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Original Research Article

Accuracy of Siriraj stroke scale in the diagnosis of stroke subtypes among stroke patients

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ABSTRACT

Background: Early detection of intracranial blood is essential for the rational use of anti hemostatic drugs in stroke patients. CT scan is quite expensive as well as it is not easily available especially in the rural areas. Clinical stroke scores were developed to overcome these limitations. Aim of present study is to identify the stroke subtype using Siriraj stroke scoring and thus asses its accuracy by comparing with CT scan reports.
Methods: A cross sectional study was conducted in a tertiary centre that evaluated 464 patients admitted with a diagnosis of stroke. Siriraj Stroke score was calculated for each patient and a CT scan of brain was also taken. The results of diagnosis made by Siriraj stroke scoring were compiled and compared with the diagnosis obtained by CT Scan.
Results: Of the total 464 patients, the incidence of hemorrhagic stroke was 27.8% and ischemic stroke was 72.2%, as per the CT scan reports, while the Siriraj stroke score diagnosed 16.8% patients to have hemorrhagic stroke and 74.6% to have ischemic stroke and no definite diagnosis was made in rest of the patients (8.6%). The sensitivity of the scoring was found to be 59.2% in diagnosing hemorrhagic stroke and 95.5% in ischemic stroke.
Conclusions: Our study has shown that siriraj stroke scoring has a high degree of accuracy in detecting both types of strokes, with roughly 80% 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: Computerised tomography, Hemorrhagic, Ischemic

INTRODUCTION

Developing countries like India are having a huge burden of both communicable and non-communicable diseases. Among non-communicable diseases stroke grabs a lion's share, in causing both mortality and morbidity among general population especially elderly. The poor are increasingly affected by stroke, because of both the changing population exposures to risk factors and, most tragically, not being able to afford the high cost for stroke care. The World Health Organization (WHO) defines stroke as "a clinical syndrome of rapidly developing focal or global disturbance of brain function lasting greater than 24 hours or leading to death with no obvious non-vascular cause".[1]

Stroke may be due to two major pathological subtypes including ischemic as well as hemorrhagic. Optimal patient management largely depends on whether the stroke is hemorrhagic or ischemic. Diagnosis and onset of treatment has to be immediate because the tolerance of the brain tissue to ischemia is lower than any other tissue. According to current evidence, aspirin should be given as soon as possible after the onset of stroke symptoms in

cases of likely cerebral infarction but is contraindicated in cases of intracerebral haemorrhage.

With the arrival of computerized tomography of the brain, diagnosis of subtype of stroke has been taken from the age of calculated speculation with details of clinical features to the present day of arrival of a definitive diagnosis in a matter of minutes. Quite unfortunately, in developing countries like ours, where a major chunk of the population is below poverty line and dwelling in rural areas, such modern technologies are not easily accessible, and even if it is there most of them find it not affordable.

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. Still various authors have suggested bedside scoring system for easy but correct evaluation. Siriraj Stroke Score (SSS) and Guy's Hospital score were two such scorings developed. Guy's Hospital score based on eight variables but requiring cumbersome calculations showed that 89% of cerebral infarction and 55% of cerebral hemorrhage could be correctly diagnosed at bed side. Siriraj Stroke Score (SSS), postulated to distinguish intracerebral hemorrhage from infarction at Bangkok using clinical variables and simple calculations showed a sensitivity of 89.3% for cerebral hemorrhage and 93.2% for bedside diagnosis of cerebral infarct. Unlike Guy's Hospital Score, Siriraj Stroke score requires simple calculations and is easily applicable at the bedside.

This study is being done to determine the accuracy of Siriraj score in the diagnosis of stroke subtypes.

METHODS

This is a cross sectional study done in a tertiary hospital in Thrissur, Kerala over a period of 1 year (Jan 2014-Jan 2015). All consecutive patients with acute onset of neurological deficit over a period of 12 months were enrolled and screened using a predetermined proforma.

Inclusion criteria

Patients whose deficit lasted for more than 24hrs and a CT scan of brain had been taken.

Exclusion criteria

- Patients admitted 72hrs after onset of neurological deficit.
- Patients in whom CT brain was not done.
- Sample size: 464

Data collection

All acute onset stroke patients satisfying the inclusion criteria were enrolled. Some of them were excluded as per exclusion criteria. A detailed history was obtained from the patient and bystanders, followed by a meticulous clinical examination. Also an informed consent was taken from the patient or bystanders for participating in the study.

The Siriraj Stroke Score was calculated at bedside itself and a plain CT brain was taken immediately. The study was conducted after acquiring consent from the scientific and ethics committee and by abiding the rules and regulations as per Helsinki Declaration.

Statistical analysis

The data were consolidated and entered in Microsoft Excel and analysed using SPSS16 Software. Description of the socio-demographic characteristics and clinical features were done in terms of frequencies and percentages. Associations of study outcome with other factors were found out by using the chi square test. The Fischer exact test was used instead of chi square test, when expected frequencies were considerably small. A p value <0.05 was considered to be a statistically significant result.

RESULTS

Of the total 464 patients, 207(44.6%) were females and 257(55.4%) were males. The age range of 464 patients included in this study was 20-100 yrs.

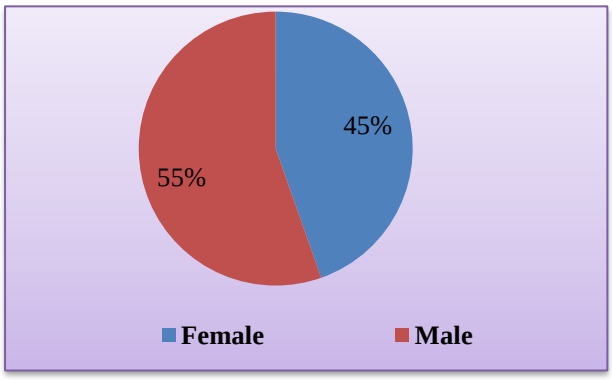

Figure 1: Gender distribution of Stroke.

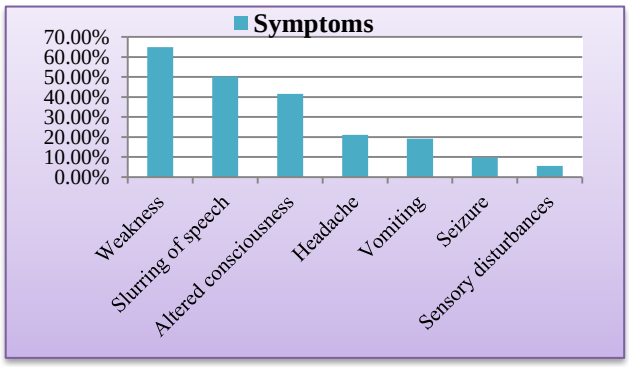

Figure 2: Distribution of clinical symptoms among stroke patients.

Maximum number of cases were observed in the age group 61-70 yrs. While the maximum cases of females belonged to the age group 71-80 yrs, maximum number of males belonged to 61-70 yrs age group.

Table 1: Age and gender distribution of stroke.

Age	Sex				Total	
	Female		Male			
	Frequency	%	Frequency	%	Frequency	%
20-30	3	1.4	4	1.6	7	1.5
31-40	4	1.9	15	5.8	19	4.1
41-50	21	10.1	25	9.7	46	9.9
51-60	42	20.3	74	28.8	116	25.0
61-70	45	21.7	83	32.3	128	27.6
71-80	65	31.4	43	16.7	108	23.3
81-90	23	11.1	12	4.7	35	7.5
>91	4	1.9	1	0.4	5	1.1
Total	207	100.0	257	100.0	464	100.0

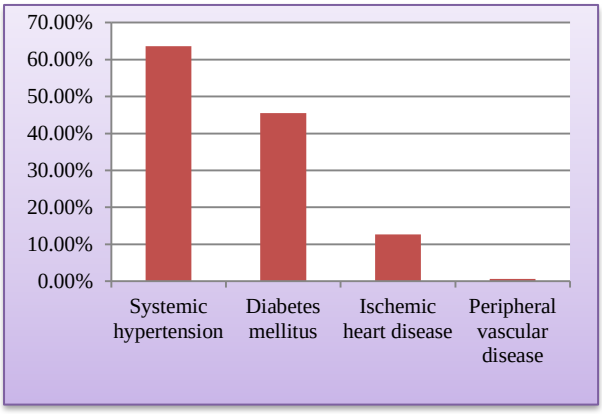

Figure 3: Distribution of co morbidities among stroke patients.

The usual co morbidities among these stroke patients were systemic hypertension, diabetes mellitus, cardiac disease, peripheral vascular disease. While 295(63.6%) patients were hypertensive, 211(45.5%) were diabetic and 59(12.7%) had cardiac disease. Only 3(0.6%) patients had peripheral vascular disease. Siriraj stroke score was calculated at the bedside. As per the scoring, 78(16.8%) patients were diagnosed to have hemorrhagic stroke, 346(74.6%) had ischemic stroke and no definite diagnosis could be made in 40(8.6%) patients.

Table 2: Distribution of stroke subtypes.

CT	Frequency	Percentage
Hemorrhagic stroke	129	27.8
Ischemic stroke	335	72.2
Total	464	100.0

Comparative analysis of siriraj stroke scale and ct brain

Of the total 78 cases diagnosed as hemorrhagic stroke by Siriraj Stroke Scale, 64(82%) cases were confirmed to be hemorrhagic stroke by CT Brain. Rest of the 14 patients(17.9%) were misdiagnosed.

Similarly, of the 346 cases diagnosed as ischemic stroke by Siriraj Stroke Scale, 302(87.2%) were confirmed to be ischemic by CT Brain and rest of the 44 cases were misdiagnosed (12.7%). Among the study population, no diagnosis could be made by Siriraj Stroke Scoring in 40 patients. These have been excluded while comparing the scoring system with CT as it would have been meaningless.

The results were subjected to Chi square analysis and found that p value is 0.0001 which is significant. Of the total 108 hemorrhagic stroke cases analysed 64 were successfully diagnosed using Siriraj scoring. Hence the sensitivity of the Scoring system in diagnosing hemorrhagic strokes was calculated and found to be 59.2%.

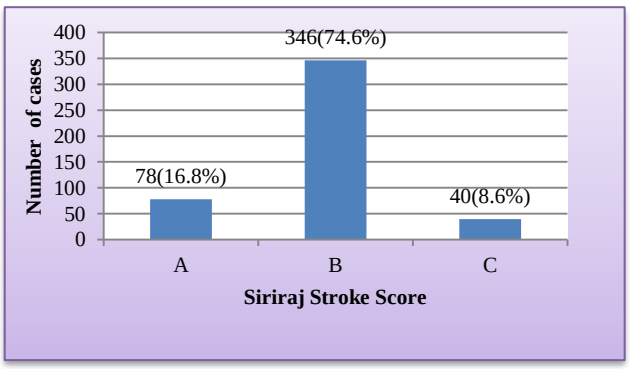

Figure 4: Distribution of stroke subtypes diagnosed using Siriraj stroke scoring.

Table 3: Comparing results of Siriraj stroke scoring with CT brain.

Siriraj stroke scale	CT brain		Total P value 0.0001
	Hemorrhagic stroke	Ischemic stroke	
Hemorrhagic stroke	64 82%	14 17.9%	78 100%
Ischemic stroke	44 12.7%	302 87.2%	346 100%
Total	108 25.4%	316 74.5%	424 100%

Sensitivity of the scoring system in diagnosing hemorrhagic stroke = $a/a+c = \frac{64}{108} = 59.2\%$

Siriraj stroke scale	CT brain		total
	Hemorrhagic stroke	Ischemic stroke	
Hemorrhagic stroke	64(a)	0(b)	64
Ischemic stroke	44(c)	0(d)	44
Total	108	0	108

Similarly, among the total 316 ischemic stroke cases analysed 302 were successfully diagnosed using siriraj scoring. Hence the sensitivity of the Scoring system in diagnosing ischemic strokes was calculated and found to be 95.5%.

Sensitivity of the scoring system in diagnosing ischemic stroke = $a/a+c = \frac{302}{316} = 95.5\%$

Siriraj stroke scale	CT		Total
	Ischemic stroke	Hemorrhagic stroke	
Ischemic stroke	302(a)	0(b)	302
Hemorrhagic stroke	14(c)	0(d)	14
Total	316	0	316

DISCUSSION

The present study analysed the accuracy of Siriraj Stroke Scoring in diagnosing the stroke subtypes among 464 patients presented with acute stroke over a period of one year. Majority of these patients belonged to the age group 61-70 yrs (n=173). 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.[2] The increasing incidence of stroke with increasing age has been demonstrated convincingly by the Framingham study.[3] While the maximum cases of females belonged to the age group 71-80 yrs, maximum number of males belonged to 61-70 yrs age group. Out of the total study population, 55.4% (n=257) were males and 44.6% (n=207) were females making up the male to female ratio, 1.2:1 showing almost equal distribution between the two sexes. This is again in tally with the findings of Framingham study.[3] The main presenting complaint of stroke patients was weakness, (n=301, 64.9%) followed by slurring of speech (n=233, 50.2%) and altered consciousness (n=193, 41.6%). Headache, vomiting, seizure and sensory disturbances were other complaints. Unlike ischemic stroke, hemorrhagic stroke patients presented predominantly with altered consciousness, headache and vomiting. Their general condition was poor when compared to ischemic stroke at the time of admission. Among the study population, 72.2% were ischemic strokes and rest 27.8% 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.[4] Data from Kerala state were obtained from the Trivandrum Stroke registry where 83.6% were ischemic strokes and 16.4% were hemorrhagic stroke.[5] While this data is from South Kerala, our study reflects the epidemiology of stroke in Middle Kerala.

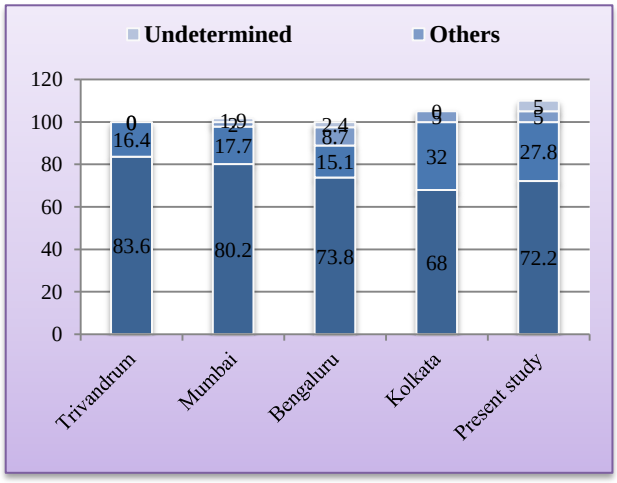

Figure 5: Distribution of stroke subtypes in the various incidence studies and its comparison to present study.[7]

There were more strokes of undetermined type in patients enrolled from the rural communities because of a lack of neuroimaging information due to financial constraints. It was in Kolkata study where 32% of the patients had hemorrhagic stroke, which is the highest figure reported so far from India.[6]

Siriraj stroke scoring

The objective of such clinical scoring is to ease and hasten the diagnosis of stroke subtypes at bedside and to initiate appropriate treatment. Other stroke scorings include Allen scoring and Greek scoring. However many studies attribute Siriraj scoring to be more easy and and quick. This scoring was developed by Niphon Poungvarin in Siriraj Medical School, Thailand. Poungvarin et al[8] have shown that the sensitivity of Siriraj stroke score for

cerebral hemorrhage and cerebral infarction were 89% and 93% respectively, with an overall predictive accuracy of 90%.[8]

Celani MG et al have shown 61% sensitivity for detecting hemorrhage. They concluded that when computerised tomography scan 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.[9] Salawu et al have shown a sensitivity of 35% in detecting hemorrhage.[10] Hung LY et 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.[11] Of the 100 cases studied in Pakistan, Shah FU et al reported 71% and 73% sensitivity for ischemic and hemorrhagic stroke respectively. In another study by Akpunonu et al, sensitivity was 36 % for hemorrhagic stroke and 90% for ischemic ones. [12,13] Hawkins GC et al reported a sensitivity of 48% for hemorrhage 61% for ischemic stroke.[14] Connor et al in his studies rejected the utility of Siriraj scoring in stroke subtyping.[15] Reviewing the Indian studies, 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%.[16] Badam et al inferred that Siriraj scoring should not be used in stroke subtyping. Their sensitivity was 52% for ischemic and 44 % for hemorrhagic stroke.[17]

Our study has shown 59.2% sensitivity in diagnosing hemorrhagic strokes and 95.5% sensitivity in diagnosing ischemic strokes. This is in keeping with most of the studies where the sensitivity was greater for ischemic strokes, which is understandable considering the potential of the CT scan in picking up hemorrhagic strokes much better.

Our results tally with the studies by

- Salawu et al who have shown a sensitivity of only 35% in detecting hemorrhage . [10]
- Akpunonu et al, (sensitivity was 36 % for hemorrhagic stroke and 90% for ischemic ones). [13]
- Hawkins GC et al (sensitivity of 48% for hemorrhage 61% for ischemic stroke).[14]

Our study results demonstrate that the Siriraj Score could correctly identify 82% of hemorrhagic strokes and 87.2% of ischemic strokes comparing to the CT scan. Even though this is a high number, it is disturbing to note that 17.9% of hemorrhagic strokes and 12.7% of ischemic strokes were mislabeled by the scoring system. Hence the assumption that the scoring system can do away with a CT scan is fraught with danger. But it is also worthwhile noting that only 12.7% labelled as ischemic strokes turned out to be actually hemorrhagic and these patients would have been put on antiplatelets. Hence in resource poor setting the scoring system can identify people at low risk of bleeding with antiplatelets initiated on the basis of scoring system. Celani MG et al have shown 61% sensitivity for detecting hemorrhage. They concluded that when computerised tomography scan 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. According to the present study type II asterion was the commonest (73%). A thorough knowledge of location & morphometric features of transverse & sigmoid sinus with other superficial landmarks is essential during posterlateral approaches to the posterior cranial fossa. The measurements of asterion with other bony landmarks provide database for the clinical-surgical practice & also for forensic & anthropological application.

CONCLUSION

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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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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