

## Stroke Patients Who Are Recipients of Kidney Transplant Have Higher All-Cause Mortality and Are Healthier, Younger Than General Stroke Patients

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### Introduction

Stroke is the second most common cause of mortality and the third most common cause of disability, worldwide [1], and kidney transplantation (KT) is the preferable treatment for end-stage renal disease, with nearly 18,000 patients transplanted per year [2]. However, little is known about the characteristics and epidemiology of kidney transplant recipients (KTRs) who have strokes. We sought to determine (1) the proportion of patients with stroke and KT and their characteristics and (2) whether KT influences stroke population mortality.

### Methods

- Data: administrative claims data on hospital discharges from the National Inpatient Sample (NIS) database for patients who had strokes from 2000-2014
- Cross-sectional study of adult patients admitted with acute stroke
- We divided the population into kidney transplant recipients (KTRs) and non-KTRs
- We performed univariate analysis on known risk factors for stroke and multivariable quasi-logistic regression modelling on all factors found to be significant at the univariate level

### Results

- Compared to the general stroke population, KTRs were younger, more male, and more likely to have some expected risk factors (e.g., PKD, PVD)
- KTRs were less likely to have other expected risk factors (e.g., overweight/obese, COPD)
- Controlling for all other factors, all-cause mortality (OR 1.16 95% CI 1.01-1.32, P=0.031), age (OR 0.94, 95% CI 0.93-0.94, P<0.001), female sex (OR 0.87, 95% CI 0.79-0.95, P=0.002), HTN, overweight/obese status, atrial fibrillation, COPD, PKD, and PVD remained significantly different between KTRs with stroke and non-KTRs with stroke
- KTRs with stroke were no more likely to have diabetes mellitus than the general stroke population (P=0.946)

Table 1					
Characteristics	All Stroke Patients	Non-KTRs with Stroke	KTRs with Stroke	P	Sig
Demographics, n (%)					
n	8,064,596	8,050,407	14,189		
Age (SD)	72 (0)	72 (0)	60 (0)	<0.001	***
Female (%)	4,354,406 (54)	6,800 (50)	6,057 (43)	<0.001	***
Mortality (%)	669,492 (8)	668,636 (8)	1,405 (10)	0.005	***
Race					
					0.8
White	4,705,145 (58)	4,697,892 (58)	7,253 (51)		
Black	1,044,228 (13)	1,041,699 (13)	2,529 (18)		
Hispanic	475,347 (6)	474,041 (6)	1,306 (9)		
Asian or Pacific Islander	167,342 (2)	166,873 (2)	469 (3)		
Native American	28,899 (0)	28,816 (0)	83 (1)		
Other	160,248 (2)	159,975 (2)	273 (2)		
Invalid/Missing	1,436,031 (18)	1,433,868 (18)	2,163 (15)		
Smoking					
	1,394,734 (17)	1,393,400 (17)	1,334 (9)	<0.001	***
Covariates, n (%)					
Hypertension	4,608,856 (57)	4,603,491 (57)	5,365 (38)	<0.001	***
Diabetes Mellitus	68,282 (1)	68,100 (1)	122 (1)	0.9	
Overweight/Obese	448,183 (6)	447,688 (6)	495 (3)	<0.001	***
Marfan	1,140 (0)	1,140 (0)	0 (0)		
Ehler Danlos	409 (0)	409 (0)	0 (0)		
Dissection	38,295 (0)	38,245 (0)	50 (0)	0.3	
Hypercoagulable State	42,077 (1)	41,948 (1)	129 (1)	0.02	*
Heart Failure	1,282,206 (16)	1,280,280 (16)	1,926 (14)	<0.001	***
Myocardial Infarction	781,206 (10)	779,820 (10)	1,386 (10)	0.9	
Atrial Fibrillation	1,758,905 (22)	1,756,671 (22)	2,234 (16)	<0.001	***
COPD	962,359 (12)	961,589 (12)	770 (5)	<0.001	***
CKD	727,246 (9)	713,057 (9)	14,189 (100)	<0.001	***
PKD	4,195 (0)	3,939 (0)	256 (2)	<0.001	***
PVD	338,052 (4)	337,177 (4)	875 (6)	<0.001	***
Nationally representative statistics comparing kidney transplant recipients (KTRs) with stroke to non-KTRs with stroke. P-values shown for parametric univariate tests. Abbreviations: COPD=Chronic Obstructive Pulmonary Disease, CKD=Chronic Kidney Disease, PKD=Polycystic Kidney Disease, PVD = Peripheral Vascular Disease. Significance (grey): *** P<0.001, ** P<0.01, * P<0.05.					

### Conclusions

- KTRs with stroke are more likely to die from all causes compared to non-KTRs with stroke

Table 2			
Covariate	OR (95% CI)	P	Sig
Age	0.94 (0.93-0.94)	<0.001	***
Female	0.87 (0.79-0.95)	0.002	**
Death	1.16 (1.01-1.32)	0.03	*
Smoking	0.56 (0.48-0.64)	<0.001	***
Hypertension	21.2 (19.1-23.5)	<0.001	***
Overweight/Obese	0.37 (0.30-0.47)	<0.001	***
Hypercoagulable State	0.95 (0.63-1.45)	0.020	*
Heart Failure	0.51 (0.45-0.57)	<0.001	***
Atrial Fibrillation	1.28 (1.14-1.43)	<0.001	***
COPD	0.60 (0.50-0.71)	<0.001	***
CKD	-	<0.001	***
PKD	3.54 (2.40-5.22)	<0.001	***
PVD	1.02 (0.86-1.21)	0.08	
Odds Ratios for quasi-logistic regression of significant covariates on KTRs with strokes. CKD OR excluded from table (> 6E09) due to 100% of KTRs having CKD. Significance: *** P<0.001, ** P<0.01, * P<0.05.			

### Conclusions (cont.)

- KTRs are more likely to be healthy by several measures, no more likely to have diabetes mellitus, despite the known phenomenon of new -onset diabetes after transplantation [3]
- This analysis exposes the need for further study into this at-risk population and should inform clinicians of the unique characteristics of KTRs with stroke

### References

[1] Krishnamurthi RV, Feigin VL, Forouzanfar MH. Global and regional burden of first-ever ischemic and haemorrhagic stroke during 1990-2010: findings from the Global Burden of Disease Study 2010, GBP Stroke Experts Group. Lancet Glob Health. 2013;1(5):e259. [2] Suthanthiran M, Strom TB. Renal transplantation. N Eng J Med. 1994;331(6):365. [3] Sharif A, Hecking M, de Vries AP, et al. Proceedings from an international consensus meeting on posttransplantation diabetes mellitus: recommendations and future directions. Am J Transplant. 2014 Sep; 14(9):1992-2000.