Research Article

Contrast Induced Nephropathy In Diabetic And Non-Diabetic Patients Underwent Percutaneous Coronary Intervention In Erbil City

Aram Taher. Aziz, *HD student interventional cardiology*
DR. Mohammad Hasan Alwan, *D.M, F.I.B.M.S(Med)F.I.B.M.S(Cardiol) Assistant professor cardiology, HMU*
Prof. Abdul Hameed Al Qaseer , *FICMs*

Date Submitted: 6/6/2016
Date Accepted:30/11/2016

Address for Correspondence:
Aram Taher. Aziz, HD student interventional cardiology

Abstract

Background: Since the advent of coronary angioplasty more than 3 decades ago, the volume of percutaneous coronary interventions has been rising progressively. Contrast medium was used in diagnostic coronary angiography and percutaneous coronary intervention. The use of iodinated contrast medium is a common precipitator of contrast-induced nephropathy.
The objective of this study was to evaluate the incidence for the development of Contrast induced nephropathy in diabetic and non diabetic patients underwent percutaneous coronary intervention which was not studied in Erbil before.
Patients and methods: One hundred twenty five consecutive patients,64 diabetic and 61 non diabetic underwent Percutaneous coronary intervention were included in this study which was conducted in Erbil surgical specialty center in Erbil. The renal function has been assessed before the procedure , 24hours and 1 week post procedure.
Results: The incidence of contrast induce nephropathy was 5.6%(7patients) one day and 13.6% (17patients) one week post procedure. There were a statistically significant association between development of contrast induce nephropathy in diabetic patients (P value<0.001), non-diabetic (P value 0.001). hypertensive patients (p value 0.03), ,contrast volume (P value 0.001),those who receieved intravenous fluid (p value 0.01) . Comparing diabetic with non-diabetic group there were a statistically significant association between volume of contrast in diabetic group (p value 0.001) and non-significant association with the non-diabetic group (p value 0.1).
Conclusions: Contrast induce nephropathy is an important complication developed after percutaneous coronary intervention and ,it is more in diabetic patients .

Key words: Contrast, Nephropathy, Diabetic, Coronary Intervention

INTRODUCTION

An intravenous pyelography in 1919 was the first reported parenteral application of an iodinated contrast medium.[1] Acute renal failure following intravenous pyelography in a patient with myelomatosis in 1954 was the first reported case of contrast induce nephropathy CIN.[2] It is the third most common cause of in-hospital acute renal failure (12%) after decrease renal perfusion (42%) and post-operative acute renal failure (18%).[3] The most common definition of CIN today is a relative increase of 25% or more, or an absolute increase of 0.5 mg/dl (44.2 µmol/L) or more in serum creatinine from baseline value 48–72 hr. following exposure to contrast. The first 24 h post-exposure appear to be crucial in the development of CIN. A study of the trajectory of serum creatinine elevation in the randomized Prevention of Radio contrast Induced Nephropathy Clinical Evaluation trial indicated that in 80% of CIN cases serum creatinine started to rise within the first 24 hr.[4,5] Among all the procedures that uses radio contrast materials for the purpose of diagnosis and therapeutics, coronary angiography and percutaneous coronary interventions (PCI) are associated with higher risk of

CIN.[6]

The advantages of the nonionic, low-osmolar agents include less hemodynamic loading, patient discomfort, binding of ionic calcium, depression of myocardial function and blood pressure and possibly fewer anaphylactoid reactions.[7]

All contrast media is excreted predominantly (99%) by glomerular filtration with about 1% excreted by the biliary system. The normal half-time of excretion is 20 minutes.[8] Adequate hydration is the simplest and most effective way of protecting renal function. Currently hydration is the only universally accepted method to prevent CIN.[9] Intravenous hydration seems better than oral hydration.[10]

PATIENTS AND METHODS

This prospective study was conducted in Erbil surgical specialty center in Erbil city between the 1st of March 2014 till 31th of December 2014.

Total of 125 consecutive patients who underwent PCI were included. The study population consist of 83males (66.4%) and 42 females (33.6%). Sixty four diabetic and 61nondiabetic patients were included in the study. The ages of patients ranged from 36 to 92 years old with mean age of 60.5±12.5. During the PCI all patients received contrast material in the form of Omnipaque which is composed of Lohexol 750mg , Trometanol 1.2mg, sodium calcium, Editate 0.1 mg and water for injection. High risk patients such as those with border line or impaired renal function, those who received high dose contrast during PCI, those who developed complications received intravenous fluid in the form of normal saline over a period of few hours. All included patients were counseled about the participation in the study and their informed consent has been obtained and the risk of development of contrast induced nephropathy has been explained for them. After taking history and physical examination basic investigations has been done pre PCI for all patients which include (Hb, FBS, Virology, RFT). Patients followed up for the development of contrast induced nephropathy by measuring renal function in the form of serum creatinine has been done before, after 24 hours and one week of the procedure in Erbil surgical specialty center laboratory by using REOCH HITACHI COBAS 311 analyzer manufactured by Roch diagnostics Ltd at 2010.

Exclusion criteria: the exclusion criteria were: 1- Patients with primary PCI 2- Patients with cardiogenic shock

RESULTS

Table 1 describes basic clinical, laboratory and angiographic data of patients.

DM=Diabetes Mellitus

Variable	Patients (N=125)	DM (N=64) (51.2%)	NDM (N=61) (48.8%)	P value
Age/Y <50 50-59 60-69 >70	Mean60.5±12 24(19.2%) 37(29.6%) 31(24.8%) 33(26.4%)	61.2±12.0 10(15.6%) 19(29.7%) 15(23.4%) 20(31.3%)	59.8±12.4 14(22.9%) 18(29.5%) 16(26.2%) 13(21.3%)	**0.4**
Males	83(66.4%)	39(60.9)	44(72.1%)	**0.011**
Females	42(33.6%)	25(39.1)	17(27.9%)	
Hypertension	73(58.4%)	42(65.6%)	31(50.8)	**0.012**
Scr d0	Mean 0.8±0.25	0.9±0.3	0.8±0.3	**0.1**
Renal dysfunction	3(2.4%)	1(1.6%)	2(3.3%)	**0.2**
Cardiac dysfunction	5(4%)	4(6.3)	1(1.6%)	**0.008**

NDM: No diabetes mellitus
Scrd0: serum creatinine before the procedure

The association between DM and the development of CIN is shown in table 2. The current study sample composed of 64 diabetic patients (51.2%) and 61 non-diabetic. Seven patients developed CIND1, five of them were diabetic and only 2 patients were non diabetic. The statistical association between DM and development of CIND1 was statistically non-significant (0.4). Regarding CIN1W it was more prevalent among the diabetic patients as among the 17 patients who developed CIN1W, 13 of them were diabetics and the statistical association between diabetes DM and development of CIN1W was significant (P value 0.02).

Table 2: Distribution of cases according to the association between diabetes mellitus and the development of both CIND1 and CIN1W

DM	CIND1		Total	P value	CIN1W		Total	P value
	No	Yes			No	Yes		
Yes	59	5	64 51.2%	0.4	51	13	64 51.2%	**0.02**
No	59	2	61 48.8%		57	4	61 48.8%	
Total	118	7	125 100%		108	17	125 100%	

Table 3: Comparing development of CIN in diabetic and non-diabetic group using paired sample t test

Diabetes Mellitus	ScrD0-Scr1W
Diabetic group	<0.001
Non diabetic group	0.001

In this study 73 cases were hypertensive (58.4%) and 52 cases were non hypertensive (41.6%). As shown in Table 4, CIND1 and CIN1W were more prevalent among hypertensive patients as among the 7 patients who developed CIND1, six of them were hypertensive and the statistical association between hypertension and development of CIND1 was non-significant (p value 0.1). Regarding CIN1W, among the 17 patient who developed CIN1W, 14 of them were hypertensive and the statistical association between hypertension and development of CIN1W was significant (p value 0.03)

Table 4: Distribution of cases according to the prevalence of Hypertension and the association between hypertension and the development of CIND1 and CIN1W

Hypertension	CIND1		Total	P value	CIN1W		Total	P value
	No	Yes			No	Yes		
Yes	67	6	73 58.4%	0.1	59	14	73 58.4%	**0.03**
No	51	1	52 41.6%		49	3	52 41.6%	
Total	118	7	125 100%		108	17	125 100%	

Table 5 describes the association between contrast volume and development of CIND1 and CIN1W. Among the 78 patients who received < 200cc contrast only2 patient developed CIND1 and among those who received >200 cc contrast 5 patients developed CIND1 and the statistical association between the dose of contrast and the development of CIND1 was significant (p value 0.05). The statistical association between the dose of contrast and the development of CIND1 was also tested separately for both diabetic and non-diabetic groups and was non-significant for both groups separately with P values of 0.2 and 0.06 respectively. Regarding the association between the volume of contrast and the development of CIN1W which was also more prevalent among the group who received larger doses of contrast as among the 17 patients who developed CIN1W, 13 of them received >200 cc contrast and the statistical association was significant (P value 0.001). The statistical association between the volume of contrast and the development of CIN1W was also tested separately for both diabetic and non-diabetic groups and was significant for the diabetic groups with P values of 0.001 and non-significant for the non-diabetic group with p value 0.1.

Table 5: Distribution of cases according to the association between the volume of contrast and the development of CIND1 and CIN1W

Dose of contrast	CIND1		Total	P value	CIN1W		Total	P value
	No	Yes			No	Yes		
<200cc	76	2	78	**0.050** Dm 0.2 0.06 non DM	74	4	78	**0.001** **0.001DM** 0.1 NDM
>200cc	42	5	47		34	13	47	
Total	118	7	125		108	17	125	

In the current study only 24patients had received intravenous fluid in the form of 500 ml 0.9% NaCl and those patients were high risk patients. As shown in Table 6: among the 24 patients who received, four patients developed CIND1 and the statistical association was significant (p value 0.009). This association also studied separately for both diabetic and non-diabetic groups which show non-significant association (P value 0.06 and 0.1) respectively. Regarding the development of CIN1W, among the 24patients who received intravenous fluid 7 patients developed CIN1W and the statistical association was significant (P value 0.01). This association also studied separately for both diabetic and non-diabetic groups which show significant for the diabetic group (P value 0.04) and non-significant for the non-diabetic group (P value 0.4)

Table 6: Distribution of cases according to the association between receiving intravenous fluid and the development of CIND1and CIN1W

Intra venous fluid	CIND1		total	P value	CIN1W		Total	P value
	No	Yes			No	Yes		
Yes	20	4	24	**0.009** DM 0.06 NDM0.1	17	7	24	**0.01** DM **0.04** NDM 0.4
No	98	3	101		91	10	101	
Total	118	7	125		108	17	125	

The development of CIND1 and CIN1W in both diabetic and the non-diabetic groups were compared using paired sample t test. The statistical association between diabetes mellitus and the development of CIND1 was strongly significant with P value <0.001 and it was also significant for the non-diabetic group with P value 0.014. Regarding the statistical association between DM and the development of CIN1W it was strongly significant with P value < 0.001 and for the non-diabetic group it was significant with P value 0.001.A s shown in Table 7.

Table 7: Comparing development of CIND1 and CIN1W in diabetic and non-diabetic group using paired sample t test

Diabetes Mellitus	ScrD0-ScrD1	ScrD0-Scr1W
Diabetic group	<0.001	<0.001
Non diabetic group	0.014	0.001

.

DISCUSSION

The CIN is an increasingly common event that warrants careful assessment of affected patients. Prevention of CIN requires careful identification of the factors that increase the risk and affect early and long-term outcome.

In the current study the incidence of CIN a week post procedure was 13.6% and this is comparable with the result obtained in the study from William Beaumont Hospital, as among 1826 patients treated with PCI the incidence of CIN was 14.5%.[11]

Regarding the association between DM and the development of CIN, in the current study there were a strongly significant association between DM and development of CIN (P value 0.02). Also in this study when comparing the rate of development of CIN between diabetic and non-diabetic patients the statistical association between diabetes mellitus and development of CIN was much more stronger (P value <0.001) which was in consistence with the result obtained by the study conducted by Rahman et al , as among 245 patients who underwent PCI and coronary angiography 59 patients developed CIN and among those 57 patients were diabetics (p value <0.001).[12]

In this study the statistical association between hypertension and development of CIN 1 week post procedure was significant (P value 0.03) . This result was in consistence with the result obtained in a study conducted by Hossein Nough et al there were a statistically significant association between hypertension and development of CIN (P value 0.02).[13] In the current study there were a statistically significant association between contrast volume and development of CIN with P value of 0.05 at day 1 and 0.001 one week post procedure. This result was in consistence with the result obtained in a study conducted by Kooiman et al (N= 82,120) who found a statistically significant association between contrast volume and development of CIN with (P value 0.004).[14]

In the current study only 24 patients had received intravenous fluid in the form of post procedure 500 ml normal slaine and it was administered only for the high risk group such as those receiving high dose of contrast volume >250-300 ml or those with complications during the procedure or those with preexisting renal function impairment. The statistical association between administering IVF and development of CIN D1 and CIN1W was significant with P values of 0.009 and 0.01 respectively. This was comparable with results obtained in a study conducted by Trivedi et al who compared the effects of intravenous normal saline at a rate of 1 ml/kg per hour for 24 hours beginning 12 hours before contrast administration versus hydration with unrestricted oral fluids on the incidence of CIN. One of 27 patients (3.7%) in the intravenous saline group suffered from CIN compared with 9 of 26 patients (34.6%) in the orally hydrated group (relative risk, 0.11; 95% CI, 0.02 to 0.79; *P*=0.005).[15] We conclude that contrast induce nephropathy is an important complication developed after PCI , it is more common in diabetic patients. Good hydration and using more save contrast is recommended especially in high risk patients.

REFERENCES

1. Heuser C. Pieloradiographia con iodure potascio y las injections intravenosas de iodure potascio en radiografia. Sem Med. 1919;26:424–427
2. Bartels ED, Brun GV, Gammeltoft A, Gjorup PA. Acute anuria following intravenous pyelography in a patient with myelomatosis. Acta Med Scand. 1954;150:297–302.
3. Hou SH, Bushinsky DA, Wish JB, Cohen JJ, Harrington JT. Hospitalacquiredbrenal insufficiency: a prospective study. Am J Med.1983;74(2):243–8.cited by *Tilman Perrin, Eric Descombes, Stéphane Cook*; Contrast-induced nephropathy in invasive cardiology; Swiss Med Wkly. 2012;142:w13608.
4. Stevens MA, McCullough PA, Tobin KJ et al. A prospective randomized trial of prevention measures in patients at high risk for contrast nephropathy: results of the P.R.I.N.C.E. Study: Prevention of Radiocontrast Induced Nephropathy Clinical Evaluation. J Am CollCardiol 1999; 33: 403–411.
5. Guitterez NV, Diaz A, Timmis GC et al. Determinants of serum creatinine Trajectory in acute contrast nephropathy. J. InteryCardiol 2002: 15: 349-354
6. McCullough PA, Sandberg KR. Epidemiology of contrast-induced nephropathy. Rev Cardiovasc Med 2003; 4(Suppl 5): S3–S9.
7. Hirshfield JW. Cardiovascular effects of contrast agents.Am J Cardiol. 1990;66:9F-17F.
8. Kern MJ. Selection of radiocontrast media in cardiac catheterization: comparative physiology and clinical effects of nonionic and ionic dimeric formulations. Am Heart J. 1991;122:195-201.
9. Murphy SW, Barrett BJ, Parfrey PS. Contrast nephropathy. J Am SocNephol 2000; 11:177-82.
10. Persson PB, Patzak A. Renal hemodynamic alternation in contrast medium nephropathy and the benefit of hydration. Nephrol Dial Transplant 2005;20 (suppl):i2-i5.
11. R Mehran and E Nikolsky, Contrast-induced nephropathy: Definition,epidemiology, and patients at risk; Kidney International (2006) 69, S11–S15.
12. Rahman MM, Haque HS, Banerjee SK, Ahsan SA, Rahman MF, Mahmood M, Salman M, Azam MG;Contrast induced nephropathy in diabetic and non-diabetic patients during coronary angiogram and angioplasty; Mymensingh Med. J . 2010 Jul;19(3):372-6.
13. e90233Nough H, Eghbal F, SoltaniM., Nejafi F FalahzadehH, Fazel H and Sheikhvatanb M; Incidence and Main Determinants of Contrast-Induced Nephropathy following Coronary Angiography or Subsequent Balloon Angioplasty;;Cardiorenal Med 2013;3:128–135.
14. Kooiman J,Seth M , Share D , Dixon S , and Hitinder SG;The Association between Contrast Dose and Renal Complications Post PCI across the Continuum of Procedural Estimated Risk, PLoS One. 2014; 9(3):
15. Trivedi HS, Moore H, Nasr S, Aggarwal K, Agrawal A, Goel P, Hewett J. A randomized prospective trial to assess the role of saline hydration on the development of contrast nephrotoxicity. *Nephron ClinPract.* 2003; 93: C29–C34.