



Research Article

Identification of Bedside Clinical Scoring Systems in Classifying Stroke

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Abstract

Background: Stroke is one of the leading cause of premature death globally. Early identification of ischaemic stroke is crucial. Neuro-Imaging techniques have been indispensable to distinguish between these Ischaemic and haemorrhagic stroke but infrequently available in rural areas. To overcome these difficulties and to enhance clinical bedside diagnosis, clinical scores have been developed. The most commonly used ones include Besson score (BS), Greek score (GS) and Siriraj score (SS). We aimed to identify the best among these scores

Methods: A cross sectional study was conducted on patients with stroke admitted in KLES Dr Prabhakar Kore Hospital and Medical Research Centre, Belagavi from Jan 2016 to Dec 2016. The diagnosis of stroke was entertained after fulfilling WHO definition of stroke by the patient. They were then scored according to the scoring systems and validity tests of these scores were obtained by comparing it with neuroimaging.

Results: 61 patients (42 patients (68.85%) ischemic stroke and 19 patients (31.15%) hemorrhagic stroke) were included in our study. For hemorrhagic stroke GS had the highest specificity (97.62%) while SS had the highest sensitivity (78.95%). For ischemic stroke BS had the highest specificity (94.74%) while SS had the highest sensitivity (80.95%). SS was better tool in identifying stroke type in our study [AUC (0.902)].

Conclusion: We found SS was a better scoring system for both types of strokes although all have certain limitations. Hence we feel neuroimaging is the still the best in differentiating the type of stroke.

Keywords: Besson score, Greek score, Siriraj score, stroke.

Introduction

A stroke, or cerebrovascular accident, is defined as abrupt onset of a neurologic deficit of vascular origin. World Health Organization defines the clinical syndrome of “stroke” as, “rapidly developing clinical signs of focal (or global) disturbance of cerebral function with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than vascular origin”.¹

Stroke is the third leading cause of premature death globally and is associated with up to 5.54 million deaths every year, two thirds of which occur in resource poor countries.² According to the India stroke factsheet updated in 2012, the estimated age-adjusted prevalence rate for stroke ranges between 84/100,000 and 262/100,000 in rural and between 334/100,000 and 424/100,000 in urban areas.³

Thus, cerebrovascular disease is a huge public health problem imposing both as a large disease burden and a large economic burden on our country.⁴ Incidence of stroke varies considerably from country to country. Stroke is an illness of escalating socioeconomic importance, especially among the ageing population.

The poor are increasingly affected by stroke, because of both the changing population exposures to risk factors and not being able to bear the expense for stroke care. Majority of stroke survivors continue to live with disabilities, and the costs of ongoing rehabilitation and long term-care are largely undertaken by family members, which impoverish their families.^{6,7}

Stroke is divided into two main subtype's ischemic or hemorrhagic stroke. Most strokes (87%) are ischemic strokes. Accordingly, stroke is also an important cause of morbidity and long term disability, up to 40% of survivors are not expected to recover their independence and self-care.⁸

Early identification of ischemic stroke is crucial as it leads to earlier antiplatelet initiation with aspirin. Imaging techniques such as computerized tomography (CT) scan and magnetic resonance imaging (MRI) have been valuable in this regard to distinguish between these subtypes. Quite unfortunately, in developing countries like ours, where a large group of the population is below poverty line and dwelling in rural areas, do not have access to these facilities, and even if accessible most of them find it unaffordable.

To overcome these difficulties and to enhance clinical bedside diagnosis, clinical stroke scores have been developed. The most commonly used ones include the Guy's hospital score (GHSS),⁹ the Besson score (BS),¹⁰ the Greek stroke score (GSS)¹¹ and the Siriraj stroke score (SSS).¹²

These scores can be potentially used identify the stroke subtypes. While these scores are not more accurate than neuro-imaging, they are simple, cheap and practical. However, their validity in the diagnosis of stroke in resource poor settings remains debatable.

This impelled us to identify clinical scoring systems in distinguishing between hemorrhagic and ischemic stroke.

Methods

The present study was conducted in a tertiary care hospital at Belagavi. It was a hospital based cross-sectional study for a period of one year from January 2016 to December 2016. A total of 61 patients with stroke (ischemic and hemorrhagic) were studied.

Selection criteria

Inclusion Criteria

- All patients of stroke >18yrs of age admitted in the department of medicine with the diagnosis of stroke (according to WHO criteria as "Rapidly developing signs of focal (or global) disturbance of cerebral function, leading to death or lasting longer than 24 hours , with no apparent cause other than vascular")
- Neuroimaging showing intracerebral hemorrhage or cerebral infarction

Exclusion Criteria

- Patients with stroke due to other causes such as space occupying lesions, trauma
- Patients receiving anticoagulant therapy
- Patients with SAH (traumatic)

The patients who fulfilled the selection criteria were informed about the nature of study and a written informed consent was obtained. In case of comatose patients, the relatives / caretakers were informed about the study. The patients/caregivers expressing their willingness to participate in the study were enrolled after obtaining a written informed consent.

Data collection

The selected patients' demographic data such as age and sex were recorded. History of other comorbid conditions such as, hypertension, diabetes mellitus, previous stroke, personal history such as habits of alcohol consumption, smoking, were noted. A thorough physical examination was conducted for vitals (pulse rate, blood pressure and respiratory rate) followed by systemic

examination. The diagnosis of stroke was entertained after fulfilling WHO definition of stroke by the patient. These findings were noted on a predesigned and pretested proforma.

Venous blood samples (10 mL) were collected immediately on admission from the selected patients and were subjected following investigations.

- Hemogram (CBC)
- X-ray chest
- 12 lead ECG
- CT/MRI

Calculation of various stroke scores

The stroke scores were calculated from this data. The scoring systems are adapted from existing literature and are detailed in Table 1, 2 and 3. The inferences of the scoring systems were “ischemic stroke,” “hemorrhagic stroke,” or uncertain, except in the BS where the inferences were “ischemic stroke” and “non-ischemic stroke.”

Results

Data comprised of 61 Stroke patients which had 42 ischemic and 19 hemorrhagic stroke patients.

The youngest patient was 33 years old and the oldest was 82 years. The mean age of stroke was 59.15. There were 45 (74%) were males and 16 (26%) were females. Table 4 shows the calculated sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) for the diagnosis of Ischemic stroke. GS and SS were taken into consideration to calculate the same for hemorrhagic stroke. It was noticed that when it came to ischemic stroke the highest sensitivity was for SS (80.95%) and highest specificity was for BS (94.74%). For hemorrhagic stroke the highest sensitivity was for SS (78.95%) and highest specificity for GS (97.62%)

We attempted the plot the ROC curve for all the 3 data sets using neuroimaging as the criteria value. Area under the curve (AUC) was estimated for each GS, SS and BS which revealed highest AUC for SS- 0.902 followed by BS- 0.822 and last GS- 0.813

Table 1: Greek score¹¹

Parameter	score
Neurological deterioration within three hours of admission	6
Vomiting	4
Total leucocyte >12000	4
Decreased level of consciousness at admission	3
TOTAL	17

<=3 ischemic stroke, >3 → <11 equivocal/uncertain, ≥11 hemorrhagic stroke

Table 2: Siriraj score¹²

Parameter	Score	
level of consciousness (x2)	alert	0
	drowsy/stupor	1
	coma	2
vomiting (x2.5)	no	0
	yes	1
headache (x2.5)	no	0
	yes	1
atheroma markers (diabetes mellitus, angina, intermittent claudication) (x-3)	none	0
	one or more	1
diastolic BP (x0.1)	mmhg	
constant		-12

<-1= ischemic stroke, >1= hemorrhagic stroke, -1 → 1 = equivocal/ uncertain

Table 3: Bessons score:¹⁰

PARAMETER	SCORE	
	Alcohol consumption	Absent
	Present	2
Plantar response (x1.5)	Bilateral flexor	0
	Extensor ipsilateral to deficit	1
	Extensor contralateral to deficit	2
	Both extensors	3
Headache	Absent	0
	Present	3
History of transient neurological deficit	Absent	0
	Present	-5
Hyperlipidemia	Absent	0
	Present	-1.5
Atrial fibrillation at admission	Absent	0
	present	-2.5

<1 = ischemic stroke

Table 4: Comparison of SS, GS, and BS against Neuro-imaging of brain for the diagnosis of ischemic stroke

Diagnosis	Neuro-imaging diagnosis		Sensitivity	Specificity	PPV	NPV
	IS	Not IS				
GS						
IS	26	3	61.9	84.21	89.66	50.00
Not IS	16	16				
SS						
IS	34	2	80.95	89.47%	94.44%	68.00%
Not IS	8	17				
BS						
IS	19	1	45.24%	94.74%	95.00%	43.90%
Not IS	23	18				

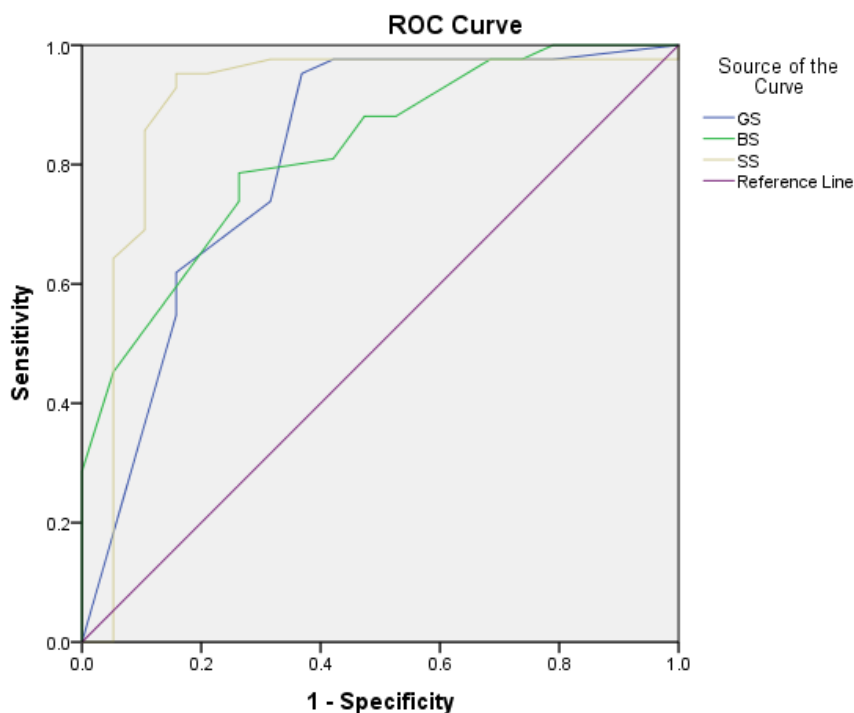
IS=ischemic stroke, SS=Siriraj score, GS=Greek score, BS=Besson score, PPV= Positive predictive value, NPV= negative predictive value

Table 5: Comparison of SS and GS against Neuro-imaging of brain for the diagnosis of hemorrhagic stroke

Diagnosis	Neuro-imaging diagnosis		Sensitivity	Specificity	PPV	NPV
	HS	Not HS				
GS						
HS	10	1	52.63%	97.62%	90.91%	82.00%
Not HS	9	41				
SS						
HS	15	2	78.95%	95.24%	88.24%	90.91%
Not HS	4	40				

HS= Haemorrhage Stroke, SS=Siriraj score, GS=Greek score, PPV= Positive predictive value, NPV= negative predictive value

Figure 1: Receiver operating characteristic (ROC) curve of Greek score (GS), Siriraj score (SS) and Besson score (BS)



Area Under the Curve

Test Result Variable(s)	Area
GS	.813
BS	.822
SS	.902

Discussion

Early management of stroke depends on the identification of hemorrhagic vs ischemic stroke. This is where clinical scoring system can help especially in rural areas where the availability of CT/MRI is sparse. Early identification of ischemic stroke may help in early treatment initiation with aspirin. Studies have been done in the past where these scoring systems were compared with each other as well as the gold standard i.e. neuroimaging. Soman et al compared SS and GS and found to have similar sensitivity and specificity.¹³

We noted in our study the specificity of GS and SS in diagnosing Hemorrhagic stroke were excellent. While they lacked considerable sensitivity. The specificities to diagnose ischemic

stroke by BS was high and while SS had a satisfactory specificity.

To our knowledge only one study has been done in the past in India by Goswami et al to utilize BS to discriminate ischemic stroke from non-ischemic stroke.¹⁴ BS was in fact developed for this purpose.¹⁰ similar to the study by Goswami et al we too observed a high specificity (94.74%) for BS with a PPV of 95%.

On comparing all the scores via ROC curve. We noticed that SS was in fact superior to the other two as an early screening tool evidenced by the highest AUC for SS in the ROC curve. This is in contrast to the study done by Goswami et al who suggested the superiority of GS in comparison to SS and BS.¹⁴

The utility of these scores should be used as a “rule out” rather than “rule in” measure for stroke evaluation has been suggested.¹⁵ A score that could exclude hemorrhagic stroke with a considerable degree of certainty could enable physicians to initiate aspirin in rural areas.

Conclusion

The scores have high specificity and moderate sensitivity in identifying stroke subtype. SS is the single best score. Although these scoring systems help in differentiating ischemic and hemorrhagic stroke on arrival of patients to the casualty, all have certain limitations. Hence we feel neuro-imaging is still the best in differentiating the type of stroke.

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Declarations

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