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THE ASSOCIATION BETWEEN THE INCIDENCE OF CONTRAST-INDUCED NEPHROPATHY AND DIABETES IN PATIENTS WITH NORMAL RENAL FUNCTION UNDERGOING CARDIAC CATHETERIZATION

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ABSTRACT

Even though diabetic nephropathy is a well-known risk factor for CIN, the tendency of diabetic patients with normal renal function to develop CIN remains controversial Aim: Identifying the possible association between diabetes with normal renal function and the incidence of CIN. Methods: This is a prospective analytical study that has included 111 patients, all underwent an objective exam, hematochemical measurements. The patients were divided into two groups depending on the presence of diabetes. The incidence of CIN (defined as an increase in creatinine level equal or more than 25% from baseline values within 48-72 hours after the coronary procedure) was compared in the two groups. Results: CIN took place in 23 patients, 8 of them were in the diabetic group. No significant difference was noted in the incidence of CIN in the diabetic and non-diabetic group (24% vs 19% respectively with a p value of 0.55) Conclusion: No significant association between the incidence of CIN and diabetes was noted in patients with normal renal function.

KEYWORDS: Contrast-induced nephropathy, Coronary angiography, Percutaneous coronary intervention, Diabetes.

INTRODUCTION

Contrast-Induced nephropathy (CIN) is a usually-reversible form of acute renal injury (AKI) occurring within a short period of administration of contrast media. Many issues related to CIN remain unresolved including pathogenesis, the relative efficacy of various prophylactic methods, and the nephrotoxicity of various types of iodine contrast media

CIN is usually defined as a severe deterioration in renal function characterized by an increase in serum creatinine levels typically more than 0.5 mg / dL or more than 25% of baseline levels within 72 hours of exposure to the contrast media after excluding alternative explanations for renal failure.[1]

Contrast-induced nephropathy may sometimes be a serious complication of coronary angiography with significant short- and long-term sequelae. However, it can be mitigated by appropriate risk stratification, choosing appropriate contrast media along with preventive measures.

Most of the information on pathogenesis of induced nephropathy was obtained from animal studies where studies show evidence of acute tubular necrosis of ATN but the mechanism by which it occurs is not well understood.[2]

There are two main theories about the mechanism: the first is that acute tubular necrosis is caused by renal vascular constriction, which may be caused by changes in NO, endothelin and / or adenosine and the resulting medullary hypoxia. In another theory, ATN is caused by the direct cytotoxic effect of contrast agents.[2]

However, CIN is usually characterized by relatively rapid recovery unlike other forms of acute tubular necrosis. The underlying cause of the relatively rapid recovery (within a few days) compared to a longer duration (1-3 weeks) in other causes of ATN is still unclear.

According to several reports, the incidence of CIN ranges from 0 to 24%.[3]

Known risk factors for CIN include
- Chronic kidney disease
- Diabetic nephropathy with renal insufficiency
- High dose of contrast agent
- First generation hyperosmolal ionic contrast agents
- Percutaneous coronary intervention (PCI)
- Advanced heart failure
- Multiple myeloma (specially with old generation contrast agents)

Diabetic nephropathy has been a well-known risk factor for developing CIN. However, the association between diabetes itself and CIN is still controversial.

This may be due to different types of diabetic nephropathy, especially in the early stages of the disease.

AIM OF STUDY

The study aims to identify possible association between diabetes and CIN development in patients with normal renal function.

MATERIALS AND METHODS

This is a prospective analytical study conducted in The Division of Cardiology, Tishreen University Hospital between July 2017 and July 2018.

The study included patients undergoing coronary angiography or percutaneous coronary intervention whether they were in a stable or unstable clinical condition.

We excluded patients with impaired renal function (defined as serum creatinine greater than 1.5 mg/dl), patents aged more than 70 or less than 18 years and patients who had a previous exposure to the contrast media within 7 days of the current procedure.

Finally, we had a sample of 111 patients (72 with coronary angiography and 39 with PCI).

Patients were assessed at the time of the procedure; a detailed medical history was taken including information related to:

Age, Sex. Smoking, associated diseases, past medical history and cardiac symptoms. All patients underwent comprehensive clinical examination.

Laboratory tests were performed for patients prior to the procedure, including:
Complete blood count, serum creatinine, urea, glucose and CRP.

These tests were performed in the Central Laboratory of Tishreen University Hospital where serum creatinine was performed using Mindray - BS -380 according to the Modified Jaffe method.

Omnipaque 350 (iohexol 755mg / ml) was the contrast agent used in all patients.

The periprocedure hydration method was open oral intake in all patients.

The type of the procedure and the amount of contrast agent used were recorded.

Serum creatinine was repeated 48-72 hours after the procedure.

Definitions
Anemia was defined as: hemoglobin less than 13 g / dl in men or less than 12 g / dl in women.

Diabetes mellitus was defined as: known Diabetes under treatment, random blood glucose value of ≥200 mg / dl, fasting blood glucose of more than 125 mg/dl.

Advanced heart failure (HF) was defined as: Class III or IV heart failure according to the NYHA classification.

A basal creatinine value greater than 1.5 mg / dl was adopted for the presence of renal disease before catheterization.

Cardiac catheterization was considered urgent when it was performed within 24 hours of admission to hospital with the diagnosis of acute coronary syndrome.

Contrast-induced nephropathy was defined as an increase in serum creatinine of ≥25% of the baseline value within 48-72 hours after the procedure.

RESULTS

111 patients were enrolled. 33 patients had diabetes according to the definition mentioned above.

Overall, CIN occurred in 23 patients.

The study population was divided into two groups depending on the presence of diabetes.

We studied the differences between the two groups regarding age, sex, the presence of heart failure, hypertension (HTN), the patient clinical condition, the type of the procedure and the amount of contrast media used, and the results were summarized in tables 1-5.

Table 1: Age and sex in the two study subgroups.

	Total	Diabetic	Non- diabetic	P value
Number	111	33	78	
Sex (Female)	36 (32%)	16 (48%)	20 (26%)	**0.018**
Age (mean)	53.49	57.97	51.60	**0.0003**

Table 2: Associated diseases in the two study subgroups.

	Total	Diabetic	Non- diabetic	P value
HF	10(9%)	4(12%)	6(8%)	0.48
HTN	52(47%)	20(61%)	32(41%)	0.06

Table 3: Clinical setting of coronary artery angiography/PCI in the two study subgroups.

	Total	Diabetic	Non- diabetic	P value
Urgent	13(12%)	2(6%)	11(14%)	0.33
Selective	98(88%)	31(94%)	67(86%)	

Table 4: Type of procedure in the two study groups.

	Total	Diabetic	Non- diabetic	P value
Coronary Angiography	72(65%)	20(61%)	52(67%)	0.54
PCI	39(35%)	13(39%)	26(33%)	

Table 5: The amount of contrast media used in the two study groups.

	Total	Diabetic	Non- diabetic	P value
<200 ml	106(95%)	31(94%)	75(96%)	0.63
≥200 ml	5 (5%)	2(6%)	3(4%)	

The diabetic group had larger proportion of women when compared to the non-diabetic group. Diabetic patients also tended to be older. However, no significant differences were noted regarding associated diseases, clinical condition, type of procedure or the need for large amounts of contrast media.

CIN took place in 23 patients (8 patients with diabetes and 15 non-diabetic patients) with no significant difference between the two groups (p value: 0.55).

Table 6: Incidence of CIN in patients of the two study groups.

	Total	Diabetic	Non- diabetic	P value
CIN	23(21%)	8(24%)	15(19%)	0.55
No CIN	88(79%)	25(76%)	63(81%)	

DISCUSSION

In the current study, no significant difference in CIN incidence was noted between diabetic and non-diabetic patients in spite of the diabetic group being generally of older ages.

Theoretically, there is evidence that diabetes is associated with impaired nitric oxide generation, which could contribute to the susceptibility to contrast agents.[4] However, the tendency of diabetic patients with normal renal function to develop CIN remains controversial.

For example, in a randomized trial involving 341 patients with serum creatinine less than or equal to 1.5 mg / dl who were given iohexol during percutaneous coronary intervention there was no difference In the low incidence of induced nephropathy among diabetic and non-diabetic patients.[5]

On the other hand, another study involving 254 patients with normal renal function who underwent a diagnostic coronary angiography found a significant association between diabetes and CIN.[6]

CONCLUSION

Even though diabetic nephropathy is a well-known risk factor for CIN, no significant association between the incidence of CIN and diabetes was noted in patients with normal renal function.

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