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**ORIGINAL ARTICLE**

# Clinical Manifestation and Short-Term Outcome of Emergency Percutaneous Revascularization of Patient with ST-Segment Elevation Myocardial Infarction at a Rural Satellite Center

SARFRAZ HUSSAIN SAHITO[1], MUHAMMAD RAFIQUE KANHER[2], JAVED KHURSHED SHAIKH[3], TARIQ ASHRAF[4], RIZWAN KHAN[5], AMJAD ALI HULIO[6]

[1]*FCPS (Cardiology) Assistant Professor National Institute of Cardiovascular Diseases(NICVD) Khairpur*
[2]*Assistant professor National Institute of Cardiovascular Diseases(NICVD) Khairpur*
[3]*Assistant Professor National Institute of Cardiovascular Diseases(NICVD) Sukkur*
[4]*FCPS (Cardiology) Professor National Institute of Cardiovascular Diseases(NICVD) Karachi*
[5]*FCPS Cardiology Assistant professor National Institute of Cardiovascular Diseases(NICVD) Sehwan*
[6]*MD Cardiology Senior Registrar National Institute of Cardiovascular Diseases(NICVD) Larkana*
*Correspondence to: Sarfraz Hussain Sahito, Email: sarfrazarham12@gmail.com, Cell: 03313614249*

## ABSTRACT

**Background:** In Pakistan, the prevalence of acute coronary syndrome (ACS) patients is among the highest in the world. A patient's rate of morbidity and mortality depends greatly on the time that passes during ACS, especially in ST-elevation myocardial infarction patients (STEMI).

**Objectives:** This research aimed to assess the spectrum of the acute coronary syndrome (ACS) and factors leading to delay in presentation and treatment to evaluate its impact on the short-term outcome in patients presenting to a rural satellite center of NICVD at Khairpur, Pakistan.

**Material & Methods:**

This observational study was conducted on 400 patients at the Department of Adult Cardiology at Kharipur Satellite Center of National Institute of Cardiovascular Diseases (NICVD), Pakistan for six months. All patients presenting to ER with ACS whose age was ≥18 years were included. Participants' informed consents were obtained verbally and confidentiality was maintained in regards to their participation in and publication of findings from the study. Consecutive patients presenting with ACS to the satellite center of NICVD at Khairpur, Pakistan were included in this research. Baseline characteristics were analyzed using the statistical package for social sciences (SPSS 25).

**Results:** A total of 400 (295 males and 105 females) patients with ACS were included. The mean age was 63.3 ± 11.5 (range 40-70) years, 42.5% had low SES, 35.0% had mid-SES, and 22.5% had high SES.159 (39.8%) patients were from the urban area and 241(60.2%) were from a rural region. However, age, smokers, hypertension, dyslipidemia, area of residence, obesity, diabetic Mellitus, and atrial fibrillation were found to be significant factors associated with socioeconomic status for the acute coronary syndrome. (p-value = <0.05)

The epicardial coronary disease was significantly less common in individuals with a high SES compared to those with a mid or low SES. We observed that mode of transport may be a significant cause of death (p-value = <0.0001) because of late arrival to the hospital. In our research, we showed 7.8% 30-day mortality out of total samples. Area of residence, mode of transport, 30-day mortality, OS-ECG (in min), and inferior and anterior STEMI were found to be significantly associated factors (p-value = <0.05).

**Conclusion:** Even though the low-SES STEMI patients at the National Institute of Cardiovascular Diseases Khairpur show more adverse clinical and cardiovascular risk factors than patients from urban areas with higher SES. The 30-day mortality for these patients is comparable to the higher-SES patients.

**Keywords:** Clinical manifestation, short-term outcome, percutaneous revascularization, STEMI, myocardial infarction, rural areas**.**

## INTRODUCTION

This condition includes myocardial infarctions with ST-segment elevation, non-ST-segment elevation, and unstable angina which are high-risk manifestations of coronary atherosclerosis. About three-quarters of the deaths related to acute coronary syndrome occur in countries with low- and middle incomes.[1,2]

During the management of patients with ACS, especially those with acute ST-elevation myocardial infarction (STEMI), time is an important factor in determining the morbidity and mortality of the patients. Several studies have assessed the door-to-needle and door-to-balloon time as a measure of in-hospital delays in patients with (STEMI).2 However, pre-hospital delays are equally important in determining the total ischemia time.[3–8]

Morbidity and mortality improvements after ACS have been unevenly distributed around the world, with high-income countries having implemented them more frequently.[9] Different ACS emergency management strategies and population epidemiological settings, including the influence of socioeconomic status (SES), may explain these differences.

Low- and middle-income countries have a high mortality rate from ischemic heart disease (IHD) compared with those high-income countries.[10] Approximately 27% of Indian deaths are related to CVDs. According to death rates by age-standard in India from cardiovascular disease,[11] there are 272 deaths per 100 000 people, compared with 235 global deaths per 100 000.[10,11] The socioeconomic status (SES) of patients has a strong association with CVD mortality and morbidity. The mortality and morbidity rates of low-SES patients are greater than that of high-SES patients.[12–16] Researchers attribute this to increased risks of cardiovascular disease including hypertension, diabetes, smoking, and dyslipidemia, as well as unequal access to healthcare facilities, including invasive procedures. Studies from high-income countries, however, dominate these studies.

Certain patient-related factors like the misinterpretation of symptoms, denial, feeling of embarrassment, and social stigma, as well as system-related factors such as non-availability of thrombolysis/PCI capable hospitals, transport facilities, and educational facilities, can greatly affect the treatment-seeking behavior and outcome in these patients. These factors may vary from place to place depending upon the social, cultural, and local beliefs, particularly in India where there is wide variation in these practices.[5–8,17]

By implementing coordinated and standardized treatment networks, acute ST-elevation myocardial infarction (STEMI) can be detected, treated faster, and survive longer in all kinds of socioeconomic settings.[18,19]

In countries with the greatest incidence of CVD, including low- and middle-income countries, several studies have been

conducted, but the results have been inconsistent.[20,21] In a low socioeconomic cohort hospital with a rural patient population, we have an opportunity to study the spectrum of acute coronary syndrome (ACS). As a result, this registry will be maintained for patients with Acute Coronary Syndrome who visit the emergency department of a rural satellite center of NICVD at Khairpur.

## MATERIAL AND METHODS

This observational study was conducted on 400 patients at the Department of Adult Cardiology at Kharipur Satellite Center of National Institute of Cardiovascular Diseases (NICVD), Pakistan for six months. All patients presenting to ER with ACS whose age was ≥18 years were included while patients who refused to give consent were excluded.

An ethical review committee of the National Institute of Cardiovascular Disease (NICVD) in Karachi, Pakistan, approved the study. Participants' informed consents were obtained verbally and confidentiality was maintained in regards to their participation in and publication of findings from the study. Consecutive patients presenting with ACS to the satellite center of NICVD at Khairpur, Pakistan were included in this research. Demographic characteristics, clinical history, angiographic findings, clinical course, and in-hospital outcomes were obtained using a structured questionnaire. Collected data were stored in a secure location and will be accessible to the primary investigators and their co-investigators.

Baseline characteristics were analyzed using the statistical package for social sciences (SPSS 21). For quantitative (continuous) variables, Shapiro-Wilk tests were applied to verify that they were normal. Quantitative (continuous) variables were evaluated using descriptive statistics such as mean ± SD, median (IQR), skewness, maximum, and minimum. Categorical variables were analyzed with frequencies and percentages.

## RESULTS

A total of 400 (295 males and 105 females) patients with ACS were included. The mean age was 63.3 ± 11.5 (range 40-70) years. The most affected age group was between 51-60 years (45.9%) followed by 41-50 years (22.4%) and 61-70 years (20.6%). Only 19 patients (11.2%) were seen in the age group >70 years. The distribution of patients with STEMI treated in rural areas of Khairpur district Sindh, according to their SES is shown in **Table 1.** In this study, 42.5% had low SES, 35.0% had mid-SES, and 22.5% had high SES.159 (39.8%) patients were from the urban area and 241(60.2%) were from a rural regions. 161(40.2%) patients had hypertension, 112(28.0%) patients were diabetic, 10 (2.5%) patients had previous stroke, 20(5.0%) had AV blockade, 55(13.8%) patients were obese. However, age, smokers, hypertension, dyslipidemia, area of residence, obesity, diabetic Mellitus, and atrial fibrillation were found to be significant factors associated with socioeconomic status for the acute coronary syndrome. (p-value = <0.05) **Table 1.**

They were also more likely to have a detrimental cardiovascular risk factor profile compared to patients with higher socioeconomic status. At the STEMI presentation by SES, there was no difference in Killip's class. The first treatment given by patients was PPCI in more than 93.5% of cases, with no significant variations based on SES. Epicardial coronary disease is significantly less common among patients with high SES than those with low or mid-SES. **Table 2**

Low socioeconomic status patients were less likely than those in the middle and higher socioeconomic class to receive drug-eluting stents (DESs) (52.9 vs. 57.1 vs. 66.7%, respectively, p < 0.103). Significantly lower use of DES is seen in lower socioeconomic groups than in mid and high socioeconomic groups. **Table 2**

Only sixty-eight (17%) patients managed to reach the hospital within the first 2 hours of symptoms, 148 (37%) reached between 2 to 6 hours, and 184 (46%) reached after 6 hours. In comparing gender, only 48(16.2%) of 295 males reached the hospital within the first 2 hours of symptoms as compared to 20 (1.9%) of 105 females. **Table 3**

In our study, 71 (17.8%) patients traveled by ambulance out of which only 18 (25.3%) reached the hospital within 2 hours. 97(24.2%) patients traveled by own car out of which 24 (24.7%) patients reached within 2 hours. 52(40.4%) patients traveled by bike out of which only 6 (11.5%) patients reached within 2 hours, 21(14.2%) reached in 2-6 hours, and 25 (13.6%) of these reached hospitals after 6 hours. Four patients 128 (32.0%) traveled by a rickshaw out of which 10 (7.8%) reached within 2 hours, 38 (29.7%) reached in 2-6 hours, and 80 (62.5%) of these reached hospitals after 6 hours. 52(13.0%) patients traveled by bus out of which 10(19.2%) patients reached within 2 hours, 18(34.6%) patients reached in 2-6 hours and 24 (46.2%) reached the hospital after 6 hours. We observed that the mode of transport may be a significant cause of death (p-value = <0.0001) because of late arrival at the hospital. **Tables 3**.

Low-SES patients experienced longer delays from symptom onset to diagnosis (first electrocardiogram) than those of high SES **(Table 3)**, and their symptoms were experienced farther away from PPCI hospitals than those of mid-and high-SES patients. In the past decade, electrocardiograms to open arteries have decreased with SES. Lower SES patients had longer ischemic times. In our research, we showed 7.8% 30-day mortality out of total samples, and area of residence, mode of transport, 30-day mortality, OS-ECG (in min), and inferior and anterior STEMI were found to be significantly associated factors (p-value = <0.05). **Table 3**

Table 1: Baseline clinical characteristics according to socioeconomic status (SES) classification (n = 400)

| Characteristics | Low SES (n = 170) | Mid SES (n = 140) | High SES (n = 90) | Total (n= 400) | P-value |
|---|---|---|---|---|---|
| Age, years | 65.4 ± 11.9 | 64.8 ± 11.3 | 66.3 ± 10.0 | 63.3 ± 11.5 | 0.002* |
| Age in groups: | | | | | |
| 41 to 50 | 38(22.4%) | 31(22.1%) | 17(18.9%) | 86(21.5%) | |
| 51 to 60 | 78(45.9%) | 69(49.3%) | 46(51.1%) | 193(48.2%) | 0.975 |
| 61 to 70 | 35(20.6%) | 24(17.1%) | 17(18.9%) | 76(19.0%) | |
| >70 | 19(11.2%) | 16(11.4%) | 10(11.1%) | 45(11.2%) | |
| Male | 124 (72.9%) | 103(73.6%) | 68(75.6%) | 295(73.8%) | 0.846 |
| Female | 46(27.1%) | 37(26.4%) | 22(24.4%) | 105(26.2%) | |
| Smokers | 41(24.1%) | 26(18.6%) | 11(12.2%) | 78(19.5%) | 0.051* |
| Area of residence: | | | | | |
| Urban | 30(17.6%) | 58(41.4%) | 71(78.9%) | 159(39.8%) | < 0.0001* |
| Rural | 140(82.4%) | 82(58.6%) | 19(21.1%) | 241(60.2%) | |
| Clinical parameters | | | | | |
| Hypertension | 77(45.3%) | 58(41.4%) | 26(28.9%) | 161(40.2%) | 0.035* |
| Dyslipidemia | 76(44.7%) | 40(28.6%) | 32(35.6%) | 148(37.0%) | 0.013* |
| Obesity | 18(10.6%) | 16(11.4%) | 21(23.3%) | 55(13.8%) | 0.011* |
| Diabetes mellitus | 62(36.5%) | 32(22.9%) | 18(20.0%) | 112(28.0%) | 0.005* |
| Previous stroke | 3 (1.8%) | 2 (1.4%) | 5 (5.6%) | 10 (2.5%) | 0.106 |
| Mechanical ventilation | 7 (4.1%) | 10 (7.1%) | 8 (8.9%) | 25 (6.2%) | 0.275 |

| | | | | | |
|---|---|---|---|---|---|
| Ventricular fibrillation | 8(4.7%) | 12(8.6%) | 10(11.1%) | 30(7.5%) | 0.147 |
| Atrial fibrillation | 16(9.4%) | 2 (1.4%) | 1 (1.1%) | 19(4.8%) | 0.001* |
| AV blockade | 6(3.5%) | 9(6.4%) | 5(5.6%) | 20(5.0%) | 0.488 |
| Pulmonary edema | 3(.8%) | 4(2.9%) | 2(2.2%) | 9(2.2%) | 0.812 |
| Cardiogenic shock | 8(4.7%) | 1(8.6%) | 6(6.7% | 26(6.5%) | 0.388 |

Table 2: Primary reperfusion procedure according to SES (n = 400)

| Characteristics | Total (n= 400) | Low SES (n = 170) | Mid SES (n = 140) | High SES (n = 90) | P-value |
|---|---|---|---|---|---|
| PPCI | 374(93.5%) | 160(94.1%) | 131(93.6%) | 83(92.2%) | 0.840 |
| Thrombolysis | 1(0.2%) | 1(0.6%) | 0 | 0 | 0.508 |
| Initial TIMI 0 | 273(68.2%) | 113(66.5%) | 96(68.6%) | 64(71.1%) | 0.743 |
| Initial TIMI 3 | 56(14.0%) | 33(19.4%) | 15(10.7%) | 8(8.9%) | 0.025* |
| Final TIMI 0 | 8(2.0%) | 4(2.4%) | 2(1.4%) | 2(2.2%) | 0.834 |
| Final TIMI 3 | 366(91.5%) | 157(92.4%) | 128(1.4%) | 81(90.0%) | 0.810 |
| No significant epicardial coronary disease | 40(10.0%) | 27(15.9%) | 7(5.0%) | 6(6.7%) | 0.003* |
| 3-vessel disease | 60(15.0%) | 26(15.3%) | 22(15.7%) | 12(13.3%) | 0.877 |
| Left main disease | 17(4.2%) | 7(4.1%) | 6(4.3%) | 4(4.4%) | 0.992 |
| Stents used | | | | | |
| Only DES use | 230(57.5%) | 90(52.9%) | 80(57.1%) | 60(66.7%) | 0.103 |
| Anterior STEMI | 190(47.5%) | 73(42.9%) | 57(40.7%) | 60(66.7%) | <0.0001 |
| Inferior STEM | 167(41.8%) | 74(43.5%) | 56(40.0%) | 37(41.1%) | 0.814 |
| Bleeding with transfusion | 2(.5%) | 1(.6%) | 1(.7%) | 0 | |
| 30-day mortality | 31(7.8%) | 13(7.6%) | 12(8.6%) | 6(6.7%) | 0.868 |

* P-value is statistically significant calculated by Pearson's Test of Chi-square

Table 3: Factors associated with hospital arrival (n = 400)

| Factors | Time to reach the hospital | | | |
|---|---|---|---|---|
| | <2 hours n = 68(%) | 2-6 hours n = 148(%) | >6 hours n=184(%) | Total |
| Gender | | | | |
| Male | 48(70.6%) | 114(77.0%) | 133(72.3%) | 295(73.8%) |
| Female | 20(29.4%) | 34(23.0%) | 51(27.7%) | 105(26.2%) |
| p-value | 0.502 | | | |
| Area of residence | | | | |
| Urban | 68(100.0%) | 54(36.5%) | 37(20.1%) | 159(39.8%) |
| Rural | 0(.0%) | 94(63.5%) | 147(79.9%) | 241(60.2%) |
| P-value | <0.0001 | | | |
| Mode of transport | | | | |
| Ambulance | 18(26.5%) | 33(22.3%) | 20(10.9%) | 71(17.8%) |
| Car | 24(35.3%) | 38(25.7%) | 35(19.0%) | 97(24.2%) |
| Bike | 6(8.8%) | 21(14.2%) | 25(13.6%) | 52(13.0%) |
| Rickshaw | 10(14.7%) | 38(25.7%) | 80(43.5%) | 128(32.0%) |
| Bus | 10(14.7%) | 18(12.2%) | 24(13.0%) | 52(13.0% ) |
| P-value | <0.0001 | | | |
| Anterior STEMI | 42(61.8%) | 59(39.9%) | 89(48.4%) | 190(47.5%) |
| P-value | 0.011 | | | |
| Inferior STEMI | 19(27.9%) | 58(39.2%) | 90(48.9%) | 167(41.8%) |
| P-value | 0.008 | | | |
| Bleeding with transfusion | 0 | 0 | 6(3.3%) | 6(1.5%) |
| P-value | 0.028 | | | |
| OS-ECG, min | 91.9±37.7 | 98.5±43.8 | 107.4±48.5 | 101.5±45.4 |
| P-value | 0.034 | | | |
| ECG-Open Artery, min | 89.3±15.6 | 86.8±15.7 | 91.1±14.6 | 89.2±15.3 |
| P-value | 0.036 | | | |
| OS-Arrival to hospital min | 123.8±62.4 | 149.7±65.6 | 147.6±62.7 | 144.1±64.2 |
| P-value | 0.015 | | | |
| OS-Open Artery, min | 149.9±51.4 | 182.7±60.2 | 206.6±61.8 | 188.1±62.8 |
| P-value | <0.0001 | | | |
| 30-day mortality | 2(2.9%) | 8(5.4%) | 21(11.4%) | 31(7.8%) |
| P-value | 0.034 | | | |

## DISCUSSION

Patients with acute STEMI require reperfusion therapy at the earliest to salvage the myocardium and reduce subsequent morbidity and mortality. According to several studies, including this one, patients with lower socioeconomic status have a higher burden of cardiovascular risk factors.[22,23] There has been evidence that social class plays a role in cardiovascular disease and its risk factors, both at the individual and community level.[24]

The results of our study do not indicate that patients with low-community socioeconomic status have inferior clinical outcomes following PCI for STEMI in comparison to those with higher socioeconomic status. We investigated various factors responsible for delays in treatment and the misinterpretation of symptoms was the most significant factor responsible. Shimony et al[24] found that low-community SES was an independent predictor of MACE following PCI among 1397 patients receiving PCI in Israel, which has universal healthcare similar to Australia. Although that study included both elective and emergent PCI patients, only 5% of them were from high socioeconomic backgrounds, explaining the differences. Another study from the Swedish SWEDEHEART registry, conducted on 10895 patients with the acute coronary syndrome, showed that lower SES was

independently associated with an increased risk of dying after a MI.[25]

In this study, the median time from the onset of symptoms to arrival at the hospital was 420 minutes (range 30-2550 minutes), which is longer compared to the study conducted by Peng et al in which the median pre-hospital delay time (PDT) was 130 minutes in STEMI participants.[5]

We found interesting differences in access choices and use of DESs across SES groups in our study. In the lowest two SES groups, radial access may be more commonly used due to higher rates of PCI post fibrinolysis. Previous studies have demonstrated a lower use of DES in low-socioeconomic groups.[26]

In the present study the forty-six (46%) patients took more than 6 hours to reach the hospital which is similar to others, Mohan et al[6] in their study in district Ludhiana of Punjab which is geographically quite similar to us also reported that 42% of the patients reached the hospital after 6 hours.[6] Similarly Prashantha et al[27] and others also showed that about 40% of the patients presented after 6 hours of the onset of pain.[27] This has been reported in other studies also where misinterpretation of symptoms was found to be a major factor responsible after 6 hours for pre-hospital delays.[5,7,8,17,27,28] The other reason for the delay in presentation could be the fact that many of our patients come from hilly areas where the traffic movement is slower. This was seen more so among females, where only 2 out of 20 females (10%) received treatment in the first 2 hours compared to 15 of 80 (18.8%) men. The reason for this could be due to more atypical symptoms in women and a longer decision time in women as was observed by Sofia et al.[29] Others also reported that the female gender may have a significant impact on delay in presentation and treatment initiation.[29–32] The other reason could also be attributed to gender bias prevalent in our country. After reaching the hospital certain in-hospital delays were also noticed as 60% of patients could get their ECG done in more than 10-30 minutes. This could be attributed to the high patient load in our medical emergency. The average door-to-needle time was longer than the recommended time of <30 minutes. The likely reason for this could be the delay in getting the ECG in the majority (60%) of patients and the second reason could be the delay in procuring the thrombolytic agent from the chemist as the thrombolytic agents are not available in the hospital supply and patient has to procure by themselves from a chemist shop.

In groups with lower socioeconomic status, access to revascularization procedures is reduced in various geographical areas.[33] A homogeneous sample of STEMI patients is analyzed in this study. The majority of these patients (>93%) were treated with PPCI in a public integrated medical system, as well as patients who had not been treated with PPCI. PPCI methods are more commonly used in patients with STEMI in different regions, and this is due to some factors, such as supply factors, the number of physicians, and the availability of hospital beds for acute conditions, as well as constraining measures and "patient-level" factors.[26]

## CONCLUSION

In NICVD Khairpur, low-SES patients with STEMI who live in rural areas present with more unfavorable clinical and cardiovascular risk factors than those from urban areas. Their 30-day mortality was comparable to those of the higher-SES patients. Both pre-hospital and in-hospital delays hurt the outcome and thus efforts should be made to minimize these delays.

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