Section: General Medicine

Original Research Article

A COMPARATIVE STUDY OF SIRIRAJ AND GREEK SCORES IN DIFFERENTIATING ACUTE ISCHEMIC STROKE FROM HEMORRHAGIC STROKE

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Abstract

Background: Stroke is a prevalent neurological disease that causes death and disability in India. The prevalence varies, with poor people being the most affected. Early treatment and classification are crucial for effective management. This study aimed to assess the accuracy of the Siriraj and Greek Stroke Scoring systems in distinguishing between cerebral infarction and haemorrhage using brain CT as the gold standard. **Materials and Methods:** A cross-sectional study was conducted in the Department of Internal Medicine, KMC, Chennai, involving 120 patients who presented with acute anterior pain between March 2016 and September 2016. Comprehensive patient assessment includes tests such as complete blood count, urine routine, diabetes screening, lipid profile, bleeding time, clotting time, PT/INR, chest X-ray, ECG, and brain CT scan. **Result:** Among the 106 patients, 55 males and 51 females had a nearly equal sex distribution. In 84 patients with infarcts on brain CT, the Siriraj score was 46; in 22 patients with haemorrhage, the score was 19. A total of 45.3% of patients had an infarct, and 23.6% had a haemorrhage in the SSC. A total of 60.4% had an infarct, and 16% had a haemorrhage in the GSC. The Greek score, for the same 84 infarct cases, identified 63; for the 22 haemorrhage cases, it identified 15. The Siriraj score showed high sensitivity and specificity in diagnosing infarcts and identifying haemorrhages, whereas the Greek score showed high sensitivity and specificity. **Conclusion:** Siriraj and Greek stroke scores accurately differentiated between ischaemic and haemorrhagic stroke, with sensitivity and specificity increasing with application. Brain CT is the gold standard.

INTRODUCTION

Stroke is the most common neurological disease in adult life. It is a major cause of death and disability in India. The incidence rate of stroke in India is 119-145/100,000 based on the current population. The prevalence of stroke ranges from about 84-262/100,000 in rural and 334-424/100,000 in urban areas. Stroke most commonly affects poor people because of both risk factors and the inability to afford treatment. The inability to afford not only ends with initial treatment but also continues the rehabilitation process and ongoing care.[1,2]

Stroke management depends on the classification of stroke into subtypes. Stroke treatment should be initiated as early as possible after stroke subtyping. It isn't easy even for experienced physicians to clinically differentiate between the sub-types.[3,4] Computed Tomography of the Brain is the gold standard investigation for differentiating ischemic and hemorrhagic stroke, the two main subtypes.[3,5] Though this investigation is the gold standard, it is not readily available for people in nearby hospitals, especially in our country. A critical amount of time is lost when obtaining a CT Brain scan, which delays the initiation of treatment. Various scores were devised by combining clinical parameters to determine the stroke subtype. These scores are more useful in hospitals where advanced facilities, such as brain CT, are unavailable. Many of these scores have been used by different hospitals worldwide. Two such scores, the Siriraj Stroke score and the Greek Stroke Score, were compared, and their usefulness in differentiating ischaemic and haemorrhagic stroke was studied.

Aim

This study aimed to assess the accuracy of the Siriraj and Greek Stroke Scoring systems in distinguishing between cerebral infarction and haemorrhage, using brain CT as the gold standard, to provide a reliable diagnostic tool for stroke subtyping in rural areas lacking neuroimaging facilities.

MATERIALS AND METHODS

A cross-sectional study was conducted in the Department of Internal Medicine, KMC, Chennai, involving 120 patients who presented with acute anterior pain between March 2016 and September 2016. The study received approval from the institutional ethics committee before its initiation.

Inclusion Criteria

The study included patients aged over 50 years with acute anterior circulation stroke, defined as a sudden focal disturbance of cerebral function lasting more than 24 hours, and who were admitted within 72 hours of symptom onset.

Exclusion Criteria

Patients under 50 years of age were admitted 72 hours after stroke onset; stroke due to tumours, trauma, or bleeding diathesis were excluded.

Data for the study were collected through detailed history taking, clinical examination, and investigation of patients with acute anterior circulation stroke. Comprehensive patient assessment includes tests such as complete blood count, urine routine, diabetes screening, lipid profile, bleeding time, clotting time, PT/INR, chest X-ray, ECG, and brain CT scan. Siriraj and Greek scores were calculated for eligible patients who met these criteria, followed by a brain CT scan. The estimates of the sensitivity, specificity, positive predictive value, negative predictive value, and central tendency measures were based on the collected data.

Statistical Analysis

All data were entered into MS Excel and expressed as frequencies and percentages. The comparison between the Siriraj and Greek stroke scores involved chi-square analysis testing, and the evaluation indicators for comparing both scores with CT brain as the gold standard included sensitivity, specificity, positive predictive values, and negative predictive values.

RESULTS

Of the 120 patients, only 106 were diagnosed with infarction or haemorrhage and were included in this study. Of the remaining 14 patients, three were diagnosed with glioma, four with tuberculoma, six with cortical venous thrombosis, and one with meningioma; therefore, they were excluded from the study. The remaining 106 patients were classified based on their complaints as follows [Table 1].

Among the 106 patients, 55 males and 51 females had a nearly equal sex distribution. Regarding age groups, approximately 42 individuals were in the 50-60 years range, 32 in the 61-70 years range, 25 in the 71-80 years range, and 7 in the over 80 years age group. Eighty-four patients (79.2%) had infarctions in the brain on CT, and 22 patients (20.8%) had haemorrhage.

Among the 55 males, 81.8% had infarcts, and 18.2% had haemorrhages, while among the 51 females, 76.5% had infarcts and 23.5% had haemorrhages. Infarcts and haemorrhages were equally common in the 51-60 age group. Among patients with infarcts, 39.3% were in the 51-60 age group, 28.6% in the 61-70 years group, 27.4% in the 71-80 years group, and 4.8% above 80 years. In the haemorrhage group, 40.9% were in–51-60 years group, 36.4% were 61-70 years group, 9.1% were 71-80 years group, and 13.6% were above 80 years old [Table 1].

Of the 106 patients, 60.4% were conscious, 23.6% were drowsy, and 16% were unconscious. Headache was reported by 65.1% of the patients, while 64.2% had vomiting. Atheroma markers were present in 49 patients, contributing to the negative Siriraj scores. Elevated WBC counts were observed in 12.3%, 33 were in the DBP range of 90-100, 26 were in the range of 100-110, and 22 were in the range of DBP >120. Sixty-five patients had an eye-opening score > 4. 25 patients had neurological deterioration within 3 hours of admission, and these patients had a high risk of haemorrhage [Table 2].

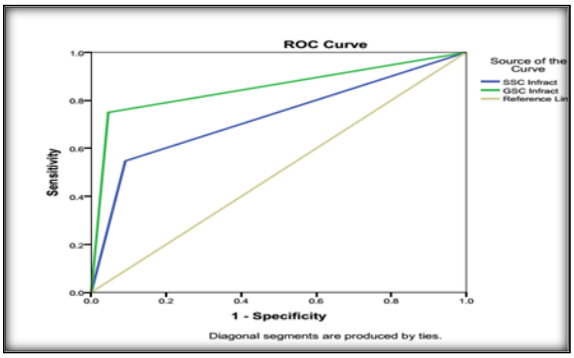

Figure 1: ROC curve for diagnosis of infarct

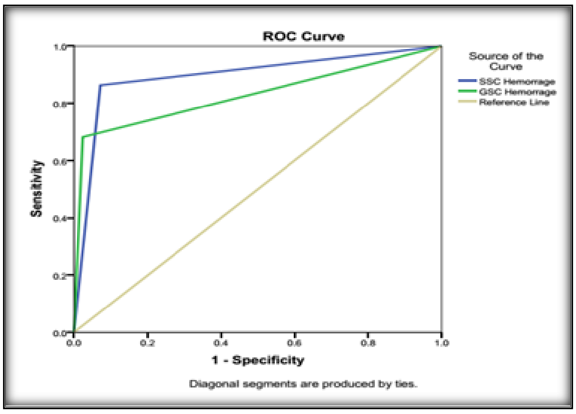

Figure 2: ROC curve for diagnosis of haemorrhage

Of the 106 patients, 45.3% had scores corresponding to infarction, 31.1% had equivocal scores, and 23.6% had scores corresponding to haemorrhage. Specifically, in 84 patients with infarcts on brain CT, the Siriraj score was 46; in 22 patients with haemorrhage, the Siriraj score was 19. A total of 45.3% of patients had an infarct, and 23.6% had a haemorrhage in the SSC. A total of 60.4% had an infarct, and 16% had a haemorrhage in the GSC. The Greek score, for the same 84 infarct cases, identified 63; for the 22 haemorrhage cases, it identified 15. The

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scores accurately identified cases without infarction or haemorrhage in the brain on CT [Table 3].

The Siriraj score demonstrated 54.8% sensitivity and 90.9% specificity in diagnosing infarcts, with a positive predictive value of 95.8%, a negative predictive value of 34.5%, and an overall accuracy of 62.3%. Haemorrhage identification showed 86.4% sensitivity, 92.9% specificity, a positive predictive value of 76%, a negative predictive value of 96.3%, and an accuracy of 91.5%. The Greek score exhibited 75% sensitivity and 95.5% specificity for diagnosing infarcts, with a positive predictive value of 98.4%, a negative predictive value of 50%, and an overall accuracy of 79.2%. In identifying haemorrhage, it demonstrated 68.2% sensitivity, 97.6% specificity, a positive predictive value, 88.2%, a negative predictive value of 92.1%, and 91.5% accuracy [Table 4].

For Siriraj's stroke score, the area was 0.728, and for the Greek stroke score, the area was 0.852. The Greek stroke score is good for diagnosing infarcts, and Siriraj's score ranks fairly. The ROC area under the curve was calculated for both scores. The area is approximately 0.896 for the Siriraj stroke score and 0.829 for the Greek stroke score. Both scores ranked well in detecting haemorrhagic stroke [Table 5, Figures 1 and 2].

Table 1: Demographic data of the study

		Frequency	Percentage
Complaints	R hemiparesis	28	26.4
	L hemiparesis	32	30.2
	R hemiplegia	23	21.7
	L hemiplegia	23	21.7
CTB	Infarct	84	79.2
	Haemorrhage	22	20.8
		Infarct	Haemorrhage
Sex	Male	45(81.8)	39(76.5)
	Female	10(18.2)	12(23.5)
Age group	50-60	39.3%	40.9%
	61-70	28.6%	36.4%
	71-80	27.4%	9.1%
	> 80	4.8%	13.6%

Table 2: Distribution of various parameters of the study population

		Frequency	Percentage
Consciousness on admission	Alert	64	60.4
	Drowsy	25	23.6
	Unconscious	17	16
	Total	106	100
Headache	Absent	69	65.1
	Present	37	34.9
Vomiting	Absent	68	64.2
	Present	38	35.8
Atheroma markers	Present	49	46.2
	Absent	57	53.8
WBC count > 12000	Present	13	12.3
	Absent	93	87.7
Diastolic BP	< 90	11	10.4
	90-100	33	31.1
	100-110	26	24.5
	110-120	14	13.2
	> 120	22	20.8
GCS-E > 4	Yes	65	61.3
	No	41	38.7
Neurological deficits	Absent	81	76.4
	Present	25	23.6

Table 3: Comparison of Siriraj stroke and Greek stroke score of the study population

Diagnosis	Siriraj stroke score		Greek stroke score	
	Frequency	Percentage	Frequency	Percentage
Infarct	48	45.3	64	60.4
Equivocal	33	31.1	25	23.6
Haemorrhage	25	23.6	17	16
	Positive	Negative	Positive	Negative
Infarct	46	2	63	1
	38	20	21	21
Haemorrhage	19	6	15	2
	3	78	7	82

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Table 4: Correlation of Siriraj stroke and Greek stroke score of the study population

		Siriraj stroke score	Greek stroke score
Infract	Sensitivity	54.8%	75%
	Specificity	90.9%	95.5%
	Positive predictive value	95.8%	98.4%
	Negative predictive value	34.5%	50%
	Accuracy	62.3%	79.2%
Haemorrhage	Sensitivity	86.4%	68.2%
	Specificity	92.9%	97.6%
	Positive predictive value	76%	88.2%
	Negative predictive value	96.3%	92.1%
	Accuracy	91.5%	91.5%

Table 5: The area under the curve of SSC and GSC Infract

	Area	P-value	Asymptotic 95% confidence interval	
			Lower Bound	Upper Bound
SSC Infract	0.728	0.001	0.623	0.834
GSC Infract	0.852	<0.001	0.773	0.931

DISCUSSION

The management of stroke involves identifying ischaemic or haemorrhagic types, as treatment and prognosis depend on the score. Early diagnosis is crucial, and brain CT is the first line of investigation. However, CT Brain is unavailable in many countries, making immediate diagnosis difficult. Bedside scoring based on clinical features is needed to differentiate between stroke types and to start immediate treatment. In our study, two available scores, Siriraj and Greek, were compared with the CT Brain.

In our study, among the 55 males, 81.8% had infarcts, and 18.2% had haemorrhages, while among the 51 females, 76.5% had infarcts, and 23.5% had haemorrhages. Infarcts and haemorrhages were equally common in the 51-60 age group. The sensitivity of the Siriraj score for the diagnosis of infarcts was 54.8%. Poungvarin et al. shows sensitivity of infarct as 93%.[6] Huang et al. show the sensitivity of infarct as 78%.[7] Hawkins et al. show that the sensitivity of infarct is 61%.[8] Kochar et al. show the sensitivity of infarct as 73%.[9] Wadhwani et al. study shows a sensitivity of infarct as 93%.[10] Badam et al.'s study shows a sensitivity of infarct as 52%, which is comparable to our study.[11]

Our study showed a specificity of 90.9% for the diagnosis of infarcts. The Hawkins et al. study's specificity for diagnosing infarcts was 74%. In a study by Kochar et al., it was found to be 80%.[9] Hawkins et al. have a specificity value of 70% for infarct.[8] Badam et al. showed a specificity of 82%, similar to our study.[11] Our study showed a sensitivity of 75% for detecting haemorrhage. Let us compare this with the various studies conducted worldwide. The sensitivity of Siriraj's score for detecting haemorrhage in the Poungvarin et al. study was 89%.[6] In the Hawkins et al. study, it was 48%.[8] In the study by Hui et al., the sensitivity was 91%.[12] In Badam et al. 's study, it was 44%.[11] In Kochar et al.'s study, the sensitivity was 85%, similar to ours.[9]

Our study showed a specificity of 95.5% for detecting haemorrhage using the Siriraj score. The specificity of Siriraj's stroke score in diagnosing haemorrhagic stroke in the Hawkins et al. study was 85%.[8] In the study by Celani et al., the specificity was 94%.[13] In the Kochar et al. study, the specificity of the score is 90%.8 In Badam et al. and Hui et al., the specificity of the score is 88% and 91%, which was comparable to our study.[11,12]

A Greek study was originally devised to rule out haemorrhage in patients with stroke. In our study, the Greek Stroke Score for Infract showed a sensitivity of 75%, specificity of 95.5%, positive predictive value of 98.4%, and negative predictive value of 50%. A sensitivity of 68.2%, specificity of 97.6%, positive predictive value of 88.2% and negative predictive value of 92.1% for haemorrhage. The sensitivity and specificity for diagnosing haemorrhage in the original Greek stroke score were 99% and 99%, respectively. In a study by Berhe et al., the sensitivity and specificity for haemorrhage were 77.8% and 89.3%, respectively.[14] Our study is similar to those of the other two studies.

CONCLUSION

Both Siriraj and Greek stroke scores are clinically useful for differentiating between ischaemic and haemorrhagic stroke. Both scores had an accuracy of 91.5% in detecting haemorrhage, while for detecting infarct, Siriraj's score had an accuracy of 62.3%, and the Greek score had an accuracy of 79.2%. Since ruling out haemorrhage is essential in initiating antiplatelet therapy, both scores can be used in rural and peripheral settings. When both scores were applied to the same patient, their sensitivity and specificity increased. However, brain CT is still the gold standard for ruling out haemorrhage in acute stroke patients whenever CT is available. These scores must be subjected to further studies before they are accepted as screening tools.

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