COMPARABILITY AND VALIDITY OF SIRIRAJ STROKE SCORE AND ALLEN STROKE SCORE IN DIFFERENTIATION OF ACUTE ISCHEMIC AND HAEMORRHAGIC STROKE

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ABSTRACT

Objective: *To compare and validate Allen stroke score (ASS) and Siriraj stroke scores (SSS) in differentiating acute cerebral hemorrhage (CH) and cerebral infarction (CI).*

Methodology*: This comparative, analytical study was conducted at Khyber Teaching Hospital Peshawar, Pakistan from July 2000 to February 2002. Study included 100 patients of acute ishemic or hemorrhagic stroke confirmed on CT scan brain after clinically evaluation. ASS & SSS were calculated for each patient and compared with the results of CT scan for comparability (Kappa Statistics) and validity by using SPSS 10.*

Results*: Out of 100 patients, 69 had CI and 31 had CH. The overall comparability of ASS & SSS was fair (Kappa=0.51). ASS & SSS were uncertain in 27 & 18 cases respectively; with Kappa showing worst comparability in term of certain results (K= 0.23). In 64 cases with both scores in the diagnostic range, the Kappa showing excellent comparability (K=0.91).The sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of ASS was 38.70%, 91.30%, 66.67%, 76.82% respectively for CH and 71.1%, 80.64%, 89.09% and 55.56% respectively for CI, with overall predictive accuracy of 61%. The sensitivity, specificity, PPV and NPV of SSS was 67.74%, 94.2%, 84% and 86.67% respectively for CH and 78.26%, 90.32%, 94.73% and 65.11% respectively for CI, with overall predictive accuracy of 75%.*

Conclusion*: Although, SSS being simple with more accuracy is better than ASS, both these scores lack sufficient validity to be used for exclusion of cerebral haemorrhage before offering antithrombotic or thrombolytic therapy.*

Key words: *Stroke, Cerebral Infarction, Cerebral Hemorrhage, Allen Stroke Score, Siriraj Stroke Score.*

INTRODUCTION

Worldwide, stroke is the third commonest cause of death after coronary heart disease and all cancers[1]. Stroke caused an estimated 5·7 million deaths in 2005, and 87% of these deaths were in low-income and middle-income countries. Due to various epidemiological factors, this burden of stroke is increasing more in the developing countries as compared to developed countries.[2] Unfortunately like other developing countries, the epidemiology of stroke in Pakistan is not well established due to lack of population-based studies on stroke[3].

Stroke is considered as medical emergency requiring the same care as a heart attack. The proper management of acute stroke patient is entirely based on the correct differentiation of cerebral infarction (CI) from cerebral haemorrhage (CH). This helps in opting for relevant therapeutic options like thrombolysis, anticoagulation, carotid endarterectomy etc. Computed Tomography (CT) scan brain is a useful, accurate and safe diagnostic tool for differentiation between acute cerebral infarction and haemorrhage. However in developing countries about 70 % of the population has poor access to C.T. brain[4]. A recent study from

Nigeria showed that only 9% of hospitalized stroke patients could afford CT scan[5]. Thus the cost constraint and availability of CT scan in developing countries restrict the attending physicians in acquisition of CT brain in every stroke patient.

Clinical differentiation between acute ischemic and haemorrhagic stroke has not been successful due to overlap in the clinical features of CH and CI[6,7]. To overcome these difficulties, several weighted clinical scoring systems, based on discriminant analysis techniques have been developed.

1. ALLEN STROKE SCORE (ASS), [8] is also called as **Guy's Hospital Score**. This score has been validated in various countries [9-10].

2. SIRIRAJ STROKE SCORE (SSS) [11] is widely used in Thailand and is much easier to determine. It was validated in Nigeria[5,12], Taiwan[13], and Malaysia[14]. Comparative studies of Allen and Siriraj scores have been done in Italy[15], New Zealand[16] and India[4]. Allen and Siriraj scores are considered as "poor man's C.T. Scan" in terms of reliability[17].

3. Two more stroke scores have been introduced as Besson Score[18] and Greek Score,[19] claiming better results. *Besson Score* has not been compared with Allen and Siriraj scores as all three scores have not been applied to the same group of patients. The most recently introduced *Greek Score* when compared with Sirira and Allen by Soman A et al[20] from India showed lack of accuracy for all scores.

In this study we selected widely used Allen stroke score and Siriraj stroke score. The aim of the study was to compare and validate Allen stroke score and Siriraj stroke scores in differentiating acute ischemic and haemorrhagic stroke in patients admitted with acute stroke in Khyber Teaching Hospital Peshawar.

METHODOLOGY

This study was conducted on 100 consecutive patients with acute stroke, admitted in Medical A unit of Khyber Teaching Hospital Peshawar Pakistan, from July 2000 to February 2002, meeting the following criteria.

INCLUSIONS CRITERIA:

- Patients with acute stroke i.e. rapidly developing symptoms and/or signs, of focal or global loss of cerebral function lasting for more than 24 hours, with no apparent cause other than that of vascular origin (WHO criteria)21.
- Presented within 7 days of onset of stroke, irrespective of age and severity of deficit.
- Patient in whom the pathological subtype of stroke was confirmed by CT scan within two weeks after the onset of stroke.

EXCLUSION CRITERIA:

Patients with any one of following conditions were excluded from the study:

- Stroke onset of more than one week.
- Patient dying or leaving the hospital in less than 24 hours after admission.
- CT Scan done after two weeks of onset of stroke.
- CT Scan could not be done due to any reason.
- CT Scan showing subarachnoid haemorrhage.
- Patients receiving anticoagulant therapy.
- Patients with bilateral motor weakness.

INSTRUMENT:

In this study we tested two clinical scoring systems, developed for the diagnosis of stroke subtypes.

Allen score (also called Guy's Hospital score[8] (Anx A), is a linear function derived from the analysis of the data from Guy's Hospital London. Score was developed by analyzing 13 clinical variables and score for each patient was obtained by adding or subtracting values given for the presence of these variables with a constant of 12.6 subtracted.

The cut off level of the Allen score in our study was taken as in the original score[8] which gave cutoff level with 90% certainty as follows.

- Score greater than + 24 = *Haemorrhage*
- Score less than + 4 = *Infarction*
- Score between + 4 and + 24 = *uncertain*

Siriraj stroke score[11] (Anx B) testing five clinical variables, was developed at Siriraj Hospital Medical School, Mahidol University, Bangkok. In developing this score, stepwise discriminant analysis of the clinical variables was followed by a linear discriminant equation to differentiate between supratentorial haemorrhage and infarction.

Cut off level for Siriraj stroke score validated by original study [11] was used in this study.

- Score greater than +1 = Haemorrhage
- Score less than -1 = Infarction
- Score between +1 and –1 = uncertain

Annexure A: Allen Stroke Sore

Variable	Clinical Features	Score
♦ *Apoplectic Onset* *loss of consciousness* *Headache(within 2 hrs)* *Vomiting* *Neck stiffness*	 -None or one -Two or more	 *0* *+21.9*
♦ *Level of consciousness* *[24 hrs after admission]*	 -Alert -Drowsy -Unconscious	 *0* *+7.3* *+14.6*
♦ *Planter Response*	 -Both flexors or single extensor -Both extensor	 *0* *+ 7.1*
♦ *Diastolic BP* *[24 hrs after admission]*	----------	*+ [---- x 0.17]*
♦ *Atheroma Markers* *Diabetes* *Angina* *Intermittent claudications*	 - None - One or more	 *0* *-3.7*
♦ *Hx. Of Hypertension*	 - Not present - Present	 *0* *-4.1*
♦ *Previous Event* *(TIA / STROKE)*	 -None -Any number of previous events	 *0* *-6.7*
♦ *Heart Diseases*	 -None -Aortic or mitral murmur -Cardiac failure -Cardiomyopathy -AF -Cardiomegaly -MI within 6 months	 *0* *-4.3* *-4.3* *-4.3* *-4.3* *-4.3* *-4.3*
Constant	----------	*-12.6*

Score <+4 - cerebral infarct, >+24 - cerebral haemorrhage, +4 to +24 - uncertain

Both scores were calculated by obtaining details of each clinical variable. If any variable was not available e.g. if patient was aphasic or unconscious, information from a valid surrogate respondent was taken. A valid surrogate respondent was considered a spouse or first degree relative that was living in the same home or was self-identified as aware of the patient's previous medical history and current therapies. If the valid surrogate respondent was unaware of the particular variable, then the variable score was adjusted as zero.

We tried to record BP and conscious level of every patient at the base line and 24 hours after admission. If due to any reason the record at 24 hours was not possible, then the nearest recording was obtained for the calculation of Allen score. Systolic pressure was determined by the first heard sound (Korotkoff phase I) while diastolic pressure was recorded at the level when the sound just disappeared (Korotkoff phase V).

History of hypertension was obtained from patient himself or attendants. They were asked about use of antihypertensive drugs or patient's old record showing BP reading of > 140/90 mm Hg[22] on two different occasions before the onset of stroke.

Annexure B: Siriraj Stroke Score

Variable	Clinical Features	Score
• Consciousness	Alert	+0 x 2.5
	Drowsy , Stupor	+1 x 2.5
	Semicoma ,Coma	+2 x 2.5
• Vomiting	No	+0 x 2
	Yes	+1 x 2
• Headache [within 2 hrs]	No	+ 0 x 2
	Yes	+1 x 2
• Diastolic BP	----------mm Hg	+(___ x 0.1)
• Atheroma markers [DM , Angina , Intermittent Claudication]	None	-0 x 3
	One or More	-1 x3
• Constant	----------	-12

Score: < -1 - cerebral infarction, >+1- cerebral haemorrhage, -1 to +1 - uncertain

Diabetes mellitus was considered when the patient or his attendants confirmed the history of DM or use of insulin or oral hypoglycemic agents or if patient had a random blood sugar level of 11.1 mmol /L or more[23].

History of intermittent claudication was taken from patient or his attendant by considering following criteria: calf pain which is atherosclerotic in origin, induced by exercise and relieved within 10 minutes by rest.

Atrial fibrillation was confirmed by ECG recording at arrival. Cardiomegaly was considered if cardiothoracic ratio was more than 0.5 on chest x-ray.

C.T. scan brain was used as the gold standard for the diagnosis of cerebral Infarction and haemorrhage. Every CT scan was reported by consultant radiologist who was blinded to both scores.

C.T. Scan was done within two weeks of the onset of stroke to rule out any misdiagnosis of resolving haematoma. Cerebral infarction was diagnosed when the C.T. Scan showed a hypodense area corresponding to the clinical picture. Cerebral haemorrhage was diagnosed by presence of parenchymatous hyperdense area on CT brain with or without intraventricular extention. Patients with normal CT scan, after the 24 hours of the onset of stroke, were not included in the study.

Procedure

This was a prospective study, conducted on admitted patients of acute stroke. Every patient with the clinical suspicion of acute stroke was admitted to the Medical A ward, Khyber Teaching Hospital Peshawar. A detailed history was taken and general physical and neurological examination followed by systemic examination was carried out at the time of admission. Relevant information was recorded at the time of admission. Patients were reassessed at 24 hours after admission for level of consciousness and BP recording (for Allen score). Every patient was subjected to undergo CT scan preferably within 24-72 hours after admission but not later than two weeks after the onset of the stroke. CT scan was reported by a consultant radiologist. Other investigations performed were, complete blood count, ESR, platelet count, blood glucose, BUN, serum cholesterol, triglycerides, electrocardiogram and chest X Ray. Investigations performed in selected cases, where indicated, were cerebrospinal fluid examination, echocardiography, doppler examination of neck vessels, angiography, antiphospholipid antibodies and prothrombin time.

Allen and Siriraj scores were calculated and compared with the results of CT scan. Both these scores were compared in term of detecting ICH and cerebral infarcts, according to the cut off suggested by original studies[8,11]. Statistical analysis were done by using SPSS 10 (statistical package for the social sciences). The scores were tested for comparability (Kappa Statistic) i.e. agreement between the two scores; and validity (sensitivity, specificity, positive and negative predictive values and overall diagnostic accuracy).

RESULTS

Analysis of the data of 100 cases, recruited in our study, showed that there were 69 cases with cerebral infarction (CI) and 31 cases with cerebral haemorrhage (CH). Out of 100 patients, 55 patients were males with age ranging from 17-96 years. The rest of 45 patients were females with age ranging from 35-80 years. The overall mean age was 60.51±13.68 years.

In ASS, the score of >+24 was taken as CH, < +4 as CI, and between +4 & +24 was taken as "uncertain". In Siriraj score, the score of >+1 was considered as CH,<-1 as CI and between +1 and -1 as "uncertain". By Applying these cutoff points, ASS and SSS gave a *certain diagnosis* as CH or CI in 73 cases and 82 cases respectively. Out of these cases with definitive diagnosis (*certain cases*) ASS and SSS diagnosed as *haemorrhage stroke* in 18 and 25 cases respectively and as *ischemic stroke* in 55 and 57 cases respectively. The remaining cases were classified as "*uncertain*" (27 cases with ASS and 18 cases with SSS). Thus in *certain cases,* the probability of haemorrhage by ASS was 24.65% (n=18/73) and by SSS was 30.48% (n=25/82).

Both ASS and SSS were compared by Kappa Statistics, by using SPSS program (Windows version. 10.0). Kappa value of 1 shows ideal agreement; more than 0.75 shows excellent agreement beyond chance; less than 0.40 shows poor agreement and between 0.40-0.75 reveals intermediate to good agreement. The overall comparability of Allen and Siriraj score was fair (Kappa = 0.51) (Table 1). As ASS was "uncertain" in 27 cases and 'certain' in 73 cases and SSS was "uncertain" in 18 cases and certain in 82 cases; the Kappa showed a poor comparability in term of "certain results" (k=0.23), Table 2). However while considering those results that were within the "diagnostic range" (certainty) with both scores (64 cases), the Kappa showed an excellent agreement in diagnosing cerebral infarction and haemorrhage (K=0.91, table = 3).

Table 1: Comparison of Allen and Siriraj Score

		SIRIRAJ STROKE SCORE		
		Hemorrhage (n = 25)	**Infarction** (n = 57)	**Uncertain** (n = 18)
ALLEN STROKE SCORE	**Haemorrhage** (n = 18)	15	1	2
	Infarction (n = 55)	1	47	7
	Uncertain (n = 27)	9	9	9

Kappa = 0.511

Table 2: Certain and Uncertain Results with Allen and Siriraj Score

		ALLEN STROKE SCORE		
		Certain	**Uncertain**	**Total**
SIRIRAJ STROKE SCORE	**Certain**	64	18	82
	Uncertain	9	9	18
	Total	73	27	100

Kappa = 0.235

The comparison ASS with C.T Scan is shown in Table 4. Out of 31 cases of cerebral haemorrhage on CT scan, the ASS correctly diagnosed cerebral haemorrhage in 12 cases, with 6 cases misdiagnosed as cerebral infarction. The rest of 13 cases of CH were reported as "uncertain" by ASS. Out of 69 cases with cerebral infarction, the ASS correctly diagnosed 49 cases as CI, misdiagnosed 6 cases as CH and reported 14 cases as "uncertain". Thus the Allen Score has sensitivity (probability of a positive test in people with disease) of 38.70% and specificity (probability of a negative result in people without disease) of 91.30% for cerebral haemorrhage. The positive predictive value (probability of the person having the disease when the test is positive) for CH was 66.67 % and negative predictive value (probability of the person to be free of disease when the test is negative) is 76.82% for CH (Table 5). For ischemic stroke the sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of Allen score was 71.1%, 80.64%, 89.09% & 55.56% respectively (table 6). The overall predictive accuracy of Allen score was

Table 3: Diagnostic Agreement of Allen and Siriraj Scores

		ALLEN STROKE SCORE	
		Haemorrhage	**Infarction**
SIRIRAJ STROKE SCORE	**Haemorrhage**	15	1
	Infarction	1	47

Total certain results = 64
Kappa = 0.917

Table 4: Comparison of Allen & Siriraj Stroke Scores with the Results of Computed Tomography

		COMPUTED TOMOGRAPHY	
		Haemorrhage (n = 31)	**Infarction** (n = 69)
ALLEN STROKE SCORE	**Haemorrhage** (n = 18)	12 (38.7 %)	6 (8.7 %)
	Infarction (n = 55)	6 (19.4 %)	49 (71.0 %)
	Uncertain (n = 27)	13 (41.9 %)	14 (20.3 %)
SIRIRAJ STROKE SCORE	**Haemorrhage** (n = 25)	21 (67.7 %)	4 (5.8 %)
	Infarction (n = 57)	3 (9.7 %)	54 (78.3 %)
	Uncertain (n = 18)	7 (22.6 %)	11 (15.9 %)

61%.

The results of Siriraj score are shown in table 6. In 31 cases of cerebral haemorrhage on CT scan, the SSS correctly diagnosed 21 cases as CH, misdiagnosed 3 cases as cerebral infarction and the remaining 7 cases were described as "uncertain" by SSS. Out of 69 cases of cerebral infarction, 54 cases were correctly diagnosed as CI and 4 cases were wrongly diagnosed as CH by SSS. In the remaining 11 cases of cerebral infarction, the SSS showed "uncertain" results. Thus the sensitivity, specificity, PPV, and NPV of Siriraj score 67.74%, 94.2%, 84.0% and 86.67% for CH respectively (Table 7) and 78.26% 90.32%, 94.73% and 65.11% for cerebral infarction respectively (Table 8). The overall predictive accuracy of Siriraj score was 75%.

DISCUSSION

Stroke the "acute brain attack" is a life threatening condition. The management of acute stroke depends on the stroke subtype i.e. ischemic or haemorrhagic. Introduction of Allen stroke score[8] and Siriraj stroke score[11] led to the hopes of bed side differentiation between ischemic and haemorrhagic stroke and thus helping in the acute

Table 5: Predicting Cerebral Haemorrhage with Allen Score

		RESULT OF C.T. SCAN	
		Cerebral Hemorrhage (n=31)	**NOT Cerebral Haemorrhage** (n=69)
PREDICTING STROKE SUBTYPES WITH ALLEN SCORE	**Cerebral Haemorrhage** (n =18)	12	6
	NOT Cerebral Haemorrhage (n =82)	19	63

Sensitivity = 38.70%, Specificity = 91.30%, Positive Predictive Value = 66.67%, Negative Predictive Value = 76.82%

Table 6: Predicting Cerebral Infarctionwith Allen Score

		RESULTS OF CT SCAN	
		Cerebral infarction (n=69)	**Not cerebral infarction** (n=31)
PREDICTING STROKE SUBTYPES WITH ALLEN SCORE	**Cerebral infarction** (n=55)	49	6
	Not cerebral Infarction (n = 45)	20	25

Sensitivity = 71.1%, Specificity = 80.64%, Positive Predictive Value = 89.09% Negative Predictive Value = 55.56%

Table 7: Predicting Cerebral Haemorrhage with Siriraj Score

		RESULT OF C.T. SCAN	
		Cerebral Hemorrhage (n=31)	**Not Cerebral Haemorrhage** (n=69)
PREDICTING STROKE SUBTYPES WITH SIRIRAJ SCORE	**Cerebral Haemorrhage** (n =25)	21	4
	NOT Cerebral Haemorrhage (n =75)	10	65

Sensitivity = 67.74%, Specificity = 94.20%, Positive Predictive Value = 84.00%

Negative Predictive Value = 86.67%

Table 8: Predicting Cerebral Infarction with Siriraj Score

		RESULTS OF C.T. SCAN	
		Cerebral infarction (n=69)	**Not cerebral infarction** (n=31)
PREDICTING STROKE SUBTYPES WITH SIRIRAJ SCORE	**Cerebral infarction** (n=57)	54	3
	Not cerebral Infarction (n = 43)	15	28

Sensitivity=78.26%, Specificity = 90.32%, Positive Predictive Value = 94.73%
Negative Predictive value = 65.11%

management of stroke. The practical utilization of these scoring systems as screening tests would be to exclude cerebral haemorrhage in patients with acute stroke, in order to offer any thrombolytic or antithrombotic treatment in settings where CT scan is not vaialable. In order to exclude CH, the clinical score should have a high sensitivity for CH.

In our study, the Allen stroke score with the sensitivity of 38% for CH is not sufficiently sensitive to be used for exclusion of CH, before anticoagulation is started. Our results are in agreement with other studies showing the sensitivity of ASS of not more than 70% for CH e.g. Hawkins GC et al[16] (31%), Conner MD et al[24] (34%), Celani MG et al[9] (38%), Soman A et al[20] (50%), Kocher et al[25] (60%), Salawu F et al[26] (64.3%) and Huang JA et al [10] (67%). Only Badam P et al[27] had sensitivity of 81% for CH for ASS. In our study the specificity of ASS was 91% for CH which was again favouring other studies[10,15,16,20,24,25] having specificty of 90%-100% for CH. PPV of 66 % for CH in our study is not much different from Celani MG et al (71%)[15] and Hawkins et al (73%)[16] as is the NPV of 76% for CH matching NPV of 78% by Soman A et al[20] and 71% by Salawu F et al[26].

Similarly the Siriraj stroke score had a sensitivity of 67% for CH in our study. This figure is again not allowing us to use Siriraj stroke score as a valid screening tool to rule out cerebral haemorrhage before offering thrombolytic or antithrombotic treatment.Our figures are supported by various studies with the sensitivity rate of less than 80% for Siriraj score. The sensitivity of siriraj stroke score for CH was reported as 48% by Hawkins GC et al[16], 50% by Ogan S et al[28], 60% by Connor MD et al[24], 61% by Celani MG[15], 71% by Salawu F et al[26] 73% by Shah FU et al[29], 75% by Soman et al[20], 77% by Zenebi et al[30] and 78% by Badam P[27]. All these figures are in agreement with our results (67%). Our findings are in conflict with the original study by Pongvarin et al[11] and some other validation studies[13.25,31] showing sensitivity of SSS in the range of 80-90% for CH. The difference in the frequency of cerebral hemorrhage may be the reason for varying sensitivity of siriraj score for CH. In our study 31% of patients had CH as compared to 42% and 44.17% in Pongvarin et al[11] and Kochar DK[25] respectively. In this study the specificity of Siriraj score for CH was 94% which is favoured by results of other studies showing specificty of 94%[15], 90%[29,31], and 88%[24] for SSS in patients with CH. The PPV of SSS for CH in our study was 84% which is matching 83%[29] & 77%[20] and opposing others showing PPV of around 70% or less[15,16,25,30,31]. The NPV of SSS for CH in our study was 86% favouring 85% and 93% by Kochar et al[25] and Celani MG et al[16] respectively.

In our study, cerebral infarction was present in 69% of patients with stroke. Sensitivity of Allen score for CI in our study was 71 % which is favouring results from some other studies[16,24,26] with Allen score's sensitivity of <80% for CI. Similarly specificity of ASS for CI in our study (80%) was nearer to 74% specifity for CI by Connor MD et al[24]. PPV for CI with ASS was 89% which was almost matching 91% by Celani MG et al[15] and NPV of 55% for CI by ASS was favouring 40% Salawu F[26].

The sensitivity of Siriraj stroke score for CI was 78% in our study.These findings are consistant with the results of some other studies i.e. 80% by Hui ACF,[31] 73% by Kochar et al,[25] 71% by Shah FU[29] and 70% by Conner MD et al.[24] Original study[11] of SSS had sensitivity of 93% for CI which was only endorsed by Hung LY et al[13] with a sensitivity of 90% for CI. High specificity 90% of SSS for CI in our study was almost nearer to 85%[13,25] and 84%[24] PPV of 94% for CI observed by SSS in our study was also matching others having PPV of 93%[12] and 90%.[25] Similarly 65% NPV of SSS for CI was consistant with 71% NPV by Kochar et al[25].

In comparing Allen and Siriraj score, like Celani et al[15], our results show that both these scours do not diagnose the same cases as being certain haemorrhage or infarction. Out of 100 cases, 15 cases as CH, 47 cases as CI and 9 cases as "uncertain" were diagnosed as same by both scores, while in 29 cases both scores were showing different results. In our study, the overall comparability of Allen and Siriraj score was fair (Kappa = 0.51) and was similar to k=0.51 by Badam P[27] but a bit higher than k=0.39 observed by Kochar et al[25]. However the Kappa showing a poor comparability in term of "certain results" (k=0.23) in our study is favoured by studies from Celani MG[15] with k=23 and Kochar et al[25] with k=0.14. The comparability between ASS and SSS is markedly increased by considering those results that were within the "diagnostic range" (certainty) of both scores (64 cases). The Kappa showing an excellent agreement in diagnosing CI and CH (K=0.91) in diagnostic range of ASS and SSS is also evident from results of other studies having kappa figures of 0.93[26], 0.87[25] and 0.75[15] in certain diagnostic range.

The overall predictive accuracy of ASS was 61% and SSS was 75% in our study. By using both score together, it has been shown that the diagnostic accuracy is increased[15,32] but there are certain limitations in applying both scores simultaneously. Allen score can only be calculated 24 hours after admission, so in less number of patients, surviving for 24 hours after the admission, both scores can be applied. Furthermore, the clinical variables used in the Siriraj score are all present in the ASS, so it will not only limit the additional effects but also leading to waste of time in double calculations. In comparison with ASS, the Siriraj score is simple, can be immediately calculated at bed side and requires less information for the calculations. As suggested by Weir et al[33], by selecting more variables than appropriate in development of Allen score, there may be increase in the standard errors of the linear discriminant coefficient. One major limitation with both scores is the vague definition of clinical variables like level of consciousness, a very important variable in both scoring systems. The terms drowsy, stupor, coma and semi coma, need to be defined properly to avoid the subjective bias in calculating the scores. Hawkins GC et al[16] used the Glasgow come scale (GCS),but that resulted in low sensitivities as use of GCS intend to underscore patients with high GCS scores and mild drowsiness[16]. It was our observation that GCS may underscore in patients with expressive aphasia who were otherwise fully alert. As observed by Hawkins et al[16], in our study too, both scoring systems tend to classify severe stroke as haemorrhagic and stroke of less severity as

ischemic, regardless of the etiology involved.

The variability of results from different studies may be explained by different settings, difference in patients ethnic bachground, prevalence rate of cerebral hemorhage and cerebral infarction of various countries and aslo the methodological variation (e.g. prospective versus retrospective collection of data and missing data etc) of various studies. Although a few studies[4,13,15] have shown results favouring the use of Siriraj score in randomizing patients in clinical trials, epidemiological studies or starting antithrombotic treatment. Celani et al[15] suggested that clinicians can rely on Siriraj score in starting antithrombotic treatment, while waiting for the C.T. Scan results. However in thier study the sensitivity of Siriraj score for cerebral haemorrhage is 0.61 only. In their study, the patients with indeterminate score (uncertain results) were unjustifiable excluded from the calculations for sensitivity and specificity thus increasing both the parameters. By taking into consideration the results of "certain" category only, it may eliminate a considerable number of patients with "uncertain results e.g. 43.62% in case of study from Ilic et al[32].

Over all our findings suggest that both scoring systems are lacking sufficient statistical power to differentiate between ischemic and haemorrhagic stroke for therapeutic decisions. Although some physical findings may favour haemorrhagic or ischemic stroke, but no such finding or combination of findings is definitively diagnostic of stroke subtype in all patients and neuroimaging is definitely needed for accurate diagnosis for cerebral haemorrage and infarction[34].

CONCLUSION

Although, Siriraj stroke score being simple with more accuracy is better than Allen stroke score, both these scores lack sufficient validity to be used for exclusion of cerebral haemorrhage before offering antithrombotic or thrombolytic therapy. CT brain is essential for such type of therapeutic decisions. Further studies on larger basis are required for epidemiological utilization of these scores or for case selection during randomized trials before the avaialablity of CT scan.

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