بسم الله الرحمن الرحيم

Abdulatif Alhamad University of Technology

Faculty of Medicine and Health Sciences

Program of Medical Laboratory Sciences

Assessment of Coagulation Profile Prothrombin time and International Normalize Ratio in Sudanese Patients with Acute Myocardial Infraction in May 2026

A proposal submitted in partial fulfillment for the requirement of B.SC. degree in medical laboratory science Heamatology and Immunoheamatology

Prepared by:

Abbas Mohammed Almofadal Ahmed Ali

Fatima Abdel kareem Mohammed Ahmed Khair Alseed

Yosra Omer Khalifa Khalaf Allah

Supervised by:

Dr Tarig Altayb

July 2026

Chapter One

Introduction and Literature Review

1.1 Introduction:

Cardiovascular diseases (CVDs) represent the leading cause of global mortality, accounting for approximately 19.8 million deaths annually, with acute myocardial infarction (AMI) serving as the most critical clinical manifestation [1]. The underlying pathophysiology of AMI typically involves the rupture of an unstable atherosclerotic plaque within the coronary arteries. This rupture triggers a cascade of platelet activation and subsequent activation of the coagulation cascade, resulting in acute coronary thrombosis and myocardial ischemia [2].

The coagulation system plays a dual role in AMI; while hypercoagulability drives the initial thrombotic occlusion, therapeutic management heavily relies on systemic anticoagulation to restore patency and prevent recurrent ischemic events [3]. In clinical practice, monitoring the coagulation status of AMI patients is vital. Prothrombin Time (PT) and its standardized derivative, the International Normalized Ratio (INR), are essential laboratory assays used to evaluate the extrinsic and common pathways of coagulation [4]. Under standard conditions, PT measures the speed of clotting through clotting factors I, II, V, VII, and X. In patients experiencing myocardial infarction, alterations in PT can reflect either a systemic hypercoagulable state or the pharmacological effect of initiated anticoagulant therapies, making its precise estimation a critical determinant of patient outcomes [5].

In patients diagnosed with myocardial infarction, maintaining a delicate balance between preventing further thrombosis and avoiding life-threatening bleeding complications is a paramount clinical challenge [4]. Despite the widespread clinical use of PT/INR to monitor anticoagulant therapies (such as vitamin K antagonists or low-molecular-weight heparins), there remains a critical gap in understanding baseline fluctuations of PT in AMI patients who are not yet on therapy, or those presenting with complex comorbidities [6].

Recent evidence indicates that abnormal baseline PT/INR values in patients with coronary artery disease are independently associated with increased long-term all-cause mortality and adverse cardiovascular events [6]. For instance, a prolonged baseline PT can signal subclinical hepatic congestion due to heart failure or systemic inflammatory responses,

whereas a shortened PT indicates a heightened state of hypercoagulability [6]. However, systematic local data estimating these precise PT patterns in specific cohorts of AMI patients are still scarce, especially within regional healthcare centers.

1.2 Literature Review

The clinical utility of coagulation parameters, particularly Prothrombin Time (PT) and its standardized derivative, the International Normalized Ratio (INR), has transcended beyond simple pre-operative screenings [7]. In contemporary cardiovascular medicine, evaluating the extrinsic coagulation pathway in acute ischemic events like Myocardial Infarction (MI) has gained profound interest [2]. This literature review synthesizes recent clinical findings and physiological mechanisms across three key areas: the hypercoagulable state in acute coronary syndromes, the prognostic value of baseline PT/INR in cardiac patients, and the role of coagulation profiles in therapeutic monitoring and risk stratification.

.1Coagulation Cascades and Hypercoagulability in Acute Myocardial Infarction

Acute myocardial infarction (AMI) is primarily triggered by the rupture or erosion of an unstable atherosclerotic plaque, exposing thrombogenic subendothelial components to circulating blood [2]. This exposure initiates a rapid coagulation cascade. Under these acute conditions, the tissue factor (TF) pathway (extrinsic pathway) is heavily upregulated, complexing with factor VIIa to accelerate thrombin generation and subsequent fibrin clot formation [7, 3].

Studies published within the last decade have consistently highlighted that during the acute phase of an MI, patients exhibit distinct alterations in their baseline coagulation profiles [4, 5]. In a key clinical study, baseline prothrombin times in patients presenting with acute coronary syndromes (ACS) were found to be altered compared to healthy cohorts [5]. This shift is attributed to the systemic inflammatory response accompanying cardiac necrosis. Pro-inflammatory cytokines (such as IL-6 and TNF-alpha) directly stimulate vascular endothelial cells and circulating monocytes to express high levels of tissue factor, thereby

accelerating the extrinsic pathway, which clinically manifests as a shortened baseline PT [7, 4].

.2Prognostic Significance of Baseline PT/INR in Cardiovascular Diseases

While PT/INR is historically monitored during active anticoagulant therapy, recent epidemiological studies have investigated the independent prognostic value of baseline (pre-treatment) PT/INR values in patients with established coronary artery disease (CAD) [6].

A landmark retrospective cohort study involving a large registry of over 44,000 CAD patients demonstrated a significant U-shaped relationship between baseline PT/INR levels and long-term all-cause mortality [6]. The researchers discovered that:

Shortened PT/INR values reflect a severe hypercoagulable state, directly correlating with an increased risk of recurrent ischemic events, stent thrombosis, and re-infarction [6].

Prolonged baseline PT/INR values (even in patients not taking oral anticoagulants) were independently linked to adve4rse cardiac events [6]. A prolonged PT in untreated cardiac patients often indicates subclinical hepatic congestion—a consequence of early-stage right heart failure or poor systemic perfusion—and systemic inflammatory tissue damage [2, 6].

These findings indicate that pre-treatment PT values carry clinical weight as independent biomarkers for risk stratification in cardiac units [6]. Furthermore, abnormal baseline coagulation parameters in patients presenting with heart diseases have been strongly linked with increased hospitalization durations and higher in-hospital mortality rates [2].

.3The Balance Between Thrombosis and Hemorrhage: Clinical Challenges

The immediate management of AMI involves aggressive antithrombotic and anticoagulant regimens to restore and maintain coronary artery patency [4]. However, these therapies significantly elevate the patient's bleeding risk [1]. Establishing a baseline PT/INR is critical before initiating therapies such as low-molecular-weight heparin, direct oral anticoagulants (DOACs), or vitamin K antagonists (VKAs) like warfarin [7].

Recent data emphasize that local monitoring of PT variations in specific populations is crucial due to genetic, dietary, and lifestyle differences that affect coagulation factor

synthesis [5]. In clinical settings where baseline profiles are not routinely analyzed, patients are at a higher risk of receiving miscalculated therapeutic doses, leading to either sub-therapeutic failure (recurrent thrombosis) or supratherapeutic complications (major hemorrhagic events) [7, 2].

Therefore, current clinical guidelines suggest that a precise, timely estimation of PT/INR upon admission provides a "haemostatic baseline" that allows cardiologists to customize patient-specific anticoagulant dosages, lowering the clinical margin of error in acute cardiac care [7, 6].

Al-Nimer et al. in Irag (2013) measured PT in AMI patients result was :

PT =15.98 ± 0.96 seconds (STEMI)

PT =16.03 ± 0.97 seconds (NSTEMI)

P-value < 0.05 .

1.3 Rationale of the Study:

Conducting this study is highly justified as it will provide local empirical data on the exact distribution and clinical significance of PT alterations in myocardial infarction patients, by estabilishing these patterns this research will improve risk stratification by enabling clinicians to identify AMI patients at higher baseline risk of bleeding or thrombotic complications before initiating intensive antithrombotic regimens. Furthermore, it will optimize therapeutic monitoring by helping laboratory professionals and cardiologists fin-tune anticoagulant dosing based on precise local baseline value. Ultimately, this well enhance laboratory-clinical collaboration by bridging the gap between clinical laboratory finding and critical bedside decision-making in a cute cardiac care units.

1.4 Objectives:

1.4.1 General Objective :

To estimate Coagulation Profile Prothrombin time and International Normalize Ratio in Sudanese patients with acute myocardial infraction.

1.4.2 Specific Objectives :

To estimate Prothrombin Time and International Normalized Ratio in patients with acute myocardial infraction.

To estimate Prothrombin Time and International Normalized Ratio in control case.

To correlate result of test with control.

To correlate result of test with possible risk factor (Age-gender-hypertension-diabetes mellitus and smoking).

1.5 Research Question:

What is the baseline level of Prothrombin Time (PT) and International Normalized Ratio (INR) among patients diagnosed with acute myocardial infarction (AMI) upon admission?

How do the estimated PT and INR values of AMI patients compare with those of healthy controls?

Is there a statistically significant association between altered PT/INR values and the demographic or clinical characteristics (such as age, gender, smoking status, and history of hypertension or diabetes) of AMI patients?

1.6 Hypothesis:

Null Hypothesis (H0) :There is no statistically significant difference in the estimated Prothrombin Time (PT) and International Normalized Ratio (INR) values between myocardial infarction (MI) patients and healthy control subjects, nor is there any significant association between PT/INR alterations and the patients' clinical or demographic characteristics.

Alternative Hypothesis (H1) :There is a statistically significant alteration (either shortening indicating hypercoagulability or prolongation reflecting subclinical coagulopathy/therapeutic response) in Prothrombin Time (PT) and International Normalized Ratio (INR) values among myocardial infarction (MI) patients compared to

healthy control subjects. Furthermore, these alterations are significantly associated with specific clinical profiles, demographic factors.

Chapter Two

METHODOLOGY

2 Materials and Methods :

2.1 Study Design

This study will be analytical case control.

2.2 study area and duration

The study will be conducted in Merowe locality, Northern state, Sudan, Julay 2026.

2.3 Study population

The study population consists of adult Sudanese male and female residing in Merowe locality.

2.3.1 Inclusion critera

Case group (AMI) :

Patients clinically diagnosed with acute myocardial infarction admitted to the cardiac unit.

Control group :

Healthy volunteers with no history of cardiovascular diseases, hepatic disorders, or coagulation abnormalities.

2.3.2 Exclusion criteria:

Patients with a history of liver disease, chronic kidney disease (CKD), or active hematological malignancies.

Patients with pre-existing bleeding or thrombotic disorders (e.g., hemophilia, deep vein thrombosis).

Patients with hematocrit levels above 55% or below 20%, as extreme hematocrit values artificially affect the blood-to-citrate ratio in the tube.

2.4 Sample size :

$$n = \frac{z^2 * p * q}{e^2}$$

n- The sample size

Z- The abscissa corresponding to the horizontal axis in the normal distribution curve (1.96)

P- prevalence from previous studies (take to be. 05).

q=p-1

e- desired margin of error (0.05).

Determined based on similar studies and statistical consideration

Total of 150 sample will be included

75control sample (Non- AMI)

75case sample (AMI).

2.5 Sampling Techniques

A-non probability convenience sampling technique will be used to recruit the participants.

2.6 Data collection tool

1Structured questionnaire (demographic history, patients history, medical history)

2laboratory analysis sheet for PT/INR.

2.7 Sample Collection and Laboratory Methods

2.7.1 Sample Collection

About 2.7 mL of venous blood will be collected using a sterile disposable syringe. Blood will be immediately placed in a buffered sodium citrate container (light blue top tube, 3.2% or 0.109 M) at a precise 9:1 blood-to-anticoagulant ratio. Platelet-poor plasma (PPP) will be obtained by centrifugation at 1500g for 15 minutes. Samples will be analyzed within 2 hours of collection to prevent the degradation of labile coagulation factors.

2.7.2 Laboratory Method

Plasma Prothrombin Time (PT) and International Normalized Ratio (INR) will be measured using an automated coagulation analyzer according to the manufacturer's instructions.

The assay is based on photo-optical detection technology. The coagulation cascade is initiated by adding a pre-warmed thromboplastin reagent containing tissue factor and calcium chloride (CaCl2) to the patient's platelet-poor plasma. As the extrinsic pathway is activated, fibrinogen is converted into an insoluble fibrin clot.

The analyzer monitors the reaction by transmitting a light beam through the cuvette. The formation of the fibrin clot increases the turbidity of the mixture, causing a measurable decrease in light transmission. The instrument automatically detects this optical endpoint to record the PT in seconds.

The International Normalized Ratio (INR) will be calculated automatically by the analyzer's software using the following formula:

INR= (patient PT) /MNPT) ISI

)Where MNPT represents the Mean Normal Prothrombin Time established by the laboratory, and ISI represents the International Sensitivity Index of the specific thromboplastin reagent batch).

2.8 Data analysis

Data will be analyzed using Statistic package for the social science (SPSS) software .

Descriptive statistics: Mean, standard deviation, frequencies, and percentages.

Comparative statistics:

Independent t-test to compare PT and INR levels between myocardial infarction patients and healthy controls.

A p-value < 0.05 will be considered statistically significant.

2.9 Ethical Considerations:

Ethical approval will be obtained from the Research Ethics Committee of Abdulatif Alhamad University of Technology. Written informed consent will be obtained from all participants before sample collection. Participant confidentiality will be maintained, and all collected data will be used only for research purposes.

Time line

Task	Week 1	Week 2	Week 3	Week 4	Week 5
Proposal writing					
Data collection					
Research practical					
Data analysis					
Thesis writing					
Discussion and final report					
Printing					

Budget

Item	Quantity	Price
Syringes	One box	20000
Cotton	One roll	10000
Gloves	One box	17500
Alcohol	One box	10000
Sodium citrate	100	50000
Thromboplastin Reagent	Box	110000
Yellow tips	One Package	10000
Blaster	One box	10000
	Total	237500

References

1.World Health Organization. Cardiovascular diseases (CVDs) Fact Sheet. Geneva World Health Organization; 2021. https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds

2. Aynalem M, Adane T, Getawa S. Magnitude of Coagulation Abnormalities and Associated Factors Among Patients with Heart Diseases at the University of Gondar Comprehensive Specialized Hospital. Vascular Health and Risk Management. 2022;18:617-627.

3. Sotoudeh Anvari M, Tavakoli M, Lotfi-Tokaldany M, Broumand M, Rezahosseini O,Hakki-Kazzazi E, et al. Coronary Artery Disease Presentation and Its Association with Shortened Activated Partial Thromboplastin Time. Journal of Tehran University Heart Center. 2018;13(1):1-5.

4. Tang Y, Sun J, Yu Z, Liang B, Peng B, Ma J, et al. Association between prothrombin time-international normalized ratio and prognosis of post-cardiac arrest patients: A retrospective cohort study. Frontiers in Public Health. 2023;11:1112623.

5. Khan HA, Al-homida AS, Al-Rammah TY, Sobki SH,Ola MS, Khan AA Alterations in prothrombin time and activated partial thromboplastin time in patients with acute myocardial infarction. International Journal of Clinical and experimental Medicine . 2013;6(4):294-297.

6. Liu L, Ying M, Chen S, Li Q, Chen G, Li H, et al. The association between prothrombin time-international normalized ratio and long-term mortality in patients with coronary artery disease: a large cohort retrospective study with 44,662 patients. BMC Cardiovascular Disorders. 2022;22:(1):297.

7. Amer AH, Al-Adhroey AH, Al-Shammakh AA. Evaluation of Prothrombin Time and Activated Partial Thromboplastin Time in Antithrombotic-Treated Cardiac Patients: A Cross-Sectional Study from Sana'a City, Yemen. Vascular Health and Risk Management. 2026;22:587006.

بسم الله الرحمن الرحيم

Abdulatif Alhamad University of Technology

Faculty of Medicine and Health Sciences

Program of Medical Laboratory Sciences

Assessment of Coagulation Profile Prothrombin time and International Normalize Ratio in Sudanese Patients with Acute Myocardial Infraction in May 2026

A proposal submitted in partial fulfillment for the requirement of B.SC. degree in medical laboratory science Heamatology and Immunoheamatology

Prepared by:

Abbas Mohammed Almofadal Ahmed Ali

Fatima Abdel kareem Mohammed Ahmed Khair Alseed

Yosra Omer Khalifa Khalaf Allah

Supervised by:

Dr Tarig Altayb

July 2026

Appendices

Structured Questionnaire

Questionnaire No: ------

Date: ---/---/---

Hospital: ------

Section A: Demographic Data

1 – Age ------- years

2 – gender ☐ Male ☐ Female

Section B: Clinical Information

1 – History of hypertension ☐ Yes ☐ No

2 – History of diabetes mellitus ☐ Yes ☐ No

3 – History of smoking ☐ Yes ☐ No

Section C: Laboratory finding

1 – Prothrombin time (PT) ------ seconds

2 – International Normalized Ratio (INR) ------

INFORMED CONSENT :

I am ------- hereby consent to collection of blood sample to collaboration for measured prothrombin time and international normalize ratio in acute myocardial infraction patients this submitted for approval.