ORIGINAL ARTICLE

RISK FACTORS FOR DEVELOPMENT OF CONTRAST INDUCED NEPHROPATHY IN PATIENTS UNDERGOING PERCUTANEOUS CORONARY INTERVENTION

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ABSTRACT

Background: Contrast induced nephropathy is a common form of acquired acute renal failure after coronary angiography and percutaneous coronary intervention (PCI) and this is associated with prolonge hospital stay and worse outcome. This study was conducted to find various risk factors responsible for contrast induced nephropathy in patients undergoing PCI.

Material & Methods: This was cross-sectional study performed at Hayatabad Medical Complex, Peshawar, Pakistan from July 01, 2014 to Dec. 31, 2014. Contrast induced nephropathy (CIN) is defined as increase in serum creatinine of ≥25% from baseline value and/ or an absolute increase of ≥0.5 mg/dl in serum creatinine from baseline. To identify independent characteristics associated with CIN, multivariable logistic regression analysis was used through SPSS version 15. Results of this model were presented as Odds Ratio (OR). P value was calculated to see the significance of various risk factors.

Results: We studied 177 patients with mean age of 60 ± 5.71 years. Overall frequency of CIN was found to be 10 %. CIN was found in 18.6 % of patients in older age group as compared to 5.9 % in younger age group (p-value =0.01, OR =3.6). In diabetic patients CIN was found in 19.2 % patients as compared to 6.4 % in non-diabetics (p-value =0.05, OR= 3.4). CIN was found in 40 % patients who were having baseline creatinine ≥ 1.5 mg/dl as compared to 8.4 % in <1.5mg/dl creatinine group (p-value =0.01, OR=7.2). In higher contrast dose (>150 ml), CIN frequency was significantly higher (13.7% vs. 3.3 %) and it was also significantly higher in patients with heart failure (33.3 % vs. 8 %).

Conclusion: Diabetes mellitus, heart failure, chronic kidney disease, advanced age and higher contrast dose were significantly associated with contrast induced nephropathy.

KEY WORDS: Percutaneous Coronary Intervention; Contrast Induced Nephropathy; Diabetes Mellitus; Chronic Kidney Disease; Coronary Artery Bypass Grafting; Acute Kidney Injury.

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INTRODUCTION

Coronary Artery Disease (CAD) is highly associated with Chronic Kidney Disease (CKD), its prevalence ranging from 23%–46%,[1,2] patients having CKD are at high risk of developing CAD as compared to general population.[3,4] CAD is also responsible for more than half of death secondary to end-stage renal disease (ESRD).[5] Impaired renal functions are associated with more chance of early death, cardiac events, and hospital admissions.[6] Contrast induced nephropathy (CIN) is a form of acute renal failure after coronary angiography and percutaneous coronary intervention (PCI) and leads to longer hospital stay and worse outcomes.[7] CIN is characterized by the onset of acute renal failure within 24 to 72 hours after iodinated contrast medium administration and is usually self limiting but some patients may need dialysis.[8,9]

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After advent of coronary angioplasty,trend towards PCI has increased and as a result decrease in coronary artery bypass graft (CABG). It is estimated that approximatly 1.4 million catheterization procedures are performed in united states each year.[10] Both coronary angiography and PCI needs contrast medium for procedure, and contrast medium is a common precipitator of CIN.[11]

CIN is one of the most common factor responsible for hospital-acquired Acute Kidney Injury (AKI) and is responsible for more occurence of myocardial infarction,coronory interventions[12,13] and more in hospital complications like bleeding, blood transfusions, vasculcomplications,[14] higher mortality and morbidity.[15] It also leads to more cost and more use of resources.[16]

Multiple risk factors are involved in causing CIN. These are high blood pressure,diabetes, deranged renal functions, left ventricular failure, peripheral arterial disease, use of IABP, high contrast volume > 250 ml and emergency procedure[17]

This study is important as it will provide local data of CIN and will aware our interventionist to look for risk factors before procedure to avoid its occurence and take prophylactic measures.

MATERIAL AND METHODS

This study was performed in hayat abad medical complex Peshawar from July 2014 to December 2014. This was a cross sectional descriptive study and non probability consecutive technique was used for data. All patients admitted to cardiology ward for PCI and age more than 18 years were included in our study. Patients with pre existing imapired renal functions were excluded from study. Contrast induced nephropathy was defined as either increase of serum creatinin 0.5 mg/dl or 25% from baseline after 48 hours of procedure. Diabetes mellitus (DM) was defined as random blood sugar (RBS) more than 200 mg/dl or fasting blood sugar (FBS) ≥126 mg/dl. Chronic kidney disease was defined as baseline creatinine >1.5 mg/dl. Heart failure was defined as current or previous sign and symptoms of heart failure and Echocardiographic evidence of left ventricular systolic dysfunction (Ejection Fraction <50 %). Patients were categorized in two groups, Age < 65 and age ≥65. Study was started after approval from hospital ethical committe and every patient included after informed consent.

All patients were admitted through out patient department and casuality depending upon patients presentation , detail history was taken and complete examination done followed by sending his FBS, RBS, urea and creatinin which was then repeated after 24 and 48 hour. All PCI procedures were performed by experienced operator and patients following procedure were sent to CCU.

For Data analysis SPSS version-15 was used. Means ± SD was calculated for numerical variable like age and Frequency and percentage were calculated for categorical variables like DM, gender,renal failure, left ventricular failure. P value was calculated and less than 0.05 was taken as significant. To find the significance of indivisual variables, multivariable logistic regression analysis was used and its results were presented as Odds Ratio (OR).

RESULTS

Total patients enrolled in the study were 177, Out of which 65% were male while mean Age was 60 ± 5.71 years. CIN was found in 10% of patients among the study population. Baseline characteristics of the study population is presented in Table 1.

CIN was found in 18.6 % of patients in >65 years age group as compared to 5.9 % in younger age group (P value =0.01 ,OR =3.6).In diabetic patients CIN was found in 19.2 % patients as compared to 6.4 % in non-diabetics (P value =0.05 ,OR= 3.4). CIN was found in 40 % patients who were having baseline creatinine >1.5 mg/dl as compared to 8.4 % in <1.5mg/dl creatinine group(P value =0.01,OR=7.2). In higher contrast dose (>150 ml) ,CIN was significantly higher (13.7% vs 3.3 %) as it was also significantly more common in patients with heart failure (33.3 % vs 8 %).These results are shown in table 2.

Table 1: Base line characteristics of study population.

VARIABLES	PERCENTAGE
Age ≥ 65 years	33.3 %
Male patients	65 %
DM	29.4 %
Hypertension	53 %
Heart failure	8.5 %
Creatinine >1.5 mg/dl	5.6 %
Contrast dose > 150 ml	66 %

Table 2: Risk factors for CIN.

VARIABLES	PATIENT (%)	Incidence of CIN (%)	Odds Ratio	P value
Age ≥ 65 years	33.3	18.6	3.6	.01
DM	29.4	19.2	3.4	.015
CKD	5.6	40	7.2	.011
Contrast > 150 ml	66	13.7	4.5	.03
Heart failure	8.5	33.3	5.7	.01

DISCUSSION

Literature shows that CIN is common after Coronory angiography and percutanoys coronory intervention. Different studies performed in different countries and on different population shows different findings usually ranging from 2-25% cases.[18] In our data CIN was found in 10% cases. Mehran R [17]et al studied CIN in a large data of 8600 cases and found that 13 % patients developed CIN which is very close to our findings of 10%. Similarly in another study performed by Weisbord and colleagues, 13.7% cases of CIN was found in post PCI patients .This study also supports our findings. Some studies showed less common occurence of CIN in their study populations. Chen SL[20] et al found that CIN was present in 6.5 % of patients while Dangas G[21] found similarly low percentage of 7% cases in their study. Similarly low frequency of CIN was found by Tsai TT[22] et al of 7.1 % frequency of CIN. These findings are lower as compared to our study due to the fact that study population was mostly consistant of patients with ACS rather than stable ischemic heart disease patients. Infact CIN is common in emergancy procedures as compared to elective procedures.

Advance age is considered to be a risk factor for CIN and our study shows that CIN is more common in older population as compared tlyounger population. In our study 18 % patient developed CIN who were older than 65 years. Similar findings were noted by Chen SL et al[20] and Takagi T et al.[23]

Higher contrast volume is also recognized to be a risk factor for CIN and exactly same was our experience in this study. In our study 13.7 % patients developed CIN whom were given >150 ml of contrast. Mekan et al[24] studied the effect of contrast volume in developing CIN and surprisingly they found no relation between contrast volume and CIN contrary this study Kane et al demonstrated that CIN incidence rises with high contrast volume and this study is supporting our findings of association between contrast volume and rising incidence of CIN.[25] The pathogenesis of CIN is not exactly known but it is hypothesized that it may be the result of prolong vasoconstriction dut to alteration in nitric oxide metabolism, impaired auto-regulation and direct toxicity to of contrast media to tubular epithelium.[26] Our findings are also supported by other studies like Mehran R et al[17] and Tsai TT et al[22] who found that higher contrast dose is associated with higher chances of CIN.

We found that Diabetic patients are at higher risk for development of CIN and we noted that 19 % Diabetic patients developed CIN which is significantly higher than non-diabetics. Mehran R et al[17] also found CIN was developed in 19 % patients post PCI which is similar to our findings.

CKD is establish risk factor for CIN in post PCI patients. So these patients should be given lesser contrast and ideally non ionic contrast should be given. Moreover good hydration should be ensured in these patients. We found that patients with CKD were more prone to develop CIN and 40 % patients developed CIN. Rihal et al[27],studied a large population for incidence of CIN and they found that pre-existing impaired renal functions has great impact on development of CIN. Moreover they stated that higher the base line creatinin, more is the chance of development of CIN. .Mehran R et al[17] also found that patients with CKD developed CIN in 30 % cases which is as large as our finding.

Congestive heart failure is also found is a risk factor for CIN. In our study, 33.3 % heart failure patients developed CIN .Similar very close findings were noted by Mehran R et al[17], who found 38 % patients with heart failure developed CIN. Our findings are also supported by other studies like one did by Rihal et al.[27]

Though we studied important risk factor for CIN in our study but there are several other risk factors for CIN, like number of stents deployed, type of contrast used, presentation of patient, Hypertension, peripheral vascular disease and anemia etc. So by studying all these risk factors, more authentic data can be obtained.

CONCLUSION

Diabetes mellitus, heart failure, chronic kidney disease, advance age and higher contrast dose are significantly associated with contrast induced nephropathy

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

Conception and Design:	IU, MUH,
Data collection, analysis & interpretation:	IU, FA, MI
Manuscript writing:	IU, MUH