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## Original Article

# Comparison of Siriraj Stroke Score with computerized tomography in ascertaining stroke type among South Indians

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### A R T I C L E   I N F O

### A B S T R A C T

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. 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: One hundred (100) 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 100 patients, CT brain showed cerebral infarction in 71 patients and haemorrhage in 29 patients. The sensitivity of Siriraj score for detecting infarction was 87.93% and specificity was 77.27%. The sensitivity of Siriraj score for detecting haemorrhage was 77.27% and specificity was 87.93%. The overall accuracy of Siriraj stroke score was 85%. 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.

## 1. 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.

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.

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.

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## 2. Materials and Methods

This Cross sectional study was carried out in a medical college at Bijapur, Karnataka. 100 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." [2]. Inclusion criteria were: patients whose deficit lasted for more than 24 hours and CT scan showed cerebral infarction or intracerebral  haemorrhage. Exclusion criteria used were: patients with stroke due to other causes like tuberculosis, tumors or trauma, patients with transient ischemic attack, patients receiving anticoagulant therapy, patients admitted 72 hours after the onset of neurological deficit, patients in whom CT Scan could not be done and patients with subarachnoid haemorrhage. Approval of Ethics committee of the hospital was sought prior to starting the study. Written informed consent was taken. 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 unconsciousif they scored <7 [3]. 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.

Statistical analysis was done using statistical package SPSS version 11.5. 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

| Variable | Clinical features | Score |
|---|---|---|
| ·Consciousness | Alert | +0X 2.5 |
|  | Stupor, DrowsySemicoma, | +1X 2.5 |
|  | Coma | +2X 2.5 |
| ·Vomiting | No | +0 X 2 |
|  | Yes | +1X 2 |
| ·Headache within two hours | No | +0X 2 |
|  | Yes | +1X 2 |
| ·Diastolic blood pressure | ---mm Hg | +Diastolic B.P.(x0.1) |
| ·Atheromamarkers | None | -0 X3 |
| [Diabetes, Angina, Intermittent Claudication] | One or more | -1X3 |
| ·Constant |  | -12 |

**>1 = hemorrhage; < -1 =Infarction; -1 to +1 =equivocal.**

## 3.RESULTS

One hundred cases of acute stroke were studied. Out of the total 100 patients 50 were male and 50 were female (Table 1). The mean age in the study group was 61.01±14.1 years. The mean age of male patients was 61.04±12.32 years. The mean age of female patients was 60.98±15.82 years.

**Table1: Age and gender distribution:**

| Gender | No. of patients | Mean(SD) age in years |
|---|---|---|
| Male | 50 | 61.04±12.32 |
| Female | 50 | 60.98±15.82 |

CT scan brain showed cerebral infarction in 71(71%) patients and cerebral haemorrhage in 29(29 %) patients (Table 2). Siriraj Stroke score gave unequivocal results in 80 cases (Table2). According to the Siriraj score 24 cases were classified as probable haemorrhagic stroke and 56 cases as probable ischaemic stroke. It wrongly diagnosed 5 cases of haemorrhage as infarction and 7 case of infarction as haemorrhage.

**Table2: Siriraj Stroke Score and CT comparison**

| Siriraj stroke score | Infarction (n=71) | Hemorrhage (n=29) | Total (n=100) |
|---|---|---|---|
| < -1 | 51 | 5 | 56 |
| -1 to +1 | 13 | 7 | 20 |
| > +1 | 7 | 17 | 24 |
| Total | 71 | 29 | 100 |

The sensitivity of Siriraj score for detecting infarction was 87.93%, specificity was 77. 27%, positive predictive value was 91.07% and negative predictive value was 70.83% (Table3).

**Table3: Comparison of Siriraj Stroke Score (SSS) with CT Brain Scan Diagnosis of Ischemic Stroke**

| Siriraj stroke score | CT Scan | | |
|---|---|---|---|
|  | Infarction | Noinfarction | |
| < -1 | 51 | 5 | 56 |
| > +1 | 7 | 17 | 24 |
| Total | 58 | 22 | 80 |

Sensitivity-87.93%, specificity-77.27%, positive predictive value-91.07%, negative predictive value-70%.

**Table4: Comparison of Siriraj Stroke Score (SSS) with CT Brain Scan Diagnosis of Haemorrhagic stroke**

| Siriraj stroke score | CT Scan | | |
|---|---|---|---|
|  | Haemorrhage | No Haemorrhage | |
| > +1 | 17 | 7 | 24 |
| < -1 | 5 | 51 | 56 |
| Total | 22 | 58 | 80 |

Sensitivity-77.27%, specificity-87.93%, positive predictive value-70%, negative predictive value-91.07%

## 4. Discussion

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" [4,5] and "Siriraj Stroke Score" [6]. Besson score [7] and Greek Score [8] 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 [6]  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%.  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 [9]. Kochar  DK  et al [10] 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 [11] 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 87.93%,77.27%,  91.07% and70%.The sensitivity, specificity, positive predictive value and negative predictive value of Siriraj score for haemorrhage was 77.27%, 87.93%, 70% and 91.07%. In our study the sensitivity, specificity comes close to the results obtained by the study done by Wadhwani et al and Kochar et al.

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 [12]. Salawu etal have shown that sensitivity and specificity for haemorrhage was 35% and 73% for Siriraj Hospital Stroke score [13]. 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 [14].

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 [15]. 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% [16]. 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 [17].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 [18].

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.

## 5. Conclusion

Siriraj stroke score co-related with CT scan in 80 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.

## 6.References

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