Contrast Induced Nephropathy in Patients Undergoing Percutaneous Coronary Intervention

HASIBA ILYAS¹, HAREEM NAWAZ², MUHAMMAD ZAHID³

ABSTRACT

Aim: To determine the frequency of contrast induced nephropathy (CIN) amongst those who underwent percutaneous coronary intervention (PCI).

Methods: In this descriptive cross-sectional study 100 consecutive patients who underwent PCI were enrolled. Patients of either gender aged between 30-70 years who underwent PCI (irrespective of whether primary or secondary) were included in the study. Those patients who were already on hemodialysis, received metformin, NSAID or aminoglycosides prior to the procedure, had abnormal RFTs before the procedure and who had undergone renal transplantation were excluded from the study. PCI was performed by a cardiologist having at least 3 years experience of performing independent PCIs. Low osmolar nonionic contrast media was used in angiography. Serum creatinine level was recorded at baseline and after 48 hours of angiography. Primary outcome for our study was CIN which was diagnosed as elevation of at least 0.5mg/dl in the serum creatinine concentration from base line up to 48 hours after administration of contrast agent. All the data was recorded on a pre-designed proforma and analyzed by SPSS version 21.0. p-value < 0.05 was taken as significant.

Results: Out of total 100 cases, CIN was found in total 8(8%) patients. 4 diabetics (6.9%), 2 hypertensives (4.8%) and 7 of those with ACS (11.7%) developed CIN with difference in incidence rates being statistically insignificant (p-value = 0.41).

Conclusion: CIN is a common complication following PCI, however there is no significant difference in incidence rates among different age groups, gender and risk factors.

Keywords: Contrast induced nephropathy, Percutaneous coronary intervention,

INTRODUCTION

Cardiovascular diseases are a major cause of mortality and morbidity worldwide¹. It is estimated that nearly seven million people are diagnosed with myocardial infarction (MI) each year². The incidence is highest in South Asia owing to the presence of various risk factors such as smoking, diabetes, hypertension and high ApoB100/Apo-I ratio³. The standard of care for a patient with acute MI is primary percutaneous coronary intervention (PCI). Nowadays, more than 3 million such procedures are performed every year⁴. Contrast induced nephropathy (CIN) is a well known complication of PCI. It is a type of acquired acute renal failure that occurs within 24-72 hours after administration of contrast⁵. The possible mechanism involves a complex interplay of medullary ischemia, formation of reactive oxygen species and direct tubular cell toxicity⁶.

Kidney Disease: Improving Global Outcomes (KDIGO) has defined CIN as the impairment of renal function with either a 25% increase in serum creatinine (SCr) from baseline or a 0.5mg/dL increase in absolute SCr value—within 48-72 hours after intravenous contrast administration⁷. If not managed promptly, it can lead to prolonged hospitalization and adverse clinical outcomes⁸. Several risk factors have been identified which can be broadly classified into two main categories: 1. Patient related factors (creatinine clearance, diabetes mellitus, congestive heart failure, hypertension and peripheral vascular disease) and 2. Procedure related factors (intra-aortic balloon pump usage, contrast volume >260 ml and urgent/emergency procedure)⁹.

It is important to be able to prevent this complication as a lot of patients undergo PCI daily in our setup. CIN constitutes an economic burden too as most of the patients require hemodialysis for treatment. Knowing the incidence of CIN following PCI is the first step towards prevention. Numerous studies have been done in this regard. A recent study by Ullah et al¹⁰ reported an incidence of 10% while another recent local study¹¹ found out that 7% of patients developed CIN following PCI. We conducted this study with the primary objective of determining the incidence of CIN following PCI in our setup. This would help us in formulating future preventative strategies.
MATERIALS AND METHODS

This descriptive cross-sectional study was carried out at Punjab Institute of Cardiology Lahore from March 2017 to December 2017. The sample size was calculated using Open Epi calculator with the statistical assumptions of 5% alpha error and 95% confidence interval taking frequency of CIN to be 7.11% and comes out to be at least 100 patients for this study. Patients of either gender aged between 30-70 years who underwent PCI (irrespective of whether primary or secondary) were included in the study. Those patients who were already on hemodialysis, received metformin, NSAID or aminoglycosides prior to the procedure, had abnormal RFTs before the procedure and who had undergone renal transplantation were excluded from the study. Ethical approval was taken from institutional review board. Non probability consecutive sampling was used to enroll 100 patients meeting inclusion and exclusion criteria. Written informed consent was taken in each case. History of diabetes, hypertension and acute coronary syndrome (ACS) was taken. PCI was performed by a cardiologist having at least 3 years experience of performing independent PCIs. Low osmolar nonionic contrast media was used in angiography. Serum creatinine level was recorded at baseline and after 48 hours of angiography. Primary outcome for our study was CIN which was diagnosed as elevation of at least 0.5mg/dl in the serum creatinine concentration from baseline up to 48 hours after administration of contrast agent. Patient remained admitted in the hospital for follow-up.

All the data was recorded on a pre-designed proforma and analyzed by SPSS version 21.0. Mean and standard deviation was calculated for all quantitative variables like age, serum creatinine level at baseline, after 48 hours and difference. Frequency and percentage was calculated for all qualitative variables like gender, CIN, diabetes mellitus, hypertension and acute coronary syndrome. Post-stratification Chi-square test was applied. p-value <0.05 was taken as significant.

RESULTS

Mean age of the patients was 51.78±13.26 years. Out of 100 patients, 42 patients belonged to the 30-50 years age group while 58 were from the 51-70 years age bracket. There were 55 males and 45 females in the study group. A total of 8(8%) patients developed contrast induced nephropathy (CIN) (Figure-1). Mostly patients of 51-70 years of age group developed CIN (10.3% vs 4.8%) however the difference in incidence rates amongst the two age groups was statistically insignificant (p-value=0.31). 5 males (9.1%) and 3 females (6.7%) developed CIN with the difference being insignificant (p-value=0.66). 4 diabetics (6.9%), 2 hypertensives (4.8%) and 7 of those with ACS (11.7%) developed CIN with difference in incidence rates being statistically insignificant again (p-value=0.41) (Table 1).

DISCUSSION

Pakistan has a very high disease burden of coronary artery disease (CAD) estimated to be a staggering 5.09375 million people. Since PCI is the standard procedure for diagnosis and management of CAD, one can imagine the large number of these procedures being performed routinely throughout the country. Contrast induced nephropathy is a quite common complication following PCI. Its mismanagement can lead to dire consequences for the patients as it is associated with increased occurrence of adverse clinical outcomes.

Table 1: Baseline characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>n</th>
<th>CIN(%)</th>
</tr>
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<tbody>
<tr>
<td>Age (Mean±SD= 51.78±13.26 years) (P value=0.31)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-50 yrs</td>
<td>42 (42%)</td>
<td>2 (4.8%)</td>
</tr>
<tr>
<td>51-70 yrs</td>
<td>58 (58%)</td>
<td>6 (10.3%)</td>
</tr>
<tr>
<td>Gender (P value=0.66)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>55 (55%)</td>
<td>4 (6.9%)</td>
</tr>
<tr>
<td>Female</td>
<td>45 (45%)</td>
<td>2 (4.8%)</td>
</tr>
<tr>
<td>Risk factors (p value=0.41)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diabetes</td>
<td>58 (58%)</td>
<td>4 (6.9%)</td>
</tr>
<tr>
<td>Hypertension</td>
<td>42 (42%)</td>
<td>2 (4.8%)</td>
</tr>
<tr>
<td>Acute coronary syndrome</td>
<td>60 (60%)</td>
<td>7 (11.7%)</td>
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We conducted this study with the intent of estimating the overall burden of CIN following PCI. Our study reported an incidence rate of 8%. This was consistent with the findings of Ullah et al\textsuperscript{10} and Asghar et al\textsuperscript{11} who reported incidence rates of 10% and 7% respectively. Mehran et al\textsuperscript{13} analysed 8600 cases and reported an incidence rate of 13%. The lower incidence rate in our study might be explained by the fact that we used a rather strict exclusion criteria and excluded all the patients with even minor baseline RFTs derangement. Moreover the mean contrast volume used in our study was lower compared to the other studies.

We also investigated several risk factors such as advancing age, history of diabetes, hypertension or ACS. Our results showed that although CIN was more frequent in the elderly age group (51-70 years); the difference in frequency was statistically insignificant. The same holds true for the male gender i.e., although relatively more males developed CIN; the difference was insignificant. In contrast, Asghar et al\textsuperscript{11} concluded that CIN was more frequent in male gender and elderly age group. Ullah et al\textsuperscript{10} also showed an increasing incidence rate with advancing age. 6.9% of diabetics in our study developed CIN. This was consistent with the findings of a local study done by Sajjad et al\textsuperscript{16} who reported an incidence rate of 7.10%. Literature shows that incidence rates in diabetics range from 5.2% to 35.7\%.\textsuperscript{14,15} 60% of our patients had ACS out of which 11.7% developed CIN. In contrast, 80% of the patients had ACS in study done by Ullah et al\textsuperscript{10} which probably explains the slightly higher overall rate of CIN in their study group.

There were certain limitations to our study. First of all, our sample size was much smaller compared to rest of the studies. Secondly we did not incorporate any of the procedure related factors such as contrast volume into our research. Moreover we did not account for presence of more than one risk factor in a single patient in our analysis. If these factors were taken in to consideration then the results would have been more representative of true picture.

**CONCLUSION**

CIN is a common complication following PCI, however there is no significant difference in incidence rates among different age groups, gender and risk factors.

**REFERENCES**