Original Article

Superiority of Siriraj Stroke Score Over Guy's Hospital Score in Diagnosing Acute Hemorrhagic Stroke at Bedside.

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Abstract

Background: *The clinical diagnosis of stroke in a patient admitted in the intensive care unit (ICU) is undeniably challenging. Several point-based risk scores have been developed to predict clinical outcomes after ischemic stroke.* ***Objective:*** *To assess the Siriraj stroke score and Guy's Hospital stroke score in the clinical diagnosis of acute stroke.* ***Materials and Methods:*** *All patients were subjected to Computed tomography (CT) scan head within 72 hours of admission. The sensitivity, specificity, positive predictive value was calculated for both the scores. Comparability between the scores and CT scan head finding was determined with the help of Kappa statistic program.* ***Results:*** *Sensitivity of Guy's Hospital stroke score for ischemic stroke is 100%, specificity is 96.4%, accuracy 97.1%, positive predictive value of 87.5% and negative predictive value 100%. The sensitivity of Guy's Hospital stroke score for hemorrhage stroke is 96.4%, specificity is 100%, accuracy 97.1%, positive predictive value of 100% and negative predictive value 87.5% .* ***Conclusion:*** *Siriraj stroke score as a simple method of screening patients for intracerebral hemorrhage, as it is easier to use at bedside and has a greater accuracy in diagnosing hemorrhage than Guy's Hospital score.*

Key words: *Siriraj Stroke Score, Guy's Hospital Stroke Score*

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Introduction

Stroke is the leading cause for severe disability, a major cause for cardiovascular death worldwide and one of the most time-critical emergencies in medicine.[1] Clinical parameters such as the presence of stroke risk factors can lead to changes in the cerebral vasculature and may influence infarct lesion evolution.[2–5] In the era of extended time windows for endovascular thrombectomy (EVT) and intravenous thrombolysis for patients with salvageable brain tissue, infarction growth dynamics tremendously gain importance, and factors influencing individual stroke progression may guide clinical decision-making on further patient management (eg, treatment selection and decision, which patient to transfer for EVT).[6-7] The clinical diagnosis of stroke in a patient admitted in the intensive care unit (ICU) is undeniably challenging.[8] The acute imaging work-up for patients suspected of stroke has evolved quite significantly over the past decades, evolving from a mere non-contrast head CT (NCT) to a NCT/CT-angiogram (CTA) up to now when perfusion imaging has become part of the clinical mainstay to identify salvageable tissue.[9-10] Several point-based risk scores have been developed to predict clinical outcomes after ischemic stroke. However, the predictors and their assigned points remarkably differ depending on the scores. Prognostic scores may not fit all cohorts because there are differences in racial or ethnic groups, the patients' background, hospital type, the healthcare system, and acute stroke treatment.[11] Majority of patients with stroke do not have access to brain imaging.[3] Because the shortage of brain imaging in the region is most unlikely to be resolved in the near future, it is of practical importance to know if clinical stroke scores enhance the clinicians' bedside assessment of pathologic stroke type in SSA.[12-13]

Materials and Methods

The study was conducted on 50 patients admitted with acute stroke over a period of one year. Siriraj stroke score was calculated on admission and Guy's Hospital stroke score was

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calculated 24 hours after admission. The aim of the study to assess the Siriraj stroke score and Guy's Hospital stroke score in the clinical diagnosis of acute stroke. All patients were subjected to CT scan head within 72 hours of admission. The sensitivity, specificity, positive predictive value was calculated for both the scores. Comparability between the scores and CT scan head finding was determined with the help of Kappa statistic program. The study group consisted of patients admitted to medical wards with a clinical diagnosis of acute stroke (stroke as defined by WHO definition). A detailed history, thorough clinical examinations were performed at admission and at end of 24 hours. Siriraj stroke score and Guy's Hospital stroke score were evaluated. All patients were subjected to CT scan head within 72 hours of admission. Patients were excluded who had previous history of stroke, subarachnoid hemorrhage, patients with clinical picture suggestive of postictal paralysis and patients with history of trauma. The Siriraj stroke score is calculated as (2.5x level of consiounsness) + (2 x vomiting) + (2 x headache) + (0.1 x diastolic B.P.) – (3 x atheroma markers) -12. A score of less than -1 was considered as infarction and a score of more than +1 as hemorrhage. Scores between -1 and +1 were considered as equivocal. The score of <4 was considered as infarction and a score of >24 was considered as hemorrhage. Scores between 4 and 24 were considered as equivocal. Both the Siriraj stroke score and Guy's Hospital stroke score were compared with CT findings and sensitivity, specificity and positive predictive value were calculated. Comparability between the scores and CT findings was determined with the help of Kappa statistic programme.

Results

Out of 65 patients, mean age was found 45.7±11.5 years in infarction group and 47.3±10.6 years in hemorrhage group. Male was predominant in both groups 16(59.3%) in infarction group and 23(60.5%) in hemorrhage group. The difference was not statistically significant (p>0.05) between two groups (Table-l). Cardiovascular disease was found 5(18.5%) in infraction group but found in hemorrhage group that was statistically significant (p<0.05) compared between two groups. However, other risk factors such as history of hypertension, smoking, alcohol consumption, diabetes mellitus and hypercholesterolemia were not statistically significant (p>0.05) between two groups (Table-ll). Mortality was found 3(11.1%) in infarction group and 12(31.6%) in hemorrhage group, that was not statistically significant (p>0.05) between two groups (Table-lll).Siriraj Stroke Score < -1 was found 8(29.6%) in infraction group and 1(2.6%) in hemorrhage group. Siriraj Stroke Score > +1 was observed 1(3.7%) and 33(86.8%) in infarction and hemorrhage group respectively. Siriraj Stroke Score > +1 was found 33(86.8%) in hemorrhage group and 1(3.7%) in infraction group. Siriraj Stroke Score < -1 was found 1(2.6%) in hemorrhage group and 8(29.6%) in infraction group. Sensitivity of Siriraj score for ischemic stroke is 88.9%, specificity is 97.1%, accuracy 95.3%, positive predictive value of 88.9% and negative predictive value 97.1%. The sensitivity of Siriraj score for hemorrhage stroke is 97.1%, specificity is 88.9%, accuracy 95.3%, positive predictive value of 97.1% and negative predictive value 88.9% (Table. lV-Vl). Guy's Hospital stroke score < 4 was found 7(25.0%) in infraction group and 1(2.6%) in hemorrhage group. Guy's Hospital stroke score >24 was observed 27(71.1%) in hemorrhage group not found in infraction group. Guy's Hospital stroke score < 4 was found 7(25.0%) in infraction group and 1(2.6%) in hemorrhage group. Guy's Hospital stroke score >24 was observed 27(71.1%) in hemorrhage group not found in infraction group. Sensitivity of Guy's Hospital stroke scorefor ischemic stroke is 100%, specificity is 96.4%, accuracy 97.1%, positive predictive value of 87.5% and negative predictive value 100%. The sensitivity of Guy's Hospital stroke score for hemorrhage stroke is 96.4%, specificity is 100%, accuracy 97.1%, positive predictive value of 100% and negative predictive value 87.5% (Table. Vll-Xl).

Table l: Socio-demographic characteristics of the study patients (n=65)

Variables	Infarction (n=27)		Hemorrhage (n=38)		P value
Age (years) Mean ± SD	45.7±11.5		47.3±10.6		0.564^{ns}
Sex	**n**	**%**	**n**	**%**	
Male	16	59.3	23	60.5	0.918^{ns}
Female	11	40.7	15	39.5	

ns=not significant; P value reached from unpaired t-test and Chi square test

Table ll: Distribution of the study patients by risk factors (n=65)

Risk factors	Infarction (n=27)		Hemorrhage (n=38)		P value
	n	**%**	**n**	**%**	
History of Hypertension	10	37.0	16	42.1	0.744^{ns}
Smoking	11	40.7	17	44.7	0.748^{ns}
Cardiovascular disease	5	18.5	0	0.0	0.009^{s}
Alcohol consumption	9	33.3	21	55.3	0.080^{ns}
Diabetes mellitus	4	14.8	5	13.2	0.562^{ns}
Hyper cholesterolemia	3	11.1	4	10.5	0.621^{ns}

s=significant; ns=not significant; P value reached from Chi square test

Table lll: Distribution of the study patients by mortality (n=65)

	Infarction (n=27)		Hemorrhage (n=38)		P value
Mortality	**n**	**%**	**n**	**%**	
Yes	3	11.1	12	31.6	0.053^{ns}
No	24	88.9	26	68.4	

ns=not significant; P value reached from Chi square test

Table lV: Siriraj stroke score and CT correlation for ischemic stroke

Siriraj Stroke Score	CT Scan diagnosis			
	Infarction (n=27)		Hemorrhage (n=38)	
	n	%	n	%
< -1	8	29.6	1	2.6
-1 to +1	18	66.7	4	10.5
> +1	1	3.7	33	86.8

Table V: Siriraj stroke score and CT correlation for hemorrhagic stroke

Siriraj Stroke Score	CT Scan diagnosis			
	Hemorrhage (n=38)		Infarction (n=27)	
	n	%	n	%
> +1	33	86.8	1	3.7
-1 to +1	4	10.5	18	66.7
< -1	1	2.6	8	29.6

Table Vl: Sensitivity, specificity, accuracy, positive and negative predictive values of the Siriraj Stroke Score evaluation of acute stroke

Validity test	Ischemic stroke	Hemorrhage
Sensitivity	88.9	97.1
Specificity	97.1	88.9
Accuracy	95.3	95.3
Positive predictive value	88.9	97.1
Negative predictive value	97.1	88.9

Table Vll: Guy's Hospital stroke score and CT correlation for ischemic stroke

Guy's Hospital stroke score	CT Scan diagnosis			
	Infarction (n=27)		Hemorrhage (n=38)	
	n	%	n	%
< 4	7	25.0	1	2.6
>4 to <24	20	75.0	10	26.3
> 24	0	0.0	27	71.1

Table Vlll: Guy's Hospital stroke score and CT correlation for Hemorrhage stroke

Guy's Hospital stroke score	CT Scan diagnosis			
	Hemorrhage (n=38)		Infarction (n=27)	
	n	%	n	%
> 24	27	71.1	0	0.0
>4to <24	10	26.3	20	75.0
< 4	1	2.6	7	25.0

Table lX: Sensitivity, specificity, accuracy, positive and negative predictive values of the Guy's Hospital stroke score evaluation of acute stroke

Validity test	Ischemic stroke	Hemorrhage
Sensitivity	100	96.4
Specificity	96.4	100
Accuracy	97.1	97.1
Positive predictive value	87.5	100
Negative predictive value	100	87.5

Discussion

In this study observed that mean age was found 45.7±11.5 years in infarction group and 47.3±10.6 years in hemorrhage group. Male was predominant in both groups 16(59.3%) in infarction group and 23(60.5%) in hemorrhage group. The difference was not statistically significant (p>0.05) between two groups. In Nyoduet al.[14] study, the age of the patients ranged from 22 to 90 years with a mean of 62 ± 14 years, and result of the present study is also similar with the findings of Emmanuel et al.[15] in which the mean age of stroke was 64.2 years. Men have a greater frequency of stroke than women, but because life expectancy is higher in women, women often outnumber men in many stroke studies.[16] During the pre-menopausal years, women have fewer strokes than men, but incidence levels off after age 60 years. Yukihiro et al.[17] in their hospital-based study of the Care and Cost of Acute Ischemic Stroke in Japan found 69% male-to female predominance.

In our study also, male has more percentage (60%) of stroke than that of his counterpart female (40%); this is true in both types of strokes, but gender does not have any significant role to distinguish the types of strokes (P = 0.423). Massaroet al.[18] reported the mean age was found 67±0.37 years infarction group and 59±1.06 years in hemorrhage group. Whereas male was 47.5% and 56.5% in infarction and hemorrhage group respectively. The difference was statistically significant (p>0.05) between two groups. Upadhayaet al[19] observed that the maximum incidence was between 60-70 yrs (32%) in both infarction and hemorrhage groups. There were 2 patients who were in the age group < 30yrs. Out of 50 cases, 27 were males

(54%) and 23 were females (46%) in the study group. In this study observed that cardiovascular disease was found 5(18.5%) in infraction group but found in hemorrhage group that was statistically significant ($p<0.05$) compared between two groups. However, other risk factors such as history of hypertension, smoking, alcohol consumption, diabetes mellitus and hypercholesterolemia were not statistically significant ($p>0.05$) between two groups. Upadhayaet al.[19] reported history of hypertension was present in 40% of stroke patients. Alcohol consumption was the most common risk factor (48%) especially in hemorrhage group (56.67%). Smoking was next common risk factor for stroke (44%). Associated cardiovascular disease was present in 8% of stroke patients. Diabetes mellitus was present in 14% of stroke patients and hypercholesterolemia in 12% of stroke patients. Bansal et al.[20] have observed that more than one third of stroke cases had hypertension, cardiovascular disease was seen in 42.8%, 51% were smokers, 18.9% were diabetics and hyperlipidemia was seen in 16.3%

In current study showed that mortality was found 3(11.1%) in infarction group and 12(31.6%) in hemorrhage group, that was not statistically significant ($p>0.05$) between two groups. Upadhayaet al.[19] reported Overall mortality of stroke patients included in the study was 24% with 33.3% in hemorrhagic group and 10% in ischemic group. Nilamadhab Kar et al.[21] observed 30% mortality in stroke population of which 38% were due to non-neurological causes.

In present study showed the sensitivity of Siriraj score for ischemic stroke is 88.9%, specificity is 97.1%, accuracy 95.3%, positive predictive value of 88.9% and negative predictive value 97.1%. The sensitivity of Siriraj score for hemorrhage stroke is 97.1%, specificity is 88.9%, accuracy 95.3%, positive predictive value of 97.1% and negative predictive value 88.9%. Upadhaya et al.[19] observed that the sensitivity of Siriraj score for ischemic stroke is 85.71% specificity is 96.30% and positive predictive value of 85.71%. The sensitivity of Siriraj score for haemorrhage is 96.30%, specificity is 85.71% and positive predictive value of 96.29%. Celani et al.[22] found that sensitivity was 93.2% for infarction and 89.3% for hemorrhage. Nyodu et al.[14] study, in comparing the effectiveness of the clinical diagnosis by using Siriraj stroke score with the computed tomography as a gold standard to differentiate stroke subtype, the Siriraj stroke score had a sensitivity, specificity, positive predictive value, and negative predictive value of 78.87%, 91.13%, 88.88%, and 82.75% for hemorrhagic strokes and for the ischemic strokes, they were 81.08%, 88.73%, 88.88%, and 80.76%, respectively. Many previous studies reported varied results. Our finding is consistent with the finding of Raghuramet al.[23] in which they reported sensitivity and specificity of 87.93% and 77.27% for ischemic strokes and 77.27% and 87.93% for the hemorrhagic strokes. Our finding is contradictory with the finding of Ogunet al.[24] in which Siriraj stroke score had a sensitivity of 50% for cerebral hemorrhage and 58% for cerebral infarction with an accuracy of 54.2%. But their sample size was only 96 cases. The diagnostic sensitivities of the Siriraj stroke score for intracranial hemorrhage and infarction were 85% and 90%, respectively, with an overall predictive accuracy of 88.5% in the study conducted by Hung et al.[25] and this result is also similar with finding of the present study.

In present study observed that Guy's Hospital stroke score < 4 was found 7(25.0%) in infraction group and 1(2.6%) in hemorrhage group. Guy's Hospital stroke score >24 was observed 27(71.1%) in hemorrhage group not found in infraction group. Upadhaya et al.[19] reported out of 20 patients diagnosed as infarction by CT scan head Guy's hospital stroke score was suggestive of infarction in 5 cases. In 15 cases the score was equivocal.

In this study observed that Guy's Hospital stroke score >24 was observed 27(71.1%) in hemorrhage group not found in infraction group. Guy's Hospital stroke score < 4 was found 1(2.6%) in hemorrhage group and 7(25.0%) in infraction group. Upadhaya et al.[19] reported out of 30 patients diagnosed as haemorrhage by CT scan head Guy's hospital stroke score was suggestive of haemorrhage in 21 cases. In 8 cases the score was equivocal and it wrongly diagnosed 1 case of hemorrhage as infarction.

In present study showed the sensitivity of Guy's Hospital stroke score for ischemic stroke is 100%, specificity is 96.4%, accuracy 97.1%, positive predictive value of 87.5% and negative predictive value 100%. The sensitivity of Guy's Hospital stroke score for hemorrhage stroke is 96.4%, specificity is 100%, accuracy 97.1%, positive predictive value of 100% and negative predictive value 87.5%. Mwitaet al.[26] reported sensitivity for ischemic stroke ranged from 0.25 to 0.93 while specificity ranged from 0.50 to 0.97. Overall, sensitivity for the test was 0.7 (95% CI 0.53 0.83) and specificity was 0.79 (95% CI 0.68 0.87) for ischemic stroke. The validation study of the Siriraj Hospital Stroke score in Thailand revealed higher sensitivities for supratentorial hemorrhage (89.3%) and infarction (93.2%).[27]

Conclusion

CT scan head is a precise, safe and noninvasive procedure for differentiating between cerebral hemorrhage and infarction. However, when CT scan facilities are not available, in study suggested Siriraj stroke score as a simple method of screening patients for intracerebral hemorrhage, as it is easier to use at bedside and has a greater accuracy in diagnosing hemorrhage than Guy's Hospital score. Guy's Hospital score is not useful because it can be assessed only after 24 hours of onset of stroke.

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