# Application of Greek Stroke Score in Ethiopia. A validation study

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**Citation**

T Berhe, G Zenebe, Y Melkamu. *Application of Greek Stroke Score in Ethiopia. A validation study*. The Internet Journal of Neurology. 2008 Volume 11 Number 1.

**Abstract**

Objective: To assess the applicability of Greek stroke score in Addis Abeba, Ethiopia. Method: Using a cross sectional study design, acute stroke patients who had CT scan done were evaluated with Greek stroke score. Sensitivity, specificity, positive & negative predictive values were tested.Result: Out of 91 patients enrolled in the study 42 patients had cerebral infarction and 49 patients had intracerebral hemorrhage by CT scan. The Greek score was uncertain (equivocal) in 36 (39.6%) patients. The sensitivity, specificity, positive & negative predictive values were 0.778 (95% CI, 0.573- 0.906), 0.893 (95% CI, 0.706-0.972), 0.875 (95% CI, 0.665-0.967), 0.806 (955 CI, 0.619-0.919), respectively. Its overall accuracy was 83.6%.Conclusion: The Greek stroke score has good specificity for diagnosis of intracerebral hemorrhage, but has high percentage of uncertain cases hence could not be recommended to guide physicians in the management of stroke.

## INTRODUCTION

Although its burden at national level is unknown, studies have shown that stroke is an important cause of hospital morbidity and mortality in Ethiopia. The hospital burden of stroke appears to have increased significantly from 35 in a year in 1970's, 75 in the 1980's and 128 in a year in 2005. Close to 7%of all admissions were due to stroke in 2005 which was significantly higher compared to previous hospital based studies which showed that stroke accounted for 2.5% and 3% of all admissions in Addis Ababa and Gondar, respectively [1234].

A similar study from South Africa indicated that the burden of stroke is likely to increase in South Africa and across sub-Saharan Africa as a result of unanticipated demographic and health transition [5].

According to current evidence, antiplatelets should be given as soon as possible after the onset of stroke symptoms in cases of likely cerebral infarction, but contraindicated in cases of intracerebral hemorrhage [6]. It is difficult to be sure clinically about the type of stroke in the majority of the cases as there are no specific differentiating features. Computerized Tomography (CT) Scanning allows the accurate distinction of hemorrhagic from ischemic lesions in patients presenting with acute stoke. Despite the growing burden of stroke there are very few CT scanners in Ethiopia (solely limited to the capital city) and the majority of patients with stroke don't have access to brain imaging to diagnose the type of stroke.

There are clinical stroke scores currently available which can guide the treating physician in clinical distinction of stroke type. These are the Allen score, the Siriraj score and the Greek score. The Allen score has been validated in different European setting and been found to be reasonably accurate when the suggested cutoffs are used. However it requires several historical and clinical details and cannot be used until 24 hours after onset of stroke [7].The Siriraj score has been validated in different countries and had shown low accuracy. A study in Nigerian showed a sensitivity of 50.0% for hemorrhagic stroke and 58.0% for cerebral infarction with an overall accuracy of 54.2% [8]. A study from Ethiopia showed sensitivity of 77.0% for hemorrhagic stroke and 61.5 % for cerebral infarction with an over all accuracy of 69.2%. The Greek Stroke Score, proposed by a team from Athens claimed that the sensitivity, specificity, positive and negative predictive values (99, 99, 97 and 97% respectively) were much better as compared to the previous scores [9]. A comparison and validation study done in India has shown that the Greek Stroke Score is better than Siriraj and Allen stroke scores in the diagnosis of stroke [10]. However, the sensitivity, specificity, positive and negative predictive values (41.6, 94, 71 and 81% respectively) calculated was inferior to original study from Greek. The diagnostic parameters of Greek Stroke Score are easily memorized and

can be applied at the bedside with no need of a calculator from patient information available to the physicians early (with in the first 3h) after admission.

Because the existing shortage of brain imaging in Ethiopia is unlikely to be resolved in the near future, it is of practical importance to know if clinical stroke score enhances the clinician ' s bedside assessment of stroke type. The GSS has not been validated in Ethiopia and This study was conducted with the aim of looking at the applicability of the Greek Stroke Score to differentiate between hemorrhagic and ischemic stroke in Ethiopian patients so that it may simplify doctors' decisions regarding immediate administration of anti-platelet drugs in stroke patients, with out the risk of further deterioration as a result of a missed hemorrhage.

## METHODS

The study was cross sectional by design and it was based on clinical assessment and review of records of patients who were admitted to the Tikur Anbessa Specialized Teaching Hospital. Tikur Anbessa Hospital is the largest specialized hospital in Ethiopia and serves for Addis Abeba University medical faculty teaching center for both undergraduate and specialty level trainings.

Data was collected directly from patients during clinical evaluation and from their respective records who were admitted to the hospital over six month period, from July to December 2008. The WHO definition of stroke " rapidly developing signs of focal (or global) disturbance of cerebral function leading to death or lasting longer than 24 hours with no apparent causes other than vascular " (11) was used in the study. Patients were enrolled into the study by using the following two inclusion criteria: patients with neurological deficit lasting for more than 24 hours and patients whom their CT scan showed supratentorial cerebral infarction or intracerebral hemorrhage. Patients with stroke as a result of other causes like tuberculosis, tumors or trauma and patients with subarachnoid hemorrhage were excluded from the study. Since CT scan was used as a gold standard diagnostic tool for the study all patients without CT result were excluded.

The following variables were recorded from patients at presentation & during the first three hours of hospitalization: Clinical sign & symptoms (onset of neurological deficit, vomiting, loss of consciousness, Glasgow coma scale (GCS), neurological deterioration within first 3 hours of admission), White blood cell count (WBC), and CT scan.

The principal investigator using data collection form collected the data & stroke scores were calculated for each patient individually. Results were considered to be certain for the presence of ischemic stroke or hemorrhagic stroke when the Greek Stroke Score was less than or equal to 3; or equal to 11 or above, respectively; between 3 & 11 were considered equivocal (table 1). The results were compared to CT scan results & sensitivity, specificity, positive and negative predictive values were calculated.

### Figure 1

Table 1: Criteria used for calculating Greek Stroke Score

| Signs/symptoms | Number points |
|---|---|
| Neurological deterioration within 3 hours from admission | 6 |
| Vomiting | 4 |
| White Blood Cell count >12,000 | 4 |
| Decreased level of consciousness | 3 |

The study was conducted after obtaining ethical clearance from the Department of Neurology. Consent of each patient was obtained before enrolling him or her into the study.

## RESULTS

Table 2 shows classification of the 91 patients by stroke diagnosis which are hemorrhagic stroke, ischemic stroke or equivocal. As a total of 36 (39.6%) fall in the category of equivocal, meaning it was not certain to label the cases as hemorrhagic or ischemic stroke, further analysis was based on only 55 (60.4%) cases. From the total 49 patients who were diagnosed to have Hemorrhagic Stroke by CT scan only 21 (42.9%) were diagnosed correctly by the Greek Stroke Score and 42 of those who were diagnosed as having ischemic stroke, 25 (59.5% ) were correctly diagnosed by the Greek Score to have ischemic stroke.

### Figure 2

Table 2: Diagnosis of patients by CT scan and Greek Stroke Score

| Greek Stroke Score | CT scan | | Totals |
|---|---|---|---|
| | Hemorrhagic | Ischemic Stroke | |
| Hemorrhagic Stroke | 21 | 3 | 24 |
| Ischemic Stroke | 6 | 25 | 31 |
| Equivocal | 22 | 14 | 36 |
| Totals | 49 | 42 | 91 |

From the total 55 patients who were included in the analysis, 27 had hemorrhagic stroke giving a proportion of 49.0% (35.5%-62.8%). Sensitivity of the Greek Score to diagnose hemorrhage is calculated to be 0.778 (0.573-0.906) and the specificity is 0.893 (0.706- 0.972).

Positive and negative predictive values were also calculated. A positive predictive value for hemorrhage (true positive) is 0.875 (0.665-0.967) and the negative predictive value for

hemorrhage (true negative) is 0.806 (0.619-0.919).

## DISCUSSION

The proportion of hemorrhage is slightly higher than infarction (49vs.42) in our study as opposed to the original Greek Study which has a high proportion of cerebral infarction (137vs.31). And also in our study the specificity (89.3vs.99% ), sensitivity (77.8vs.99% ), positive predictive value (87.5vs.97% ) & negative predictive values ( 80.6vs97%) calculated are inferior to the Greek study.

Compared to the Indian Study, that had equal sample size with our study, & which had slightly higher proportion of infarction (47 vs. 44); the specificity ( 89.3vs 93%) and negative predictive values( 80.6vs 81) calculated are smaller in our study. However, our study yielded a proportion of uncertain cases relatively smaller that the Indian (36 vs. 47) but higher than the Greek study (36 vs. 13), allowing stratification of 60.4%, (48.3% & 92.2% for Indian & Greek, respectively) of patients in the hemorrhage or infarction group. Of the 36 uncertain cases in our study, 22 are hemorrhage, 14 are infarction. Of the 13 uncertain cases in Greek study 11 were infarction & 2 were hemorrhage. Of the 47 uncertain cases, 32 are hemorrhage & 15 are infarction in the Indian study. Our present validation study shows that the Greek stroke score was not sufficiently accurate (accuracy is 83.6% ) to identify infarct from hemorrhage . Even though the Greek stroke score has good specificity in diagnosing intracerebral hemorrhage (89.3%), the high percentage of uncertain cases (39.6%) is the main limitation of this stroke score to be applied to guide the physician in management of stroke. It is important to note that the confidence intervals of the measures are wide implying that the sample we are worked on have no enough power; further study is required with large sample of patients to validate this score in Ethiopia. CT scan remains a gold standard diagnostic tool in differentiating stroke sub types. In view the high percentage of uncertain cases & lack of accuracy of the existing stroke scores & also the shortage of CT scanner in the country, studies should be done in the future to develop an easy & reliable new clinical stroke score for differentiation of cerebral infarction from intracerebral hemorrhage in order to aid clinicians to decide about starting anti platelet therapy in Ethiopian setup.

## ACKNOWLEDGEMENT

Dr Amanuel Amare contributed to the interpretation of the data and the writing of the paper.

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