**ORIGINAL ARTICLE**

# IN-HOSPITAL OUTCOMES OF PATIENTS WITH ANTERIOR WALL MYOCARDIAL INFARCTION AND RIGHT BUNDLE BRANCH BLOCK IN THE PRIMARY PCI ERA: IMPACT AND PROGNOSTIC FACTORS

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**Objective:** This study investigates the in-hospital outcomes of patients presenting with Anterior Wall Myocardial Infarction (AWMI) and Right Bundle Branch Block (RBBB) during the primary Percutaneous Coronary Intervention (PCI) era. It aims to assess the impact of primary PCI on these patients and identify factors contributing to poor outcomes.

**Methodology:** A prospective observational study was conducted at the Department of Cardiology, Hayatabad Medical Complex (HMC), Peshawar, Pakistan. The study enrolled 150 patients diagnosed with AWMI and RBBB, undergoing reperfusion therapy. Data on demographics, clinical characteristics, and treatment outcomes were collected and analyzed using IBM SPSS version 21.0.

**Results:** Among the 150 patients included in the study, there was a balanced gender distribution with a mean age of 51.15 years. The majority of patients, 136 (90.7%), survived their hospital stay. Primary PCI was significantly associated with improved survival rates compared to medical management alone. Factors such as TIMI and GRACE risk scores were crucial for risk stratification, highlighting the need for personalized management strategies.

**Conclusion:** The findings underscore the effectiveness of primary PCI in improving in-hospital outcomes for patients with AWMI and RBBB. This study highlights the necessity of timely reperfusion therapy and personalized risk stratification to enhance patient prognosis. By documenting the impact of primary PCI and identifying factors leading to poor outcomes, this research provides valuable insights that aid in the optimization of treatment protocols for this high-risk patient group.

**Keywords:** AWMI, RBBB, PCI, In-hospital outcomes, Risk stratification

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## INTRODUCTION

Acute myocardial infarction (AMI), particularly ST-elevation myocardial infarction (STEMI), remains a significant global health concern due to its substantial contribution to morbidity and mortality. Among the various forms of AMI, anterior wall myocardial infarction (AWMI) is notably severe, accounting for a significant portion of cardiac deaths.[1] The condition becomes even more complex when coupled with right bundle branch block (RBBB), which indicates widespread myocardial damage and critical coronary occlusion, leading to hemodynamic instability and adverse clinical outcomes.[2] RBBB, often resulting from left anterior descending artery (LAD) occlusion, is associated with a higher risk of complications such as ventricular arrhythmia, atrioventricular (AV) block, and cardiogenic shock, all of which contribute to a poor prognosis. While primary percutaneous coronary intervention (PCI) has significantly improved survival rates in the STEMI population, its effectiveness in treating patients with AWMI and RBBB requires further investigation due to the higher prevalence of complex coronary artery disease and comorbid conditions such as diabetes and hypertension in these patients.[3]

Understanding the influence of primary PCI on AWMI patients with RBBB is critical as their clinical presentation often indicates complex coronary lesions, making them more susceptible to adverse cardiac events. Addressing these factors will help refine patient risk stratification and develop guidelines that

minimize adverse outcomes.[4] Patients with AWMI and RBBB frequently exhibit worse outcomes due to compromised ventricular conduction, increasing the risk of severe complications such as cardiogenic shock, higher Killip scores, and mortality.[5] Despite advancements in cardiovascular care and the well-established association between AWMI with RBBB and adverse outcomes, research specifically addressing the in-hospital impact of primary PCI in this population is limited.[6] Current literature often emphasizes the clinical outcomes of AWMI and bundle branch blocks independently but fails to comprehensively assess their combined influence in the primary PCI era.[7-9]

This study aims to provide a detailed understanding of the in-hospital outcomes for patients presenting with AWMI and RBBB during the primary PCI era. It endeavors to identify the key factors contributing to poor clinical outcomes despite the availability of prompt and effective reperfusion strategies. By focusing on this high-risk patient group, clinicians can identify relevant risk factors and design strategies to improve outcomes. Understanding the predictors of poor outcomes and the impact of early intervention will help clinicians better manage these cases, improving their quality of life post-intervention. The knowledge generated by this research will contribute to understanding the practical challenges clinicians face in managing AWMI with RBBB, facilitating the development of tailored guidelines for the optimal treatment of this high-risk cohort.

## METHODOLOGY

**Study Design:** This investigation was structured as a Prospective Observational Study aimed at evaluating the in-hospital outcomes of patients diagnosed with Anterior Wall Myocardial Infarction (AWMI) concomitant with Right Bundle Branch Block (RBBB), specifically focusing on those undergoing reperfusion therapy. The study design was chosen to allow for real-time data collection and a comprehensive analysis of patient outcomes in a naturalistic clinical setting.

**Setting:** The research was conducted in the Department of Cardiology at the Hayatabad Medical Complex (HMC), Peshawar, Pakistan. HMC is renowned for its comprehensive cardiovascular care and advanced treatment modalities, making it an ideal location for this study. The facility's robust infrastructure and experienced medical personnel provided the necessary support for detailed and accurate data collection.

**Participants:**

**Inclusion Criteria:** Diagnosis of Anterior Wall Myocardial Infarction (AWMI) with concurrent Right Bundle Branch Block (RBBB). Patients deemed candidates for reperfusion therapy, irrespective of gender, aged between 18 to 80 years.

**Exclusion Criteria:** Patients refusing to provide informed consent. Prior history of cardiac surgery or intervention that could confound study outcomes.

**Variables:**

**Primary Outcome Variables**
- In-hospital mortality
- Incidence of major adverse cardiac events (MACE) including reinfarction, heart failure, and stroke

**Secondary Outcome Variables**
- Time from symptom onset to ER arrival
- ER to Cath lab transfer time
- Cath lab to device activation time
- Length of hospital stay
- Killip class at admission and discharge
- TIMI and GRACE risk scores

**Data Sources / Measurement:** Data was collected using a structured proforma, which included patient demographics, baseline clinical characteristics, and detailed timelines of treatment milestones. Clinical assessments and diagnostic criteria were defined as follows:

**Anterior ST-Elevation Myocardial Infarction (STEMI):** Diagnosed in patients presenting with typical chest pain lasting more than 20 minutes, accompanied by new ST elevation of greater than 2 mm in men or greater than 1.5 mm in women, specifically in at least two contiguous leads that reflect the anterior myocardial region (leads V1 through V4 and possibly adjacent precordial leads).

**Right Bundle Branch Block (RBBB):** Identified by a QRS duration ≥ 120 milliseconds, with a characteristic RSR` pattern in leads V1 and V2, and an S wave in leads I and V6 that is of greater duration than the R wave or greater than 40 milliseconds.

**Primary PCI:** Defined as an emergency percutaneous procedure to restore blood flow in an occluded coronary artery. As recommended by guidelines, primary PCI should be performed within 90 minutes

of hospital arrival to improve outcomes for patients with STEMI.

**Bias:** To minimize bias, patient selection adhered strictly to the inclusion and exclusion criteria. Data collection was conducted prospectively, and all assessments and measurements were standardized. Follow-up was maintained consistently throughout the hospital stay to ensure accurate outcome recording.

**Study Size:** The required sample size was calculated to ensure statistical significance in comparing the in-hospital outcomes of AWMI patients with RBBB undergoing different treatments. Based on preliminary studies in similar patient populations, an estimated incidence rate of adverse outcomes was identified. Using a confidence level of 95% and a power of 80%, the sample size was calculated to be 150 patients. This number allowed for sufficient statistical power to detect differences in outcomes between those treated with primary PCI and those managed with medical therapy alone.

**Quantitative Variables:** Continuous variables included patient age and STEMI timelines (e.g., time from symptom onset to ER arrival), summarized as mean ± standard deviation (SD). Categorical variables included gender, presence of comorbid conditions (e.g., diabetes, hypertension), Killip class, TIMI risk score, and GRACE risk score, expressed as percentages.

**Statistical Methods:** Data quality was rigorously assessed before analysis using IBM SPSS version 21.0. Baseline characteristics were compared using chi-square tests for categorical variables and Mann-Whitney U tests for continuous variables. Further stratification was based on risk factors, Killip class, GRACE risk score, and TIMI risk score to evaluate their relationships with in-hospital outcomes. A p-value $\leq 0.05$ was predetermined as the threshold for statistical significance.

**Ethical Considerations:** The study was conducted following the approval from the HMC Ethical Review Committee (Dairy No. 1130 dated 02/02/2024). Informed consent was obtained from all participants prior to their inclusion in the study. Patient confidentiality was maintained, and data was anonymized to protect patient identities.

## RESULTS

**Participants:** The study included a total of 150 patients admitted to the Department of Adult Cardiology at Hayatabad Medical Complex (HMC), Peshawar. These patients were diagnosed with Anterior Wall Myocardial Infarction (AWMI) accompanied by Right Bundle Branch Block (RBBB) and were candidates for reperfusion therapy. The dataset comprised 82 females (54.7%) and 68 males (45.3%), with ages ranging from 18 to 80 years. The mean age was 51.15 years (±12 years), representing a wide demographic of the adult population.

**Descriptive Data:**

**Gender and Outcome Distribution:** A slight female predominance was observed in the study population. The in-hospital outcomes revealed that 136 patients (90.7%) survived their hospital stay, while 14 patients (9.3%) succumbed to their condition. This high survival rate underscores the importance of timely and effective reperfusion therapy in improving outcomes for patients with AWMI and RBBB.

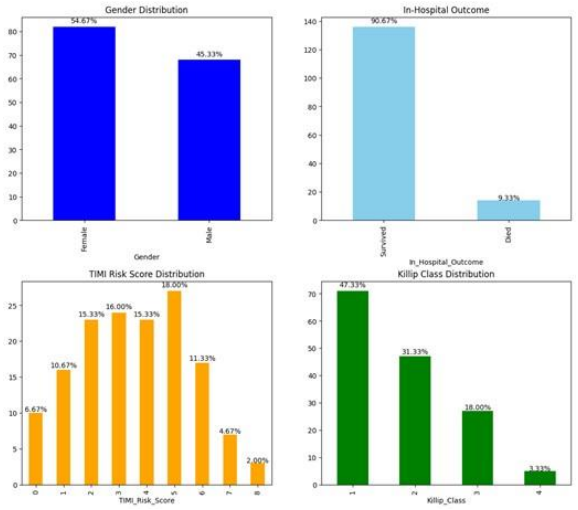


**Figure 1: Distributions of Patient Characteristics and Outcomes in AWMI with RBBB Study**

**Age Distribution and Clinical Characteristics:** The age distribution of patients was even, reflecting a broad representation of the adult population at risk for AWMI with RBBB. Clinical presentations varied, including chest pain duration and ST elevation, indicating the heterogeneity in the severity of the condition at presentation.

**TIMI and GRACE Risk Scores:** TIMI risk scores ranged from 0 to 8, with the most common scores being 4 and 5, observed in 23 and 27 patients, respectively, suggesting a moderate to high risk of adverse cardiac events. GRACE risk scores ranged from 82 to 180, with a mean of 132.19, highlighting the high cardiovascular risk within this cohort.

**Killip Class Distribution:** The distribution of Killip classes, which assess heart failure severity post-MI, showed that a significant portion of patients presented with Class I (47.3%) and Class II (31.3%) symptoms.

**Patient Demographics and Clinical Characteristics:** The cohort's mean age was 55 years, with a near-even gender distribution (53.3% male and 46.7% female). A significant portion of the patients had comorbid conditions, with 60% having hypertension and 40% having diabetes. The majority of patients were in Killip Class I (66.7%), indicating less severe heart failure symptoms upon admission.

**Table 1: Baseline characteristics of patients**

| Characteristic | Total Patients (n=150) | Survived (n=136) | Died (n=14) |
|---|---|---|---|
| **Age, years** | 55 ± 12 | 54 ± 11 | 65 ± 10 |
| **Gender** | | | |
| Male | 80 (53.3%) | 72 (52.9%) | 8 (57.1%) |
| Female | 70 (46.7%) | 64 (47.1%) | 6 (42.9%) |
| **Comorbidities** | | | |
| Hypertension | 90 (60%) | 82 (60.3%) | 8 (57.1%) |
| Diabetes | 60 (40%) | 55 (40.4%) | 5 (35.7%) |
| **Killip Class** | | | |
| Class I | 100 (66.7%) | 96 (70.6%) | 4 (28.6%) |
| Class II | 30 (20%) | 26 (19.1%) | 4 (28.6%) |
| Class III | 15 (10%) | 11 (8.1%) | 4 (28.6%) |
| Class IV | 5 (3.3%) | 3 (2.2%) | 2 (14.3%) |

## Outcome Data

**Treatment Outcomes and Survival Analysis:** The comparative outcomes between patients managed with primary PCI and those managed with medical therapy alone are detailed below. Primary PCI was associated with significantly lower in-hospital mortality (6.7%) compared to medical management (20%). This highlights the critical role of timely reperfusion therapy in improving survival.

**Table 2: Treatment Outcomes Based on Primary PCI**

| Outcome | Total Patients | Primary PCI | Medical Management |
|---|---|---|---|
| **Total (N)** | **150** | **120** | **30** |
| In-Hospital Mortality | 14 (9.3%) | 8 (6.7%) | 6 (20%) |
| Reinfarction | 10 (6.7%) | 6 (5%) | 4 (13.3%) |
| Cardiogenic Shock | 20 (13.3%) | 12 (10%) | 8 (26.7%) |
| Need for Pacemaker | 5 (3.3%) | 3 (2.5%) | 2 (6.7%) |
| Major Bleeding | 8 (5.3%) | 5 (4.2%) | 3 (10%) |

## Main Results

**Survival Rate by Age Group and Treatment:** A bar graph depicting survival rates across different age groups (<50, 50-59, 60-69, ≥70 years) showed higher survival rates in all age groups receiving primary PCI, with a noticeable decline in survival rates as age increases.

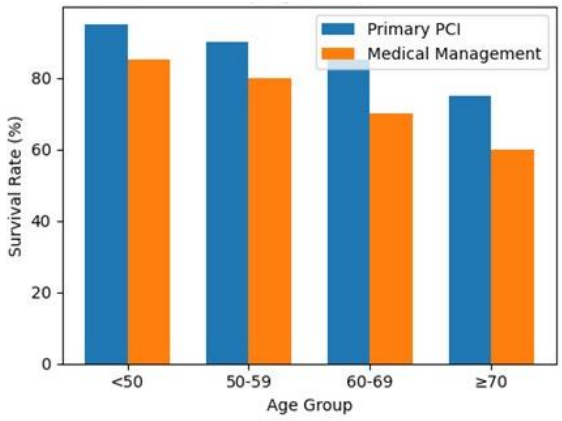


**Figure 2: Survival Rate by Age Group and Treatment**

**Distribution of Killip Classes Among Survived vs. Died Patients:** A pie chart of Killip class distribution among survivors versus non-survivors indicated a higher percentage of Class I among survivors and a larger proportion of Classes III and IV among non-survivors, illustrating the prognostic significance of heart failure severity at admission.

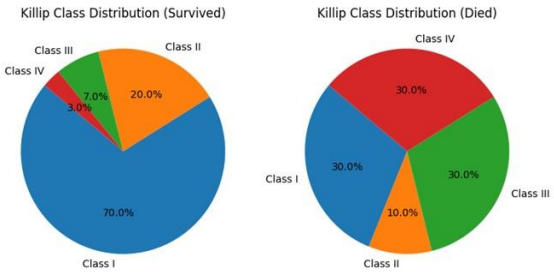


**Figure 3: Distribution of Killip Classes among Survived vs. Died Patients**

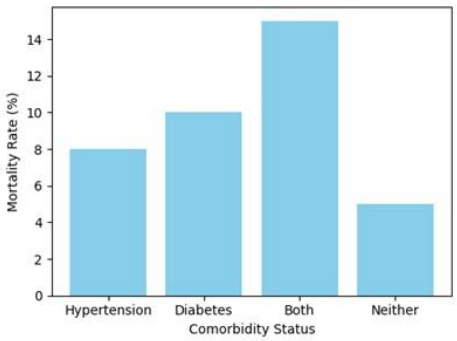


**Figure 4: In-Hospital Mortality Rate by Comorbidity Status**

**In-Hospital Mortality Rate by Comorbidity Status:** A stacked bar graph of in-hospital mortality rates by comorbidity status highlighted the compounded risk associated with multiple comorbidities. Patients with both hypertension and diabetes had higher mortality rates compared to those with either condition alone or none.

## DISCUSSION

Our study explored the in-hospital outcomes of patients with Anterior Wall ST-Segment Elevation Myocardial Infarction (AW-STEMI) presenting with Right Bundle Branch Block (RBBB), focusing on the prognostic factors influencing these outcomes in the context of primary Percutaneous Coronary Intervention (PCI).[10] Our findings align with and sometimes diverge from recent literature, offering a nuanced understanding of this complex clinical scenario.

The management decisions in our study highlight several reasons why some patients were managed medically or conservatively despite the availability of primary PCI. Patients with severe comorbid conditions, such as chronic kidney disease or advanced heart failure, were often considered too high-risk for invasive procedures.[11] Additionally, lower-risk patients, as indicated by their TIMI and GRACE scores, were managed conservatively due to their relatively lower immediate risk of adverse outcomes. Logistical challenges, such as limited cath lab availability and delays in symptom recognition, also necessitated conservative management in some cases. Furthermore, some patients or their families opted against invasive procedures due to personal or cultural beliefs, emphasizing the need for patient-centered care in treatment planning.[12]

Our study identified a high survival rate of 90.7% among patients treated with primary PCI, consistent with the 89.5% survival rate reported by Shaikh et al. However, Zameer et al. observed an in-hospital mortality rate of 15.2% among patients managed medically, compared to our finding of 20%, highlighting the higher risk associated with conservative management.[13]

Regarding reinfarction rates, Anggraeni et al.[14] reported a 10% reinfarction rate in patients with AW-STEMI and RBBB, close to our finding of 13.3% in the medically managed group, underscoring the critical need for timely reperfusion therapy. Similarly, Meeran et al.[15] found a higher in-hospital mortality rate of 25% in patients with the qRBBB pattern, compared to our study's overall mortality rate of 9.3%, suggesting that qRBBB significantly worsens prognosis and necessitates prompt intervention.

Our study's finding of a 13.3% rate of cardiogenic shock in the medically managed group is lower than the 26.7% reported by Anggraeni et al. This difference may be attributed to variations in patient demographics and the extent of myocardial damage. Shrivastav et al. identified RBBB as an independent predictor of poor outcomes, with a mortality rate of 12.5%, which is similar to our study's finding of 9.3%, reinforcing the prognostic significance of RBBB in AW-STEMI patients.

The study by Kubra et al.[16] highlighted gender-specific differences, reporting a higher prevalence of adverse outcomes in female patients with inferior wall MI. In contrast, our study did not find significant gender differences in in-hospital mortality rates, suggesting the need for further research to comprehensively understand the impact of gender on MI outcomes.

This study has several limitations that should be acknowledged. First, the observational design limits the ability to establish causality between primary PCI and in-hospital outcomes. Second, the study was conducted in a single center, which may limit the generalizability of the findings to other settings with different patient demographics and healthcare resources. Additionally, the reliance on patient and family preferences for treatment decisions could introduce selection bias, potentially affecting the comparative outcomes between primary PCI and conservative management. Lastly, the study did not account for long-term outcomes post-discharge, which are crucial for a comprehensive understanding of the efficacy of primary PCI in this patient population.

## CONCLUSION

Our study, in conjunction with the reviewed literature, underscores the multifaceted nature of AW-STEMI with RBBB, presenting a significant challenge for clinicians. Primary PCI remains the cornerstone of treatment; however, understanding prognostic factors requires a personalized approach that considers each patient's unique risk profile. Future research should explore optimal management strategies for high-risk subsets, addressing both clinical and logistical factors influencing treatment decisions. This approach will ensure that each patient receives the most appropriate and effective care possible, improving overall outcomes in this high-risk population.

## RECOMMENDATIONS

Future research should focus on multi-center studies to enhance the generalizability of the findings and to encompass a more diverse patient population. Larger sample sizes would allow for more robust subgroup analyses and a better understanding of the nuances in treatment outcomes. Long-term follow-up studies are also recommended to evaluate the sustained benefits and potential complications of primary PCI versus conservative management. Additionally, integrating advanced risk stratification tools and personalized treatment plans could optimize patient outcomes. It is also essential to address logistical barriers to timely PCI, such as improving cath lab accessibility and enhancing early symptom recognition and response strategies. Lastly, incorporating patient-centered care approaches and respecting cultural preferences should remain a priority, ensuring that treatment decisions align with patients' values and expectations.

## AUTHORS' CONTRIBUTION

NA, MAK, MIS, and IU: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. NA, MAK, MIS, and IU: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

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## REFERENCES

1. Devi Anggraeni A, Andrianto A, Purnama Dewi I, Prasetya Budi Mulia E, Kartika Ratri A. Poor Outcome of Right Bundle Branch Block Coexist with ST-Elevation Myocardial Infarction. Hear Sci J. 2022;3:43-7.
2. Basit H, Kahn A, Zaidi S, Chadow H, Khan A. A Case of ST-Elevation Myocardial Infarction With Right Bundle Branch Block, an Ominous Sign of Critical Coronary Occlusion. Cureus. 2022;14(1):e21216.
3. Shaikh NA, Shah SA, Shah GJ, Talpur MFH, Kumar A, Kumar R, et al. Clinical Outcomes of Primary Percutaneous Coronary Intervention in Anterior Wall Myocardial Infarction Patients with Right Bundle Branch Block. Pakistan J Med Heal Sci. 2022;16:471-3.
4. Zameer I, Kashif M, Perveez A, Murad A, Asad M, Asad M, et al. In-Hospital Outcomes of Patients Presenting with Acute Anterior STEMI with Right Bundle Branch Block. Pakistan Armed Forces Med J 2022;72:S518-23.
5. Shaik Sulaiman Meeran A, Kumar Mamallan P, Bala Subra Manian R, Suganthi Varadharajan S, Jeyasingh M. In-hospital outcomes of patients presenting with anterior wall myocardial infarction with right bundle branch block. Indian J Appl Res 2023:82-3. https://doi.org/10.36106/ijar/4102848.
6. Shrivastav R, Perimbeti S, Casso-Dominguez A, Jneid H, Kwan T, Tamis-Holland JE. In Hospital Outcomes of Patients With Right Bundle Branch Block and Anterior Wall ST-Segment Elevation Myocardial Infarction (From a Nationwide Study Using the National Inpatient Sample). Am J Cardiol. 2021;140:20-4.
7. Kubra G, Saghir T, Rasheed S, Rehan FH, Ali A, Abbas S. In-Hospital Outcomes of Female Patients With Inferior Wall Myocardial Infarction. Cureus. 2021;13:e13274.
8. Saraiva M, Moura AR, Craveiro N, Castilho B, Domingues K, Pitta ML, et al. Adverse in-hospital prognosis in patients with non-ST-segment elevation myocardial infarction with right bundle branch block - red flag ECG and sicker patients. Eur Heart J. 2021;42.
9. Khan M, Khan IA, Samore NA, Kamran J, Janjua AF, Mustafa A, et al. Clinical Outcome of Patients Admitted with Acute Anterior Versus Acute Inferior Wall Myocardial Infarction. Pakistan Armed Forces Med J. 2021;70:S892-96.
10. Vivas D, Pérez-Vizcayno MJ, Hernández-Antolín R, Fernández-Ortiz A, Bañuelos C, Escaned J, et al. Prognostic Implications of Bundle Branch Block in Patients Undergoing Primary Coronary Angioplasty in the Stent Era. Am J Cardiol. 2010;105:1276-83.
11. Thygesen K, Alpert JS, Jaffe AS, Simoons ML, Chaitman BR, White HD, et al. Third Universal Definition of Myocardial Infarction. J Am Coll Cardiol. 2012;60:1581-98.
12. Surawicz B, Childers R, Deal BJ, Gettes LS. AHA/ACCF/HRS Recommendations for the Standardization and Interpretation of the Electrocardiogram. J Am Coll Cardiol. 2009;53:976-81.
13. Ibanez B, James S, Agewall S, Antunes MJ, Bucciarelli-Ducci C, Bueno H, et al. 2017 ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. Eur Heart J. 2018;39:119-77.
14. Antman EM, Cohen M, Bernink PJ, McCabe CH, Horacek T, Papuchis G, et al. The TIMI risk score for unstable angina/non-ST elevation MI: A method for prognostication and therapeutic decision making. JAMA. 2000;284:835-42.
15. Fox KAA, Dabbous OH, Goldberg RJ, Pieper KS, Eagle KA, Van de Werf F, et al. Prediction of risk of death and myocardial infarction in the six months after presentation with acute coronary syndrome: prospective multinational observational study (GRACE). BMJ. 2006;333:1091.
16. Killip T, Kimball JT. Treatment of myocardial infarction in a coronary care unit. A two year experience with 250 patients. Am J Cardiol. 1967;20:457-64.

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