ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

ROLE OF RENAL FUNCTION AND ITS RELATIONSHIP WITH IN-HOSPITAL MORTALITY IN PATIENTS OF ACUTE STROKE

Prasad Madhukar Sonawane[1], Shrenik Anil Gugale[2], Rahul Ashok Barhate[3], Mayur Vikram Devraj[4*]

1.Assistant Professor, Department of General Medicine, Vasantrao Pawar Medical College and hospital, Nashik.
2.Assistant professor, Department of General Medicine, MPGIMER, MUHS Nashik
3.Assistant professor, Department of General Medicine, MPGIMER, MUHS Nashik
4.Associate professor, Department of Emergency Medicine, MPGIMER, MUHS Nashik
5.

***Corresponding Author:**
Mayur Vikram Devraj, Associate professor, Department of Emergency Medicine, MPGIMER, MUHS Nashik

Abstract

Background: Stroke being the disease of the elderly, has associated with high morbidity and mortality rate. It is increasingly apparent that people with chronic renal disorder are much more likely to die from cardio-cerebrovascular diseases. Stroke is an emergency disease and shares the same atherosclerotic risk factors with ischemic heart disease but the association of renal function and stroke is poorly investigated.

Aim: In this study, we aimed to investigate the renal function in patients with acute stroke and its relationship with in-hospital mortality.

Material and Methods: The present study was a prospective, observational study conducted in patients admitted with clinical diagnosis of acute stroke, confirmed by CT scan / MRI. Glomerular filtration rate (eGFR) on admission was assessed using MDRD formula. Outcome in stroke patients was assessed in terms of mortality at 30 days since stroke episode.

Results: 160 patients were considered for present study. Patients were divided into two groups as per eGFR. Group X with eGFR>60 and Group Y with eGFR<60. 70% were from group X while 30% were from group Y. 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. Maximum mortality was noted in >119 umol/L 12(41%) followed by 98-118 mmol-10(33%) serum creatinine 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 results.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

Key words: acute stroke, estimated glomerular filtration rate (eGFR), serum creatinine, blood urea.

1. Introduction

Acute stroke is one common cause of emergency admission. Stroke being the disease of the elderly, has associated with high morbidity and mortality rate. Stroke is the second one most common cause of mortality and 1/3 most common cause of disability worldwide. Globally, 68% of all strokes are ischemic and 32% are hemorrhagic.[1] In India incidence of stroke became 147/100,000 and the yearly incidence rate become 36/100,000. overall prevalence of stroke ranges from 147–922/100,000 in various studies.[2,3] In potential studies, advanced age, hypertension, diabetes mellitus, smoking and atrial fibrillation were determined as risk factors for stroke and the relevant mortality.[4] various common risk factors among stroke and kidney dysfunction lead to a higher morbidity and mortality in patients of stroke. Almost all types of vascular disorder 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.[5] Reduced renal function may additionally reflect both the duration and severity of different cardiovascular risk factors such as hypertension, diabetes mellitus, and dyslipidemia, and it is often related with the development of other less established vascular risk factors including anemia, oxidative stress, electrolyte imbalance, and hyperhomocysteinemia.[6] It is increasingly apparent that individuals with chronic renal disease are more likely to die from cardio-cerebrovascular diseases.[7] Stroke is an emergency disease and shares the same atherosclerotic risk factors with ischemic heart disease but the association of renal function and stroke is poorly investigated. Stroke is a vascular disorder, and it is important for the development of both preventive and therapeutic techniques to identify the role of renal function. On global cardiovascular risk after an acute stroke. In this study, we aimed to investigate the renal function in patients with acute stroke and its relationship within hospital mortality.

2. Materials and Methods

The present study was a prospective, observational study conducted in patients admitted with clinical diagnosis of acute stroke, confirmed by CT scan / MRI. Glomerular filtration rate (eGFR) on admission was assessed using MDRD formula. Outcome in stroke patients was assessed in terms of mortality at 30 days since stroke episode.

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.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

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 intake, smoking/nicotine use, drug use, trauma, past history of TIA/stroke, cardiovascular disease or any other medical illness). At admission specific clinical examination for vital parameters, neurological deficit and Glasgow coma scale scoring were done in all patients. Routine investigations (CBC, 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 have been executed in all patients. Other investigations consisting of echocardiography, connective tissue workup, etc. Were done each time needed. Glomerular filtration rate (eGFR) on admission became assessed the use of modification diet for renal disease (MDRD) formula: eGFR (in ml/min per 1. 73m2) = 186.3 x p.c. (e [−1. 154]) x Age (e [-0. 203]) × (0.742 if female) × (1.21 if black). patients had been divided into two groups on the basis of eGFR:

Group X- patients with eGFR>60 ml/min/1.73 m2 of body surface area (BSA).

Group Y --patients with eGFR>60ml/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). The qualitative data between two groups was compared using Chi Square test and for comparison of the continuous variable, student t-test was used. P<0.05was considered statistically significant.

3. Results

160 patients were considered for present study. Patients were divided into two groups as per eGFR. Group X with eGFR>60 and Group Y with eGFR <60. 70% were from group X while 30% were from group Y. 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. 103(64%) patients had ischemic stroke, while 57(36%) had hemorrhagic stroke. We noted mortality within 30 days in 30 (19%) patients.

Table 1: General characteristics

Characteristics	Group-X (eGFR>60ml/min/1.73 m2)	Group-Y (Egfr<60ml/min/1.73 m2)
Total patients	112 (70%)	48 (30%)
Age (in years)		
18-40	5(4%)	2 (3%)
46-65	30 (22%)	12 (28%)
>65	77 (74%	34 (70%)

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

Male	70 (66%)	30 (68%)
Female	42 (34%)	18 (32%)
BMI (kg/ m2)		
<30	68 (60%)	34 (71%)
>30	44 (40%)	14 (29%)
Risk Factors		
Hypertension	63 (56%)	30 (62%)
Smoking	47 (42%)	23 (47%)
Diabetes Mellitus	45 (40%)	28 (59%
Cardiovascular disease	44 (38%)	30 (62%)
Alcohol	43(36%)	19 (38%)
Dyslipidemia	39 (35%)	19 (38%)
GCS score		
3-4	24 (21%)	5 (12%)
5-8	34 (30%)	9 (18%
9-13	42 (38%)	24 (50%)
>13	12 (11%)	10 (21%)
Type of stroke		
Ischaemic	73 (65%)	30 (62%)
Haemorrhagic	39 (35%	18 (38%)
Mortality (within 30days of presentation)	17 (15%)	13 (28%)

We distributed patients according to Serum Creatinine concentration at time of presentation, most patients had serum creatinine in the range of 98-118- 52(33%) followed by 82-97- 43 (27%). Maximum mortality was noted in >119- 12(41%) followed by 98-118-10(33%) serum creatinine group.

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

Serum Creatinine (umol/L)	No. of patients (n=160)	Outcome (Mortality within 30 days) (n=30)
30-81	27 (16%)	2 (7%)
82-97	43 (27%)	6 (19%
98-118	52 (33%)	10 (33%)
>119	38 (23%)	12 (41%)

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.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

Table 3: Predictors of death among stroke patients

	Alive (n=130)	Died (n=30)	p value
Age (In years)	61.9 ± 11.2	67.1 ± 10.6	< .01*
GCS score > 10	62 (48%)	24 (81%)	< .01*
Hypertension	68 (52%)	23 (78%)	0.21
Smoking	47 (36%)	21 (70%)	0.023*
Diabetes Mellitus	45 (35%)	24 (81%)	0.038*
Cardiovascular disease	52 (40%)	18 (59%)	0.072
Type of stroke			
Ischaemic	84 (65%)	21 (68%)	0.19
Haemorrhagic	46 (35%)	9 (32%)	0.1
Aspiration pneumonitis	31 (24%)	23 (78%)	< .01*

4. Discussion

Various risk factors for stroke include non-modifiable factors, such as male gender, age, non-Caucasian ethnicity, prior stroke, transient ischemic attack, heart attack and positive family history. Modifiable risk factors include high blood pressure, smoking, diet, obesity, sedimentary lifestyle and atrial fibrillation. Factors associated with impaired renal function that may contribute to the adverse outcome of patients with stroke include insulin resistance, oxidative stress, inflammation, endothelial dysfunction, vascular calcifications and increased plasma levels of fibrinogen and homocysteine.[8] Katarzyna Snarskaa et al..,[9] 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 had been mentioned in present study. The best indicator of renal function is estimated GFR rather than creatinine.[10] individuals with a decreased eGFR have less powerful 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 haemorrhagic transformation of ischemic stroke. Haemorrhagic transformation may also result from breakthrough hyper-perfusion and microvascular injury in the setting of impaired autoregulation.[11]Analysis of heart outcomes Prevention evaluation study (wish) has shown that mild degrees of renal dysfunction have been associated with increased risk of incident ischemic stroke or TIA.[12] Ischemic stroke is frequently associated with renal dysfunction and nearly a third of patients hospitalized with intracerebral haemorrhage (ICH) have chronic kidney disease.13 This explains relation of low eGFR and stroke. Multivariate analysis in a study, noted that independent predictors of mortality in patients with ischemic stroke were: ischemic heart disease or myocardial infarction in the past, diabetes, glucose at admission, and eGFR on admission, while in patients with haemorrhagic stroke were: age and glucose at admission.[9] In present study we noted that eGFR 65 years, GCS score > 10 at the time of admission, smoking, diabetes mellitus and aspiration pneumonitis had been predictors of death in stroke patients. A study on many consecutive patients with acute stroke (ischemic or

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

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.[14] 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.[15] Lee et al.. 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.[16] There is an ∼7% increased relative risk of stroke for every 10 mL/min per 1.73 m2 decrease in glomerular filtration rate, and the finding is consistent across major stroke subtypes.[17] A retrospective cohort including more than 500,000 participants identified a stepwise association between eGFR and ICH, where the risk of hemorrhage decreased by 9% (95% CI 8–11%) for each 10 mL/min/1.73 m2 increase in eGFR, such as after adjustment for medical comorbidities, albuminuria, antiplatelet therapy, and use of anticoagulants.[18] The heightened risk of stroke in patients with low eGFR represents the interplay of the vascular co-morbidities that occur with renal impairment.[19] Early detection of deranged renal function could stimulate its treatment geared toward reducing the deterioration of renal feature and preventing future risk of cardiovascular and cerebrovascular complications.[20] In patients with high risk factors for stroke, regular evaluation 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. 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; 380:2095.
2. Pandian JD, Sudhan P. Stroke Epidemiology and Stroke Care Services in India. Journal of Stroke. 2013;15(3):128-134.
3. Prasad K, Vibha D, Meenakshi. Cerebrovascular disease in South Asia - Part I: A burning problem. JRSM Cardiovasc Dis. 2012;1:20.
4. Carter AM, Catto AJ, Mansfield MW, Bamford JM, Grant PJ. Predictive variables for mortality after acute ischemic stroke. Stroke 2007;38(6):1873-80.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE3, 2024

5. 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.
6. Schiffrin EL, Lipman ML, Mann JF. Chronic kidney disease: effects on the cardiovascular system. Circulation 2007;116(1):85-97.
7. Chillon JM, Massy ZA, Stengel B. Neurological complications in chronic kidney disease patients. Nephrol Dial Transplant. 2016, 31:1606–14.
8. David Pereg, et al.., Prevalence and Significance of Unrecognized Renal Dysfunction in Patients with Stroke, The American Journal of Medicine, 2016, 129, 1074- 1081
9. Katarzyna Snarskaa et al., Renal function predicts outcomes in patients with ischaemic stroke and haemorrhagic stroke, Kidney Blood Press Res 2016;41:424-433
10. 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.
11. 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.
12. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY: Chronic kidney disease and risk of death, cardiovascular events and hospitalization. N Engl J Med 2004;351:1296-1305.
13. Ovbiagele B, Schwamm LH, Smith EE, et al..: Hospitalized hemorrhagic stroke patients with renal insufficiency: clinical characteristics, care patterns, and outcomes. J Stroke Cerebrovasc Dis. 2014; 23(9): 2265– 73.
14. Yahalom G, Schwartz R, Schwammenthal Y, et al.. Chronic kidney disease and clinical outcome in patients with acute stroke. Stroke. 2009;40:1296-1303.
15. 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 4 prospective community-based cohorts. Stroke 2014;45:1925-1931.
16. 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.
17. Masson P, Webster AC, Hong M, Turner R, Lindley RI, Craig JC. Chronic kidney disease and the risk of stroke: a systematic review and meta-analysis. Nephrol Dial Transplant. (2015) 30:1162–69.
18. Molnar AO, Bota SE, Garg AX, Harel Z, Lam N, McArthur E, et al.. The risk of major hemorrhage with CKD. J Am Soc Nephrol. 2016 Sep; 27(9): 2825–32.
19. Nayak-Rao S, Shenoy MP. Stroke in Patients with Chronic Kidney Disease…: How do we Approach and Manage it? Indian J Nephrol. 2017 May-Jun; 27(3): 167– 71.
20. Baumelou A, Bruckert E, Bagnis C, Deray G. Renal disease in cardiovascular disorders. An underrecognized problem. Am J Nephrol. 2005;25(2):95-105.