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

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: The Recognition of Stroke in The Emergency Room (ROSIER) scale has been designed to provide physicians in the emergency department with a framework which can be used to assess patients with suspected stroke and to facilitate early identification of acute stroke & appropriate referral.
Aims: To assess the sensitivity and specificity of the ROSIER score in order to improve outcome of stoke patients.
Methodology: 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: 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

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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.

Keywords: ROSIER scale; stroke; emergency department.

1. INTRODUCTION

"A stroke is defined as a sudden interruption in the blood supply of the brain. strokes are caused mainly by an abrupt blockage of arteries leading to ischemic stroke. Other strokes are caused by bleeding into brain tissue when a blood vessel bursts so called hemorrhagic stroke. As 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]

"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" [2].

"Stroke is considered 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" [3].

"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)" [4]. **"**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" [5].

"Many Stroke scales exist for rapid detection of stroke with primary uses: (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" [6].

"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" [7].

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.

2. MATERIALS AND METHODS

2.1 Study Design

The study was a prospective cross sectional study

2.2 Study Population

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

2.3 Study Setting

The study was carried out at emergency department at Suez Canal University hospital, Ismailia, Egypt.

2.4 Study Inclusion and Exclusion Criteria

All adult patients of age 18 years and above presenting to the ED with symptoms or signs suggestive of stroke or TIA were included. On the other hand, Patients with traumatic brain injury with an external cause such as motor vehicle crashes and falls, patients with incomplete medical records and patients that did not present first to the ED were excluded.

2.5 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).

2.6 Methods and Techniques

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 include the 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" [8].

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

   a. National institutes of health stroke scale (appendix 2): "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. 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" [9]
   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 score in diagnosis of acute stroke.

2.7 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.

3. RESULTS

3.1 Demographic Characteristics, History of Disease and Risk Factors

Patients with stroke formed about 60 of 92 of the patients with suspected stroke in the ER

(65.2%) while 34.8% of them have stroke mimic diagnosis. Of all, 92 patients (59.7%) were females. 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 as shown in (Table 1).

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%).in comparison between stroke and stroke mimic patients, presence of cerebrovascular disease or previous stroke has no statistically significance (p = 0.138) as shown in (Table 1).

3.2 Clinical Characteristics

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%). Meanwhile, stroke patients had significantly higher systolic blood pressure, diastolic blood pressure and mean arterial blood pressure as shown in (Table 2).

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

Variables	Stroke mimic (n=32)	Stroke/ TIA (n=60)	p-value
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)	
10/15	2 (6.3)	2 (3.3)	**0.001*** [b]
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 their laboratory 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)	
Atrial fibrillation	4 (12.5)	13 (21.7)	0.094[b]
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*

3.3 Laboratory Characteristics

Patients with stroke had significantly higher INR level compared to patients with stroke mimic diagnosis (p=0.012) as shown in (Table 3).

3.4 Final Diagnoses' Distribution

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 (14.1%) hypoglycemia, 8 (8.7%) somatization, 5 (5.4%) syncope as shown in (Table 4).

3.5 ROSIER Scale

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) as shown in (Table 5). 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 (9.28 ± 3.67 vs 2.09 ± 2.27) (p<0.001) as shown in (Table 6).

The ROC curve analysis of ROSIER for prediction of stroke, where the areas under the curve (AUC) were 0.971 as shown in (Table 7) and (Fig. 1).

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%. as shown in (Table 8).

3.6 NIHSS Accuracy

The ROC curve analysis of NIHSS for prediction of stroke, where the areas under the curve (AUC) were 0.964 as shown in (Table 9) and (Fig. 2).

Table 4. Final diagnoses' distribution among the studied patients based 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)

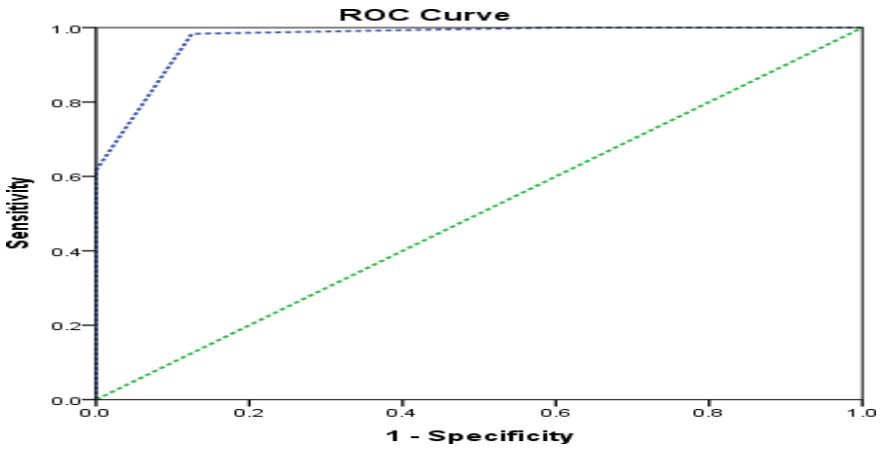

Fig. 1. (ROC) of ROSIER for prediction of stroke

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 of stroke

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

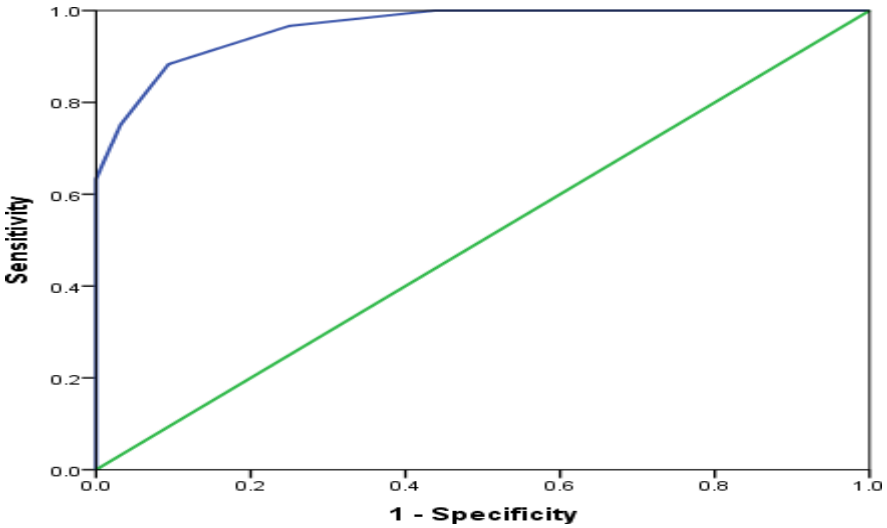

Fig. 2. (ROC) of NIHSS for prediction of stroke

Table 10. Sensitivity, specificity, PPV, NPV and diagnostic accuracy at different 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%

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% as shown in (Table 10).

4. 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. [4] and Whiteley et al. [10] However, Jiang et al. [7] and Goldstein LB [11] 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 [12]. This difference in results could be due to difference in sampling method. it could be also 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 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 [7]. While in Nor's study, frequency of cerebrovascular diseases in both groups was equal (18% in both groups) [4]. 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 ($p < 0.001$) [7]. Previous studies also have suggested that elevated blood pressure (BP) is a particularly important risk factor for stroke [13].

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%) [7]. 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.

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 [7]. 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 [10]. 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%. [4] 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 [14]. 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.

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.

6. LIMITATIONS OF THE STUDY

As all studies, this study had some limitations and strengths. The limitations of this study included the sample size is small, this is a single center study and may not reflect Egyptian population in general. Moreover, patients included in this study had various underlying diseases that could influence the evaluation of a diagnostic tool. ROSIER is not able to differentiate 100% of strokes from stroke mimics (it does not have a sensitivity of 100%) and that is why negative ROSIER is defined as a low probability of stroke and unable to rule out the stroke. Our gold standard diagnosis was dependent on the research fellow's assessment and CT, patients did not have MRI as MRI wasn't available as imaging tool in emergency room but it is more sensitive than CT especially in ischemic stroke and it is better than CT (after 48 hour) in saving time.

CONSENT

All authors declare that 'written informed consent was obtained from the patients' relatives for publication of this case report.

ETHICAL APPROVAL

All authors hereby declare that all study has been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Fatahzadeh M, Glick M. Stroke: Epidemiology, classification, risk factors, complications, diagnosis, prevention, and medical and dental management. Oral Surgery, Oral Med Oral Pathol Oral Radiol Endodontology. 2006;102(2):180–91.
2. Ovbiagele B, Nguyen-Huynh MN. Stroke epidemiology: Advancing our understanding of disease mechanism and therapy. Neurotherapeutics. 2011 Jul;8(3): 319–29.
3. Fung Y. Biomechanics: circulation. Springer Science & Business Media; 2013.

4. Nor AM, Davis J, Sen B, Shipsey D, Louw SJ, Dyker AG, et al. the recognition of stroke in the emergency room (ROSIER) scale: Development and validation of a stroke recognition instrument. Lancet Neurol. 2005;4(11):727–34.
5. Acker III JE, Pancioli AM, Crocco TJ, Eckstein MK, Jauch EC, Larrabee H, Meltzer NM, Mergendahl WC, Munn JW, Prentiss SM, Sand C. Implementation strategies for emergency medical services within stroke systems of care: A policy statement from the American Heart Association/American Stroke Association Expert Panel on Emergency Medical Services Systems and the Stroke Council. Stroke. 2007 Nov 1;38(11):3097-115.
6. Taylor-Rowan M, Wilson A, Dawson J, Quinn TJ. Functional Assessment for Acute Stroke Trials: Properties, Analysis, and Application. Front Neurol. 2018 Mar;9:191.
7. Jiang HL, Chan CPY, Leung YK, Li YM, Graham CA, Rainer TH. Evaluation of the recognition of stroke in the emergency room (ROSIER) scale in Chinese patients in Hong Kong. PLoS One. 2014;9(10).
8. Fothergill RT, Williams J, Edwards MJ, Russell IT, Gompertz P. Does use of the recognition of stroke in the emergency room stroke assessment tool enhance stroke recognition by ambulance clinicians? Stroke. 2013; 44(11):3007–12.
9. Yew KS, Cheng E. Acute stroke diagnosis. Am Fam Physician. 2009 Jul;80(1):33– 40.
10. Whiteley WN, Wardlaw JM, Dennis MS, Sandercock PA. Clinical scores for the identification of stroke and transient ischaemic attack in the emergency department: a cross-sectional study. Journal of neurology, neurosurgery, and psychiatry. 2011;82(9):1006–1010.
11. Goldstein LB. Can the ROSIER scale diagnose patients with stroke accurately in the emergency department? Commentary. Nat Clin Pract Cardiovasc Med. 2006; 3(5):242–3.
12. Lee S, Seo JS, Lee SC, Lee JH, Doh H. Prospective evaluation of the recognition of stroke in the emergency room (ROSIER) scale in emergency department. Journal of the Korean Society of Emergency Medicine. 2015 Oct 30;26(5):466-73.
13. Zhang X-F, Attia J, D'Este C, Ma X-Y. The relationship between higher blood pressure and ischaemic, haemorrhagic stroke among Chinese and Caucasians: Meta-analysis. Eur J Prev Cardiol. 2006; 13(3):429–37.
14. Zangi M, Karimi S, Mirbaha S, Sotoodehnia M, Rasooli F, Baratloo A. The validity of recognition of stroke in the emergency room (ROSIER) scale in the diagnosis of Iranian patients with acute ischemic stroke in the emergency department. Turkish J Emerg Med. 2021; 21(1):1–5.

APPENDIX

1. ROSIER SCORE

Assessment Date □□□□□□ Time □□□□

Symptomonset Date □□□□□□ Time □□□□

GCS E = □ M = □ V = □ BP □□ *BM □

*If BM <3.5 mmol/L treat urgently and reassess once blood glucose normal

Has there been loss of consciousness or syncope? Y(−1) □ N (0)

Has there been seizure activity? Y(−1) □ N (0)

Is there a NEW ACUTE onset (or on awakening from sleep)

I. Asymmetric facial weakness Y(+1) □ N (0)

II. Asymmetric arm weakness Y(+1) □ N (0)

III. Asymmetric leg weakness Y(+1) □ N (0)

IV. Speech disturbance Y(+1) □ N (0)

V. Visual field defect Y(+1) □ N (0)

*Total score_____(−2 to +5)

Provisional diagnosis

□ Stroke □ Non-stroke (specify)

GCS: The Glasgow coma scale, BP: blood pressure, BM: bed side measurement of glucose.

2. National Institutes of Health Stroke Scale

National Institutes of Health Stroke Scale

Score = 0 No stroke
Score = 1-4 Minor stroke
Score = 5-15 Moderate stroke
Score = 15-20 Moderate to severe stroke
Score = 21-42 Severe stroke

National Institutes of Health Stroke Scale score	
1a. Level of consciousness	0 = Alert; keenly responsive 1 = Not alert, but arousable by minor stimulation 2 = Not alert; requires repeated stimulation 3 = Unresponsive or responds only with reflex
1b. Level of consciousness questions: What is the month? What is your age?	0 = Answers two questions correctly 1 = Answers one question correctly 2 = Answers neither question correctly
1c. Level of consciousness commands: Open and close your eyes. Grip and release your hand.	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly
2. Best gaze	0 = Normal 1 = Partial gaze palsy 2 = Forced deviation
3. Visual	0 = No visual loss 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia
4. Facial palsy	0 = Normal symmetric movements 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis of one or both sides
5. Motor arm 5a. Left arm 5b. Right arm	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity; limb falls 4 = No movement
6. Motor leg 6a. Left leg 6b. Right leg	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
7. Limb ataxia	0 = Absent 1 = Present in one limb 2 = Present in two limbs
8. Sensory	0 = Normal; no sensory loss 1 = Mild-to-moderate sensory loss 2 = Severe to total sensory loss
9. Best language	0 = No aphasia; normal 1 = Mild to moderate aphasia 2 = Severe aphasia 3 = Mute, global aphasia
10. Dysarthria	0 = Normal 1 = Mild to moderate dysarthria 2 = Severe dysarthria
11. Extinction and inattention	0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention 2 = Profound hemi-inattention or extinction
Total score = 0–42.	

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