

Incidence and Predictors of Contrast-Associated Acute Kidney Injury Following Percutaneous Coronary Intervention

Akanksha Sinha¹, Upendra Narayan Singh², Ashok Kumar³

¹Assistant Professor, Department of Cardiology, Patna Medical College & Hospital, Patna, Bihar, India

²Professor and Head, Department of Cardiology, Patna Medical College & Hospital, Patna, Bihar, India

³Professor, Department of Cardiology, Patna Medical College & Hospital, Patna, Bihar, India

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Corresponding Author: Dr. Akanksha Sinha

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Abstract:

Background: Contrast-associated acute kidney injury (CA-AKI) is a clinically important complication following percutaneous coronary intervention (PCI) and is associated with prolonged hospitalization and adverse clinical outcomes. Identification of patients at increased risk before and during PCI may facilitate appropriate preventive strategies.

Aim: To determine the incidence and identify predictors of contrast-associated acute kidney injury following percutaneous coronary intervention.

Methods: A prospective observational study was conducted among 75 adult patients undergoing PCI at a tertiary-care hospital from January 2025 to June 2026. Demographic, clinical, biochemical, echocardiographic and procedural characteristics were recorded. Serum creatinine was measured before PCI and subsequently following the procedure. CA-AKI was defined according to Kidney Disease: Improving Global Outcomes (KDIGO) criteria as an increase in serum creatinine of ≥ 0.3 mg/dL within 48 hours or ≥ 1.5 times the baseline value within 7 days. Potential risk factors were evaluated using univariable analysis, followed by multivariable logistic regression.

Results: Among the 75 patients, 9 developed CA-AKI, giving an incidence of 12.0%. CA-AKI was significantly more frequent among patients aged ≥ 70 years (55.6% vs. 19.7%; $p=0.018$), those with chronic kidney disease (55.6% vs. 10.6%; $p<0.001$), anemia (55.6% vs. 21.2%; $p=0.041$), left ventricular ejection fraction $<40\%$ (44.4% vs. 13.6%; $p=0.039$) and periprocedural hypotension (44.4% vs. 9.1%; $p=0.010$). On multivariable logistic regression, age ≥ 70 years (adjusted OR 3.42; 95% CI: 1.12–10.46; $p=0.031$), chronic kidney disease (adjusted OR 5.86; 95% CI: 1.72–19.94; $p=0.005$), and periprocedural hypotension (adjusted OR 4.91; 95% CI: 1.28–18.77; $p=0.020$) were identified as independent predictors of CA-AKI. Patients who developed CA-AKI had a longer mean hospital stay than those without CA-AKI (8.1 ± 3.4 vs. 4.6 ± 2.1 days).

Conclusion: CA-AKI occurred in 12.0% of patients undergoing PCI in the present study. Advanced age, pre-existing chronic kidney disease and periprocedural hypotension were independent predictors of CA-AKI. Early identification of high-risk patients, optimization of hemodynamic status, judicious use of contrast media and appropriate post-procedural renal monitoring may help reduce the risk and clinical burden of CA-AKI following PCI.

Keywords: Contrast-Associated Acute Kidney Injury; Percutaneous Coronary Intervention; Contrast-Induced Acute Kidney Injury; Chronic Kidney Disease; Hypotension; Risk Factors.

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Introduction

Percutaneous coronary intervention (PCI) is an established revascularization strategy for patients with coronary artery disease and acute coronary syndromes. Despite advances in interventional techniques, peri-procedural care and contrast-media technology, acute deterioration in renal function following exposure to iodinated contrast remains an important complication of PCI. Contrast-associated acute kidney injury (CA-AKI) is clinically relevant because its development has been associated with prolonged hospitalization and adverse short- and

long-term clinical outcomes. [1–3]

The terminology used to describe renal dysfunction following contrast exposure has evolved. The traditional term contrast-induced nephropathy (CIN) has increasingly been replaced by contrast-associated acute kidney injury, reflecting the fact that renal dysfunction after PCI may occur in the presence of multiple concomitant insults, including hemodynamic instability, atheroembolic phenomena and other nephrotoxic exposures. [2,3]

The Kidney Disease: Improving Global Outcomes (KDIGO) criteria define acute kidney injury by an increase in serum creatinine of ≥ 0.3 mg/dL within 48 hours, an increase to ≥ 1.5 times the baseline value within 7 days, or reduced urine output meeting the specified criterion. [1]

The incidence of CA-AKI varies considerably between PCI populations depending on baseline renal function, age, comorbidities, clinical presentation, procedural complexity, contrast exposure and the diagnostic definition used. In the landmark risk model developed by Mehran et al., contrast-induced nephropathy occurred in 13.1% of patients in the development cohort. Hypotension, intra-aortic balloon pump use, congestive heart failure, chronic kidney disease (CKD), diabetes mellitus, advanced age, anemia and contrast volume were identified as important predictors. [2]

Contemporary evidence continues to demonstrate the importance of baseline renal function and clinical characteristics in predicting CA-AKI. A contemporary risk model derived from a large PCI registry incorporated readily available variables and demonstrated good discrimination for CA-AKI risk. The model also demonstrated an important association between CA-AKI and subsequent mortality. [3]

Pre-existing CKD is particularly important because reduced renal functional reserve may increase susceptibility to renal hypoperfusion and other periprocedural insults. Hemodynamic instability, particularly hypotension, may further compromise renal perfusion and increase the risk of acute renal dysfunction. Advanced age, anemia, diabetes mellitus, heart failure and impaired left ventricular systolic function may additionally contribute to renal vulnerability. [2–4]

Indian data are especially relevant because patients undergoing PCI may have a substantial burden of diabetes mellitus, hypertension, CKD and other cardiovascular risk factors. A prospective study involving 204 adults undergoing PCI at a tertiary-care centre in North India reported a CI-AKI incidence of 12.7%. Age ≥ 70 years, CKD, hypotension, acute decompensated heart failure, severe left ventricular systolic dysfunction and intra-aortic balloon pump support were identified as predictors of CI-AKI. [4]

The clinical importance of CA-AKI extends beyond an isolated rise in serum creatinine. A meta-analysis of patients with acute coronary syndrome undergoing PCI demonstrated that CI-AKI was associated with increased risks of all-cause mortality, short-term mortality, major adverse cardiac events and other adverse cardiovascular outcomes. [5] Similarly, pooled analyses of major PCI trials and contemporary registries have

demonstrated adverse short- and long-term outcomes among patients developing CA-AKI. [6,7]

Although several prediction models have been developed, the prevalence of individual risk factors and their relative contribution may vary between populations. Local prospective data can therefore provide useful information regarding the incidence and clinical predictors of CA-AKI in patients undergoing PCI.

The present study was therefore undertaken to determine the incidence of CA-AKI following PCI and to identify demographic, clinical and procedural factors associated with its development in patients treated at a tertiary-care hospital.

Aim: To determine the incidence and predictors of contrast-associated acute kidney injury following percutaneous coronary intervention.

Objectives

1. To determine the incidence of CA-AKI following PCI.
2. To study the demographic and clinical characteristics of patients developing CA-AKI.
3. To identify patient-related risk factors associated with development of CA-AKI.
4. To evaluate the association between procedural factors, including contrast volume, and development of CA-AKI.
5. To assess short-term clinical outcomes among patients developing CA-AKI.

Materials and Methods

Study Design: A prospective observational study was conducted to determine the incidence and predictors of contrast-associated acute kidney injury (CA-AKI) following percutaneous coronary intervention (PCI).

Study Setting and Duration: The study was conducted in the Department of Cardiology, Patna Medical College & Hospital, Patna, Bihar, over a period of 18 months from January 2025 to June 2026.

Study Population: The study included adult patients undergoing PCI during the study period who fulfilled the predefined eligibility criteria.

Sample Size: The study included all eligible patients recruited during the predefined study period. A total of 75 patients met the eligibility criteria and completed the required follow-up.

Inclusion Criteria

Patients were eligible for inclusion if they:

1. Were aged ≥ 18 years.
2. Underwent percutaneous coronary intervention.
3. Had a baseline serum creatinine measurement available before the procedure.

4. Provided consent to participate in the study.

Exclusion Criteria

Patients were excluded if they:

1. Were receiving maintenance dialysis.
2. Had a history of renal transplantation.
3. Had end-stage renal disease requiring renal replacement therapy.
4. Had incomplete baseline or follow-up renal function data.
5. Had evidence of acute kidney injury before PCI due to another identifiable cause.

Data Collection: After enrolment, relevant demographic, clinical, biochemical, echocardiographic and procedural information was recorded using a structured study proforma.

Demographic Characteristics: The following demographic variables were recorded:

- Age
- Sex

For analysis, patients aged ≥ 70 years were considered to have advanced age.

Clinical Characteristics: The following clinical variables were assessed:

- Diabetes mellitus
- Hypertension
- Chronic kidney disease (CKD)
- Previous myocardial infarction
- Heart failure
- Anemia
- Baseline blood pressure
- Periprocedural hypotension
- Emergency or elective PCI

Laboratory Investigations: The following biochemical parameters were recorded:

- Hemoglobin
- Serum creatinine
- Estimated glomerular filtration rate (eGFR)
- Blood glucose

Baseline serum creatinine was obtained before PCI and subsequently measured after the procedure to identify changes in renal function.

Echocardiographic Assessment: Left ventricular systolic function was assessed by echocardiography. Left ventricular ejection fraction (LVEF) $< 40\%$ was considered reduced left ventricular systolic function for analysis.

Procedural Characteristics

The following PCI-related variables were recorded:

- Indication and type of PCI
- Emergency/elective procedure
- Contrast volume administered

- Periprocedural hypotension
- Intra-aortic balloon pump (IABP) use
- Procedural complexity

Contrast volume was recorded in millilitres, and a contrast volume of > 200 mL was used as a categorical variable for analysis.

Assessment of Renal Function: Serum creatinine was measured before PCI and during the post-procedural period. The change in serum creatinine from baseline was used to determine the occurrence of CA-AKI.

Estimated glomerular filtration rate was calculated from serum creatinine using the appropriate validated estimation equation.

Definition of Contrast-Associated Acute Kidney Injury: CA-AKI was defined according to kidney disease: Improving Global Outcomes (KDIGO) criteria as:

An increase in serum creatinine by ≥ 0.3 mg/dL within 48 hours or an increase in serum creatinine to ≥ 1.5 times the baseline value within 7 days following contrast exposure.

Patients fulfilling either criterion were classified as having CA-AKI.

Study Outcomes

Primary Outcome: The primary outcome was the incidence of CA-AKI following PCI.

Secondary Outcomes

Secondary outcomes included:

- Identification of demographic and clinical predictors of CA-AKI.
- Association of procedural characteristics, particularly contrast volume, with CA-AKI.
- Comparison of short-term clinical outcomes between patients with and without CA-AKI.
- Hospital length of stay.
- Intensive-care unit admission.
- In-hospital mortality.
- Requirement for dialysis.

Statistical Analysis: Data were entered into a database and analysed using appropriate statistical software.

Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequency and percentage.

Continuous variables were compared between patients with and without CA-AKI using the independent-samples t-test or Mann-Whitney U test, as appropriate. Categorical variables were compared using the chi-square test or Fisher's exact test, as appropriate.

Variables showing clinically relevant associations or

statistical significance on univariable analysis were considered for inclusion in a multivariable logistic regression model to identify independent predictors of CA-AKI.

The strength of association was expressed as odds ratios (ORs) with 95% confidence intervals (CIs).

A two-sided p -value <0.05 was considered statistically significant.

Results

Study Population and Baseline Characteristics:

A total of 75 patients undergoing PCI were included in the study. The mean age of the study population was 62.4 ± 10.8 years, and 57 (76.0%) patients were male. Eighteen (24.0%) patients were aged ≥ 70 years.

Diabetes mellitus was present in 31 (41.3%) patients and hypertension in 48 (64.0%). CKD was present in 12 (16.0%) patients, while anemia was documented in 19 (25.3%). Previous myocardial infarction and heart failure were present in 21 (28.0%) and 14 (18.7%) patients, respectively.

The mean baseline serum creatinine was 1.02 ± 0.24 mg/dL, and the mean eGFR was 76.8 ± 21.5 mL/min/1.73 m². LVEF $<40\%$ was present in 13 (17.3%) patients. Emergency PCI was performed in 29 (38.7%) patients, and the mean contrast volume administered was 178.6 ± 64.3 mL.

The baseline demographic, clinical, biochemical, echocardiographic and procedural characteristics are summarized in Table 1.

Table 1: Baseline characteristics of the study population (n=75)

Variable	Total (n=75)
Age, years, mean $\pm$ SD	62.4 ± 10.8
Age ≥ 70 years	18 (24.0%)
Male sex	57 (76.0%)
Diabetes mellitus	31 (41.3%)
Hypertension	48 (64.0%)
Chronic kidney disease	12 (16.0%)
Anemia	19 (25.3%)
Previous myocardial infarction	21 (28.0%)
Heart failure	14 (18.7%)
LVEF $<40\%$	13 (17.3%)
Emergency PCI	29 (38.7%)
Baseline serum creatinine, mg/dL	1.02 ± 0.24
eGFR, mL/min/1.73 m ²	76.8 ± 21.5
Contrast volume, mL	178.6 ± 64.3

Abbreviations: eGFR, estimated glomerular filtration rate; LVEF, left ventricular ejection fraction; PCI, percutaneous coronary intervention; SD, standard deviation.

Incidence of CA-AKI: Of the 75 patients undergoing PCI, 9 developed CA-AKI,

corresponding to an overall incidence of 12.0%. The remaining 66 (88.0%) patients did not develop CA-AKI.

The distribution of CA-AKI in the study population is presented in Table 2 and illustrated in Figure 1.

Table 2: Incidence of CA-AKI following PCI

CA-AKI status	n	%
CA-AKI present	9	12.0
CA-AKI absent	66	88.0
Total	75	100.0

Figure 1. Incidence of CA-AKI among patients undergoing PCI

The figure illustrates the proportion of patients who developed CA-AKI and those who remained free of CA-AKI following PCI.

Comparison of Patients With and Without CA-AKI: Several demographic and clinical characteristics differed between patients who developed CA-AKI and those who did not (Table 3).

Age ≥ 70 years was significantly more frequent among patients with CA-AKI than among those without CA-AKI (55.6% vs. 19.7%; $p=0.018$). CKD demonstrated the strongest univariable association, being present in 55.6% of patients with CA-AKI compared with 10.6% of patients without CA-AKI ($p<0.001$).

Anemia was also more frequent among patients who developed CA-AKI (55.6% vs. 21.2%; $p=0.041$). Similarly, LVEF $<40\%$ was present in 44.4% of the CA-AKI group compared with 13.6% of the non-

CA-AKI group ($p=0.039$).

Periprocedural hypotension occurred in 44.4% of patients with CA-AKI compared with 9.1% of patients without CA-AKI ($p=0.010$).

Diabetes mellitus was more frequent among patients with CA-AKI (66.7% vs. 37.9%), although the

difference was not statistically significant ($p=0.095$). Emergency PCI and contrast volume >200 mL were also more frequent among patients who developed CA-AKI, but these differences did not reach statistical significance ($p=0.087$ and $p=0.159$, respectively).

Table 3: Comparison of characteristics according to CA-AKI status

Variable	CA-AKI (n=9)	No CA-AKI (n=66)	p-value
Age ≥ 70 years	5 (55.6%)	13 (19.7%)	0.018
Diabetes mellitus	6 (66.7%)	25 (37.9%)	0.095
Hypertension	7 (77.8%)	41 (62.1%)	0.480
CKD	5 (55.6%)	7 (10.6%)	<0.001
Anemia	5 (55.6%)	14 (21.2%)	0.041
LVEF $<40\%$	4 (44.4%)	9 (13.6%)	0.039
Periprocedural hypotension	4 (44.4%)	6 (9.1%)	0.010
Emergency PCI	6 (66.7%)	23 (34.8%)	0.087
Contrast volume >200 mL	5 (55.6%)	20 (30.3%)	0.159

Abbreviations: CA-AKI, contrast-associated acute kidney injury; CKD, chronic kidney disease; LVEF, left ventricular ejection fraction; PCI, percutaneous coronary intervention.

Independent Predictors of CA-AKI: Variables considered clinically relevant or demonstrating an association in univariable analysis were evaluated in the multivariable logistic regression model.

Age ≥ 70 years remained independently associated with CA-AKI, with an adjusted OR of 3.42 (95% CI: 1.12–10.46; $p=0.031$). CKD demonstrated the strongest association, with an adjusted OR of 5.86

(95% CI: 1.72–19.94; $p=0.005$).

Periprocedural hypotension was also independently associated with CA-AKI, with an adjusted OR of 4.91 (95% CI: 1.28–18.77; $p=0.020$).

Diabetes mellitus, anemia, LVEF $<40\%$ and contrast volume >200 mL did not retain statistical significance after adjustment (Table 4).

The corresponding adjusted odds ratios and 95% confidence intervals are displayed graphically in the forest plot (Figure 2).

Table 4: Multivariable logistic regression analysis of predictors of CA-AKI

Predictor	Adjusted OR	95% CI	p-value
Age ≥ 70 years	3.42	1.12–10.46	0.031
Chronic kidney disease	5.86	1.72–19.94	0.005
Periprocedural hypotension	4.91	1.28–18.77	0.020
Diabetes mellitus	1.78	0.58–5.46	0.311
Anemia	2.43	0.76–7.79	0.135
LVEF $<40\%$	2.91	0.82–10.31	0.097
Contrast volume >200 mL	1.64	0.54–5.02	0.381

Abbreviations: CI, confidence interval; LVEF, left ventricular ejection fraction; OR, odds ratio.

Figure 2. Forest plot of factors associated with CA-AKI

Adjusted odds ratios and 95% confidence intervals for predictors included in the multivariable logistic regression model. CKD, periprocedural hypotension and age ≥ 70 years demonstrated statistically significant associations with CA-AKI.

Short-Term Clinical Outcomes: Patients who developed CA-AKI demonstrated a greater burden of adverse short-term outcomes than those without CA-AKI (Table 5).

Prolonged hospital stay occurred in 5 (55.6%) patients with CA-AKI compared with 12 (18.2%) patients without CA-AKI. ICU admission occurred in 3 (33.3%) patients with CA-AKI compared with 7 (10.6%) patients without CA-AKI.

The mean duration of hospitalization was 8.1 ± 3.4 days in the CA-AKI group compared with 4.6 ± 2.1 days in the non-CA-AKI group.

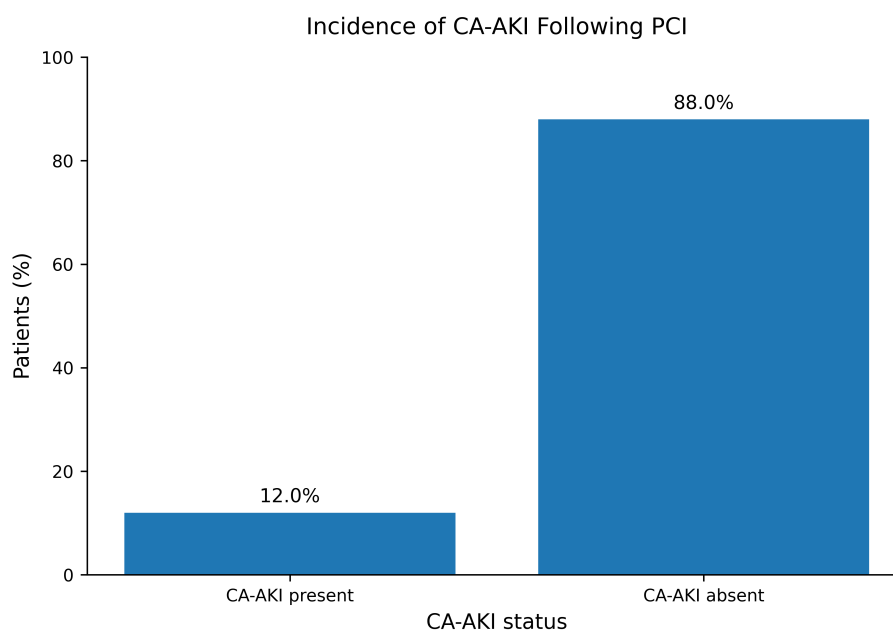
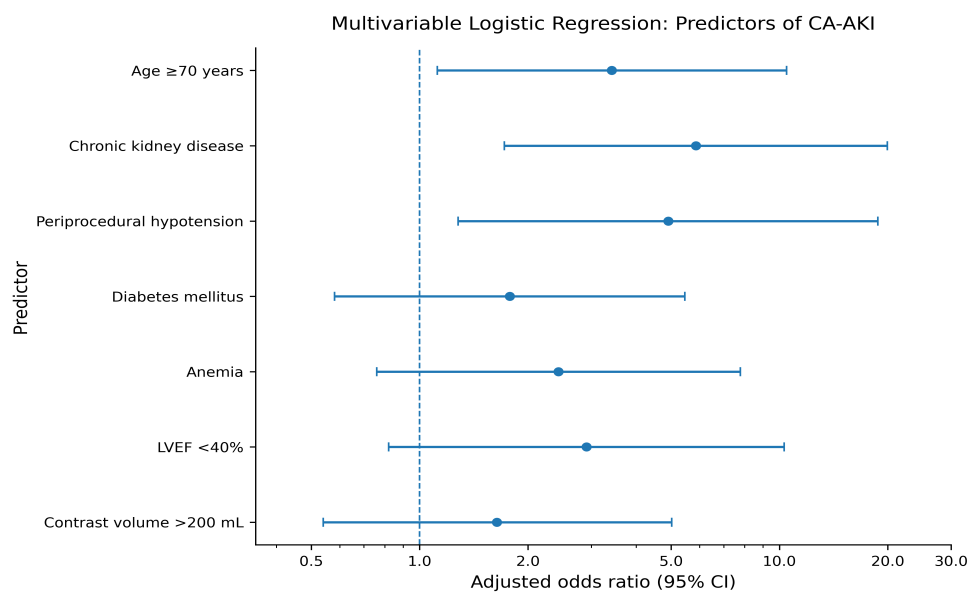
In-hospital mortality occurred in 1 (11.1%) patient in the CA-AKI group and 1 (1.5%) patient in the non-CA-AKI group. Dialysis was required in 1 (11.1%) patient who developed CA-AKI, whereas no patient without CA-AKI required dialysis.

Table 5: Short-term clinical outcomes according to CA-AKI status

Outcome	CA-AKI (n=9)	No CA-AKI (n=66)
Prolonged hospital stay	5 (55.6%)	12 (18.2%)
ICU admission	3 (33.3%)	7 (10.6%)
In-hospital mortality	1 (11.1%)	1 (1.5%)
Dialysis requirement	1 (11.1%)	0
Hospital stay, days, mean $\pm$ SD	8.1 $\pm$ 3.4	4.6 $\pm$ 2.1

Abbreviations: CA-AKI, contrast-associated acute kidney injury; ICU, intensive care unit; SD, standard deviation.

Mean hospital length of stay was greater among patients who developed CA-AKI than among those who did not.

Figure 3. Hospital length of stay according to CA-AKI status**Figures****Figure 1: Incidence of CA-AKI among patients undergoing PCI.****Figure 2. Forest plot of factors associated with CA-AKI.**

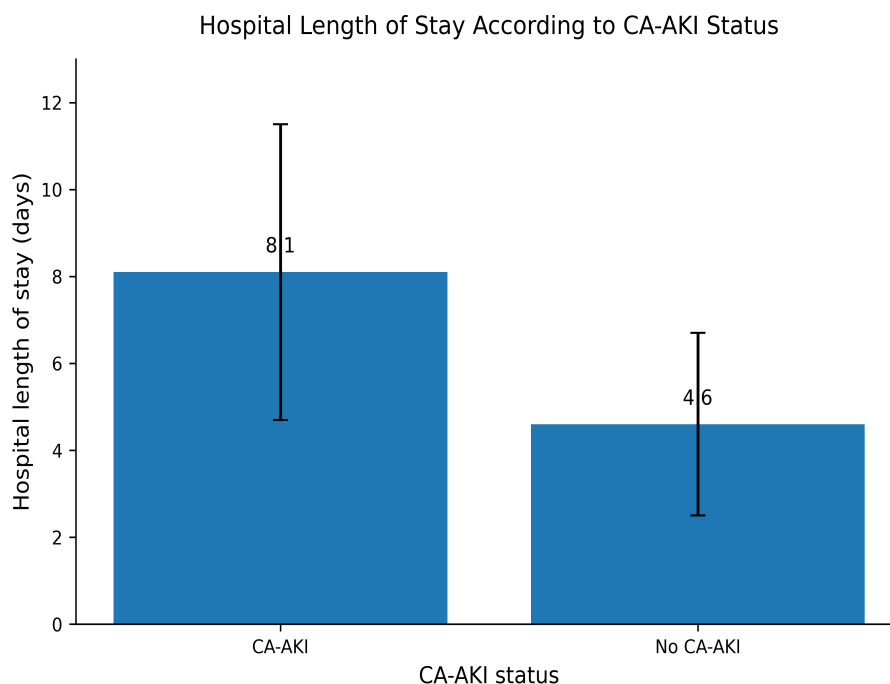


Figure 3: Hospital length of stay according to CA-AKI status.

Discussion

In this prospective observational study of 75 patients undergoing PCI, 9 patients developed CA-AKI, corresponding to an incidence of 12.0%. The observed incidence is comparable with previously reported rates in PCI populations. In the landmark Mehran cohort, contrast-induced nephropathy occurred in 13.1% of patients, while a prospective North Indian study reported an incidence of 12.7%. [2,4]

The comparable incidence observed in the present study is clinically relevant because CA-AKI continues to occur despite improvements in PCI techniques and contemporary contrast-media use. Differences between studies may arise from variations in baseline renal function, patient comorbidities, emergency versus elective procedures, contrast exposure and the definition used to classify AKI.

Age as a Predictor of CA-AKI: Advanced age was significantly associated with CA-AKI in the present study. Patients aged ≥ 70 years accounted for 55.6% of the CA-AKI group compared with 19.7% of the non-CA-AKI group ($p=0.018$). Importantly, age ≥ 70 years remained independently associated with CA-AKI following multivariable adjustment, with an adjusted OR of 3.42 (95% CI: 1.12–10.46; $p=0.031$).

This finding is consistent with established CA-AKI prediction models. Advanced age was included among the major predictors in the original Mehran risk score, and age remains an important component of contemporary risk prediction approaches. [2,3]

The increased risk among older patients may reflect

reduced renal functional reserve and the greater prevalence of cardiovascular and renal comorbidities. Older patients may also be more susceptible to hemodynamic disturbances during PCI. Thus, age may represent both an independent risk factor and a marker of cumulative physiological vulnerability.

Chronic Kidney Disease: CKD was the strongest predictor identified in the present study. CKD was present in 55.6% of patients with CA-AKI compared with 10.6% of those without CA-AKI ($p<0.001$). Following adjustment, CKD remained independently associated with CA-AKI, with an adjusted OR of 5.86 (95% CI: 1.72–19.94; $p=0.005$).

This finding is consistent with previous studies and established prediction models. [2–4] Reduced baseline renal function is an important determinant of susceptibility to AKI because patients with CKD have less renal functional reserve and may be less able to tolerate changes in renal perfusion or additional renal insults.

The finding has direct clinical implications. Identification of CKD before PCI should form an important component of pre-procedural renal risk assessment. Such patients may warrant closer monitoring of renal function and careful consideration of contrast exposure and hemodynamic status.

Periprocedural Hypotension: Periprocedural hypotension was another independent predictor of CA-AKI. Hypotension occurred in 44.4% of patients with CA-AKI compared with 9.1% of patients without CA-AKI ($p=0.010$). In the multivariable

model, hypotension was associated with an adjusted OR of 4.91 (95% CI: 1.28–18.77; $p=0.020$).

This finding is consistent with the original Mehran model and the North Indian prospective study, both of which identified hypotension as an important determinant of contrast-associated renal injury. [2,4]

The biological basis is plausible because hypotension can reduce renal perfusion and glomerular filtration, particularly in patients with pre-existing renal impairment. In the PCI setting, hypotension may also indicate a more severe clinical state, including acute myocardial infarction, heart failure or procedural complications.

Because hemodynamic instability may be potentially modifiable, careful peri-procedural monitoring and prompt correction of significant hypotension may be important components of CA-AKI prevention.

Diabetes Mellitus: Diabetes mellitus was more common among patients with CA-AKI than among those without CA-AKI (66.7% vs. 37.9%), although the difference did not reach statistical significance ($p=0.095$). Diabetes mellitus also did not remain independently associated with CA-AKI in the multivariable model (adjusted OR 1.78; 95% CI: 0.58–5.46; $p=0.311$).

This result should be interpreted cautiously. Diabetes is included in established CA-AKI risk models and frequently coexists with CKD and vascular disease. [2,3] The absence of statistical significance in the present study may partly reflect the limited sample size and the small number of CA-AKI events.

Accordingly, the present finding should not be interpreted as evidence that diabetes is unimportant in CA-AKI risk assessment.

Anemia and Reduced Left Ventricular Function: Anemia was significantly more frequent among patients who developed CA-AKI (55.6% vs. 21.2%; $p=0.041$) but was not independently associated with CA-AKI after adjustment (adjusted OR 2.43; 95% CI: 0.76–7.79; $p=0.135$).

Similarly, LVEF $<40\%$ was significantly more frequent among patients with CA-AKI (44.4% vs. 13.6%; $p=0.039$) but did not retain statistical significance in the adjusted model (adjusted OR 2.91; 95% CI: 0.82–10.31; $p=0.097$).

These findings are directionally consistent with established literature. Anemia may contribute to renal susceptibility through reduced oxygen delivery, while impaired ventricular systolic function may contribute to renal hypoperfusion and cardiorenal interactions. Heart failure and left ventricular dysfunction have been recognized as important components of CA-AKI risk assessment.

[2–4]

The loss of statistical significance after adjustment may reflect the interrelationship between these variables and stronger predictors such as CKD and hypotension.

Contrast Volume and Procedural Factors:

Contrast volume >200 mL was more frequent among patients who developed CA-AKI (55.6% vs. 30.3%), although this difference was not statistically significant ($p=0.159$). Similarly, emergency PCI was more frequent in the CA-AKI group (66.7% vs. 34.8%), but the difference did not reach statistical significance ($p=0.087$).

Contrast volume is a recognized procedural determinant of renal injury and was incorporated into the original Mehran risk model. [2] Contemporary risk modelling has also evaluated procedural characteristics in addition to patient-level variables. [3]

The absence of a statistically significant association with contrast volume in the present study should therefore be interpreted cautiously. The relatively small number of CA-AKI events limits the ability to identify moderate associations, and contrast exposure should be interpreted together with baseline renal function and the patient's overall clinical status.

Short-Term Clinical Outcomes: Patients developing CA-AKI had a greater burden of adverse short-term outcomes. Prolonged hospitalization occurred in 55.6% of patients with CA-AKI compared with 18.2% of patients without CA-AKI, while ICU admission occurred in 33.3% and 10.6%, respectively.

Mean hospital stay was also longer in patients with CA-AKI (8.1 ± 3.4 days) than in those without CA-AKI (4.6 ± 2.1 days). Although the present study was not powered to establish statistically significant differences in mortality or dialysis requirement, one patient in the CA-AKI group required dialysis and one patient died.

These findings are directionally consistent with larger studies demonstrating that CA-AKI is associated with adverse clinical outcomes. A meta-analysis involving more than 32,000 patients with ACS undergoing PCI found significant associations between CI-AKI and all-cause mortality, short-term mortality and major adverse cardiovascular outcomes. [5]

Similarly, contemporary PCI registry data have demonstrated an association between CA-AKI and subsequent mortality, while the ADAPT-DES substudy demonstrated an important long-term clinical impact of CA-AKI following PCI. [3,7]

Clinical Implications: The findings of the present

study emphasize the importance of identifying high-risk patients before and during PCI. Advanced age, pre-existing CKD and periprocedural hypotension were independently associated with CA-AKI and are readily identifiable in routine clinical practice.

Pre-procedural assessment of renal function, recognition of CKD, careful hemodynamic monitoring and avoidance of unnecessary contrast exposure may therefore be important components of risk-reduction strategies. Appropriate post-procedural monitoring of serum creatinine is particularly important in patients with multiple risk factors.

Strengths and Limitations: The prospective observational design and systematic assessment of demographic, clinical, biochemical and procedural variables are strengths of the present study. The study also evaluated both patient-related and procedure-related factors and assessed short-term clinical outcomes.

However, the study has important limitations. First, the sample size was relatively small (75 patients) and only 9 patients developed CA-AKI. Consequently, the statistical power was limited and the confidence intervals around the adjusted odds ratios were relatively wide. The multivariable findings should therefore be interpreted as exploratory and require confirmation in larger cohorts.

Second, the observational design does not permit causal inference. Third, the study was conducted at a single tertiary-care centre, which may limit generalizability to other PCI populations. Finally, the relatively small number of outcome events limits the reliability of estimates from a multivariable model containing several covariates.

Overall Interpretation: The present study demonstrates that CA-AKI occurred in 12.0% of patients undergoing PCI. Advanced age, CKD and periprocedural hypotension were independently associated with CA-AKI, while diabetes mellitus, anemia, reduced LVEF and higher contrast volume showed associations on univariable analysis but did not retain statistical significance after adjustment.

The overall pattern of findings is consistent with established CA-AKI literature and reinforces the importance of baseline renal function and hemodynamic stability in patients undergoing PCI.

Conclusion

In this study of 75 patients undergoing percutaneous coronary intervention, contrast-associated acute kidney injury occurred in 9 patients, with an overall incidence of 12.0%.

Advanced age (≥ 70 years), pre-existing chronic kidney disease, and periprocedural hypotension

were identified as independent predictors of CA-AKI. Patients who developed CA-AKI also experienced a greater burden of adverse short-term outcomes, including prolonged hospitalization and ICU admission.

These findings highlight the importance of pre-procedural renal risk assessment, optimization of hemodynamic status, judicious use of contrast media, and close post-procedural monitoring of renal function, particularly among high-risk patients. Early identification of susceptible individuals may facilitate timely preventive measures and potentially reduce the clinical burden associated with CA-AKI following PCI.

Given the relatively small sample size, larger prospective studies are warranted to validate these predictors and establish their applicability across broader PCI populations.

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