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Renal function is associated with 1-month and 1-year mortality in patients with ischemic stroke

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ABSTRACT

Background and aims: Renal dysfunction is a potent risk factor for cardiovascular diseases, including stroke. This study aimed to evaluate the impact of admission estimated glomerular filtration rate (eGFR) levels on short-term (1-month) and long-term (1-year) mortality in patients with acute ischemic stroke.
Methods: From the Taiwan Stroke Registry data, we classified ischemic stroke patients, identified from April 2006 to December 2015, into 5 groups by eGFR at admission: ≥ 90, 60–89, 30–59, 15–29, and <15 mL/min/1.73 m^2 or on dialysis. Risks of 1-month mortality and 1-year mortality after ischemic stroke were investigated by the eGFR level.
Results: Among 52,732 ischemic stroke patients, 1480 died within one month. The 1-month mortality rate was over 5-fold greater in patients with eGFR <15 mL/min/1.73 m^2 or dialysis than in patients with eGFR ≥90 mL/min/1.73 m^2 (2.88 *versus* 0.56 per 1000 person-days). The adjusted hazard ratio (HR) of 1-month mortality increased from 1.31 (95% CI = 1.08–1.59) for patients with eGFR 60–89 mL/min/1.73 m^2 to 2.33 (95% CI = 1.80–3.02) for patients with eGFR < 15 mL/min/1.73 m^2 or on dialysis. 3226 patients died within one year. The adjusted HR of mortality increased from 1.38 (95% CI = 1.21–1.59) for patients with eGFR 60–89 mL/min/1.73 m^2 to 2.60 (95% CI 2.18–3.10) for patients with eGFR < 15 mL/min/1.73 m^2 or on dialysis, compared to patients with eGFR ≥ 90 mL/min/1.73 m^2.
Conclusions: After acute ischemic stroke, patients with reduced eGFR are at elevated risks of short-term and long-term deaths in a graded relationship.

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1. Introduction

Older age, hypertension, diabetes, dyslipidemia, cardiac disease, cigarette smoking and drinking are well known risk factors for stroke [1]. Renal dysfunction is also a potent risk factor of cardiovascular diseases, including stroke [2–4]. The Kidney Early Evaluation Program demonstrated that chronic kidney disease (CKD) patients, with an estimated glomerular filtration rate (eGFR) < 60 mL/min/1.73 m^2 or urine albumin-creatinine ratio > 30 mg/g, are at a higher risk of either myocardial infarction or stroke [4]. Moreover, there is a graded association between a reduced eGFR and the risk of cardiovascular events, including stroke [2].

CKD is an important global public health problem, with estimated prevalence rates ranging from 10% to 15% in adults [5–7]. The US Renal Data System (USRDS) has shown that the prevalence of cerebrovascular disease increased from 17.5% in patients with stage 1 and 2 CKD to 19.2% in those with stage 5 CKD [8]. On the other hand, a recent investigation from the Get with the Guidelines-Stroke data found that more than half of 232,236 patients with acute stroke had renal dysfunction [9]. However, findings on the relationship between clinical outcomes of acute ischemic stroke and eGFR are inconsistent [10–17]. In addition, it is not clear whether post-stroke outcomes vary by the level of renal function impairment.

The aim of this study was to use the Taiwan stroke registry (TSR) data to investigate the impact of admission eGFR on short-term (1-month) and long-term (1-year) mortality for acute ischemic stroke patients.

2. Materials and methods

2.1. Data source

The TSR program, launched in 2006, is a government-funded project with the approval from Institutional Review Boards of 59 academic and community hospitals in Taiwan [18]. Details of the program have been reported elsewhere [18]. Pre-admission data, hospitalization data, and discharge information was recorded in the TSR database. In addition, telephone contacts were performed at 1, 3, 6, and 12 months to collect follow-up information for the registry system, including deaths. Informed consents were obtained from all patients before being included in the registry program.

2.2. Study subjects

There were 115,068 patients registered in the TSR program from April 2006 to December 2015. We excluded patients with hemorrhagic stroke and transient ischemic attack (TIA), age under 18 years, and patients without information on stroke type, dialysis status, Trial of Org 10172 in Acute Stroke Treatment (TOAST) information, body mass index (BMI), systolic blood pressure levels, hemoglobin levels, serum cholesterol levels, or serum creatinine levels at admission (Fig. 1). TIA was defined as a neurologic deficit lasting less than 24 h [19]. The remaining 52,732 ischemic stroke patients were included in this study and classified into 5 groups by eGFR: ≥ 90, 60–89, 30–59, 15–29, and <15 mL/min/1.73 m^2 or on dialysis. The eGFR was calculated by the CKD-EPI (Chronic Kidney Disease Epidemiology Collaboration) equation for each non-dialysis patient [20]. Two types of outcomes were evaluated: 1-month mortality and 1-year mortality after ischemic stroke.

2.3. Statistical analysis

Data analyses first compared the baseline characteristics among patients of the 5 eGFR groups, including distributions of sex, age, body mass index, smoking history, TOAST, stroke location, previous stroke history, comorbidities (atrial fibrillation, ischemic heart disease, congestive heart failure, diabetes mellitus), systolic blood pressure, cholesterol and hemoglobin measures, NIHSS score and medication use at admission (antiplatelet drugs, warfarin, lipid lowering drug and tissue plasminogen activator (tPA)). Chi-square test and Kruskal-Wallis test were used to examine differences of these baseline characteristics among 5 groups for categorical variables and continuous variables, respectively. The Kaplan-Meier method was used to plot survival curves for the 5 eGFR groups during the one-year follow-up period, and differences were examined by the log-rank test. The 1-month and 1-year mortality rates from ischemic stroke by the eGFR groups were calculated and presented as per 1000 person-days. Cox proportional hazards

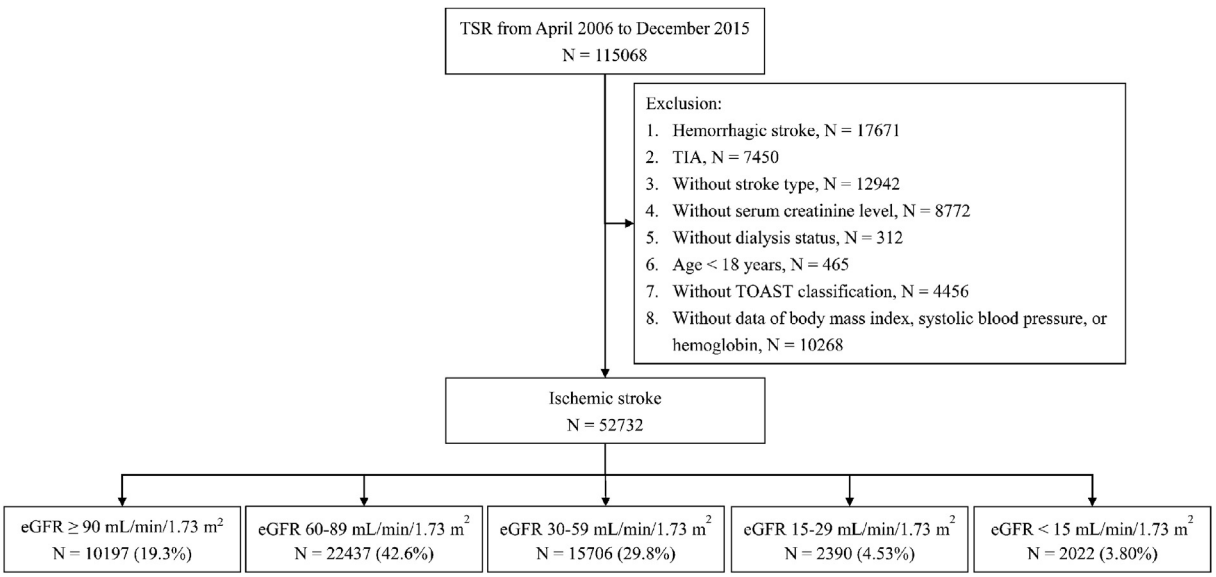

Fig. 1. Flow chart for the identification of study patients.

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