

Using the Canadian and Scandinavian Stroke Scales for Prediction of Short-Term Outcome in Ischemic Stroke Patients in Sohag; Upper Egypt. Is there a difference?

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ABSTRACT

Background: Among stroke scales, we considered the Canadian Stroke Scale (CSS) and Scandinavian Stroke Scale (SSS) as the most suitable and most simple to be applied on our population for further generalization on other community hospitals. **Objective:** We aimed to determine which one of the two scales has the best predictive power of outcome. **Methods:** Equally trained observers scored consecutive admissions to Neurology Department of Sohag University Hospital on CSS and SSS. Outcome at 3 months using the modified Rankin Score (mRS) was categorized as good (mRS \leq 2) or poor (mRS $>$ 2). Predictive accuracy of the variables was compared by receiver operating characteristic curves. **Results:** The follow up data was completed in 203 patients. Altogether 162 patients found to be alert or drowsy (60 males and 102 females) are included in the study. The two stroke rating scales each predicted 3-month outcome with an accuracy of 0.78 or greater. The diagnostic cutoff level with the optimum sensitivity and specificity was found to be >7 for the CSS, with 72.5% sensitivity, 74.4% negative predictive value, 78.0% specificity, and 76.3% positive predictive value. For the SSS the optimum diagnostic cutoff level was found to be >38 , with 77.5% sensitivity, 76.3% negative predictive value, 70.7% specificity, and 72.1% positive predictive value. **Conclusion:** We demonstrated that both the CSS and SSS are useful in the evaluation of patients with stroke and both equally predict 3-month outcome. Baseline assessments only need to include either of them. [Egypt J Neurol Psychiat Neurosurg. 2014; 51(2): 167-172]

Key Words: Cerebral infarction, Severity, Prognosis, Stroke assessment, Stroke scales.

INTRODUCTION

A valid and reliable assessment of stroke severity is an essential covariate for the analysis and interpretation of outcome studies.¹ In fact, impairment scales have often been used to predict outcome despite not having been planned for this purpose. It is unclear which stroke scale gives the best prognostic information. That's why multiple scales are often used in clinical trials.² The validity and reliability of the Canadian Stroke Scale (CSS) has been shown, and it has been used in clinical trials.³⁻⁶ The Scandinavian Stroke Scale (SSS) has been used in many clinical trials either for patients selection or rating of outcome severity.⁷⁻⁹ A low score on the SSS at onset of stroke or one day after is a strong predictor of death within one month of a hemispheric ischemic stroke¹⁰, and has been shown to predict outcome in mild stroke.^{11,12} Five years ago, we started to use the CSS, however, after 3 years we shifted to use the Scandinavian Stroke Scale without precise conclusion which one is the

most suitable for our population. Moreover, among the published literature, there were no studies that compare both scores in assessment of acute stroke and its impact on the long-term outcome.

Aim of the work: we aimed to determine which one of the two scales has the best predictive power of outcome in our population for further generalization on community hospitals and in situations where non-neurologists carry out the initial evaluation of stroke patients.

SUBJECTS AND METHODS

The patients of the study consisted of ischemic stroke patients admitted to neurology department of Sohag University hospital. The study was designed to be a prospective hospital based study. The patients were recruited within a period of 9 months starting from June 2011 up to March 2012. All patients of the study were subjected to detailed history taking, thorough general and neurological examinations, Cranial computed tomography scanning (and magnetic resonance imaging (MRI) in some cases) and non-stroke patients were

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excluded. Patients found to be alert or drowsy in the acute stage of illness were eligible for inclusion. Before starting the study we have trained our neurology residents for using both the CSS and SSS. A printed sheet was designed for each patient containing all data including the CSS and SSS. Outcome at 3 months using the modified Rankin Score (mRS) was chosen as the outcome measure for the subsequent statistical analysis. Patients with mRS of ≤ 2 were considered to have a good outcome, while those with mRS of > 2 were considered to have a poor outcome.

Statistical Analysis

Data were analyzed by sensitivity, specificity, positive, and negative predictive value derived from the receiver operating characteristic (ROC) curve. The diagnostic accuracy of the CSS and the SSS was expressed as the area under the ROC curve (AUC). Comparison between groups was made by student t-test for normally distributed data and by the Mann-Whitney test for not normally distributed data. Proportions of patients were compared using the chi square test. Statistical analysis was performed using Medcalc for Windows (version 11.0) and STATA (version 9.0).

RESULTS

During the period of the study, 335 ischemic stroke patients admitted to our department within 24 hours after the stroke. The follow up data was completed in 203 patients. Altogether 162 patients

found to be alert or drowsy (60 males and 102 females) are included in the study. Table 1 shows the baseline characteristics of the population studied. Eighty patients (49.38%) had a good outcome (mRS ≤ 2) and 82 patients (50.62%) had poor outcome (mRS > 2). Table 2 compares patients with good and poor outcome regarding the baseline characteristics. Older age was significantly related to poor outcome. Patients with good outcome were less likely to have right sided weakness. Lower Glasgow Coma Scale (GCS) on admission was a significant predictive factor for poor outcome. The same was for lower scores on either CSS or SSS, which were significant predictive factors for poor outcome. Figure (1) presents ROC curves illustrating the sensitivity and specificity of the CSS and the SSS. Table (3) shows the optimum diagnostic cutoff values, AUCs, sensitivity, specificity, positive, and negative predictive values of the CSS and the SSS for predicting outcome. The area under the ROC curve was 0.78 for the CSS (95% confidence interval 0.71-0.85) compared with 0.80 for the SSS (95% confidence interval 0.73-0.87). No statistical difference was found between the AUC for the CSS and that for the SSS ($p=0.46$). The diagnostic cutoff level with the optimum sensitivity and specificity was found to be >7 for the CSS, with 72.5% sensitivity, 74.4% negative predictive value, 78.0% specificity, and 76.3% positive predictive value. For the SSS the optimum diagnostic cutoff level was found to be >38 , with 77.5% sensitivity, 76.3% negative predictive value, 70.7% specificity, and 72.1% positive predictive value.

Table 1. Baseline characteristics of study population.

Age (Mean \pm SD)		59.1 \pm 14.5
Sex	Male	60 (37.03%)
	Female	102 (62.9%)
Hypertension		70 (43.2%)
Diabetes mellitus		39 (24%)
Previous TIAs		17 (10.4%)
Previous CVS		32 (19.7%)
History of cardiac disease		32 (19.7%)
Systolic Blood Pressure (Mean \pm SD)		143.2 \pm 25.6
Diastolic Blood Pressure (Mean \pm SD)		90.1 \pm 57.5
Admission temperature (Mean \pm SD)		37.2 \pm 3.9
Respiratory Rate (Mean \pm SD)		19.8 \pm 6.4
Pulse rate (Mean \pm SD)		84.4 \pm 13.5
Side of weakness	Right	73 (45.06%)
	Left	60 (37.03%)
	Bilateral	8 (4.9%)
	Absent	21 (12.9%)
GCS		13.5 \pm 1.9
CSS		6.6 \pm 3.3
SSS		36.4 \pm 16.7
Outcome	Good (mRS ≤ 2)	80 (49.38%)
	Poor (mRS > 2)	82 (50.62%)

CSS Canadian Stroke Scale, CVS Cerebrovascular Stroke, GCS Glasgow Coma Scale, mRS modified Rankin score, SD standard deviation, SSS Scandinavian Stroke Scale, TIAs Transient Ischemic Attacks

Table 2. Baseline characteristics of patients with good and poor outcome.

	Patients with Good outcome (MRS ≤ 2)	Patients with Poor outcome (MRS > 2)	P-value
Age (Mean±SD)	54.72 (15.87)	63.48 (11.59)	0.00001*
Sex %	Female	54 (60%)	0.44
	Male	32 (40%)	
Hypertension	31 (38.75%)	39 (47.56%)	0.26
DM	16 (20%)	23 (28%)	0.23
Previous TIA	9 (11.25%)	8 (9.76%)	0.76
Previous CVS	13 (16.25%)	19 (23.17%)	0.27
History of cardiac disease	18 (22.5%)	14 (17.07%)	0.39
Systolic Blood Pressure (M±SD)	141±24.58	145.49 ±26.67	0.27
Diastolic Blood Pressure (M±SD)	84.88 ±11.58	86.56 ±13.55	0.40
Admission temperature (M±SD)	36.76 ±3.76	37.81 ±3.97	0.09
Respiratory Rate (M±SD)	19.96 ±7.76	19.76 ±4.85	0.84
Pulse rate (M±SD)	85.6 ±14.05	84.40 ±12.10	0.56
Side of weakness	Right side	33 (41.25%)	0.003*
	Left side	27 (33.75%)	
	Bilateral	2 (2.5%)	
	No weakness	18 (22.50%)	
GCS (M±SD)	14.33 ±1.36	12.73 ±2.19	<0.00001*
CSS (M±SD)	8.28 ±2.68	4.91 ±3.15	<0.00001*
SSS (M±SD)	44.94 ±12.90	28 ±15.94	<0.00001*

CSS Canadian Stroke Scale, CVS Cerebrovascular Stroke, GCS Glasgow Coma Scale, mRS modified Rankin score, SD standard deviation, SSS Scandinavian Stroke Scale, TIAs Transient Ischemic Attacks,

*Significant at p<0.01

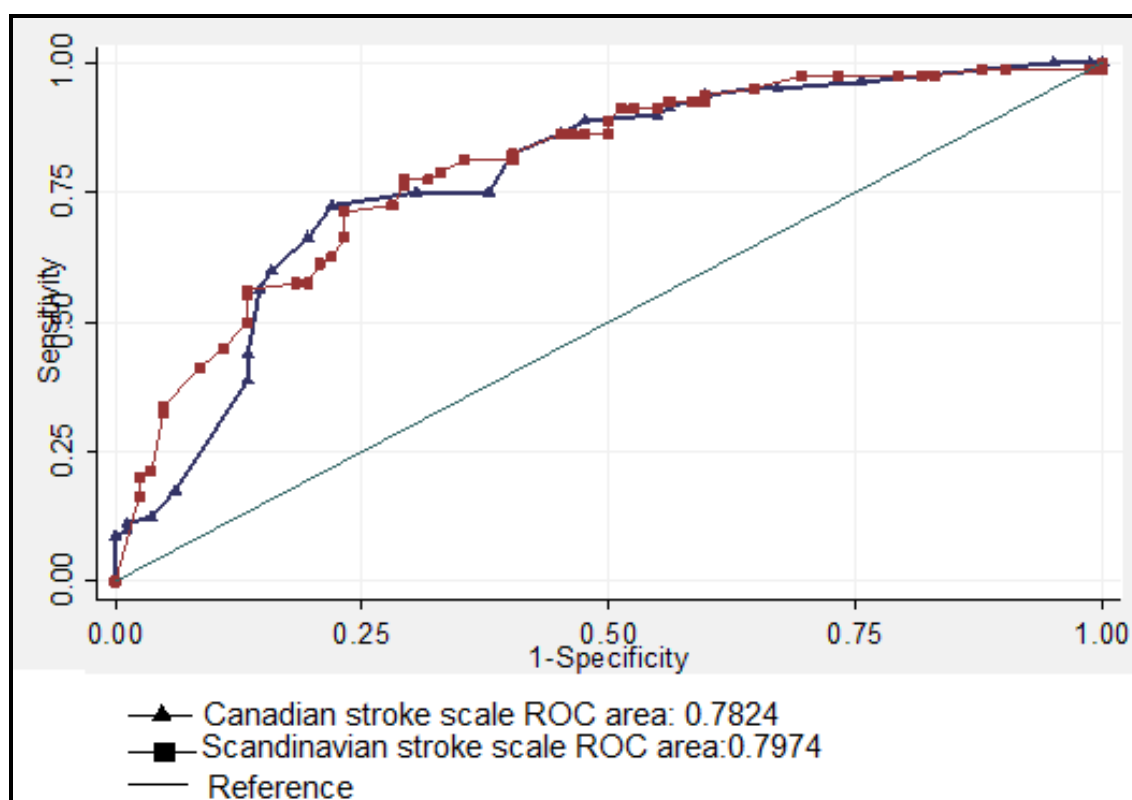


Figure 1. Receiver operating characteristic (ROC) curves comparing The Canadian stroke scale and The Scandinavian Stroke Scale for good outcome; p=0.46.

Table 3. Optimum diagnostic cut off value, AUC (parentheses 95% CI), sensitivity, specificity, PPV and NPV of CSS and SSS for good outcome.

Cutoff	AUC (95% CI)	Sensitivity	Specificity	PPV	NPP
CSS >7	0.78 (0.71-0.85)	72.50	78.05	76.3	74.4
SSS >38	0.80 (0.73-0.87)	77.50	70.73	72.1	76.3

AUC area under the curve, CI confidence interval, PPV positive predictive value, NPV negative predictive value, CSS Canadian stroke scale, SSS Scandinavian Stroke Scale

DISCUSSION

In Egypt, 2 decades ago neurology departments were nearly restricted to university hospitals (teaching and research hospitals). Nowadays, many neurology departments have been constructed in community hospitals (Ministry of Health hospitals). Despite giving more care for stroke patients the present situation adds difficulty to the research issue, due to the distribution of stroke patients - in one locality like Sohag - among many hospitals only one of them (the university hospital) considers research as a priority and restricts the initial evaluation of stroke patients to neurologists. Therefore, to expand the research field outside the university hospitals a simple, quickly applied, and double targeted (the items of which is either valuable as regard clinical decision making and research) stroke scale is needed. When considering the GCS we will find the following advantages; it is one of the broadly utilized and generally accepted tools of monitoring neurologic status, is easily applied by both medical and paramedical staffs, and is valid and reproducible in different clinical settings.⁴

However GCS does not apply in particular to acute stroke, due to the following reasons; the GCS was designed as a standardized tool for the periodic evaluation of head injury patients, the stress in this scale is on neurological deficits not repeatedly found in acute stroke patients (failure of eye opening, decerebration, decortication), important issues such as aphasia and gradation of motor deficits are not incorporated.³

The National Institutes of Health Stroke Scale (NIHSS), is a valuable method for preliminary assessments of patients with stroke in emergency departments, hospitals, or in the prehospital setting, and is predictive of ensuing resource use and long-term outcome.¹³⁻¹⁵ We did not include NIHSS in our study due to the following reasons; a previous study revealed that the reliability of the individual NIHSS items was better at teaching hospitals than in the community hospitals.¹⁶ Assessments of dysarthria, visual fields, and neglect/extinction are usually missing items from patients' records when using NIHSS. Also, items that may not affect clinical

decision making at admission such as hemianopia and extinction may not be documented. Furthermore, when the examination was documented by a non-neurologist in the community hospital, the raters disagreed more frequently on which items were missing.¹⁶

The inclusion of CSS in our study was due to the following reasons; The CSS adheres to a few simple criteria which include: detection of clinically noteworthy differences in neurologic status; testing of relevant modalities most commonly affected in acute stroke and having possible prognostic value; ease of use and interpretation by observers with different medical training, and brevity and practicality of its use in the acute stroke period. Accordingly, the CSS may be used to evaluate the neurologic status of acute stroke patients without major concern about interobserver variation.³

The use of the CSS may result in a more reliable assessment of stroke severity than the NIHSS for retrospective outcome studies that include community hospitals without acute neurologic consultative services.¹⁶ The advantages of the CSS assessment are that it can be performed in less than 5 minutes, and it assesses language and facial and proximal- and distal-limb motor strength.¹⁷ In a previous study the authors reported that, when choosing which stroke scale to apply in acute care, the committee elicited feedback from staff nurses, the greater part of whom considered the CSS assessment faster and easier to apply than the NIHSS.¹⁷

We selected SSS to be compared with CSS as they have been used in many trials and share some features with the NIHSS¹⁸, moreover SSS considers qualitative as well as quantitative aspects of limb movements¹⁹, and it can be interconverted with the NIHSS in both directions using mathematic equations with acceptable fit and accuracy allowing data from different observational studies and randomized trials to be integrated.¹⁸

We found almost perfect levels of agreement for total CSS and SSS scores when both scales were assigned prospectively to patients with ischemic stroke. The total initial CSS and SSS scores were found to be a significant predictor of death, morbidity, and recovery after ischemic stroke. Patients with high initial CSS and SSS scores were at lower risk of poor

outcomes at 3 months. The total score of >7 on CSS and of >38 on SSS strongly predicts the good outcome at 3 months. Sensitivity, specificity, and positive and negative predictive values of CSS and SSS for good outcome are nearly the same.

Conclusion

According to the present study, the CSS and SSS can be used to evaluate the neurologic status of acute stroke patients. Changes in the scores obtained for a particular patient are more likely to reflect changes in clinical status. No difference could be detected between the two scales.

Our study has several limitations. First, most patients had only mild to moderate strokes, reliability may differ in settings with patients with a wider range of deficits. Second, the scales were not applied by single observer. However, the purpose of this study was to assess the comparative reliability of the CSS and the SSS and not to revalidate the scales. Third, the study was done in Sohag University hospital and the observers were neurologists. However, the present study could be considered as a preliminary step to catch out the best scale for further generalization on community hospitals and non-neurologists.

[Disclosure: Authors report no conflict of interest]

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المخلص العربي

استخدام مقياس السكتة الدماغية الكندي والاسكندنافي للتنبؤ بالنتائج على المدى القصير في مرضى السكتة الدماغية الإقفارية في سوهاج بصعيد مصر. هل هناك فرق؟

بين مقياس السكتة الدماغية اعتبرنا مقياس السكتة الدماغية الكندي ومقياس السكتة الدماغية الاسكندنافي انهم الأنسب والأكثر بساطة ليتم تطبيقها على المرضى لمزيد من التعميم على المستشفيات المحلية الأخرى. ويهدف هذا البحث الى تحديد أي المقياسين لديه الافضلية التنبؤية بالنتائج في مرضى السكتة الدماغية الإقفارية. وقد أجريت هذه الدراسة على 162 مريض من مرضى السكتة الدماغية الإقفارية (60 من الذكور و 102 من الإناث). وقد خضع المرضى للآتي: وصف تفصيلي للتاريخ المرضي والفحص الإكلينيكي للجهاز العصبي, التحاليل المعملية الدورية, أشعة مقطعية على المخ, المقياس الكندي الإسكندنافي لشدة السكتة الدماغية, مقياس (رانكن) لقياس درجة الإعاقة بعد ثلاثة اشهر من تاريخ حدوث السكتة الدماغية. وقد أوضحت نتائج البحث ما يلي: تنبأ كلا المقياسيين نتائج السكتة الدماغية بعد 3 أشهر بدقة 0.78 أو أكثر و لم يوجد اى اختلاف بينهما. كما بينت الدراسة مستوى قطع التشخيص الأمثل ليكون < 7 لمقياس السكتة الدماغية الكندي ، و حساسية 72.5%، والقيمة التنبؤية السلبية 74.4%، و 78.0%، والقيمة التنبؤية الإيجابية 76.3%. بالنسبة لمقياس السكتة الدماغية الاسكندنافي وجد مستوى قطع التشخيص الأمثل ليكون < 38، و حساسية 77.5%، والقيمة التنبؤية السلبية 76.3%، والخصوصية 70.7%، والقيمة التنبؤية الإيجابية 72.1%.