Jurnal Saintika Medika
Jurnal Ilmu Kesehatan dan Kedokteran Keluarga
Faculty of Medicine UMM

Vol. 16 No. 2 December 2020
p-ISSN : 0216-759X e-ISSN : 2614-X476X
http://ejournal.umm.ac.id/index.php/sainmed

Research Article

Sensitivity, Specificity, and Diagnosting Value of Bahrudin's Score in Diagnosing Stroke Compared to CT-Scan

Mochamad Bahrudin[1], Salsabilla Rihadatul Aisy D. P.[2]

[1]Departement of Neurology, Faculty of Medicine, University of Muhammadiyah Malang Jl. Bendungan Sutami, No. 188 A, Malang

Email : mochbahrudin1012@gmail.com

Received : Mart4th2020. Revised : May3th2020. Published: Dec27th2020

DOI: https://doi.org/10.22219/sm.Vol16.SMUMM2.15044

ABSTRACT

Stroke is an emergency situation leading to disability and death. Fast, precise, and easy diagnostic tools is needed as an substitute for CT-Scan, especially when CT-Scan is not available. This study is conducted to determined sensitivity, specificity, and diagnostic value of Bahrudin's Score compared to CT-Scan in diagnosing bleeding or infarct stroke. This research was conducted at Gambiran Kediri Hospital and Lamongan Muhammadiyah Hospital using 89 patients as samples. It was analyzed to define sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, negative likelihood ratio, accuracy, reciever operating characteristic curve, and area under curve in order to define diagnostic value of Bahrudin's Score. Infarct stroke was found in 54%, 58% happened in male and 96,6% found in age over 40. Sensitivity of Bahrudin's Score is 0.868, specificity 0.860, positive predictive value os 0.825, negative predictive value is 0.896, positive likelihood ratio is 6.600, negative likelihood ratio is 0.153, accuracy 0.864, and AUC 86.4%. It is determined that Bahrudin's score with AUC 86.4% is feasible to replace CT-Scan when it is not available.

Keywords : Bahrudin's Score, CT-Scan, Stroke, Diagnostic Tool

INTRODUCTION

WHO definition of stroke is a rapidly developing clinical signs of focal (or global) disturbance of cerebral function. Symptoms of stroke is lasting 24 hours or more, or those symptoms causing death, with no apparent cause other than vascular origin.(Coupland AP, 2009)Stroke is an emergency condition widely known as brain attack. This term needs to be spread to the community in order to raise awareness about stroke symptoms, so that when stroke strikes, they will seek for competent help.(Kusuma Y, 2009. Bahrudin M, 2015)

Stroke still become a major health problem, not only in medical field, but also in psychological and sosioeconomics. Stroke is ranked as second cause of death worldwide. WHO estimated 5.54 million people die due to stroke, or about 9.5% out of all death in the world.

Moreover, 50 million people or 3.5% out of all people in the world becoming disable.(Coupland AP, 2009) Stroke is rocketing up as high as 30% today compared to 1983.(Sustrani Alam, 2006) Indonesia has highest proportion of stroke in Asia, and also ranked fourth worldwide (right after India, China, and USA.Indonesian Ministry of Health releasing Basic Healthcare Research at 2013, indicates that the incidence of stroke is increasing from 8.3 per 1000 (per mil) in 2007 to 12.1 per 1000 in 2013. (Kemenkes RI, 2013. Kemenkes RI, 2014. Kemenkes RI, 2018)

Stroke demand not only quick diagnosis and treatment, but also a precise one. Gold standart diagnosing tool to diagnose stroke is using CT-Scan.(Choudhury MJH,2015) In Indonesia, only a few hospital has this modality, that is why we need an early diagnostic tool to differentiate hemorrhage and ischaemic stroke. Hemorrhagic and ischaemic stroke had different treatment. One of this diagnostic tool is scoring system. There are few scoring system widely used, such as Siriraj Score, Gajahmada Algorithm, Allen score, Guy's hospital stroke score, and Bahrudin's score. Those scoring system had been tested for its accuracy, but the results are varied.(Feignin V, 2007.American Heart Association, 2017)For example, Kochar et al stated that Siriraj and Allen Score are less good in differentiating hemorrhagic and ischaemic stroke. Other studies by Raghuram express that Siriraj and Guy's hospital score can be used as CT-Scan substitute.

Bahrudin's Score is a method to identify type of stroke, especially in place with no neuroimaging tools. Bahrudin's Score was developed in 2009 and calculated as (1 x level of consciousness) + (1 x vomiting) + (1 x headache) + (1 x high blood pressure). GCS equal to 15 is scored as 0 and GCS below 15 scored as 1. If there is no vomiting, it scored as 0 and vice versa. No headache scored as 0 and if the patient had headache it is scored as 1. Lastly, if the person had normal blood pressure, it is scored as 0, and if the person had high blood pressure it is scored as 1. A total score above 2 indicates ischaemic stroke, score 2 indicates borderline result and need to be confirmed using computerised brain scan, and score below 2 indicates hemorrhagic type stroke. (Bahrudin, 2015) According to that, we want to evaluate sensitivity, specificity,and accuracy of Bahrudin's Score in differentiate hemorrhagic and ischaemic stroke compared to CT-Scan.

METHODS

This study is an obervational analytic-cross sectional study by taking sample of 89 patient. The inclusion criteria Research was conducted at inpatient ward of Gambiran Kediri State Hospital and Lamongan Muhammadiyah Hospital, from October 2018 to December 2018. Data was taken using physical examination and put in a form filled by junior doctor at Gambiran Kediri State Hospital and Lamongan Muhammadiyah Hospital. Data was analyzed using diagnostic test to figure the sensitivity, specificity, positive predictive value, negative predictive value, positive likelihood ratio, negative likelihood ratio, and its accurary. We also analyzed Receiver Operating Characteristic curve so that we found area under curve value to determine diagnostic value of Bahrudin's Score.

RESULTS AND DISCUSSION

This research was conducted at inpatient ward of Gambiran Kediri State Hospital dan Muhammadiyah Lamongan Hospital from October 2018 to December 2018. The sample obtained according to inclusion criteria were 88 patients .

Table 1. Distribution of age, gender, and type of stroke

	Frequency	Percentage
Age		
≤ 40 yrs	3	3,4 %
>40 yrs	85	96,6%
Gender		
Female	37	42%
Male	51	58%
Type of Stroke		
Hemorrhagic	40	45,5%
Infarction	48	54,5%

From the table above, stroke appear more in person with old age (>40 yrs) with 96.6%, mostly in male with 58%, and infarct in dominating with 54.5%. A study stated that old age multiply the risk of stroke incidence. Person over 45 years old have more risk to develop stroke later in life, and its risk arise every three years by 11-20%. (Feignin V, 2007)

Male have higher incidence of stroke based on this study with 58% stroke happened in male. This is similar to a study in Indonesian hospital, stroke appear more frequent in male with 1.25 higher risk rather than female. (Sustrani Alam, 2006) This support the theory that women having lower stroke incidence presumably due to estrogen. Estrogen has protective value against atherosclerosis. (Choudhury MJH, 2015)

The incidence rate of infarct type of stroke is 83% and the rest is hemorrhagic stroke.[7] Based on table 1, infarct stroke had dominating with 54.5% (48 people out of 88 samples), and 45.5% the rest is hemorrhagic stroke.

Table 2. Distribution of Clinical Manifestation of Stroke using Bahrudin's Score

	Type of Stroke		Total
	Hemorrhagic	Infarction	
Consciousness			
Normal	21(37,7%)	35(62,5%)	56(100%)
Decreased	19(59,4%)	13(40,6%)	32(100%)
Vomiting			
No Vomiting	14(23,7%)	45(76,3%)	59(100%)
Vomiting	26(89,7%)	3(10,3%)	29(100%)
Headache			
No Headache	9 (24,3%)	28(75,7%)	37(100%)
Headache	31(60,8%)	20(39,2%)	51(100%)
Blood Pressure			
Normal	13(28,3%)	33(71,7%)	46(100%)

Hypertension	27(64,3%)	15(35,7%)	42(100%)

It is shown in table 2 that loss of consciousness, vomiting, headache, and higher blood pressure were more dominant in hemorrhagic one rather than the infarct one. This condition is similar as in other studies stated that loss of consciousness, vomiting, and headache are signs of high intracranial pressure. Hemorrhagic stroke happened due to rupture of brain vessels causing blood clot formation. Blood clot formation induce mass effect leading to higher intracranial pressure. High intracranial pressure causing compression at diencephalon, especially in reticular formation, leading to fast decrease of consciousness. (Masood CT, 2016. Parmar P, 2018)

Blood clot formation also distend, distort, deform, and stretch pain-sensitive structure at central nervous system, resulting headache and vomiting. (Masood CT, 2016) This is different from ischaemic type stroke, which causing occlusion at blood vessel of the brain. Those occlusion causing lower blood flow and accumulation of lactic acid. This leads to faster cell death, but it not causing too much mass effect because there is no hematome. (Japardi, Iskandar, 2002)

Higher blood pressure affect more people with hemorrhage stroke with 64.3%, compared to ischaemic stroke with 35.7%. Most of hemorrhagic stroke caused by hemodynamic factor, one of it being hypertension. Other than that, it also affected by anatomical problem such as brain vessel malformation and hemostatic factor related to platelet and coagulation. (Bahrudin M, 2017)

Table 3. Cross Tabulation of Bahrudin Score compared to CT Scan

		Bahrudin Score		Total
		Hemorrhagic	Infarct	
CT Scan	Hemorrhagic	33(86.8%)	7(14.0%)	40(45.5%)
	Infarct	5(13.2%)	43(86.0%)	48(54.5%)
Total		38(100.0%)	50(100.0%)	88(100.0%)
Sensitivity			0.868	
Specificity			0.860	
Positive Predictive Value			0.825	
Negative Predictive Value			0.896	
Positive Likelihood Ratio			6.600	
Negative Likelihood Ratio			0.153	
Accuracy			0.864	

We found that Bahrudin Score had 86.8 % sensitivity and 86 % specificity. This means that true positive proportion compared to all subject with stroke as big as 86.8%, and the specificity means true negative proportion compared to all subject with no stroke attain 86%.

Positive predictive value of this scoring system were 0.825 and negative predictive value 0.896. Positive likelihood ration were 6.600 and negative likelihood ratio were 0.153.The accuracy of this scoring system 86.4%.

When the doctor gets a positive test result, the question arises how much of this positive result is really positive and vice versa. This question is related to positive predictive value (PPV) and negative predictive value (NPV). For clinicians, PPV and NPV have a more important meaning than the value of sensitivity and specificity because in the end what a clinician does is interpret the results of the tests that have been carried out. The PPV and NPV values are strongly influenced by the prevalence of the disease. These two values will be different if done in diseases that have different prevalence. Therefore we need a diagnostic parameter that is not affected by prevalence.The diagnostic parameters that were not affected by prevalence were the positive likelihood ratio (PLR) and the negative likelihood ratio (NLR). (Dahlan Sopiyudin, 2009)

The Diagnostic value of Bahrudin's score was rated using receiver operator Curve (ROC) and we seach for area under curve. We determined its intersection point using a graphic of sensitivity and specificity. The higher the sensitivity, the lower the specificity, and vice versa. Based on that, an attempt to raise sensitivity will lower the specificity, so that the closer ROC curve to diagonal line, the worse the result is. Best intersection point ois the farthest left over diagonal line. (Dahlan Sopiyudin, 2009)

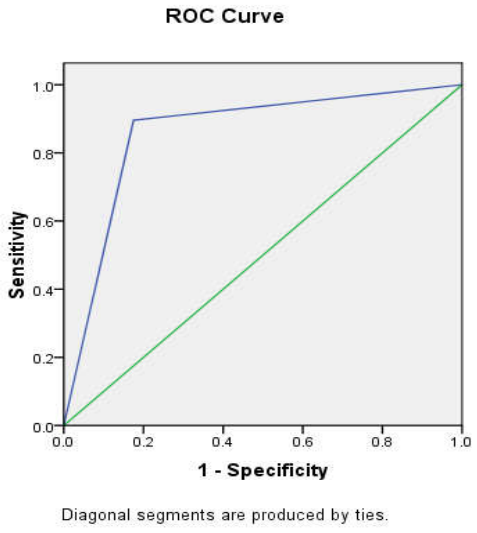

Figure 1. ROC curve

Based on those curve, we attained area under curve (AUC) value 86.4%, which means that diagnostic value of Bahrudin's Score compared to CT-Scan is good and relevant as substitute for CT-Scan in diagnosing type of stroke.

CONCLUSION

Characteristics of stroke patients based on age mostly occurred at the age of more than 40 years 96.6%, occurred more frequently in male patients 58%, and infarct stroke dominated 54.5%. The sensitivity of this scoring system is 86.8% with specificity 86%, positive predictive value 0.825, negative predictive value 0.896, positive likelihood ratio 6,600, negative likelihood ratio 0.153, accuracy 86.4%, and under curve area value (AUC) 86.4%. Diagnostic value of Bahrudin's Score compared to CT-Scan is good and relevant as substitute for CT-Scan in diagnosing type of stroke. The sooner we identify the typoe of stroke, the faster we can carry the treatment. Further research is needed to determine the strength of the diagnostic value of the method in diagnosing acute stroke and to compare it with other stroke diagnostic scoring methods such as Siriraj score or Gajah Mada Algorithm, so that this method is feasible to use like other stroke diagnostic scoring methods.

REFERENCES

American Heart Association (2017). Let's Talk about Stroke : *Risk factors for stroke*. tersedia pada : www.strokeassociation.org/letstalkaboutstroke. (diakses 15 September 2019)

Bahrudin M, 2015, Bahrudin Skor (Skor diagnostic untuk menentukan jenis stroke perdarahan atau sumbatan berdasarkan gejala klinis), Cakrawala Indonesia, Malang. pp. 68 – 72.

Bahrudin M, 2017, Stroke dalam Neurologi Klinis, UMM Press, Malang, pp. 239 – 302.

Choudhury MJH, Chowdhury MTI, Nayeem A, & Jahan WA, 2015, *Modifiable and Non-Modifiable Risk Factors of Stroke: A Review Update*, *Journal of National Institute of Neurosciences Bangladesh*, 1(1), pp.22–26. https://doi.org/10.3329/jninb.v1i1.22944

Coupland AP, Thapar A, Qureshi MI, Jenkins H, Davies AH. The definition of stroke. J R Soc Med. 2017;110(1):9–12.

Dahlan Sopiyudin, 2009, Penelitian diagnostik, Salemba medika, Jakarta.

Feignin V. 2007, Stroke, Panduan Bergambar Tentang Pencegahan dan Pemulihan Stroke. Jakarta: PT Bhuana Ilmu Populer. Pp. 9-20

Japardi, Iskandar 2002, Patofisiologi Stroke Infark akibat tromboemboli, Available from URL: http://www.library.usu.ac.id diakses 20 Juli 2009

Kemenkes RI, 2013, Riset Kesehatan Dasar (RISKESDAS), Balitbang Kemenkes RI, Jakarta.

Kemenkes RI, 2014, Infodatin : Situasi Kesehatan Jantung, Pusat Data dan Informasi Kementrian Kesehatan RI, Jakarta.

Kemenkes RI, 2018, Hasil Utama Riskesdas di Indonesia *2018*, Balitbang Kemenkes RI, Jakarta.

Kusuma Y, Venketasubramanian N, Kiemas LS, Misbach J. Burden of stroke in Indonesia. Int J Stroke. 2009;4(5):379–80.

Masood CT, Hussain M, Anis-ur-Rehman, & Abbasi S, 2016, *Clinical presentation, risk factors and outcome of stroke at a district level teaching hospital*, Journal of Ayub Medical College,Abbottahad : JAMC, *25*(1-2), pp. 49-51

Parmar P, 2018, *Stroke : classification and diagnosis*, The Pharmaceutical Journal, London North West University Healthcare NHS Trust, pp. 01 – 15 https://doi.org/10.1211/CP.2018.20204150

Sustrani, Alam, 2006, Stroke, Jakarta, Gramedia Pustaka Utama, pp 7 – 33 Trisetiawati