Impaired Renal Function in Stroke Patients with Atrial Fibrillation

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Background: Stroke patients with atrial fibrillation (AF) are prone to have comorbidities such as impaired renal function. Because poly-pharmacotherapy is often required in those patients, renal function is important to consider in light of renally cleared medications such as direct oral anticoagulants. In this study, we analyzed frequency and predictors for impaired renal function and its impact on functional outcome in stroke patients with underlying AF. *Methods:* We analyzed 272 patients with acute ischemic stroke and AF of our prospective, observational stroke database. Estimated glomerular filtration rate (eGFR) was calculated on admission and during hospitalization from the equation of the Modification Diet for Renal Disease. Outcome measures included mortality and functional outcome at 90 days, assessed as modified Rankin Scale (mRS) score. *Results:* On admission, impaired renal function was found in 41.5% (n = 113) and was associated with worse 90-day outcome (mRS score ≤ 2: 26.5% versus 45.9%, $P = .001$) and a higher mortality rate (23.9% versus 14.5%, $P = .043$). Multivariate logistic regression identified older age and history of myocardial infarction as independent predictors of renal dysfunction on admission ($P < .05$). Normalization of eGFR during hospitalization was achieved in 55.8%. *Conclusions:* In patients with acute ischemic stroke and AF, impaired renal function on admission is frequent and associated with worse outcome. Normalization of eGFR can often be achieved during hospitalization, but in everyday life, fluctuations of renal function because of infection or dehydration have to be considered. Careful monitoring of renal status is indispensable and should influence drug treatment decisions. **Key Words:** Acute ischemic stroke—atrial fibrillation—kidney disease—renal dysfunction—oral anticoagulation—direct oral anticoagulants.

Introduction

Impaired renal function is an independent risk factor for poor functional outcome after stroke.[1,2] Patients with stroke in the context of atrial fibrillation (AF) are frequently affected by comorbidities and often require poly-pharmacotherapy including oral anticoagulation as secondary prophylaxis. With the introduction of partially renally eliminated direct oral anticoagulants into clinical practice, kidney function has to be considered and closely monitored when choosing the optimal substance and

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Table 1. *Baseline characteristics*

Parameter	n = 113, GFR < 60 mL/min/ 1.73 m^2	n = 159, GFR ≥ 60 mL/min/ 1.73 m^2	*P*
Age (y)	80.3 ± 8.7	75.9 ± 10.8	.000
Male	44 (38.9%)	83 (52.2%)	.031
NIHSS score, median (range)	6 (0-40)	7 (0-40)	.630
Ischemia	96 (85.0%)	139 (87.4%)	.559
Transient ischemic attack	17 (15.0%)	20 (12.6%)	.559
Intravenous thrombolysis	36 (31.9%)	42 (27.0%)	.418
Prior myocardial infarction	23 (20.4%)	14 (8.8%)	.006
Prior ischemic stroke	57 (50.4%)	67 (42.1%)	.175
Prior hemorrhagic stroke	5 (4.4%)	4 (2.5%)	.386
Diabetes mellitus	50 (44.2%)	45 (28.3%)	.007
Arterial hypertension	109 (96.5%)	152 (95.6%)	.722
Hyperlipidemia	79 (69.9%)	107 (67.3%)	.648
Current smoking	9 (8.0%)	16 (10.1%)	.555
Pre-existing coronary heart disease	64 (56.6%)	64 (40.3%)	.008
$CHADS_2$ score, median (range)	4 (1-6)	3 (1-6)	<.001

Abbreviation: GFR, glomerular filtration rate; NIHSS, National Institutes of Health Stroke Scale.

dosage for long-term anticoagulation. We performed a databank-based analysis to assess renal function and its impact on outcome in acute ischemic stroke patients with underlying AF.

Materials and Methods

Study Population and Data Sources

Between January 2011 and January 2012, 279 patients with ischemic stroke (n = 242) or transient ischemic attack (n = 37) and AF were treated on our stroke or neurointensive care unit (Universitätsklinikum Erlangen, Germany). Patient characteristics, stroke specific information, and outcome were prospectively collected in our observational stroke database, which was approved by the institutional ethics committee. On admission, cardiovascular risk factors and standard blood samples were evaluated. Glomerular filtration rate was estimated (eGFR) applying the abbreviated equation of the Modification of Diet in Renal Disease study[3] on admission and repeatedly during hospital stay. Impaired renal function was defined as eGFR less than 60 mL/min/1.73 m^2.[4] Seven patients with acute kidney injury were excluded from further analysis.[5] Mortality and functional outcome after 90 days were assessed in a standardized telephone interview.

Statistical Analysis

Distribution of data was assessed with the Kolmogorov–Smirnov test. Continuous and categorical variables are expressed as mean (SD) or median (range) and as percentages, as appropriate. Normally distributed variables were compared with the unpaired *t* test, otherwise nonparametric tests (Mann–Whitney *U* test) were used. Categorical variables were compared using χ^2 test. Univariate and multivariate associations were evaluated with logistic regression. All parameters demonstrating a trend ($P < .15$) in univariate analysis were introduced into the multivariate model. Significance was set at *P* less than .05. Data were analyzed using the SSPS 19.0 for Windows software (SPSS, Inc., Chicago, IL).

Results

On admission, 120 patients had impaired renal function, 7 of those showed acute kidney injury and were excluded from further analysis.[5] Baseline patient characteristics depending on renal function (n = 113 with impaired renal function versus n = 159 with normal eGFR) are shown in Table 1. Mean serum creatinine on admission was 1.4 ± 0.5 mg/dL and .8 ± 0.2 mg/dL, respectively ($P < .001$). Independent predictors for an

Table 2. *Renal function status on admission*

Parameter	n = 113, GFR < 60 mL/min/ 1.73 m^2
Serum creatinine > 1.2 mg/dL	71 (62.8%)
Serum creatinine ≥ 1.5 mg/dL	35 (31.0%)
Mean eGFR (mL/min/1.73 m^2)	44.4 ± 10.7
eGFR ≥30 to <60 mL/min/ 1.73 m^2	100 (88.4%)
eGFR < 30 mL/min/1.73 m^2	13 (11.5%)
eGFR < 15 mL/min/1.73 m^2	1 (.9%)
Normalization of eGFR during hospital stay	63 (55.8%)

Abbreviations: eGFR, estimated glomerular filtration rate.