

Original Research Article

**Incidence And Outcome Of Contrast Induced Nephropathy In Diabetic Hypertensive Patients With Stage 1to Stage 3 Ckd Undergoing Coronary/Peripheral Interventions As Detected By Egfr And Serum Creatinine**

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**Abstract**

**Background & Objectives:** Contrast-induced nephropathy is a leading cause of morbidity and mortality in high-risk patients undergoing any cardiac catheterisation especially among diabetic hypertensive patients with near normal creatinine. There have been many studies previously in diabetic patients developing CIN however not many studies have addressed the incidence and clinical predictors in combined hypertensive diabetics. The need for this study is to identify the incidence of contrast induced nephropathy, among diabetic hypertensive patients with normal serum creatinine and stage 1 to stage 3 CKD as assessed by eGFR undergoing cardiac catheterization.

**Materials & Methods:** The study was carried out in the Department of Cardiology, Sri Jayadeva Institute of Cardiology, Bengaluru. The study included patients like diabetic and hypertensive who are undergoing coronary/peripheral catheterisation attending the Department of Cardiology, Sri Jayadeva Institute of Cardiology, Bengaluru during the period of February 2016 to July 2017 (18 months study). Serum Creatinine was collected by pre and post catheterization in patients with diabetes undergoing cardiac catheterization and six months post procedure. Other variables were also calculated like hemoglobin, blood sugar and HbA1c, LVEF.

**Results:** Among 140 patients 26(18.57%) patients developed CIN and 114 (81.43%) did not develop CIN. Diabetic patients had significantly higher incidence of CIN (p value 0.013). Incidence of CIN in hypertensive patients was (15.8%) which was statistically insignificant. Patient with CKD as determined by eGFR <60 ml/min/1.73m<sup>2</sup> had significantly higher incidence of CIN (p value 0.039). Mean serum creatinine values pre, post and follow up after

6 months were 0.868, 0.956 and 0.962 mg/dl respectively (p value <0.001). Mean eGFR values pre, post and follow up after 6 months were 100.39, 90.74 and 89.57 ml/min/1.73m<sup>2</sup> respectively (p value <0.001). Mean Hb values pre, post and follow up after 6 months were 14.12, 13.30 and 13.9 gm/dl respectively (p value <0.001)

**Conclusion:** CIN is an iatrogenic disorder, resulting from the administration of Contrast media. Periprocedural blood loss, tachycardia, eGFR<60, low ejection fraction, diabetes, greater amount of contrast medium, and higher number of stents are important factors correlating with CIN. These risk factors are synergistic in their ability to predispose to the development of CIN. A careful risk-benefit analysis must always be performed prior to the administration of CM to patients at risk for CIN. Perhaps the most beneficial, and easily applicable, intervention is minimizing the amount of radio contrast dye used during the case.

**Keywords:** Nephropathy, Diabetic Hypertension, Creatinine, Catheterisation

### Introduction

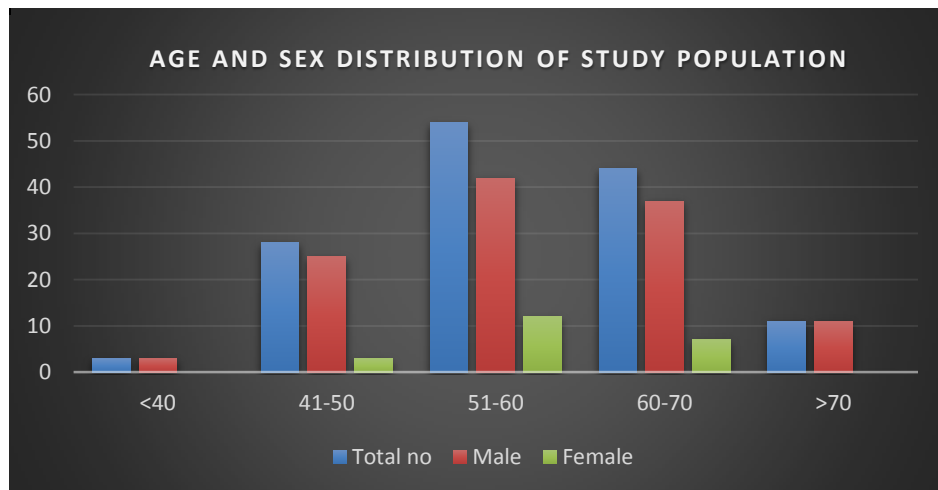
Kidney injury following cardiac catheterization may occur for several reasons, including radio contrast exposure, atheroembolism, or hypotension and renal hypo perfusion<sup>[1]</sup>. CIN, also called Contrast induced acute kidney injury (AKI), is one of the major adverse events taking place following cardiac catheterization procedures. It is defined as an elevation of serum creatinine more than 25% or  $\geq 0.5$  mg/dl from base-line within 48-72 hour<sup>[2,3]</sup> after exposure to a contrast agent compared to baseline serum creatinine values; accordingly, other etiologies for renal impairment including hypotension, urinary obstruction, nephrotoxins and atheromatous emboli should be initially excluded<sup>[4]</sup>. Contrast induced nephropathy (CIN) is the leading cause of morbidity and mortality in high risk patients undergoing cardiac catheterization and PCI using iodinated contrast media especially among diabetic hypertensive patients with near normal creatinine. CIN is associated with increased morbidity, short- and long-term mortality, and healthcare costs<sup>[5]</sup>. Risk factors for development of CIN include chronic kidney disease, large iodinated contrast volume, diabetes mellitus, advanced age, and especially periprocedural hemodynamic instability<sup>[6,7]</sup>. Despite the aggressive and increasing use of pre and post hydration protocols and low osmolar containing iodinated contrast media the incidence of CIN is high in general population. Since diabetes and hypertension are known risk factors for contrast induced nephropathy the incidence is even higher. Prevalence of CIN is highly variable and has been estimated to be about 13-25% in general population.<sup>[8]</sup> Despite low or iso-osmolar agents having been introduced and different preventive techniques being implemented, CIN is still the leading cause of iatrogenic AKI due to the expanding application of contrast media for imaging and intravascular procedures<sup>[9]</sup>. Pre-existing renal dysfunction and with eGFR less than 60 mL/min/1.73 m<sup>2</sup> is the main predictor of CIN<sup>[10]</sup>. The need for this study is to identify the incidence of contrast induced nephropathy, among diabetic hypertensive patients with normal serum creatinine and stage 1 to stage 3 CKD as assessed by eGFR undergoing cardiac catheterization.

**Materials & Methods :**

The study was carried out in the Department of Cardiology, Sri Jayadeva Institute of Cardiology, Bengaluru study included patients like diabetic and hypertensive who are undergoing coronary/peripheral catheterisation attending the Department of Cardiology, Sri Jayadeva Institute of Cardiology, Bengaluru during the period of February 2016 to July 2017 (18 months study).Serum Creatinine was collected by pre and post catheterization in patients with diabetes undergoing cardiac catheterization and six months post procedure. Other variables were also calculated like hemoglobin,blood sugar and HbA1c,LVEF.

**Results**

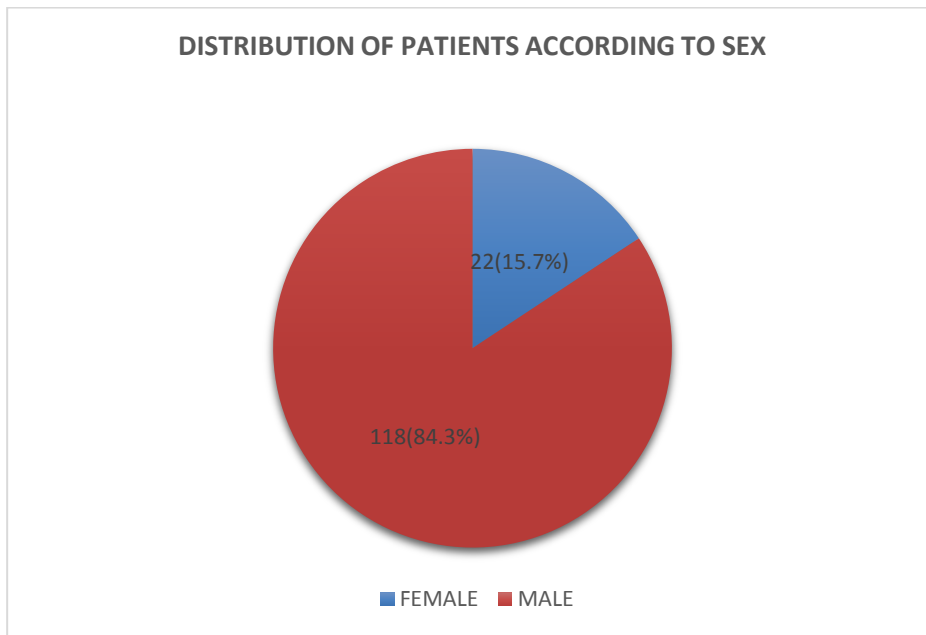
The study was conducted on total 140 diabetic & hypertensive patients undergoing elective or emergency PCI. Out of 140 patients, 22 (15.71%) were female and 118(84.3%) were male.



**Figure 1: Age and Sex Distribution of Study Population**

**Table:1**

Age group	Total no of cases	Percentage	Male	Percentage	Female	Percentage
<40	3	2.14	3	100	0	0
41-50	28	20	25	89.3	3	10.7
51-60	54	38.6	42	77.8	12	22.2
60-70	44	31.4	37	84	7	16
>70	11	7.9	11	100	0	0
<b>Total</b>	<b>140</b>		<b>118</b>		<b>22</b>	



**Figure 2: Distribution of Patients According to Sex**

**Table:2**

<b>GENDER</b>	<b>FREQUENCY</b>	<b>PERCENT</b>
<b>MALE</b>	<b>118</b>	<b>84.3</b>
<b>FEMALE</b>	<b>22</b>	<b>15.7</b>
<b>Total</b>	<b>140</b>	<b>100</b>

Out of the total 140 patients 22(16%) were females and 118(84%) were males. In the present study, 140 patients for cardiac and peripheral intervention were included, out of which 118 patients (84%) were male and 22 patients (16%) were females. On decade wise grouping, we found maximum number of patients between 51-60 years (38.6%). The mean age for the total number of patients was 58.02. The mean age for male patients was 58.27. The mean age for female patients was 56.63. Male to female ratio in the study group was 5.36:1

**INCIDENCE OF CIN**

Out of total 140 patients, 26 (18.57%) developed CIN.

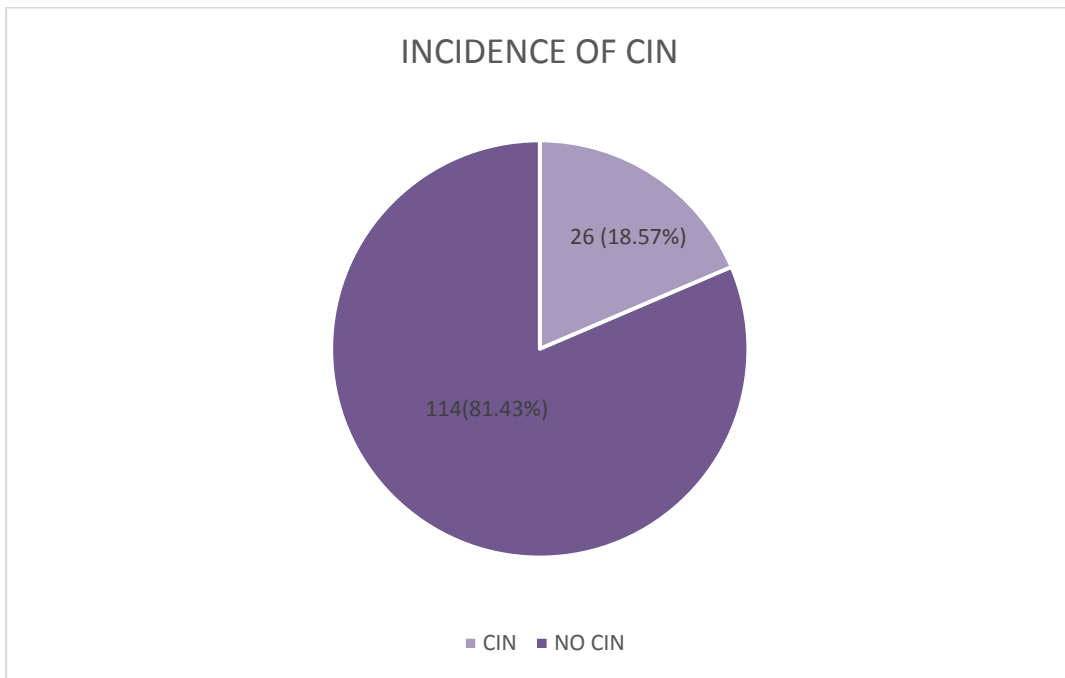
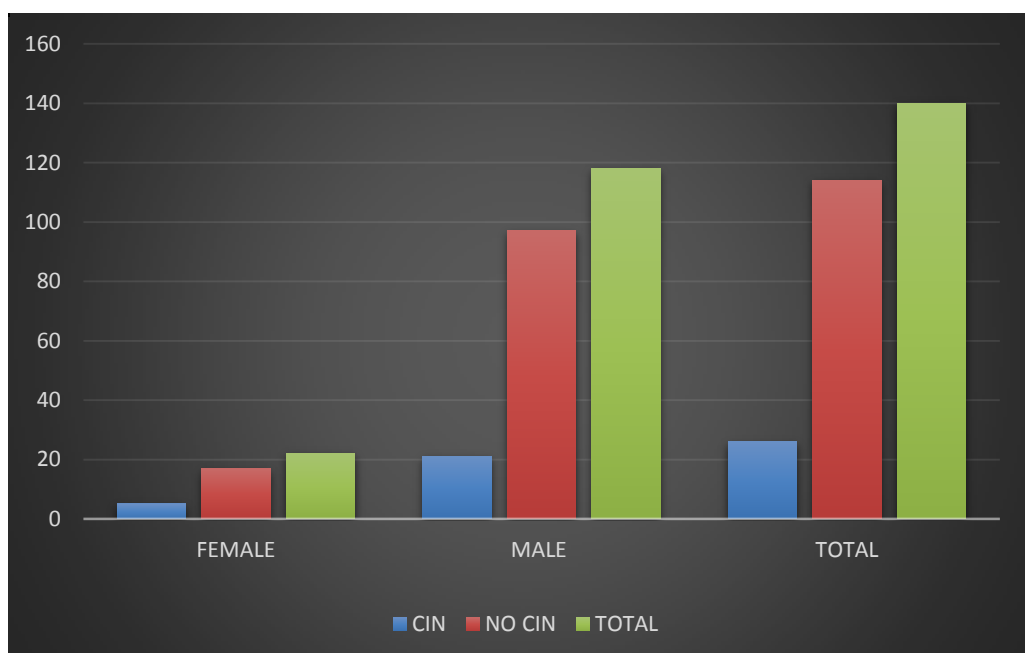


FIGURE3: NUMBER OF PATIENTS DEVELOPED CIN

Table:3

	Frequency	Percent
<b>CIN</b>	<b>26</b>	<b>18.57</b>
<b>NO CIN</b>	<b>114</b>	<b>81.43</b>
<b>TOTAL</b>	<b>140</b>	<b>100.0</b>

Out of 140 patients 22 patients developed CIN,118 patients did not develop CIN.Five females out of 22 developed CIN and 21 males out of 118 developed CIN.

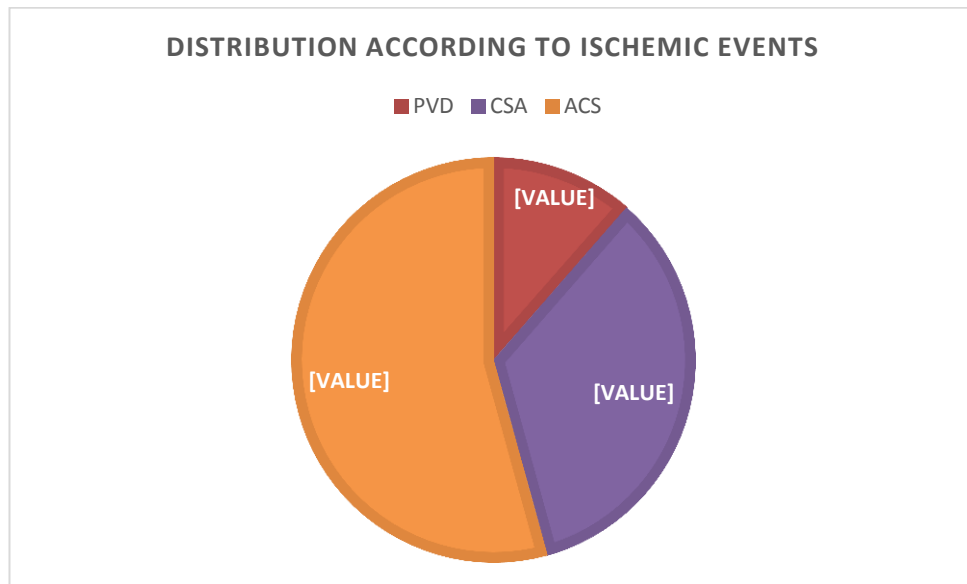


**Figure 4: Distribution of patients according to development of contrast induced nephropathy**

**Table:4**

	<b>FEMALE</b>	<b>MALE</b>	<b>TOTAL</b>
<b>CIN</b>	<b>5</b>	<b>21</b>	<b>26</b>
<b>NO CIN</b>	<b>17</b>	<b>97</b>	<b>114</b>
<b>TOTAL</b>	<b>22</b>	<b>118</b>	<b>140</b>

Out of 140 patients, 16(11%) had Peripheral vascular disease,48(34%) had chronic stable angina and 76 (54%) had history of acute coronary syndrome.



**Figure 5: Distribution of patients according to ischemic event**

**Table 5:**

<b>ISCHEMIC EVENT</b>	<b>Frequency</b>	<b>Percent</b>
<b>PVD</b>	<b>16</b>	<b>11.4</b>
<b>CSA</b>	<b>48</b>	<b>34.3</b>
<b>ACS</b>	<b>76</b>	<b>54.3</b>
<b>TOTAL</b>	<b>140</b>	<b>100</b>

Out of total 140 patients, 109 (78%) had Diabetes Mellitus and 31(22%) did not have Diabetes Mellitus.

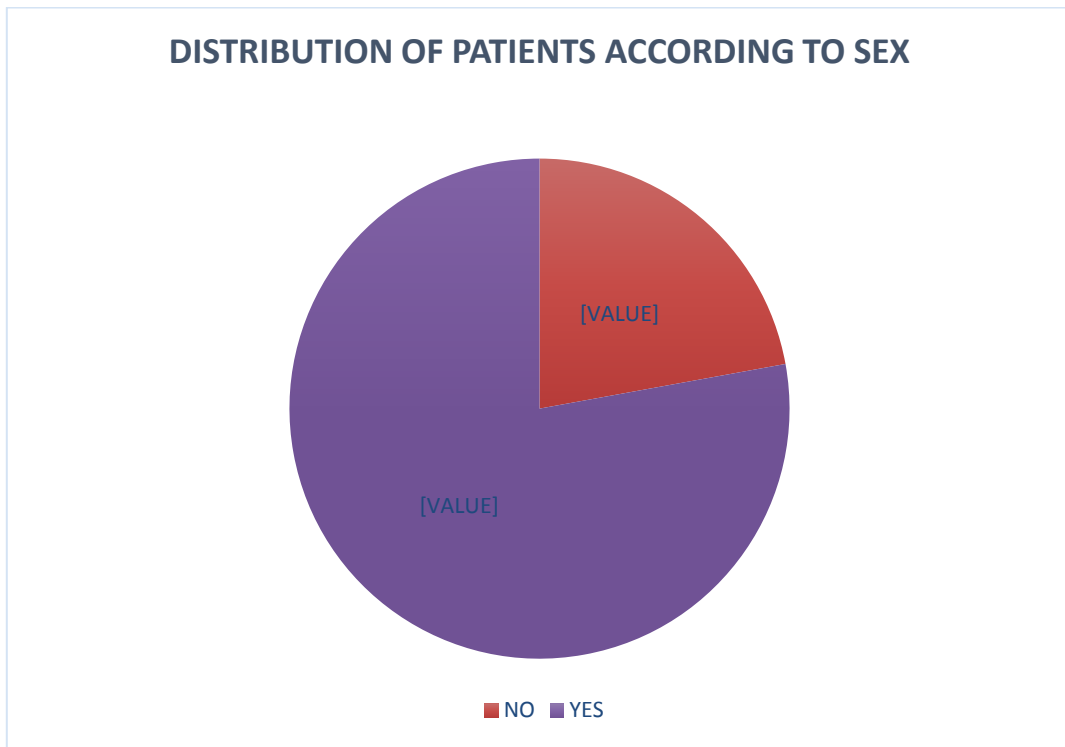


Figure 6: Number of patients with diabetes mellitus.

Table 6:

DM	Frequency	Percent
NO	31	22.14
YES	109	77.85
Total	140	100.0

Out of total 140 patients, 101 (72%) had Essential Hypertension and 39(28%) did not have Essential Hypertension.

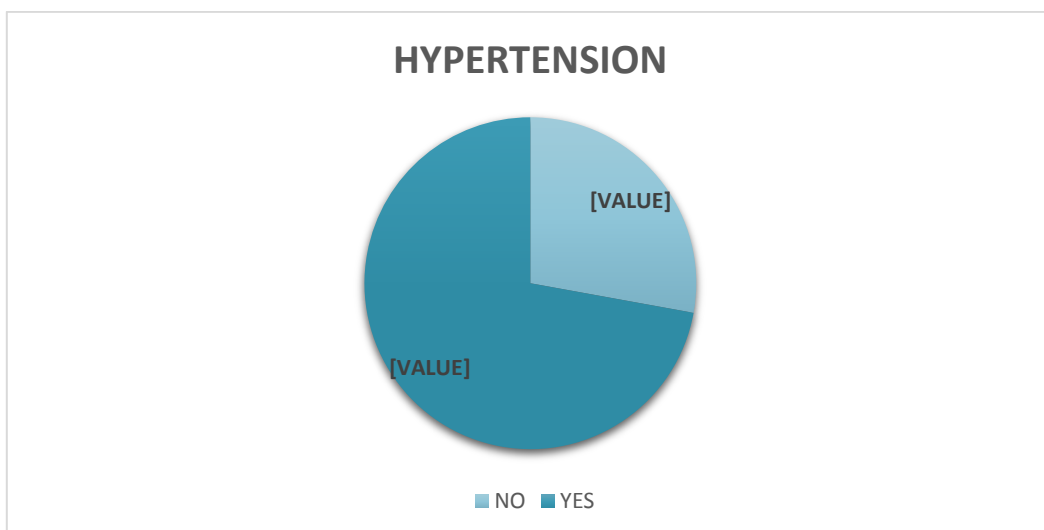


Figure 7: Number of patients with essential hypertension

Table 7:

HTN	Frequency	Percent
NO	39	27.85
YES	101	72.14
<b>Total</b>	<b>140</b>	<b>100.0</b>

Out of total 140 patients, 80 (57.14%) had both Diabetes Mellitus and Essential Hypertension and 60(42.86%) had either Diabetes or Hypertension.

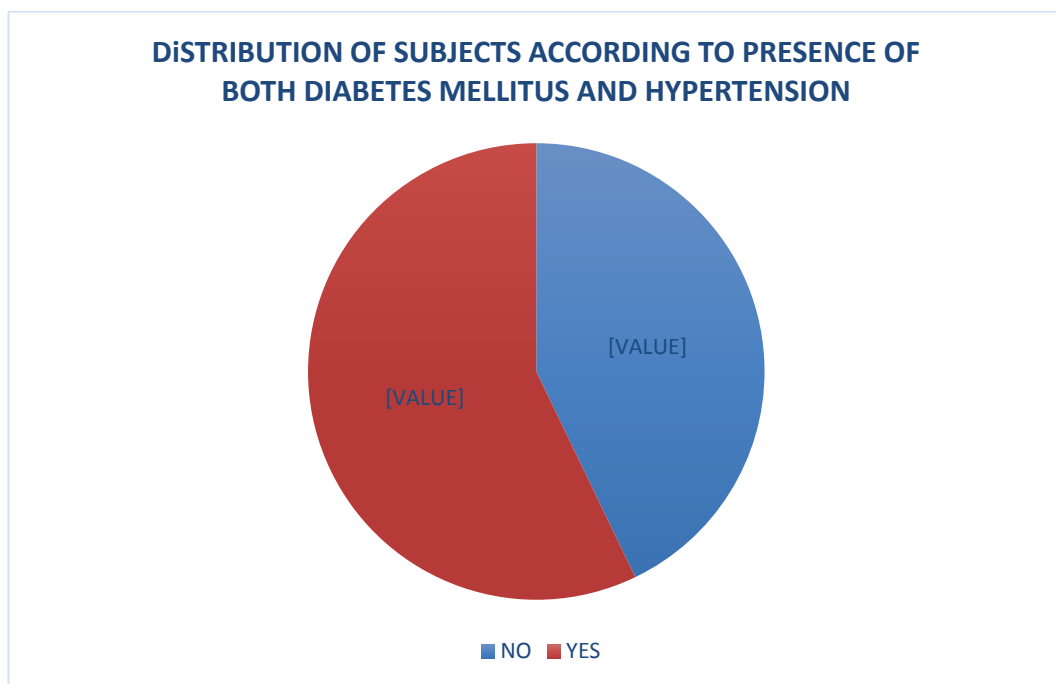


Figure 8: Number of patients with both diabetes and essential hypertension

Table 8:

BOTH	Frequency	Percent
YES	80	57.4
NO	60	42.6
<b>Total</b>	<b>140</b>	<b>100</b>

**Discussion**

The main findings of our study are that patients with diabetes undergoing cardiac/peripheral catheterization were associated with higher incidence of CIN when compared to the general population. The incidence of CIN is concordant with previous studies. The other important observation which we measured was low ejection fraction EF<40% was associated with a higher risk of CIN. Another new finding we observed was HbA1c was significantly higher in



patients with CIN. This was a prospective observational cohort study performed over 140 patients who had diabetes and hypertension. The patients underwent either elective or emergency PCI depending on the initial presentation. After the cardiac/peripheral catheterization procedure incidence of CIN was calculated, out of 140 patients, 26 (18.57%) patients developed CIN and 114 (81.43%) did not develop CIN. Baseline characteristics of patients in both the groups were comparable with respect to age, sex, blood pressure at the time of admission, hypertension, dyslipidemia, fasting and post prandial blood sugar level, packed cell volume, eGFR, vessel involvement involving RCA and LAD, LCX vessel involvement, & anemia. Diabetes, Reduced LVEF, LVEF < 40%, pulse rate, HbA1c, Hemoglobin, serum creatinine, eGFR < 60%, number of stents deployed, volume of contrast used were significantly higher in patients with contrast induced nephropathy as compared to patients without contrast induced nephropathy. The incidence of CIN in our study was 18.57% in our study comprised of diabetics and hypertensive patients. The results of the study are concordant with the study done by Orgesen et al. study. In their study the incidence of CIN was 20-30% in population with high risk groups which included diabetics, hypertensives and patients with CKD. The incidence of CIN in diabetics was 22.9% in our study. The results of the study were concordant with the study done by Nikolsky and Mehran<sup>11,12</sup>. In their study the incidence of CIN in diabetic patients varies from 5.7 to 29.4%. DM duration and DM complications are strictly related to an increased incidence of CIN. A recent observational prospective study showed that acute hyperglycemia represents a risk factor for CIN. In this study of diabetic patients, CIN occurred in 8 out of 19 patients (42%) with hyperglycemia and in 1 out of 19 patients (5.3%) with normal glycemia at the moment of PCI<sup>13</sup>. So it seems to be important to manage blood glucose levels in the periprocedural time. In addition, evidence suggests that even patients in a prediabetic state are at increased risk of CIN if they also have CKD. toprak et al.<sup>14</sup> showed that CIN occurred in 20% of patients with CKD and diabetes and in 11.4% of patients with CKD and prediabetes (defined as having a fasting glucose level of 5.55–6.94 mmol/l), versus 5.5% of patients with CKD but no evidence of diabetes or prediabetes. This observation suggests that mild glucose intolerance, which does not fulfil the current criteria for diabetes mellitus, increases the risk of CIN in the presence of renal impairment. In one study, despite pre-procedure hydration and the use of non-ionic CM, CIN occurred in one-third of 439 consecutive patients who underwent PCI and had baseline serum creatinine  $\geq 1.8$  mg/dl<sup>15</sup>. However, baseline creatinine is not reliable enough for identification of patients at risk for CIN. This is because serum creatinine value varies with age, muscle mass, and gender. Since creatinine production decreases with age, a normal serum creatinine in an elderly patient generally correlates with at least moderate decrease in renal function. To evaluate renal function reliably, assessment of creatinine clearance should be performed. While it is not practical to measure creatinine clearance directly, its estimation based on the Cockcroft–Gault formula or Modification of Diet in Renal Disease equation may be easily performed. Several studies showed that an estimated glomerular filtration rate (eGFR) of 60 ml/min/1.73m<sup>2</sup> is a reliable cut-off point for identifying patients at high risk for the

development of CIN. This make calculation of eGFR highly recommended before exposure to CM for the CIN risk assessment<sup>16,17</sup>

### **Conclusions**

CIN is an iatrogenic disorder, resulting from the administration of Contrast Media., The prognostic impact of CIN after percutaneous coronary/ peripheral intervention is substantial in diabetes and CKD patients. Although rare in the general population CIN occurs frequently in patients with underlying renal dysfunction, diabetes. Peri procedural blood loss, tachycardia, eGFR<60,low ejection fraction, diabetes, greater amount of contrast medium, and higher number of stents are important factors correlating with CIN. These risk factors are synergistic in their ability to predispose to the development of CIN. A careful risk–benefit analysis must always be performed prior to the administration of CM to patients at risk for CIN. Volume of contrast medium was one of the strongest predictor of CIN all attempts should be made to limit the amount of CM without compromising the result of the procedure. It is of utmost importance to assess patient kidney function by either calculating creatinine clearance or estimated GFR.Perhaps the most beneficial, and easily applicable, intervention is minimizing the amount of radio contrast dye used during the case. Additional renal protection may be afforded by volume expansion with intravenous hydration before, during, and after the catheterization, with administration rates guided by the patient’s intravascular volume status, clinical stability.It is of utmost importance to assess patient kidney function by either calculating creatinine clearance or estimated GFR .Further progress continues toward safer radio contrast agents, catheterization techniques, and therapeutic preventive strategies to minimize renal injury following angiographic procedures.

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