Comparability and Validity of Clinical Scorings in Differentiating Cerebral Infarct and Hemorrhage

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Abstract- **AIM:** To study the validity of, Siriraj and Allen's clinical scores for the differential diagnosis of cerebral ischemia and hemorrhage in acute stroke patients.

Methods: 100 cases of acute stroke admitted in Government General Hospital, Kurnool were included in the study. All the patients were examined clinically and CT scan brain done and they were validated according to Siriraj and Allen's clinical scores.

Results: In this study group 69 were male patients and the rest were females. According to Siriraj score 51 patients were classified as having cerebral infarct and 23 patients as having hemorrhage and 26 patients as equivocal. Out of 51 patients who were classified as cerebral infarct 49 had infarct and 23 patients who were classified as having cerebral hemorrhage 16 patients showed cerebral hemorrhage by CT scan. Out of 26 patients who were classified as equivocal, 19 had cerebral infarct and 7 had cerebral hemorrhage.

Allen's score classified 48 patients as having cerebral infarct and 19 patients as having hemorrhage and 33 patients as equivocal. Out of 48 patients who were classified as cerebral infarct 46 showed infarct and 19 patients who were classified as having cerebral hemorrhage 15 patients showed cerebral hemorrhage by CT scan. Out of 33 patients who were classified as equivocal, 25 had cerebral infarct and 8 had cerebral hemorrhage.

Conclusion: Our study showed that overall sensitivity of Allen's score and Siriraj score for hemorrhage is same and the overall sensitivity of Allen's score for cerebral infarct is slightly better than Siriraj score. Siriraj and Allen's scores are well accepted simple screening diagnostic tools at bed side.

Index Terms- Siriraj score, Allen's score, CT scan Brain, Cerebral Infarct, Cerebral Hemorrhage.

I. INTRODUCTION

Stroke is a major cause of morbidity and mortality worldwide and it is the leading cause of death and disability in India. The estimated adjusted prevalence rate of stroke is 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on the recent population based studies. [1]

Stroke is a medical emergency. Diagnosis of the acute stroke syndrome is relatively easy, but diagnosis of stroke subtype in the acute setting is certainly difficult. The management of acute stroke depends entirely on the correct differentiation of cerebral infarction from cerebral hemorrhage. Despite the growing burden of stroke, there are very few computed tomography centers in Rural India and the vast majority of patients with stroke do not have access to brain imaging.[2] Because of this shortage of brain imaging centers, it is of importance to know if clinical stroke scorings improve the physicians' assessment of pathologic stroke type.

There are many stroke scores which can guide the treating physician in clinical distinction of hemorrhagic and ischemic stroke. Siriraj Scoring System and the Allen's Scoring System have been studied at various centers in India for efficacy.
Our study aimed to compare and to determine the sensitivity, specificity and accuracy of Siriraj scoring and Allen' scoring system in distinguishing between Cerebral Hemorrhage and Cerebral Infarct in stroke patients in South Indian setup.

II. MATERIALS AND METHODS

Hundred patients of acute cerebro vascular accidents, admitted in Government General Hospital, Kurnool, Andhra Pradesh, India were enrolled in this study. Patients who were aged 18 years or more with acute stroke whose neurological deficit lasted for more than 24 hours and CT scan showing cerebral infarct or hemorrhage were included in the study. Patients with transient ischemic attack and stroke due to other causes like Trauma, Sub arachnoid hemorrhage, Intra cranial Tumors and Tuberculosis were excluded from the study.

Detailed history was taken and clinical examination done in all the patients. Variables like age, sex, date of admission, presence of headache, vomiting, loss of consciousness, the level of blood pressure, history of hypertension, transient ischemic attacks, diabetes mellitus, obesity, angina pectoris, intermittent claudication, atrial fibrillation and level of consciousness were recorded initially and after 24 hours. These patients were subjected to CT Scan Brain and stroke type was noted and validated according to Siriraj and Allen's scores.

Variables included in Siriraj score [3] are Consciousness, Vomiting, Headache within two hours Diastolic blood pressure, Atheroma Markers like Diabetes, Angina, and Intermittent Claudication.

The Siriraj stroke score was calculated as (2.5 x level of consciousness) + (2 x vomiting) + (2 x headache) + (0.1 x diastolic blood pressure) - (3 x atheroma markers) - 12. A score above +1 indicates intracerebral hemorrhage, while a score below -1 indicates infarction. A score between -1 and +1

represents an equivocal result needing a CT scan to verify the diagnosis.

Variables included in Allen score [4] are Apoplectic onset (Loss of consciousness, Headache within two hours, Vomiting, Neck stiffness), Level of consciousness (24 hours after admission), Plantar responses, Diastolic blood pressure, (24 hours after admission), Atheroma markers (Diabetes, angina, intermittent Claudication), History of hypertension, Previous event of Transient ischemic attack, Heart disease.

Allen score calculated as number of points = Apoplectic onset + level of consciousness + plantar response + [diastolic blood pressure (24 hrs after admission) $\times$ 0.17] + Atheroma markers + history of hypertension + previous event (Transient ischemic attacks) +Heart disease + constant (-12). Score < 4 indicates Infarct, > 24 Hemorrhage and 4 -24 Equivocal.

The classification of the stroke subtypes using Siriraj and Allen's scores were compared with the CT scan diagnosis, which was taken as the gold standard. Data analysis for sensitivity, specificity of individual scores was calculated by using kappa statistics and by standard statistical methods.

III. Results

In this study group, 69 were males and 31 were females out of 100 patients. Their age ranges between 26 and 80 years, with mean age of 56.41yrs. According to Siriraj score out of 100 cases with acute stroke, 51 patients were classified as cerebral infarct and 23 patients as hemorrhage and 26 patients as equivocal. Allen's score classified 48 patients as cerebral infarct and 19 patients as hemorrhage and 33 patients as equivocal. They were all subjected to computerized brain scanning; it showed cerebral infarction in 75 patients and cerebral hemorrhage in 25 patients.

Out of 51 patients who were classified according to Siriraj score as cerebral infarct 49 had infarct and 23 patients who were classified as having cerebral hemorrhage 16 patients showed cerebral hemorrhage by CT scan. Out of 26 patients who were classified as equivocal, 19 had cerebral infarct and 7 had cerebral hemorrhage. Out of 48 patients who were classified as cerebral infarct by Allen's score 46 showed infarct and 19 patients who were classified as having cerebral hemorrhage 15 patients showed cerebral hemorrhage by CT scan. Out of 33 patients who were classified as equivocal, 25 had cerebral infarct and 8 had cerebral hemorrhage, nearly a quarter of the Siriraj score and about one third of the Allen's score found to be equivocal.100 cases with acute stroke Siriraj score classified 51 patients as cerebral infarct and 23 patients as hemorrhage and 26 patients as equivocal. Allen's score classified 48 patients as cerebral infarct and 19 patients as hemorrhage and 33 patients as equivocal.

Table1: Validation of Siriraj score :[5]

Siriraj score	True hemorrhage	True infarct	Total
Below -1	2	49	51
-1 to 1	7	19	26
Above 1	16	7	23

Table 2: Validation of Allen score :[4]

Allen's score	True hemorrhage	True infarct	Total
Below 4	2	46	48
4 to 24	8	25	33
Above 24	15	4	19

The sensitivity of Siriraj Stroke Score was 88.88% for hemorrhage; 87.5% for infarction (equivocal cases were excluded); over all accuracy was 87.83%.The sensitivity of Allen's score was 88.23%for hemorrhage; 92%for infarction (equivocal cases were excluded); and overall accuracy was 91%.

Table 3: Comparison of Siriraj &Allen scores in Infarctions

Clinical scores	True positives	False positives	Total
Allen's score	46	2	48
Siriraj score	49	2	51
Total	95	4	99

Applying the Chi square test, Chi square value (X2) is 0.0042. On referring to x^2 table with 1 degree of freedom, the value of x^2 for a probability of 0.05 is 3.84.since the observed value (0.0042) is much lower, we conclude that null hypothesis is true and there was no significant difference between two scores.

Table 4: Comparisons of Siriraj &Allen scores in Hemorrhages

Clinical scores	True positives	False positives	Total
Allen's score	15	4	19
Siriraj score	16	7	23
Total	31	11	42

Applying the Chi square test, Chi square value(X^2) is 0.473.On referring to x^2 table with 1 degree of freedom, the value of x^2 for a probability of 0.05 is 3.84.since the observed value (0.473) is much lower, we conclude that null hypothesis is true and there was no significant difference between two scores.

On applying Kappa statistics the overall Kappa value is 0.46, there is moderate agreement between two scores inferring no statistical significance.

IV. Discussion

The objective of clinical scorings is to improve accuracy in diagnosing the acute stroke syndrome based on clinical variables which are simple, reliable, and safe diagnostic model at bedside. This can enable us to benefit from new developments in the management of acute stroke. The risk factors for stroke are increasing age, male sex, hypertension, atheroma markers and atrial fibrillation. It is well known that some risk factors are specific to either cerebral infarction or cerebral hemorrhage.

Among the 100 cases in the present study ischemic strokes were more common as compared to the hemorrhagic strokes.

Hypertension is a potent risk factor for both brain infarction and hemorrhage [6].History of hypertension is 57% in our study group. It correlated well with higher incidence of stroke, but not with the stroke types. The level of admitting blood pressure especially diastolic blood pressure was more elevated in patients with hemorrhage in the present study. There are 8 patients with diastolic blood pressure between 120 and 150 mm Hg and among them 7 patients had hemorrhage.

In our study 29% of patients were having one or more atheroma markers. Among these patients 75.86% of patients had infarct, which is more consistent with the fact that atheroma markers predispose to infarct.

Diabetes and coronary artery disease were strongly associated with infarction, which has also been depicted in numerous studies. [7]

Among 79 patients with the apoplectic onset (Headache /loss of consciousness/ vomiting/ Neck stiffness) with one or none of the above features 71 patients had infarct. Among 21 patients of two or more features 17 patients had hemorrhage. Clinical features at the onset may also help to discriminate between infarction and hemorrhage. The high frequency of severe headache at onset noted in brain hemorrhage has also been reported by others. [8]

Vomiting, decreased consciousness and coma were also found to be more predictive of hemorrhage than infarct. History of Transient ischemic attack and stroke has more often preceded a brain infarction than hemorrhage.

Table: 5: Comparison of this study with previous studies on Siriraj score

Author	Settings	n	Haemorrhage sensitivity (%)	Infarction sensitivity (%)	Equivocal results (%)
Weir et al[9]	Glasgow	991	68	not available	not available
Wadhwani et al[10]	Indore	152	66	93	8
Badam et al[11]	Sevagram	134	44	52	28
Kochar[12]	Bikanir	240	85	73	33
Poungarin et al[13]	Bangkok	174	89	93	not available
Present study		100	87.5	87.23	26

Hemorrhage sensitivity in Kochar study is 85%, in Poungarin et al study 89%. The result of the present study is consistent with the above studies and the sensitivity for infarction in Poungarin et al and Wadhwani et al is 93%. In present study it is around 87%.

Table: 6: Comparison of this study with previous studies on Allen's score

Author	Settings	n	Haemorrhage sensitivity (%)	Infarction sensitivity (%)	Equivocal results (%)
Sandercock et al[14]	Oxford	228	81	78	not available
Weir et al[9]	Glasgow	991	70	not available	not available
Wadhwani et al[10]	Indore	152	66	93	0
Badam et al[11]	Sevagram	134	35	52	41
Kochar[12]	Bikanir	240	60	91	39
Present study		100	88.23	92	33

The sensitivity for hemorrhage Sandercock et al is 81% but in other Indian studies like Wadhwani et al, Badam et al is very low, where as In present study it is 88.23%.But the sensitivity for infarction is more than 90% in Wadhwani et al and Kochar study group. Present study's results are consistent with these studies.

The Allen's score included 8 variables that were obtained not only by clinical history but also using clinical examination and chest X-rays. In addition, some variables can only be calculated 24 hours after the stroke, such as level of consciousness and diastolic blood pressure and also Calculating Allen's score at bed side is not easy. The Siriraj Hospital Stroke score is simpler and can be calculated immediately after stroke at bedside, because it involves fewer variables with the greater possibility of having more complete data to calculate the score in this study. Moreover, it would be easier to apply in a busy, less well-equipped clinical setting,

Small deep hemorrhage may mimic the clinical features of infarct and large infarcts may simulate hemorrhage. Due to this fact, Allen's and Siriraj scoring systems have created an equivocal group that will effectively increase the sensitivity and specificity of the final calculation. Though both scores showed high sensitivity for both infarct and hemorrhage in Asian setup, about a quarter of patients in Siriraj score and one third of patients in Allen's score are falling into equivocal category which weakens the utility of the scores. In Allen's score some variables can only be calculated 24 hours after the stroke, so it cannot be used in acute stroke management. Siriraj score having fewer variables, it is easier to apply in a busy, less equipped clinical setting. There is greater possibility of complete data to calculate the score as inferred from this study.

In conclusion, the overall sensitivity of Allen's score and Siriraj score for hemorrhage is same and the overall sensitivity of

Allen's score for cerebral infarct is slightly better than Siriraj score which is not having any statistical significance. Hence Siriraj and Allen's scores are well accepted simple screening diagnostic tools at bed side.

REFERENCES

[1] J Stroke. Sep 2013; 15(3): 128–134.

[2] Hospital management.net 15 March 2010

[3] SIRIRAJ STROKE SCORE: useful tool in management of   dr dipendrapandey. Word press.

[4] Clinical diagnosis of the acute stroke syndrome, CMC Allen - QJM, 1983 - Oxford Univ Press

[5] Poungvarin N, Viriyavejakul A, Komontri C. Siriraj stroke score and validation Study to distinguish supratentorial intracerebral hemorrhage from infarction BMJ 1991; 302:1565-1567

[6] Collins, R. and MacMahon, S. (1994). Blood pressure, antihypertensive drug treatment and the risks of stroke and of coronary heart disease. British Medical Bulletin, 50, 272–98.

[7] Sacco RL, Benjamin EJ, Broderick JP, et al. Risk factors. AHA conference Proceedings. Stroke 1997; 28:1507-1517.

[8] Melo TP, Pinto AN, Ferro JM. Headache in intracerebral hematomas. Neurology 1996; 47:494-500.

[9] Weir CJ, Murray GD, Adams FG, Muir KW, Grosset DG, Lees KR. Poor accuracy of stroke scoring systems for differential clinical diagnosis of intra cranial Haemorrage and infarction. Lancet; 344:999-1002. 1994.

[10] Wadhwani J Husain, R,Raman PG. Nature of lesion in cerebro vascular Stroke Patients: Clinical score and computed tomography scan Brain correlation Assoc Physicians India 50:777-812000.

[11] Priya Badam, Vaishali Solao, Madhukar Pai, S.P.Kalanthri. The national medical journal of India. Vol. 16, No. 1, 2003.

[12] Kochar Dk, Joshi A, Agarwal N, Aseri S, Sharma BV, Agarwal TD Poor diagnostic accuracy and applicability of Siriraj stroke score,Allen' score and their combination in differentiating acute Haemorragic and thrombotic stroke J Assoc Physians of India 48;584-8;2000.

[13] Poungvarin N, Viriyavejakul A, Komontri C. Siriraj stroke score and validation study to distinguish supratentorial intracerebral haemorrhage from infarction. BMJ 302:1565-1567; 1991.

[14] Sandercock PAG, Allen CMC, Corston RN, et al. Clinical diagnosis of Intracranial haemorrhage using Guy's Hospital score. BMJ 291: 1675-1677; 1985

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