices, treatment protocols and healthcare delivery between the two study settings could have introduced institutional bias.
3. Limited generalizability of the results, because of the data colelction from two hospitals only, which was also limited by time constrain and the current war situation that limited transporation to allow data collection from more hospitals and exapnd the sample size.

List of abbreviations

Abbreviation	Full term
IHD	Ischemic Heart Disease
ACS	Acute Coronary Syndrome
MI	Myocardial infarction
CAD	Coronary Artery Disease
HF	Heart failure
ECG	Electrocardiogram
PCI	Percutaneous Coronary Intervention
CABG	Coronary artery bypass graft
AMI	Acute myocardial infarction
CS	Cardiogenic shock
LV	Left ventricle
STEMI	ST-segment elevation myocardial infarction
AKI	Acute kidney injury
NNUH	An-Najah National University Hospital
PMC	Palestine Medical Hospital
ED	Emergency department
LOS	Length of stay
DM	Diabetes mellitus
HTN	Hypertension
KFT	Kidney function test
CBC	Complete blood count
CRP	c-reactive protein
UGIB	Upper gastrointestinal bleeding
tPA	Tissue plasminogen activator
VAS	Visual analogue scale
RCT	Randomized controlled trial
PPCI	Primary percutaneous coronary intervention
CI-AKI	Contrast-induced acute kidney injury
GFR	Glomerular filtration rate
LAD	Left anterior descending (coronary artery)
RA	Radial access
FA	Femoral access
EMR	Electronic medical record
SPSS	Statistical Package for Social Sciences
SD	Standard deviation
OS	Operating system
ANOVA	Analysis of variance

Abbreviation	Full term
IRB	Institutional review board
PSH	Past surgical history
PMH	Past medical history
EF	Ejection fraction
BUN	Blood urea nitrogen
CK	Creatine kinase
RBS	Random blood sugar
LDL	Low-density lipoprotein
HDL	High-density lipoprotein
PT	Prothrombin time
PTT	Partial thromboplastin time
INR	International Normalized Ratio
HIS	Health information system
JCIA	Joint Commission Internation Accreditation
STEPP-AMI	ST-Elevation Myocardial Infarction Pilot Project–Acute Myocardial Infarction
STREAM-2	Strategic Reperfusion Early After Myocardial Infarction 2
ACC	American College of Cardiology
ESC	European Society of Cardiology
SAFARI-STEMI	Safety and Efficacy of Femoral Access versus Radial Access in ST-Segment Elevation Myocardial Infarction
MACE	Mortality and major adverse cardiovascular events
IABP	Intra-aortic balloon pump
DAPT	Dual antiplatelet therapy

References

Abbott, K. V., Barton, F. B., Terhorst, L., & Shembel, A. C. (2016). Retrospective Studies: A Fresh Look. *American journal of speech-language pathology*, *25 2*, 157-163.

Ahmad, M., Mehta, P., Reddivari, A. K. R., & Mungee, S. (2022). Percutaneous Coronary Intervention. In *StatPearls*. StatPearls Publishing Copyright © 2022, StatPearls Publishing LLC.

Aissaoui, N., Riant, E., Lefèvre, G., Delmas, C., Bonello, L., Henry, P., Bonnefoy, E., Schiele, F., Ferrières, J., Simon, T., Danchin, N., & Puymirat, E. (2018). Long-term clinical outcomes in patients with cardiogenic shock according to left ventricular function: The French registry of Acute ST-elevation and non-ST-elevation Myocardial Infarction (FAST-MI) programme. *Arch Cardiovasc Dis*, *111*(11), 678-685. https://doi.org/10.1016/j.acvd.2017.11.002.

Akbar, H., Foth, C., Kahloon, R. A., & Mountfort, S. (2022). Acute ST Elevation Myocardial Infarction. In *StatPearls*. StatPearls Publishing Copyright © 2022, StatPearls Publishing LLC.

Alex, A., Lahiri, A., Devika, Geevar, T., & George, O. K. (2018). Observational study comparing pharmacoinvasive strategy with primary percutaneous coronary intervention in patients presenting with ST elevation myocardial infarction to a tertiary care centre in India. *Journal of Postgraduate Medicine*, *64*, 80 - 85.

Araiza-Garaygordobil, D., Gopar-Nieto, R., Cabello-López, A., Martinez-Amezcua, P., Eid-Lidt, G., Baeza-Herrera, L. A., Gonzalez-Pacheco, H., Briseño-De la Cruz, J. L., Sierra-Lara Martinez, D., Mendoza-García, S., Altamirano-Castillo, A., & Arias-Mendoza, A. (2021). Pharmacoinvasive Strategy vs Primary Percutaneous Coronary Intervention in Patients With ST-Elevation Myocardial Infarction: Results From a Study in Mexico City. *CJC Open*, *3*(4), 409-418. https://doi.org/10.1016/j.cjco.2020.11.012.

Arboine, L., Galván, E. d. T., Palacios, J. M., Jáuregui, O., Cruz, R. d. l., Vargas, J. F., Bonfil, M., Mendez, J. R., Ontiveros, R., Fong, M.-C., Cordova, H. I., Sierra, A., Alej, Zapata, R. V., Muñoz, C., & Alvarado, G. (2018). Comparison of radial vs femoral approach in patients with st-segment elevation acute myocardial infarction in a code-stemi program. *Journal of Cardiology & Current Research*, *11*.

Armstrong, P. W., Bogaerts, K., Welsh, R. C., Sinnaeve, P. R., Goldstein, P., Pagès, A., Danays, T., & Van de Werf, F. (2020). The Second Strategic Reperfusion Early After Myocardial Infarction (STREAM-2) study optimizing pharmacoinvasive reperfusion strategy in older ST-elevation myocardial infarction patients. *American heart journal*, *226*, 140-146.

Ashmawy, M. M., El-din, S. S., Deraz, E. M., & Mosaad, A. M. (2019). Efficacy of pharmacoinvasive percutaneous coronary intervention versus primary percutaneous coronary intervention in ST elevation myocardial infarction.

Auffret, V., Laurin, C., Leurent, G., Didier, R., Filippi, E., Hacot, J. P., Zabalawi, A., Rouault, G., Saouli, D., Druelles, P., Coudert, I., Boulanger, B., Bot, E., Treuil, J., Bedossa, M., Boulmier, D., Loirat, A., Sharobeem, S., Guellec, M. L., . . . Breton, H. L. (2020). Pharmacoinvasive Strategy Versus Primary Percutaneous Coronary Intervention for ST-Segment Elevation Myocardial Infarction in Patients ≥70 Years of Age. *The American journal of cardiology*.

Bajraktari, G., Rexhaj, Z., Elezi, S., Zhubi-Bakija, F., Bajraktari, A., Bytyçi, I., Batalli, A., & Henein, M. Y. (2021). Radial Access for Coronary Angiography Carries Fewer Complications Compared with Femoral Access: A Meta-Analysis of Randomized Controlled Trials. *Journal of Clinical Medicine*, *10*.

Balami, J. S., Sutherland, B. A., & Buchan, A. M. (2013). Complications associated with recombinant tissue plasminogen activator therapy for acute ischaemic stroke. *CNS Neurol Disord Drug Targets*, *12*(2), 155-169. https://doi.org/10.2174/1871527311312020004 1871527311211999005O.

Balzi, D., Barchielli, A., Buiatti, E., Franceschini, C., Lavecchia, R., Monami, M., Santoro, G. M., Carrabba, N., Margheri, M., Olivotto, I., Gensini, G. F., & Marchionni, N. (2006). Effect of comorbidity on coronary reperfusion strategy and long-term mortality after acute myocardial infarction. *American heart journal*, *151 5*, 1094-1100.

Barick, U., Vijaykanth, A., Bharucha, H., Gowda, A., Patil, A., Bosbach, S., & Zomorodi, B. (2018). Are Retrospective Patient Chart Audits an Affordable and Reliable Answer to healthcare data needs? Assessing the Ground Reality. *Hämostaseologie*, *39*, S1 - S92.

Bhatt, D. L., Lopes, R. D., & Harrington, R. A. (2022). Diagnosis and Treatment of Acute Coronary Syndromes: A Review. *Jama*, *327*(7), 662-675. https://doi.org/10.1001/jama.2022.0358.

Boukhris, M., Molié, C. D., Chenard, P., Gourceyrol, A., Gasnier, A., Virot, P., & Aboyans, V. (2022). Poster No. 109 Prognostic value of white blood cell count variation during in-hospital stay in STEMI patients: Insights from SCALIM Registry. *Cardiovascular Research*.

Buluş, M. (2021). Sample Size Determination and Optimal Design of Randomized/Non-equivalent Pretest-posttest Control-group Designs.

Capranzano, P., Tamburino, C., & Dangas, G. D. (2013). Combination Antithrombotic Management of STEMI with Pharmacoinvasive Strategy, Primary PCI, or Rescue PCI. *Interventional cardiology clinics*, *2 4*, 573-583.

Ciulla, M. M., & Vivona, P. (2019). Time arrow in published clinical studies/trials indexed in MEDLINE: a systematic analysis of retrospective vs. prospective study design, from 1960 to 2017. *PeerJ*, *7*.

Claessen, B. E. P. M., Ben-Yehuda, O., Mehran, R., Sorrentino, S., Guedeney, P., Chen, S., Dressler, O., Kini, A. S., Sharma, S. K., Mansour, S., Noiseux, N. O., Li, D., Kappetein, A. P., Sabik, J. F., Serruys, P. W., & Stone, G. W. (2021). White blood

cell count and clinical outcomes after left main coronary artery revascularization: insights from the EXCEL trial. *Coronary Artery Disease*, *33*, 45 - 51.

Clifford, C. R., Le May, M., Chow, A. L. S., Boudreau, R., Fu, A., Barry, Q., Chong, A.-Y., & So, D. Y. (2020). Delays in ST-Elevation Myocardial Infarction Care During the COVID-19 Lockdown: An Observational Study. *CJC Open*, *3*, 565 - 573.

D'Ascenzo, F., Grosso, A., Abu-Assi, E., Kinnaird, T., Ariza-Solé, A., Manzano-Fernández, S., Templin, C., Velicki, L. U., Xanthopoulou, I., Cerrato, E., Rognoni, A., Boccuzzi, G. G., Omede', P., Montabone, A., Taha, S., Durante, A., Gili, S., Ali, H. H., Magnani, G., . . . Raposeiras-Roubín, S. (2018). Incidence and predictors of bleeding in ACS patients treated with PCI and prasugrel or ticagrelor: An analysis from the RENAMI registry. *International journal of cardiology*, *273*, 29-33.

Das, S., Mitra, K., & Mandal, M. (2016). Sample size calculation: Basic principles. *Indian Journal of Anaesthesia*, *60*, 652 - 656.

Dexter, F., Epstein, R. H., Thenuwara, K. N., & Lubarsky, D. A. (2017). Large Variability in the Diversity of Physiologically Complex Surgical Procedures Exists Nationwide Among All Hospitals Including Among Large Teaching Hospitals. *Anesthesia & Analgesia*, *127*, 190–197.

El-Ahmadi, A., Abassi, M. S., Andersson, H. B., Engstrøm, T., Clemmensen, P., Helqvist, S., Jørgensen, E., Kelbæk, H., Pedersen, F., Saunamäki, K., Lønborg, J., & Holmvang, L. (2019). Acute kidney injury – A frequent and serious complication after primary percutaneous coronary intervention in patients with ST-segment elevation myocardial infarction. *PLOS ONE*, *14*(12), e0226625. https://doi.org/10.1371/journal.pone.0226625 .

Endo, H., Dohi, T., Shitara, J., Wada, H., Doi, S., Naito, R., Konishi, H., Tsuboi, S., Ogita, M., Kasai, T., Okazaki, S., Isoda, K., Miyauchi, K., & Daida, H. (2018). Impact of body mass index on long-term outcomes in Japanese patients following percutaneous coronary intervention: The Juntendo PCI Registry. *Journal of cardiology*, *72 3*, 208-214.

Fazel, R., Joseph, T. I., Sankardas, M. A., Pinto, D. S., Yeh, R. W., Kumbhani, D. J., & Nallamothu, B. K. (2020). Comparison of Reperfusion Strategies for ST-Segment-Elevation Myocardial Infarction: A Multivariate Network Meta-analysis. *J Am Heart Assoc*, *9*(12), e015186. https://doi.org/10.1161/jaha.119.015186.

Ferrières, J., Lautsch, D., Gitt, A. K., de Ferrari, G. M., Toplak, H., Elisaf, M. S., Drexel, H., Horack, M., Baxter, C. A., Ambegaonkar, B., Brudi, P., & Toth, P. P. (2018). Body mass index impacts the choice of lipid-lowering treatment with no correlation to blood cholesterol – Findings from 52 916 patients in the Dyslipidemia International Study (DYSIS). *Diabetes, Obesity & Metabolism*, *20*, 2670 - 2674.

Ford, E., Carroll, J. A., Smith, H. E., Scott, D. R., & Cassell, J. A. (2016). Extracting information from the text of electronic medical records to improve case detection: a systematic review. *Journal of the American Medical Informatics Association : JAMIA*, *23*, 1007 - 1015.

Freitas-Ferraz, A. B., Lerakis, S., Barbosa Ribeiro, H., Gilard, M., Cavalcante, J. L., Makkar, R. R., Herrmann, H. C., Windecker, S., Enriquez-Sarano, M., Cheema, A. N., Nombela-Franco, L., Amat-Santos, I. J., Muñoz-García, A. J., García Del Blanco, B., Zajarías, A., Lisko, J. C., Hayek, S. S., Babaliaros, V. C., le Ven, F., . . . Rodés-Cabau, J. (2020). Mitral Regurgitation in Low-Flow, Low-Gradient Aortic Stenosis Patients Undergoing Transcatheter Aortic Valve Replacement: Insights From the TOPAS-TAVI Registry. *JACC. Cardiovascular interventions*.

Gazzaz, Z. J., Iftikhar, R., Jameel, T., Baig, M., & Murad, M. A. (2020). Association of Dyslipidemia and Comorbidities with Risk Factors Among Diabetic Patients: A Retrospective Analysis. *Diabetes, Metabolic Syndrome and Obesity: Targets and Therapy*, *13*, 935 - 941.

Gershlick, A. H., Westerhout, C. M., Armstrong, P. W., Huber, K., Halvorsen, S., Steg, P. G., Ostojić, M., Goldstein, P., Carvalho, A. C., Van de Werf, F., & Wilcox, R. G. (2015). Impact of a pharmacoinvasive strategy when delays to primary PCI are prolonged. *Heart*, *101*, 692 - 698.

Gour, P. R., Bagati, K. D., Balakrishnan, S., ChittiBabu, G., & SLDV, R. M. K. (2020). Trends and management of comorbid conditions in diabetes mellitus type 2 patients in a tertiary care hospital. *International Journal of Research in Pharmaceutical Sciences*.

Grayburn, P. A., Sannino, A., & Packer, M. (2019). Proportionate and Disproportionate Functional Mitral Regurgitation: A New Conceptual Framework That Reconciles the Results of the MITRA-FR and COAPT Trials. *JACC. Cardiovascular imaging*, *12 2*, 353-362.

Han, Y. L., Liu, J.-n., Jing, Q. m., Ma, Y.-y., Jiang, T.-m., Pu, K., Zhao, R.-p., Zhao, X., Liu, H., Xu, K., Wang, G., Wang, B., Sun, R.-h., & Wang, J. (2013). The efficacy and safety of pharmacoinvasive therapy with prourokinase for acute ST-segment elevation myocardial infarction patients with expected long percutaneous coronary intervention-related delay. *Cardiovascular therapeutics*, *31 5*, 285-290.

Helal, A. M., Shaheen, S. M., Elhammady, W., Ahmed, M. I., Abdel-Hakim, A. S., & Allam, L. E. (2018). Primary PCI versus pharmacoinvasive strategy for ST elevation myocardial infarction. *International Journal of Cardiology. Heart & Vasculature*, *21*, 87 - 93.

Huang, H., Liu, J., Bao, K., Huang, X., Huang, D., Wei, H.-y., Remutula, N., Tuersun, T., Lai, W., Li, Q., Wang, B., He, Y., Yang, H., Chen, S., Chen, J.-y., Chen, K.-h., Tan, N., Wang, X., Chen, L.-l., & Liu, Y. (2022). Prevalence and Mortality of Moderate or Severe Mitral Regurgitation Among Patients Undergoing Percutaneous Coronary Intervention With or Without Heart Failure: Results From CIN Study With 28,358 Patients. *Frontiers in Cardiovascular Medicine*, *9*.

Hyde, J. N. (2004). *Retrospective Cohort Study Strengths and weaknesses* https://web.archive.org/web/20170512164859/http://ocw.tufts.edu/Content/1/lecturenotes/194039/194062.

Jamal, J., Idris, H., Faour, A., Yang, W., McLean, A., Burgess, S. N., Shugman, I. M., Wales, K., O'Loughlin, A., Leung, D., Mussap, C. J., Juergens, C. P., Lo, S., & French, J. K. (2022). Late outcomes of ST-elevation myocardial infarction treated by pharmaco-invasive or primary percutaneous coronary intervention. *European heart journal*.

Jilani, T. N., & Siddiqui, A. H. (2022). Tissue Plasminogen Activator. In *StatPearls*. StatPearls Publishing, Copyright © 2022, StatPearls Publishing LLC.

Jin, Q. W., Haroon, A. Y. A., & Kandasamy, B. (2021). TCTAP A-007 Transradial Versus Transfemoral Access in STEMI Patients Undergoing Rescue Percutaneous Coronary Intervention Post Fibrinolytic Therapy: A 10-year Contemporary National Centre Experience. *Journal of the American College of Cardiology*, *77*.

Jonker, L., Fisher, S. J., & Dagnan, D. (2020). Patients admitted to more research-active hospitals have more confidence in staff and are better informed about their condition and medication: Results from a retrospective cross-sectional study. *Journal of evaluation in clinical practice*.

Kabil, H., Elkeshk, E. S., Sewilam, F., & Othman, M. A. M. (2020). Pharmacoinvasive Strategy Versus Lysis and Risk Stratification Strategy in Treatment of Stemi Patients.

Kaier, T. E., Alaour, B., & Marber, M. (2021). Cardiac troponin and defining myocardial infarction. *Cardiovasc Res*, *117*(10), 2203-2215. https://doi.org/10.1093/cvr/cvaa331.

Kamran, F., Tang, S., Otles, E., McEvoy, D. S., Saleh, S. N., Gong, J. J., Li, B., Dutta, S., Liu, X., Medford, R. J., Valley, T. S., West, L., Singh, K., Blumberg, S., Donnelly, J. P., Shenoy, E. S., Ayanian, J. Z., Nallamothu, B. K., Sjoding, M. W., & Wiens, J. (2022). Early identification of patients admitted to hospital for covid-19 at risk of clinical deterioration: model development and multisite external validation study. *The BMJ*, *376*.

Kanic, V., Kompara, G., Šuran, D., Tapajner, A., Naji, F. H., & Sinkovic, A. (2019). Acute kidney injury in patients with myocardial infarction undergoing percutaneous coronary intervention using radial versus femoral access. *BMC Nephrol*, *20*(1), 28. https://doi.org/10.1186/s12882-019-1210-8.

Khalfallah, M., Elsheikh, A., & Abdalaal, M. (2018). Very Early Versus Early Percutaneous Coronary Intervention After Successful Fibrinolytic Therapy in Pharmacoinvasive Strategy. *Global heart*, *13 4*, 261-265.

Khan, Z. U., Ullah, W., Shams, S., Saleem, S., Afsar, R., & Shah, S. (2023). Prevalence of Hypertension and Diabetes Mellitus in Patients Thrombolysed for STEMI. *Pakistan Journal of Medical and Health Sciences*.

Kvakkestad, K., Gran, J. M., & Halvorsen, S. (2022). Short- and long-term survival after ST-elevation myocardial infarction treated with pharmacoinvasive versus primary percutaneous coronary intervention strategy: a prospective cohort study. *BMJ Open*, *12*.

Larson, D. M., Duval, S., Sharkey, S. W., Garberich, R. F., Madison, J. D., Stokman, P. J., Dirks, T. G., Westin, R., Harris, J., & Henry, T. D. (2012). Safety and efficacy of a pharmaco-invasive reperfusion strategy in rural ST-elevation myocardial infarction patients with expected delays due to long-distance transfers. *European heart journal*, *33 10*, 1232-1240.

Li, S. X., Chaudry, H. I., Lee, J., Curran, T. B., Kumar, V., Wong, K. S. K., Andrus, B. W., & DeVries, J. T. (2018). Patterns of in-hospital mortality and bleeding complications following PCI for very elderly patients: insights from the Dartmouth Dynamic Registry. *Journal of Geriatric Cardiology : JGC*, *15*, 131 - 136.

Li, T., Saldanha, I. J., Jap, J., Smith, B. T., Canner, J. K., Hutfless, S. M., Branch, V., Carini, S., Chan, W. V., de Bruijn, B., Wallace, B. C., Walsh, S. A., Whamond, E. J., Murad, M. H., Sim, I., Berlin, J. A., Lau, J., Dickersin, K., & Schmid, C. H. (2019). A randomized trial provided new evidence on the accuracy and efficiency of traditional vs electronically annotated abstraction approaches in systematic reviews. *Journal of clinical epidemiology*.

Liu, Z., Tang, H., Liang, H., Bai, X., Zhang, H., Yang, H., Wang, H., Wang, L., & Qian, J. M. (2022). Dyslipidaemia Is Associated with Severe Disease Activity and Poor Prognosis in Ulcerative Colitis: A Retrospective Cohort Study in China. *Nutrients*, *14*.

Mehta, S. R., Paré, G., Lonn, E. M., Jolly, S. S., Natarajan, M. K., Pinilla-Echeverri, N., Schwalm, J. D., Sheth, T. N., Sibbald, M., Tsang, M. B., Valettas, N., Velianou, J. L., Lee, S. F., Ferdous, T., Nauman, S., Nguyen, H., McCready, T., & McQueen, M. J. (2022). Effects of routine early treatment with PCSK9 inhibitors in patients undergoing primary percutaneous coronary intervention for ST-segment elevation myocardial infarction: a randomised, double-blind, sham-controlled trial. *EuroIntervention : journal of EuroPCR in collaboration with the Working Group on Interventional Cardiology of the European Society of Cardiology*.

Miciak, J., Taylor, W. P., Stuebing, K., Fletcher, J. M., & Vaughn, S. (2016). Designing Intervention Studies: Selected Populations, Range Restrictions, and Statistical Power. *Journal of Research on Educational Effectiveness*, *9*, 556 - 569.

Mishra, S., & Verma, S. K. (2013). Application of STREAM trial in management of acute myocardial infarction in real world practice. *Indian heart journal*, *65*, 629-630.

Montalto, C., Crimi, G., Fortuni, F., Mirizzi, A. M., Ferri, L. A., Morici, N., Tortorella, G., Grosseto, D., Sganzerla, P., Ferrario, M. O., Savonitto, S., & Servi, S. D. (2019). P1781Burden of significant valvular heart disease in elderly patients presenting with acute coronary syndromes. *European heart journal*.

Naji, F. H., Berro, M., Šuran, D., & Kanič, V. (2021). Heart rate reduction using ivabradine protects against periprocedural myocardial injury and angina symptoms in patients with stable coronary disease undergoing coronary intervention. *Acta Medico-Biotechnica*.

Ono, M., Tomaniak, M., Koenig, W., Khamis, R., de Silva, R., Chichareon, P., Kawashima, H., Hara, H., Gao, C., Wang, R., Huber, K., Vrolix, M., Jasionowicz,

P., Wykrzykowska, J. J., Piek, J. J., Jüni, P., Hamm, C. W., Steg, P. G., Windecker, S., . . . Serruys, P. W. (2020). Impact of White Blood Cell Count on Clinical Outcomes in Patients Treated with Aspirin-Free Ticagrelor Monotherapy after Percutaneous Coronary Intervention: Insights from the GLOBAL LEADERS Trial. *European heart journal. Cardiovascular pharmacotherapy*.

Palmer, S. C., Layland, J., Adams, H. S. L., Ashokkumar, S., Williams, P. D., Judkins, C., La Gerche, A., Burns, A. T., Whitbourn, R., Macisaac, A. I., & Wilson, A. M. (2018). Measurement of microvascular function in patients presenting with thrombolysis for ST elevation myocardial infarction, and PCI for non-ST elevation myocardial infarction. *Cardiovascular revascularization medicine : including molecular interventions*, *19 8*, 917-922.

Permatasari, P. D., Fadil, M., & Syafri, M. (2020). Effect of Remote Ischemic Postconditioning on miRNA-145 and Troponin I levels in STEMI patients undergoing primary percutaneous coronary intervention. *Indonesian Journal of Cardiology*.

Polnaszek, B. E., Gilmore-Bykovskyi, A. L., Hovanes, M., Roiland, R. A., Ferguson, P., Brown, R., & Kind, A. J. H. (2016). Overcoming the Challenges of Unstructured Data in Multisite, Electronic Medical Record-based Abstraction. *Medical Care*, *54*, e65–e72.

Pr, B., & George, S. (2018). ASSESSMENT OF CLINICAL PROFILE OF ELDERLY PATIENTS WITH ACUTE STELEVATION MYOCARDIAL INFARCTION UNDERGOING REPERFUSION THERAPY. *International journal of scientific research*, *6*.

Pu, J., Ding, S., Ge, H., Han, Y., Guo, J., Lin, R., Su, X., Zhang, H., Chen, L., & He, B. (2017). Efficacy and Safety of a Pharmaco-Invasive Strategy With Half-Dose Alteplase Versus Primary Angioplasty in ST-Segment-Elevation Myocardial Infarction: EARLY-MYO Trial (Early Routine Catheterization After Alteplase Fibrinolysis Versus Primary PCI in Acute ST-Segment-Elevation Myocardial Infarction). *Circulation*, *136*(16), 1462-1473. https://doi.org/10.1161/circulationaha.117.030582.

Purayil, M. S. M., Jose, J., Vynat, G. P., & Mukkunnath, A. N. (2020). Correlation between White Blood Cell Count and Clinical Outcome of Patients with Acute Myocardial Infarction Who Underwent Primary Percutaneous Coronary Intervention. *Journal of Evidence Based Medicine and Healthcare*.

Rana, N., Vijayvergiya, R., Kasinadhuni, G., Khanal, S., & Panda, P. K. (2021). Comparison of radial versus femoral access using hemostatic devices following percutaneous coronary intervention. *Indian heart journal*, *73*, 382 - 384.

Rashid, M. K., Guron, N., Bernick, J., Wells, G. A., Blondeau, M., Chong, A.-Y., Dick, A., Froeschl, M., Glover, C. A., Hibbert, B., Labinaz, M., Marquis, J.-F., Osborne, C. M., So, D. Y., & Le May, M. (2016). Safety and Efficacy of a Pharmacoinvasive Strategy in ST-Segment Elevation Myocardial Infarction: A Patient Population Study Comparing a Pharmacoinvasive Strategy With a Primary Percutaneous

Coronary Intervention Strategy Within a Regional System. *JACC. Cardiovascular interventions*, *9 19*, 2014-2020.

Rashid, M. K., Singh, K., Bernick, J., Wells, G. A., Hibbert, B., Russo, J. J., So, D. Y. F., & Le May, M. (2019). Periprocedural Bivalirudin Versus Unfractionated Heparin During Percutaneous Coronary Intervention Following Fibrinolysis for ST-Segment Elevation Myocardial Infarction. *The Journal of invasive cardiology*, *31 12*, E387-E391.

Redfors, B., Furer, A., Selker, H. P., Thiele, H., Patel, M. R., Chen, S., Udelson, J. E., Ohman, E. M., Eitel, I., Granger, C. B., Maehara, A., Kirtane, A. J., Généreux, P., Jenkins, P. L., Ben-Yehuda, O., & Stone, G. W. (2020). Effect of Smoking on Outcomes of Primary PCI in Patients With STEMI. *Journal of the American College of Cardiology*, *75 15*, 1743-1754.

Robles-Ledesma, M., Nájera-Rojas, N. A., Ezquerra Osorio, A., Alonso-Bringas, A. P., Sánchez-Leony, G., Gopar-Nieto, R., Sierra Lara Martinez, J. D., Arias-Mendoza, A., & Araiza, D. (2023). Abstract 17066: Efficacy and Safety of the Pharmacoinvasive Strategy Compared With Primary Percutaneous Coronary Intervention in Patients Initially Presenting to Hospital Centers Without Capacity for Coronary Intervention. *Circulation*.

Roule, V., Schwob, L., Briet, C., Lemaître, A., Bignon, M., Ardouin, P., Sabatier, R., Blanchart, K., & Beygui, F. (2020). Residual platelet reactivity, thrombus burden and myocardial reperfusion in patients treated by PCI after successful pre-hospital fibrinolysis compared to primary PCI. *Journal of Thrombosis and Thrombolysis*, 1-9.

Sandoval, Y., Thygesen, K., & Jaffe, A. S. (2020). The Universal Definition of Myocardial Infarction. *Circulation*, *141*(18), 1434-1436. https://doi.org/doi:10.1161/CIRCULATIONAHA.120.045708.

Severino, P., D'Amato, A., Pucci, M., Infusino, F., Adamo, F., Birtolo, L. I., Netti, L., Montefusco, G., Chimenti, C., Lavalle, C., Maestrini, V., Mancone, M., Chilian, W. M., & Fedele, F. (2020). Ischemic Heart Disease Pathophysiology Paradigms Overview: From Plaque Activation to Microvascular Dysfunction. *Int J Mol Sci*, *21*(21). https://doi.org/10.3390/ijms21218118.

Shavadia, J. S., Granger, C. B., Alemayehu, W., Westerhout, C. M., Povsic, T. J., Brener, S. J., van Diepen, S., Defilippi, C. R., & Armstrong, P. W. (2019). High-throughput targeted proteomics discovery approach and spontaneous reperfusion in ST-segment elevation myocardial infarction. *American heart journal*, *220*, 137-144.

Shavadia, J. S., Ibrahim, Q., Sookram, S., Brass, N., Knapp, D., & Welsh, R. C. (2013). Bridging the gap for nonmetropolitan STEMI patients through implementation of a pharmacoinvasive reperfusion strategy. *The Canadian journal of cardiology*, *29 8*, 951-959.

Sia, C.-H., Zheng, H., Ho, A. F. W., Bulluck, H., Chong, J. H., Foo, D. C.-G., Foo, L. L., Lim, P. Z.-Y., Liew, B. W., Tan, H.-C., Yeo, T. C., Chua, T. S. J., Chan, M. Y.-Y., & Hausenloy, D. J. (2020). The Lipid Paradox is present in ST-elevation but not in

non-ST-elevation myocardial infarction patients: Insights from the Singapore Myocardial Infarction Registry. *Scientific Reports*, *10*.

Siddiqui, M. N., Kumar, R., Sial, J. A., & Karim, M. (2022). UNFOLDING THE REALITY OF SMOKING PARADOX IN PATIENTS PRESENTING WITH STE-ACS UNDERGOING PRIMARY PERCUTANEOUS CORONARY TREATMENT. *Pakistan Heart Journal*.

Som, P., Seth, B. C., & Acharyya, M. (2023). Dyslipidemia as a risk factor for acute myocardial infarction in postmenopausal women: An observational study. *MGM Journal of Medical Sciences*, *10*, 63 - 70.

Son, S. M., Okada, R., Fresquez, Z., Formanek, B., Mertz, K., Wang, J. C., & Buser, Z. (2023). The Effect of Hyperlipidemia as a Risk Factor on Postoperative Complications in Patients Undergoing Anterior Cervical Discectomy and Fusion. *Clinical Spine Surgery*, *36*, E530 - E535.

Staffa, S. J., & Zurakowski, D. (2018). Five Steps to Successfully Implement and Evaluate Propensity Score Matching in Clinical Research Studies. *Anesthesia & Analgesia*, *127*, 1066–1073.

Stepura, A. O., Parkhomenko, A. N., Lutay, Y. M., Irkin, O., Kushnir, S. P., Bilyi, D. O., Sokolov, Y., & Sokolov, M. Y. (2019). P4615Dyslipidemia as a predictor of no-reflow after primary PCI in STEMI pts. *European heart journal*.

Talari, K., & Goyal, M. (2020). Retrospective Studies – Utility and Caveats. *Journal of the Royal College of Physicians of Edinburgh*, *50*, 398 - 402.

Tuxun, M., Zhao, Q., Xiang, Y., Liu, F., Shan, C.-f., Zhou, X.-r., Song, N., Waisiding, A., Zhang, X.-H., Aihemaiti, G., Yang, Y., & Li, X. (2020). Predicting value of white cell count and total bilirubin on clinical outcomes in patients with ST-elevation myocardial infarction following percutaneous coronary intervention: a cohort study. *BMJ Open*, *10*.

Victor, S. M., Subban, V., Alexander, T., G, B. C., Srinivas, A., S, S., & Mullasari, A. S. (2014). A prospective, observational, multicentre study comparing tenecteplase facilitated PCI versus primary PCI in Indian patients with STEMI (STEPP—AMI). *Open Heart*, *1*.

Ye, C., Cong, G., Jia, S., Ma, X., & Yan, R. (2023). Abstract 15332: Obesity is Associated With Acute Kidney Injury in STEMI Undergoing PCI: A National Representative Cohort Study. *Circulation*.

Yuan, Y., Qiu, H., Hu, X. Y., Luo, T., Gao, X. J., Zhao, X. Y., Zhang, J., Wu, Y., Yan, H. B., Qiao, S. B., Yang, Y. J., & Gao, R. L. (2017). Risk Factors of Contrast-induced Acute Kidney Injury in Patients Undergoing Emergency Percutaneous Coronary Intervention. *Chin Med J (Engl)*, *130*(1), 45-50. https://doi.org/10.4103/0366-6999.196578.

Zhang, J., & Ding, G. (2021). Improved Cardiac Function and Attenuated Inflammatory Response by Additional Administration of Tirofiban during PCI for ST-Segment

Elevation Myocardial Infarction Patients. *Evidence-based Complementary and Alternative Medicine : eCAM*, *2021*.

Zubaid, M., Khraishah, H., Alahmad, B., Rashed, W. A., Ridha, M., Alenezi, F. F., Aljarralah, M., Al-Marri, K., Almutairi, M., Althalji, K., & Alfaddagh, A. (2020). Efficacy and Safety of Pharmacoinvasive Strategy Compared to Primary Percutaneous Coronary Intervention in the Management of ST-Segment Elevation Myocardial Infarction: A Prospective Country-Wide Registry. *Annals of Global Health*, *86*.

Appendices

Appendix A

Study Tool/ Abstract Sheet

Part One: Demographic data of the patient

Question	Answers	
Serial number		
Patient's age (in complete year)		
Gender	Male	Female
Residency	City	
	Village / town	
	Camp	
Social status	Single	
	Married	
	Widowed / divorced	
Past medical history	Diabetes mellitus	
	Hypertension	
	Ischemic heart disease	
	Dyslipidemia	
	Obesity	
	Others	
Smoking status	Current smoker	
	Previous smoker	
	Non-smoker	
Past surgical history	Previous PCI	
	Open heart surgeries	
	Vascular surgeries	
	Others	
Echocardiogram findings	Valve stenosis	
	Valve regurgitation	
	Cardiac muscle hypokinesia	
	Ventricular hypertrophy	
	Cardiomegaly	
	Ejection fraction: ___________%	
Treatment approach	PCI	Pharmacoinvasive

Part Two: Treatment approach and perioperative parameters

Question	Options	
Catheter insertion approach	Radial artery	
	Femoral artery	
When the intervention was done	Day of admission	
	First day after admission	
	Second day after admission	
	Third day after admission	
	Other	
Location of STEMI	Inferior MI	
	Septal MI	
	Anterior MI	
	Posterior MI	
	Lateral MI	
Laboratory results	Preoperative	Postoperative

Hemoglobin (g/dL)		
White blood cells (k/uL)		
Platelets (k/uL)		
BUN (mg/dL)		
Creatinine (mg/dL)		
Potassium (mmol/L)		
Sodium (mmol/L)		
Calcium (mmol/L)		
Troponin-I (Quantitative)		
CK-MB		
Random blood sugar (mg/dL)		
LDL (mg/dL)		
HDL (mg/dL)		
Triglyceride (mg/dL)		
PT (second)		
PTT (second)		
INR		
CRP (mg/dL)		
ECG parameters		
ST-Elevation (mV)		
Heart rate (bpm)		
Regularity		
PR interval		

Part Three: Postoperative outcomes

Question	Options
Specific postoperative complications	Insertion site hematoma
	Hemorrhagic stroke
	Upper GI bleeding
	Epistaxis
	Hematemesis
Patient's survival (within 30 days)	Survived
	Died

Appendix B

Institutional Review Board [IRB] Form)

An-Najah National University
Faculty of Medicine &
Health Sciences
Institutional Review Board

جامعة النجاح الوطنية
كلية الطب وعلوم الصحة
لجنة اخلاقيات البحث العلمي

Ref: Mas . May. 2023/18

IRB Approval Letter

Title of Research:

Comparison of the outcomes between percutaneous coronary intervention alone and pharmacoinvasive coronary intervention among ST-segment elevation myocardial infarction (STEMI) patients

Submited by:
Basel Khairy Ali Ma'ali

Supervisor:
Jamal Qaddoumi

Approved:
14th May. 2023

Your Study Title **Comparison of the outcomes between percutaneous coronary intervention alone and pharmacoinvasive coronary intervention among ST-segment elevation myocardial infarction (STEMI) patients"** reviewed by An-Najah National University IRB committee and was approved on 15th, May . 2023

Hasan Fitian, MD

IRB Committee Chairman

IRB Institutional Review Board

Nablus - P.O Box :7 or 707 | Tel (970) (09) 2342902/4/7/8/14 | Faximile (970) (09) 2342910| E-mail : IRB@najah.edu

Appendix C

Approval from Ministry of Health for Palestine Medical Complex)

State of Palestine
Ministry of Health
Education in Health and Scientific Research Unit

دولة فلسطين
وزارة الصحة
وحدة التعليم الصحي والبحث العلمي

Ref.: ....
Date:..................

الرقـــم: [illegible]
التـاريخ: [illegible]

عطوفة الوكيل المساعد المدير التنفيذي لمجمع فلسطين الطبي المحترم،،،

تحية واحترام...

الموضـــوع: تسهيل مهمة بحث

يرجى تسهيل مهمة الطالب: **باسل خيري علي معالي**- برنامج ماجستير التمريض- جامعة النجاح، في عمل بحث بعنوان:

" Comparison of the outcomes between percutaneous coronary intervention alone and pharmacoinvasive coronary intervention among ST-Segment elevation myocardial infarction (STEMI) patients "

حيث سيتم جمع معلومات من ملفات المرضى في قسم القلب في الفترة ما بين 2023/7/1 الى 2023/8/30، علما ان البحث تحت اشارف د. جمال قدومي، وذلك في:

- **مجمع فلسطين الطبي**

على ان يتم الالتزام باساليب واخلاقيات البحث العلمي، وعدم التعرض للمعلومات الشخصية للمرضى.
على ان يتم تزويد الوزارة بنسخة PDF من نتائج البحث.

مع الاحترام...

د. عبد الله القواسمي

رئيس وحدة التعليم الصحي والبحث العلمي

نسخة: مدير دائرة التمريض والقبالة المحترمة/ جامعة النجاح

Telfax.:09-2333901 scientificresearch.dep@gmail.com تلفاكس: 09-2333901

Appendix D

Approval from An-Najah National University Hospital

An-Najah National University

Faculty of Medicine & Health Sciences
Department of Nursing

بسم الله الرحمن الرحيم

جامعة النجاح الوطنية

كلية الطب وعلوم الصحة
دائرة التمريض

التاريخ: 2022/04/22

حضرة الاستاذ لؤي الزبن المحترم / مدير دائرة التمريض في مستشفى النجاح الوطني الجامعي ، ،

الموضوع: تسهيل مهمة طالب ماجستير باسل خيري معالي – ماجستير العنايه التمريضيه المكثفه–

تحية طيبة وبعد،

تهديكم دائرة التمريض والقباله في كلية الطب وعلوم الصحه / جامعة النجاح الوطنية أطيب التحيات ونشكر لحضرتكم حسن تعاونكم معنا ونرجو من حضرتكم التكرم بالموافقه على تسهيل مهمة الطالب المذكور اعلاه.

وحيث أن الطالب سيقوم بعمل دراسة بغرض البحث العلمي لمشروع التخرج تحت عنوان:

Comparison of the Outcomes between Percutaneous Coronary Intervention (PCI) and Pharmacoinvasive Coronary Intervention among STEMI Patients

فنرجو التكرم بالموافقة على تسهيل مهمة الطلبة في مستشفاكم الموقر بالسماح لهم بالاطلاع على ملفات المرضى ذوي العلاقة بالدراسة في الفتره الواقعه ما بين 1الى 10 لسنه 2024

تحت اشراف: – د جمال قدومي
:– د محمد حايك

- مرفق ملخص الدراسه و IRB
- Data Sheet

وتفضلوا بقبول الطلب ولكم فائق الاحترام ، ،

مديرة دائرة التمريض والقباله

د. عائدة أبو السعود القيسي

كلية الطب وعلوم الصحة – جامعة النجاح الوطنية – نابلس – دائرة التمريض والقباله

نابلس - ص.ب 7 أو 707 هاتف 2342902;4;7;8;14 (09) (970) فاكسميل 2342910 (09) (970)
(Nablus- P.O.Box 7 or 707- Tel (970) (09) 2342902;4;7;8;14- Faximile (970) (09) 2342910
Email: nursing@najah.edu Web Site: www.najah.edu

جامعة النجاح الوطنية
كلية الدراسات العليا

المقارنة بين نتائج التدخل الشرياني التاجي عبر الجلد لوحده والتدخل الشرياني مع الأدوية عند مرضى الذبحة الصدرية مع ارتفاع شريحةST

إعداد
باسل خيري علي معالي

إشراف
د. جمال القدومي
د. محمد الحايك

قدمت هذِه الرسالة استكمالاً لمتطلبات الحصول على درجة الماجستير في تمريض العناية المكثفة، من كلية الدراسات العليا، في جامعة النجاح الوطنية، نابلس، فلسطين.

2025

المقارنة بين نتائج التدخل الشرياني التاجي عبر الجلد لوحده والتدخل الشرياني مع الأدوية عند مرضى الذبحة الصدرية مع ارتفاع شريحة ST

إعداد

باسل خيري علي معالي

إشراف

د. جمال القدومي

د. محمد الحايك

الملخص

الخلفية: يُعد احتشاء عضلة القلب أحد أكثر الأمراض القلبية شيوعًا على مستوى العالم وفي فلسطين، ويتم علاجه بشكل أساسي من خلال التدخلات الجراحية التداخلية للسيطرة على انسداد الشرايين التاجية أو علاجه، بينما تعتمد بعض المراكز على إضافة منشط البلازمينوجين النسيجي ضمن ما يعرف بالنهج الصيدلاني التداخلي (Pharmacoinvasive). وبما أن حدوث المضاعفات بعد الجراحة أمر لا مفر منه، فإن الهدف من هذه الدراسة هو تحديد أكثر المضاعفات شيوعًا بين نهجين مختلفين لإدارة احتشاء عضلة القلب، وهما التدخل التاجي عن طريق الجلد (PCI) والنهج الصيدلاني التداخلي، وذلك في مركزين طبيين متخصصين في مدينتي رام الله ونابلس، بالإضافة إلى تحديد عوامل الخطر الأكثر شيوعًا المرتبطة بالفروقات بين النهجين.

المنهجية: اعتمدت الدراسة على تصميم التحليل الاسترجاعي للمرضى (Retrospective Cohort) على عينة عشوائية تتكون من 160 مريضًا بالغًا (تتراوح أعمارهم بين 30 و 75 عامًا) تم إدخالهم إلى وحدات العناية المركزة لأمراض القلب في مجمع فلسطين الطبي (لمرضى النهج الصيدلاني التداخلي) ومستشفى النجاح الوطني الجامعي (لمرضى التدخل التاجي عن طريق الجلد). استُخدمت استمارة بيانات تم تطويرها بالاعتماد على الدراسات السابقة، وتم تحليل البيانات باستخدام البرامج الإحصائية المتخصصة.

النتائج: كان المرضى الذين خضعوا للتدخل التاجي عن طريق الجلد (عددهم = 82، بنسبة 51.2%) أكبر سنًا بشكل ملحوظ (بمتوسط = 59.8 ± 9.7 سنة) مقارنة بمرضى النهج الصيدلاني التداخلي (عددهم =

78، بنسبة 48.8%، بمتوسط = 56.2 ± 12.7 سنة). كما كان موقع إدخال القسطرة أكثر شيوعًا في الشريان الكعبري لدى مرضى التدخل التاجي عن طريق الجلد (بنسبة 95.1%) مقارنة بمرضى النهج الصيدلاني التداخلي (بنسبة 15.4%)، بينما لم يكن هناك فرق كبير بين المجموعتين في موقع احتشاء عضلة القلب. وأظهرت نتائج التحاليل المختبرية أن مرضى التدخل التاجي عن طريق الجلد سجلوا انخفاضًا أكثر وضوحًا في عدد كريات الدم البيضاء، والدهون منخفضة الكثافة، والدهون عالية الكثافة، والدهون الثلاثية، ومعدل ضربات القلب، بالإضافة إلى زيادة أكثر وضوحًا في مستويات التروبونين–I، وارتفاعًا أقل في مستويات الصوديوم، مقارنةً بمرضى النهج الصيدلاني التداخلي ($p\text{-value} < 0.05$) بين المرحلتين قبل وبعد الجراحة. أما فيما يتعلق بالمضاعفات بعد الجراحة، فكانت جميع المضاعفات أعلى بشكل ملحوظ لدى مرضى النهج الصيدلاني التداخلي ($p\text{-value} < 0.05$) باستثناء نزيف الجهاز الهضمي العلوي، بينما كان معدل الوفيات خلال 30 يومًا أعلى أيضًا في هذه المجموعة. بالإضافة إلى ذلك، وُجدت مضاعفات أكثر بشكل ملحوظ لدى المرضى الذين يعانون من اضطرابات الدهون في الدم، وارتجاع الصمامات القلبية، وضعف حركة جدران القلب.

الاستنتاج: أظهرت الدراسة أن المرضى الذين خضعوا للعلاج باستخدام النهج الصيدلاني التداخلي كانوا أكثر عرضة للإصابة بالمضاعفات بعد الجراحة، وكان لديهم معدل وفيات أعلى خلال 30 يومًا. وبناءً على ذلك، هناك حاجة إلى مزيد من الأبحاث في هذا المجال لتقييم طرق إدارة احتشاء عضلة القلب في فلسطين. كما يُوصى بإجراء دراسات مستقبلية تعتمد على تصميم البحث المستقبلي لتقديم نتائج أكثر دقة حول هذا الموضوع.

الكلمات المفتاحية: احتشاء عضلة القلب مع ارتفاع مقطع ST، النهج الصيدلاني التداخلي، منشط البلازمينوجين النسيجي، المضاعفات.