

Contrast-Induced Nephropathy Factors and Prevalence in Patients Getting Multi-Vessel Percutaneous Coronary Intervention

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ABSTRACT

Objective: To assess the prevalence of contrast-induced nephropathy and its associated risk factors in patients undergoing multi-vessel percutaneous coronary intervention (PCI).

Study Design: Observational/ Prospective study

Place and Duration: Armed forces institute of cardiology & National Institute of heart diseases, Rawalpindi, during from the period September 2019 to Feb 2020.

Methods: There were 112 patients of both genders with ages 18-75 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 24.0.

Results: The mean age of the patients was 51.6±9.53 years and had mean BMI 23.5±15.67 kg/m². Majority were males 68 (60.7%) and 44 (39.3%) were females. There were 75 (66.96%) patients married and 55 (49.1%) patients were educated. Frequency of contrast induced nephropathy was among 25 (22.3%) cases. Most common risk factor of CIP was contrast volume 19 (76%) and hypertension found in 17 (68%) cases, followed by diabetes mellitus in 15 (60%) cases, age >65 years in 13 (52%) cases, CHF in 11 (44%) cases, smoking history in 9 (36%) cases and family history of CAD was 4 (16%).

Conclusion: Patients undergoing PCI are at a considerable risk of developing contrast-induced nephropathy. Among the risk variables for CIN were anaemia (age >70 years), diabetes mellitus (contrast volume >150 ml), and heart failure.

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

INTRODUCTION

Patients with ST-segment elevation myocardial infarction should have primary percutaneous coronary intervention (PCI) as their preferred method of reperfusion (STEMI). Compared to thrombolysis, it has a lower mortality and morbidity rate when administered during the first 12 hours following the start of symptoms [1]. When contrast media is used during surgery, it is possible that the patient will develop contrast-induced nephropathy (CIN), which reduces their glomerular filtration rate. CIN is associated with a higher mortality and morbidity rate, as well as an increased use of healthcare resources and an increase in the cost of care [2]. Between 10% and 23% of patients who underwent initial PCI developed CIN, according to recent studies. CIN has been linked to an increased risk of death in the hospital following primary PCI by a factor of four to eight [3-5].

Despite the widespread use of contrast agents in diagnostic imaging and interventional procedures [3,6], it is still unclear how CIN develops, but different processes like oxidative stress, vasoconstriction and medullary ischemia as well as allergic responses to contrast media have all been implicated [3,6]. Acute kidney damage (AKI) is more likely in patients with chronic renal disease, diabetes, hemodynamic abnormalities and volume depletion as a consequence of cardiogenic shock or heart failure, advanced interventional procedures, and the administration of extra contrast dye during treatment [7].

However, conflicting findings have been found in several meta-analyses and large trials [8, 9] regarding the benefits of two-stage multivessel revascularization in AMI compared to immediate complicated angioplasty [10]. Contrast burden, which tends to be larger in sophisticated multivessel procedures, is a major factor in developing CIN [11]. Additionally, post-procedural CIN patients have a higher risk of short- and long-term cardiac complications [11, 12]. In order to minimize CIN incidence and enhance outcomes, it is critical to identify AMI patients who are at high risk of CIN early in the course of their treatment.

CIN's aetiology, on the other hand, remains a mystery. CIN is still untreatable in today's day and age. Perioperative preventions include intravenous hydration before and after surgery, lowering contrast doses, and the use of low- or iso-osmolar contrast medium, all of which have been developed by researchers [13]. There is yet no conclusive evidence on the effectiveness of hydration and Western pharmacological therapies on the prevention of CIN. Traditional Chinese medicine may give a supplemental therapy for CIN because of Western medicine's limitations. Experiments in the past have shown that the oxidative stress response, which plays a crucial part in CIN formation, was reduced by Xuefu Zhuyu decoction, although the specific processes of CIN have not been fully understood.[14,15]

Among patients undergoing multi-vessel percutaneous coronary intervention, this study seeks to determine the frequency of contrast-induced nephropathy and the risk factors that may contribute to its development (PCI).

MATERIAL AND METHODS

This Observational/ Prospective study was conducted at Armed forces institute of cardiology & National Institute of heart diseases, Rawalpindi, during from the period September 2019 to Feb 2020 and comprised of 112 patients. Data on the ages, genders, weights, and marital statuses of patients were only obtained with their express written consent. In this trial, patients under the age of 18, those with pre-existing renal impairment, and those who refused to take part were excluded.

Consenting patients who met the study's eligibility requirements were enrolled one at a time. Participants had to be either male or female, aged 18 to 75, and have a normal baseline serum creatinine level (1.2 mg/dL. Shock or Killip class IV or CKD or end-stage renal disease patients were not included in the study.

All of the patients' medical records were collected and catalogued in this manner. There was a history of chest pain lasting more than half an hour and an ST-segment elevation at baseline on the baseline ECG used to make the STEMI diagnosis.

After six months of being on medication, individuals were categorised as either hypertensive or diabetic. If you've been smoking for more than a year, you've been deemed a regular user of the tobacco product. Creatine levels at baseline and 48 to 72 hours after the initial PCI operation were used to identify patients as CIN if they had a 25% or 0.5 mg/dL elevation in post-procedure creatinine levels within 48 to 72 hours after the primary PCI surgery. A total of mL of contrast was used throughout PCI surgeries by the consultant cardiologists to achieve this.

On the basis of the patients' phenotypic characteristics, we calculated the mean standard deviation, minimum and maximum values, and frequency (percentage). This study examined the relationship between several risk factors (such as age, gender, and co-occurring diseases including hypertension, diabetes, and smoking) and a set of procedural parameters using the chi-square test (such as the type of contrast used during the procedure). All of the data was examined using SPSS 24.0.

RESULTS

Majority were males 68 (60.7%) and 44 (39.3%) were females in this study.(fig 1)

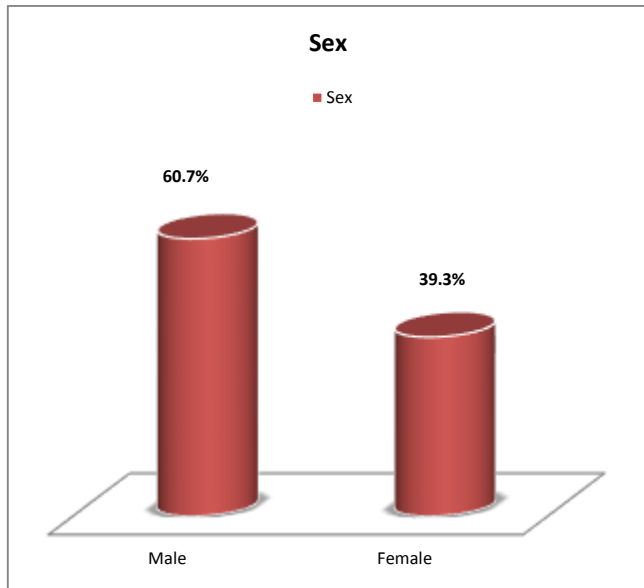


Figure-1: Sex distribution among presented cases

The mean age of the patients was 51.6±9.53 years and had mean BMI 23.5±15.67 kg/m². There were 75 (66.96%) patients married and 55 (49.1%) patients were educated.(table 1)

Table-1: Age and demographics details of enrolled cases

| Variables | Frequency | Percentage |
|-------------------------------|------------|------------|
| Mean age (years) | 51.6±9.53 | |
| Mean BMI (kg/m ²) | 23.5±15.67 | |
| Marital Status | | |
| Yes | 75 | 66.96% |
| No | 37 | 33.4% |
| Education Status | | |
| Yes | 55 | 49.1 |
| No | 57 | 50.9 |

Frequency of contrast induced nephropathy was among 25 (22.3%) cases.(fig 1)

Most common risk factor of CIP was contrast volume >150ml 19 (76%) and hypertension found in 17 (68%) cases, followed by diabetes mellitus in 15 (60%) cases, age >65 years in 13 (52%) cases, CHF in 11 (44%) cases, smoking history in 9 (36%) cases and family history of CAD was 4 (16%).(table 2)

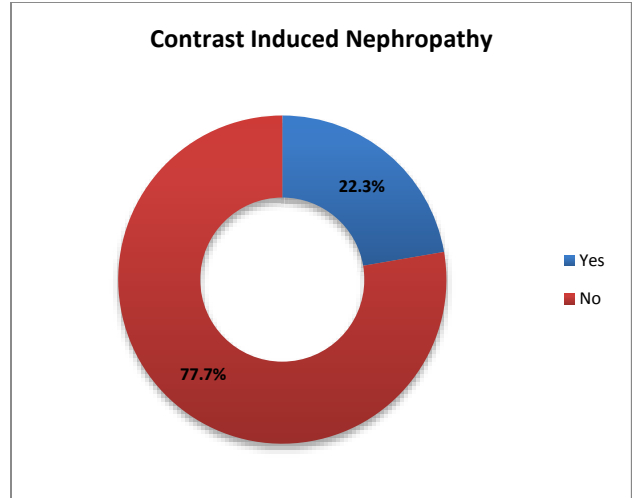


Figure-1: Prevalence of CIP

Table-2: Risk factors of CIP

| Variables | Frequency (25) | Percentage |
|------------------------|----------------|------------|
| contrast volume >150ml | | |
| Yes | 19 | 76 |
| No | 6 | 24 |
| hypertension | | |
| Yes | 17 | 68 |
| No | 8 | 32 |
| diabetes mellitus | | |
| Yes | 15 | 60 |
| No | 10 | 40 |
| age >65 years | | |
| Yes | 13 | 52 |
| No | 12 | 48 |
| CHF | | |
| Yes | 11 | 44 |
| No | 14 | 56 |
| smoking history | | |
| Yes | 9 | 36 |
| No | 16 | 64 |
| family history of CAD | | |
| Yes | 4 | 16 |
| No | 21 | 84 |

DISCUSSION

Complications of primary PCI, including CIN, have been linked to a greater risk of in-hospital mortality, longer hospitalisation, and post-procedure issues such as the need of a ventilator and major bleeding episodes [16]. After initial PCI, 22.3 percent of patients developed CIN. This is greater than the 12.4% reported in the study by Batra et al. [16] and the 10.2% reported in the research by Ullah et al. [17] for our population. Both experiments were done on the same group of people. The frequency of CIN after primary PCI varied from 10.4% to 23.2% in previous international research [18,19]. These findings are in line with those of earlier investigations. Patients who had PCIs experienced immediate renal injury in 7.1% of cases, according to research done by Tsai et al. [20] using data from the NCDR CathPCI Registry.

In current study 112 patients of both genders were presented. The mean age of the patients was 51.6±9.53 years and had mean BMI 23.5±15.67 kg/m². Majority were males 68 (60.7%) and 44 (39.3%) were females. There were 75 (66.96%) patients married and 55 (49.1%) patients were educated. These results were comparable to the previous studies. [21,22] Most common risk factor of CIP was contrast volume >150ml 19 (76%) and hypertension found in 17 (68%) cases, followed by diabetes mellitus in 15 (60%) cases, age >65 years in 13 (52%) cases, CHF in 11 (44%) cases, smoking history in 9 (36%) cases and family history of CAD was 4 (16%). Several previous research [23,24]

have shown that there is a correlation between an increasing dose of contrast agent used during the surgery and a higher incidence of CIN. This link is a positive one. When it comes to diabetes mellitus, researchers Batra et al. [16] and Tsai et al. [20] reached the same conclusion. Female gender, chronic kidney disease (CKD), hypertension (hyperlipidemia), anaemia and congestive heart failure (CHF) were found to be major risk factors for the development of CIN following initial percutaneous coronary intervention (PCI). There was also a higher death rate, a larger risk of post-procedure complications such as the need for a ventilator and bleeding in patients who had CIN. [16,20]. Atherosclerosis, circulatory instability, and a significant adverse cardiovascular event can all be predicted by a higher blood creatinine level at the start of a research [25].

Retrospective data from the Mayo Clinic PCI Registry shows that patients with CIN had a higher mortality risk in the near term. There was a statistically significant difference ($p < 0.0001$) of 254 individuals (3.3 percent), with a mortality rate of 22 percent for those patients.[26] According to the same research, diabetics had a higher risk of developing CIN than people without diabetes. Although CIN was more widespread than previously reported by the Mayo Clinic and Victor's observation, there was no mortality as a result [27].

Because of the consequences of this problem in the current era of intervention, preventive measures, whether pharmacological or nonpharmacological, should be applied to these individuals. Chong et al. [28] found that pre-hydration with sodium chloride for 12 hours may minimise CIN. To prevent CIN, researchers studied high-dose atorvastatin, although the evidence was inconclusive on its impact in this regard [29]. Preventing CIN following elective PCI, according to Nawa et al. [30], is possible even in patients with impaired renal function who receive nicorandil intravenously for 4 hours prior to the surgery and for 24 hours afterwards. Intravenous magnesium sulphate can be used to prevent CIN, according to Firouzi and co-workers [31].

CONCLUSION

Patients undergoing PCI are at a considerable risk of developing contrast-induced nephropathy. Among the risk variables for CIN were anaemia (age >70 years), diabetes mellitus (contrast volume >150 ml), and heart failure.

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