ORIGINAL ARTICLE

ANNALS OF PUNJAB MEDICAL COLLEGE

Assessing the Risk of Acute Kidney Injury Related to Contrast Exposure in Patients of Stroke

Asim Rehmani[1], Quratulain Khan[2], Khurram Danial[3], Aamna Qazi[4], Farrukh Zulfiqar[5], Syed Muneeb Younus[6]

1 *Assistant Professor, Department of Neurosurgery, DUHS / Civil Hospital, Karachi Pakistan*
Contribution in the study

2 *Assistant Professor, Department of Critical Care Medicine, Ziauddin University Hospital, Karachi Pakistan*
Contribution in the study

3 *Associate Professor, Department of Nephrology, Karachi Medical & Dental College, Karachi Pakistan*
Contribution in the study

4 *Consultant Physician, Department of Medicine, Jinnah Postgraduate Medical Centre, Karachi Pakistan*
Contribution in the study

5 *Assistant Professor, Department of Neurosurgery, DUHS / Civil Hospital, Karachi Pakistan*
Contribution in the study

6 *Consultant Neurosurgeon, Department of Neurosurgery, KVSS Site Hospital, Karachi Pakistan*
Contribution in the study

CORRESPONDING AUTHOR
Dr. Syed Muneeb Younus
Consultant Neurosurgeon, Department of Neurosurgery, KVSS Site Hospital, Karachi Pakistan
Email: muneebkazi@gamil.com

Submitted for Publication: 13-12-2021
Accepted for Publication 06-08-2022

How to Cite: Rehmani A, Khan Q, Danial K, Qazi A, Zulfiqar F, Younus SM. Assessing the Risk of Acute Kidney Injury Related to Contrast Exposure in Patients of Stroke. APMC 2022;16(4):265-267. **DOI: 10.29054/APMC/2022.1263**

ABSTRACT

Background: The computerized tomographic angiography (CTA) and the computerized tomographic perfusion (CTP) are imaging techniques that help physicians in identifying and assessing the cases of acute ischemic stroke. Studies have reported very low incidence of acute kidney injury in acute ischemic stroke patients who undergo these diagnostic modalities. **Objective:** To determine the incidence of AKI following administration of iodinated contrast media in patients presenting with acute ischemic stroke. **Study Design:** A prospective cohort study. **Settings:** A single large tertiary care hospital in Karachi Pakistan. **Duration:** A total of 18 months from Jan 2020 till June 2021. **Methods:** The type of study is a prospective cohort study conducted for a period of 18 months. The inclusion criteria were patients who presented to us with signs and symptoms of ischemic stroke, with no visible hemorrhage on CT scan and undergoing CT angiography. To perform the angiography procedure isotonic contrast of 1.5 ml/kg was injected at 4 ml/second. **Results:** A total of n= 180 patients were included in the study, of which n= 108 were males and n= 72 were female. The mean age of the patients was 66.75 ± 12.4 years. N= 86 patients were in group A with only CTA performed and n= 94 patients were included in group B where patients underwent both CTA and DSA procedures. Out of 180 patients included n= 8 patients met our criteria for the diagnosis of acute kidney injury. N= 2 of the patients were in group A and n= 6 of the patients were in group B having a p value of 0.17. The mean change in creatinine levels of diagnoses AKI patients of the two groups were recorded as 0.25 ± 0.05 mg/dL in group A and 1.70 ± 2.43 mg/dL in group B. **Conclusion:** Our study showed that there is no significant increase in the incidence of acute kidney injury in patients who undergo CT angiography for acute ischemic stroke.

Keywords: *Contrast medium, Kidney injury, Ischemic stroke.*

INTRODUCTION

The computerized tomographic angiography (CTA) and the computerized tomographic perfusion (CTP) are imaging techniques that help physicians in identifying and assessing the cases of acute ischemic stroke. Studies have reported very low incidence of acute kidney injury in acute ischemic stroke patients who undergo these diagnostic modalities. This is only true for patients with no history of renal diseases. [1,2,3]

Besides the afore mentioned techniques, some of the patients especially at centers which are equipped with the latest equipment and trained personnel, undergo intraarterial thrombectomy. This procedure is also associated with the exposure of the patient to iodinated contrasts during Digital Subtraction Angiography (DSA).[4.5.6.7.8]

As the risk associated with an exposure to the iodinated contrast medium is directly proportional to the dose of the medium utilized, multiple dosages will lead to a greater risk of acute kidney injury.[9,10] There have been multiple studies which have explored this area, however those studies often had several limitations, such as small sample size, type of study being cross-sectional in nature

not allowing to establish causality or had different interpretations of the definition of acute kidney injury.[11-14] Hence the issue of acute kidney injury following iodinated contrast medium is still considered a risk. The aim of our study is to determine the incidence of acute kidney injury following consecutive and multi-dosing of iodinated contrast media in patients presenting with acute ischemic stroke.

METHODS

The type of study is a prospective cohort study that is conducted for a period of 18 months from Jan 2020 till June 2021, at a single large tertiary care hospital in Karachi Pakistan. All the participants signed an informed consent to participate in the study, and when the patient was unable to sign the consent for whatever reason, they were either excluded from the study or their caretaker provided consent. The study was approved by the Departmental Research Ethics Committee. The inclusion criteria were all the patients above the age of 18 years who presented to us with signs and symptoms of ischemic stroke, with no visible hemorrhage on CT scan and undergoing computer tomographic angiography (CTA) at our institute. The exclusion criteria were all the patients who had missing data and situations where we lacked baseline creatinine levels or the patients who were not followed up for signs of acute kidney injury 48 hours after performing the angiography procedure. All the imaging was performed with a 64 section CT scanner and for performing the angiography procedure isotonic contrast of 1.5 ml/kg was injected at 4 ml/second. Afterwards a bolus of 20 ml normal saline was administered. We set the maximum volume of contrast material administered in any one person at 100 ml. Various intra-arterial procedures were performed as deemed necessary such as, balloon angioplasty, carotid artery stent placement, thrombolysis and mechanical thrombectomy among others. Various variables such as patient demographics, clinical, laboratory and radiographic findings along with amounts of the contrast and other drugs utilized was recorded in a predesigned proforma. A greater than 25% rice in the serum creatinine value above the recorded baseline levels 48 hours after the angiography procedure was considered to be acute kidney injury. Patients were divided in to two groups. Group A consisted of all the patients who underwent the angiography procedure only once hence got exposed to the contrast medium only once. Group B consisted of patients who underwent the digital subtraction angiography (DSA) as well. For continuous variables we used the Mann-Whitney U test or the student t test, and for categorical variables we used the chi square test of the fisher exact test. Finally, a p value of less than 0.05 was considered to be statistically significant and we used IBM SPSS version 20 for windows to perform the statistical analysis.

RESULTS

A total of n= 180 patients were included in the study, of which n= 108were males and n= 72 were female. The mean age of the patients was 66.75 ± 12.4 years. N= 86 patients were in group A that is only CTA performed hence single exposure to the contrast medium and n= 94 patients were included in group B where patients underwent both CTA and DSA procedures, that is exposed consecutively. The patient demographics and other variables are provided in table 1. Out of 180 patients included n= 8 patients met our criteria for the diagnosis of acute kidney injury. N= 2 of the patients were in group A and n= 6 of the patients were in group B having a p value of 0.17 respectively. The mean change in creatinine levels of diagnoses AKI patients of the two groups were recorded as 0.25 ± 0.05 mg/dL in group A and 1.70 ± 2.43 mg/dL in group B respectively.

Table 1: Patient demographics and other variables

Variable		Group A (n=86)	Group B (n=94)	P value
Age in years		66.4 ± 11.5	67.1 ± 13.1	0.708
Gender	**Male**	52	56	0.315
	Female	34	38	
Co-morbidities	**Chronic Kidney Disease**	0	0	1.00
	Heart Failure	1	10	0.01
	Atrial fibrillation	9	47	0.00
	Prior Stroke	22	15	0.08
	Smoking	19	20	0.93
	Hyperlipidemia	8	6	0.43
	Diabetes	29	20	0.06
	Hypertension	51	56	0.88
History of contrast use		3	3	0.71
NSAIDs		13	11	0.51
Hemoglobin in g/dL		13.79 ± 16	13.35 ± 16.2	0.70
WBC count (*10⁹/L)		7.3 ± 2.7	8.1 ± 2.7	0.12
mRS score at 3 mo of <3		85	86	0.10
Baseline NIHSS (IQR)		3	14	0.00
Baseline Creatinine (mg/dL)		0.83 ± 0.22	0.91 ± 0.35	0.06
48-Hour Creatinine (mg/dL)		0.81 ± 0.29	0.98 ± 0.92	0.16
Change in creatinine (mg/dL)		-0.02 ± 0.12	0.10 ± 0.80	0.17
Contrast administered for CTA in ml		95 ± 7	94 ± 7.5	0.36
Contrast administered for DSA in ml		0	93.5 ± 15.6	NA
Total contrast medium administered		95.01 ± 6.86	187.03 ± 15.69	0.00

DISCUSSION

Our study showed that increased use of the contrast medium for the treatment of ischemic stroke when utilized during the angiography procedures is not associated with an increase in the incidence of acute kidney injury in patients. These results are well aligned with other studies. [10-15]

We did not find any statistically significant differences when it comes to acute kidney injury in the CTA and DSA groups, however upon closer inspection we did observe a trend that shows a higher occurrence of kidney insults with consecutive and multiple doses of the contrast. It is universally believed that the benefits of the endovascular procedure are far out weighing the risks associated with using the contrast medium. [4,5,6,7,8]

We recommend that care should be taken when administering the contrast medium and the volume administered should be monitored. Studies have previously used different definitions of kidney injury with changes in creatinine levels from 25% to 50% from baseline or an increment of 0.3 to 0.5 mg/dl. [10-15] In our study we chose the lower limit of 25% hence our criteria was more sensitive.

CONCLUSION

Our study showed that there is no significant increase in the incidence of acute kidney injury in patients who undergo CT angiography for acute ischemic stroke.

LIMITATIONS

Our study had some limitations as well. Firstly, the sample size was small and all the patients were from a single large tertiary care center of a large metropolitan city. Secondly, few patients had to be eliminated from our final study population as their data was incomplete due to a variety of reasons, most common one being that the patient left the hospital at an earlier time. Lastly, we noticed that the co-morbidities were more prevalent in patients in group B (that is those patients who received both CTA and DSA respectively)

SUGGESTIONS / RECOMMENDATIONS

Through this study we suggest that contrast medium can be administered for CT angiography with ischemic stroke patients and the chances of developing acute kidney injury following contrast is minimal.

CONFLICT OF INTEREST / DISCLOSURE

None.

ACKNOWLEDGEMENTS

We like to thank all the patients and their caregivers who agreed to partake in the study, we would also like to thank our research team and staff at our hospital for their hard work and dedication in making these projects a success.

REFERENCES

1. Brinjikji W, Demchuk AM, Murad MH, et al. Neurons over nephrons: systematic review and meta-analysis of contrast-induced nephropathy in patients with acute stroke. Stroke 2017;48: 1862–68 CrossRef Medline
2. Ehrlich ME, Turner HL, Currie LJ, et al. Safety of computed tomographic angiography in the evaluation of patients with acute stroke: a single-center experience. Stroke 2016;47:2045–50 CrossRef Medline
3. Demel SL, Grossman AW, Khoury JC, et al. Association between acute kidney disease and intravenous dye administration in patients with acute stroke: a population-based study. Stroke 2017;48: 835–39 CrossRef Medline
4. Berkhemer OA, Fransen PS, Beumer D, et al. A randomized trial of intraarterial treatment for acute ischemic stroke.NEngl JMed2015; 372:11–20 CrossRef Medline
5. Campbell BC, Mitchell PJ, Kleinig TJ, et al; EXTEND-IA Investigators. Endovascular therapy for ischemic stroke with perfusion-imaging selection. N Engl J Med 2015;372:1009–18 CrossRef Medline
6. Goyal M, Demchuk AM, Menon BK, et al; ESCAPE Trial Investigators. Randomized assessment of rapid endovascular treatment of ischemic stroke. N Engl J Med 2015;372:1019–30 CrossRef Medline
7. Jovin TG, Chamorro A, Cobo E, et al; REVASCAT Trial Investigators. Thrombectomy within 8 hours after symptom onset in ischemic stroke. N Engl J Med 2015;372:2296–306 CrossRef Medline
8. Saver JL, Goyal M, Bonafe A, et al; SWIFT PRIME Investigators. Stent-retriever thrombectomy after intravenous t-PA vs. t-PA alone in stroke. N Engl J Med 2015;372:2285–95 CrossRef Medline
9. Rao QA, Newhouse JH. Risk of nephropathy after intravenous administration of contrast material: a critical literature analysis. Radiology 2006;239:392–97 CrossRef Medline
10. Krol AL, Dzialowski I, Roy J, et al. Incidence of radiocontrast nephropathy in patients undergoing acute stroke computed tomography angiography. Stroke 2007;38:2364–66 CrossRef Medline
11. Hall SL, Munich SA, Cress MC, et al. Risk of acute kidney injury associated with neuroimaging obtained during triage and treatment of patients with acute ischemic stroke symptoms. J Neurointerv Surg 2016;8:1231–34 CrossRef Medline
12. Sharma J, Nanda A, Jung RS, et al. Risk of contrast-induced nephropathy in patients undergoing endovascular treatment of acute ischemic stroke. J Neurointerv Surg 2013;5:543–45 CrossRef Medline
13. Loh Y, Mcarthur DL, Vespa P, et al. The risk of acute radiocontrastmediated kidney injury following endovascular therapy for acute ischemic stroke is low. AJNR Am J Neuroradiol 2010;31:1584–87 CrossRef Medline
14. Lima FO, Lev MH, Levy RA, et al. Functional contrast-enhanced CT for evaluation of acute ischemic stroke does not increase the risk of contrast-induced nephropathy. AJNR Am J Neuroradiol 2010;31: 817–21 CrossRef Medline
15. Ahmad N, Nayak S, Jadun C, et al. Mechanical thrombectomy for ischaemic stroke: the first UK case series. PLoS One 2013; 8:e82218 CrossRef Medline.