Original Research Article

Assessment of Effectiveness of the Recognition of Stroke in The Emergency Room Scale in Emergency Department of Suez Canal University Hospital

Abstract

Background: The ROSIER scale, which was developed in a United Kingdom population, has been designed to provide physicians in the emergency department with a framework which can be used to assess patients with suspected stroke, to facilitate early identification of acute stroke & appropriate referral. In the present study we aim to assess the sensitivity and specificity of the ROSIER score in order to improve outcome of stoke patients presenting to the emergency department in Suez Canal university hospital. **Methods:** The current study was designed as a prospective cross sectional study that included Patients over 18 years of age with suspected stroke presenting at emergency department in Suez Canal university hospital. **Results:** The present study was designed as an observational prospective cross sectional study that included 92 patients over 18 years of age with suspected stroke presentation attending to the Emergency Department (ED) of the Suez Canal University Hospital. Patients with stroke formed about 65.2% of the patients with suspected stroke in the ER. Patients with stroke/ TIA were found to have significantly higher age compared to other patients (63.58 ±12.55 vs 39.18±11.12) ($p<0.001$). The most frequent comorbid diseases among patients were hypertension and diabetes mellitus. For ROSIER accuracy, a value of 1.00 or more was found to be the best cut-off point for prediction of stoke among patients attending with suspected stroke, with sensitivity = 98.3% and specificity = 87.5 % and accuracy= 94.5%. **Conclusion:** The ROSIER scale is simple, rapid, effective and sensitive screening tool in early detection of patients presenting with stroke and differentiating stroke from stroke mimics in the emergency room.

Key words: ROSIER scale - Stroke – Emergency Department.

Introduction:

A stroke is a sudden interruption in the blood supply of the brain. Most strokes are caused by an abrupt blockage of arteries leading to the brain (ischemic stroke). Other strokes are caused by bleeding into brain tissue when a blood vessel bursts (hemorrhagic stroke). Because stroke occurs rapidly and requires immediate treatment, stroke is also called a brain attack. When the symptoms of a stroke last only a short time (less than an hour), this is called a transient ischemic attack (TIA) or mini stroke.[(1)]

There is currently no active national registry for stroke in Egypt and only limited community-based data exist on stroke incidence and prevalence. Khedr *et al.* recently reported a rather high prevalence of stroke in Assiut, one of the southern governorates of Egypt with a population of about 3.5 million inhabitants (crude prevalence of 9.63/1000 population; age-adjusted prevalence 6.99/1000).[(2)] Stroke was far more prevalent in men and among illiterates, who constitute a substantial proportion of the population. El Tallawy *et al.* reported that incidence of stroke in the desert governorate of the New Valley is 2.5/1000 with a prevalence of 5.6/1000 (data collected in 2007).[(3)]

The prevalence of stroke and its cost will undoubtedly rise as the aging population increases. In addition, stroke incidence and mortality are increasing in less developed countries in which the lifestyles and population restructuring are rapidly changing. More population-based research to assess incidence, risk factors, and outcomes are needed in these countries.[(4)]

It is the third most common cause of disability and reduces mobility in more than half of stroke survivors in ages 65 and over. Furthermore, the economic burden of stroke on the nation through health care services, medications, rehabilitation and loss of productivity is around $33 billion annually.[(5)]

In patients with acute stroke, rapid intervention is crucial to maximize early treatment benefits. Stroke patients commonly have their first contact with medical staff in the emergency room (ER).[(6)]

The benefits of emergency medical services (EMS) activation by patients with stroke symptoms appear to occur in both the prehospital and in hospital settings. For faster access to acute stroke management, stroke

patients need to be accurately identified in the emergency department (ED), and ideally prior to ED arrival.[7]

Stroke scales exist principally as a result of clinical trials, and their existence reflects the heterogeneity of stroke patients and attendant difficulties in reliably assessing outcome with respect to disability or neurological deficit. Scales seek to quantify different aspects of function within the framework of the World Health.[8]

Although the purpose of many of these scales has not been explicit, their primary uses have been (1) to compare the baseline stroke severity of patient groups and (2) to quantify neurological recovery over time. In effect, impairment scales have often been used to predict outcome despite not having been designed for this purpose. Baseline measurements on the CNS predict functional outcome 6 months after stroke. Acute scores on the NIH Stroke Scale/Score (NIHSS) correlate with both CT infarct volumes at 7 to 10 days after stroke and functional outcome at 3 months. Stroke assessment scales should not, however, be used as a measure of functional outcome itself, since impairment scales only partly explain functional health.[9]

The ROSIER scale, which was developed in a UK population, has been designed to provide physicians in the emergency department with a framework which can be used to assess patients with suspected stroke, to facilitate early identification of acute stroke and appropriate referral.[10]

The ROSIER is a 7-item stroke tool that incorporates the FAST elements (facial weakness, arm weakness, and speech disturbance) plus leg weakness and visual field deficit.These symptoms are indicative of a stroke and, if present, each receives a score of 1. The ROSIER also includes assessment of loss of consciousness or syncope and seizure activity both of which reduce the likelihood of a stroke and, if present, receive a score of -1. A ROSIER score, the total of all 7 items, of ≥ 1 suggests a stroke or transient ischemic attack (TIA), whereas a ROSIER score of ≤ 0 indicates nonstroke.[11]

We aim to assess the sensitivity and specificity of the ROSIER score in order to improve outcome of stoke patients presenting to the emergency department in Suez Canal university hospital.

Patients and Methods

This was a prospective cross sectional study. The study was carried out at emergency department at Suez Canal Universityhospital, Ismailia.

Study population

Patients over 18 years of age with suspected stroke presenting at emergencydepartment in Suez Canal university hospital.

Inclusion criteria:

1- Patients 18 years or older.
2- Patients presenting to the ED with symptoms or signs suggestive of strokeor TIA.

The signs of a stroke [12] are:

- Sudden numbness or weakness of the face, arm or leg, especially on one side of the body
- Sudden confusion
- Sudden trouble speaking
- Sudden trouble seeing in one or both eyes
- Sudden trouble walking
- Sudden dizziness, loss of balance or coordination
- Sudden, severe headache with no known cause

Exclusion criteria:

1- Patients with traumatic brain injury with an external cause such as motor vehicle crashes and falls.
2- Patients with incomplete medical records
3- Patients that did not present first to the ED

Sampling method

Consecutive sampling, all patients that presented with stroke symptoms to the emergency department of Suez Canal University hospital and fulfilled the inclusion criteria were selected among the sample during a 6-months period (From June 2021 till November 2021)

Sample size:

The sample size was calculated using the following formula.

[13]

$$n = \left[\frac{Z_{\alpha/2}}{E}\right]^2 * \frac{S_n(1 - S_n)}{(P)}$$

Where:

n = sample size

$Z\alpha/2$ = 1.96 (The critical value that divides the central 95% of the Zdistribution from the 5% in the tail)

P = Prevalence/proportion of disease = 52% [13]

Sn = Sensitivity = 87% [13]

E = Margin of error/width of confidence interval = 10%

So, by calculation, the sample size is **equal to 92** cases after the addition of10% drop-out proportion.

Methods

1- Patients was initially assessed at the emergency room of the emergency department of Suez Canal university hospitals.
2- Patients or their relatives signed an informed consent form that will includethe purpose and the type of the study.
3- The researcher assessed the patients directly to collect data.
4- Data were collected through a data collection sheet that includes socio demographic data, medical history.
5- The Recognition of Stroke in The Emergency Room (ROSIER) Scale (appendix 1) was assessed for each patient.

The ROSIER is a 7-item stroke tool that incorporates the FAST elements (facial weakness, arm weakness, and speech disturbance) plus leg weakness and visual field deficit. These symptoms are indicative of a stroke and, if present, each receives a score of 1. The ROSIER also includes assessment of loss of consciousness or syncope and seizure activity both of which reduce the likelihood of a stroke and, if present, receive a score of -1. A ROSIER score, the total of all 7 items, of ≥1 suggests a stroke or transient ischemic attack (TIA), whereas a ROSIER score of ≤0 indicates nonstroke [11]

6- The patients were followed up till a confirmed diagnosis is reached by:

   a. National institutes of health stroke scale (appendix 1) : The National Institutes of Health Stroke Scale, or NIH Stroke Scale (NIHSS) is a tool

used by healthcare providers to objectively quantify the impairment caused by a stroke. The NIHSS is composed of 11 items, each of which scores a specific ability between a 0 and 4. For each item, a score of 0 typically indicates normal function in that specific ability, while a higher score is indicative of some level of impairment. The individual scores from each item are summed in order to calculate a patient's total NIHSS score. The maximum possible score is 42, with the minimum score being a 0 **(15)**

chart 1 : 7-item stroke tool that incorporates the FAST elements

1a. Level of Consciousness: The investigator must choose a response if a full evaluation is preventedby such obstacles as an endotracheal tube, language barrier, orotracheal trauma/bandages. A 3 is scored only if the patient makes no movement (other than reflexive posturing) in response to noxious stimulation.	0 = **Alert;** keenly responsive. 1 = **Not alert**; but arousable by minorstimulation to obey, answer, or respond. 2 = **Not alert**; requires repeatedstimulation to attend, or is obtunded and requires strong or painfulstimulation to make movements (not stereotyped). 3 = Responds only with reflex motor orautonomic effects or totally unresponsive, flaccid, andareflexic.
1b. LOC Questions: The patient isasked the month and his/her age. The answer must be correct - there is nopartial credit for being close. Aphasic and stuporous patients who donot comprehend the questions will score 2. Patients unable to speakbecause of endotracheal intubation, orotracheal trauma, severedysarthria from any cause, language barrier, or any other problemnot secondary to aphasia are given a 1. It is important that only theinitial answer be graded and that the examiner not "help" the patient withverbal or non-verbal cues.	0 = **Answers** both questions correctly.1 = **Answers** one question correctly. 2 = **Answers** neither question correctly.

1c. LOC Commands: The patient isasked to open and close the eyes and then to grip and release the non-paretic hand. Substitute another one step command if the handscannot be used. Credit is given if an unequivocal attempt is madebut not completed due to weakness. If the patient does not respondto command, the task should be demonstrated to him or her (pantomime), and the result scored (i.e., follows none, one or two commands). Patients with	0 = **Performs** both tasks correctly.1 = **Performs** one task correctly. 2 = **Performs** neither task correctly.
trauma, amputation, or other physical impediments should be given suitable one-step commands. Only the first attempt is scored.	
2. Best Gaze: Only horizontal eyemovements will be tested. Voluntary or reflexive (oculocephalic)eye movements will be scored, but caloric testing is not done. If thepatient has a conjugate deviation of the eyes that can be overcome by voluntary or reflexive activity, the score will be 1. If a patienthas an isolated peripheral nerve paresis (CN III, IV or VI), score a 1. Gaze is testable in all aphasic patients. Patients with ocular trauma, bandages, pre-existing blindness, or other disorder of visualacuity or fields should be tested with reflexive movements, and a choicemade by the investigator. Establishing eye contact and then movingabout the patient from side to side will occasionally clarify the presence of a partial gaze palsy.	0 = **Normal.** 1 = **Partial gaze palsy;** gaze is abnormal in one or both eyes, but forced deviation or total gaze paresis is not present. 2 = **Forced deviation,** or total gaze paresis not overcome by the oculocephalic maneuver.

3. Visual: Visual fields (upper and lowerquadrants) are tested by confrontation, using finger counting orvisual threat, as appropriate. Patients may be encouraged, but if theylook at the side of the moving fingers appropriately, this can bescored as normal. If there is unilateral blindness or enucleation, visualfields in the remaining eye are scored. Score 1 only if a clear-cutasymmetry, including quadrantanopia, is found. If patient is blind from any cause, score 3. Double simultaneous stimulation is performed at this point. If there is extinction, patient receives a 1, and theresults are used to respond to item 11.	0 = **No visual loss.** 1 = **Partial hemianopia.** 2 = **Complete hemianopia.** 3 = **Bilateral hemianopia** (blind including cortical blindness).
4. Facial Palsy: Ask – or use pantomime to encourage – the patient to show teeth or raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli inthe poorly responsive or non-comprehending patient. If facial trauma/bandages, orotracheal tube, tape or other physical barriersobscure the face, these should be removed to the extent possible.	0 = **Normal** symmetrical movements. 1 = **Minor paralysis** (flattened nasolabial fold, asymmetry on smiling). 2 = **Partial paralysis** (total or near-total paralysis of lower face). 3 = **Complete paralysis** of one or bothsides (absence of facial movement in the upper and lower face).
5. Motor Arm: The limb is placed in the appropriate position: extend the arms (palms down) 90 degrees (ifsitting) or 45 degrees (if supine). Drift is scored if the arm fallsbefore 10 seconds. The aphasic patient is encouraged usingurgency in the voice and pantomime, but not noxious stimulation.Each limb is tested in turn, beginning with the non-paretic arm. Onlyin the case of amputation or joint fusion at the shoulder, the examinershould record the score as untestable (UN), and clearly write the explanation for this choice.	0 = **No drift;** limb holds 90 (or 45)degrees for full 10 seconds. 1 = **Drift;** limb holds 90 (or 45) degrees,but drifts down before full 10 seconds; does not hit bed or other support. 2 = **Some effort against gravity;** limbcannot get to or maintain (if cued) 90 (or 45) degrees,drifts down to bed, but has some effort against gravity. 3 = **No effort against gravity;** limb falls.4 = **No movement.** UN = **Amputation** or joint fusion, explain:_____ **5a. Left Arm** **5b. Right Arm**

6. Motor Leg: The limb is placed in the appropriate position: hold the leg at 30 degrees (always testedsupine). Drift is scored if the leg falls before 5 seconds. The aphasicpatient is encouraged using urgency in the voice and pantomime, butnot noxious stimulation. Each limb is tested in turn, beginningwith the non-paretic leg. Only in the case of amputation or joint fusionat the hip, the examiner should record the score as untestable(UN), and clearly write the explanation for this choice.	0 = **No drift;** leg holds 30-degree positionfor full 5 seconds. 1 = **Drift;** leg falls by the end of the 5-second period but does not hit bed. 2 = **Some effort against gravity;** leg fallsto bed by 5 seconds, but has some effort againstgravity. 3 = **No effort against gravity;** leg falls tobed immediately. 4 = **No movement.** UN = **Amputation** or joint fusion, explain: _____ **6a. Left Leg 6b. Right Leg**
7. Limb Ataxia: This item is aimed at finding evidence of a unilateral cerebellar lesion. Test with eyes open. Incase of visual defect, ensure testing is done in intact visualfield. The finger-nose-finger and heel-shin tests are performed on both sides, and ataxia is scored only if present out of proportion to weakness. Ataxia is absent in the patient who cannot understand or is paralyzed. Only in the case of amputation or joint fusion, the examinershould record the score as untestable (UN), and clearly write the explanation for this choice. In case of blindness, test by having the patient touch nose from extended arm position.	0 = **Absent.** 1 = **Present in one limb.** 2 = **Present in two limbs.** UN = **Amputation** or joint fusion, explain: _____

8. Sensory: Sensation or grimace to pinprick when tested, or withdrawal from noxious stimulus in the obtunded or aphasic patient. Only sensory loss attributed to stroke is scored as abnormal and the examiner should test as many body areas (arms [not hands], legs, trunk, face) as needed to accurately check for hemisensory loss. A score of 2, "severe or total sensory loss," should only be given when a severe or total loss of sensation can be clearly demonstrated. Stuporous and aphasic patients will, therefore, probably score 1 or 0. The patient with brainstem stroke who has bilateral loss of sensation is scored 2. If the patient does not respond and is quadriplegic, score 2. Patients in a coma (item 1a=3) are automatically given a 2 on this item.	0 = **Normal;** no sensory loss. 1 = **Mild-to-moderate sensory loss;** patient feels pinprick is less sharp or is dull on the affected side; or there is a loss of superficial pain with pinprick, but patient is aware of being touched. 2 = **Severe to total sensory loss;** patient is not aware of being touched in the face, arm, and leg.
9. Best Language: A great deal of information about comprehension will be obtained during the preceding sections of the examination. For this scale item, the patient is asked to describe what is happening in the attached picture, to name the items on the attached naming sheet and to read from the attached list of sentences. Comprehension is judged from responses here, as well as to all of the commands in the preceding general	0 = **No aphasia;** normal. 1 = **Mild-to-moderate aphasia;** some obvious loss of fluency or facility of comprehension, without significant limitation on ideas expressed or form of expression. Reduction of speech and/or comprehension, however, makes conversation about provided materials difficult or impossible. For example, in conversation about

neurological exam. If visual loss interferes with the tests, ask thepatient to identify objects placed in the hand, repeat, and produce speech. The intubated patient should be asked to write. The patient in acoma (item 1a=3) will automatically score 3 on this item. The examiner must choose a score for the patient with stupor orlimited cooperation, but a score of 3 should be used only if the patient ismute and follows no one-step commands.	provided materials, examiner can identify picture or naming card content from patient's response. 2 = **Severe aphasia;** all communication is through fragmentary expression; great need for inference, questioning, and guessing by the listener. Range of information thatcan be exchanged is limited; listener carries burden of communication. Examiner cannot identify materials provided from patient response. 3 = **Mute, global aphasia;** no usable speech or auditory comprehension.
10. Dysarthria: If patient is thought to be normal, an adequate sample of speech must be obtained byasking patient to read or repeat words from the attached list. If thepatient has severe aphasia, the clarity of articulation of spontaneous speech can be rated. Only if the patient is intubated orhas other physical barriers to producing speech, the examiner shouldrecord the score as untestable (UN), and clearly write an explanation for this choice. Do not tell the patient why he or she is beingtested.	0 = **Normal.** 1 = **Mild-to-moderate dysarthria;** patient slurs at least some words and, at worst, can be understoodwith some difficulty. 2 = **Severe dysarthria;** patient's speech isso slurred as to be unintelligible in the absence of or out of proportion to any dysphasia, or is mute/anarthric. UN = **Intubated** or other physical barrier, explain:_____
11. Extinction and Inattention (formerly Neglect): Sufficient information to identify neglect may beobtained during the prior testing. If the patient has a severevisual loss preventing visual double simultaneous stimulation, andthe cutaneous stimuli are normal, the score is normal. If thepatient has aphasia but does appear to attend to both sides, thescore is normal. The presence of visual spatial neglect or anosagnosiamay also be taken as evidence of abnormality. Since the abnormality	0 = No abnormality. 1 = Visual, tactile, auditory, spatial, or personal inattention or extinction to bilateral simultaneous stimulation in one of the sensory modalities. 2 = Profound hemi-inattention or extinction to more than one modality; does not recognize ownhand or orients to only one side of space.

is scored only if present, the item is never untestable.	

b. Noncontrast brain CT or brain MRI

c. Blood glucose

d. Serum electrolytes and renal function tests

e. Electrocardiograph

f. Markers of cardiac ischemia

g. Complete blood count, including platelet count

h. Prothrombin time/international normalized ratio

i. Activated partial thromboplastin time*

j. Oxygen saturation

7- CT brain was done to confirm findings of acute stroke. (hypodense lesions).CT imaging was reviewed by the neurology team at Suez Canal university hospitals (at 0 hour and 48 hours later).

8- Statistical analysis was done to evaluate the effectiveness of ROSIER scorein diagnosis of acute stroke.

Diagnosis of TIA

-History Taking: Clinical presentation and duration of neurological symptoms
-CT imaging: No definitive findings.

- Severity assessment using $ABCD^2$.[16]

The ABCD2 score is based on five parameters: age, blood pressure, presenting neurological features, duration of neurological symptoms, and presence of diabetes mellitus. Each item is scored and the results are added to a result ranging between 0 and 7.

- Score ≤3 is associated with approximately 1% risk of stroke recurrence within2 to 7 days.
- Score 4-5 is associated with 4% risk of stroke recurrence at 2 days, and 6%at 7 days
- Score >5 is associated with 8% risk of stroke recurrence at 2 days, and 12%at 7 days

Chart 2 : Clinical presentation and duration of neurological symptoms

POINTS	AGE (YEARS)	BLOOD PRESSURE SBP ≥140 or DBP ≥90	CLINICAL FEATURES	DURATION OF SYMPTOMS (MINUTES)	DIABETES MELLITUS
0	<60	No	Other than stated below	<10	No
1	≥60	Yes	Speech disturbance	10 to 59	Yes
2			Unilateral weakness ± speech disturbance	≥60	

Data analysis: It involved data {entry, data visualization, data manipulation and statistical analysis}. The Statistical Package for Social Science (SPSS) software was utilized for data capture and statistical analysis. Mean and standard deviation was estimated for each continuous variable. Student t-test and chi-square test was used to assess the statistical difference between variables, each test according to the type of variable. Study results were described in tables and graphs.

Ethics consideration:

An informed consent was obtained from all patients or relatives of participantsbefore taking any data.

The consent contained:

1. Explanation of the study aim in a simple and clear manner to be understood by the common people.
2. Patients or relatives were informed about the techniques and its possible side effects.
3. No harmful maneuvers were performed or used. There are no foreseen hazards to be anticipated from conducting the study on these patients.
4. All data was considered confidential and was not used outside this study without patient or relatives' approval.
5. Researcher phone number and all possible communicating methods were identified to the patients or relatives to return at any time for any explanation.
6. All patients or relatives were announced by the result of the study.
7. All patients or relatives have the right to refuse participation or to withdraw from the study at any time without giving any reason and with neither jeopardized the right of the patient to be treated nor affecting the relationship between the patient and the care provider.
8. Signature or fingerprints of the patients or relatives.

Results:

Table 1 shows the baseline characteristics of the studied patients. Patients with stroke formed about 60 of 92 of the patients with suspected stroke in the ER (65.2%). Patients with stroke/ TIA were found to have significantly higher agecompared to other patients (63.58 ±12.55 vs 39.18 ±11.12) ($p<0.001$). The most frequent comorbid diseases among patients, according to their medical history, were hypertension and diabetes mellitus.
Table 2 shows the clinical characteristics of the studied patients. The most frequent presentations among stroke patients were sudden numbness or weakness of the face, arm or leg, especially on one side of the body and suddentrouble walking. On the other hand, the most frequent clinical symptoms among stroke mimic patients were sudden confusion and sudden trouble speaking. Meanwhile, stroke patients had significantly higher systolic blood pressure, diastolic blood pressure and mean arterial blood pressure.
Table 3 summarizes the laboratory characteristics of the studied patients. Patients with stroke had significantly higher INR level compared to patients with stroke mimic

diagnosis (p=0.012).

Table 4 summarizes the final diagnoses' distribution among the studied patients. Patients with stroke diagnosis formed 65.2% of the patients, where ischemic stroke formed 53.2%, hemorrhagic stroke formed 8.7% and transient ischemic attack formed 3.3%. The most common stroke mimic diagnoses were hypoglycemia (14.1%), somatization (8.7%) and syncopal attacks (5.4%).

Table 5 shows that patients with stroke had significantly higher ROSIER total score compared to those with stroke mimic diagnosis (2.83 ± 0.86 vs 0.47 ± 1.01) (p<0.001).

Table 6 shows that patients with stroke had signicantly higher NIHSS total score compared to those with stroke mimic diagnosis (9.28 ± 3.67 vs 2.09 ± 2.27) (p<0.001)

Figure (1) shows the ROC curve analysis of ROSIER for prediction of stroke,where the areas under the curve (AUC) were 0.971 **(Table 7).**
For ROSIER, a value of 1.00 or more was found to be the best cut-off point forprediction of stoke among patients attending with suspected stroke, with sensitivity = 98.3% and specificity = 87.5 % and accuracy= 94.5% (**Table 8).**

Figure (2) shows the ROC curve analysis of NIHSS for prediction of stroke,where the areas under the curve (AUC) were 0.964 (**Table 9).**

For NIHSS, a value of 5.00 or more was found to be the best cut-off point for prediction of stoke among patients attending with suspected stroke, with sensitivity = 88.3% and specificity = 90.6 % and accuracy= 89.1% (**Table 10).**

Table 1. Comparison between stroke/ TIA and Stroke mimic patients regarding their baseline characteristics

Variables	Stroke mimic (n=32)	Stroke/ TIA (n=60)	p-value
Age (years)			
mean ± SD	39.18 ±11.12	63.58 ±12.55	**<0.001*** [a]
median (range)	41.5 (22 - 68)	63.5 (35 - 84)	
Gender, n (%)			
male	10 (31.3)	27 (45)	0.200 [b]
female	22 (68.8)	33 (55)	
Comorbid diseases, n (%)			
Hypertension	18 (56.3)	41 (68.3)	0.250 [b]
Diabetes mellitus	15 (46.9)	23 (38.3)	0.428 [b]
Ischemic heart diseases	5 (15.6)	20 (33.3)	0.069 [b]
Cerebrovascular disease	3 (9.4)	13 (21.7)	0.138 [b]
Atrial fibrillation	1 (3.1)	6 (10)	0.236 [b]
Smoking, n (%)			
Absent	25 (78.1)	45 (75)	0.738 [b]
Present	7 (21.9)	15 (25)	

[a] P values are based on independent t- test. Statistical significance at P < .05.
[b] P values are based on chi-square test. Statistical significance at P < .05.

Table 2. Comparison between stroke/ TIA and Stroke mimic patients regarding their clinical characteristics

Variables	Stroke mimic (n=32)	Stroke/ TIA (n=60)	p-value
Sudden numbness or weakness of the face, arm or leg, especially on one side of the body	21 (65.6)	60 (100)	**<0.001*[b]**
Sudden confusion	23 (71.9)	17 (28.3)	**<0.001*[b]**
Sudden trouble speaking	22 (68.8)	31(51.7)	0.114
Sudden trouble seeing in one or both eyes	0 (0)	8 (13.3)	**0.031*[b]**
Sudden trouble walking	18 (56.3)	59 (98.3)	**<0.001*[b]**
Sudden dizziness, loss of balance or coordination	9 (28.1)	3 (5)	**0.002*[b]**
Sudden severe headache with no known cause	2 (6.3)	1 (1.7)	0.238
GCS			
9/10	0 (0)	2 (3.3)	
10/10	0 (0)	2 (3.3)	
6/15	1 (3.1)	0 (0)	
7/15	2 (6.3)	0 (0)	
8/15	0 (0)	0 (0)	
9/ 15	3 (9.4)	0 (0)	**0.001*[b]**
10/15	2 (6.3)	2 (3.3)	
11/15	2 (6.3)	2 (3.3)	
12/15	5 (15.6)	1 (3.3)	
13/15	2 (6.3)	3 (5)	
14/15	1 (3.1)	10 (16.7)	
15/15	14 (43.75)	38 (63.3)	
Vital signs			
Systolic blood pressure (mmHg)	123.21 ±17.39	145.50 ±12.40	**<0.001*[a]**
Diastolic blood pressure (mmHg)	74.96 ±9.45	82.33 ±62.0	**<0.001*[a]**
Mean Arterial blood pressure (mmHg)	91.15 ±11.68	103.16 ±7.71	**<0.001*[a]**
Random blood sugar (mg/ dl)	85.65 ±41.37	157.00 ±39.07	**<0.001*[a]**

[a] P values are based on independent t- test. Statistical significance at P < .05.
[b] P values are based on chi-square test. Statistical significance at P < .05.

Table 3. Comparison between stroke/ TIA and Stroke mimic patients regarding theirlaboratory characteristics

Variables	Stroke mimic (n=32)	Stroke/ TIA (n=60)	p-value
CBC indices, n (%)			
Hemoglobin (gm/ dl)	11.09 ±1.21	11.22 ±1.32	0.652[a]
WBC count (1000/mm^3)	5.66 ±1.95	6.15 ±1.86	0.241[a]
PLT count (1000/mm^3)	196. 69 ±92.48	218.33 ±68.82	0.207[a]
PT	13.34 ±1.94	13.23 ±0.42	0.665[a]
INR	1.034 ± 0.17	1.10 ±0.068	**0.012***[a]
Na (mEq/L)	138.56 ±2.07	137.83 ±6.05	0.511[a]
K (mEq/L)	4.14 ±0.45	4.163 ±0.48	0.827[a]
Creatinine (mg/ dl)	1.35 ±1.46	0.778 ±0.25	**0.004***[a]
Arterial blood gas			

SpO2 (%)	97.62 ± 2.52	97.81 ± 0.87	0.051 [a]
pH	7.37 ± 0.05	7.37 ± 0.26	0.312 [a]
PCO2 (mmHg)	36.59 ± 3.03	35.13 ± 4.21	0.086 [a]
PO2 (mmHg)	76.15 ± 6.84	73.26 ±5.36	0.078 [a]
Bicarbonate ions (mEq/l)	19.81 ± 2.30	20.33 ±1.17	0.154 [a]
ECG findings			
Sinus rhythm	26 (81.3)	47 (78.3)	0.094[b]
Atrial fibrillation	4 (12.5)	13 (21.7)	
Supraventricular tachycardia	2 (6.3)	0 (0)	

[a] P values are based on independent t- test. Statistical significance at P < .05.
[b] P values are based on chi-square test. Statistical significance at P < .05.

Table 4. Final diagnoses' distribution among the studied patientsbased on CT findings

Variables	N (%)
Stroke diagnosis	**60 (65.2%)**
Ischemic stroke	49 (53.2)
Hemorrhagic stroke	8 (8.7)
Transient ischemic attack (TIA)	3 (3.3)
Stroke mimic diagnosis	**32 (34.7%)**
Hypoglycemia	13 (14.1)
Somatization	8 (8.7)
Syncope	5 (5.4)
Post-ictal (Todd paralysis)	4 (4.3)
Sepsis	2 (2.2)

Table 5. Comparison between stroke/ TIA and Stroke mimic patients regarding ROSIER total score

Variables	Stroke mimic (n=32)	Stroke/ TIA (n=60)	p-value
ROSIER total score			
mean ±SD	0.47 ± 1.01	2.83 ± 0.86	**<0.001***
median (range)	1 (-1 – 2)	3 (1 – 5)	

P values are based on independent t- test. Statistical significance at P < .05

Table 6. Comparison between stroke/ TIA and Stroke mimic patients regarding NIHSS total score

Variables	Stroke mimic (n=32)	Stroke/ TIA (n=60)	p-value
NIHSS total score			
mean ±SD	2.09 ± 2.27	9.28 ± 3.67	**<0.001***
median (range)	3 (1 – 5)	8 (3 – 17)	

P values are based on independent t- test. Statistical significance at P < .05

Table 7. Area under the curve for analysis of ROSIER for prediction of stroke

Variable	Area	Stand. error	p-value	95% CI
ROSIER	0.971	0.016	**<0.001***	(0.940 – 1.000)

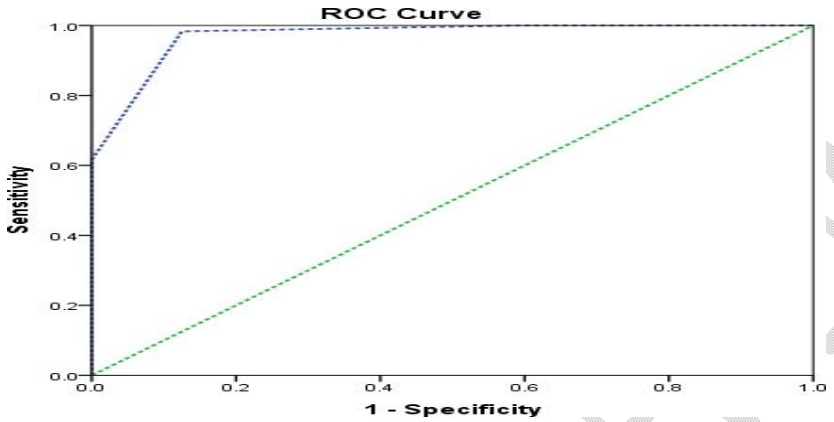

Figure (1): (ROC) of ROSIER for prediction of stroke

Table 8. Sensitivity, specificity, PPV, NPV and diagnostic accuracy at different cut-off levels of ROSIER for prediction of stroke

Cut-off points	Sensitivity	Specificity	PPV*	NPV*	Accuracy
ROSIER					
1.00	98.3%	87.5%	93.7%	96.6%	94.5%

Table 9. Area under the curve for analysis of NIHSS for prediction ofstroke

Variable	Area	Stand. Error	p-value	95% CI
NIHSS	0.964	0.016	**<0.001***	(0.932 – 0.996)

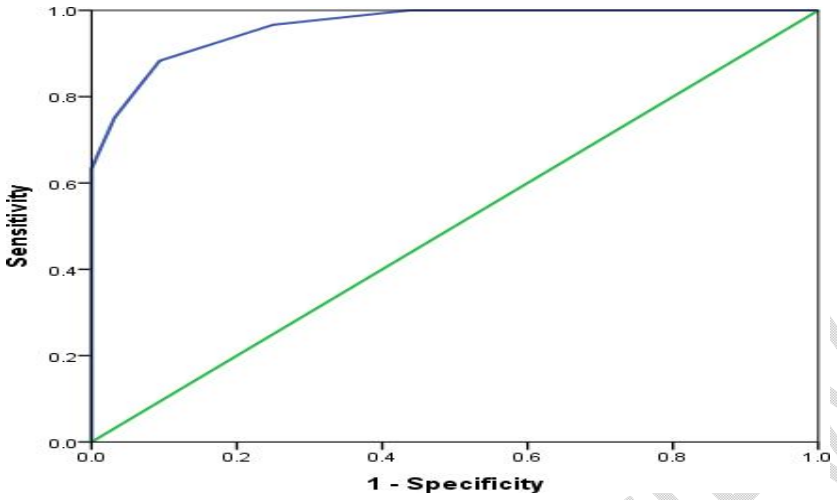

Figure (2): (ROC) of NIHSS for prediction of stroke

Table 10. Sensitivity, specificity, PPV, NPV and diagnostic accuracy atdifferent cut-off levels of NIHSS for prediction of stroke

Cut-off points	Sensitivity	Specificity	PPV*	NPV*	accuracy
NIHSS					
5.00	88.3%	90.6%	94.6%	80.4%	89.1%

Discussion

In our study, Patients with stroke formed about 65.2% of the patients with suspected stroke in the ER while 34.8% of them have stroke mimic diagnosis. So, the ratio of stroke and non-stroke patients is about (2:1). This is consistent with the results of Nor *et al.* [6] and Whiteley *et al*.[17]. However, Jiang *et al*.[14] and Goldstein LB [18] had a ratio of approximately (1:1). On the other hand, Lee et al. study which was conducted on 312 patients with suspected stroke showed that the number of non-stroke group was about 2 times more than stroke group.[19] This difference in results could be due to difference in sampling method. Also, it could be contributed to number of sample size in each study, the work setting where the study has been conducted (emergency department, pre hospital settings, ambulance...etc.) and investigators.

In present study, Patients with stroke/ TIA were found to have significantly higher age compared to other patients (63.58 ±12.55 vs 39.18 ±11.12) (p<0.001). Similarly, to our finding, Jiang *et al*. showed that the stroke patients were older than stroke mimic patients (P= 0.003).[14]

In our study, comorbid diseases were more frequent in stroke patients than stroke mimics patients; hypertension (68.3% vs 56.3%), diabetes mellitus (38.3% vs 46.9%), ischemic heart disease (33.3% vs15.6%), cerebrovascular disease (21.7% vs 9.4%) and atrial fibrillation (10% vs 3.1%). This is in accordance to Jiang *et al*. study where hypertension, diabetes mellitus, ischemic heart disease and atrial fibrillation in stroke patients were more than stroke mimics but patients with a past history of previous stroke were less frequent in stroke patients than in stroke mimics.[14] While in Nor's study, frequency of cerebrovascular diseases in both groups was equal (18% in both groups).[6] This difference with original study may affect the observed accuracy of ROSIER in our study. These differences in studies can be explained by different prevalence of comorbid diseases among populations.

Here, in comparison between stroke and stroke mimic patients, presence of cerebrovascular disease or previous stroke has no statistically significance (p = 0.138) but we should keep in mind that if

patients have any prior neurological deficits, this will complicate the evaluation of patients with ROSIER criteria; hence, it will result in higher ROSIER scores and may affect the observed accuracy.

In present study, stroke patients had significantly higher systolic blood pressure, diastolic blood pressure and mean arterial blood pressure. This is consistent with the results of Jiang *et al*. that showed that the first SBP and DBP in stroke patients were higher than in stroke mimics ($p < 0.001$).[14] Also, Previous studies have suggested that elevated blood pressure (BP) is a particularly important risk factor for stroke.[20]

Regarding presentation of suspected stroke patients, the most frequent presentations among stroke patients (60 patients) were sudden numbness or weakness of the face, arm or leg in 60 patients (100%), especially on one side of the body and sudden trouble walking in 59 patients (98.3%). On the other hand, our results revealed that the most frequent clinical symptoms among stroke mimic patients (32 patients) were sudden confusion in 23 patients (71.9%) and sudden trouble speaking in 22 patients (68.8%). In Jiang et al. study which was conducted on 715 Chinese patients presented with stroke symptoms showed that asymmetric arm weakness (65%), speech disturbance (59%) and visual field defect (19%) were the most frequent presentations among stroke patients. While the most frequent clinical symptoms among stroke mimic patients were leg paresis (41%), arm paresis (38%), speech disturbance (26%) and loss of consciousness (13.7) .[14] These differences are postulated to be due to differences in sample size, age group and education level.

Our results showed that patients with stroke had significantly higher ROSIER total score compared to those with stroke mimic diagnosis (2.83 ± 0.86 vs 0.47 ± 1.01) ($p<0.001$). For assessing neurological deficits and stroke severity, we used NIHSS where patients with stroke had significantly higher NIHSS total score compared to those with stroke mimic diagnosis. A value of 5.00 or more was found to be the best cut-off point for prediction of stroke among patients attending with suspected stroke, with sensitivity = 88.3% and specificity = 90.6 % and accuracy= 89.1%. For diagnosis of TIA we depended on clinical presentation, duration of neurological symptoms and CT imaging. For TIA severity assessment, we used $ABCD^2$ score.[16]

Regarding the final diagnosis, we used emergency CT (at 0 hour and 48 hours later) to confirm diagnosis of stroke, to know stroke etiology and to exclude stroke mimic diagnosis. Of the 92 patients, 60 (65.2%) had stroke diagnosis; 49 (53.26%) ischemic stroke, 8 (8.7%) hemorrhagic stroke and 3 (3.26%) TIA while 32 (34.8%) patients had stroke mimics; 13 hypoglycemia, 8 somatization, 5 syncope, 4 post-ictal, 2 sepsis. This is in accordance to Jiang *et al*. study where 715 suspected stroke patients were recruited for assessment, of whom 371 (52%) had stroke (42.2% ischemic strokes, 8% hemorrhagic stroke, 3% TIA) and (48%) had stroke mimics; spinal neuropathy, dementia, labyrinthitis and sepsis.[14] Another study showed that about third of the patients had mimics of stroke, the commonest stroke mimics were primary headache disorders (usually focal migraine), seizures and sepsis.[17] These differences in subtype patterns may be due to differences in age group, presence of comorbid diseases as hypertension, ischemic heart disease and diabetes mellitus, and lifestyle factors as smoking.

For ROSIER accuracy, a value of 1.00 or more was found to be the best cut-off point for prediction of stoke among patients attending with suspected stroke, with sensitivity = 98.3% and specificity = 87.5 % and positive predictive value = 93.788%, and negative predictive value = 96.6% and accuracy= 94.5%. We have had a case presented with motor weakness (+1) and seizure activity (- 1) so the resultant score was (0), and CT showed right thalamic hematoma. This may result in high false negative rate and affect sensitivity. Nor *et al.* in the UK in 2005 reported that the threshold of more than zero had a sensitivity of 92%, specificity of 86%, positive predictive value of 88%, and negative predictive value of 91%.[6] Here, in our study, although we confirmed its high sensitivity and specificity at this cut-off point. While in Zangi, *et al* study in 2021 reported that the best-calculated cutoff point (score ≥ 1) has a sensitivity of 85.4% and the specificity of 65.8% for the diagnosis of stroke.[21] Reviewing the results of previously conducted studies on the validity of the

ROSIER scale reveals that most authors agreed on its proper sensitivity, but controversies exist on its specificity. We believe that the controversies may have been raised due to different tests being used for final confirmation of stroke by neurologist decision, CT or MRI.

Conclusion:

The ROSIER scale is simple, rapid, effective and sensitive screening tool in early detection of patients presenting with stroke and differentiating stroke from stroke mimics in the emergency room.

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