

# Acute Kidney Injury is Associated with Increased In-Hospital Mortality after Acute Stroke.

Julia Arnold<sup>1</sup>, Don Sims<sup>2</sup>, Paramjit Gill<sup>3</sup>, Paul Cockwell<sup>1</sup>, Charles Ferro<sup>1</sup>.

<sup>1</sup>University Hospitals Birmingham NHS Foundation Trust, Department of Renal Medicine, Birmingham, United Kingdom.

<sup>2</sup>University Hospitals Birmingham NHS Foundation Trust, Department of Stroke Medicine, Birmingham, United Kingdom.

<sup>3</sup>Institute of Applied Health Research, University of Birmingham, Birmingham, United Kingdom.

## INTRODUCTION

Stroke is the second biggest cause of death worldwide, after ischaemic heart disease. The association between chronic kidney disease (CKD) and worse outcomes after acute stroke is well recognised. However, there is a paucity of data on the relationship between acute kidney injury (AKI) and outcomes following acute stroke with no published studies from the United Kingdom. We therefore investigated the incidence of AKI and associated mortality in hospitalised stroke patients.

## METHODS

We conducted a single-centre, prospective, observational study of all patients with acute stroke admitted to a large tertiary centre between December 2012 and September 2015. Anonymised electronic data from the Sentinel Stroke National Audit Programme (SSNAP) and patient electronic health records were combined. AKI was defined as per the Kidney Disease Improving Global Outcomes (KDIGO) guidelines and using blood creatinine values.

## RESULTS

1440 patients were hospitalised with acute stroke in the study period. The mean age was 72.17 years. 48.8% of the cohort had a pre-existing diagnosis of hypertension and 29% had a previous stroke or transient ischaemic attack (TIA). 43.7% presented with moderate or severe stroke as determined by the National Institutes of Health Stroke Scale (NIHSS) score. The prevalence of CKD stage 3 or greater was 29% using the Modification of Diet in Renal Disease (MDRD) equation and 33.5% using the Chronic Kidney Disease Epidemiology (CKD-EPI) Collaboration equation.

Overall, 103 (7.6%) patients had an episode of AKI (65 had AKI stage 1, 22 had stage 2 and 16 had stage 3). In total, 151 (10.5%) patients died during the admission. 29 (19.2%) of patients with AKI died during the admission compared with 74 (6.2%) of patients without AKI (P value <0.001). In a univariable logistic regression, having an episode of AKI was associated with an increased risk of in-hospital mortality (Odds Ratio 3.620; 95% confidence interval (CI) 2.267-5.782; P <0.001). This relationship persisted after adjustment for age, gender, baseline renal function and stroke severity on admission (Odds Ratio 2.444; 95% CI 1.474-4.053; P=0.001).

Table 1. Baseline characteristics.

Variable	N = 1440	Data Completeness (100%)
Gender	Male	785 (54.5%)
	Female	655 (45.5%)
Age (SD)	72.17 ± 15.18	
Baseline comorbidities	Congestive cardiac failure	56 (3.7%)
	Hypertension	741 (48.8%)
	Atrial fibrillation	286 (18.8%)
	Previous stroke/ TIA	440 (29%)
	Diabetes mellitus	331 (21.8%)
	On antiplatelet agents	110 (7.2%)
	On anticoagulants	124 (8.2%)
Baseline blood tests (SD)	Creatinine (mean pre-admission) (µmol/L)	100.31 ± 72.67
	Creatinine (µmol/L)	93.11 ± 56.89
	Urea (mmol/L)	6.521 ± 3.65
	Haemoglobin (g/L)	13.301 ± 1.86
	Platelets (10 <sup>9</sup> /L)	224.68 ± 76.07
	INR	1.166 ± 0.44
Baseline blood pressure (SD)	Systolic (mmHg)	148.10 ± 26.18
	Diastolic (mmHg)	80.29 ± 15.48
Modified Rankin scale* score prior to admission with stroke	0-2	1220 (84.7%)
	3-4	191 (13.3%)
	5	29 (2.0%)
NIHSS Score** on arrival	0	175 (12.2%)
	1-4	637 (44.2%)
	5-15	414 (28.8%)
	16-20	106 (7.4%)
	21-42	108 (7.5%)

\*modified Rankin scale (mRS) score (0-6) where: 0-2 no symptoms/ mild disability; 3-4 moderate disability; 5 severe disability (6 dead)

\*\*NIHSS score, used to objectively quantify stroke severity, 11 item scale, each item scores 0-4, maximum possible score 42, where: 0 no stroke symptoms; 1-4 minor stroke symptoms; 5-15 moderate stroke; 16-20 moderate to severe stroke; 21-42 severe stroke

## CONCLUSIONS

AKI is associated with increased in-hospital mortality after an acute stroke. This association requires further investigation, focussing on potentially reversible risk factors that may help improve outcomes.

REFERENCES:  
Arnold et al. *Clin Kidney J.* 2016 Feb;9(1):29-38. Modulation of stroke risk in chronic kidney disease.

