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Original Article

Comparison of Siriraj Stroke Score with Computerized Tomography in Establishing the Type of the Stroke among Pakistani Population

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ABSTRACT

Computed Tomography (CT) Scan is an accurate and a routinely done imaging technique to diagnose and differentiate haemorrhagic and ischaemic stroke. Siriraj Stroke Score (SSS) is weighted clinical score and European recognized for clinical and bedside differentiation between ischemic and haemorrhagic stroke. This study aimed to establish the accuracy of SSS in the bedside diagnosis of cerebral haemorrhage in comparison with CT scan to avoid delay in treatment. Total 152 patients were included in the study. Out of which 39.5% were male. Overall, mean age was 59.28±11.91, 56.32 ±12.69 in haemorrhagic group and 62.32±10.28 in non-haemorrhagic group. Sensitivity, specificity, PPV, and NPV of SSS for haemorrhagic stroke was 71.4%, 81.3%, 79.7% and 73.5% respectively. Overall accuracy for haemorrhagic stroke was found to be 76.3%. SSS had higher sensitivity for haemorrhagic stroke and is more sensitive in Asian population, but still not accurate enough to replace CT scan as investigation of choice but can plays a role to avoid delay in the management where CT scan is delayed or not available.

Key words: *Haemorrhagic stroke, intracerebral haemorrhage, Siriraj score, CT Scan*

Pakistan'da İnme Tipinin Saptanmasında Bilgisayarlı Tomografi ile Siriraj İnme Skorunun Karşılaştırılması

ÖZET

Bilgisayarlı Tomografi (BT) hemorajik ve iskemik inmeleri ayırt etmek ve tanı koymak için doğru ve rutin yapılan bir görüntüleme tekniğidir. Siriraj inme skoru (SSS) iskemik ve hemorajik inme arasındaki yatak başı ve klinik ayırımı için tanımlanan bir skorlamadır. Bu çalışmanın amacı, tedavide gecikmeyi önlemek için serebral kanamanın yatakbaşı tanısında BT ile SSS'nin doğruluğunu saptamaktır. Toplam 152 hasta çalışmaya alındı. Bunların % 39,5'i erkekti. Genel olarak yaş ortalaması hemorajik grupta 59.28±11.91, 56.32±12.69 ve hemorajik olmayan grubunda ise 62.32±10.28 idi. Hemorajik inmede SSS için duyarlılık, özgüllük, PPV ve NPV değerleri sırasıyla %71.4, %81.3, %79.7 ve %73.5 oldu. Hemorajik inme için genel doğruluk %76.3 olarak bulunmuştur. SSS hemorajik inme için yüksek hassasiyete sahipti ve Asya nüfusunda daha duyarlı idi, fakat hala seçim araştırmasında CT taramasının yerine geçemiyeceği fakat BT'nin gecikmesi veya bulunamaması durumunda tedavi gecikmesini önlemek için bir rol oynayabilir.

Anahtar kelimeler: *Hemotrajik inme, kafa içi kanama, Siriraj skoru, BT görüntüleme*

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INTRODUCTION

Cerebrovascular disease or stroke is the third most common cause of death after cancer and ischemic heart disease. The death rate following stroke is 25% (1). Stroke is characterized by the sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurological function. Stroke is uncommon below age of 40 years and is more common in males. In elderly, it remains a major cause of morbidity and mortality. The burden of the disease in South Asian countries (India, Pakistan, Bangladesh, and Sri Lanka) has inclined and is expected to rise (2).

Stroke can be classified as either haemorrhagic or ischemic. Ischemic stroke refers to the blockage of cerebral blood flow due to a blood clot, which is either due to thrombosis or due to embolism and is more common than haemorrhagic stroke. Haemorrhagic stroke accounts for 10-15% of all strokes and is associated with higher mortality rates than cerebral infarctions (3). Khan et al. conducted a study on 280 stroke patients at Ziauddin Hospital Karachi observed (70.1%) had cerebral infarction and (29%) had cerebral haemorrhage (4).

Distinction between cerebral ischaemia and haemorrhage is necessary for safe administration of thrombolytic and anti thrombotic for patients with ischemic stroke. Non-contrast CT scan is the standard and accurate non-invasive tool to distinguish between cerebral infarction and haemorrhage (5). It is impossible for all stroke patients to have CT scan of brain immediately after admission because of lack of facilities and limited access due to cost or distance, especially in rural areas in the developing countries such as Pakistan.

Haemorrhagic and ischemic stroke cannot be distinguished clinically that is why the use of weighted clinical scores has been proposed to differentiate haemorrhagic from ischemic stroke. The two European recognized clinical scores are Allen's or Guys Hospital score and Siriraj Hospital score (6,7).

Siriraj Stroke Score was developed in Thailand (Siriraj Hospital) by Poungvarin et al. in 1991 (8). Studies comparing the two scores have concluded that the Siriraj score is better than the Guy's hospital score (9-11). Results of the most of the studies has concluded that Siriraj score is better than Allen's score especially in diagnosis of cerebral haemorrhage and has utility of being used within 24 hours of acute stroke (11-13).

The purpose of this study is to compare the accuracy of Siriraj score in comparison with CT scan brain in differentiating between cerebral infarction and cerebral haemorrhage; considering CT scan as standard investigation. For haemorrhagic stroke CT brain, sensitivity is 89% and specificity 100%(14). By conducting this study in our population, we can analyse how much sensitive and specific Siriraj score is, when applied to our population. The results would be very beneficial and cost effective.

MATERIALS AND METHODS

This is a cross sectional study conducted in the department of medicine of a tertiary care hospital, Karachi. Sample size was calculated by using WHO formula, it was 152, and the study was conducted from May to October 2011. All consecutive 152 patients admitted with acute stoke were registered in a pre-tested questionnaire after taking informed consent. A favourable ethical opinion was obtained from the Abbasi Shaheed hospital ethical committee for the study. Acute stroke was defined as per WHO criteria "rapidly developing signs of focal or global disturbance of cerebral functions leading to death or lasting longer than 24 hours with no apparent cause other than vascular" (15).

All patients with measureable neurological deficit, whose symptoms lasts for more than 24 hours, having age between 40-85 years, of either gender were included. Patients with altered consciousness after head injury, with a measureable neurological deficit lasting for less than 24 hours and with subarachnoid haemorrhage or space occupying lesions were excluded. Patients with

Table 1. *Siriraj score*

Variables	*Clinical features*	*Score*
Consciousness	*Alert*	*+0x2.5*
	Stupor, Drowsy ,Semi coma	*+1x2.5*
	Coma	*+2x2.5*
Vomiting	*No*	*+0x2*
	Yes	*+1x2*
Headache within 2 hours	*No*	*+0x2*
	Yes	*+1x2*
Diastolic Blood Pressure	*mm Hg*	*Diastolic BP x0.1*
Atheroma Markers	*None*	*-0x3*
Diabetes, Angina Intermittent Claudication	*One or more*	*-1x3*
Constant		*-12*

Where >1 = Haemorrhage, <-1 = Infarction, -1 t0 +1 = Equivocal

Table 2. Patients characteristics and included variables

	Haemorrhagic n (%)	Non-haemorrhagic n (%)	Total n (%)
Gender			
Male	32 41.6)	28 (37.3)	60 (39.5)
Female	45 (58.4)	47 (62.7)	92 (60.5)
Level of consciousness			
Alert	16 (20.8)	20 (26.7)	36 (23.7)
Semiconscious	28 (36.4)	42 (56)	70 (46.10)
Comatose	33 (42.9)	13 (17.3)	46 (30.3)
Vomiting			
Yes	44 (57.1)	12 (16)	56 (36.8)
No	33 (42.9)	63 (84)	96 (63.2)
Headache at on-set			
Yes	31 (40.3)	26 (34.7)	57 (37.5)
No	46 (59.7)	49 (65.3)	95 (62.5)
Atheroma Markers			
Yes	27 (35.1)	44 (58.7)	71 (46.7)
No	50 (64.9)	31 (41.3)	81 (53.3)

cerebellar or brainstem lesions were also excluded as they are not easily visualized by CT scan. Patients admitted with a measureable neurological deficit due to other causes like viral encephalitis, bacterial or tuberculous meningitis and Todd's paralysis were also excluded. Patients presented after 72 hours of stroke or who do not have CT scan brain were also excluded. The subjects included in the study were asked about demographic profile such as age, gender, variables of Siriraj score (level of consciousness, vomiting, headache within 2 hrs. of onset, presence of atheroma markers, diabetes, history of angina, claudication) and detailed GPE and neurological examination was carried out at the time of registration.

Patients were categorized as conscious having Glasgow Coma Scale (GCS) > 13, drowsy having GCS, between 08 to 12 and unconscious having GCS < 08. Siriraj Score was calculated and compared with CT scan findings of the patient on admission. The Radiologist of the hospital was blinded to the clinical feature and was asked to report the scan as having cerebral haemorrhage or infarction. Siriraj Stroke Score 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 performed in every patient. Score was calculated after obtaining all relevant information and examining the patient if patient was conscious and from if he brought unconscious than from the witness, who first saw the patient. If any variable was not measured than the score was adjusted as zero. A score of > 01 indicates cerebral haemorrhage while score of < 01 indicates cerebral infarction. The score between 01 and -01 represents unequivocal results.

Statistical Analysis

Statistical analysis was performed using SPSS (IBM SPSS Statistics 20.0) software. Continuous variables (Age and diastolic blood pressure), were calculated by mean ± SD. Frequencies and percentages were calculated for gender, level of consciousness, vomiting, headache at onset. Sensitivity and specificity, Positive Predictive Value (PPV) and Negative predictive Value (NPV) were calculated for diagnostic accuracy of Siriraj score for haemorrhagic stroke, taking CT scan as gold standard.

RESULTS

Total 152 patients meeting inclusion criteria were included in the study. Out of which 39.5% were male. Overall, mean age was 59.28±11.91, 56.32±12.69 in haemorrhagic group and 62.32±10.28 in non-haemorrhagic group.

Table 3. Comparison of Siriraj Stroke Score with CT scan diagnosis of ischaemic stroke

Siriraj stroke score(SSS)	Haemorrhagic n (%)	Non-haemorrhagic n (%)	Total n (%)
SSS > + 1	55 (71.4%)	14(18.7%)	69 (45.4%)
SSS < 1	22 (28.6%)	61(81.3%)	83 (54.6%)
Total	77 (50.7%)	75 (49.3%)	152 (100%)

Table 4. Screening tests for Siriraj score

Sensitivity	Specificity	PPV	NPV	Accuracy
71.4%	81.33 %	79.7%	73.5%	76.3%

Regarding variables of Siriraj score, 20.8% were alert, 36.4% were semiconscious, and 42.9% were comatose in haemorrhagic group while in non-haemorrhagic group 26.7% were alert, 56.0% semiconscious, and 17.3% were comatose. Vomiting was present 57.1% in haemorrhagic group while 16% in non-haemorrhagic group. Headache at the onset was present in 40.3% in haemorrhagic group while 34.7% in non-haemorrhagic group. Atheroma markers were present in 35.1%, absent in 64.9% in haemorrhagic group while these markers were present in 58.7%, and absent in 41.3% in non-haemorrhagic group (Table 2).

Mean diastolic blood pressure 94.67 ±18.3 in haemorrhagic group and 90.7 ±16.22 in non-haemorrhagic group. Siriraj score was applied to all 152 patients, according to the scale, 69 (45.4%) were diagnosed as haemorrhagic group and 83 (54.6%) were diagnosed as non-haemorrhagic group. The results were compared with CT scan brain, which showed 50.7% in haemorrhagic group and 49.3%, were in non-haemorrhagic group. In haemorrhagic 71.4% were diagnosed correctly and 28.6% were diagnosed wrong by Siriraj score. In non-haemorrhagic group 81.3% were correctly diagnosed and 18.7% were diagnosed wrong (Table 3). We calculated true positive in haemorrhagic group, which were found to be 55 (36.1 %), false negative that were found to be 22 (14.4 %), false positive were 14 (9.2%) and true negative which were 61 (40.1%). Sensitivity, specificity, PPV, NPV and accuracy of Siriraj score for haemorrhagic stroke were calculated (Table 4).

DISCUSSION

Management of stroke largely depends on differentiation between haemorrhagic from ischemic stroke. Clinical stroke scores like Siriraj score can be helpful in clinical differentiation between subtypes of stroke, where the facility of CT brain is not available. The practical utilization of these scoring systems would be effective to exclude cerebral haemorrhage so that use of thrombolytic or antithrombotic can be safely offered to the patients with ischemic stroke. To exclude cerebral haemorrhage the clinical score should have high sensitivity for haemorrhagic stroke. The sensitivity of Siriraj score in our study was 71.4%, is closer in comparison with other studies of Indo Pak region where the incidence of haemorrhagic stroke is higher than western population (4). Sensitivity of Siriraj score for haemorrhagic stroke was reported 78% by Badam et al. (16), 75% by Soman et al. (12), 73% by Shah et al. (13), 67% by Sherin et al. (17). All these figures are comparable to results in our study.

Specificity of Siriraj score for haemorrhagic stroke from our study was found to be 81.33% which was also favoured by results from other studies in Indo Pak. Specificity was reported 90% by Shah et al. (13), 81% Soman et al. (12), 71% by Badam et al. (16) and 94.2% by Sherin et al. (17), and Positive p value of Siriraj score from our study was found to be 79.7%. Similar results were reported 77% by Soman et al. (12), 83% by Shah et al. (13), and 84% by Sherin et al. (17). In the recent study conducted by Pavan et al. (20). In South Indian hospital, the specificity and sensitivity of Siriraj score in intra cerebral haemorrhage was 87.93% and 77.27% respectively. An overview of African studies showed slightly lower sensitivity of Siriraj score for haemorrhagic stroke as compared to Asian studies. Nouira et al. (10) reported 60%, Nyandaiti et al. (18) reported 94.4%, Zenebe et al. (19) reported 61% and Connor et al. reported 0.88 (11). Somman et al. conducted a study at Sir JJ Group of Hospital Mumbai in 2004; in which they measured comparability of Siriraj scale with other scales as well as validity with CT scan, found that over all sensitivity, specificity, PPV, NPV were 0.75, 0.81, 0.77 and 0.78 (12).

Faridullah et al. carried out a study in 2003 at F.G Services Hospital and Pakistan Institute of Medical Sciences Islamabad concluded that sensitivity and specificity of cerebral infarction was 71% and 85% respectively and for cerebral haemorrhage were 87% and 83% respectively, Positive predictive value of Siriraj score for cerebral infarction and cerebral haemorrhage were 87% and 83% respectively (13). The variation in results of different studies may be explained by different settings, difference in patient's ethnic background and prevalence of haemorrhagic stroke as well as methodological variations (e.g.; perspective versus retrospective collection of data) of various studies. Over all, Siriraj score has better sensitivity in Asian population and less sensitivity in African and western population. Our study showed the sensitivity of 71% so it cannot be safe enough for accurate diagnosis of haemorrhagic stroke and we recommend the use of

CT brain for accurate diagnosis. Still it is unlikely that CT scan would be available and easily accessible to all stroke patients and therefore the search must be continued for simple scoring system having better accuracy. Further studies are required to modify the variables of Siriraj score to exclude variables of low discriminate value and to include new variables like neck stiffness, seizures that are more specific for haemorrhagic stroke and atrial fibrillation, Carotid Doppler and lipid profile which are more specific for ischemic stroke.

Siriraj score is more sensitive for the diagnosis of haemorrhagic stroke but still not accurate enough to replace the CT scan brain as investigation of choice. Further studies are required to improve the accuracy of Siriraj score by adding new variables of high discriminate values and development of clinical scores having more accuracy for diagnosis of stroke. Siriraj scoring system can give a clinical and bed side diagnosis of haemorrhagic stroke in the setting where CT Scan brain not available especially in rural areas of a third world country such as Pakistan, however the CT scan is the only reliable investigation for distinguishing between haemorrhagic and ischemic stroke and it should be made available and affordable.

REFERENCES

1. *Clarke CRA. Neurological diseases. In: Kumar P, Clark M. Clinical medicine. London: Elsevier Saunders, 2006:1173-273*
2. *Donnan GA, Fisher M, Macleod M, Davis SM. Stroke. Lancet 2008;371(9624):1612-23*
3. *Broderick J, Connolly S, Feldmann E, et al. Guidelines for the management of spontaneous intracerebral hemorrhage in adults: 2007 update: a guideline from the American Heart Association/American Stroke Association Stroke Council, High Blood Pressure Research Council, and the Quality of Care and Outcomes in Research Interdisciplinary Working Group. Circulation 2007;116 (16):e391-413*
4. *Khan SN, Vohra EA. Risk factors for stroke: a hospital based study. Pak J Med Sci 2007;23(1):17-22*
5. *Kidwell CS, Chalela JA, Saver JL, et al. Comparison of MRI and CT for detection of acute intracerebral hemorrhage. JAMA 2004;292(15):1823-30*
6. *Ozeren A, Bicakci S, Burqut R, Sarica Y, Bozedemir H. Accuracy of bedside diagnosis versus Allen and Siriraj Score in Turkish Patients. Eur J Neurol 2006;13(6):611-5.*
7. *Allen CM. Clinical diagnosis of the acute stroke syndrome. Q J Med 1983;52(4):515-23*
8. *Poungvarin N, Viriyavejakul A, Komontri C. Siriraj stroke score and validation study to distinguish supratentoral haemorrhage from infarction. BMJ 1991;302(6792):1565-7.*
9. *Wadhwani J, Hussain R, Raman PG. Nature of Lesion in Cerebrovascular Stroke patients: Clinical Stroke Score and Computed Tomography Scan Brain Correlation. J Assoc Physicians India 2002;50:777-81*
10. *Nouira S, Boukef R, Bouida W, et al. Accuracy of two scores in the diagnosis of stroke subtype in a multicenter cohort study. Ann Emerg Med 2009;53(3):373-8.*
11. *Connor MD, Modi G, Warlow CP. Accuracy of the Siriraj and Guy's Hospital Stroke Scores in urban South Africans. Stroke 2007;38(1):62-8.*
12. *Soman A, Joshi SR, Tarvade S, Jayaram S. Greek stroke score, Siriraj score and Allen score in clinical diagnosis of intracerebral hemorrhage and infarct: Validation and comparison study. Indian J Med Sci 2004;58(10):417-22*
13. *Shah FU, Salih M, Saeed MA, Tariq M. Validity of Siriraj Stroke Scoring. J Coll Physicians Surg Pak 2003;13(7):391-3.*
14. *Chalela JA, Kidwell CS, Nentwich LM, et al. Magnetic resonance imaging and computed tomography in emergency assessment of patients with suspected acute stroke: a prospective comparison. Lancet 2007;369(9558):293-8.*
15. *Hatano S. Experience from a multicentre stroke register: a preliminary report. Bull World Health Organization 1976;54:541-53.*
16. *Badam P, Solao V, Pai M, Kalantri SP. Poor accuracy of Siriraj and Guy's hospital stroke scores in distinguishing haemorrhage from ischaemic stroke in a rural, tertiary care hospital. Natl Med India 2003;16(1):8-12.*
17. *Sherin A, Khan A, Rehman S, Shah NH, Shabbier G, Zarif M. Comparability and validity of Siriraj stroke score and Allen stroke score in differentiation of acute ischemic and haemorrhagic stroke. J Postgrad Med Inst 2011; 25(3):206-16.*
18. *Nyandaiti YW, Bwala SA. Validation study of the Siriraj stroke score in North-east Nigeria. Niger J Clin Pract 2008;11(3):176-80.*
19. *Zenebe G, Asmera J, Alemayehu M. How accurate is Siriraj stroke score among Ethiopians? A brief communication. Ethiop Med J 2005;43(1):35-8.*
20. *Pavan MR, Madi MD, Achappa B, Unnikrishnan B. Comparison of Sriraj Score with computerized tomography in ascertaining stroke type among South Indians. Int J Biol Med Res 2012;3(3):1930-3*