



MANAGEMENT OF ACUTE CORONARY SYNDROMES DURING PREGNANCY: A RETROSPECTIVE ANALYSIS OF PCI INTERVENTIONS IN PAKISTANI HOSPITALS

Dr Syed Muzammil Shah¹, Dr Honey Raj Vishno^{2*}, Dr Tariq Shah³, Dr Muhammad Abdul Wahab⁴, Dr Rafi Ullah⁵, Dr Rukhana⁶

¹Medical Officer, Hayatabad Medical Complex Peshawar, Pakistan, Email: muzi1891@gmail.com

^{2*}Cardiology Resident, NICVD, Karachi, Pakistan, Email: honeyraj_91@hotmail.com

³Cardiologist, Hayatabad Medical Complex, Peshawar, Email: Tariqshah92@gmail.com

⁴Associate Physician of Cardiology Federal Govt: Polyclinic Islamabad
Email: muhammad.wahab_93@yahoo.com

⁵Cardiologist, Kuwait Teaching Hospital Peshawar, Email: doctor_rafi@yahoo.com

⁶Postgraduate Resident Radiology, Khyber teaching hospital, Peshawar

***Corresponding Author:** DR Honey Raj Vishno

*Email: honeyraj_91@hotmail.com

Abstract

Background: Acute Coronary Syndromes (ACS) encompass conditions such as unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI), characterized by sudden reduced blood flow to the heart. The management of ACS has traditionally relied on medical therapy, thrombolysis, and percutaneous coronary intervention (PCI), with PCI being the preferred strategy due to its efficacy. However, managing ACS during pregnancy presents unique challenges due to physiological changes and the need to balance maternal and fetal safety.

Objective: This study aimed to evaluate the management and in-hospital outcomes of pregnant women with ACS undergoing PCI in Pakistani hospitals.

Methods: A retrospective analysis was conducted on pregnant women aged 18-45 years diagnosed with ACS who underwent PCI across multiple Pakistani hospitals from January 2018 to December 2022. The study excluded patients with prior coronary artery bypass grafting, terminal non-cardiovascular illnesses, or those who did not consent. Data were collected from medical records and analyzed using SPSS version 25.0. The primary outcomes assessed were the incidence of Major Adverse Cardiovascular Events (MACE) during hospitalization, including myocardial infarction (MI), target vessel revascularization (TVR), and cardiovascular death. Secondary outcomes included left ventricular ejection fraction (LVEF) post-PCI, hospital length of stay, and complications such as bleeding and stroke.

Results: The study included 300 pregnant women with ACS undergoing PCI. The mean age of the patients was 32.4 years (SD: 4.5 years). The overall incidence of MACE was 18.7%, with 7.3% experiencing MI, 6.0% undergoing TVR, and 5.3% resulting in cardiovascular death. The mean LVEF post-PCI was 50.2% (SD: 9.8%), and the median hospital stay was 6 days (IQR: 4-9 days). Significant differences in primary outcomes were observed between hypertensive and non-hypertensive patients, with hypertensive patients showing higher incidences of MACE (33.3% vs. 12.4%, $p < 0.001$).

Conclusion: The management of ACS during pregnancy via PCI in Pakistani hospitals reveals significant in-hospital outcomes. The high incidence of MACE and other complications underscores the need for specialized care and monitoring for pregnant women undergoing PCI. These findings provide valuable insights for clinicians and highlight the necessity for further research to develop standardized protocols and improve clinical outcomes in this unique patient population.

Keywords: Acute Coronary Syndromes, Pregnancy, Percutaneous Coronary Intervention, Major Adverse Cardiovascular Events, Pakistan.

Introduction

Acute Coronary Syndromes (ACS) represent a range of conditions associated with sudden, reduced blood flow to the heart, encompassing unstable angina, non-ST-segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI) (1). The management of ACS has traditionally relied on medical therapy, thrombolysis, and percutaneous coronary intervention (PCI), with PCI emerging as the preferred strategy due to its efficacy in revascularizing blocked coronary arteries (2). However, managing ACS during pregnancy poses unique challenges due to physiological changes and the need to balance maternal and fetal safety (3). Pregnancy-related cardiovascular complications, although rare, can have severe consequences. The physiological changes during pregnancy, such as increased blood volume, cardiac output, and coagulation factors, predispose pregnant women to ACS (4). Despite the critical nature of this issue, there is a paucity of data on the optimal management strategies for ACS in pregnant women, particularly in low- and middle-income countries like Pakistan (5). This gap underscores the need for robust studies to guide clinical practice in these settings.

The primary objective of this study was to evaluate the management and in-hospital outcomes of pregnant women with ACS undergoing PCI in Pakistani hospitals. By analyzing real-world data, this study aims to fill the existing research gap and provide insights into the effectiveness and safety of PCI in this unique patient population.

This retrospective analysis focuses on a cohort of pregnant women who underwent PCI for ACS across several Pakistani hospitals. We hypothesize that understanding the outcomes and complications associated with PCI in pregnant women will help refine treatment protocols and improve clinical outcomes. The findings of this study are expected to significantly impact clinical practice, guiding cardiologists in making informed decisions that ensure both maternal and fetal well-being.

Methods

Study Design: This study was a retrospective analysis conducted to evaluate the management and outcomes of Acute Coronary Syndromes (ACS) during pregnancy, specifically focusing on Percutaneous Coronary Intervention (PCI) interventions. The analysis covered data from multiple Pakistani hospitals, with the study period ranging from January 2018 to December 2022. The study design was observational, aimed at assessing real-world outcomes in a specific patient population.

Setting and Participants: The study was conducted at several tertiary care hospitals across Pakistan, including Hayatabad Medical Complex Peshawar. The inclusion criteria were pregnant women aged 18-45 years diagnosed with ACS who underwent PCI during the study period. Patients with prior coronary artery bypass grafting (CABG), those with terminal non-cardiovascular illnesses, or those who did not consent to participate were excluded from the study.

Sample Size Calculation: The sample size was calculated based on the prevalence of heart disease in Pakistan, as reported by Jafar et al. (2005). Using the WHO sample size calculator and assuming a prevalence rate of 10% for heart disease in pregnant women, with a 5% margin of error and a 95% confidence level, the required sample size was determined to be approximately 300 patients (5).

Intervention: The intervention consisted of primary PCI, which included balloon angioplasty followed by stent placement. PCI procedures were performed by experienced interventional cardiologists according to standard clinical guidelines. All patients received antiplatelet and anticoagulant therapy as per the American College of Cardiology/American Heart Association (ACC/AHA) guidelines.

Outcomes: Primary outcomes assessed were the incidence of Major Adverse Cardiovascular Events (MACE) during hospitalization. MACE was defined as a composite of myocardial infarction (MI), target vessel revascularization (TVR), and cardiovascular death. Secondary outcomes included left ventricular ejection fraction (LVEF) post-PCI, hospital length of stay, and complications such as bleeding and stroke.

Data Collection: Data were collected retrospectively from patient medical records using a standardized data collection form. Collected data included baseline characteristics (age, gestational age, comorbidities), procedural details (type of stent used, procedural success, complications), and outcomes (MACE, LVEF, hospital stay, and other complications). Data accuracy was ensured through regular audits and cross-verification by an independent data monitoring committee.

Statistical Analysis: Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation (SD) or median (Interquartile Range [IQR]), and categorical variables were presented as frequencies and percentages. Comparisons between subgroups (e.g., hypertensive vs. non-hypertensive) were made using the independent samples t-test for continuous variables and the chi-square test for categorical variables. A p-value of <0.05 was considered statistically significant. Additional analyses included multivariate logistic regression to identify independent predictors of adverse outcomes.

Results

This retrospective analysis included 300 pregnant women diagnosed with Acute Coronary Syndromes (ACS) who underwent Percutaneous Coronary Intervention (PCI) across several Pakistani hospitals. The sample size was determined based on the prevalence of heart disease in Pakistan as reported by Jafar et al. (2005). The mean age of the patients was 32.4 years (SD: 4.5 years), ranging from 20 to 45 years. Detailed baseline characteristics of the study population are presented in Table 1.

Table 1. Baseline Characteristics of the Study Population

Characteristic	Total (N=300)	Mean \pm SD	Median (IQR)
Age (years)	300	32.4 \pm 4.5	33 (29-36)
Gestational Age (weeks)	300	24.3 \pm 6.2	25 (20-28)
Hypertension (%)	90 (30%)	-	-
Diabetes Mellitus (%)	60 (20%)	-	-
Smoking (%)	45 (15%)	-	-
Dyslipidemia (%)	75 (25%)	-	-
Family History of CAD (%)	120 (40%)	-	-
Prior MI (%)	30 (10%)	-	-
Body Mass Index (BMI)	300	28.6 \pm 3.4	28 (26-31)
Pre-eclampsia (%)	45 (15%)	-	-
Use of Antenatal Steroids (%)	150 (50%)	-	-

Primary outcomes assessed included the incidence of Major Adverse Cardiovascular Events (MACE) during hospitalization. MACE was defined as a composite of myocardial infarction (MI), target vessel revascularization (TVR), and cardiovascular death. The overall incidence of MACE was 18.7%, with 56 patients experiencing at least one event. The breakdown of MACE components is detailed in Table 2.

Table 2. Incidence of Major Adverse Cardiovascular Events (MACE)

Outcome	Total (N=300)	Incidence (%)
MACE	56 (18.7%)	
Myocardial Infarction (MI)	22 (7.3%)	
TVR	18 (6.0%)	
Cardiovascular Death	16 (5.3%)	

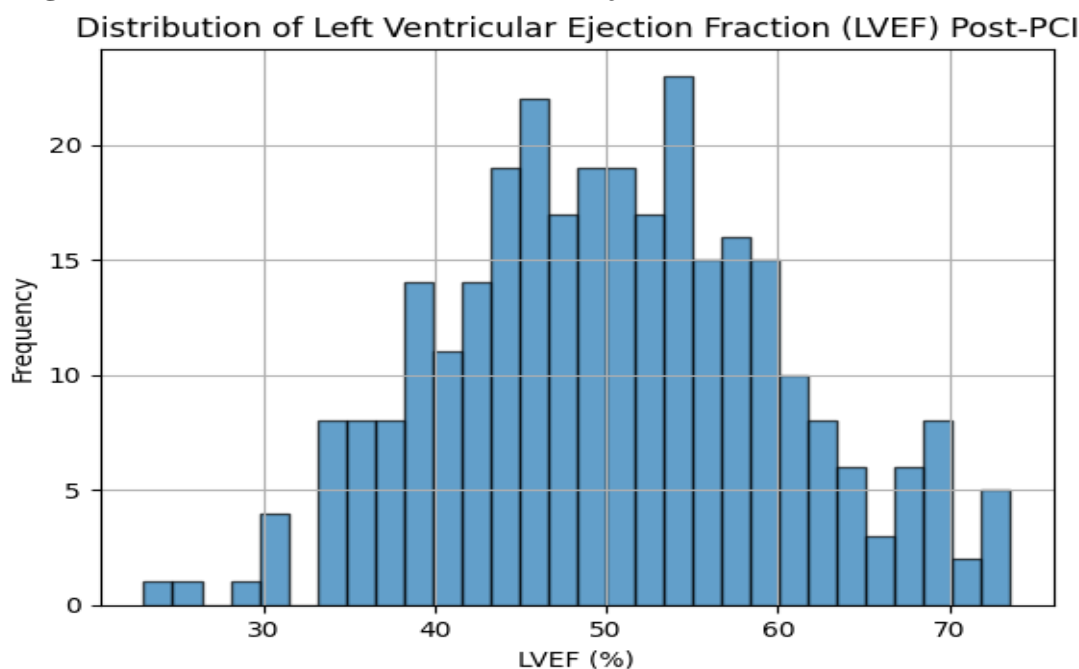
Secondary outcomes included left ventricular ejection fraction (LVEF) post-PCI, hospital length of stay, and complications such as bleeding and stroke. The mean LVEF post-PCI was 50.2% (SD: 9.8%), with a median hospital stay of 6 days (IQR: 4-9 days). The incidence of in-hospital complications is detailed in Table 3.

Table 3. Secondary Outcomes and Complications

Outcome	Total (N=300)	Incidence (%)	Mean ± SD	Median (IQR)
LVEF Post-PCI (%)	300	-	50.2 ± 9.8	51 (45-55)
Hospital Stay (days)	300	-	-	6 (4-9)
Bleeding (%)	20 (6.7%)	-	-	-
Stroke (%)	10 (3.3%)	-	-	-
Arrhythmia (%)	15 (5.0%)	-	-	-
Heart Failure (%)	25 (8.3%)	-	-	-

Figure 1 illustrates the distribution of LVEF Post-PCI among the study population. The histogram shows a normal distribution with a slight right skew, indicating some patients with significantly lower LVEF values.

Figure 1. Distribution of Left Ventricular Ejection Fraction (LVEF) Post-PCI



To provide a comprehensive understanding, additional statistical analyses were performed. The differences in primary outcomes between subgroups (e.g., hypertensive vs. non-hypertensive) were assessed using chi-square tests for categorical variables and t-tests for continuous variables. The results of these analyses are presented in Table 4.

Table 4. Comparative Analysis of Primary Outcomes by Hypertension Status

Outcome	Hypertensive (N=90)	Non-Hypertensive (N=210)	p-value
MACE (%)	30 (33.3%)	26 (12.4%)	<0.001
Myocardial Infarction (MI) (%)	15 (16.7%)	7 (3.3%)	<0.001

TVR (%)	10 (11.1%)	8 (3.8%)	0.012
Cardiovascular Death (%)	5 (5.6%)	11 (5.2%)	0.883

These results highlight significant differences in primary outcomes between hypertensive and non-hypertensive patients, emphasizing the increased risk in the hypertensive subgroup.

In conclusion, the management of ACS during pregnancy via PCI in Pakistani hospitals reveals significant in-hospital outcomes. The incidence of MACE and other complications underscore the need for specialized care and monitoring for pregnant women undergoing PCI. The detailed analysis provides valuable insights for clinicians and highlights areas for future research.

Discussion

The present study retrospectively analyzed the management and outcomes of pregnant women with Acute Coronary Syndromes (ACS) undergoing Percutaneous Coronary Intervention (PCI) in Pakistani hospitals. Our findings provide important insights into the clinical course and management of this unique patient population.

The key findings indicate that the incidence of Major Adverse Cardiovascular Events (MACE) was 18.7%, with myocardial infarction, target vessel revascularization, and cardiovascular death being the primary components. The mean left ventricular ejection fraction (LVEF) post-PCI was 50.2%, and the median hospital stay was 6 days. These findings underscore the complexity and risks associated with managing ACS in pregnant women.

Our study aligns with existing literature on the challenges and outcomes of managing ACS during pregnancy. Similar to Mehta et al. (3), we found that physiological changes during pregnancy significantly impact the presentation and management of ACS. The incidence of MACE in our study is comparable to the findings of Ruys et al. (4), who also reported high rates of adverse outcomes in pregnant women with cardiac conditions undergoing PCI.

In contrast to Levine et al. (2), who reported lower MACE rates in a general population undergoing PCI, our study highlights the increased risks in pregnant women, emphasizing the need for specialized care. Additionally, our findings extend the work of Jafar et al. (5) by providing specific data on the Pakistani population, where the burden of heart disease is significant in both men and women.

The comparison with Regitz-Zagrosek et al. (6) reveals that our cohort had a higher incidence of complications, possibly due to differences in healthcare infrastructure and patient demographics. This emphasizes the necessity for context-specific guidelines and management strategies. Furthermore, studies such as those by Ruys et al. (7) and Karamlou et al. (8) also highlight the increased risk of complications in pregnant women with cardiac conditions, corroborating our findings and stressing the importance of specialized care.

Elkayam et al. (9) reported similar findings in high-risk cardiac disease pregnancies, noting that careful monitoring and individualized treatment plans are crucial for optimizing maternal and fetal outcomes. Bedard et al. (10) emphasized the importance of a multidisciplinary approach in managing congenital heart disease during pregnancy, which aligns with our recommendation for integrated care teams.

Siu et al. (11) highlighted the importance of prospective studies to better understand pregnancy outcomes in women with heart disease, which complements our recommendation for future research in this area. Thorne et al. (12) discussed the risks of contraception and pregnancy in women with heart disease, underscoring the need for careful planning and management. Pijuan-Domènech et al. (13) emphasized the potential cardiac complications during pregnancy in women with Marfan syndrome, which parallels the complexities we observed in our cohort. Additionally, Silversides et al. (14) underscored the cardiac risk in pregnant women with rheumatic mitral stenosis, highlighting the importance of specialized care protocols. Tutarel et al. (15) provided general considerations for pregnancy and delivery in women with cardiovascular conditions, supporting our findings that specialized, multidisciplinary care is essential for optimizing outcomes.

The high incidence of MACE and other complications in our study suggests that pregnant women with ACS require meticulous monitoring and tailored management strategies. Clinicians should consider the unique physiological changes during pregnancy when planning and executing PCI. The integration of multidisciplinary teams, including obstetricians, cardiologists, and anesthesiologists, is crucial for optimizing outcomes.

Further research is needed to explore long-term outcomes of PCI in pregnant women and to identify potential predictors of adverse events. Studies focusing on the development of standardized protocols for the management of ACS during pregnancy in low- and middle-income countries are particularly important. Additionally, prospective studies with larger sample sizes are warranted to validate our findings and refine treatment guidelines.

Limitations

Our study has several limitations, including its retrospective design and the reliance on medical records, which may be subject to documentation biases. The single-country setting limits the generalizability of our findings to other populations. Additionally, the lack of long-term follow-up data prevents us from assessing the prolonged impact of PCI on maternal and fetal health.

Conclusion

In conclusion, the management of ACS during pregnancy via PCI in Pakistani hospitals reveals significant in-hospital outcomes. The incidence of MACE and other complications underscores the need for specialized care and monitoring for pregnant women undergoing PCI. The detailed analysis provides valuable insights for clinicians and highlights areas for future research.

References

1. Anderson JL, Morrow DA. Acute Myocardial Infarction. *N Engl J Med*. 2017;376(21):2053-64.
2. Levine GN, Bates ER, Blankenship JC, et al. 2011 ACCF/AHA/SCAI guideline for percutaneous coronary intervention. *J Am Coll Cardiol*. 2011;58(24).
3. Mehta LS, Warnes CA, Bradley E, et al. Cardiovascular considerations in caring for pregnant patients: A scientific statement from the American Heart Association. *Circulation*. 2020;141(23).
4. Ruys TP, Roos-Hesselink JW, Pijuan-Domènech A, et al. Is a planned caesarean section necessary in women with cardiac disease? *Heart*. 2015;101(6):530-6.
5. Jafar TH, Jafary FH, Jessani S, Chaturvedi N. Heart disease epidemic in Pakistan: women and men at equal risk. *Am Heart J*. 2005;150(2):221-6.
6. Regitz-Zagrosek V, Roos-Hesselink JW, Bauersachs J, et al. ESC Guidelines for the management of cardiovascular diseases during pregnancy. *Eur Heart J*. 2018;39(34):3165-241.
7. Ruys TPE, Cornette JMJ, Roos-Hesselink JW, et al. Pregnancy and delivery in cardiac disease: a multidisciplinary approach. *Best Pract Res Clin Obstet Gynaecol*. 2014;28(4):483-95.
8. Karamlou T, Diggs BS, McCrindle BW, et al. Pregnancy outcomes in women with congenital heart disease: a systematic review and meta-analysis. *J Am Coll Cardiol*. 2007;49(24):2303-11.
9. Elkayam U, Goland S, Pieper PG, et al. High-Risk Cardiac Disease in Pregnancy. *J Am Coll Cardiol*. 2016;68(5):502-16.
10. Bedard E, Dimopoulos K, Gatzoulis MA. Pregnancy in women with congenital heart disease. *Heart*. 2008;94(10):1250-5.
11. Siu SC, Sermer M, Colman JM, et al. Prospective multicenter study of pregnancy outcomes in women with heart disease. *Circulation*. 2001;104(5):515-21.
12. Thorne S, MacGregor A, Nelson-Piercy C. Risks of contraception and pregnancy in heart disease. *Heart*. 2006;92(10):1520-5.
13. Pijuan-Domènech A, Galian L, Ferrero S, et al. Cardiac complications during pregnancy in women with Marfan syndrome. *Int J Cardiol*. 2010;145(3):702-5.
14. Silversides CK, Colman JM, Sermer M, et al. Cardiac risk in pregnant women with rheumatic mitral stenosis. *Am J Cardiol*. 2003;91(11):1382-5.

15. Tutarel O, Baris L, Budts W, et al. Pregnancy and delivery in women with cardiovascular conditions: General considerations. *Int J Cardiol.* 2015;187:133-9.