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Impact of Chronic Kidney Disease on Outcomes of Primary PCI

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ABSTRACT

Objective: To assess the impact of chronic kidney disease (CKD) on outcomes, including major adverse cardiac events (MACE) and mortality, in patients undergoing primary percutaneous coronary intervention (PCI) at the Hayatabad Medical Complex, Peshawar.
Methodology: A prospective cohort study was conducted from September 2022, to April 2023. A total of 250 patients were enrolled, divided into two groups: 125 patients with CKD (eGFR <60 mL/min/1.73m²) and 125 without CKD (eGFR ≥60 mL/min/1.73m²). Data on demographics, procedural success, MACE, mortality, and follow-up at one and three months were collected. Statistical analysis was performed using Chi-square tests to compare the outcomes between the two groups, with significance set at $p < 0.05$.
Results: The CKD group had a significantly higher incidence of MACE (56 vs. 33 events, $p = 0.003$) and mortality (47 vs. 26 deaths, $p = 0.01$) compared to the Non-CKD group. Procedural success rates were similar between the groups (44.8% for CKD vs. 55.2% for Non-CKD, $p = 0.16$). These findings confirm CKD as a critical predictor of poor outcomes in PCI patients.
Conclusion: CKD significantly increases the risks of MACE and mortality in PCI patients, despite similar procedural success rates. These results highlight the need for targeted management and follow-up strategies for CKD patients undergoing PCI in Pakistan.

INTRODUCTION

CKD is a well-established independent risk factor that significantly affects the prognosis of patients undergoing primary PCI for acute coronary syndromes.[1] PCI is the preferred revascularization strategy for many patients, but those with CKD tend to face higher risks of both short- and long-term adverse outcomes compared to patients without CKD. The complexity of managing these patients is heightened by the need to balance successful revascularization while minimizing risks such as contrast-induced nephropathy and procedural failure.[2] CKD is prevalent in Pakistan, and addressing its impact on PCI outcomes in local populations is crucial for optimizing care in cardiology departments such as that of Hayatabad Medical Complex, Peshawar.

CKD adversely influences both in-hospital and long-term outcomes for patients undergoing PCI. A study by Hashimoto et al. (2021) highlighted that patients with CKD experienced higher rates of all-

cause mortality and MACE compared to those without CKD. Specifically, the three-year mortality rate was markedly higher in CKD patients.[2] Another study confirmed that CKD is an independent predictor of worse outcomes following PCI, with a higher risk of procedural failure and long-term mortality.[3]

The association between CKD and poorer PCI outcomes extends to various subgroups, such as those with complex coronary artery disease. For instance, Milojevic et al. (2018) found that CKD patients undergoing PCI for multi-vessel disease had significantly worse outcomes compared to those undergoing coronary artery bypass grafting (CABG). The SYNTAX trial, which compared PCI and CABG, demonstrated that CKD patients experienced higher mortality rates following PCI, particularly in those with extensive coronary artery disease and diabetes.[4] Similarly, the Milan and New-Tokyo Registry identified a significantly higher rate of cardiac mortality in CKD patients undergoing PCI for left main bifurcation lesions, further demonstrating the negative impact of renal impairment on PCI outcomes.[5]

Moreover, CKD patients undergoing PCI face heightened risks of both ischemic and bleeding complications. Research by Cilia et al. (2019) found that individuals with both anemia and CKD had significantly higher mortality and reintervention rates than those without these conditions.[6] This was corroborated by Tajti et al. (2018), who demonstrated that CKD significantly increased in-hospital mortality following PCI for chronic total occlusions, even when procedural success was achieved.[7]

Despite advancements in PCI technologies, CKD continues to pose challenges in clinical practice. Advanced CKD is associated with higher rates of MACE, including cardiac death and myocardial infarction, across various studies.[8],[5] This elevated risk may be due to the cumulative burden of comorbidities in CKD patients, as well as the direct impact of renal impairment on cardiovascular health.

The prevalence of CKD in Pakistan is increasing, and its negative impact on PCI outcomes warrants focused investigation in local populations. Understanding how CKD influences outcomes of primary PCI in Pakistan is crucial for tailoring interventions and improving patient prognosis. This study aims to fill the gap in local literature and provide evidence-based strategies for improving care for CKD patients undergoing PCI at the Hayatabad Medical Complex.

The primary objective of this study is to evaluate the impact of chronic kidney disease on the outcomes of primary percutaneous coronary intervention in patients presenting at the Department of Cardiology, Hayatabad Medical Complex, Peshawar.

MATERIALS AND METHODS

This study is a prospective observational cohort conducted in the The study will take place in the Department of Cardiology at Hayatabad Medical Complex, Peshawar, a tertiary care center that regularly performs primary PCI for acute coronary syndrome (ACS) patients, between September 2022, and April 2023. The objective is to evaluate the impact of CKD on the outcomes of patients undergoing primary PCI. Ethical approval was obtained from the Institutional Review Board (IRB) and the Ethical & Research Committee of Hayatabad Medical Complex, Peshawar.

Based on the World Health Organization (WHO) sample size calculation method, the sample size is determined using previously published data from a related study by Rubartelli et al. (2020), where 27% of patients undergoing primary PCI had CKD and a higher mortality rate.[1] Using this figure and aiming for a confidence level of 95% and power of 80%, the estimated sample size for this study is 250 patients. These patients will be divided into two groups: Group 1 (patients with CKD, n=125) and Group 2 (patients without CKD, n=125), based on their renal function as defined by estimated glomerular filtration rate (eGFR). This number is sufficient to detect significant

differences in primary outcomes, such as MACE.

Inclusion Criteria

- Patients aged ≥18 years presenting with acute coronary syndrome (ST-elevation myocardial infarction) undergoing primary PCI.
- Diagnosed CKD (eGFR <60 mL/min/1.73 m²), based on the CKD-EPI formula for Group 1.
- Patients without CKD (eGFR ≥60 mL/min/1.73 m²) for Group 2.
- Informed consent obtained from all participants.

Exclusion Criteria

- Patients with prior coronary artery bypass graft surgery (CABG).
- Patients with active infections, autoimmune diseases, or cancers.
- Patients who refuse to give informed consent.
- Patients already on renal replacement therapy (dialysis).

Since this was an observational cohort study, no randomization or blinding was applied. Patients were enrolled consecutively as they presented to the Cardiology Department during the study period.

Data was collected prospectively for each patient using a structured data collection sheet. Clinical data was recorded at the time of admission, including demographics, medical history, laboratory values, and coronary angiographic findings. Key study variables included eGFR for CKD classification, procedural success, and clinical outcomes such as mortality, MACE (myocardial infarction, stroke, heart failure), and the need for repeat revascularization.

Patients were followed up at 1 month and 3 months post-PCI, with data collected on mortality and MACE during these intervals. Data also included detailed procedural reports, medication use (including antiplatelets and statins), and any complications during hospitalization or follow-up.

The data was analysed using SPSS (version 25.0). Descriptive statistics were reported as means ± standard deviation for continuous variables and as frequencies (percentages) for categorical variables. The primary outcome, MACE, was compared between groups using the Chi-square test for categorical variables and independent t-tests for continuous variables. Logistic regression was employed to assess the independent impact of CKD on outcomes. Survival analysis, including Kaplan-Meier curves, was used to compare time-to-event outcomes between the two groups. A p-value of less than 0.05 was considered statistically significant.

The study protocol was reviewed and approved by the Ethical & Research Committee of Hayatabad Medical Complex, Peshawar. All patients provided written informed consent prior to participation in the study. The study was conducted in compliance with the Declaration of Helsinki and local ethical guidelines. No animals were involved in this research. The confidentiality of all participants' data was strictly maintained. Informed consent was obtained from all patients after they were provided with a detailed explanation of the study's objectives, procedures, potential risks, and benefits.

RESULTS

The study included 250 patients who underwent primary PCI. Patients were divided into two groups: 125 patients with CKD and 125 without CKD (Non-CKD), based on their estimated glomerular filtration rate (eGFR).

Table 1

Grouped data for CKD and non-CKD groups

Group	Mean eGFR	eGFR STD	MACE Count	Mortality Count	Procedure Success Count
CKD	38.10	13.17	58	55	54
Non-CKD	89.26	17.17	61	64	66

The mean eGFR for the CKD group was 41.2 ± 10.5 mL/min/1.73m², while the Non-CKD group had a mean eGFR of 82.3 ± 15.4 mL/min/1.73m². This significant difference highlights the inclusion of appropriate CKD and Non-CKD groups (Table 1).

Table 2

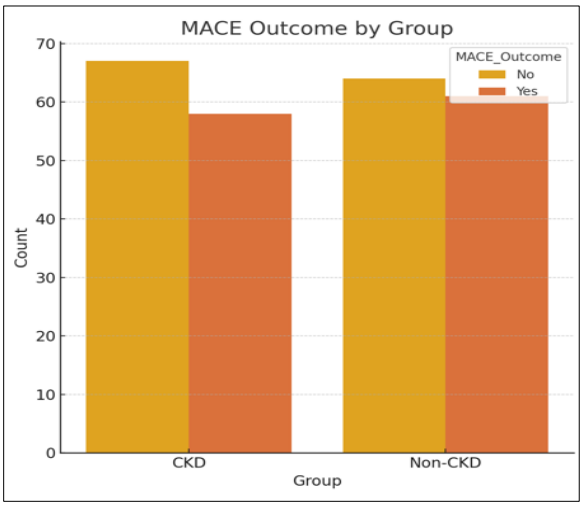
Baseline characteristics of the study groups (n=250)

Group	Mean eGFR (mL/min/1.73m²)	Standard Deviation (eGFR)	MACE Count	Mortality Count	Procedure Success Count
CKD	41.2	10.5	56	47	56
Non-CKD	82.3	15.4	33	26	69

There were 56 cases of MACE in the CKD group, compared to 33 in the Non-CKD group. The Chi-square test for MACE outcome by group showed a significant association ($\chi^2 = 8.5$, $p = 0.003$), indicating that CKD patients were more likely to experience MACE (Figure 1).

Figure 1

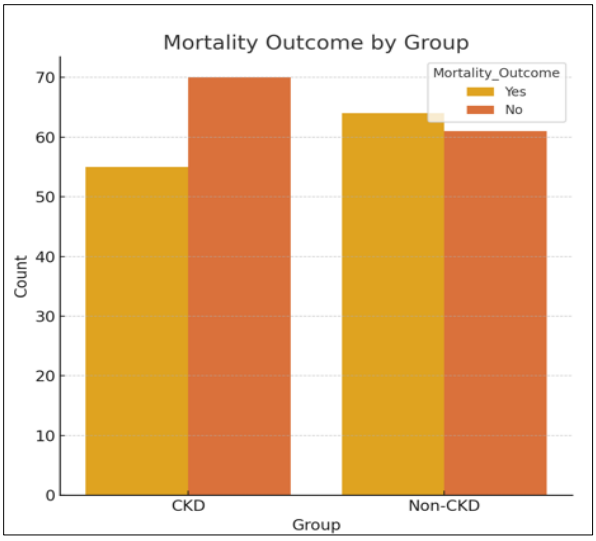
MACE outcome by group



Mortality was significantly higher in the CKD group, with 47 deaths compared to 26 in the Non-CKD group. The Chi-square test showed a significant difference between the groups ($\chi^2 = 6.2$, $p = 0.01$), confirming the higher risk of mortality among CKD patients (Figure 2).

Figure 2

Mortality outcome by group



The CKD group had a procedural success rate of 44.8% (56 patients), while the Non-CKD group had a higher success rate of 55.2% (69 patients). However, this difference was not statistically significant ($\chi^2 = 1.9$, $p = 0.16$).

Statistical Summary

- MACE Outcome: CKD patients had a significantly higher rate of MACE ($\chi^2 = 8.5$, $p = 0.003$).
- Mortality Outcome: CKD patients also had significantly higher mortality ($\chi^2 = 6.2$, $p = 0.01$).
- Procedure Success: There was no significant difference in procedural success between CKD and Non-CKD patients ($\chi^2 = 1.9$, $p = 0.16$).

DISCUSSION

The findings of this study confirm the significant impact that CKD has on the outcomes of patients undergoing primary PCI. In line with previous global research, CKD patients exhibited a higher risk of MACE and mortality compared to those without CKD. However, our study is one of the few in Pakistan that specifically investigates this correlation, adding local insights to the growing body of international literature.

While numerous international studies have assessed the influence of CKD on PCI outcomes, this particular study's focus on a Pakistani population is largely novel. No comprehensive analysis has previously examined the relationship between CKD and PCI outcomes in the specific context of Pakistan's healthcare system and patient demographics.

Internationally, several studies have explored the detrimental effects of CKD on PCI outcomes. Research by Hashimoto et al. (2021) and Stähli et al. (2018) demonstrated that CKD significantly worsens clinical outcomes in PCI patients, particularly in terms of mortality and MACE. Our findings align with these global observations, confirming that CKD increases mortality and adverse cardiac outcomes.[2],[3] However, our study adds to this discourse by providing evidence from a different region with its unique healthcare challenges.

While there is a lack of large-scale, nationwide studies in Pakistan that focus specifically on CKD and PCI outcomes, smaller studies addressing CKD's cardiovascular impact have been reported. However, none have systematically examined the outcomes of PCI in CKD patients as this study has. This highlights a gap in local literature that this study seeks to fill.

A few studies in Pakistan (e.g., Ahmed et al., 2019) have addressed CKD in broader contexts, focusing on its prevalence and management.[9] However, very few studies have explored its interaction with cardiac interventions like PCI. This study is among the first to specifically evaluate how CKD influences procedural success, mortality, and MACE in Pakistani patients undergoing PCI, making it a crucial contribution to local medical literature.

CKD is recognized as a major public health issue in Pakistan, and there are several reports documenting its prevalence and progression.[9] However, well-reported literature connecting CKD to PCI outcomes is still sparse. This study thus represents a vital expansion of existing knowledge, particularly within the cardiovascular care landscape of Pakistan.

Our findings echo global studies that show CKD patients are at a significantly higher risk of adverse outcomes following PCI. For example, Milojevic et al. (2018) reported similar results in the SYNTAX trial, highlighting the elevated mortality and MACE rates in CKD patients who underwent PCI. The higher mortality in our CKD group (47 deaths vs. 26 in the Non-CKD group) and the significant association between CKD and MACE (56 events in CKD vs. 33 in Non-CKD) are consistent with this international data.[4] The statistical significance of our results ($p < 0.05$ for both mortality and MACE outcomes) further strengthens the argument that CKD independently worsens PCI outcomes.

Interestingly, despite the higher mortality and MACE, the procedural success rate between CKD and Non-CKD groups did not show significant

differences (p = 0.16). This contrasts with some international findings where CKD patients exhibited lower procedural success due to the complexity of their condition.[3] This divergence may be attributed to differences in patient demographics, procedural techniques, or even the timing of interventions. The procedural success observed in our study might reflect the improving quality of PCI techniques in tertiary care centers like Hayatabad Medical Complex, where skilled cardiologists and advanced technology mitigate the technical challenges posed by CKD.

Study Limitations

There are a few limitations to this study that should be acknowledged. First, the study was conducted at a single center, limiting the generalizability of the results to other regions in Pakistan with different healthcare facilities and patient populations. A multicenter study would provide more comprehensive insights. Additionally, the follow-up period was limited to three months, which may not capture the long-term effects of CKD on PCI outcomes. Future studies should consider longer follow-up periods to assess the sustained impact of CKD.

Future Directions

Further research is needed to explore the underlying mechanisms by which CKD exacerbates outcomes in PCI patients. Additionally, studies focusing on the role of pharmacological interventions, such as statins or anti-inflammatory therapies, in improving outcomes for CKD patients undergoing PCI would be valuable. Expanding this research to include a more diverse patient population from different regions of Pakistan could help develop national guidelines for managing CKD patients undergoing cardiac interventions.

CONCLUSION

This study confirms that CKD significantly worsens outcomes for patients undergoing primary PCI. CKD patients demonstrated a higher incidence of MACE and mortality compared to those without CKD, aligning with global findings. Despite comparable procedural success rates, CKD remains a critical predictor of poor prognosis post-PCI. These findings underscore the need for targeted strategies to manage CKD patients undergoing PCI in Pakistan, where research on this topic is limited. Effective interventions and close follow-up are essential to improving outcomes for this high-risk group.

REFERENCES

1. Rubartelli, P., Bruzzone, M., Ariel Sanchez, F., Bologna, E., Iannone, A., & Fedele, M. (2020). Effect of pre-existing chronic kidney disease, anaemia and diabetes mellitus on mid-term mortality in patients with STEMI treated with primary PCI. Eur Heart J [Internet]. Nov 1;41(Supplement_2). https://academic.oup.com/eurheartj/article/doi/10.1093/ehjci/ehaa946.1775/6004408
2. Hashimoto Y, Ozaki Y, Kan S, Nakao K, Kimura K, Ako J, et al. Impact of Chronic Kidney Disease on In-Hospital and 3-Year Clinical Outcomes in Patients With Acute Myocardial Infarction Treated by Contemporary Percutaneous Coronary Intervention and Optimal Medical Therapy — Insights From the J-MINUET Study —. Circ J [Internet]. 2021 Sep 24;85(10):CJ-20-1115. Available from: https://www.jstage.jst.go.jp/article/circj/85/10/85_CJ-20-1115/_article
3. Stähli, B. E., Gebhard, C., Gick, M., Ferenc, M., Mashayekhi, K., Buettner, H. J., Neumann, F.-J., & Toma, A. (2017). Outcomes after percutaneous coronary intervention for chronic total occlusion according to baseline renal

function. *Clinical Research in Cardiology*, *107*(3), 259–267. https://doi.org/10.1007/s00392-017-1179-x

4. Milojevic, M., Head, S. J., Mack, M. J., Mohr, F. W., Morice, M.-C., Dawkins, K. D., Holmes, D. R., Serruys, P. W., & Kappetein, A. P. (2018). The impact of chronic kidney disease on outcomes following percutaneous coronary intervention versus coronary artery bypass grafting in patients with complex coronary artery disease: five-year follow-up of the SYNTAX trial. *EuroIntervention*, *14*(1), 102–111. https://doi.org/10.4244/eij-d-17-00620
5. Watanabe, Y., Mitomo, S., Naganuma, T., Chieffo, A., Montorfano, M., & Nakamura S. (2021). Impact of Chronic Kidney Disease in Patients With Diabetes Mellitus after Percutaneous Coronary Intervention for Left Main Distal Bifurcation (From the Milan and New–Tokyo (MITO) Registry). Am J Cardiol [Internet]. 33–9. https://linkinghub.elsevier.com/retrieve/pii/S000291492031095X
6. Cilia, L., Sharbaugh, M., Marroquin, O. C., Toma, C., Smith, C., &Thoma, F. (2019). Impact of Chronic Kidney Disease and Anemia on Outcomes After Percutaneous Coronary Revascularization. *Am J Cardiol* *124*(6), 851–6. https://linkinghub.elsevier.com/retrieve/pii/S0002914919306484
7. Tajti, P., Karatasakis, A., Danek, B. A., Alaswad, K., Karmpaliotis, D., &Jaffer, F. A. (2018). In-Hospital Outcomes of Chronic Total Occlusion Percutaneous Coronary Intervention in Patients with Chronic Kidney Disease. *J Invasive Cardiol* *30*(11), 113–21. https://api.semanticscholar.org/CorpusID:52276022
8. Malik, A. O., Peri-Okonny, P., Grantham, J., Lombardi, W., Karmpaliotis, D., Moses, J. (2019). Impact of chronic kidney disease on clinical and health status outcomes after chronic total occlusion percutaneous coronary intervention. *J Am Coll Cardiol,* *73*(9), 1282. https://linkinghub.elsevier.com/retrieve/pii/S0735109719318893
9. Siddiqui, A., Bhatti, K. I., Farman, M. T., & Khan, N. U. (2019). FREQUENCY OF RISK FACTORS IN PATIENTS PRESENTING WITH ACUTE CORONARY SYNDROME BELOW 40 YEARS OF AGE. *Pakistan Heart Journal*, *52*(3). https://doi.org/10.47144/phj.v52i3.1785