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RESEARCH ARTICLE

RISK FACTORS OF CONTRAST INDUCED ACUTE KIDNEY INJURY -A SINGLE CENTRE STUDY IN A TERTIARY HOSPITAL OF BANGLADESH

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ABSTRACT

Background: Contrast induced Acute Kidney Injury (CI-AKI) is a potentially reversible cause of acute kidney Injury (AKI) following intravascular contrast administration. Common diagnostic procedures like computed tomography (CT), coronary angiogram (CAG) and intravenous urography (IVU) utilize intravascular iodinated contrast media. This cross sectional observational study was conducted in a tertiary hospital of Bangladesh to assess the proportion of CI-AKI with their risk factors over a period of six months.

Material and Methods: Total 50 patients were included in the study. Twenty four had hypertension (HTN) and 14 had Diabetes mellitus (DM). Serum creatinine (Scr) of fourteen patients was ≥ 1.2 mg/dl. We measured serum creatinine at baseline (before procedure) and 48 hours after the procedure. CI-AKI was defined as rise in serum creatinine ≥ 0.5 mg/dl or 25% rise from baseline. Data was analyzed by computer based software SPSS-19 and p value <0.05 was considered statistically significant.

Results: Among 14 diabetic patients seven (50.0%) developed CI-AKI, among 24 hypertensive patients six (25.0%) developed CI-AKI, among 14 patients with baseline serum creatinine level ≥ 1.2 mg/dl ten (71.4%) developed CI-AKI. Statistical analysis showed base line serum creatinine ≥ 1.2 mg/dl ($p<0.000$) and DM ($p<0.05$) are the important predictor for the development of CI-AKI. Though CI-AKI was more in the hypertensive, male and age >50 years, but there was no statistical significance ($p>0.05$). Diabetic patients and patients with Scr. ≥ 1.2 mg/dl had 2.5 times and 6.4 times higher risk of developing CI-AKI respectively.

Conclusions: Though it was a small hospital based cross sectional descriptive study, yet Diabetes and even mild degree of renal insufficiency were found to be risk factors predicting CI-AKI following coronary angiogram, contrast CT and IVU.

INTRODUCTION

Contrast induced Acute Kidney Injury (CI-AKI) is the third commonest cause (about 10% cases) of in- hospital AKI (Cohan and Dunnick, 1987). CI-AKI is usually defined as a post contrast transient increase in SCr level of at least 0.5 mg/dl or of more than 25% above pre contrast values occurring within 24 to 48 hours of the administration returning to baseline value within 7 days (Langner *et al*., 2008). The risk of CI-AKI is low in patients with normal renal function (Gleeson and Bulugahapitiya, 2004). DM in presence of preexisting renal impairment is the major risk factor (Gleeson and Bulugahapitiya, 2004). Other additional risk factors are HTN, pre-existing CKD, advancing age, cardiovascular disease, multiple myeloma and high dose contrast (Manske *et al*., 1990). Even in developing country imaging procedures using intravenous contrast are increasing and so also proportion of CI-AKI. Comparing age and sex matched population without nephropathy the mortality of CI-AKI is higher (34%vs 7%) (McCullough *et al*., 1997, Levy *et al*., 1996). Moreover it remains under reported due to unawareness and follow-up post procedure Scr assay especially in resource limited country.

The causes of CI-AKI are vasoconstriction and direct tubolotoxicity due to reduction of antioxidant enzymes (Yoshioka *et al*., 1992). CI-AKI can be prevented by some measures such as N- Acetylcysteine, Ascorbic acid, intravenous Sodium bicarbonate and normal saline which are available even in primary health care level. Nationally we have very scanty data about the incidence of CI-AKI in our country. In this decade, contrast CT scan and IVU is done even in district hospitals and CAG is done even in peripheral tertiary hospital. This study was aimed at to find out proportion of CI-AKI and associated risk factors following contrast agents in a tertiary level hospital.

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MATERIALS AND METHODS

This cross sectional descriptive study was conducted in the Department of Medicine, Neuromedicine, Nephrology and Cardiology Department of Chittagong Medical college Hospital, Bangladesh through January 2010 to July 2010. Total 50 patient exposed to intravenous contrast agents were included. Scr >2mg% and Uses of Nephrotoxic agents (aminoglycoside, metformin and non-steroidal anti-inflammatory drugs) within 3 days before the procedure were excluded. The study was approved by the departmental committee. After getting informed written consent patient's age, sex, blood pressure, glyacaemic status, pre procedural Scr and 48 hrs post-procedural Scr were noted in predesigned data sheet. The patients were divided into two groups: those with a baseline serum creatinine value of ≥1.1mg/dl, or those with a baseline serum creatinine value of ≤1.2mg/dl. Venous blood glucose and serum creatinine were measured enzymatically on a technicon RA –XT analyzer (Technicon Ltd, Dubline, Treland). The relation between the incidence of CI-AKI with age, sex and presence and absence of hypertension, diabetes mellitus, and degree of renal insufficiency were analyzed using SPSS software package (SPSS for Windows version 15, SPSS Corporation). P value <0.5 was taken as significant.

RESULTS

Mean age of the patient was 48.46±13.93 years. Two-third of the patients were male. Mean Scr was 0.98 ± 0.31mg%. Baseline Scr ≤1.1 mg was in 72% of cases (Table 1).

Table 1. Baseline characteristics of patients (n = 50)

Variables	Frequency	Percentage
Age		
≤50 years	24	48
>50 years	26	52
Sex		
Male	34	68
Female	16	32
Baseline Scr		
≤1.1 mg%	36	72
≥1.2	14	28
Distribution Of CIN		
Present	14	28
Absent	36	72

Table 2. Distribution of CI-AKI by different variables (n = 50)

Variable	CIN Present	CIN absent	P value*
Age			
≤50 years	05(20.8)	19(79.2)	0.278 NS†
>50 years	09(34.6)	17(65.4)	
Sex			
Male	11(32.4)	23 (67.4)	
Female	03(18.8)	13 (81.2)	0.318 NS
HTN			
Present	07(29.2)	17(70.8)	
Absent	07(26.9)	19(73.1)	0.860 NS
DM			
Present	07 (50)	07(19.4)	
Absent	07(50)	29 (80.6)	0.031 S‡
Scr (mg%)			
≤1.1	04(11.1)	32(88.9)	
≥1.2	10(71.4)	04 (28.6)	0.000 HS″

*Chi-square test was done to measure the level of significance. Figures within parentheses indicate percentages
†NS : Not significant; ‡S : Significant; ″HS : highly significant

Though CI-AKI was more in male, age >50 years and hypertensive patients but it was not significant. Baseline Scr ≥ 1.2 mg % and presence of DM significantly increased CI-AKI (Table 2). DM increased risk of CI-AKI more than two times and Scr ≥1.2 mg% increased risk of that more than six times (Table 3).

Table 3. Multiple logistic regressions for risk factors of CI-AKI

Variables	P value	Odds Ratio	95.0% C.I. for Odds Ratio
Age (> 50 Yrs)	0.960	1.36	0.81 – 2.29
Sex (Male)	0.552	1.23	0.85 – 1.78
Hypertension	0.577	1.06	0.56 – 1.98
Diabetes	0.468	2.57	1.10 – 5.99
Serum Creatinine (≥ 1.2 mg/dl)	0.001	6.43	2.41 – 17.15

DISCUSSION

This cross sectional descriptive study was conducted to evaluate risk factors of CIN due to coronary angiogram, contrast induced CT and intravenous urography (IVU) in a tertiary hospital of Bangladesh over a period of six months. Though in other study done mean age was higher and CI-AKI occurrence more in advanced age, mean age is below 50 years and no significant age related increase of CI-AKI in our study due to earlier onset of Ischaemic heart disease in our society and small sample size (Cigarroa, 1989) (Table 2). In our study there is no statistically significant difference in development of CI-AKI with respect to sex (p>0.05). The male to female ratio in some previous studies like were 1:1.17 and 10.13:1 respectively (Cigarroa, 1989, Rahman, *et al.,* 2010). The appeared less percentage of female patients in our study was due to less contrast exposure for cardiology intervention in female possibly because of less incidence of IHD among females or less presentation of female patients in hospital in our male dominant society.

In our study, out of 50 patients 14(28%) developed CI-AKI (Table 1). It is less (37% vs 28%) than that of others (Gruberg et al., 2000). It is due to large sample size (439 vs 50) and inclusion of higher base line Scr (≥1.8 mg/dL) than that of ours (1.01 ± 0.24mg/dl). However our incidence of CI-AKI is higher than that (1.69% only) Haque's study of (Haque AFMS *et al*., 2009). This difference is possibly due to higher baseline serum creatinine level (1.7mg/dl vs 1.4mg/dl) in Haque's study as well as more number of diabetic patients in our study (28% vs. 16.94%). Our result is almost similar to the study of (24.08% in 245 patients) (Rahman *et al*., 2010). Out of Fourteen patients with base line serum creatinine level ≥ 1.2 mg/dl ten patients (71.4%) developed CI-AKI. In one study CI-AKI developed in only 4.9% when serum creatinine ≤ 1.1 mg/dl, whereas Probability of CI-AKI increases to almost 20% if the base line serum creatinine level was ≥ 1.2 mg/dl or more, which is almost near to our findings (Davidson CJ1989).

Half of DM and CKD patients developed CI-AKI in study done by (Amini *et al.,* 2009). In our study also Half of our diabetic patients developed CI-AKI. One-fourth of our hypertensive patients developed CI-AKI however it does not significantly differ from normotensive patients (Table 2). It showed that hypertension is an independent risk factor for the development of CI-AKI, which was not observed in our study possibly due to lower mean age of our patients and small

sample size (Yuniadi and Ningrum, 2008). Our study showed only DM and the base line serum creatinine level was ≥ 1.2 mg/dl were only statistically significant variables (Table 3). Chen's study showed CI-AKI incidence were five times more in age≥70 years and nine times more in DM patients but his sample was much bigger (936) (Chen *et al*., 2008). In a study of 245 consecutive patients also showed significant incidence of CI-AKI in DM patients undergoing CAG or PTCA (p<=0.0001) (Rahman *et al*., 2010).

The study had few limitations like

l) The study was conducted in a single center in Chittagong which may not representative for the whole country.

2) Long term monitoring was not done due to financial constrain and

3) Small sample size.

Conclusion

Though our study was small, one third patients developed CI-AKI and higher base line serum creatinine and diabetes mellitus were the most predictable risk factors to develop CI-AKI.A large multicentre or population based study is needed to explore risk factors associated with CI-AKI.

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Conflict of Interest: Nil

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