

## Is Hypertension Influence the Outcome of Stroke? Comparative Study between Ischemic and Hemorrhagic Stroke

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Received: May 17, 2018; Published: July 12, 2018

### Abstract

**Purpose:** This study aims to compare impact of ischemic and hemorrhagic stroke with hypertension on clinical outcomes.

**Methods:** This comparative study identified 346 patients over 40 years old who had hypertension and were first time ischemic stroke or hemorrhagic stroke patients recorded in the Bethesda Hospital Yogyakarta Stroke Registry (2015 - 2016). Clinical outcomes were measured using the modified Rankin Scale (mRS). The data was analyzed using univariate and bivariate analysis followed by the chi-square test and independent t-test.

**Results:** From the 346 patients with 173 acute ischemic stroke, consist of ninety-two male (53.2%), and eighty-one female (46.8%). Fifty four patients (31.2%) were fifty-one until sixty years old. Sixty two of those patients (35.8%) experienced poor functional outcome (mRS  $\geq$  2). Compare to 173 hemorrhagic stroke patients, consist of one hundred and three male (59.5%), and seventy female (40.5%). Forty seven patients (27.2%) were fifty one until sixty years old, 128 of those patients (74%) experienced poor functional outcome (mRS  $\geq$  2). Bivariate analysis showed that hemorrhagic stroke patient with hypertension were significantly associated with clinical outcomes (RR: 2.06, 95% CI: 1,66 - 2,56,  $p < 0,001$ ).

**Conclusion:** Hemorrhagic stroke gives poor prognosis compare to acute ischemic stroke in patient with hypertension.

**Keywords:** Ischemic; Hemorrhagic; Stroke; Hypertension; Outcome

### Introduction

Stroke is the first leading cause of death in Indonesia [1] and second leading cause of death behind heart disease, accounting for 11.13% of total deaths worldwide. First-time incidence of stroke occurs almost 17 million times a year worldwide; one every two seconds [2]. In 2012, stroke was responsible for the death of 6.7 million in the world in 2012 [3]. The burden of disease (disability, illness and premature deaths) caused by stroke is set to double worldwide by 2030 [4].

Hypertension presents in 70% of patients with stroke, it is the most common and the most potent and modifiable risk factor [4]. High blood pressure is a contributing factor to 54% of strokes in England, Wales and Northern Ireland [5]. About 69 percent of people who have a first heart attack, 77 percent of people who have a first stroke and 74 percent who have congestive heart failure have blood pressure higher than 140/90 mm Hg [6]. Blood pressure is a simple physiologic parameter that is always measured, can be modulated, the identification and recognition of these, will influence the mortality rate of stroke patients.

Observational studies have given varying results about high blood pressure (BP) is common in acute stroke and might be associated with a poor outcome. Previous study also showed that high BP in acute ischemic stroke or PICH is associated with subsequent death, death or dependency, and death or deterioration [7]. A multivariate logistic regression analysis was performed to determine the independent association of cardiovascular risk factors on stroke type. Hypertension favored either of the stroke types [8].

**Methods**

This comparative study used secondary data from patients admitted between 2015 and 2016 as listed in the Stroke Registry of Bethesda Hospital Yogyakarta. The sample consisted of 346 patients over 40 years old who had hypertension and were first time ischemic stroke or hemorrhagic stroke patients recorded in the Bethesda Hospital Yogyakarta Stroke Registry (2015 - 2016). Clinical outcomes were measured using the modified Rankin Scale (mRS). The data was analyzed using univariate and bivariate analysis followed by the chi-square test and independent t-test.

**Results**

From the 346 patients with 173 acute ischemic stroke, consist of ninety-two male (53.2%), and eighty-one female (46.8%). Fifty four patients (31.2%) were fifty-one until sixty years old. Sixty two of those patients (35.8%) experienced poor functional outcome (mRS ≥ 2). Compare to 173 hemorrhagic stroke patients, consist of one hundred and three male (59.5%), and seventy female (40.5%). Forty seven patients (27.2%) were fifty one until sixty years old, 128 of those patients (74%) experienced poor functional outcome (mRS ≥ 2).

The independent, confounding and dependent variables are presented in table 2 and 3 which in table 3, demonstrate that gastrointestinal bleeding was significantly associated with clinical outcomes of hemorrhagic stroke patients (RR: 0.683, 95% CI: 0.611 - 0.764, p < 0.001)

Bivariate analysis showed that hemorrhagic stroke patient with hypertension were significantly associated with poor clinical outcomes (RR: 2.06, 95% CI: 1,66 - 2,56, p < 0,001).

Characteristics	Ischemic		Hemorrhagic	
	N = 173	%	N = 173	%
<b>Age, years</b>				
> 70	42	24.3	40	23.1
61 - 70	43	24.9	42	24.3
51 - 60	54	31.2	47	27.2
40 - 50	34	19.7	44	25.4
<b>Sex</b>				
Male	92	53.2	103	59.5
Female	81	46.8	70	40.5
<b>Onset-to-door time (ODT)</b>				
< 3 hours	20	11.6	26	15
3 - 6 hours	31	17.9	50	28.9
6 - 12 hours	31	17.9	33	19.1
12 - 24 hours	26	15	21	12.1
> 24 hours	65	37.6	43	24.9
<b>Complications</b>				
Urinary Tract Infection	0	0	4	2.3
Pneumonia	2	1.2	8	4.6
Gastrointestinal bleeding	4	2.3	31	17.9
Atrial Fibrillation	3	1.7	3	1.7
Pressure sores	2	1.2	6	3.5
Dyslipidemia	57	32.9	20	11.6
Ischemic Heart Disease	7	4	6	3.5
<b>Treatments</b>				
Antihypertension therapy	111	64.2	113	65.3
Statin therapy	90	52	14	8.1
Multivitamin	55	31.8	56	32.4
Neuroprotector therapy	45	26	43	24.9
<b>Clinical outcomes</b>				
Good (mRS < 2)	111	64.2	45	26
Poor (mRS ≥ 2)	62	35.8	128	74

**Table 1:** Baseline characteristics of stroke patients with hypertension as main risk factor.

Variables	mRS < 2	mRS ≥2	RR	95% CI	p-value
<b>Age, years</b>					
40 - 50	33 (9.5%)	45 (13%)	1.00	Reference	0.001
51 - 60	54 (15.6%)	47 (13.6%)	1.70	0.94 - 3.06	
61 - 70	42 (12.1%)	43 (12.4%)	2.10	1.05 - 4.21	
>70 years	27 (7.8%)	55 (15.9%)	0.77	0.48 - 1.22	
<b>Sex</b>					
Male	64 (37%)	28 (16.2%)	1.00	Reference	0.114
Female	47(27.2%)	34 (19.7%)	0.72	0.48 - 1.08	
<b>Onset - to - door time (ODT)</b>					
< 3 hours	23 (6.6%)	23 (6.6%)	1.00	Reference	0.282
3 - 6 hours	32 (9.2%)	49 (14.2%)	0.77	0.34 - 1.73	
6 - 12 hours	32 (9.2%)	32 (9.2%)	1.03	0.43 - 2.45	
12 - 24 hours	23 (6.6%)	24 (6.9%)	1.30	0.49 - 3.42	
> 24 hours	46 (13.3%)	62 (17.9%)	0.67	0.32 - 1.38	
<b>Ischemic Heart Disease</b>					
Yes	4(2.3 %)	3 (1.7%)	0.829	0.344 - 1.999	0.693
No	107 (61.8%)	59 (34.1%)			
<b>Dyslipidemia</b>					
Yes	42 (24.3%)	15(8.7%)	1.540	0.946 - 2.506	0.067
No	69 (39.9%)	47 (27.2%)			
<b>Atrial Fibrillation</b>					
Yes	1 (0.6%)	2(1.2%)	0.529	0.232 - 1.209	0.261
No	110 (63.6%)	60 (34.7%)			
<b>Urinary tract infection</b>					
Yes	0 (0%)	0 (0%)	-	-	-
No	111 (64.2%)	62 (35.8%)			
<b>Pneumonia</b>					
Yes	0 (0%)	2 (1.2%)	0.351	0.286 - 0.430	0.057
No	111 (64.2%)	60 (34.7%)			
<b>Gastrointestinal bleeding</b>					
<b>Yes</b>	0 (0 %)	4 (2.3%)	0.343	0.279 - 0.423	0.007
No	111 (64.2%)	58 (33.5%)			
<b>Pressure sores</b>					
Yes	0 (0%)	2 (1.2%)	0.351	0.285 - 0.430	0.057
No	111 (64.2%)	60(34.7%)			
<b>Antihypertension therapy</b>					
Yes	75 (43.4%)	36 (20.8%)	1.293	0.869 - 1.924	0.211
No	36 (20.8%)	26 (15%)			
<b>Statin therapy</b>					
Yes	60 (34.7)	30 (17.3%)	1.157	0.776 - 1.724	0.474
No	51 (29.5%)	32 (18.5%)			
<b>Multivitamin</b>					
Yes	32 (18.5%)	23(13.3%)	0.790	0.528 - 1.184	0.263
No	79 (45.7%)	39 (22.5%)			
<b>Neuroprotectant</b>					
Yes	26 (15%)	19 (11%)	0.796	0.523 - 1.211	0.299
No	85 (49.1%)	43 (24.9%)			

**Table 2:** Bivariate analysis of independent variables and dependent variable for ischemic stroke patients.

Variables	mRS < 2	mRS ≥2	RR	95% CI	p- value
<b>Age. years</b>					
40 - 50	14 (8.1%)	30 (17.3%)	1.00	Reference	0.487
51 - 60	14 (8.1%)	33 (19.1%)	0.97	0.73 - 1.27	
61 - 70	8 (4.6%)	34 (19.7%)	0.84	0.65 - 1.08	
>70 years	9 (5.2%)	31 (17.9%)	0.88	0.67 - 1.14	
<b>Sex</b>					
Male	26 (15%)	77 (44.5%)	1.00	Reference	0.780
Female	19 (11.0%)	51 (29.5%)	1.026	0.85 - 1.23	
<b>Onset - to - door time (ODT)</b>					
< 3 hours	9 (5.2%)	17 (9.8%)	1.00	Reference	0.560
3 - 6 hours	13 (7.5%)	37 (21.4%)	0.88	0.63 - 1.22	
6 - 12 hours	10 (5.8%)	23 (13.3%)	0.93	0.65 - 1.34	
12 - 24 hours	3 (1.7%)	18 (10.4%)	0.76	0.54 - 1.06	
> 24 hours	10 (5.8%)	33 (19.1%)	0.85	0.61 - 1.17	
<b>Ischemic Heart Disease</b>					
Yes	1 (0.6%)	5 (2.9%)	0.884	0.611 - 1.278	0.595
No	44 (25.4%)	123 (71.1%)			
<b>Dyslipidemia</b>					
Yes	8 (4.6%)	12 (6.9%)	1.264	0.874 - 1.827	0.129
No	37 (21.4)	116 (67.1)			
<b>Atrial Fibrillation</b>					
Yes	0 (0.0%)	3 (1.7%)	0.735	0.672 - 0.805	0.300
No	45 (26%)	125 (72.3%)			
<b>Urinary tract infection</b>					
Yes	0 (0.0%)	4 (2.3%)	0.734	0.670 - 0.803	0.230
No	45 (26%)	124 (71.7%)			
<b>Pneumonia</b>					
Yes	2 (1.2%)	6 (3.5%)	0.986	0.654 - 1.486	0.947
No	43 (24.9%)	122 (70.5%)			
<b>Gastrointestinal bleeding</b>					
Yes	0 (0.0%)	31 (17.9%)	0.683	0.611 - 0.764	<0.001
No	45 (26%)	97 (56.1%)			
<b>Pressure sores</b>					
Yes	1 (0.6%)	5 (2.9%)	0.884	0.611 - 1.278	0.595
No	44 (25.4%)	123 (71.1%)			
<b>Antihypertension therapy</b>					
Yes	33 (19.1%)	80 (46.2%)	1.130	0.950 - 1.344	0.189
No	12 (6.9%)	48 (27.7%)			
<b>Statin therapy</b>					
Yes	7 (4 %)	7 (4%)	1.522	0.895 - 2.588	0.033
No	38 (22%)	121 (69.9)			
<b>Multivitamin</b>					
Yes	17 (9.8%)	39 (22.5%)	1.092	0.894 - 1.335	0.367
No	28 (16.2%)	89 (51.4%)			
<b>Neuroprotectant</b>					
Yes	13 (7.5%)	30 (17.3%)	1.081	0.867 - 1.346	0.467
No	32 (18.5%)	98 (56.6%)			

Table 3: Bivariate analysis of independent variables and dependent variable for hemorrhagic stroke patients.

Variables	mRS < 2	mRS ≥2	RR	95% CI	p-value
<b>Type stroke</b>					
Ischemic	111 (32.1%)	62 (17.9%)	1.00	Reference	< 0.001
Hemorrhagic	45 (13.0%)	128 (37.0%)	2.06	1.66- 2.56	

**Table 4:** Bivariate analysis of independent variables and dependent variable for type of stroke.

**Discussion**

Descriptive analysis showed that from 346 patients with 173 acute ischemic stroke sixty two of those patients (35.8%) experienced poor functional outcome (mRS ≥ 2), compare to 173 hemorrhagic stroke patients, 128 of those patients (74%) experienced poor functional outcome (mRS ≥ 2). Bivariate analysis showed that hemorrhagic stroke patient with hypertension were significantly associated with poor clinical outcomes (RR: 2.06, 95% CI: 1,66 - 2,56, p < 0,001).

There are two cohort studies that clearly showed that the higher the degree of hypertension, the higher is the risk of developing ICH. Leppälä, *et al.* [9] found an adjusted relative risk of 2.20 for systolic BP of 140 to 159 mmHg and 3.78 for ≥ 160 mmHg compared with ≤ 139 mmHg. In another study, Suh, *et al.* [10] found an RR of 2.2 for high normal BP, 5.3 for stage 1 hypertension 10.4 for stage 2 hypertension, and 33 for stage 3 hypertension. Hypertension related ICH tends to have a higher risk of hematoma expansion. Hematoma expansion is frequently associated with early neurological deterioration in patients with ICH. Patients with neurological deterioration had worse mRS (p < 0.001) [11].

Hypertension induces a high intraluminal pressure in the intracerebral arteries leads to extensive alterations in the smooth muscle wall and endothelium functions. Fibrinoid necrosis (lipohyalinosis) of penetrating arteries and arterioles supplying the white matter, resulting in small white matter infarcts (lacunes) or brain hemorrhage, hyalinosis, and Charcot-Bouchard aneurysms could be the form of the changes [12,13]. A condition that leads to a particular type of degeneration, known as lipohyalinosis or fibro- hyalinosis, which results in necrotic lesions in the small penetrating arteries of the brain [14]. Lipohyalinosis may lead to vascular occlusions, rearrangement of the cellular architecture and changes in the composition of the vascular wall alters the mechanical and hemodynamic properties of the vessels [13].

**Conclusion**

Hemorrhagic stroke gives poor prognosis compare to acute ischemic stroke in patient with hypertension.

**Bibliography**

1. World Health Organization. The Top 10 Causes of Death. Switzerland: WHO (2014).
2. World Health Organization. "State of The Nation: Stroke Statistics". England: WHO (2015).
3. World Health Organization. "Global Burden of Disease". Switzerland: WHO (2004).
4. Feigin VL, *et al.* "Global and Regional Burden of Stroke During 1990-2010: Findings From The Global Burden of Disease Study 2010". *The Lancet* 383.9913 (2013): 245-254.
5. Royal College of Physicians Sentinel Stroke National Audit Programme (SSNAP). Clinical Audit April - June 2015 Report. Royal College of Physicians, Clinical Effectiveness and Evaluation Unit on behalf of the Intercollegiate Stroke Working Party (2015).
6. American Heart Association. Statistical Fact Sheet 2013 Update: High Blood Pressure. Dallas: AHA (2013).

7. Willmot M., *et al* . "High Blood Pressure in Acute Stroke and Subsequent Outcome: A Systematic Review". *Hypertension* 43.1 (2004): 18-24.
8. Andersen KK., *et al* . "Hemorrhagic and Ischemic Strokes Compared Stroke Severity, Mortality, and Risk Factors". *Stroke* 40.6 (2009): 2068-2072.
9. Leppälä JM., *et al* . "Different Risk Factors for Different Stroke Subtypes: Association of Blood Pressure, Cholesterol, and Antioxidants". *Stroke* 30.12 (1999): 2535-2540.
10. Suh I., *et al* . "Low Serum Cholesterol and Haemorrhagic Stroke in Men: Korea Medical Insurance Corporation Study". *Lancet* 257.9260 (2001): 922-925.
11. Kumar S. "Hypertension and Hemorrhagic Stroke". *Hypertension* 3.2 (2017): 89-93.
12. Johansson BB. "Hypertension Mechanism Causing Stroke". *Clinical and Experimental Pharmacology and Physiology* 26.7 (1999): 563-565.
13. Ladeola C and Davisson RL. "Hypertension and Cerebrovascular Dysfunction". *Cell Metabolism* 7.6 (2008): 476-484.
14. Lammie GA. "Hypertensive Cerebral Small Vessel Disease and Stroke". *Brain Pathology* 12 (2002): 358-370.

**Volume 10 Issue 8 August 2018**

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