VOLUME - 10, ISSUE - 03, MARCH - 2021 • PRINT ISSN No. 2277 - 8160 • DOI : 10.36106/gjra

Original Research Paper

General Medicine

STUDY FOR COMPARISON OF SIRIRAJ STROKE SCORE WITH COMPUTERISED TOMOGRAPHY IN DECIDING THE TYPE OF STROKE AMONG THE PATIENTS ADMITTED AT SNMC, BAGALKOT (KARNATAKA).

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ABSTRACT

Background and objective: Computed tomography (CT) scan is an accurate, noninvasive procedure, routinely used as an investigative tool to distinguish between cerebral infarction and haemorrhage . However, quick access to CT scan is not available in every country and hospital. Different investigators have tried to develop scoring systems which can be used at the bedside for diagnosing stroke subtypes. Siriraj Stroke Score and Guy's hospital score are two popular stroke scores. Early detection of intracranial blood is essential for the rational use of anti hemostatic drugs in stroke patients. The aim of this study was to differentiate between cerebral infarct and intracerebral haemorrhage on the basis of Siriraj stroke score and to find out the sensitivity, specificity and overall accuracy of the scoring system by comparing it with CT scan findings. **Material and methods:** Fifty (50) consecutive cases of acute stroke were studied. Siriraj Stroke Score (SSS) was calculated. Sensitivity and specificity of SSS for infarction and haemorrhage was tested against computed tomography scanning (CT) of brain as a gold standard. The findings were recorded and statistically analyzed. **Results:** Out of the total 50 patients, CT brain showed cerebral infarction in 37 patients and haemorrhage in 13 patients. The sensitivity of Siriraj score for detecting infarction was 96.88% and specificity was 53.85%. The sensitivity of Siriraj score for detecting haemorrhage was 53.85% and specificity was 96.88%. The overall accuracy of Siriraj stroke score was 84.4%. **Conclusion:** In centers where CT scan is not available Siriraj Stroke Score can be used for the bedside diagnosis of the nature of the lesion in stroke patients. When computed tomography is not immediately available and the clinician wishes to start anti-thrombotic treatment, the clinical diagnosis based on the Siriraj stroke score can be useful to identify patients at low risk of intracerebral hemorrhage. Our study has shown that siriraj stroke scoring has a high degree of accuracy in detecting both types of strokes, with roughly 84% of both hemorrhagic and ischemic strokes being correctly identified. However there is a low sensitivity in diagnosing hemorrhagic strokes and higher sensitivity in diagnosing ischemic strokes.

KEYWORDS : Siriraj Stroke score, Cerebral infarction , Intracerebral haemorrhage, CT Scan

INTRODUCTION :

Globally, stroke is the third commonest cause of mortality [1].Developing countries like India have been burdened not only with infectious diseases but also with non-communicable diseases such as diabetes mellitus, hypertension, heart disease, stroke and cancer. Stroke is a major health issue not only because it is the third major cause of death but also because it leaves patients with several residual disabilities like physical dependence, dementia and depression. The death rate following stroke is 25% (2).

Stroke is uncommon below age of 40 years and is more common in males. In elderly, it remains a major cause of morbidity and mortality. The burden of the disease in South Asian countries (India, Pakistan, Bangladesh, and Sri Lanka) has inclined and is expected to rise (3).

Stroke can be classified as either haemorrhagic or ischemic. Ischemic stroke refers to the blockage of cerebral blood flow due to a blood clot, which is either due to thrombosis or due to embolism and is more common than haemorrhagic stroke. Haemorrhagic stroke accounts for 10-15% of all strokes and is associated with higher mortality rates than cerebral infarctions (4).

Distinction between cerebral ischaemia and haemorrhage is necessary for safe administration of thrombolytic and anti thrombotic for patients with ischemic stroke.

Haemorrhagic and ischemic stroke cannot be distinguished clinically that is why the use of weighted clinical scores has been proposed to differentiate haemorrhagic from ischemic stroke. The two European recognized clinical scores are Allen's or Guys Hospital score and Siriraj Hospital score (5,6).

Siriraj Stroke Score was developed in Thailand (Siriraj Hospital) by Poungvarin et al. in 1991 (7). Studies comparing the two scores have concluded that the Siriraj score is better than the Guy's hospital score (8-10).

Computed tomography (CT) scan is an accurate, safe, noninvasive procedure routinely used as an investigative tool for stroke to distinguish between infarction and haemorrhage. Computed tomography scanning of brain is expensive in both the initial investment and maintenance. In developing countries like India, cost and availability constraints prohibit its widespread use especially in rural areas. The bedside clinical diagnosis of the pathology of stroke (hemorrhage and infarction) is difficult to make by clinical features alone due to unreliability of these symptoms.

Clinical stroke scores were developed to overcome these limitations. Differential diagnosis between infarction and haemorrahge can be made on clinical grounds with aid of Siriraj scoring system and Guy's hospital scoring system. CT scan is not readily available in semi-urban and rural areas and the scoring systems will then come into play in differentiating the stroke subtype. This study is being done to determine the sensitivity, specificity of Siriraj score.

MATERIALS AND METHODS :

Study design: Cross sectional study.

Source of study population: This Cross sectional study was carried out in SNMC and HSK Hospital,Bagalkot, Karnataka. 50 consecutive patients admitted with an acute onset of neurological deficit were enrolled in the study. We defined stroke according to the World Health Organization criteria as "rapidly developing signs of focal (or global) disturbance of cerebral function, leading to death or lasting longer than 24 hours, with no apparent cause other than vascular." Approval of Ethics committee of the hospital was taken prior to starting the study. Written informed consent was taken.

Inclusion criteria:
- Patients whose deficit lasted for more than 24 hours.
- CT scan showed cerebral infarction or intra-cerebral haemorrhage.
- Patients of both sex.
- Patients age > 18 years.

Exclusion criteria:
- Age <18 years.
- Duration of stroke >14 days because of the possibility of missing an ICH.
- Causes of focal neurological deficit other than stroke (tuberculosis, tumour or trauma, transient ischemic attack).
- Patients on anti-coagulation therapy.
- Patients in whom CT scan could not be done.
- Patients admitted 72 hours after the onset of neurological deficit.
- Patients with sub-arachnoid haemorrhage.
- Repeat or recurrent stroke.

Sample size:
Title: Comparison of Siriraj Stroke Score with computerized tomography in ascertaining stroke type among South Indians.

Author: Pavan MR , Madi MD , Achappa B , Unnikrishnan B

Journal: International Journal of Biological & Medical Research

Date: 2012

By this article,
Sample Size of 50 was obtained from OpenEpi, Version 2,open source calculator- SSMean.

Sample size (n) = $[DEFF*Np(1-p)]/[(d^2/Z^2 1-\alpha/2)*(N-1)+p*(1-p)]$

Data collection:
- 50 consecutive patients admitted with an acute onset of neurological deficit were enrolled in the study.
- We defined stroke according to the World Health Organization criteria as "rapidly developing signs of focal (or global) disturbance of cerebral function, leading to death or lasting longer than 24 hours, with no apparent cause other than vascular." (11) Patients were selected based on the inclusion and exclusion criteria as mentioned above.
- Approval of Ethics committee of the hospital was sought prior to starting the study.
- On admission detailed history and thorough clinical examination including neurological assessment was carried out.
- Patients were assumed to be fully conscious if they had a score of >13 on the Glasgow Coma Scale (GCS), drowsy if they had a GCS score of 8–13 and unconscious if they scored <7.(12)
- Siriraj Stroke Score was calculated and compared with the CT findings done on admission.
- A radiologist from the institute, blind to the clinical features, classified the CT brain scans as either those demonstrating infarction or haemorrhage.

Siriraj Stroke Score (SSS) was calculated using the formula = (2.5×level of consciousness) + (2×vomiting) + (2×headache)+ (0.1×diastolic blood pressure) - (3×atheroma markers) -12.

This was computed for each patient. Scores were calculated by obtaining details of each clinical variable. If any variable was not available e.g. if patient was unconscious, information was obtained from patients relatives. If the relatives were unaware of a particular variable, then the variable score was adjusted as zero. A score above 1 indicates intracranial haemorrhage, while a score below -1 indicates infarction. The score between 1 and -1 represents an equivocal result.

Investigations:
CBC, RBS, CT – Brain.

Plan for statistical analysis:
Statistical analysis was done using statistical package SPSS version 2 . The Siriraj stroke score was compared with the results of CT brain and sensitivity, specificity; positive predictive and negative predictive values were calculated (excluding equivocal scores).

Siriraj Stroke Score (SSS)

Variable	Clinical Features	Score
Consiousness	Alert	+0 x 2.5
	Stupor, Drowsy, Semicoma	+1 x 2.5
	Coma	+2 x 2.5
Vomiting	No	+0 x 2
	Yes	+1 x 2
Headache within 2 hours	No	+0 x 2
	Yes	+1 x 2
Diastolic Blood Pressure	– mmHg	+Diastolic BP x (0.1)
Atheroma Markers	None	- 0 x 3
(Diabetes, Angina, Intermittent Claudication)	One or More	-1 x 3
Constant		-12

>+1 = Hemorrhage , < -1 = Infarction, -1 to +1 = Equivocal

RESULTS :
Fifty cases of acute stroke were studied. Out of the total 50 patients, 38 were male and 12 were female **(Table 1).** The mean age in the study group was 61.1±16.9 years. The mean age of male patients was 58.5±18.54 years. The mean age of female patients was 68.58±9.59 years.

Table 1 : Age and Gender Distribution

Gender	No. of patients	Mean (SD) age in years
Male	38	58.5±18.54
Female	12	68.58±9.59

CT scan brain showed cerebral infarction in 37 (74%) patients and cerebral haemorrhage in 13 (26 %) patients (Table 2). Siriraj Stroke score gave unequivocal results in 5 cases **(Table2).**

According to the Siriraj score 8 cases were classified as probable haemorrhagic stroke and 37 cases as probable ischaemic stroke. It wrongly diagnosed 1 case of haemorrhage as infarction and 6 cases of infarction as haemorrhage.

Table 2 : Siriraj Stroke Score and CT Scan Comparison

Siriraj Stroke Score	Infarction n = 37	Hemorrhage n = 13	Total n = 50
< -1	31	6	37
-1 to +1	5	0	5
> +1	1	7	8
Total	37	13	50

The sensitivity of Siriraj score for detecting infarction was 96.88%, specificity was 53.85%, positive predictive value was 83.78% and negative predictive value was 87.5% **(Table3)**.

Table 3 : Comparison of Siriraj Stroke Score (SSS) with CT Brain scan in diagnosis of Ischemic Stroke

Siriraj Stroke Score	CT Scan		
	Infarction	No Infarction	
< -1	31	6	37

> +1	1	7	8
Total	32	13	45

Sensitivity-96.88%, Specificity-53.85%, positive predictive value-83.78%, negative predictive value-87.5%.

Table 4 : Comparison of Siriraj Stroke Score (SSS) with CT Brain scan in diagnosis of Hemorrhagic Stroke

Siriraj Stroke Score	CT Scan		
	Hemorrhage	No Hemorrhage	
< -1	7	1	8
> +1	6	31	37
Total	13	32	45

Sensitivity-53.85%, Specificity-96.88%, positive predictive value-87.5%, negative predictive value-83.78%.

DISCUSSION :

The present study analysed the accuracy of Siriraj Stroke Scoring in diagnosing the stroke subtypes among 50 patients presented with acute stroke . The mean age group was 61.1±16.9 years. This is in comparison with the study done by Sridharan SE et al in Kerala population where mean age of stroke occurrence was 67 years (13). The increasing incidence of stroke with increasing age has been demonstrated convincingly by the Framingham study (14).

Among the study population, 74% were ischemic strokes and rest 26% were hemorrhagic strokes as confirmed by CT brain. Reviewing the Indian stroke epidemiological data, the Mumbai registry has recorded 80.2% ischemic strokes and 17.7% hemorrhagic strokes (15).

Management of acute stroke syndromes depends on the diagnosis of haemorrhage or infarction. In most developed countries, diagnosis is easily obtained by CT scan. However, quick access to CT scan is not available in every country and hospital. Different investigators have tried to develop scoring systems which can be used at the bedside for diagnosing stroke subtypes.

Of these, two scoring systems have gained much attention "Allen's/Guy's hospital score" [16,17] and "Siriraj Stroke Score" [18]. Besson score [19] and Greek Score [20] are other stroke scores.

The Siriraj Stroke Score was developed by Niphon Poungvarin and others at Siriraj hospital, Bangkok. The Guy's hospital score was developed as a diagnostic tool for intracranial haemorrhage and was later validated. The number of variables in Siriraj stroke score are five as compared to eight in Guy's hospital score. The Siriraj stroke score is easy and can be calculated at presentation itself while Guy's hospital score is calculated 24 hours after admission to the hospital since the level of consciousness and diastolic blood pressure after 24 hours are considered.

Poungvarin et al [18] have shown that the sensitivity of Siriraj stroke score for cerebral haemorrhage and cerebral infarction were 89% and 93% respectively, with an overall predictive accuracy of 90%.

Studies from India have determined the sensitivity and specificity of SSS in Indian patients. Wadwani J et al in their study of acute stroke patients have reported that the sensitivity of Siriraj score was 92.54% for infarction and 87% for haemorrhage and its overall accuracy was 91.11%. (21)

The Guy's hospital score had a sensitivity of 93.42% for infarction, 66.66% for hemorrhage and overall accuracy was 87%. They concluded that Siriraj stroke score is easier to use at bedside and has greater accuracy (especially in diagnosis of haemorrhage) than the Guy's hospital score [22].

Kochar DK et al [22] in their study have shown that that the sensitivity, specificity, positive predictive value, negative predictive value of SSS for infarction was 73%, 85%, 85%, 71% and 85%, 73%, 71%, and 85% for haemorrhage.

Badam et al [23] in their study have shown that that the sensitivity and specificity of SSS for infarction was 52%, 82% and 44%, 85% for haemorrhage. They have concluded that scoring systems should not be used in clinical practice.

In our study the sensitivity, specificity, positive predictive value and negative predictive value of Siriraj score for infarction was 96.88%,53.85%, 83.78% and 87.5%.The sensitivity, specificity, positive predictive value and negative predictive value of Siriraj score for haemorrhage was 53.85%, 96.88%, 87.5% and 83.78%.

Celani MG et al have shown that sensitivity, specificity, positive and negative predictive values for haemorrhage were 61%, 94%, 63%, and 93% for Siriraj score. They concluded that when computed tomography was not available and when clinician wanted to start antithrombotic treatment, the Siriraj score could be useful to identify patients at low risk of intracerebral hemorrhage [24].

Salawu etal have shown that sensitivity and specificity for haemorrhage was 35% and 73% for Siriraj Hospital Stroke score [25].

Hung LYet al. in their study have reported that the diagnostic sensitivities of the Siriraj stroke score for intracranial haemorrhage and infarction were 83% and 90% respectively [26].

Shah FU et.al in their study of 100 consecutive cases of acute supratentorial strokes in Pakistan reported that the sensitivity and specificity of Siriraj stroke score for cerebral infarction was 71% and 85% respectively and for intracerebral haemorrhage, it was 73% and 90% respectively [27].

Hawkins GC et al have shown that for Siriraj Hospital Stroke score, the sensitivity and the specificity for hemorrhage were 48% and 85%, the positive predictive value was 59%. The sensitivity and specificity for ischemic stroke were 61% and 74%, respectively, and the positive predictive value was 84% [28].

Akpunonu et al studied the accuracy of Siriraj Stroke score and concluded that the sensitivity was 36% for the haemorrhagic stroke and 90% for the non haemorrhagic stroke, and the positive predictive values were 77% and 61% respectively [29].

Connor et al have concluded that the Siriraj Stroke Score and Guy's Hospital Stroke Score were not sufficiently accurate for use in either epidemiologic studies or to guide clinical management in sub-Saharan Africa [30].

One major limitation of SSS is the vague definition of level of consciousness. Hawkins et al and Badam et al have used Glasgow come scale (GCS) to define the level of consciousness. We have used Glasgow come scale (GCS) in our study.

The variability of results from various studies may be explained by different settings, prevalence rate of stroke in various places and also the methodological variation (prospective versus retrospective) of the studies.

Our study had some limitations. First, our sample size was not large enough. Second, the study population represents only hospitalized subgroup of stroke patients.

CONCLUSION :

Siriraj stroke score co-related with CT scan in 45 patients. Siriraj stroke score has 5 variables and is easy to calculate and can be applied at admission. In centers where CT scan is not available this scoring system can be used for the bedside diagnosis of the nature of the lesion in stroke patients. Among stroke subtypes, the incidence of ischemic stroke predominated over hemorrhagic stroke and this is comparable with other Indian studies. Our study has shown that Siriraj Stroke Scoring has a high degree of accuracy in detecting both types of strokes. However there is a low sensitivity in diagnosing hemorrhagic strokes and higher sensitivity in diagnosing ischemic strokes. The low sensitivity of the scoring system in diagnosing hemorrhagic stroke might turn potentially disastrous, as it can mislead the clinician to initiate the patient on antithrombotic agents which could worsen the bleed. The accuracy of Siriraj Stroke Scoring in all settings is thus questionable, even though it could be used to predict a low risk of bleeding in ischemic strokes identified by the scores alone.

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