

ORIGINAL ARTICLE

Examine the Risk Factors for Contrast-Induced Nephropathy in Patients Undergoing Percutaneous Coronary Intervention (PCI) and the Prevalence of this Complication

GAUHAR RAHMAN¹, HIBBA AZIZ², NAVEED YAQOUB³, RIFAT YASMIN⁴, MUJEEBULLAH TAREEN⁵, FAIZAN AHMED⁶¹Fellow Interventional Cardiology, Department of Interventional Cardiology, Peshawar Institute of Cardiology Peshawar²Medical Officer, Department of Medicine, Jinnah Postgraduate Medical Centre Karachi, Sindh.³MBBS, FCPS Medicine, FCPS Cardiology, Associate Professor of Cardiology, Rawal Institute of Health Sciences, Islamabad⁴FCPS Medicine, Associate Professor of Medicine, Department of Medicine, POF HOSPITAL, Wah Medical College (affiliated with NUMS) Wah Cantt.⁵Professor of Cardiology, Bolan Medical College, & Head of Cardiology Department, Sandeman Provincial Hospital, Quetta⁶House Officer, Internal Medicine, Lahore General Hospital.Corresponding author: Hibba Aziz, Email: irfanhiba8@gmail.com

ABSTRACT

Objective: The purpose of this study was to determine the incidence of contrast-induced nephropathy and risk variables among patients undergoing multi-vessel percutaneous coronary intervention (PCI).

Study Design: Prospective / Observational study

Place and Duration: Department of Interventional Cardiology, Peshawar Institute of Cardiology Peshawar in the duration from November 2022 to April, 2023.

Methods: There were 168 patients of both genders with ages 20-70 years were presented in this study. Data on enrolled patients' age, gender, BMI, marital status and education level were collected after receiving written permission from each patient. This research included people who had undergone a percutaneous coronary intervention. Serum creatinine >0.5mg/dl from the baseline value was classified as contrast induced nephropathy. CIN-related risk factors were studied. Data was analyzed using SPSS 22.0.

Results: Patients mean age was 49.8±19.44 years and with mean body mass index 24.1±7.37 kg/m². 90 patients were males. CIN was found in 42 (25%) cases. Contrast volume, hypertension, diabetes mellitus, and age >60 were the most common risk factors for CIN.

Conclusion: Contrast-induced nephropathy is a serious danger for patients undergoing PCI. Anemia (age >60), diabetes mellitus (contrast volume >150 ml), and heart failure were found to increase the likelihood of developing CIN.

Keywords: Contrast Induced Nephropathy, Percutaneous Coronary Intervention, Risk Factors

INTRODUCTION

Despite significant improvements in cardiovascular outcomes, the widespread adoption of the initial percutaneous coronary intervention (PPCI) in the management of ST elevation myocardial infarction (STEMI) has increased the incidence of contrast induced nephropathy (CIN) due to the challenges associated with assessing CIN risk and starting prophylactic measures for prevention of CIN due to the emergency nature of STEMI, attendant hemodynamic compromise, and the use of higher contrast concentrations. Contrast-induced acute kidney damage (CI-AKI) occurs when radiographic contrast media are administered and is thought to be reversible after exposure to the contrast media [3, 4]. In most cases, kidney function returns to normal within 7-10 days after contrast media exposure [4]. This happens within 48 hours. The most well-known risk factor for CIN is the presence of preexisting stage III chronic kidney disease (CKD), when the e-GFR has been 60 mL/min/1.73 m² for more than three months. Despite this, CIN can still develop if additional risk factors are present and CKD is not the underlying cause [5].

When it comes to interventional radiology patients, chronic kidney disease (CKD) is the third leading cause of kidney injury, making CIN a key cause of AKI in hospitalized patients. [4]CIN occurs in less than 2%[5] of the population; however, it occurs in over 12% of people with chronic kidney disease (CKD) and in patients who experienced an ACS and required emergency percutaneous coronary intervention (PCI). [6] Moreover, it is linked to higher mortality and a lengthier stay in the hospital.[7,8]

Although contrast-induced nephropathy is usually a short-lived condition, it has the potential to cause lasting kidney damage, increase hospital length of stay, and raise medical costs. Nonrenal problems are more likely to become life-threatening in patients with renal insufficiency. Patients with renal failure had a 34% higher mortality risk than those who did not. Nosocomial renal impairment is common, and contrast-induced nephropathy is a major contributor. If the serum creatinine level rises by more than 25%, or 44umol/l, within 3 days following intravascular delivery of contrast agents, renal function is impaired. There must be no other

explanation for this.[9] Mellitus, congestive heart failure, hypertension, and peripheral vascular disease have all been linked to an increased risk of CIN, as have the use of an intra-aortic balloon pump, a contrast volume greater than 260 ml, and an urgent or emergency treatment.[10]

Patients at high risk for complications during percutaneous coronary intervention were included in the current investigation to determine the prevalence and risk factors of contrast-induced nephropathy.

MATERIAL AND METHODS

This Observational/ Prospective study was conducted at Department of Interventional Cardiology, Peshawar Institute of Cardiology Peshawar in the duration from November 2022 to April, 2023 and comprised of 168 patients. All demographic information, including patients' ages, sexes, weights, and marital statuses, was collected only after receiving their informed, written consent. Patients under the age of 20, those with preexisting renal impairment, and those who refused to participate were all disqualified from this study.

Individual participants who gave informed consent and met the study's inclusion criteria were enrolled. Men and women between the ages of 20 and 70 were eligible to participate, as were those with normal blood creatinine levels at baseline (1.2 mg/dL. Patients in shock, Killip class IV, chronic kidney disease, or end-stage renal disease were excluded.

The entire database of patients' medical histories was assembled in this way. The STEMI diagnosis was made based on a baseline ECG showing ST-segment elevation and a patient history of chest discomfort lasting more than 30 minutes. Patients were classified as hypertensive or diabetic after six months of treatment. Anyone who has smoked for more than a year can be classified as a chronic smoker. Patients were classified as having CIN if their post-procedure creatinine levels increased by 25% or 0.5 mg/dL within 48 to 72 hours after the primary PCI operation compared to their pre-procedure levels. Consultant cardiologists used a total of mL of contrast during PCI procedures.

We determined the median, interquartile range, and proportion of patients who exhibited various phenotypic traits. This study employed the chi-square test to investigate the association between a number of potential risk variables (including age, gender, and co-occurring conditions including hypertension, diabetes, and smoking) and a group of operative parameters (including the type of contrast used). SPSS 22.0 was utilized for all data analysis.

RESULTS

Patients mean age was 49.8±19.44 years and with mean body mass index 24.1±7.37 kg/m². 90 patients were males. Majority of the patients 98 (58.7%) were non-educated and 70 (41.3%) cases were educated. There were 102 (60.7%) married patients. As per socio-economic status, 80 patients had high status and 88 patients were had low socio-economic status.(table 1)

Table-1: Case enrollment data, including ages and other demographics

Variables	Frequency (168)	Percentage
Mean age (years)	49.8±19.44	
Mean BMI (kg/m ²)	23.5±15.67	
Education Status		
Literate	75	41.3
Illiterate	98	58.7
Marital status		
Married	102	60.7
Non-married	66	39.3
Socio-economic status		
Poor	88	52.4
High	80	47.6

CIN was found in 42 (25%) cases in which 26 cases were males and 16 cases were females.(table 2)

Table-2: Association of CIN among all cases

Variables	Frequency (168)	Percentage
Contrast Induced Nephropathy		
Yes	42	25
No	126	75
Gender		
Female	26	15.5
Male	16	9.5

Contrast volume >150 ml was found in 30 (71.4%) of patients, hypertension was found in 25 (59.5%), diabetes mellitus was found in 23 (54.8%), age >60 years was found in 18 (42.9%), congestive heart failure was found in 14 (33.3%), smoking was present in 11 (26.2%) of cases, and a family history of coronary artery disease was present in 4 (14.3%) of cases.

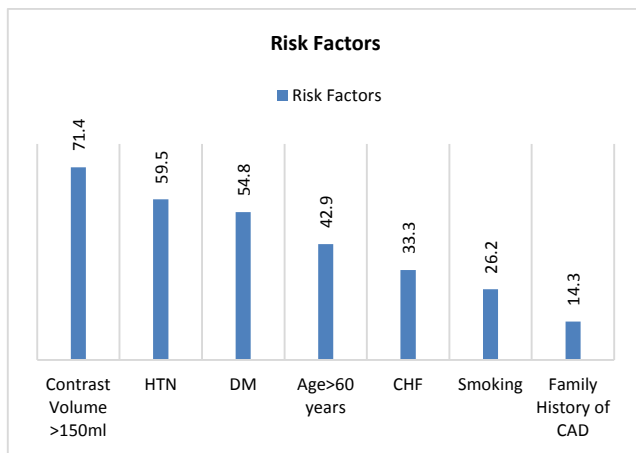


Figure-1: Factors that put patients at risk for CIN

DISCUSSION

Incidence rates of CIN in the general population are estimated to be between 0.3 and 2.6%.[11,12] High-risk individuals with several risk factors, such as patients with diabetes and renal insufficiency (up to 50%), have a much higher incidence of CIN.[13] In a recent study [14], the authors found that 14.5 percent of 510 patients with PCI-related CIN. Our research found that the prevalence of CIN among PCI patients was 15.33%. This finding indicates that CIN is more common after PCI and warrants increased awareness. Patients with an LVEF of 45% or less, serum creatinine levels of 60 mol/L or less, age of 65 years or more, log NT-proBNP levels of 2.5 pg/mL or less, uric acid levels of 350 mol/L or less, emergency PCI, and triglyceride levels of 1.30 mmol/L or less were all revealed to be independent risk factors for CIN. Early intervention is necessary for prophylaxis of CIN in patients with those risk factors following PCI.

In current study 168 patients of both genders were presented. Patients mean age was 49.8±19.44 years and with mean body mass index 24.1±7.37 kg/m². 90 patients were males. CIN was found in 42 (25%) cases. These findings were consistent with those of prior research. [15,16] There is no clear evidence linking NSAID use to an increased risk of CIN in the scientific literature. These medicines may have an additive effect on contrast agents in the development of CIN because they are nephrotoxic in and of themselves. When calculating the patient's risk, it's important to factor in how long and how much NSAIDs they've been taking. Using multivariate regression analysis, we discovered that NSAID use was an independent predictor of CIN, and that the proportion of patients who reported using NSAIDs was considerably greater among those with CIN. Diogo et al. [17] argued that our findings on the link between NSAID use and CIN development were incorrect. In addition, age > 60 years was an independent predictor of CIN in our multivariate regression analysis. A lower estimated glomerular filtration rate (e-GFR) is correlated with an increase in age, the presence of several chronic conditions, and the presence of more severe coronary artery disease. Diabetic nephropathy and microvascular renal lesions are complications of diabetes mellitus with hyperglycemia. Decreased renal perfusion and volume depletion [18] are the results of cardiogenic shock. Our findings are consistent with those of Newhouse et al. [19], who also found that concomitant risk factors such low intravascular volume, diabetes, renal dysfunction at baseline, and heart failure play a significant role in determining whether or not a patient develops CIN.

Increased levels of NT-proBNP can be considered a separate risk factor for CIN. Myocytes in the ventricles of the heart secrete NT-proBNP, which is then eliminated by the kidneys. Patients with ACS have ventricular myocytes that are highly ischemic, hypoxic, and necrotic, all of which increase the secretion of NT-proBNP.[21] NT-proBNP levels dramatically rise in response to high levels of oxidative stress, inflammation, and the immune system's response to the former two.[22] High levels of NT-proBNP cause CIN by relaxing blood vessels, decreasing sympathetic nerve activity, and increasing urine output. This reduces renal blood flow and causes ischemia and hypoxia in the medullary tissue. Consistent with our findings, previous research has linked elevated NT-proBNP levels to an increased incidence of CIN in patients with ACS. Patients who have emergency PCI may not have had enough time to make necessary preoperative preparations, such as having their renal function stabilized, which may explain why emergency PCI is a risk factor for CIN. Therefore, it's possible that these patients are more likely to develop CIN.[23,24]Future research must confirm this possibility.

Different risk stratification methodologies have been proposed for use in the clinical setting to help identify people at high risk for developing CIN. A simple score for the categorization of patients at high risk of CIN was created by Mehran et al. [25] and has since been validated and used in a number of studies. Among patients who underwent PCI for non-NSTEMI, an elevated neutrophil-to-lymphocyte ratio (NLR) was found to be an

independent predictor of CIN, as assessed by Kurtul et al. [26]. According to research by Kurtul and Duran [27], individuals with STEMI who undergo primary PCI are more likely to develop CIN if their QRS complex is fragmented.

CONCLUSION

Contrast-induced nephropathy is a serious danger for patients undergoing PCI. Anemia (age >60), diabetes mellitus (contrast volume >150 ml), and heart failure were found to increase the likelihood of developing CIN.

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