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Characteristics of Stroke in Prehospital Settings in Saudi Arabia: A Descriptive Analysis

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Abstract—**Background: Stroke is considered a time-sensitive emergency; thus, early recognition of this condition is a crucial function of emergency medical services (EMS) and medical practitioners. In this study, we aimed to assess the characteristics observed by EMS practitioners in stroke-suspected cases.**

Methodology: This is a retrospective observational study, using the data available in the registry of the Saudi Red Crescent Authority (SRCA). We collected data from the beginning of January 2018 to the end of December 2020.

Results: We reviewed 753 patients who met the study's inclusion criteria. Participants aged 61-70 years represented 29% of the study group, and 66% of the group were male. Patients living in Makkah constituted 32.9%, while most of the patients (71.7%) were Saudi nationals. Weakness was the most common complaint, reported in 45% of patients. The most associated disease was hypertension (54.4%), whereas hypoglycaemic patients represented 0.4% of the group.

Conclusion: Weakness was the most prevalent complaint among stroke-suspected patients, and hypertension was the most associated risk factor. Blood glucose measurement and neurological examination were both included in the EMS assessment of stroke-suspected patients. This might indicate the high quality of the EMS assessment for stroke and stroke-mimickers.

Index Terms—**EMS, Prehospital, Saudi Arabia, Stroke.**

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I. Introduction

Stroke is a time-sensitive medical emergency, and delayed arrival to the emergency department is common. According to Centers for Disease Control and Prevention (CDC), stroke is the third leading cause of death in Saudi Arabia [1] and the most common cause of neurological disability worldwide [2]. There are various kinds of stroke, although it is broadly categorised into two types: ischaemic (85%) and haemorrhagic (15%). Since stroke complications have a major impact on morbidity and mortality, early recognition of the condition is considered a crucial aspect of its management. Nonetheless, recognition is challenging, since many other conditions may resemble the clinical manifestations of stroke. These include transient ischaemic attack (TIA), hypoglycaemia, seizure, and electrolyte imbalance [3], which also present as an acute onset of neurological deficit. Treatment of ischaemic stroke is time-sensitive after the manifestation of neurological symptoms; it is mainly treated with a thrombolytic agent, tissue plasminogen activator (tPA). Unfortunately, only one out of four patients present in time to receive tPA, likely due to the inability to recognise stroke symptoms and the seriousness of these symptoms [4]. As reported, an average of 1.8 days of healthy life is lost for every minute of delay.

Of the data regarding EMS protocols and stroke measures, only one study was conducted in Saudi Arabia, focusing on adults with stroke symptoms and comparing the outcomes of stroke patients transported by EMS with those who were transported in other ways. They concluded that "EMS

transportation of stroke patients can shorten the time to stroke team activation that will lead to shorter triage and faster patient management" [5].

As stroke is a time-sensitive condition, early action and stroke team activation are essential for a better outcome [5]. Prehospital stroke recognition plays a major role in faster stroke code activation, which can help improve patients' recovery and outcomes [6]. Prenotification of EMS personnel, along with instructions to dispatchers, can impact the rate of mortality and morbidity in stroke-suspected patients by reducing the prehospital time interval, hence the implementation of stroke guidelines including the Face Arm Speech Time (FAST) scale, Cincinnati Prehospital Stroke Scale (CPSS), and the Los Angeles Prehospital Stroke Screen (LAPSS).

Due to a lack of data, no studies have been conducted in Saudi Arabia to assess prehospital recognition of stroke and its mimickers by EMS providers. In the present study, we aimed to assess the characteristics of stroke observed by EMS providers in stroke-suspected cases.

II. Methodology

This is a retrospective observational study using the data available at the registry of the Saudi Red Crescent Authority (SRCA). We collected data from the beginning of January 2018 until the end of December 2020. The study was approved by the Institutional Review Board at King Abdullah International Medical Research Center, Riyadh, Saudi Arabia (IRB number H-01-R-005). Our inclusion criteria were all patients under the age of 80 with clinical pictures suggestive of a stroke.

The data sheet from which we collected our data included all patients who had called the SRCA complaining of neurological disabilities, such as, but not limited to: weakness, slurred speech, facial deviation, and decreased level of consciousness.

We measured the quality of EMS assessment with regard to the differentiation between stroke and stroke mimickers, the number of suspected stroke patients transported, proficiency in measuring vital signs and glucose level, and carrying out EMS interventions accordingly. Furthermore, we assessed the neurological examination conducted by the EMS, including but not limited to weakness, loss of consciousness, paraesthesia, and pupil reactivity.

Descriptive statistics were summarised as numbers, percentages, and mean and standard deviation. The data were coded using Microsoft Office Excel 2010, and analysed using Statistical Packages for Social Sciences (SPSS) version 26 (Armonk, NY: IBM Corp, USA).

III. Results

All 13 provinces of Saudi Arabia were included in the study: of a total of 1200 patients, only 753 met our inclusion criteria. As described in Table 1, 29% were aged between 61 to 70 years, with males the dominant gender (66%). Patients from Makkah constituted 32.9%, while most of the patients were Saudi nationals (71.7%).

In Figure 1, the most reported patient complaint was weakness/fatigue (45.2%), followed by a decreased level of consciousness (9.4%) and body pain (9.3%), while tingling was the least-reported symptom (0.5%).

Figure 2, showing the patients' medical history, illustrates that the most associated disease was hypertension (54.4%), followed by diabetes (28%) and stroke (26.8%).

As seen in Table 2, most patients responded to the eye response examination, with only 4 cases and 5 cases showing fixed right and left eyes, respectively. Patients who received their first IV catheter constituted 58.3%, while only 3% received a second. 10.5% received normal saline, 2.3% received lactated Ringer's solution, 2.7% received 5% dextrose, and 0.40% received 50% dextrose. Only 4.1% of patients underwent ECG, and only one received CPR (0.10%). The prevalence of patients who had had contact with people who were sick with infectious diseases was 2.8%.

Regarding the patients' management, the proportion of patients who received oxygen via masks, through nasal cannulas, and via non-rebreather masks were 25.9%, 6.2%, and 20.8%, respectively. Patients who were treated by opening their airway, the use of oral airway, nasal airway, and/or suction were 2.9%, 1.2%, 0%, and 1.1%, respectively. 13.3% of the subjects were unstable and an ambulance siren was used for 90.3% during transport. The prevalence of patients with drug allergies was 2.3%.

Table 1. Baseline characteristics of patients

Variables	N (%)
Age group	
≤50 years	154 (20.5%)
51 – 60 years	183 (24.3%)
61 – 70 years	218 (29.0%)
71 – 80 years	198 (26.3%)
Gender	
Male	497 (66.0%)
Female	256 (34.0%)
Region	
Asir	25 (03.3%)
Arar	7 (0.90%)
Dammam	104 (13.8%)
Hail	6 (0.80%)
Jizan	35 (04.6%)
Jouf	8 (01.1%)
Madinah	123 (16.3%)
Makkah	248 (32.9%)
Qassim	19 (02.5%)
Riyadh	164 (21.8%)
Tabuk	14 (01.9%)
Nationality	
Saudi	540 (71.7%)
Non-Saudi	213 (28.3%)

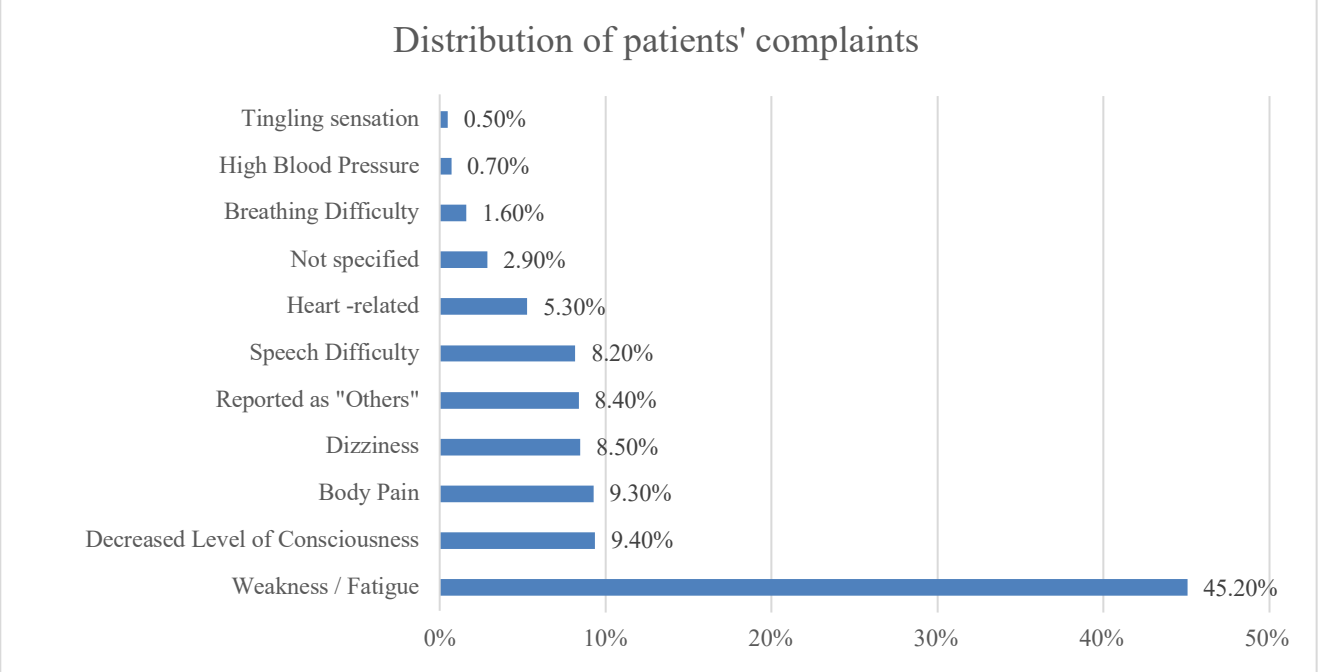

Figure 1. Distribution of symptoms

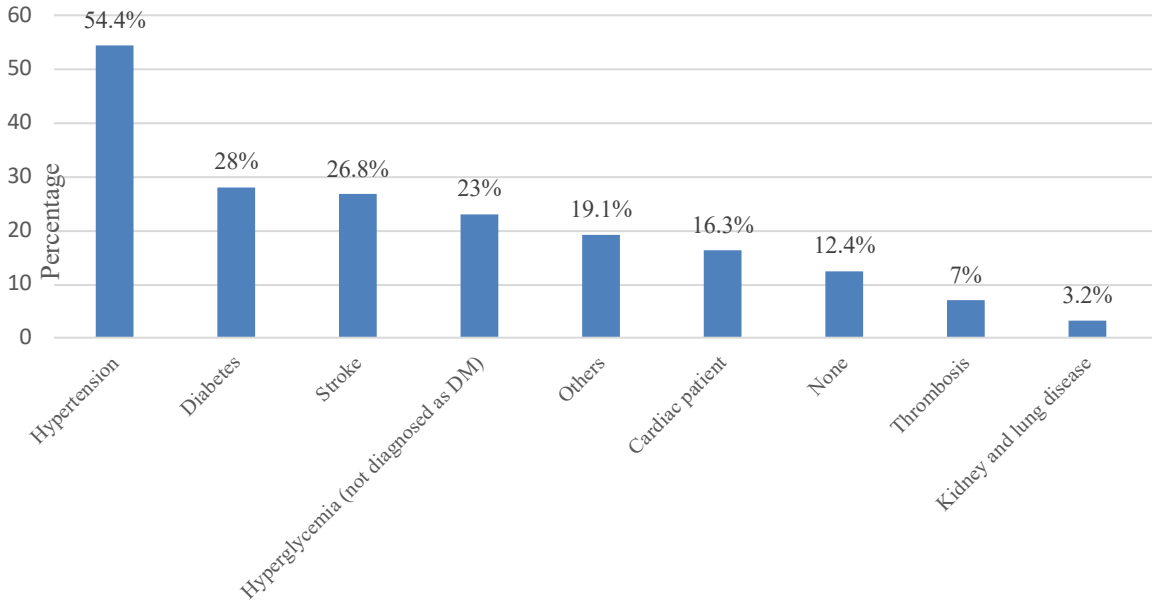

Figure 2. Patients' medical history

The mean glucose level was 176, while mean GCS was 13.6 and mean respiratory rate was 16.5/min. Temperatures were obtained twice for each patient, with means of 36.9 and 36.8 C, respectively. Mean oxygen saturation was 95.4%. Pulse rates were taken twice, with means of 88.7 and 90 bpm, respectively. The mean systolic blood pressure was 141.8, and mean diastolic blood pressure was 88.8 mmHg.

IV. Discussion

Our study was conducted to assess the characteristics of stroke observed by EMS personnel in stroke-suspected patients, given that stroke was the second-largest cause of death in Saudi Arabia in 2015, according to the World Health Organization (WHO) [7]. Furthermore, given the aging population in Saudi Arabia and worldwide, the rate of stroke is expected to rise. Thus, a comprehensive understanding by prehospital personnel of the common presentation of stroke in the field is a matter of significant importance. To our knowledge, this is the first study highlighting patient characteristics and the approach of prehospital healthcare workers to stroke recognition in the field.

A male predominance (66%) was evident in our study, similar to another study by Alhazzani et al in 2018, which showed a male predominance of 65%; this can be due to a higher incidence of vascular risk factors in males [8]. Age is the most important risk factor, with the 61-70 age group being most affected, as endorsed by Alsenany et al, 2020 [9].

Hypertension (54%) was the most common modifiable risk factor (this is supported by other studies conducted in the region [10] and worldwide), followed by diabetes. The combination of both risk factors significantly increases the risk of stroke symptoms. A previous history of stroke was found in 26.8% of our population; this can aid paramedics to raise their suspicion of stroke as a primary diagnosis when encountering patients with a previous history of stroke.

Makkah is the region that most commonly uses the stroke code during patient transport and evaluation, followed by Riyadh; this is not in line with the demographic population data. Fatigue and weakness were the most common symptoms used to identify stroke, followed by a decreased level of consciousness. The awareness of prehospital healthcare providers is of utmost significance, since the complaints are not unified and each patient presents with their own individual complaints [11, 12]. Sometimes, the complaint is not found in any previous literature or guidelines, considering that we are an Arabic-speaking country and most of the teaching and scoring systems are in English.

During transport, 86% of patients were stable and had at least one peripheral line to provide medications and fluids as needed. However, oxygen was only supplied when patients were hypoxic, as suggested by the guidelines and research [6]. Only 2.7% of patients received dextrose 5%, and 0.40%

Table 2. Examination and intervention

Variables	N (%)
Right eye response	
Respond	715 (95%)
Slow	22 (2.9%)
Fixed	4 (0.50%)
Unknown	12 (1.6%)
Left eye response	
Respond	709 (94.2%)
Slow	28 (3.7%)
Fixed	5 (0.70%)
Unknown	11 (1.5%)
IV catheter 1	
Yes	439 (58.3%)
No	314 (41.7%)
IV catheter 2	
Yes	3 (0.40%)
No	750 (99.6%)
Normal saline	
Yes	79 (10.5%)
No	674 (89.5%)
Lactated Ringer's solution	
Yes	17 (2.3%)
No	736 (97.7%)
5% dextrose	
Yes	20 (2.7%)
No	733 (97.3%)
50% dextrose	
Yes	3 (0.40%)
No	750 (99.6%)
Electrocardiogram	
Yes	31 (4.1%)
No	722 (95.9%)
CPR	
Yes	1 (0.10%)
No	752 (99.9%)
Contact with sick patients	
Yes	21 (2.8%)
No	732 (97.2%)

Table 3. On-scene management.

Variables	N (%)
Oxygen mask	
Yes	195 (25.9%)
No	558 (74.1%)
Nasal cannula	
Yes	47 (6.2%)
No	706 (93.8%)
Non-rebreather mask (NRB)	
Yes	157 (20.8%)
No	596 (79.2%)
Ambulance siren	
Yes	680 (90.3%)
No	73 (9.7%)
Allergy to drugs	
Yes	17 (2.3%)
No	736 (97.7%)

Table 4. Laboratory characteristics of patients

Parameters	Mean ± SD
Blood glucose level	176.1 ± 112.3
Glasgow Coma Scale	13.6 ± 2.76
Respiratory rate	16.5 ± 5.51
Temperature (first reading)	36.9 ± 0.40
Temperature (second reading)	36.8 ± 2.10
Oxygen saturation	95.4 ± 11.9
Pulse (first reading)	88.7 ± 20.7
Pulse (second reading)	90.0 ± 17.8
Systolic blood pressure (SBP)	141.8 ± 31.9
Diastolic blood pressure (DBP)	88.8 ± 22.6

received dextrose 50%; this indicates that the EMS providers measured glucose levels and administered dextrose accordingly.

Hospital designation is determined by the stability of the patient, the nearest stroke centre, and expected traffic. This was not included in our data because no universal designation is available, and some patients are not eligible for admission to certain hospitals. The choice of hospital depends on the dispatcher, and upon the hospital's approval.

V. Conclusion

Weakness was the most prevalent complaint among stroke-suspected patients, and hypertension was the most associated risk factor. Blood glucose measurement and neurological examination were both included in the EMS assessment for stroke-suspected patients. This might indicate the high quality of the EMS assessment for stoke and stroke-mimickers. However, there is a lack of proper documentation when it comes to onset of symptoms and tPA candidacy, which has a crucial effect on the decision of dispatchers and receiving hospitals.

VI. Limitations

A lack of standardised language and education for some prehospital healthcare workers, as well as standardised codes for stroke and medical conditions, made data collection and its subsequent analysis prone to flaws and translation errors. The lack of unification of codes and documentation processes and the language barriers were the most significant limitation with regard to data collection.

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