Assessment of the experience of Saudi emergency medical services personnel with acute stroke

On-scene stroke identification, triaging, and dispatch of acute stroke patients

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ABSTRACT

الأهداف: تقييم معرفة رجال الإسعاف الطبي السعودي وخبرة وتأثيرالأقدمية في التعامل مع مرضى السكتة الدماغية الحادة.

الطريقة: أجريت دراسة مقطعية بإستخدام إستبيان منظم ومقسم إلى ثلاثة أجزاء ضمت 102 موظف من رجال الإسعاف الطبي السعودي في الرياض خلال الفترة من أكتوبر حتى ديسمبر 2011م. قمنا بتقييم العوامل الديموغرافية للمشاركين، وقدرتهم على معرفة الأعراض الأساسية لمرضى السكتة الدماغية، وإستخدام أدوات التقييم، ومعرفتهم حول عقار ال (t-PA)، ونقل المرضى.

النتائج: كان متوسط عمر المشاركين (4.5±) 27.6 أعوام. كان لدى نصف المشاركين خبرة أقل من سنتين تقريباً. ستة في المئة من المشاركين ليس لديهم علم بأعراض السكتة الدماغية، و 3% المئة فقط تعرفوا على 5 أو أكثر من الأعراض الصحيحة. لا يوجد أحد من المشاركين استخدم أدوات تقييم خاصة بمرضى السكتة الدماغية. تم نقل حوالي 38% من المشاركين إلى المستشفيات القريبة منهم دون الأخذ بعين الاعتبار توفر مرافق معالجة السكتة الدماغية. وحد 6% فقط من المشاركين لديهم علم بعقار ال (t-PA) واستخدامه في رعاية السكتة الدماغية.

خاتمة: يفتقرالغالبية العظمى من رجال الإسعاف الطبي السعودي معرفة الأعراض الأساسية لمرضى السكتة الدماغية، والإستخدامات الأساسية لعقار الـ (t-PA) والوقت المتاح للإستفادة منه. هناك حاجة ماسة إلى توفير فرص تدريب إلى جانب تنفيذ أدوات فحص وفرز لمرضى السكتة الدماغية ونظام إسعافهم ونقلهم.

Objective: To assess the knowledge, experience, and the impact of seniority of Saudi emergency services (EMS) personnel in dealing with acute stroke patients. Methods: We conducted this cross-sectional survey using a 3-part structured questionnaire involving 102 EMS personnel in Riyadh, Kingdom of Saudi Arabia between October and December 2011. We assessed participants' demographic factors, their ability to identify cardinal symptoms of stroke, use of assessment tools, knowledge of tissue plasminogen activator (t-PA), and dispatch of patients.

Results: The mean age of participants was 27.6 (\pm 4.5) years. Approximately half of the group had experience of up to 2 years. Six percent of participants were not aware of any stroke symptoms, and only 3% identified 5 or more correct symptoms. None of the participants used any stroke specific assessment tools. Around 98% of participants dispatched patients to the nearest hospitals without taking into account availability of stroke treatment facilities. Only 6% of the participants were aware of t-PA and its use in stroke care.

Conclusions: Most of the EMS personnel lacked knowledge of the cardinal stroke symptoms, t-PA's principal uses, and its therapeutic time window. Training opportunities coupled with the implementation of screening tools, stroke triage, and dispatch protocols are urgently required.

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schemic stroke is a common disorder and a leading Leause of death and disability in the Kingdom of Saudi Arabia.^{1,2} Recent advances have been made along the stroke care continuum, particularly in the acute stage to reverse the neurological deficit, and limit the consequences of stroke.^{3,4} Recombinant tissue plasminogen activator (t-PA), a clot-busting medication, has proven effective in acute ischemic stroke. However, this medication works only within the first 41/2 hours from the onset of symptoms. This "therapeutic time window" is crucial to reverse the neurological deficit and restore brain function.^{5,6} Despite its proven effectiveness, the majority of stroke patients are not treated with t-PA, largely due to delayed presentation to the emergency department (ED) beyond the therapeutic time window. In the United States, for instance, the median time to seek medical care for acute stroke is 3-6 hours, thereby attenuating the chances of thrombolysis.7 In Saudi Arabia, t-PA use for acute ischemic stroke is limited to a few hospitals.8 Several pre-hospital and in-hospital barriers have been identified that should be overcome if thrombolysis is to be administered to stroke patients efficiently and equitably. The reported barriers include sociodemographic factors, knowledge of stroke symptoms and their recognition, Emergency Medical Services (EMS) personnel triaging stroke as non-urgent, delays in neuroimaging, and physicians' uncertainty regarding administering thrombolysis.9,10

The EMS systems and personnel are now seen as integral parts of the health care system and have a fundamental role in prompt and accurate recognition of stroke symptoms, timely triaging, and rapid dispatch of patients to appropriate care facilities in order to improve disease outcomes.¹¹⁻¹⁴ Acute stroke care in the Kingdom of Saudi Arabia is currently considered inadequate, and it is very important to understand the current set-up, limitations, and obstacles that may interfere with the provision of optimum care in line with international standards and guidelines.8 This study aims to assess the experience and knowledge of Saudi EMS personnel in dealing with acute stroke, specifically focusing on stroke identification, triaging, and dispatch of acute stroke patients to appropriate care facilities. In addition, we sought to assess the impact of EMS personnel seniority on stroke identification, triaging, and dispatch.

Methods. *Study setting, design, and participants.* There are 21 EMS centers in the capital city of Riyadh out of which 20 are managed by the Saudi Red Crescent Authority (SRCA),¹⁵ and one by KAMC. We conducted a cross-sectional survey by face-to-face interviews using a structured questionnaire at 17 EMS centers between October and December 2011. Four of the centers could not be reached due to administrative difficulties. We approached respective center coordinators for lists of personnel working at the center on the day of survey. We did not employ any exclusion criteria, and all EMS personnel available on the day of survey and willing to participate were considered for this study. We then randomly chose 120 EMS personnel for this study.

Ethical approval. The review board at King Abdullah International Medical Research Center, Riyadh, Kingdom of Saudi Arabia approved this study. Verbal consent was obtained, and all participants were informed that they could refuse to participate or withdraw from the interviews at any time.

Data collection. Data were gathered on paper-based questionnaires and were subsequently collated in electronic format. The questionnaire was developed in Arabic language and consisted of 3 parts with each part having 4 items. The first part collected information on demographic factors such as age, level of education, nationality, and years of experience as EMS personnel. The second part included questions on the ability to identify the cardinal symptoms of stroke, knowledge of the subtypes of stroke (ischemic and hemorrhagic), use of assessment tools, and information collected from the patient or family. In the third part, participants' knowledge of t-PA and the time window for its use, mode of triage, and dispatch of stroke patients were assessed. The cardinal signs and symptoms were defined as sudden facial deviation, limb weakness, speech difficulty, numbress in one side of the body, severe headache, imbalance, dizziness, or visual loss.

Participants were divided to years of EMS experience groups as follows: group 1 = experience of up to 2 years; group 2 = experience of 2-5 years; group 3 = experience of more than 5 years. The division into 3 groups was carried out to assess the impact of seniority on stroke identification, triaging, and dispatch.

Statistical analyses. Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 17.0 software. Continuous data were expressed as mean \pm SD. One-way ANOVA was used to compare means by years of experience. Categorical data were expressed as n, percentage, and analyzed with chi-square test or Fisher's exact test. All statistical assessments were 2-tailed, and the level of significance was set at p = 0.05.

Results. A total of 102 (85%) EMS personnel agreed to take part in this study. Eighteen personnel refused on account of their work commitments. However,

their sociodemographic profiles were no different to the ones who participated in the study. The mean age was 27.6 ± 4.5 years, and the age range was 20-50years. The most frequent age group was 20-30 years old, accounting for 85% (n=87) of participants. All participants were males, and 95% (n=97) were Saudis. The baseline characteristics of the participants and their stroke related knowledge by their years of experience in EMS are shown in **Table 1**.

Approximately half of the group (46.1%) had experience of up to 2 years as EMS personnel. A similar proportion (53.9%) dealt with up to 20 stroke cases every year. However, the group with more than 5 years of experience saw a higher number of cases, and this difference was statistically significant. Ten percent of interviewed EMS personnel had not seen any stroke cases, but all of them were junior members with up to 2 years of experience. Assessment of EMS personnel on their knowledge of stroke symptoms revealed that 6% were unaware of any stroke symptoms, while 3% could identify 5 or more correct symptoms. Within the 3 experience subgroups, approximately half of the participants could name at least 3 symptoms. Most participants (78%) did not know any subtype of stroke, and it was interesting to note that three-quarters of those with >5 years of experience were also unaware of any stroke subtype.

In response to the question on the use of specific assessment tools to evaluate stroke patients, none of the participants used any such tools (Table 2). Approximately 85% of the participants checked details of onset of symptoms, patient's medications use, and underlying risk factors as part of the clinical history when any case presented to them. In response to dispatch strategy, the vast majority of participants (98%) responded that they usually dispatch stroke patients to the nearest hospital, and a similar picture emerged on subgroup analysis with even those having >5 years of experience sending patients to the nearest hospital as opposed to a tertiary care hospital with stroke treatment facilities (Table 3). On the question of t-PA awareness, 94% of the participants were unaware of t-PA and its use in stroke care, and only 10% in the >5 years experience group knew of this drug, but this finding was not statistically significant. Likewise, correspondingly similar proportions were found for their knowledge of the time window of t-PA.

Discussion. Rapid on-scene identification and dispatching of stroke patients to the appropriate health

Parameters	All n (%)	Experience of groups n (%)				
		Group 1 (Up to 2 years)	Group 2 (2.1 to 5.0 years)	Group 3 (>5 years)	P-value*	
Number (%)	102	47 (46.1)	26 (25.5)	29 (28.4)	-	
Mean age (± SD) (years)	27.6 (±4.5)	24.7 (±2.1)	27.8 (±1.8)	32.2 (±5.3)	< 0.001	
How many stroke patients do you se	ee each year?					
None	10 (9.8)	10 (21.3)	0	0		
1-20	55 (53.9)	32 (68.1)	14 (53.8)	9 (31.0)	0.001	
21-40	29 (28.4)	4 (8.5)	10 (38.5)	15 (51.7)	<0.001	
41-60	8 (7.8)	1 (2.1)	2 (7.7)	5 (17.2)		
Number of correctly identified card	inal symptoms o	of stroke				
Does not know	6 (5.9)	3 (6.4)	2 (7.7)	1 (3.4)		
1 symptom	7 (6.9)	4 (8.5)	2 (7.7)	1 (3.4)		
2 symptoms	20 (19.6)	9 (19.1)	8 (30.8)	3 (10.3)		
3 symptoms	44 (43.1)	21 (44.7)	9 (34.6)	14 (48.3)	0.32	
4 symptoms	22 (21.6)	7 (14.9)	5 (19.2)	10 (34.5)		
5 or more symptoms	3 (2.9)	3 (6.4)	0	0		
How many subtypes of stroke are yo	ou aware of?					
None	79 (77.5)	35 (74.5)	22 (84.6)	22 (75.9)		
Ischemic	1 (1.0)	1 (2.1)	0	0	0.12	
Hemorrhagic	3 (19.0)	0	0	3 (10.3)	0.12	
Both ischemic and hemorrhagic	19 (18.6)	11 (23.4)	4 (15.4)	4 (13.8)		
* <i>p</i> -value for diffe	erence in experi	ence of groups, EM	S - emergency medic	cal services		

Table 1 - Baseline characteristics and stroke related knowledge of the EMS personnel by their years of experience.

EMS personnel and acute stroke patients ... Althubaity et al

Parameters		Experience of groups n (%)			
	All n (%)	Group 1 (Up to 2 years)	Group 2 (2.1 to 5.0 years)	Group 3 (>5 years)	P-value*
Number (%)	102	47 (46.1)	26 (25.5)	29 (28.4)	-
Do you use any specific assessme	ent tools to evaluate	stroke patients?			
No	102 (100)	47 (100)	26 (100)	29 (100)	
Yes	0	0	0	0	
What specific questions do you	ask regarding paties	nt history from the	patient or family?		
None	1 (1.0)	1 (2.1)	0	0	
Onset of symptoms	4 (3.9)	2 (4.3)	2 (7.7)	0	
Medications use	5 (4.9)	4 (8.5)	1 (3.8)	0	0.35
Risk factors	7 (6.9)	5 (10.6)	1 (3.8)	1 (3.4)	
All of the above	85 (83.3)	35 (74.5)	22 (84.6)	28 (96.6)	
	* <i>p</i> -value for d	ifference in experie	nce of groups		

Table 2 - On-site assessment of stroke patients by emergency medical services personnel.

Table 3 - The emergency medical services personnel's knowledge of t-PA and dispatch of stroke patients.

	Experience of groups n (%)			
All n (%)	Group 1 (Up to 2 years)	Group 2 (2.1 to 5.0 years)	Group 3 (>5 years)	P-value*
102	47 (46.1)	26 (25.5)	29 (28.4)	-
e taken to?				
100 (98.0)	46 (97.9)	26 (100)	28 (96.6)	
0	0	0	0	0.65
2 (2.0)	1 (2.1)	0	1 (3.4)	
96 (94.1)	45 (95.7)	25 (96.2)	26 (89.7)	0.48
6 (5.9)	2 (4.3)	1 (3.8)	3 (10.3)	
1 administration	, ,			
99 (97.1)	46 (97.9)	26 (100)	27 (93.1)	0.29
3 (2.9)	1 (2.1)	0	2 (6.9)	
	All n (%) 102 <i>te taken to?</i> 100 (98.0) 0 2 (2.0) 96 (94.1) 6 (5.9) A <i>administrationi</i> 99 (97.1) 3 (2.9)	$\begin{array}{c} \text{All} \\ \textbf{n} (\%) & \begin{array}{c} \text{Group 1} \\ (\text{Up to 2 years}) \end{array} \\ \hline 102 & 47 (46.1) \\ \text{in taken to?} \\ 100 (98.0) & 46 (97.9) \\ 0 & 0 \\ 2 (2.0) & 1 (2.1) \\ \hline 96 (94.1) & 45 (95.7) \\ 6 (5.9) & 2 (4.3) \\ \hline \textbf{administration?} \\ 99 (97.1) & 46 (97.9) \\ 3 (2.9) & 1 (2.1) \\ \end{array}$	$\begin{array}{c c} \text{Experience of group} \\ \text{All} \\ \textbf{n} (\%) & \hline \textbf{Group 1} \\ (Up to 2 years) & \hline \textbf{Group 2} \\ (2.1 to 5.0 years) \\ \hline 102 & 47 (46.1) & 26 (25.5) \\ \hline 100 (98.0) & 46 (97.9) & 26 (100) \\ 0 & 0 & 0 \\ 2 (2.0) & 1 (2.1) & 0 \\ \hline 96 (94.1) & 45 (95.7) & 25 (96.2) \\ 6 (5.9) & 2 (4.3) & 1 (3.8) \\ \hline \textbf{A} administration? \\ 99 (97.1) & 46 (97.9) & 26 (100) \\ 3 (2.9) & 1 (2.1) & 0 \\ \hline \end{array}$	All n (%) Group 1 (Up to 2 years) Group 2 (2.1 to 5.0 years) Group 3 (>5 years) 102 47 (46.1) 26 (25.5) 29 (28.4) 100 (98.0) 46 (97.9) 26 (100) 28 (96.6) 0 0 0 0 2 (2.0) 1 (2.1) 0 1 (3.4) 96 (94.1) 45 (95.7) 25 (96.2) 26 (89.7) 6 (5.9) 2 (4.3) 1 (3.8) 3 (10.3) 4 administration? 99 (97.1) 46 (97.9) 26 (100) 27 (93.1) 3 (2.9) 1 (2.1) 0 2 (6.9)

care facility by EMS shortens the arrival time to the hospital, thereby catching up on the time window for thrombolytic therapy. The reason for no female participant in the study was that EMS personnel almost exclusively are men in Saudi Arabia. Assessment of EMS personnel knowledge and awareness of stroke symptoms reveal that most of them are unaware of cardinal stroke symptoms or major subtypes of stroke. This finding is reflective of the weakness in the system. As EMS personnel serve at the front-line, their lack of awareness of cardinal symptoms can delay patients' dispatch within the t-PA therapeutic time window thereby missing the opportunity to reverse the neurological deficit. A large majority of EMS personnel in our study were relatively junior professionals with experience of 1-5 years, and approximately 10% of them had not dealt

with any stroke case. This may explain their inadequate knowledge of stroke symptoms.

Another interesting finding is the annual number of cases that each years of experience subgroup used to deal with. We found that the group with more than 5 years of experience was seeing a higher number of cases, and this difference was statistically significant. Years of experience should not determine the number of annual cases seen unless the more senior personnel attend exclusively to stroke notification, which to our understanding is not the case in Saudi Arabia's EMS. A possible explanation of this finding could be that relatively inexperienced personnel are not confident in their clinical judgment and seek a second opinion from their senior colleagues. We are, however, unable to confirm this matter based on the available data. Therefore, this should be further explored in any subsequent similar studies in the region.

Pre-hospital stroke recognition tools - like the Face Arm Speech Test (FAST), the Cincinnati Pre-Hospital Stroke Scale (CPSS), and the Los Angeles Pre-Hospital Stroke Screen (LAPSS) - have been found to improve diagnostic accuracy in identifying stroke symptoms in adults.¹⁶⁻²⁰ However, in this study we found that the EMS personnel were not using any of these instruments or other equivalents. Regarding t-PA use in stroke, only 6% of EMS personnel knew the role of t-PA with 3% being aware of the time window for its administration. This lack of awareness can have a significant effect in dispatching a patient within the therapeutic time window thereby losing the chance to reverse the neurological deficit. In response to interviewer questions on stroke patient dispatch, the vast majority responded that they would dispatch patients to the nearest hospital. Again, this is of concern, as we know that not all health care facilities in Saudi Arabia have resources to receive and manage stroke cases properly.8

Based on the findings of the current study, inadequate knowledge, and skills of staff can be an important barrier in effective and timely stroke care. Inappropriate practical education, lack of formal guidelines or use of assessment tools, and insufficient opportunities to attend training courses could probably explain the main reasons for this problem in the context of the current study. Greater knowledge of the barriers that impede the widespread adoption of acute stroke thrombolysis is crucial to designing effective educational interventions, and this study would help in explaining some of the pertinent issues to that end. Previously, it has been shown that education and training can improve treatment rates in stroke.¹⁰ However, for educational efforts to be successful, it is critical that the effort is tailored to the targeted populations of providers.^{10,21}

Our study was a cross-sectional survey involving a relatively small proportion of EMS personnel from the Riyadh area. This may be a limitation of the study as the situation might be different in other cities with similar EMS set-up. We used a non-validated survey, and this is another limitation. It is, therefore, recommended that a national survey is carried out to fully understand the situation so that effective treatment can be provided to all stroke patients.

In conclusion, most of the EMS personnel in our study lacked knowledge of cardinal stroke symptoms, t-PA's principal uses, and its therapeutic time window. Training opportunities coupled with the implementation of screening tools and stroke triage, and dispatch protocols are needed for EMS personnel in Riyadh.

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