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An Observational Study Assessing Association of Renal Function with in-Hospital Mortality in Patients of Acute Stroke

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ABSTRACT

Aim: The aim of the present study was aimed to investigate the renal function in patients with acute stroke and its relationship with in-hospital mortality.

Methods: The present study was a prospective, observational study conducted for the period of 2 years. Institutional ethical committee approval was taken prior to start of study. 100 patients were considered for present study. Patients were divided into two groups as per eGFR.

Results: 70% were from group A while 30% were from group B. Most patients were from >65 years age group, male, BMI<30. Hypertension, smoking, diabetes mellitus, cardiovascular disease, alcohol consumption, dyslipidemia, previous history of stroke/TIA were common risk factors in both groups. We noted mortality within 30 days in 20 patients. We distributed patients according to Serum Creatinine concentration at time of presentation, most patients had serum creatinine in the range of 98-118 (32%) followed by 82-97 (28%). Maximum mortality was noted in >119 followed by 98-118 serum creatinine group. We distributed patients according to blood urea concentration at time of presentation, most patients had blood urea in the range of 6.8-8.9 (39%) followed by 5.3-6.7 (27%). Maximum mortality was noted in >9 followed by 6.8-8.9 blood urea group. We noted that age > 65 years, GCS score > 10 at the time of admission, smoking, diabetes mellitus and aspiration pneumonitis were predictors of death in stroke patients.

Conclusion: The severity of impaired kidney function in patients hospitalized with acute stroke is associated with increased mortality independent of age, sex, and major comorbidities. Unrecognized renal insufficiency noted by low eGFR is common in patients with acute stroke and is associated with higher mortality adverse short-term outcomes.

Keywords: acute stroke, estimated glomerular filtration rate (eGFR), serum creatinine, blood urea

1. INTRODUCTION

Stroke is interrupted or decreased blood flow towards brain leading to localized as well as global cerebral dysfunction. Symptoms may last for >24 hours and death may occur without any apparent reason except for the vessel origin. Given the commonalities between the arterial

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beds of the renal, heart, as well as brain, there is rising indication in the research records of the significance of cardiovascular and cerebrovascular disorders in kidney failure. Renal failure is associated mainly with atherosclerotic condition (a significant risk factor of stroke). Acute renal failure is a frequent co-morbid state in the population with a variety of medical conditions such as cardiovascular disorders, DM, HT, cerebrovascular disease, and in-patient treatment in an ICU. Acute renal failure occurs after stroke as its complication. Older patients (>60 years) with cardiovascular comorbid are managed through multiple drugs mostly for underlying acute renal failure.[1]

Patients with stroke and AKI have many similar risk factors that cause morbidity as well as mortality. It is found that most of the vascular origin diseases like stroke are associated with AKI. The severity of AKI or damaged renal vessels are strongly associated with stroke severity.[2] According to many studies, haemorrhagic stroke tends to cause more AKI in contrast to ischemic stroke. Though after controlling for other factors, serum creatinine was proved to be an independently associated indicator of death and prolonged hospitalization in stroke survivors. Even though AKI is widespread and has a high morbidity and death rate, it is preventable, promptly detectable, as well as treatable.[3]

CKD is associated with a significantly increased risk of cerebrovascular disease. Even subtle kidney dysfunction, as suggested by albuminuria, increases stroke risk. Stage 3 CKD with microalbuminuria increased stroke risk 1.5 to 2 fold. Dialysis patients have six times increased risk of stroke. Stroke accounts for 3% of deaths in end-stage renal disease (ESRD). Stroke in CKD could be ischemic, hemorrhagic, or both; Infarction strokes are more prevalent than hemorrhages. Risk factor reduction (primary and secondary prevention therapies) is the mainstay of therapy.[4]

The aim of the present study was aimed to investigate the renal function in patients with acute stroke and its relationship with in-hospital mortality.

2. MATERIALS AND METHODS

The present study was a prospective, observational study conducted for the period of 2 years. 100 patients were considered for present study. Patients were divided into two groups as per eGFR.

Inclusion Criteria:

Patients above 18 years of age, admitted to the hospital or reporting in OPD/Emergency, with clinical diagnosis of acute stroke, confirmed by CT scan / MRI, willing to participate in study and follow up.

Exclusion Criteria:

Patients with acute kidney injury (AKI), head injury, metastasis, bleeding disorder, primary SOL (space occupying lesion), on anticoagulation therapy.

A written informed consent was taken from relatives of stroke patient. Patient details were recorded (demographic data, medical history of diabetes, hypertension, alcohol consumption, smoking/nicotine use, drug use, trauma, past history of TIA/stroke, cardiovascular disease or any other medical illness). At admission detailed clinical examination for vital parameters, neurological deficit and Glasgow coma scale scoring were done in all patients.Routine investigations (complete haemogram, ESR, BT, CT, PT, aPTT, platelet count, routine and microscopic examination of urine, RBS, blood urea, serum creatinine, eGFR, serum electrolytes, LFT, lipid profile), CT scan/MRI head, ECG, Chest X-Ray were done in all patients. Other investigations such as echocardiography, connective tissue workup, etc. were done whenever needed.

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Glomerular filtration rate (eGFR) on admission was assessed using Modification Diet for Renal Disease (MDRD) formula: eGFR (in ml/min per 1. 73m2) = 186.3 x P cr (e [−1. 154]) x Age (e[-0. 203]) × (0.742 if female) × (1.21 if black).
Patients were divided into two groups on the basis of eGFR:
Group A -patients with eGFR>60 ml/min/1.73 m2 of body surface area (BSA).
Group B -patients with eGFR <60 ml/min/1.73 m2 of body surface area (BSA).
All patients received standard care. Outcome in stroke patients was assessed in terms of mortality at 30 days since stroke episode. Follow up was kept till 3 months. Data was collected prospectively in proforma and analyzed by means of appropriate statistical technique. Data was analysed using SPSS Statistics software (version 23).

3. RESULTS

Table 1: General characteristics

Characteristics	**Group A (eGFR>60 ml/min/1.73 m2)**	**Group B (eGFR<60 ml/min/1.73 m2)**
Total patients	70	30
Age (in years)		
18-40	2	1
40-65	20	6
>65	48	23
	Sex	
Male	50	20
Female	20	10
BMI (kg/ m2)		
<30	45	21
>30	25	9
	Risk Factors	
Hypertension	48	18
Smoking	36	14
Diabetes Mellitus	34	16
Cardiovascular disease	34	19
Alcohol	30	10
Dyslipidemia	28	9
Previous history of stroke/TIA	16	8
	GCS score	
3-4	17	3
5-8	23	4
9-13	20	15
>13	10	7
	Type of stroke	
Ischaemic	50	18
Haemorrhagic	20	12
Mortality (within 30 days of presentation)	12	8

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE6, 2024

70% were from group A while 30% were from group B. Most patients were from >65 years age group, male, BMI<30. Hypertension, smoking, diabetes mellitus, cardiovascular disease, alcohol consumption, dyslipidemia, previous history of stroke/TIA were common risk factors in both groups. On admission most patients had GCS score 5-13. 68 patients had ischemic stroke, while 32 had hemorrhagic stroke. We noted mortality within 30 days in 20 patients.

Table 2: Distribution of Patients according to Serum Creatinine concentration at time of presentation and Mortality within 30 days

Serum Creatinine (umol/L)	**N=100**	**Outcome N=20**
30-81	15	1
82-97	28	3
98-118	32	6
>119	25	10

We distributed patients according to Serum Creatinine concentration at time of presentation, most patients had serum creatinine in the range of 98-118 (32%) followed by 82-97 (28%). Maximum mortality was noted in >119 followed by 98-118 serum creatinine group.

Table 3: Distribution of Patients according to Blood Urea concentration at time of presentation and mortality within 30 days

Blood Urea	**N=100**	**Outcome N=20**
1.8-5.2	8	1
5.3-6.7	27	2
6.8-8.9	39	7
>9	26	10

We distributed patients according to blood urea concentration at time of presentation, most patients had blood urea in the range of 6.8-8.9 (39%) followed by 5.3-6.7 (27%). Maximum mortality was noted in >9 followed by 6.8-8.9 blood urea group.

Table 4: Predictors of death among stroke patients

	Alive N=85	Died N=15	P Value
Age (In years)	62.8 ± 12.4	68.2 ± 10.6	< .01
GCS score > 10	44	11	< .01
Hypertension	46	10	0.25
Smoking	32	9	0.025
Diabetes Mellitus	31	12	0.042
Cardiovascular disease	34	9	0.064
Type of stroke			
Ischaemic	60	10	0.18
Haemorrhagic	25	5	0.7

We noted that age > 65 years, GCS score > 10 at the time of admission, smoking, diabetes mellitus and aspiration pneumonitis were predictors of death in stroke patients.

4. DISCUSSION

Stroke is the leading cause of neurological disability and the second commonest cause of death in the world.[5] Chronic kidney disease (CKD) is frequently associated with cardiovascular

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diseases; it is considered a cardiovascular risk equivalent. Patients with CKD are more likely to die of cardiovascular diseases (CVD) than to eventually develop renal failure requiring renal replacement therapy.[6] Conversely, diagnosis of CKD is higher among patients with cardiovascular diseases than in the general population.[4]

Various common risk factors between stroke and kidney dysfunction lead to a higher morbidity and mortality in patients of stroke. Almost all types of vascular disease including stroke have been found to be associated with renal function impairment and severity of stroke could reflect the degree of injury in small renal vessels.[7] Reduced renal function may reflect both the duration and severity of different cardiovascular risk factors such as hypertension, diabetes mellitus, and dyslipidemia, and it is often linked with the development of other less established vascular risk factors such as anemia, oxidative stress, electrolyte imbalance, and hyperhomocysteinemia.[8] It is increasingly apparent that individuals with chronic renal disease are more likely to die from cardio-cerebrovascular diseases.[9] 70% were from group A while 30% were from group B. Most patients were from >65 years age group, male, BMI<30. Hypertension, smoking, diabetes mellitus, cardiovascular disease, alcohol consumption, dyslipidemia, previous history of stroke/TIA were common risk factors in both groups. On admission most patients had GCS score 5-13. 68 patients had ischemic stroke, while 32 had hemorrhagic stroke. We noted mortality within 30 days in 20 patients. Katarzyna Snarskaa et al[10] noted that 18,6% of patients with ischemic stroke and 9,4% of patients with stroke had a high proportion of elevated serum creatinine at admission. The mean serum creatinine at admission was significantly higher among patients who died in both types of stroke. Similar findings were noted in present study. The best indicator of renal function is estimated GFR rather than creatinine.11 Individuals with a decreased eGFR have less effective cerebral autoregulation. A prospective study of patients after acute ischemic stroke found that poorer autoregulation was correlated with lower eGFR and associated with an increased risk of hemorrhagic transformation of ischemic stroke. Hemorrhagic transformation may result from breakthrough hyper-perfusion and microvascular injury in the setting of impaired autoregulation.[12]

We distributed patients according to Serum Creatinine concentration at time of presentation, most patients had serum creatinine in the range of 98-118 (32%) followed by 82-97 (28%). Maximum mortality was noted in >119 followed by 98-118 serum creatinine group. We distributed patients according to blood urea concentration at time of presentation, most patients had blood urea in the range of 6.8-8.9 (39%) followed by 5.3-6.7 (27%). Maximum mortality was noted in >9 followed by 6.8-8.9 blood urea group. We noted that age > 65 years, GCS score > 10 at the time of admission, smoking, diabetes mellitus and aspiration pneumonitis were predictors of death in stroke patients. A study on 821 consecutive patients with acute stroke (ischemic or hemorrhagic) demonstrated that chronic renal dysfunction defined as estimated glomerular filtration rate <60 mL/min/1.73 m2, was associated with increased mortality and adverse outcomes compared with patients with normal renal function.[13] Similarly, in a pooled analyses of 4 prospective community based cohorts low eGFR was significantly associated with increased risk of ischemic, but not haemorrhagic, stroke risk, while high albumin/creatinine ratio was associated with both stroke types.[14] Lee et al[15] in meta-analysis of 21 articles derived from 33 prospective studies, found that patients with a baseline eGFR of <60 ml/min/1.73 m2 had a risk of future stroke that was 43% greater than those with a normal baseline eGFR.

Early detection of deranged renal function could stimulate its treatment geared toward reducing the deterioration of renal function and preventing future risk of cardiovascular and cerebrovascular complications.[16] In patients with high risk factors for stroke, regular evaluation

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of renal function could reduce risk of stroke as well as complication and mortality after stroke. The specific causes for the adverse outcome and whether a more aggressive therapeutic approach can improve the prognosis of these patients should be assessed by future studies.

5. CONCLUSION

The severity of impaired kidney function in patients hospitalized with acute stroke is associated with increased mortality independent of age, sex, and major comorbidities. Unrecognized renal insufficiency noted by low eGFR is common in patients with acute stroke and is associated with higher mortality adverse short-term outcomes.

6. REFERENCES

1. Aggarwal HK, Jain D, Khare P, Bishnoi A. Evaluation of Renal Function in Patients of Acute Stroke and its Relationship with in-hospital Mortality. Journal, Indian Academy of Clinical Medicine. 2019 Jul;20(3-4).
2. Andersen KK, Olsen TS, Dehlendorff C, Kammersgaard LP. Hemorrhagic and ischemic strokes compared: stroke severity, mortality, and risk factors. Stroke. 2009 Jun 1;40(6):2068-72.
3. Hao Z, Wu B, Lin S, Kong FY, Tao WD, Wang DR, Liu M. Association between renal function and clinical outcome in patients with acute stroke. European Neurology. 2010 Mar 24;63(4):237-42.
4. Foley RN. Chronic Kidney Disease and the Risk for Cardiovascular Disease, Renal Replacement, and Death in the United States Medicare Population, 1998 to 1999. J Am Soc Nephrol. 2005;16(2):489–495.
5. Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: A systematic analysis for the Global Burden of Disease Study 2010. Lancet. 2012;380(9859):2095–2128.
6. Sarnak MJ, Levey AS, Schoolwerth AC, Coresh J, Culleton B, Hamm LL, et al. Kidney Disease as a Risk Factor for Development of Cardiovascular Disease: A Statement from the American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. Hypertension. 2003;42(5):1050–1065.
7. Kobayashi M, Hirawa N, Morita S et al.. Silent brain infarction and rapid decline of kidney function in patients with CKD: a prospective cohort study. Am J Kidney Dis 2010; 56: 468-76.
8. Schiffrin EL, Lipman ML, Mann JF. Chronic kidney disease: effects on the cardiovascular system. Circulation 2007;116(1):85-97.
9. Chillon JM, Massy ZA, Stengel B. Neurological complications in chronic kidney disease patients. Nephrol Dial Transplant. 2016, 31:1606–14.
10. Katarzyna Snarskaa et al., Renal function predicts outcomes in patients with ischaemic stroke and haemorrhagic stroke, Kidney Blood Press Res 2016;41:424-433
11. Bax L, Algra A, Mail WP, Edlinger M, Beutler JJ, van der Graaf Y; SMART study group: Renal function as a risk indicator for cardiovascular events in 3216 patients with manifest arterial disease. Atherosclerosis 2008;1:31- 38.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE6, 2024

12. Castro P, Azevedo E, Rocha I, Sorond F, Serrador JM. Chronic kidney disease and poor outcomes in ischemic stroke: is impaired cerebral autoregulation the missing link? BMC Neurol. 2018 Mar; 18(1): 21.
13. Yahalom G, Schwartz R, Schwammenthal Y, et al.. Chronic kidney disease and clinical outcome in patients with acute stroke. Stroke. 2009;40:1296-1303.
14. Mahmoodi BK, Yatsuya H, Matsushita K, Sang Y, Gottesman RF, Astor BC, Woodward M, Longstreth WT Jr, Psaty BM, Shlipak MG, Folsom AR, Gansevoort RT, Coresh J: Association of kidney disease measures with ischemic versus hemorrhagic strokes: pooled analyses of prospective community-based cohorts. Stroke 2014;45:1925-1931.
15. Lee M, Saver JL, Chang K-H, Liao H-W, Chang S-Ch, Ovbiagele B: Low glomerular filtration rate and risk of stroke: metaanalysis. BMJ 2010;341:4249-4259.
16. Baumelou A, Bruckert E, Bagnis C, Deray G. Renal disease in cardiovascular disorders. An underrecognized problem. Am J Nephrol. 2005;25(2):95-105.