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Comparison of Siriraj Stroke Score and the WHO criteria in the clinical classification of stroke subtypes".

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Summary
Clinical distinction between cerebral haemorrhage (CH) and cerebral infarction (CI) is important in the management of stroke patients in areas where CT scan facility is lacking or access limited by cost and distance. This distinction is necessary in our environment where an increasing proportion of patients are suspected to have haemorrhagic stroke. This study compares Siriraj stroke score (SSS) and the WHO criteria for the acute stroke syndrome as simple tools for this purpose. The computerised tomography (CT) brain scans of all patients referred with clinical diagnosis of stroke at the University College Hospital (UCH), Ibadan, and RADMED diagnostic centre, Lagos were retrieved and reviewed as well as the case notes of these patients at the referral hospitals. Relevant clinical data were extracted from the case records. The patients were classified into either CI or CH using the WHO criteria for acute stroke syndrome and the SSS. This classification was compared with the CT scan diagnosis using the latter as the gold standard. Data analysis was performed with Epi-info software, and Kappa statistics (k value) for comparability test with 95% confidence interval was used to compare the two clinical criteria with the gold standard. Ninety-six patients had complete clinical records and CT scan features consistent with the diagnosis of stroke, of which 52 were diagnosed as CI and 44 as CH. SSS had sensitivity of 50% for haemorrhage and 58% for infarction with an overall accuracy of 54.2%. The WHO criteria for the acute stroke syndrome had sensitivity of 73% for haemorrhage and 69% for infarction with an overall accuracy of 71%. The kappa coefficient was 0.18 for the SSS and 0.41 for the WHO criteria. The diagnostic accuracy of the WHO criteria for the acute stroke syndrome is higher than that of the Siriraj stroke score. The WHO criteria showed moderate agreement (k=0.41) with the CT scan, while the SSS showed no agreement (k=0.18). When CT scan is not affordable or its use is limited by distance, the WHO criteria for acute stroke syndrome could be more useful. A prospective study with a larger sample size is suggested for definitive conclusion.

Keywords: *Cerebral haemorrhage, infarction Siriraj stroke score. WHO criteria.*

Résumés
La distinction clinique entre l'hemorragie cerebrale (HC) et infarction cerebrale (IC) est important dans la gestion des patients souffrant du coup de sang dans les zones on le scanner CT manque on l'acces est limite a couse du cout etn la distance. Cette distinction est necessaire dans notre environnement ou une proportion croissante de patients sont suspectes avoir cette forme d'hemorragie. Cette etude compare SSS (Siriraj stroke score) et les critere de l'OMS pour le stroke aigu comme simple outils a ce propos. La tomographie informatisee (TI) du cerveau passe au scanner de tous les patients ayant les symptomes de cette maladei referre au centre hospitalier Universitaire (UHC), Ibadan, et RAMED centre de diagnostique, Lagos a ete recuperee et revue ainsi que les cas de remargues de ces malades. Les donneers cliniques ayant une relevance ont ete extraits de ces records,. Les malades etainet classes suivant IC ou HC d'apres les criteres de l'OMS pour les strokes aigues et SSS. Cette classification etait aussi comparee au CT en utilisant ce dernier comme mesure standard. L'analyse des donnes etait effectuee avec l'Epi - infor software et Kappa statistics (valeur K) pour le test de compatibilite avec 95% d'intervale de confidence utilise pour comparer les deux criteres cliniques avec la methode standard. 96 patients avaient une sonche complete et les faits CT compatibles au diagnostic du stroke, sur lesquels 52 etaient CI et 44 HC. SSS avait une sensibilite de 50% pour l'hemorragie et 58% pour l'imfarction avec une exaititude totali de 54, 2%. Les criteres de l"OMS pour le symdome aigu du stoke etaitent sensible a 73% pour l;hemorragie et 67% pour l'infarctiobn avec une exactitude totale de 71%. Le coeffiecient k=0,18 pour SSS et 0,41 pour l'OMS (criteres). L'exactitude du diagnostic des criteres de l'OMS pour le syndome du stroke aigu est plus eleve que celui de Siraraj stroke score (SSS). Les criteres de l'OMS montreient une agrement modere (K=0,410 avec CT alors que SSS ne montrait aucum agrementr (K=0,18). Lorsigue les moyens de se procurer le CT ne sont pas reunis ou bien limites par la distance, les criteres ue l'OMS peuvent etre tres utiles. Une etude prospective avec une plus grand nobre de patients est suggeree pour en tirer une conclusion definitive.

Introduction

Proper management of the acute stroke sydrome is based on the correct diagnosis of its pathological type [1]. Computerised tomography (CT) of the brain is an accurate, safe and non-invasive procedure for differentiating between cerebral infarction (CI) and cerebral haemorrhage (CH) [2]. However, in Nigeria, this facility is not available nation-wide. Physicians in charge of acute stroke have to resort to the usual clinical distinction, which has often been shown to be unreliable because of considerable overlap in the clinical features of CI and CH [3,4]. The clinical accuracy of distinction of stroke subtypes has sensitivity of 68% and specificity of 67% [5] but this accuracy increases with sensitivity of up to 95% [2,6] and specificity between 66 to 97% [3,5] when stroke has to be distinguished from non-stroke lesions.

There are several clinical methods to determine the relative likelihood of infarction or haemorrhage to provide a most probable diagnosis. Scoring systems such as the Guy's hospital score [7] (also called the Allen score), the Siriraj Stroke Score (SSS) [8], the clinical scores by Besson [4] as well as the WHO criteria for acute stroke syndrone [9] have seen developed to distinguish cerebral haemorrhage from infarction. These are simple, cheap and practical means of distinction but are not sufficently sensitive replace CT. scan [3,10]. This study aimed

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to determine and compare the sentivity, specificit, accuracy and predictive values of the Siriraj scoring systemsystem and the WHO criteria in stroke patients confirmed by CT scan.

Methodology

Records of computerised tomography (CT) of the brain done between 1991 – 1999 at University college hospital (UCH), Ibadan, and RADMED diagnostic centre, Lagos were reviewed. The CT brain scans of all patients referred with clinical diagnosis of stroke were retrieved and reviewed by two of the authors (A.O.,B.F). The CT of the brain was done with G.E. CT. MAX 640 in Lagos and G.E. 9000 in Ibadan using 5mm slices at 5mm intervals at the base of the skull and 10mm slices at 10mm intervals for the rest of the brain. The criteria for CT diagnosis of cerebral haemorrhage and infarction were the same in both centres [2]. These were (a): cerebral infarction: Hypodense area in the brain with no mass effect on cerebral tissue. The shape and distribution of the lesion usually should be within the territory of a particular arterial blood vessel and there should be no change after contrast enhancement. (b): cerebral haemorrhage: Hyperdense area in the brain and CT values between 50-80 Haunsfield units (HU). The interval between the time of the culpable ictus and the CT scan ranged from 5 to 15 days with a mean of 10 ± 0.6 days.

The case notes of patients with CT confirmed diagnosis were retrieved at the referral hospitals and reviewed by the neurologists (S.O.,O.O.,F.O) in the team. A questionnaire was designed to extract relevant clinical data from the case records. The questionnaire recorded the age, sex, date of admission and discharge from hospital, presence of headache, vomiting, loss of consciousness, the level of blood pressure, history of hypertension, transient ischaemic attacks, diabetes mellitus, obesity, angina pectoris, intermittent claudication, haemoglobinopathy, atrial fibrillation and cholesterol level. The stroke type and anatomic localisation were also recorded. Some patients were comatose on admission and the history was obtained from the relations. Only patients with adequate clinical notes were included in the study. The patients were classified into either cerebral infarction or haemorrhage using the WHO [9] criteria for acute stroke syndrome and the SSS [8].

In the WHO criteria, a patient is classified as having cerebral infarction if there is an acute onset of focal neurological deficit with or without impairment of consciousness, which may be preceded by a T.I.A, occurs at rest with normal or mild elevation of the blood pressure and there is no associated headache and vomiting. The cerebrospinal fluid is usually clear. Intracerebral haemorrhage on the other hand, occurs during activity with rapidly changing neurological deficit and impairment of consciousness. There is moderate to severe elevation of the blood pressure and the cerebrospinal fluid may be bloody. Previous T.I.A. is uncommon but vomiting and headache are common.

In the Siriraj stroke score, the clinical variables were 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 haemorrhage, while a score below –1 indicates infarction. A score between –1 and +1, is an equivocal result needing a CT scan toverify the diagnosis (Appendix 1).v The classification of the stroke subtypes using both criteria was compared with the CT scan diagnosis using this as the gold standard. Data analysis for sensitivity, specificity, accuracy, positive and negative predictive values were done with the Epi-info software and by standard statistical methods [11]. Comparison was made between the SSS and the WHO criteria using the Kappa statistics for comparability test (Epitable) with 95% confidence interval. (k = 0.0 = no agreement; 0.20 = slight; 0.21 – 0.4 = fair; 0.41 – 0.60 = moderate; 0.61 – 0.80 = substantial; 0.81 – 1.00 = almost perfect agreement).

Results

From the review of CT scans, 123 patients had CT features of stroke. Of these, the clinical notes of 21 were incomplete and that of six were not available. Ninety-six patients had complete clinical records and these were the subjects for this study. Sixty–seven were men and 29 were women. The male: female ratio was 2.4:1.0. The age of the patients ranged from 51 to 69 years with a mean of 60 ± 4.3 years. Eleven patients (12%) were comatose on presentation and history from the relations was relied upon. (8.3%) and these could not be classified into either subtype. Using the WHO criteria, 48 patients were classified as having had cerebral infarction and 48 as having had cerebral haemorrhage.

Of the 52 patients with CT scan diagnosis of CI, 30 (58%) were correctly classified as cerebral infarction and 18 (35%) as cerebral haemorrhage using the SSS (table I). Four patients could not be classified. Using the WHO criteria, 36 (69%) were correctly classified as cerebral infarction and 16(31%)as haemorrhage (tableII).

Of the 44 patients with CT scan diagnosis of CH, 22 (50%) were correctly classified as cerebral haemorrhage and 18 (41%) as cerebral infarction using the SSS. Classification was uncertain in 4 patients. Using the WHO criteria, 32 (73%) were correctly classified as cerebral haemorrhage and 12 (27%) as cerebral infarction.

Table 1: SSS classification into stroke subtypes in patients with CT confirmed diagnosis of stroke

SSS classification	CT DIAGNOSIS Cerebral haemorrhage n=44	Cerebral infarction n=52	Total
>+1 (haemorrhage	22	18	40
<-1 (infarction)	18	30	48
> -1 < +1 (Uncertain)	4	4	8
Total	44	52	96

sensitivity for cerebral haemorrhage (CH) = 50%;
specificity for CH = 62.5%
positive predictive value for CH =55%
negative predictive value for CH = 62.5%
sensitivity for cerebral infrarction (CI) = 58%
specificify for CL = 55%;
positive predictive value for CI = 62.5%
negative predictive value for CI =55%
overall accuracy =54.2%;

Table 2: WHO classifciation into stroke subtypes patients with CT confirmed diagnosis of stroke

WHO criteria classification	CT DIAGNOSIS Cerebral haemorrhage n = 44	Cerebral infarction n = 52	Total
Haemorrhage	32	16	48
Infarction	12	36	48
Total	44	52	96

sensitivity for cerebral haemorrhage (CH) = 73%.
specificity for CH = 69%
positive predictive value for CH =66.7%
negative predictive value for CH = 75%
sensitivity for cerebral infrarction (CI) = 69%
specificify for CI. = 73%;
positive predictive value for CI = 69%
negative predictive value for CI =73%
overall accuracy =71%;

Table 3: Comparison of stroke classification using SSS and WHO criteria

	Siriraj stroke score				WHO criteria		
	CH	CI	Un-certain	Total	CH	CI	Total
CT Scan							
CH (n=44)	22	18	4	44	32	16	48
CI (n=52)	18	30	4	52	12	36	48
Total (n=96	40	48	8	96	44	52	96

SSS: k = kappa coefficient = 0.18; p value = 0.05 No agreement with CT scan
WHO . k = 0.42; p value = 0.00: moderate agreement with CT scan
CI = cerebral infarction
CH = cerebral haemorrhage

Appendix I : Calculation of Siriraj Score

Variable	Clinical feature	Score
Consciousness (x2.5)	Alert	0
	Drowsy, stupor	1
	semicoma/coma	2
Vomiting (x2)	No	0
	Yes	1
Headache within two hours	No	0
(x2)	Yes	1
Diastolic blood pressure (x0.1)		
Atheroma markers (x3)	None	0
Diabetes mellitus, angina, intermittent cluadication	One or more	1
Constant		-12

SSS had sensitivity of 50% for haemorrhage and 58% for infarction, specificity of 62.5% for haemorrhage and 55% for infarction with an overall accuracy of 54.2%. The positive predictive values for haemorrhage and infarction were 55% and 62.5% respectively with the corresponding negative predictive values of 62.5% and 55%. The WHO criteria for acute stroke syndrome had sensitivity of 73% for haemorrhage and 69% for infarction, specificity of 69% for haemorrhage and 73% for infarction with an overall accuracy of 71%. The positive predictive values for haemorrhage and infarction were 66.7% and 69% respectively with the corresponding negative predictive values of 75% and 73%.

For the SSS, the Kappa coefficient for comparability was 0.18; p value = 0.05. (no agreement) while for the WHO criteria, k = 0.41; P = 0.00 (moderate agreement) (Table III).

Discussion

This study has shown that the SSS has a sensitivity of 50% for CH and 58% for CI, with accuracy of 54.2% amongst African Nigerians while the WHO has sensitivity of 73% for haemorrhage, 69% for infarction and accuracy of 71%. The SSS had lower predictive values compared with WHO criteria for the acute stroke syndrome. Furthermore, the kappa coefficient for agreement shows no agreement (k = 0.18) with the SSS but moderate agreement (k = 0.41) with the CT scan. Thus, compared with the gold standard, the WHO criteria has higher diagnostic accuracy than the SSS in the diagnosis of stroke subtypes in this study. The Allen score was not used for this retrospective study because it requires several historical and clinical details, and cannot be used until 24 hours after the onset of stroke. The clinical score by Besson [4] also involves more clinical variables than the SSS. The SSS is much easier to determine and can be used immediately after onset of stroke. The predictive values of the SSS in this study were lower than that in the original validation study in Thailand that reported sensitivity of 89% for CH and 93% for CI, with accuracy of 90% [8]. Low predictive values of the SSS in populations outside Asia have also been reported from centres in Europe [12,13].

The preponderance of haemorrhagic stroke in Asia compared with Europe and Africa could be contributory [8,14]. We were surprised to find low predictive values in this study despite the recent suspicion of an increase in haemorrhagic stroke in our population [15]. Furthermore, over 8% of the patients in this study could not be classified into either stroke subtype, thus limiting its usage in our environment.

We are of the opinion that the WHO criteria for the acute stroke syndrome is better in classifying stroke subtypes than the SSS. The WHO classification is qualitative with no attempt at quantitation. Absence of one or more of the clinical variables did not significantly affect the classification unlike in the SSS in which the absence of headache and vomiting implied a loss of 4 points. A patient who is obtunded may not complain of headache. Also, the relative of a comatose patient may not be aware of the past medical history of DM or other atheroma markers in the patient. Furthermore, the weighting of the SSS may not be applicable worldwide where prevalence of haemorrhagic stroke, hypertension, diabetes and cultural pain threshold may differ. CT scan rather than autopsy was used as the gold standard in this study because of the very low autopsy rate in our environment [15]. The total number of CT with features of stroke over the nine-year period was also small. This

was probably because, in our environment, the request for CT scan is usually more likely when the diagnosis of stroke seems questionable [16]. The high cost of CT could also be contributory.

In conclusion, the diagnostic accuracy of the WHO criteria for acute stroke syndrome is higher than that of the SSS in distinguishing between cerebral haemorrhage and infarction. When CT scan is not affordable or its use is limited by distance, the WHO criteria for acute stroke syndrome could be more useful than the SSS in our environment. A prospective study with a larger sample size is suggested for definitive conclusion.

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