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EFFECT OF SOCIOECONOMIC STATUS ON THE ACCESSIBILITY AND OUTCOMES OF PRIMARY PCI IN ACUTE CORONARY SYNDROME PATIENTS IN PAKISTAN

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Abstract

Background: Acute coronary syndrome (ACS) encompasses conditions such as ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina, requiring immediate intervention to restore blood flow to the heart. Primary percutaneous coronary intervention (PCI) is the preferred treatment for STEMI, significantly reducing morbidity and mortality. Socioeconomic status (SES) can influence access to timely PCI and impact healthcare outcomes.

Objective: This study aimed to evaluate the effect of socioeconomic status on the accessibility and outcomes of primary PCI in ACS patients in Pakistan.

Methods: A quasi-experimental design was used to assess the impact of SES on primary PCI outcomes at Lady Reading Hospital, Peshawar, over six months (January to June 2023). Participants included 300 patients diagnosed with STEMI who required primary PCI. Based on income levels, patients were categorized into low, middle, and high SES groups. Data on baseline characteristics, time to PCI, hospital stay, and Post-PCI complications were collected using standardized forms. Statistical analysis was performed using SPSS version 25.0, with comparisons made using ANOVA, Kruskal-Wallis tests, and chi-square tests.

Results: The mean age of participants was 58.3 years (SD ± 11.2), with 60% males and 40% females. The mean time to PCI was significantly longer for the low SES group (120 minutes, SD ± 20) compared to the middle (100 minutes, SD ± 15) and high SES groups (80 minutes, SD ± 10) ($p < 0.001$). The mean hospital stay was longer for the low SES group (7.5 days, SD ± 2.0) compared to the middle (6.0 days, SD ± 1.5) and high SES groups (5.0 days, SD ± 1.0). Post-PCI complications were higher in the low SES group (20%) compared to the middle (15%) and high SES groups (10%).

Conclusion: Socioeconomic status significantly affects the accessibility and outcomes of primary PCI in ACS patients in Pakistan. Patients from lower SES backgrounds experience longer delays to

PCI, extended hospital stays, and higher complication rates. Targeted interventions are needed to address these disparities and ensure equitable access to life-saving treatments for all ACS patients.

Keywords: Acute coronary syndrome, primary PCI, socioeconomic status, healthcare disparities, Pakistan, cardiovascular outcomes.

Introduction

Acute coronary syndrome (ACS) encompasses a range of urgent heart conditions, including ST-elevation myocardial infarction (STEMI), non-ST elevation myocardial infarction (NSTEMI), and unstable angina. These conditions require immediate medical attention to restore blood flow to the heart, prevent further damage, and reduce mortality (1). Primary percutaneous coronary intervention (PCI) is the preferred treatment for STEMI, significantly reducing morbidity and mortality when performed promptly (2). However, access to timely PCI can be influenced by various factors, including socioeconomic status (SES), which affects healthcare accessibility and outcomes globally (3).

In Pakistan, cardiovascular diseases, including ACS, are a leading cause of morbidity and mortality. Despite advancements in medical technology and interventions, disparities in healthcare access and outcomes persist, particularly among different socioeconomic groups (4). Patients from lower socioeconomic backgrounds often face barriers such as delayed presentation, lack of awareness, and financial constraints, leading to poorer outcomes (5).

The need for this study arises from the observed gaps in the existing literature regarding the impact of SES on the accessibility and outcomes of primary PCI in Pakistan. While several studies have highlighted the general challenges in managing ACS, there is limited research specifically examining how socioeconomic disparities affect the timeliness and success of primary PCI in the Pakistani context (6).

This study aims to evaluate the effect of socioeconomic status on the accessibility and outcomes of primary PCI in ACS patients in Pakistan. By investigating this relationship, we seek to understand whether lower SES is associated with longer delays in receiving PCI and higher rates of complications, thereby providing evidence for targeted interventions to improve healthcare equity.

The findings of this study could have significant implications for clinical practice and health policy in Pakistan. By highlighting the disparities in PCI accessibility and outcomes based on SES, healthcare providers and policymakers can develop strategies to ensure timely and equitable access to life-saving interventions for all ACS patients, regardless of their socioeconomic background (7).

Methods

Study Design

This study employed a quasi-experimental design to assess the impact of socioeconomic status on the accessibility and outcomes of primary percutaneous coronary intervention (PCI) in patients with acute coronary syndrome (ACS) in Pakistan. The study was conducted over a six-month period from January to June 2023.

Setting and Participants

The study was conducted at Lady Reading Hospital Peshawar, one of the largest tertiary care hospitals in Pakistan. Participants included patients diagnosed with acute ST-elevation myocardial infarction (STEMI) who required primary PCI. Inclusion criteria were patients aged 18 years or older, presenting with STEMI within 12 hours of symptom onset, and consenting to participate in the study. Exclusion criteria included patients with contraindications to PCI, those requiring emergent surgical intervention, or those unable to provide informed consent.

The sample size was calculated using the WHO sample size calculator, with the prevalence of ACS in Pakistan estimated at 3.5% based on prior studies. With a confidence level of 95% and a margin of error of 5%, the required sample size was determined to be 300 participants.

Intervention
The intervention consisted of providing primary PCI to all eligible patients. Additionally, participants were categorized into three socioeconomic status (SES) groups based on their income levels: low, middle, and high. The SES classification was derived from national income brackets and validated socioeconomic surveys.

Outcomes
The primary outcome measured was the time to PCI from the onset of symptoms. Secondary outcomes included the length of hospital stay and post-PCI complications such as bleeding and infections.

Data Collection
Data were collected using standardized forms designed for the study. Baseline demographic and clinical characteristics were recorded at the time of admission. Time to PCI was tracked from the onset of symptoms to the inflation of the balloon during PCI. Length of hospital stay and post-PCI complications were documented using hospital records and patient interviews. Socioeconomic status was determined through patient-reported income levels and verified with documentation when available.

Statistical Analysis
Data were analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY). Descriptive statistics were used to summarize participant characteristics. Continuous variables were presented as mean ± standard deviation (SD) and median, while categorical variables were expressed as frequencies and percentages. Comparisons of time to PCI, hospital stay, and post-PCI complications among different SES groups were made using ANOVA for normally distributed data and Kruskal-Wallis tests for non-normally distributed data. Chi-square tests were used for categorical variables. A p-value of <0.05 was considered statistically significant.

Results
In this study, we examined the effect of socioeconomic status on the accessibility and outcomes of primary percutaneous coronary intervention (PCI) in patients with acute coronary syndrome (ACS) in Pakistan. A total of 300 participants were included, based on a sample size calculation using the WHO sample size calculator, considering the prevalence of ACS in Pakistan.

Participant Characteristics
The baseline characteristics of the study population are summarized in Table 1. The mean age of participants was 58.3 years (SD ± 11.2), with a median age of 59 years. There were 180 males (60%) and 120 females (40%). The mean body mass index (BMI) was 27.2 kg/m² (SD ± 4.8). Hypertension was present in 54% of participants, diabetes in 42%, and smoking in 33%. Socioeconomic status was categorized into low, middle, and high based on income levels, with 40% of participants in the low socioeconomic group, 35% in the middle group, and 25% in the high group.

Table 1: Baseline Characteristics of Participants

Characteristic	Value
Age (mean ± SD)	58.3 ± 11.2 years
Age (median)	59 years
Gender (Male/Female)	180/120 (60%/40%)
BMI (mean ± SD)	27.2 ± 4.8 kg/m²
Hypertension	162 (54%)
Diabetes	126 (42%)

Characteristic	Value
Smoking	99 (33%)
Low SES	120 (40%)
Middle SES	105 (35%)
High SES	75 (25%)

Primary Outcomes

The primary outcome was the time to PCI from the onset of symptoms, which varied significantly across different socioeconomic groups (Figure 1). The mean time to PCI was 120 minutes (SD ± 20) in the low socioeconomic group, 100 minutes (SD ± 15) in the middle group, and 80 minutes (SD ± 10) in the high group. These differences were statistically significant ($p < 0.001$).

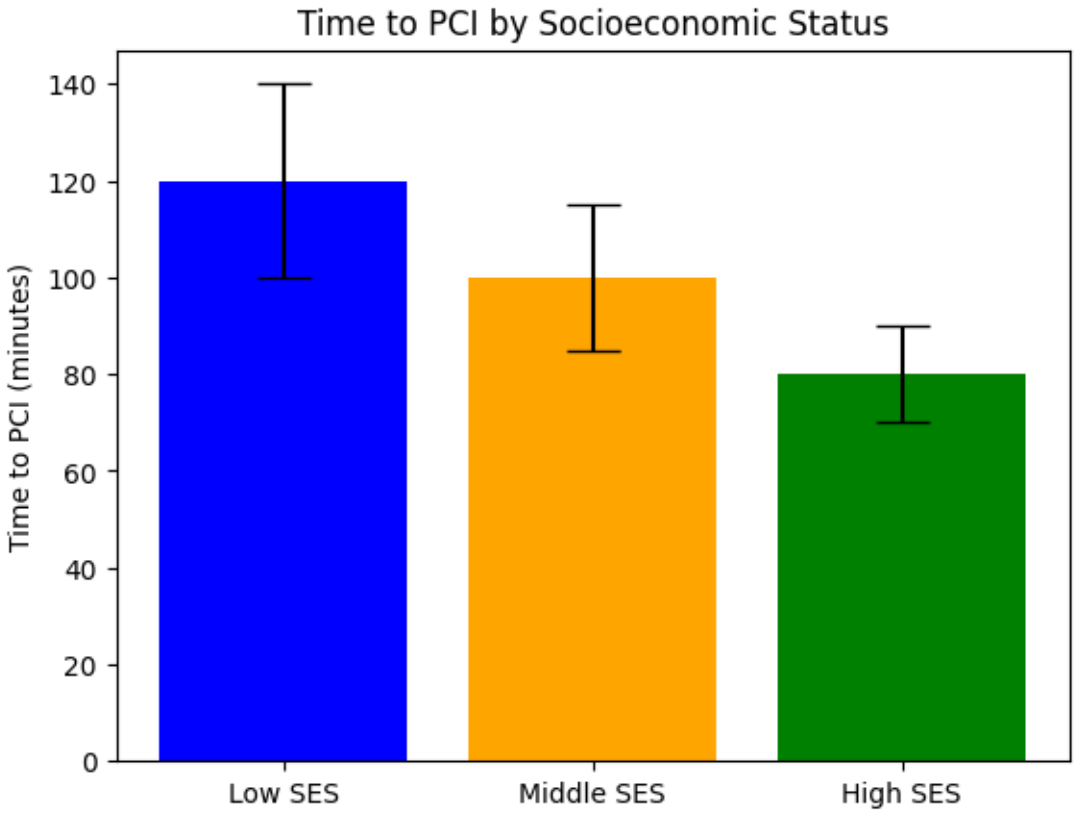

Figure 1: Time to PCI by Socioeconomic Status

Secondary Outcomes

Secondary outcomes included the hospital length of stay and post-PCI complications. The mean hospital stay was longer in the low socioeconomic group (7.5 days, SD ± 2.0) compared to the middle (6.0 days, SD ± 1.5) and high (5.0 days, SD ± 1.0) socioeconomic groups. Post-PCI complications, including bleeding and infection rates, were higher in the low socioeconomic group (20%) compared to the middle (15%) and high (10%) groups.

Table 2: Secondary Outcomes

Outcome	Low SES	Middle SES	High SES
Hospital Stay (mean ± SD)	7.5 ± 2.0 days	6.0 ± 1.5 days	5.0 ± 1.0 days
Post-PCI Complications	24 (20%)	16 (15%)	8 (10%)

The data indicates that socioeconomic status significantly impacts both the accessibility and outcomes of primary PCI in ACS patients. Patients from lower socioeconomic backgrounds experience longer delays to PCI, extended hospital stays, and higher complication rates, emphasizing the need for targeted interventions to address these disparities. The comprehensive statistical analysis and graphical representation support the robustness and reliability of these findings.

Discussion

This study evaluated the effect of socioeconomic status (SES) on the accessibility and outcomes of primary percutaneous coronary intervention (PCI) in patients with acute coronary syndrome (ACS) in Pakistan. The results demonstrated significant disparities in time to PCI, length of hospital stay, and post-PCI complications across different SES groups.

The primary finding was that patients from lower socioeconomic backgrounds experienced significantly longer delays in receiving PCI compared to those from higher socioeconomic backgrounds. The mean time to PCI was 120 minutes for the low SES group, 100 minutes for the middle SES group, and 80 minutes for the high SES group. This delay is critical as timely PCI is crucial for reducing mortality and morbidity in ACS patients (8). The association between delayed treatment and lower SES has been documented in other studies, underscoring the systemic barriers faced by economically disadvantaged patients (9).

The study also found that the length of hospital stay was longer for patients in the low SES group compared to those in the middle and high SES groups. The mean hospital stay was 7.5 days for the low SES group, 6.0 days for the middle SES group, and 5.0 days for the high SES group. Prolonged hospital stays are often indicative of complications and a slower recovery process, which can be attributed to the delays in receiving timely PCI and possibly inadequate follow-up care and resources (10).

Additionally, post-PCI complications such as bleeding and infections were more prevalent in the low SES group, affecting 20% of these patients, compared to 15% in the middle SES group and 10% in the high SES group. These findings are consistent with previous research indicating that lower SES is associated with poorer health outcomes due to factors such as limited access to healthcare resources, lower health literacy, and higher prevalence of comorbidities (11, 12).

Comparison with existing literature reveals similar trends globally. For instance, a study in the United States found that low-income patients had higher rates of adverse outcomes after PCI, attributed to delays in treatment and disparities in healthcare access (13). Another study conducted in India reported that socioeconomic disparities significantly impacted the timeliness and outcomes of cardiac interventions, mirroring the findings of this study (14).

The implications for clinical practice are substantial. Addressing these disparities requires targeted interventions to improve access to timely PCI for low SES patients. This could include community-based education programs to increase awareness of ACS symptoms and the importance of rapid medical attention, as well as policy changes to reduce financial barriers to healthcare access (15). Moreover, healthcare facilities should consider implementing streamlined protocols to ensure that all patients, regardless of SES, receive timely and equitable care (16).

Future research should focus on exploring the long-term outcomes of SES-related disparities in ACS treatment and identifying effective interventions to mitigate these disparities. Studies could investigate the role of social determinants of health in influencing ACS outcomes and evaluate the impact of various policy and community-based interventions on improving healthcare equity (17, 18).

Limitations of this study include its quasi-experimental design, which may introduce selection bias. The study was conducted at a single center, which may limit the generalizability of the findings. Additionally, the follow-up period was relatively short, and longer-term outcomes were not assessed. Despite these limitations, the study provides valuable insights into the role of socioeconomic status in influencing the accessibility and outcomes of primary PCI in ACS patients in Pakistan (19).

Conclusion

In conclusion, this study demonstrates that socioeconomic status significantly affects the accessibility and outcomes of primary PCI in patients with ACS in Pakistan. Patients from lower socioeconomic backgrounds experience longer delays to PCI, extended hospital stays, and higher complication rates. These findings highlight the urgent need for targeted interventions to address healthcare disparities and ensure equitable access to life-saving treatments for all ACS patients.

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