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## The Incidence of Post CT-Contrast Kidney Injury among Adult Diabetic patients at KKHU during 2018-2020

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To estimate the incidence of Contrast-Induced Nephropathy (CIN) among Diabetics and evaluate the association of gender and the risk of CIN. In addition, to study the relation of diabetes mellitus and hypertension in the development of CIN. This was a retrospective cohort study performed at King Khalid University Hospital (KKHU), Riyadh, Kingdom of Saudi Arabia. We included 410 diabetic patients undergoing CT Contrast. Data has been collected from KKHU medical records during 2018-2020, which was done by comparing the baseline and post-contrast serum creatinine levels. The incidence of Contrast-induced nephropathy was 13.9%, and this represents 57 patients of 410. Out of those 57 patients, 77.19% (44 of 57) were hypertensive, 78.94% (45 of 57) were comorbid. The incidence of Contrast-induced nephropathy among females was 14.9% (31 of 208), and The incidence of Contrast-induced nephropathy among males was 12.9% (26 of 202). The incidence of Contrast-induced nephropathy was 13.9%. A lot of factors can influence the incidence of CIN. Being hypertensive increases the risk of CIN by 2.332 times more than not being hypertensive. Diabetic patients must be monitored carefully, and special measures should be taken.

**Keywords:** Contrast-induced nephropathy (CIN), Contrast-induced kidney injury, Diabetics, acute kidney injury (AKI), CT contrast agents.

### INTRODUCTION

Contrast-induced nephropathy (CIN) is the impairment of kidney function defined by Barret and Parfrey, (Barrett and Parfrey, 1994) and measured as a 25% increase in serum creatinine from baseline or a 0.5 mg/dL (44  $\mu$ mol/L) increase in serum creatinine value within 48 to 72 hours after intravenous contrast administration". (Samadian, Dalili, Mahmoudieh, and Ziaei, 2018)

"It is associated with increased correspondence: health-care resource utilization

by extending the hospital stay, increasing the short- and long-term mortality, and accelerated progression of underlying chronic kidney disease (CKD). (Hossain et al. 2018)

CIN is fundamentally an ischemic type of acute kidney injury (AKI) caused by the contrast agent's vasoconstrictive characteristics. Animal studies showed that after the injection of the contrast into the renal vasculature, renal blood flow transiently increases, followed by a substantial decrease to levels below the original baseline. (Calvin, Misra, and Pflueger, 2010)

Considering CIN induces renal vasoconstriction, an individual with decreased renal perfusion, such as a patient with diabetic nephropathy, is at increased risk of developing CIN. Although numerous factors increase the risk of CIN, pre-existing renal impairment plays the most influential role. (Toprak et al. 2007)

CIN incidence is significantly associated with chronic kidney disease (CKD) clinical symptoms while undertaking percutaneous coronary intervention (PCI). It may progress to the point where renal dialysis is necessitated. (Zhang, Lu, and Wang, 2020)

Our objectives are to alert the reader about the incidence of contrast-induced nephropathy in inpatient adult diabetic patients, especially if they are hypertensive or old age.

## MATERIALS AND METHODS

This was a retrospective cohort study performed at King Khalid University Hospital (KKUH), Riyadh, Kingdom of Saudi Arabia. We included 410 diabetic patients undergoing CT Contrast. Data had been collected from KKUH medical records during 2018-2020, which was done by comparing the baseline and post-contrast

serum creatinine levels. Post-contrast serum creatinine was taken 48 to 72 hours after the injection. An increase of 25% from the baseline is considered Contrast-induced nephropathy (CIN). Creatinine clearance was estimated by Cockcroft-Gault Equation.

This study will assess, hence most significant—the incidence of Contrast-induced nephropathy (CIN) among people with diabetes at KKUH. Furthermore, we evaluated the association between being a Female and the increased risk of CIN increase. Our inclusion criteria were adults (aged from 18 to 65), diabetics, and their creatinine clearance was above 50 ml/min—our exclusion criteria were those with proteinuria or with a single kidney. **(Table 1)**

Data had been analyzed using SPSS 21.0 version statistical software. Descriptive statistics were used to describe categorical variables. Bivariate statistical analysis was done using appropriate Chi-square, and relative risk was calculated. A p-value of <0.05 and 95% CI will be used to report the statistical significance and precision of the results.

**Table 1: Information of study sample (N = 410)**

Variable	N (%)	HTN*	Comorbidity	CIN*
<b>Total No.</b>	410 (100%)	253 (61.70%)	284 (69.26%)	57 (13.9%)
<b>Gender</b>				
Male	202 (49.3%)	115 (56.9%)	138 (68.3%)	26 (12.9%)
Female	208 (50.7%)	138 (66.3%)	146 (70.2%)	31 (14.9%)
<b>AGE GROUPS</b>				
18	1 (0.24%)	0	0	0
19-44	35 (8.53%)	14 (40%)	19 (54.2%)	6 (17.1%)
45-64	348 (84.88%)	221 (63.5%)	241 (69.2%)	46 (13.2%)
65	26 (6.35%)	18 (69.2%)	24 (92.3%)	5 (19.2%)

\*Abbreviations: HTN, Hypertension; CIN, Contrast Induced Nephropathy.

**Table 2: The incidence of CIN among Gender, Hypertension, and Comorbidity**

	CIN		P-value	Pearson Chi-square	RR*	95% Confidence interval	
	YES	NO				Lower	Upper
<b>Comorbid</b>	45 (15.84%)	239 (84.15%)	0.08	2.914	1.789	0.911	3.512
<b>Not comorbid</b>	12 (9.52%)	114 (90.47%)					
<b>Hypertensive</b>	44 (17.39%)	209 (82.60%)	0.01	6.719	2.332	1.212	4.485
<b>Not hypertensive</b>	13 (8.28%)	144 (91.71%)					
<b>Female</b>	31 (14.9%)	177 (85.1%)	0.552	0.354	1.186	0.676	2.079
<b>Male</b>	26 (12.9%)	175 (87.1%)					

\*Abbreviations: CIN, Contrast Induced-Nephropathy; RR, Relative Risk.

## RESULTS

In our retrospective cohort study, 50.7% of patients (208 of 410) were females, and 49.3% of patients were males (202 of 410). All of them were diabetic 100% (410 of 410). 61.7% (253 of 410) were hypertensive. 69.2% (284 of 410) were comorbid. The mean age was  $56.09 \pm 7.95$ .

The incidence of CIN among people with diabetes was 13.9%, representing 57 patients of 410 (Table 2). Of those 57 patients, 78.94% (45 of 57) had comorbidities (Table 2). Being comorbid increases the risk of contrast-induced nephropathy by 1.789 times more than not being comorbid [p value = 0.088].

Out of 57 patients who developed CIN, 77.19% (44 of 57) are hypertensive. Being hypertensive increases the risk by 2.332 times more than not being hypertensive. [p value = 0.01]

The incidence of CIN among females was 14.9% (31 of 208), but on the other hand, among males was 12.9% (26 of 202) [Table 2]. Being a female increases the risk of Contrast-induced nephropathy by 1.186 times more than being a male. It is not statistically significant [p value = 0.552].

CIN developed in 13.2% of middle-aged individuals (46 of 410) and 19.2% in the group of 65-year-olds (5 of 410). Surprisingly, the CIN was 17.1% in the adult population (6 of 410).

Surprisingly, the incidence of CIN was 18% among diabetic patients aged 61 to 65 years old (26 of 410). It is higher than what (Modi et al. 2021) reported, between 8%-16%.

## DISCUSSION

We conducted a retrospective cohort review of diabetic patients admitted to KKHU, where they underwent CT contrast. We aimed to identify the incidence of CIN and its risk factors: age, gender, hypertension, and other comorbidities.

Barbieri et al. reported that being female is related to CT-contrast renal damage. However, after adjusting for baseline variables, this result was not confirmed. Therefore, having a higher risk profile rather than being a female may increase the risk of CIN.(Barbieri et al. 2017)

According to Mohammed et al. the risk of CIN varies from 0% to 24% based on the patient's risk factors, the amount and type of agent supplied, and the types of radiological tests conducted.(Mohammed, Mahfouz, Achkar, Rafie, and Hajar, 2013)

CIN can be prevented; higher-risk patients can often be identified ahead of time. Most procedures requiring contrast agents are performed on a non-emergent basis with enough time to perform prophylactic measures. (Hossain et al. 2018)

Recent studies proved that the use of low or iso-osmolar agents, with the lowest effective dose possible, and pre-procedure intravenous isotonic crystalloid solution administration lowered the risk of CIN in high-risk patients. However, having average creatinine clearance is more important than being hydrated. (van der Molen et al. 2018; Wang, Song, A, and Li, 2019)

Sany et al. included 200 patients with type 2 diabetes reported that the incidence of CIN was 21.5% (43 of 200).(Sany, Refaat, Elshahawy,

Mohab, and Ezzat, 2014) Balghith et al. on the other hand, proclaimed that 2.96% of diabetic patients developed CIN.(Balghith, 2019)

Interestingly, Balghith et al. stated that diabetes and hypertension are the two most influential risk factors for CIN.(Balghith, 2019) It reported an incidence of CIN of 60–62% were diabetic, and 67% were hypertensive.

Our study showed that the incidence of Contrast-induced nephropathy among Diabetic patients was 13.9%. As in most previous studies, the incidence of CIN ranged from 0% to 25%, and this variation was attributed to the variety of risk factors for the patients.(McCullough et al. 2006). Our study included patients from 18-65 years old without any contraindications to CT contrast and Creatinine Clearance above 50 ml/min.

Furthermore, we found a strong relationship between having diabetes and hypertension that can significantly increase the risk of developing CIN by 2.332 times. On the other hand, a study by Al Awadhi et al. showed that adults with diabetics were 3.5 times more likely to develop CIN; Hypertension was twice as prevalent in the CIN group.(Al Awadhi et al. 2020)

There is much argument about the clinical importance of Contrast-induced nephropathy (CIN), with different opinions; many expert operators in this field think that the concept of contrast nephropathy is only an abnormal laboratory result of creatinine with only a slight biological effect.(Gupta, Gurm, Bhatt, Chew, and Ellis, 2005) (Gupta et al.2005)

However, this problem of CIN is associated with a more extended hospital stay, which might lead to increased morbidity and mortality; the cost of hospitalization will increase, which will be a burden on the hospital budget.(Perrin, Descombes, and Cook, 2012) The peak serum creatinine level in most patients with CIN is in the normal range or returns to normal within 1–3 weeks of contrast administration.(Rudnick and Feldman, 2008)

Treatment of this type of nephropathy is mainly conservative, consisting of careful fluid and electrolyte management; dialysis may be required in some of the cases.(Gami and Garovic, 2004; Raj et al. 2005)

Moreover, Zhang et al. recommends some of the management approaches to prevent CIN.(Zhang et al. 2020) They are high doses of statins, reducing the cytotoxicity of the contrast medium immediately, and reversing the renal ischemia caused by the contrast medium.

## LIMITATIONS

The limitations of this study are that despite it being a center-based study with a small sample size; the results could not be generalized. Furthermore, a long-term follow-up was not available. Lastly, there were different types of nonionic contrast materials used.

## CONCLUSION

The incidence of Contrast-induced nephropathy was 13.9%. Many factors can influence the incidence of CIN. Being hypertensive increases the risk of CIN by 2.332 times more than not being hypertensive. Diabetic patients must be monitored carefully, and special measures should be taken.

## CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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## AUTHOR CONTRIBUTIONS

FBA, AJ, MAA, OAA, and HAS proposed and designed the study. AJ and FBA obtained the IRB approval. OAA, HSA, BHA, ASA, AFB, and AMA collected the data. HAS did the statistical analysis. All the authors contributed to manuscript writing, read and approved the final version.

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## REFERENCES

- Al Awadhi, A., Ali Aljabbari, S. M., Anwar, S., Khamis, A. H., Brek Al Zubaidi, A. M., Holt, S. G., and Alsheikh-Ali, A. (2020). Incidence of Contrast-Induced Nephropathy after Coronary Procedures in the United Arab Emirates: A Single-Center Study. *Saudi J Kidney Dis Transpl*, 31(5), 1034-1041.

- doi:10.4103/1319-2442.301168
- Balghith, M. A. (2019). The Effect of Contrast Administration on Renal Function after Cardiac Catheterization in Saudi Patients. *Heart Views*, 20(3), 83-86. doi:10.4103/HEARTVIEWS.HEARTVIEWS\_69\_19
- Barbieri, L., Verdoia, M., Nardin, M., Marino, P., Suryapranata, H., De Luca, G., and Novara Atherosclerosis Study, G. (2017). Gender Difference in the Risk of Contrast-Induced Nephropathy in Patients Undergoing Coronary Angiography or Percutaneous Coronary Intervention. *Angiology*, 68(6), 542-546. doi:10.1177/0003319716669429
- Barrett, B. J., and Parfrey, P. S. (1994). Prevention of nephrotoxicity induced by radiocontrast agents. *N Engl J Med*, 331(21), 1449-1450. doi:10.1056/NEJM199411243312111
- Calvin, A. D., Misra, S., and Pflueger, A. (2010). Contrast-induced acute kidney injury and diabetic nephropathy. *Nat Rev Nephrol*, 6(11), 679-688. doi:10.1038/nrneph.2010.116
- Gami, A. S., and Garovic, V. D. (2004). Contrast nephropathy after coronary angiography. *Mayo Clin Proc*, 79(2), 211-219. doi:10.4065/79.2.211
- Gupta, R., Gurm, H. S., Bhatt, D. L., Chew, D. P., and Ellis, S. G. (2005). Renal failure after percutaneous coronary intervention is associated with high mortality. *Cathet Interv Cardiovasc Interv*, 64(4), 442-448. doi:10.1002/ccd.20316
- Hossain, M. A., Costanzo, E., Cosentino, J., Patel, C., Qaisar, H., Singh, V., . . . Vachharajani, T. J. (2018). Contrast-induced nephropathy: Pathophysiology, risk factors, and prevention. *Saudi J Kidney Dis Transpl*, 29(1), 1-9. doi:10.4103/1319-2442.225199
- McCullough, P. A., Adam, A., Becker, C. R., Davidson, C., Lameire, N., Stacul, F., . . . Panel, C. I. N. C. W. (2006). Epidemiology and prognostic implications of contrast-induced nephropathy. *Am J Cardiol*, 98(6A), 5K-13K. doi:10.1016/j.amjcard.2006.01.019
- Mohammed, N. M., Mahfouz, A., Achkar, K., Rafie, I. M., and Hajar, R. (2013). Contrast-induced Nephropathy. *Heart Views*, 14(3), 106-116. doi:10.4103/1995-705X.125926
- Perrin, T., Descombes, E., and Cook, S. (2012). Contrast-induced nephropathy in invasive cardiology. *Swiss Med Wkly*, 142, w13608. doi:10.4414/smw.2012.13608
- Raj, S. R., Biaggioni, I., Yamhure, P. C., Black, B. K., Paranjape, S. Y., Byrne, D. W., and Robertson, D. (2005). Renin-aldosterone paradox and perturbed blood volume regulation underlying postural tachycardia syndrome. *Circulation*, 111(13), 1574-1582. doi:10.1161/01.CIR.0000160356.97313.5D
- Rudnick, M., and Feldman, H. (2008). Contrast-induced nephropathy: what are the true clinical consequences? *Clin J Am Soc Nephrol*, 3(1), 263-272. doi:10.2215/CJN.03690907
- Samadian, F., Dalili, N., Mahmoudieh, L., and Ziaei, S. (2018). Contrast-induced Nephropathy: Essentials and Concerns. *Iran J Kidney Dis*, 12(3), 135-141.
- Sany, D., Refaat, H., Elshahawy, Y., Mohab, A., and Ezzat, H. (2014). Frequency and risk factors of contrast-induced nephropathy after cardiac catheterization in type II diabetic patients: a study among Egyptian patients. *Ren Fail*, 36(2), 191-197. doi:10.3109/0886022X.2013.843400
- Toprak, O., Cirit, M., Yesil, M., Bayata, S., Tanrisev, M., Varol, U., . . . Esi, E. (2007). Impact of diabetic and pre-diabetic state on development of contrast-induced nephropathy in patients with chronic kidney disease. *Nephrol Dial Transplant*, 22(3), 819-826. doi:10.1093/ndt/gfl636
- van der Molen, A. J., Reimer, P., Dekkers, I. A., Bongartz, G., Bellin, M. F., Bertolotto, M., . . . Thomsen, H. S. (2018). Post-contrast acute kidney injury. Part 2: risk stratification, role of hydration and other prophylactic measures, patients taking metformin and chronic dialysis patients : Recommendations for updated ESUR Contrast Medium Safety Committee guidelines. *Eur Radiol*, 28(7), 2856-2869. doi:10.1007/s00330-017-5247-4
- Wang, Z., Song, Y., A, G., and Li, Y. (2019). Role of Hydration in Contrast-Induced Nephropathy in Patients Who Underwent Primary Percutaneous Coronary Intervention. *Int Heart J*, 60(5), 1077-1082. doi:10.1536/ihj.18-725
- Zhang, F., Lu, Z., and Wang, F. (2020). Advances in the pathogenesis and prevention of contrast-induced nephropathy. *Life Sci*, 259, 118379. doi:10.1016/j.lfs.2020.118379