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A STUDY ON HEMODYNAMIC CHANGES IN CARDIAC ARREST PATIENTS DURING THROMBOLYSIS IN A TERTIARY CARE CENTRE

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Abstract

Background: Cardiac arrest is a critical condition with high morbidity and mortality rates, necessitating rapid and effective intervention. Thrombolysis is a therapeutic strategy used to dissolve blood clots and restore blood flow, primarily in acute myocardial infarction. This study aims to explore the hemodynamic changes associated with thrombolysis in cardiac arrest patients and assess its impact on patient outcomes. **Materials and Methods:** This hospital-based cross-sectional study was conducted in the Department of Emergency Medicine at a tertiary care center from May 2023 to October 2023. The study included 70 patients diagnosed with acute ST-Elevation Myocardial Infarction (STEMI) who experienced cardiac arrest. Data were collected on socio-demographic characteristics, clinical history, and hemodynamic parameters during and after thrombolysis. Hemodynamic changes, including heart rate, systolic and diastolic blood pressure, and ECG rhythm changes, were recorded at specific intervals (0, 5, 10, 15, 20, 25, 30, and 60 minutes) post-thrombolysis. Statistical analysis was performed using SPSS version 21, with a significance level set at $p<0.05$. **Results:** The mean age of participants was 58.5 years, with a predominance of males (76.6%). Comorbidities such as hypertension (29.4%) and Type 2 Diabetes Mellitus (23.2%) were prevalent. Hemodynamic monitoring revealed a slight initial decrease in systolic and diastolic blood pressure, followed by stabilization around baseline values. Heart rate decreased slightly immediately post-thrombolysis but returned to baseline within an hour. The most common ECG change observed was Ventricular Premature Contractions (43.4%). No significant differences were found in the duration of hospital stay or blood pressure outcomes between patients with and without comorbid conditions. **Conclusion:** Thrombolysis in cardiac arrest patients leads to manageable hemodynamic changes, with initial fluctuations in blood pressure and heart rate. The procedure is associated with a safety profile that does not significantly impact short-term outcomes or vary substantially based on the presence of comorbid conditions. Continuous hemodynamic and ECG monitoring is essential to ensure patient stability and optimize treatment outcomes.

Keywords: *Cardiac arrest, thrombolysis, hemodynamic changes, myocardial infarction, ECG changes, emergency medicine*

Introduction

Cardiac arrest represents a critical and life-threatening medical emergency characterized by the sudden cessation of cardiac function, leading to the loss of effective blood circulation and

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subsequent end-organ damage if not promptly addressed. The global burden of cardiac arrest is substantial, with over 350,000 out-of-hospital cardiac arrests occurring annually in the United States alone, and survival rates remaining notably low despite advances in medical treatment.[1] Thrombolysis, a therapeutic intervention aimed at dissolving blood clots, has emerged as a critical strategy in managing acute myocardial infarction and other thromboembolic events. The application of thrombolysis in the context of cardiac arrest, however, is complex and controversial due to the need for rapid and effective intervention while balancing potential risks and benefits.[2]

Cardiac arrest affects a diverse demographic, with incidence rates influenced by various factors including age, gender, underlying health conditions, and lifestyle. According to a study by Wolthers *et al.*[3]. (2020), the incidence of cardiac arrest in the general population is approximately 50-100 cases per 100,000 person-years, with a higher prevalence among older adults and those with pre-existing cardiovascular diseases. The epidemiology of thrombolysis in cardiac arrest patients is less well-defined, primarily due to the rarity of such cases and the inherent challenges associated with studying this population. Nonetheless, it is estimated that a small percentage of cardiac arrest patients might benefit from thrombolytic therapy if administered promptly, highlighting the need for more targeted research in this area.[4,5]

The management of cardiac arrest requires rapid and effective treatment to restore circulation and improve patient outcomes. Thrombolysis, traditionally used in acute myocardial infarction and stroke management, offers a potential therapeutic avenue in certain cardiac arrest scenarios, particularly when associated with acute coronary thrombosis[6]. Understanding the hemodynamic changes that occur during and after thrombolysis in this patient population is crucial for optimizing treatment protocols and improving survival rates. While guidelines for thrombolysis in cardiac arrest are still evolving, there is a growing body of evidence suggesting that thrombolysis may offer benefits when administered early and in specific clinical contexts.[7] However, concerns regarding the safety and efficacy of thrombolysis in cardiac arrest patients persist, underscoring the need for comprehensive studies to guide clinical practice.

Rationale

This study aims to address gaps in medical knowledge regarding hemodynamic changes during thrombolysis in cardiac arrest patients. While thrombolysis has been extensively studied in acute myocardial infarction and stroke, its application in cardiac arrest scenarios is less understood. The study aims to assess hemodynamic parameters to provide insights into the immediate effects of thrombolysis and its impact on patient stability. It also aims to identify factors contributing to successful resuscitation and recovery, elucidating the effectiveness of thrombolysis in improving survival rates and functional recovery. The study's findings could inform clinical practice guidelines and improve decision-making processes in emergency settings, leading to refined protocols for thrombolysis administration in cardiac arrest cases. This would ultimately contribute to better patient outcomes and more efficient use of medical resources.

Aim And Objectives

- To determine the hemodynamic changes during and after thrombolysis in cardiac arrest patients.
- To assess the outcome among the study participants
- To find the association between the outcome and the co-morbidities among the study participants.

Materials And Methods

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Study Design: This research was designed as a hospital-based cross-sectional study.
Study Area: The study was conducted in the Department of Emergency Medicine at a tertiary care centre.
Study Population: The study population comprised cardiac arrest patients diagnosed with Acute ST Elevation Myocardial Infarction (STEMI).
Study Period: The study was carried out over six months, from May 2023 to October 2023.
Sampling Method: Convenient sampling was employed to select the study participants.
Sample Size: A total of 70 patients diagnosed with myocardial infarction (acute ST elevation MI) were enrolled in the study.
Data Collection

- Socio-demographic Details: Information such as age, gender, and other relevant socio-demographic details were collected.
- Clinical History: A complete clinical history, including past medical history, comorbid conditions, and previous treatments, was documented.

Examination and Initial Assessment
Each patient underwent a comprehensive examination and initial assessment upon admission to the emergency department.
Thrombolysis Procedure
After the initial assessment, thrombolysis was performed according to standard medical protocols for managing acute STEMI.
Hemodynamic Monitoring
The hemodynamic changes were meticulously recorded at specific time intervals during and after thrombolysis. The time points for recording were at 0, 5, 10, 15, 20, 25, 30, and 60 minutes. The parameters monitored included:

- Heart rate (HR)
- Systolic blood pressure (SBP)
- Diastolic blood pressure (DBP)
- ECG rhythm changes

Data Management
The collected data were entered into Microsoft Excel for organization and preliminary analysis. The data were then analyzed using SPSS version 21.
Statistical Analysis
Descriptive statistics were used to summarize the baseline characteristics of the study participants. Continuous variables were expressed as means and standard deviations, while categorical variables were presented as frequencies and percentages. Comparative analysis was performed to evaluate the impact of comorbid conditions on hemodynamic outcomes using appropriate statistical tests. A p-value of less than 0.05 was considered statistically significant.
Ethical Considerations
The study was conducted in accordance with the ethical standards of the institutional research committee and the Declaration of Helsinki. Informed consent was obtained from all participants or their legal guardians prior to inclusion in the study.

Results
Table 1: Baseline characteristics among study participants

Characteristics	**Study Participants (n=70)**

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Age (years)	58.5 ± 9.1
Gender	
Male	76.6%
Female	23.4%
Duration of Stay in hospital (days)	6.27 ± 3.7

This table provides the basic demographic and clinical characteristics of the 70 study participants. The mean age is 58.5 years with a standard deviation of 9.1 years. The majority of participants are male (76.6%), and the mean duration of hospital stay is 6.27 days with a standard deviation of 3.7 days.

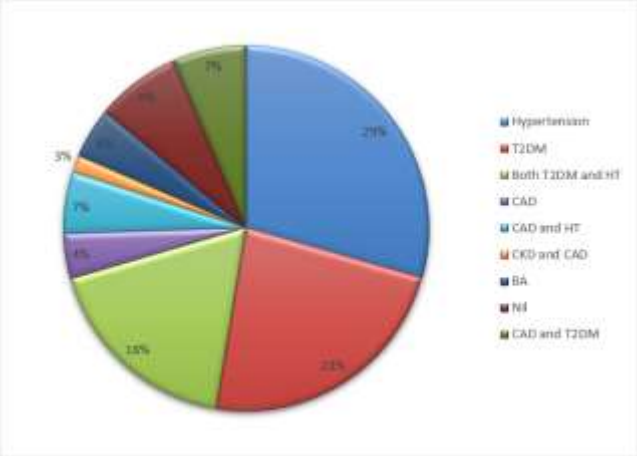

Figure 1: Comorbidities among Study Participants

This figure illustrates the distribution of comorbid conditions among the study participants. The most common comorbidities are hypertension (29.4%) and Type 2 Diabetes Mellitus (T2DM) (23.2%). A significant proportion of participants have both T2DM and hypertension (17.9%).

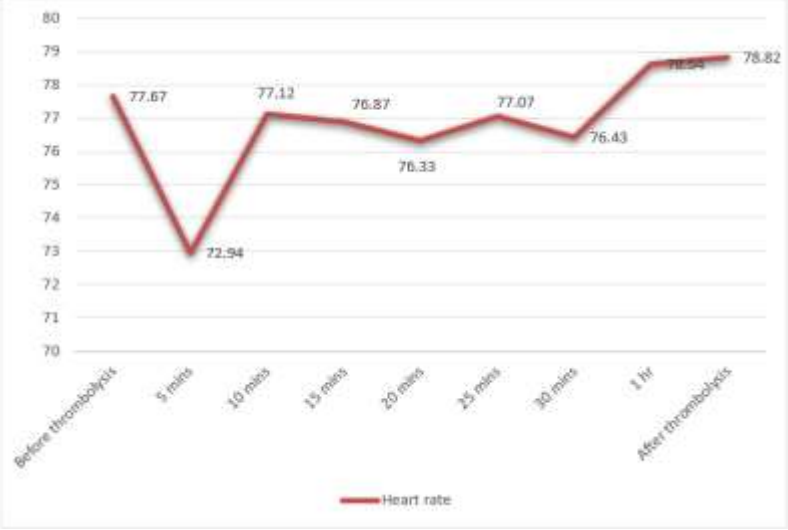

Figure 2: Heart Rate Changes During and After Thrombolysis

This figure shows the variation in heart rate at different time points during and after thrombolysis. The heart rate decreases slightly at 5 minutes after thrombolysis initiation but gradually returns to near baseline levels by 1 hour post-thrombolysis.

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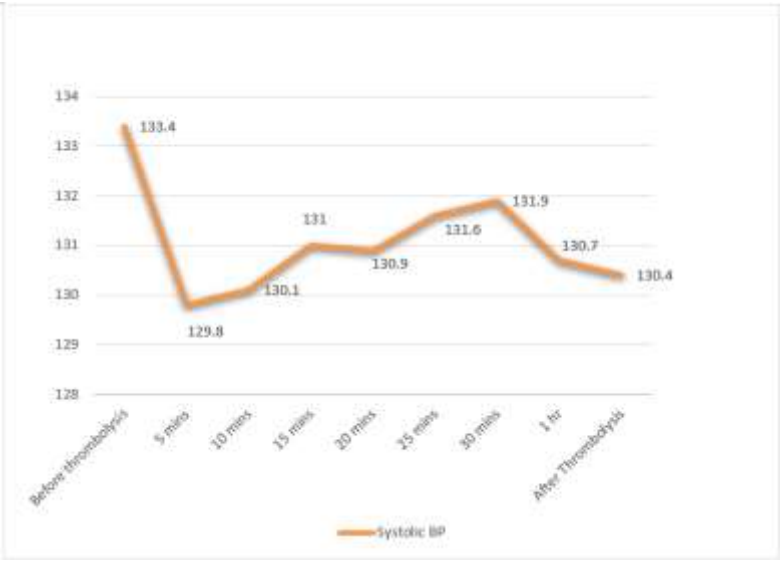

Figure 3: Systolic Blood Pressure During and After Thrombolysis

This figure details the changes in systolic blood pressure during and after thrombolysis. There is a slight decrease in systolic BP 5 minutes post-thrombolysis, which stabilizes and slightly fluctuates around the baseline values.

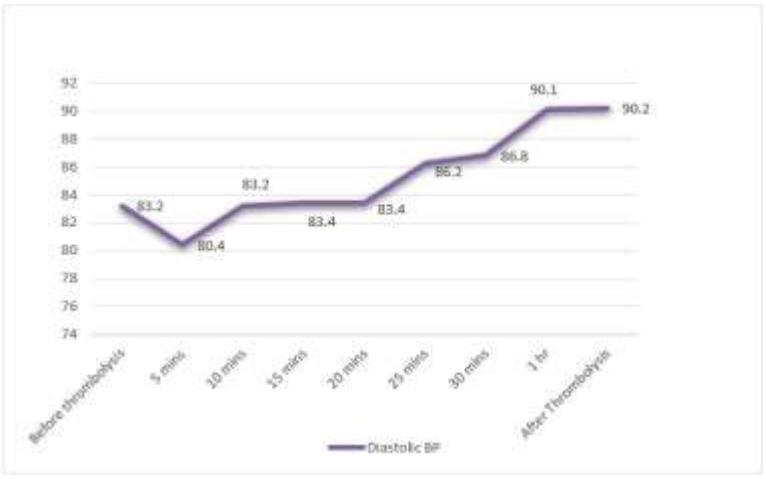

Figure 4: Diastolic Blood Pressure Changes During and After Thrombolysis

This figure shows the diastolic blood pressure changes at different time intervals during and after thrombolysis. Diastolic BP initially decreases but then increases gradually, peaking at 1 hour post-thrombolysis.

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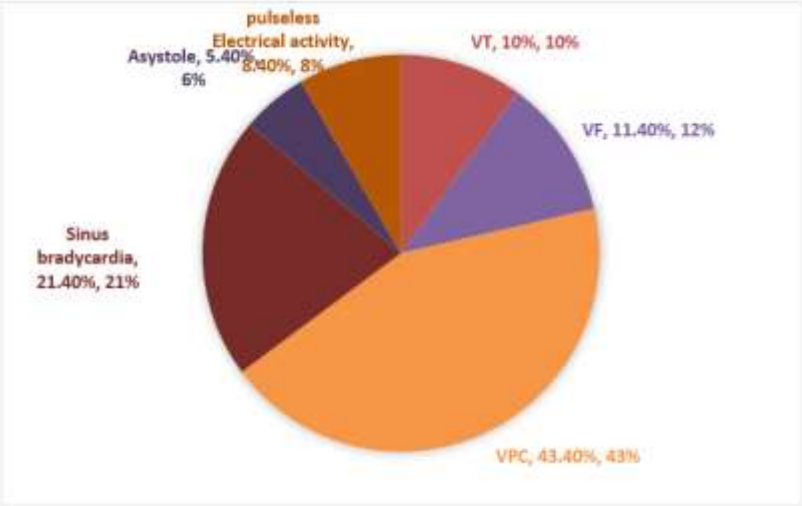

Figure 5: ECG Rhythmic Changes

This figure illustrates the percentage distribution of various ECG rhythmic changes observed among the study participants. Ventricular Premature Contractions (VPC) were the most common (43.4%), followed by Sinus Bradycardia (21.4%).

Table 2: Outcome variable comparison

Variable	Comorbid Condition Present	Comorbid Condition Absent	P Value
Duration of Stay (days)	6.98 ± 2.4	6.1 ± 2.1	0.12
Systolic BP 1 hr (mmHg)	130.75 ± 9.3	124.63 ± 4.4	0.32
Diastolic BP 1 hr (mmHg)	85.22 ± 11.3	82.56 ± 9.3	0.47

This table compares the outcome variables between participants with and without comorbid conditions. The variables include the duration of hospital stay, systolic BP, and diastolic BP 1 hour post-thrombolysis. No significant differences are found between the two groups, indicating that comorbid conditions did not significantly affect these outcome variables.

Discussion

Our study provides valuable insights into the hemodynamic changes in cardiac arrest patients during and after thrombolysis, and how these changes correlate with patient outcomes and comorbidities.

Hemodynamic Changes During Thrombolysis

Our study found that both systolic and diastolic blood pressure (BP) experienced an initial drop at 5 minutes post-thrombolysis, followed by a gradual rise up to 60 minutes. This observation aligns with the findings of Kang Y (2019) *et al.*[8], who emphasized the importance of maintaining stable blood pressure for better prognosis in post-cardiac arrest patients . Similarly, the study by Zheng *et al.*[9]. (2009) also reported fluctuations in BP during thrombolysis, highlighting the critical need for vigilant hemodynamic monitoring during the procedure.

Demographic characteristics:

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The demographic characteristics of our study participants, with a mean age of 58.5 years and a male predominance (76.6%), are comparable to those reported by Er F *et al.*[10]. (2009), where the mean age was 61.4 years, and the majority of participants were also male. This similarity suggests a consistent demographic pattern in studies involving cardiac arrest patients undergoing thrombolysis.

ECG Rhythmic Changes

Our study identified Ventricular Premature Contractions (VPC) as the most common ECG rhythmic change (43.4%), followed by Sinus Bradycardia (21.4%). These findings differ from those reported by Dunne RB *et al.*[11]. (2007), who observed higher incidences of Ventricular Fibrillation (VF) and Ventricular Tachycardia (VT) in out-of-hospital cardiac arrest patients. The variation could be attributed to differences in study settings and patient populations, as our study was conducted in a tertiary care center with immediate medical interventions.

Outcomes and Comorbidities

Our study did not find significant differences in the duration of hospital stay, systolic BP, and diastolic BP between participants with and without comorbid conditions. This contrasts with the findings of David *et al.*[12]. (2009), who reported that comorbidities like hypertension and diabetes mellitus adversely affected patient outcomes post-thrombolysis. The discrepancy might be due to differences in the sample size and the specific criteria used to define comorbid conditions.

Implications for Clinical Practice

The consistent drop and subsequent rise in BP during thrombolysis observed in our study underscores the need for continuous hemodynamic monitoring in cardiac arrest patients. Additionally, the high incidence of VPC highlights the importance of vigilant ECG monitoring to detect and manage arrhythmias promptly. While comorbidities did not significantly impact the primary outcomes in our study, their potential influence on long-term prognosis cannot be overlooked, necessitating a comprehensive management approach for cardiac arrest patients with underlying health conditions[13,14].

Limitations

The study's findings may be limited due to its small sample size of 70 participants, being confined to a single tertiary care center, and its short follow-up period. The focus was on immediate hemodynamic changes during and shortly after thrombolysis, without long-term follow-up to assess sustained effects or late complications. The absence of a control group of cardiac arrest patients not undergoing thrombolysis limits the ability to attribute observed changes to the thrombolytic intervention.

Conclusion

In this study, we evaluated the hemodynamic changes in cardiac arrest patients during thrombolysis in a tertiary care center. The primary findings indicate that heart rate and blood pressure undergo slight fluctuations during and after thrombolysis, with heart rate showing an initial decrease followed by a return to baseline levels within an hour, and both systolic and diastolic blood pressures experiencing slight declines before stabilizing. Ventricular Premature Contractions (VPC) emerged as the most frequent ECG rhythmic change observed. Additionally, the presence of comorbid conditions such as hypertension and Type 2 Diabetes Mellitus did not significantly influence the duration of hospital stay or the blood pressure outcomes post-thrombolysis. Overall, thrombolysis was associated with manageable hemodynamic changes, demonstrating its safety profile in this patient population.

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Monitoring hemodynamic status during thrombolysis in cardiac arrest patients is crucial to prevent the occurrence of post-cardiac arrest syndrome. This study highlights the importance of closely observing heart rate, systolic and diastolic blood pressure, and ECG rhythmic changes throughout the thrombolytic process to ensure patient stability and optimize outcomes.

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