

1
2
3
4
5
6
7
8
9
10

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

11
12
13
14

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 stroke 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 to be the best cut-off point for prediction of stroke 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.

11
12
13
14

Keywords: ROSIER scale; Stroke; Emergency Department.

1. INTRODUCTION

15
16
17
18
19
20

“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]

21
22
23
24
25

“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]

26
27
28
29

“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]

30 “In patients with acute stroke, rapid intervention is crucial to maximize early treatment
31 benefits. Stroke patients commonly have their first contact with medical staff in the
32 emergency room (ER)”. [4] “The benefits of emergency medical services (EMS) activation
33 by patients with stroke symptoms appear to occur in both the prehospital and in hospital
34 settings. For faster access to acute stroke management, stroke patients need to be
35 accurately identified in the emergency department (ED), and ideally prior to ED arrival”. [5]

36 “Many Stroke scales exist for rapid detection of stroke with primary uses: (1) to compare the
37 baseline stroke severity of patient groups and (2) to quantify neurological recovery over time.
38 In effect, impairment scales have often been used to predict outcome despite not having
39 been designed for this purpose. Baseline measurements on the CNS predict functional
40 outcome 6 months after stroke. Acute scores on the NIH Stroke Scale/Score (NIHSS)
41 correlate with both CT infarct volumes at 7 to 10 days after stroke and functional outcome at
42 3 months. Stroke assessment scales should not, however, be used as a measure of
43 functional outcome itself, since impairment scales only partly explain functional health”. [6]

44 “The ROSIER scale, which was developed in a UK population, has been designed to provide
45 physicians in the emergency department with a framework which can be used to assess
46 patients with suspected stroke, to facilitate early identification of acute stroke and
47 appropriate referral”. [7]

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

51 **2. MATERIAL AND METHODS**

52

53 **2.1 Study Design**

54 The study was a prospective cross sectional study

55 **2.2 Study Population**

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

58

59 **2.3 Study Setting**

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

62 **2.4 Study Inclusion and Exclusion Criteria**

63 All adult patients of age 18 years and above presenting to the ED with symptoms or signs
64 suggestive of stroke or TIA were included. On the other hand, Patients with traumatic brain
65 injury with an external cause such as motor vehicle crashes and falls, patients with
66 incomplete medical records and patients that did not present first to the ED were excluded.
67

68 **2.5 Sampling Method**

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

72 **2.6 Methods and Techniques**

- 73 1- Patients was initially assessed at the emergency room of the emergency
74 department of Suez Canal university hospitals.
- 75 2- Patients or their relatives signed an informed consent form that will include the
76 purpose and the type of the study.
- 77 3- The researcher assessed the patients directly to collect data.
- 78 4- Data were collected through a data collection sheet that includes socio
79 demographic data, medical history.
- 80 5- The Recognition of Stroke in The Emergency Room (ROSIER) Scale (**appendix**
81 **1**) was assessed for each patient.

82 “The ROSIER is a 7-item stroke tool that incorporates the FAST elements (facial weakness,
83 arm weakness, and speech disturbance) plus leg weakness and visual field deficit.
84 These symptoms are indicative of a stroke and, if present, each receives a score of 1. The
85 ROSIER also includes assessment of loss of consciousness or syncope and seizure activity
86 both of which reduce the likelihood of a stroke and, if present, receive a score of -1. A
87 ROSIER score, the total of all 7 items, of ≥ 1 suggests a stroke or transient ischemic attack
88 (TIA), whereas a ROSIER score of ≤ 0 indicates nonstroke”. [8]

- 89 6- The patients were followed up till a confirmed diagnosis is reached by:
- 90 a. National institutes of health stroke scale (**appendix 2**) : “The National
91 Institutes of Health Stroke Scale, or NIH Stroke Scale (NIHSS) is a tool
92 used by healthcare providers to objectively quantify the impairment caused
93 by a stroke. The NIHSS is composed of 11 items, each of which scores a
94 specific ability between a 0 and 4. For each item, a score of 0 typically
95 indicates normal function in that specific ability. The individual scores from
96 each item are summed in order to calculate a patient's total NIHSS score.
97 The maximum possible score is 42, with the minimum score being a 0”. [9]
- 98 b. Noncontrast brain CT or brain MRI
- 99 c. Blood glucose
- 100 d. Serum electrolytes and renal function tests
- 101 e. Electrocardiograph
- 102 f. Markers of cardiac ischemia
- 103 g. Complete blood count, including platelet count
- 104 h. Prothrombin time/international normalized ratio
- 105 i. Activated partial thromboplastin time*
- 106 j. Oxygen saturation
- 107 7- CT brain was done to confirm findings of acute stroke. (hypodense

108 lesions).CT imaging was reviewed by the neurology team at Suez
109 Canal university hospitals (at 0 hour and 48 hours later).

110 8- Statistical analysis was done to evaluate the effectiveness of
111 ROSIER score in diagnosis of acute stroke.

112 2.7 Data Analysis

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

119 3. RESULTS

120

121 3.1 Demographic characteristics, history of disease and risk factors

122

123 Patients with stroke formed about 60 of 92 of the patients with suspected stroke in the ER
124 (65.2%) while 34.8% of them have stroke mimic diagnosis. Of all, 92 patients (59.7%) were
125 females. Patients with stroke/ TIA were found to have significantly higher age compared to
126 other patients (63.58 ±12.55 vs 39.18 ±11.12) (p<0.001). The most frequent comorbid
127 diseases among patients were hypertension and diabetes mellitus as shown in (Table 1).

128

129 Comorbid diseases were more frequent in stroke patients than stroke mimics patients;
130 hypertension (68.3% vs 56.3%), diabetes mellitus (38.3% vs 46.9%), ischemic heart disease
131 (33.3% vs 15.6%), cerebrovascular disease (21.7% vs 9.4%) and atrial fibrillation (10% vs 3.
132 1%).in comparison between stroke and stroke mimic patients, presence of cerebrovascular
133 disease or previous stroke has no statistically significance (p = 0.138) as shown in (Table 1).

134

135

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

138

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)	

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

140 ^b P values are based on chi-square test. Statistical significance at P < .05.

141 3.2 Clinical characteristics

142 The most frequent presentations among stroke patients (60 patients) were sudden
 143 numbness or weakness of the face, arm or leg in 60 patients (100%), especially on one side
 144 of the body and sudden trouble walking in 59 patients (98.3%). On the other hand, our
 145 results revealed that the most frequent clinical symptoms among stroke mimic patients (32
 146 patients) were sudden confusion in 23 patients (71.9%) and sudden trouble speaking in 22
 147 patients (68.8%). Meanwhile, stroke patients had significantly higher systolic blood pressure,
 148 diastolic blood pressure and mean arterial blood pressure as shown in **(Table 2)**.

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

Variables	Stroke (n=32)	mimicStroke/ 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	9 (28.1)	3 (5)	0.002 ^{* b}

coordination

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)

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}**

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

153 ^b P values are based on chi-square test. Statistical significance at P < .05.

154 **3.3 Laboratory characteristics**

155
156 Patients with stroke had significantly higher INR level compared to patients with stroke mimic
157 diagnosis (p=0.012) as shown in **(Table 3)**.

158

159 **Table 3. Comparison between stroke/ TIA and Stroke mimic patients regarding their**
 160 **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)	

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

162 ^b P values are based on chi-square test. Statistical significance at P < .05.

163 **3.4 Final diagnoses' distribution**

164 Of the 92 patients, 60 (65.2%) had stroke diagnosis; 49 (53.26%) ischemic stroke, 8 (8.7%)
165 hemorrhagic stroke and 3 (3.26%) TIA while 32 (34.8%) patients had stroke mimics; 13
166 (14.1%) hypoglycemia, 8 (8.7%) somatization, 5 (5.4%) syncope as shown in **(Table 4)**.

167 **Table 4. Final diagnoses' distribution among the studied patients based on CT**
168 **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)

170

171 **3.5 ROSIER Scale**

172 That patients with stroke had significantly higher ROSIER total score compared to those with
173 stroke mimic diagnosis (2.83 ± 0.86 vs 0.47 ± 1.01) ($p < 0.001$) as shown in **(Table 5)**. For
174 assessing neurological deficits and stroke severity, we used NIHSS where patients with
175 stroke had significantly higher NIHSS total score compared to those with stroke mimic
176 diagnosis (9.28 ± 3.67 vs 2.09 ± 2.27) ($p < 0.001$) as shown in **(Table 6)**.

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

179 For ROSIER accuracy, a value of 1.00 or more was found to be the best cut-off point for
180 prediction of stroke among patients attending with suspected stroke, with sensitivity = 98.3%
181 and specificity = 87.5 % and positive predictive value = 93.788%, and negative predictive
182 value = 96.6% and accuracy = 94.5%. as shown in **(Table 8)**.

183

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 \pm SD	0.47 \pm 1.01	2.83 \pm 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

184

185

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 \pm SD	2.09 \pm 2.27	9.28 \pm 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

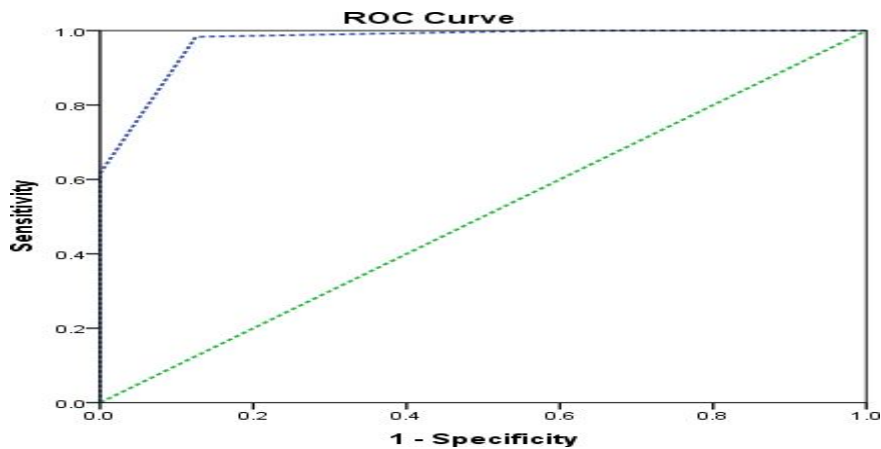
186

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

188

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

189



190

191

192

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

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

196

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

197

198 **3.6 NIHSS accuracy**

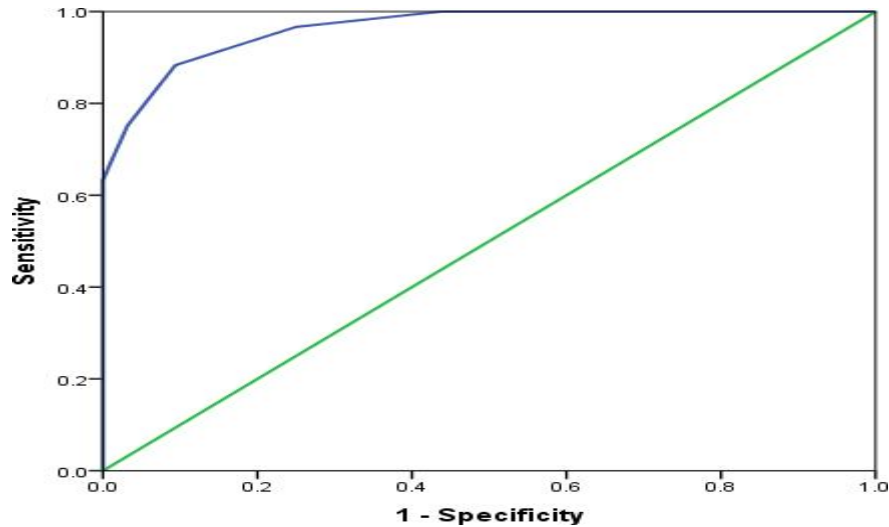
199 The ROC curve analysis of NIHSS for prediction of stroke, where the areas under the curve
 200 (AUC) were 0.964 as shown in **(Table 9)** and **(Figure 2)**.

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

204 **Table 9. Area under the curve for analysis of NIHSS for prediction of stroke**

205

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



206

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

208 **Table 10. Sensitivity, specificity, PPV, NPV and diagnostic accuracy at different cut-off**
 209 **levels of NIHSS for prediction of stroke**

210

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

211

212

213

4. DISCUSSION

214

215

216

217

218

219

220

221

222

223

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.

224 In our study, comorbid diseases were more frequent in stroke patients than stroke mimics
225 patients; hypertension (68.3% vs 56.3%), diabetes mellitus (38.3% vs 46.9%), ischemic
226 heart disease (33.3% vs 15.6%), cerebrovascular disease (21.7% vs 9.4%) and atrial
227 fibrillation (10% vs 3.1%). This is in accordance to Jiang *et al.* study where hypertension,
228 diabetes mellitus, ischemic heart disease and atrial fibrillation in stroke patients were more
229 than stroke mimics but patients with a past history of previous stroke were less frequent in
230 stroke patients than in stroke mimics. [7] While in Nor's study, frequency of cerebrovascular
231 diseases in both groups was equal (18% in both groups). [4] This difference with original
232 study may affect the observed accuracy of ROSIER in our study. These differences in
233 studies can be explained by different prevalence of comorbid diseases among populations.

234 Here, in comparison between stroke and stroke mimic patients, presence of cerebrovascular
235 disease or previous stroke has no statistical significance ($p = 0.138$) but we should keep in
236 mind that if patients have any prior neurological deficits, this will complicate the evaluation of
237 patients with ROSIER criteria; hence, it will result in higher ROSIER scores and may affect
238 the observed accuracy.

239 In present study, stroke patients had significantly higher systolic blood pressure, diastolic
240 blood pressure and mean arterial blood pressure. This is consistent with the results of Jiang
241 *et al.* that showed that the first SBP and DBP in stroke patients were higher than in stroke
242 mimics ($p < 0.001$). [7] Previous studies also have suggested that elevated blood pressure
243 (BP) is a particularly important risk factor for stroke. [13]

244 Regarding presentation of suspected stroke patients, the most frequent presentations
245 among stroke patients (60 patients) were sudden numbness or weakness of the face, arm or
246 leg in 60 patients (100%), especially on one side of the body and sudden trouble walking in
247 59 patients (98.3%). On the other hand, our results revealed that the most frequent clinical
248 symptoms among stroke mimic patients (32 patients) were sudden confusion in 23 patients
249 (71.9%) and sudden trouble speaking in 22 patients (68.8%). In Jiang *et al.* study which was
250 conducted on 715 Chinese patients presented with stroke symptoms showed that
251 asymmetric arm weakness (65%), speech disturbance (59%) and visual field defect (19%)
252 were the most frequent presentations among stroke patients. While the most frequent clinical
253 symptoms among stroke mimic patients were leg paresis (41%), arm paresis (38%), speech
254 disturbance (26%) and loss of consciousness (13.7%) [7] These differences are postulated
255 to be due to differences in sample size, age group and education level.

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

264 Regarding the final diagnosis, we used emergency CT (at 0 hour and 48 hours later) to
265 confirm diagnosis of stroke, to know stroke etiology and to exclude stroke mimic diagnosis.
266 Of the 92 patients, 60 (65.2%) had stroke diagnosis; 49 (53.26%) ischemic stroke, 8 (8.7%)
267 hemorrhagic stroke and 3 (3.26%) TIA while 32 (34.8%) patients had stroke mimics; 13
268 hypoglycemia, 8 somatization, 5 syncope, 4 post-ictal, 2 sepsis. This is in accordance to
269 Jiang *et al.* study where 715 suspected stroke patients were recruited for assessment, of
270 whom 371 (52%) had stroke (42.2% ischemic strokes, 8% hemorrhagic stroke, 3% TIA) and
271 (48%) had stroke mimics; spinal neuropathy, dementia, labyrinthitis and sepsis. [7] Another

272 study showed that about third of the patients had mimics of stroke, the commonest stroke
273 mimics were primary headache disorders (usually focal migraine), seizures and sepsis. [10]
274 These differences in subtype patterns may be due to differences in age group, presence of
275 comorbid diseases as hypertension, ischemic heart disease and diabetes mellitus, and
276 lifestyle factors as smoking.

277 For ROSIER accuracy, a value of 1.00 or more was found to be the best cut-off point for
278 prediction of stroke among patients attending with suspected stroke, with sensitivity = 98.3%
279 and specificity = 87.5 % and positive predictive value = 93.788%, and negative predictive
280 value = 96.6% and accuracy= 94.5%. We have had a case presented with motor weakness
281 (+1) and seizure activity (- 1) so the resultant score was (0), and CT showed right thalamic
282 hematoma. This may result in high false negative rate and affect sensitivity. Nor *et al.* in the
283 UK in 2005 reported that the threshold of more than zero had a sensitivity of 92%, specificity
284 of 86%, positive predictive value of 88%, and negative predictive value of 91%. [4] Here, in
285 our study, although we confirmed its high sensitivity and specificity at this cut-off point. While
286 in Zangi, *et al* study in 2021 reported that the best-calculated cutoff point (score ≥ 1) has a
287 sensitivity of 85.4% and the specificity of 65.8% for the diagnosis of stroke [14] Reviewing
288 the results of previously conducted studies on the validity of the ROSIER scale reveals that
289 most authors agreed on its proper sensitivity, but controversies exist on its specificity. We
290 believe that the controversies may have been raised due to different tests being used for
291 final confirmation of stroke by neurologist decision, CT or MRI.

292 **5. CONCLUSION**

293

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

297 **CONSENT**

298

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

301

302

303 **ETHICAL APPROVAL**

304

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

308

309 **LIMITATIONS OF THE STUDY**

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

320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370

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, W. N., Wardlaw, J. M., Dennis, M. S., & Sandercock, P. A. (2011).** 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,* 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.

371 13. **Zhang X-F, Attia J, D'Este C, Ma X-Y.** The relationship between higher
 372 blood pressure and ischaemic, haemorrhagic stroke among Chinese and
 373 Caucasians: meta- analysis. *Eur J Prev Cardiol.* 2006;13(3):429–37.
 374 14. **Zangi M, Karimi S, Mirbaha S, Sotoodehnia M, Rasooli F, Baratloo A.**
 375 The validity of recognition of stroke in the emergency room (ROSIER) scale
 376 in the diagnosis of Iranian patients with acute ischemic stroke in the
 377 emergency department. *Turkish J Emerg Med.* 2021;21(1):1–5.
 378
 379 **APPENDIX**
 380

381 **1. ROSIER SCORE**
 382

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)

384 GCS: The Glasgow coma scale, BP: blood pressure, BM: bed side measurement of glucose.
 385
 386
 387
 388

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.	