ORIGINAL ARTICLE

CONTRAST INDUCED NEPHROPATHY IN HIGH RISK PATIENTS – MYTH OR REALITY

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Background: Contrast induced nephropathy (CIN) is a potential stumbling block in administration of contrast media. CIN has been defined as an elevation of serum creatinine (sCr) of more than ≥0.5 mg/dl (44 μmol/l) or 25% from the baseline within 48-72 hours in the truancy of alternate tenets of acute kidney injury. Incidence of CI-AKI in patients undergoing coronary angiography with normal baseline renal function was reported to be <3%. However, the occurrence of CI-AKI was found to be as high as 50% in CKD patients undergoing Coronary Angiography. This high incidence reported by different studies is mainly because of the difference in definition, underlying renal failure, type and dose of contrast media used and frequency of other co-existing important causes of acute kidney injury (AKI). Recent studies have been published showing that risk of CIN is an overestimated and over-reckoned entity in literature. **Objective:** To determine the frequency of CIN in CKD patients with Creatinine clearance (Crcl) less than 60 ml/min undergoing contrast exposure. **Methods:** We conducted Prospective, controlled single center trial in 42 patients having the creatinine clearance of less than 60 ml/min, they were risk stratified according to Mehran scoring system and underwent coronary angiography or contrast enhanced CT scan with contrast and specific protocol for prevention of CIN including intra-venous (IV) hydration with 0.9% Normal Saline was given before the procedure and were followed up to initial 72 hours post procedure. **Results:** 33 out of 42 patients, i.e., got adequate hydration as per protocol however 11 patients underwent procedure as pre-existing condition did not allow so. Out of 42 patients, risk stratification according to Mehran Scoring system revealed that 15 patients out of 42 patients were included in very high risk group, 14 were in high risk group and 13 patients were in intermediate risk group. Our experience revealed that 5 out of 42 patients (11.3%) were those who experienced CI-AKI and interestingly none of them required haemodialysis. **Conclusion:** Our study has raised serious question on incidence of CIN in high risk patients as reported previously. However, more studies are needed over this issue till that time we might consider CIN A myth rather than a reality.

Keywords: Contrast induced Nephropathy; Contrast induced AKI; Angiography in CKD Patients; Creatinine clearance (CrCl)

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INTRODUCTION

Contrast induced Nephropathy is the 3rd most frequent cause of AKI in hospital setting.[1] It is reversible cause of Acute kidney injury. Multiple risk factors related to patient and the procedure contribute to CIN that include already underlying renal insufficiency [estimated glomerular filtration rate {eGFR} <60 ml/min] and among all diabetes mellitus as the most significant one. Other risk factors, include age >75 years, hypotension that require use of inotropic support, uncontrolled hypertension, congestive heart failure (CHF), application of intra-aortic balloon pump (IABP), low haemoglobin levels, low albumin levels and hepatic cirrhosis.[2,3] Risk factors associated with the procedure include high volume of contrast, high osmolality or high viscosity, and multiple repeated exposures to contrast media (CM) within 72 hours. At the same time, parallel use of diuretics or nephrotoxic drugs (for example, non-steroidal anti-inflammatory drugs (NSAIDs) and antibiotics like aminoglycosides) have also been made responsible as an important risk factor.[2,3] The occurrence of CIN in population with normal renal function is very low (i.e., 0–5%), However it is reported as 12–27% in patients with already underlying renal failure and as high as 50% in high risk patients.[4] Pathophysiology of CIN includes renal medullary hypoxia secondary to decrement in vasodilators, i.e., prostaglandins or nitric oxide, or an increment in vasoconstrictors, i.e., endothelin or adenosine. Second mechanism includes direct toxicity of contrast media due to the oxidative stress and the free radicals. It is believed that the main responsible underlying pathophysiological mechanism is the activation of cytokine-induced inflammatory mediators by reactive free radicals. On the other hand, hampering the process of free radicals' formation may decrease incidence of CIN

by alkalization of tubular cells. Furthermore, apoptosis has also been found to play a significant role in the pathogenesis of CIN. Treatment involves Only Hydration with 0.9% Normal Saline and No Role of N-Acetylcysteine or IV Soda Bicarbonate.[6–8]

Elevation of creatinine level of more than 25% above baseline and within 48–72 hours post Contrast exposure is the key diagnostic criteria after excluding other causes. Mehran *et al* developed a risk scoring system for CIN.[8] This system is based on eight different factors: i) hypotension for more than 1 h and requiring inotropic support, ii) utilization of IABP within 24 h of the procedure, iii) CHF New York Heart Association (NYHA) class III or IV, iv) anaemia having haematocrit value of less than 39% for men and less than 36% for women, v) age >75 years, vi) diabetes mellitus, vii) volume of used contrast (1 point for each 100 cc), and viii) baseline serum creatinine >1.5 mg/dl (132 μmol/l). The incidence of CIN and dialysis increased with higher risk score (CIN incidence; 7.5,14, 26.1, and 57.3%) if total risk score ≤5 (low), 6–10 (moderate), 11–16 (high), and ≥16 (very high), respectively.[9,10] However, there are lot of conflicts in literature about incidence of Contrast induced Nephropathy with one study showing 50% of High-Risk Patients suffering from CIN.[2] There is inclination of Medical Society of Not giving contrast medium to patients with underlying chronic kidney disease and especially to patients who have serum creatinine levels above 1.5 mg/dl, posing great problem in diagnostic approach for such patients and a number of these patients are devoid of life saving procedures.[9] Also, there is an approach of not doing coronary angiography of patients having chronic kidney disease due to risk of CIN. Therefore, we present 42 cases having CKD who underwent coronary angiography/contrast exposure and only 5 of them suffered from CIN.

Operational definition:

1) Contrast induced Nephropathy: CIN is a sudden rise in serum creatinine from the baseline serum creatinine concentration of at least 0.5 mg/dL or at least 25% within 48–72 hours after exposure to contrast media.

2) Creatinine Clearance is calculated by using MDRD equation.

3) Hydration protocol: Based on clinical assessment, most patients hydrated at 30ml/kg/hour 1 hour before procedure and 10 ml/kg/hour up to 6 hours after procedure.

4)Contrast Material: Patients were given 75 ml of non-ionic, iso-osmolar Contrast medium.

5) Efficacy was assessed in terms of non-occurrence of CIN.

Hypothesis: CIN does not occur in patients with CKD Patients if proper hydration protocol is used before administering Contrast media.

MATERIAL AND METHODS

This study was carried out at Nephrology Department of KRL Hospital. Inclusion criteria involved patients a) Patients with Crcl less than 60 ml/min, b) Age between 20–80 years, c) Patient belonging to intermediate, high and very high-risk group. Exclusion criteria involved are a) Patient not giving consent for study, b) Patients already on maintenance HD, c) Patients belonging to low-risk group, d) Patients having other causes of AKI assessed on history. This study was performed over the time period of 24 months.

After approval from ethical review committee, Patients presented to OPD of Nephrology department KRL hospital for Nephrology clearance for Coronary angiography/Contrast Media exposure with Crcl less than 60 ml/min and having intermediate, high or very high-risk score according to Mehran risk scoring system were included in study after taking informed consent. Baseline creatinine was measured, and Pre-contrast exposure proper Hydration protocol was given as mentioned in operational definition. Post procedural RFTs were calculated at 24 hours, 48 hours and 72 hours. Data was plotted in the form of bar graphs and pie charts.

DISCUSSION

Total 42 patients were involved in study who underwent contrast exposure. Out of 42 patients, we were able to hydrate 31 (73.8%) patients properly according to protocol and 11 (26%) patients presented with Acute LVF and were stabilized by giving diuretics and were not hydrated properly. Age of Patients was between 40–80 years. 35 patients underwent coronary angiography and 7 patients underwent CT scan with contrast.

Risk stratification according to Mehran Scoring system revealed that 15 (35.7%) patients out of 42 patients were included in very high risk group, 14 (33.3%) were in high risk group and 13 (30.9%) patients were in intermediate risk group.

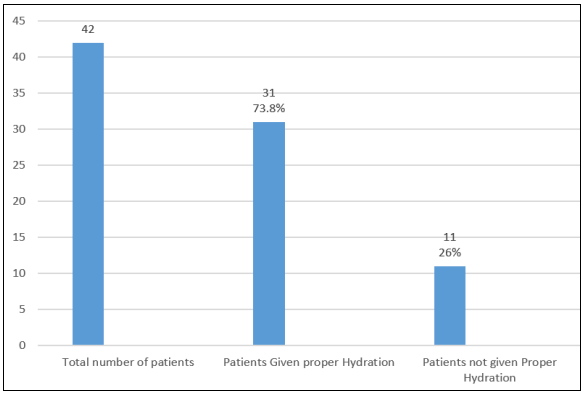

Figure-1: Patients Hydration Status at procedure

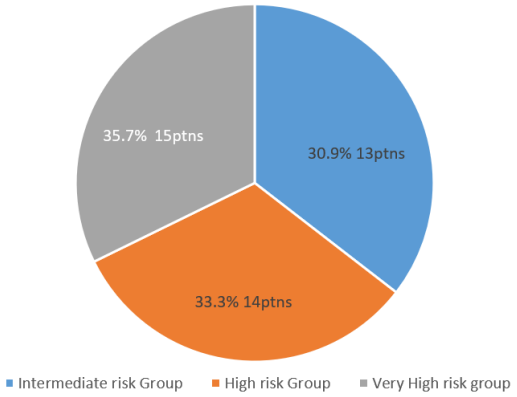

Figure-2: Risk Clarification according to Mehran Scoring System

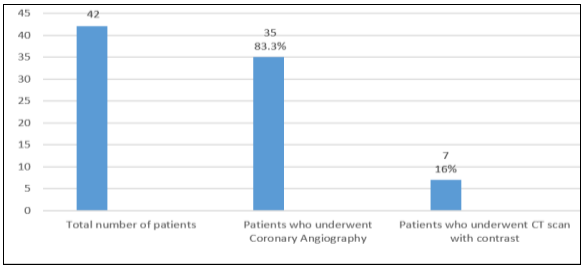

Figure-3: Procedure %age performed in patients

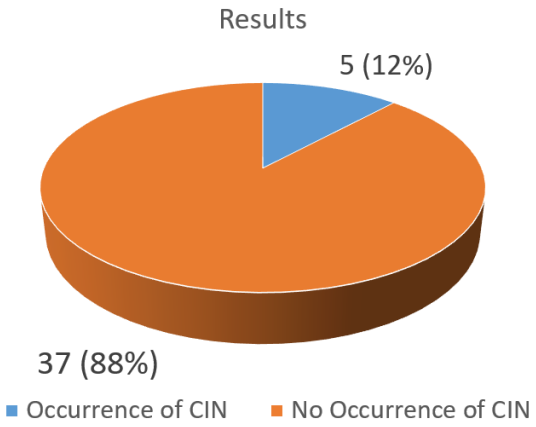

Figure-4: Results of study

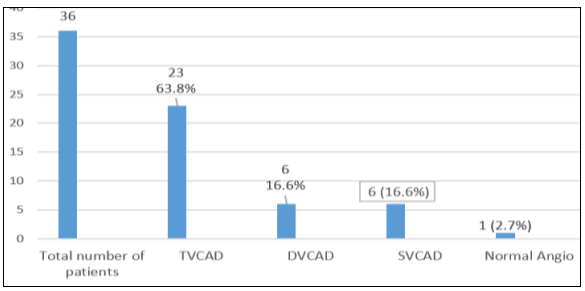

Figure-5: Outcome of patients who underwent coronary angiography

Out of our 42 patients only 5 patients (11.9%) suffered from Contrast Induced Nephropathy. Thus, previous studies done on high risk patients have clearly overestimated the probability of contrast induced nephropathy. The reason being the inclusion of patients having Acute Kidney injury due to other reasons like Inter-current illness, i.e., Sepsis, Pre-renal Acute kidney injury and Drugs including NSAIDS and Diuretics. Our study involved 29 High & Very High-risk patients and it is noteworthy that out of these 29 patients we were unable to hydrate 11 patients because of their presentation with Acute LVF and still CIN occurred in only Five patients. Effective Hydration might reduce the ratio of CI-AKI via a combination of its known physiological effects that is lowering concentration of CM in the kidneys, a more rapid transit of Contrast through renal medulla, and less overall exposure to toxic Contrast material, a potential decrement of oxygen consumption in the renal medulla, and maintenance of flow in the renal collecting system, which reduces sludging and precipitation of Contrast in renal tubular cells. Preclinical testing in a canine model supported the ability of matched hydration to blunt the decrease in renal function after CM exposure[9,10].

Also, of note is outcome of patients who underwent Coronary angiography. Out of 36 patients in total, 23 patients had TVCAD out of which 11 had High risk Stenting performed after Family consent and 12 were advised CABG, 6 patients had DVCAD out of which 5 underwent Stenting and One patient was advised CABG. Six patients had SVCAD out of which 5 underwent Stenting and 1 patient was advised medical therapy and only one patient out of whole 36 patients had normal coronary angiography.

Out of 7 patients who underwent CT scan with contrast, 3 patients had Metastatic Carcinomas and 2 patients had Renal stone disease and 1 patient had No metastatic disease and 1 had SVCAD on CT angiography.

Five patients who suffered from Contrast induced Nephropathy were among those 11 patients who were not well hydrated because of presentation as Acute LVF and underwent Emergency Coronary Angiography. Still, none of 5 patients went on to Haemodialysis and Creatinine returned to baseline creatinine within a week of procedure.

CONCLUSION

Although, contrast induced nephropathy is a potential stumbling block in administration of contrast media, but proper hydration and standard precautions make CIN a real Myth. Thus, we recommend that this data is to be shared with whole medical fraternity and it would be unjustifiable that Patients are devoid of Life

Saving Procedures like Coronary Angiography based on Deranged Renal function tests.

AUTHORS' CONTRIBUTION

NA: Literature search, data analysis, data interpretation, data collection, write-up. ZN: Conceptualization of study design. RMR, ZZ: Data collection.

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