Serum Creatinine Level doesn't Change much at 2nd Day after Percutaneous Coronary Intervention (PCI): Amount of Contrast Injected may be the Key Factor

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Dept. of Invasive and interventional Cardiology, Apollo Hospitals Dhaka Abstract:

Key Words :
PCI, AKI, CIN

Abstract:

Background: *The changes in serum creatinine level after Percutaneous coronary Intervention has been reported by different authors.*

Methods: *Total 87 (Male71: Female 16) patients were enrolled in this very preliminary study who underwent elective PCI and has normal serum creatinine level. Total 116 stents were deployed in 108 territories. Mean age for both male : female were (55: 58) yrs. Associated CAD risk factors were Dyslipidemia, High Blood pressure, Diabetes Mellitus, Positive FH for CAD and Smoking (all male).*

Results: *Among the study group; 65(74.3%) were Dyslipidemic, 74(85%) were hypertensive; 52(58%) patients were Diabetic, FH 12(13.8%), Hypothyroid 3(3.4%) and 30(42.3%) were all male smoker. Female patients were more obese (BMI: M 25: F 28). Average uses of contrast material was 81 ml. Serum Creatinine level was pre-procedural male: female (1.35: 1.44) and post-procedural 2nd day for male: female were (1.24: 1.45). Common stented territory was LAD 48(44.4%), RCA 41(38%), and LCX 19(17.6%). Stent used were all DES. Among them, Everolimus eluting stents 69 (70.4%), Sirolimus Eluting stents 22(22.4%) and Biolimus Eluting stents 7 (7.1%).*

Conclusion: *In the current prospective non randomized study, we found that the cautious injection of Iodinated contrast doesn't change post procedural s. creatinine level at 2nd day-of PCI.*

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Introduction:

The risk of percutaneous coronary interventions is increased in patient with renal dysfunction with impaired acute and long-term outcomes compared with the general populations.[1,2] Chronic kidney diseases (CKD) carries an increased risk of death, cardiovascular events and hospitalization.[3] Even, mild CKD is associated with worsened outcomes after myocardial infarction.[4] Compared with the general population, patients with CKD are more likely to have CAD and exhibits an advance stage of disease at the time of primary diagnosis or coronary revascularization.[5] Heart failure is associated with chronically impaired renal functions, irrespective of the presence of CAD.[6] On the contrary, patients with CKD reveal a higher frequency of diffuse disease and an increased rate of multivessel disease, applied contrast volume are generally higher compared with regular patients.[7]

Although the risk of CIN in preserved renal function is very low, the risk for patients with risk factors such as chr. renal failure and diabetes is considerably increased.

The continuing growth in diagnostic imaging and Percutaneous coronary intervention increases the number of patients exposed to iodinated contrast agents. Contrast Induced Nephropathy (CIN) is one of the important causes of renal failure and is associated with morbidity and mortality after coronary intervention.[8-10] The typical clinical feature of CIN is a transient rise in serum creatinine beginning with first 24hrs of contrast injection, typically reaching peak within 2-3 days and returning to baseline within 2 weeks.[11]

The purpose, of this prospective non-randomized cohort study was to see effects of the radio-opaque contrast material, on serum creatinine level in our patient populations with normal serum creatinine after elective PCI.

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Methods:

Study Population:
From January 2015 to December 2015, total 87 patients with pre-PCI normal serum creatinine level were selected for the study, after getting written consent from patient as well as the first degree relative. In this observational study we wanted to see the changes of serum creatinine level at day-2 post -PCI.

Definitions
The common definitions of contrast induced AKI is an absolute increase of s. creatinine level of >0.5mg/dl or relative of >25% after exposure to iodinated contrast materials compared to baseline level at 48 to 72 hour after the exposure to contrast media.[12] The choice of 48 to 72 h as the window for the last serum creatinine measurement in the present study followed the recommendation of Contrast-Induced Nephropathy Consensus Panel.[13]

Besides ionicity, contrast media are categorized according to their osmolality as high-osmolar (osmolality >1000 mosm/kg), low (600-1000msm/kg), and iso-osmolar (280-290mos/kg).[14] Now a days high osmolar contrast replaced by low or iso-osmolar contrast because of better tolerability, lower side effects and low incidences of CIN.[16]

Drug Therapy
All the patients received Aspirin 300 mg/day and Clopidegrol as a loading dose 300 mg prior to PCI and continued for 9-12 months and received atorovastatin along with standard medical management for CAD. During the procedure, an intravenous heparin bolus (lOOIU/Kg) and GP Ilb/IIIa receptor blocker Integrillin were administered as required. The use of GP Ilb/IIIa Receptor blocker was recommended as per protocol.

The use of N-acetylcysteine (NAC) was as per individual operator's discretion and hydration with IV normal saline at least 3-5 hrs before the index procedure, throughout the

/ventional procedures and at least for 12hr after contrast material (CM) administration were individual operators discretion and based on renal function status and LV ejection fraction.

Stents:
Among the stent used; Sirolimus Eluting stent - Orsiro, Bitronik, Everolimus Eluting stent-(Boston Scientific and Abbott vascular) and Biolimus Eluting stents- (Noboriand Biosensor).

Data: Data were presented as mean ± SD with percentage.

Limitations: We measured S. Creatinine level at base line and day-2 i.e., first 24hrs post PCI. Due to financial constrain, we were not able to measure S. Creatinine at day 2-3 and 2wks post-PCI time, to compare the effects of contrast material on kidney in our settings.

Results:
We have carried out this very preliminary non-randomized, non-comparative prospective cohort study of a very small number population in our center who underwent PCI. We did not found that there is gross changes of pre and post procedural Serum Creatinine level. In the Table 1. Shows the profile of studied population. Female patients were more obese (BMI; M 26: F 27 and having CAD in advance age (M: 55: F58). Table 2. Shows the average size of stent used. Table 3. Shows serum Creatinine level before and after PCI with the amount of contrast used. Average uses of contrast material was 81 ml. Serum Creatinine level was pre-procedural male: female (1.35: 1.44) and post-procedural 2nd day for male: female were *m* : 1.4Drig 1. snows tne percentage distribution of CAD risk factors. Among the study group; 65(74.3%) were Dyslipidemia, 74(85%) were hypertensive; 52(58%) patients were Diabetic, FH 12(13.8%), Hypothyroid 3(3.4%) and 30(42.3%) were all male smoker. Fig 2. Shows the percentage distribution of the common stented territory. Common stented territory was LAD 48(44.4%), RCA 41(38%), and LCX 19(17.6%).

Fig 3. Shows the percentage distribution of different DES. Among them, Everolimus.Eluting stents 69 (70.4%), Sirolimus Eluting stents 22(22.4%) and Biolimus Eluting stents 7 (7.1%) were used. Fig 4. Showed the serum Creatinine level before and after the PCI. Fig 5. Showed Correlation between increment level of SCR level and amount of contrast used

Discussion:
Acute Kidney injury (AKI) or Contrast induced nephropathy is a common, serious problem of percutaneous coronary intervention that is associated with increased morbidity, mortality (MI, Death) and health care cost.[15"17] Conditions that heighten the risk of CIN such as chronic kidney disease, diabetes, congestive heart failure, hemodynamic instability, and anemia are not typically modified able at the time of cardiac catheterization, but other strategies has emerged to minimize the nephrotoxicity of contrast media. The pathophysiology of Contrast induced

nephropathy is not well understood, is thought to have multiple possible mechanism. Such as alteration in renal hemodynamic, rheological properties, endocrine and paracrine factors (adenosine, endothelin and reactive oxygen species), hyper-osmolar and hyperviscious alteration of intratubular fluids and direct cytotoxic effects on renal tubular cell.[18] Although, the eGFR is associated with higher risk of acute kidney injury as denned by Creatinine, this risk is independent or exposure to contrast material.[19]

Iso-osmoler and Low-osmolar contrast media are less likely than other types of contrast to be associated with CIN.

Proven effective preventative measures against CIN in PCI patients include hydration with normal saline and minimization of contrast.[20"22] The Benefits of N-acetyl Cysteine or . isotonic sodium bicarbonate remains controversial with considerable disagreement between various studies and meta-analysis.[22"23]

It is thought patients with certain risk factors , including worse baseline renal function, DM, advance age are more prone to contrast -induced nephropathy than those without risk. In our present population, incidence of DM is the third common prevalence's of CAD risk factors after Dyslipidemia as first and HTN as second. FH, Hypothyroid and smoking were the other CAD risk factors.

Joshua et al has demonstrated that pre-procedural glucose is associated with greater risk for CI-AKI in patients whom undergo coronary angiogram in the setting of AMI. Much care is needed to prevent CIN by using peri-procedural hydration. Intra-arterial administration of contrast, not only, but the higher amount of contrast injected in coronary angiogram are responsible for CIN. Arterial manipulation exposes patients to other forms of nephropathy, such as cholesterol embolization - induced AKI. 24 Approximately, 7% patient undergoing a PCI experience in AKI, which is strongly associated with in-hospital mortality.[25] Acute Kidney injury after a PCI is a common and serious complication of the procedure and is associated with an increased risk of MI, dialysis and Death.[26-29]

Even, small increases 01 serum Creatinine have been associated with increased hospital length of stay and excess cost as well.[30]

In this very preliminary non randomized prospective observational cohort study we did not found any gross or significant changes of serum Creatinine level at 2nd post PCI day. We found that, negative correlation between increment level of SCR and amount of contrast used, indicated that the minimal usage of iodinated contrast material, pre and post PCI hydration and usage of N-Acetyl cysteine, may not increase the post PCI serum creatinine level.

Although, it is very difficult to conclude the effect of contrast used in inducing contrast induced nephropathy. In this regard, we need more patient inclusion and follow-up by estimating serum Creatinine level at day 2-3, two weeks interval by which Creatinine comes to baseline as mentioned earlier. Contrast amount uses, might be key a factor in inducing CIN, which is in need to be investigated in our patient population. If possible, we need more patient inclusion and more comparison of serum Creatinine level, different days after post-PCI period. In our patient perspective, to avoid or overcome CIN, we need to set a standard amount of contrast dose in our population. As many of the patients are reluctant to have Creatinine test several times after PCI due to financial restrain in our socioeconomic standards. In addition, the development of patient awareness may also be the key factor in preventing the CIN.

Thomas[25] et al has demonstrated that approximately 7% of patients undergoing a PCI experience AKI, which is strongly associated with in-hospital mortality. Defining strategies to minimize the risk of AKI in patients undergoing PCI. are needed to improve the safety and outcomes of the procedure.

The rate of CIN, in high-risk patients who undergo coronary angiography or percutaneous coronary intervention is not statistically different between use of iopamidol-370 or iodixanol- Iopamidol-370 demonstrated a significantly smaller mean increase of S. Creatinine. Therefore, iopamidol-370 may be used at least as safely as iodixanol-320 in this high-risk clinical setting.

In the era of PCI, CIN is a frequent complication, even in patients with normal renal function, and is associated with a more complicated in-hospital course and very high mortality rate. Thus, newer preventive strategies of renal protection during PCI are warranted, particularly in high-risk patients.

Conclusion:

Patients with decreased renal function at baseline are treated as being the higher risk of contrast-induced nephropathy, and peri-procedural IV

hydration often is used for patients prior to contrast exposure. As renal impaired patient or patient with CKD with or without dialysis may have advance stage of coronary artery disease with multi-vessel involvement. Therefore, PCI of these patient populations, cautious injection of reduce amount of iodinated contrast material and sub-sequent post procedural follow-up could help from further worsening of their disease condition.

Draw-backs and future perspectives: Our main drawback was that, this is an observational non-randomized prospective cohort. Serum Creatinine level was estimated only at 2nd post PCI day. We need more patient inclusion and compare S. Creatinine level at day 2, 3, 7, 14 and 21 days post PCI. Thereby, need to find out the safest amount of iodinated contrast material needs to optimize CIN and thereby reduce morbidity and mortality.

Conflict of Interest - None.

References:

l. Osten MD1, Ivanov J, Eichhofer Impact of renal insufficiency on angiographic, procedural, and in-hospital outcomes following percutaneous coronary intervention. Am J Cardiol. 2008 Mar 15; 101(6):780-5.

2. Gruberg CCI02) Luis Gruberg MD1,*, George Dangas MD, PhD2, Roxana Mehran MD2 Clinical outcome following percutaneous coronary interventions in patients with chronic renal failure Catheterization and Cardiovascular Interventions Volume 55, Issue 1, pages 66-72, January 2002

3. Go AS, Chertow GM, Fan D et al Chronic Kidney Disease and the Risks of Death, Cardiovascular Events, and Hospitalization. N Engl J Med 2004; 351:1296-305

4. Anavekar NS, McMurray JJV, et al. Relation between Renal Dysfunction and Cardiovascular Outcomes after Myocardial Infarction N Engl J Med 2004; 351:1285-1295

5. Lemos PA1, Arampatzis CA, Hoye A Impact of baseline renal function on mortality after percutaneous coronary intervention with sirolimus-eluting stents or bare metal stents. Am J Cardiol. 2005 Jan 15; 95(2).T67-72

6. Ezekowtiz J, McAlister FA, Humphries KH et al. The association among renal insufficiency, pharmacotherapy, and outcomes in 6,427 patients with heart failure and coronary artery disease. J Am Coll Cardiol 2004; 44(8): 1987-1992

7. Davidson CJ, Laskey WK, Hermiller JB, et al. Randomized trial of contrast media utilization in high-risk PTCA: the COURT trial. Circulation. 2000 May 9;101(18):2172-7.

8. Katzberg RW, Haller C. Contrast induced nephrotoxicity: clinical landscape. Kidney Int Suppl 2006:S3-7

9. Mehran R, Aymong ED, Nikolsky E, et al. A simple risk score for prediction of contrast-induced nephropathy after percutaneous coronary intervention: development and initial validation. J Am Coll Cardiol 2004; 44:1393-9

10. McCullough PA, Wolyn R, Rocher LL, Levin RN, O'Neill WW. Acute renal failure after coronary intervention: incidence, risk factors, and relationship to mortality. Am J Med 1997; 103:368-75.

11. Goldenberg I, Matetzky S,. et al. Nephropathy induced by contrast media: pathogenesis, risk factors and preventive strategies. CMAJ. 2005 May 24; 172(11): 1461-1471.

12. Solomon R, Deray G. How to prevent contrast-induced nephropathy and manage risk patients: practical recommendations. Kidney Int Suppl 2006:S51-3.

12. Mehran R, Nikolsky E. Contrast-induced nephropathy: definition, epidemiology, and patients at risk. Kidney Int Suppl 2006:S11-5.

14. Parfrey PS, Barrett BJ. High-osmolality and low-osmolality contrast agents. N Engl J Med. 1992 Jul 16; 327(3):204-5.

15. Rihal Circ 2002, Rihal CS, Textor SC, Grill DE, et al. Incidence and prognostic importance of acute renal failure after percutaneous coronary intervention. Circulation 2002; 105:2259-64.

16. Liss P, Persson PB, Hansell P, Lagerqvist B. et al. Renal failure in 57 925 patients undergoing coronary procedures using iso-osmolar or low-osmolar contrast media, Kidney Int. 2006 Nov;70(10):1811-7

17. Barrett BJ1, Parfrey PS. Et al. Clinical practice. Preventing nephropathy induced by contrast medium. NEJM 2006 N Engl J Med. 2006 Jan 26; 354(4):379-86.

18. Stratta P, Bozzola C, Quaglia M, et al. (2012). Pitfall in nephrology: contrast nephropathy has to be differentiated from renal damage due to atheroembolic disease. Journal of nephrology 25(3):282-9.

19. McDonald RJ, McDonald JS, Bida JP, et al. Intravenous contrast material-induced nephropathy: causal or coincident phenomenon? Radiology 2013;267(1):106-118

20. Solomon R, Werner C, Mann D et al. Effects of Saline, Mannitol, and Furosemide on Acute Decreases in Renal Function Induced by Radiocontrast Agents. N Engl J Med 1994; 331:1416-1420

21. Kahn JK, Rutherford BD, McConahay DR et al. High dose contrast agent administration dyuring complex coronary anmgioplasty. Am Heart J 1990;120:533-6

22. Meier P, Ko DT, Tamura A et al. Sodium bicarbonate based hydration prevents contrast: induced nephropathy: a meta analysis BMC Med 2009;7:23

23. Nallamothu BK1, Shojania KG, Saint S et al. Is acetylcysteine effective in preventing contrast-related nephropathy? A meta-analysis. Am J Med. 2004 Dec 15; 117(12):938-47.

24. Fukumoto Y, Tsutsui H, Tsuchihashi M, Masumoto A, Takeshita A. The incidence and risk factors of cholesterol embolization syndrome, a complication of cardiac catheterization: a prospective study. J Am Coll Cardiol 2003; 42:211-6. _

25. Thomas T. Tsai, MD, MSc,*y Uptal D. Patef MD,z Tara *L* Chang, et al. Contemporary Incidence, Predictors, and Outcomes of Acute Kidney Injury in Patients Undergoing Percutaneous Coronary Interventions. J Am Coll Cardiol intv 2014;7:1-9