SciMedCentral

Journal of Neurological Disorders & Stroke

Research Article

# Stroke Code Reliability: First Aid Trader and Emergency Physician Mismatch a Prospective Study

**Domenico Bosco[1]*, Antonietta Fava[2], Maria Ettore[1], Gaetano Gorgone[1], Maria Pantusa[1], Dario Cristiano[1], Antonio Vaccaro[1], Demetrio Messina[1], Pasquale Mungari[3] and Massimiliano Plastino[1]**

[1]*Department of Neuroscience, "S. Giovanni di Dio" Hospital, Italy*
[2]*Department of Clinical and Experimental Medicine, Campus Universitario, loc. Germaneto, University "Magna Graecia", Italy*
[3]*Department of Emergency Medicine, "S. Giovanni di Dio" Hospital, Italy*

***Corresponding author**
Domenico Bosco, Department of Neuroscience, "S. Giovanni di Dio" Hospital, Italy, Tel: 39-0962924241; Fax: 39-0962 924561; Email: nico_bosco@libero.it

**Submitted:** 27 April 2020
**Accepted:** 27 May 2020
**Published:** 28 May 2020
**ISSN:** 2334-2307



**Abstract**

Stroke rapid response (stroke code) teams facilitate the evaluation and treatment of patients with potential stroke. We investigated the accuracy of the pre-hospital diagnosis in triggering the stroke path of an acute cerebrovascular disease (CVA) by emergency medical services. During a period of 12-months we prospectively recorded all consecutive patients for whom a stroke code (SC) has been activated. Discharge diagnosis was classified into CVA and NO-CVA. The protocol is activated by triage nurses or emergency department is identified within 4,5-hours from onset. SC has been activated in 126 cases by "emergency department staff", in 157 cases by emergency ambulance physicians and only in 2 cases by non-neurological unit cares. Stroke was correctly diagnosed in 57% patients. The remaining 43% had a diagnosis classified as "stroke mimics". Stroke patients were significantly more likely diabetics, hypertensive and coronary heart disease affected. The rate of incorrect CVA referrals was higher in emergency ambulance physicians (49%) vs physicians from other emergency department (35,7%). Constant educational programs could be effective for improving diagnostic accuracy of CVA into the emergency care system.

## INTRODUCTION

Stroke is one of the most common acute and severe diseases presenting to an emergency department (ED) [1]. The early assessment and management of stroke patients should reduce morbidity and mortality [1]. Time to treatment is a key factor for achieving a good outcome in patients suffering from acute cerebrovascular accidents (CVAs) [1-3]. Effective communication between the pre-hospital 118-Emergency Medical Services (EMS) and the ED may improve the door-to-needle time [4]. Therefore, EMS should be able not only to identify all potential cases of stroke or Transient Ischemic Attack (TIA), but also to differentiate CVAs from their frequent mimics conditions [5,6]. Other diagnoses, such as metabolic/infectious encephalopathies, seizures, syncope, peripheral neuropathies, space occupying lesions and migraine, may mimic a stroke, as observed in 22 to 31% of patients presenting to the emergency department with stroke like symptoms [6]. On the other hand, unusual clinical presentations look like a non-vascular pathology while it is stroke in reality: the so called "stroke-chameleons" [7]. The first-line medical assessment is usually done in the pre-hospital setting by a paramedic or a physician who is not trained in neurology. Fast assessment of suspected stroke patients to determine eligibility for specific treatments, therefore, remains a critical step. Acute Stroke care implemented with "Stroke Code" (SC) systems is commonly executed to shorten the hospital delay in the ED [8,9]. However, lack of in-hospital stroke code protocol might cause up to 18% of eligible stroke patients not receiving tissue plasminogen activator (tPA) because of an avoidable cause [10]. Overall, implementation of code stroke systems requires considerable logistic and human resources [11].

The main goal of our study was to evaluate the accuracy of a stroke code assignment both by ambulance EMS physicians and by ED physicians when the latter faced patients directly referring to the hospital. We also wanted to describe and quantify the conditions leading more commonly to an incorrect SC activation, seeking to identify targets for quality improvement.

## MATERIALS AND METHODS

Our neurological department with a stroke unit provides inpatient and outpatient neurological care for approximately 170.000 inhabitants of a highly urbanized area (Crotone, Italy). During the study period the hospital profile was solely neuropsychiatric. The patient sample (18 years and holder) included all consecutive acute stroke consults, who were already

admitted as an in-patient at the time of activation. Patients could be referred to the ED by EMS physicians and other specialists from outpatient clinics or non-neurological medical service. They could also report to the ED without any formal referral.

Neurological care in our ED is covered nonstop by a doctor on duty. The annual volume of neurological patients seen in the ED is approximately 4000 and the number of confirmed strokes is approximately 300-350. Patients referred to the hospital with a suspicion of CVA (defined as a new stroke or Transient Ischemic Attacks) were given top priority and immediately qualified for intravenous thrombolysis according to the European License for Alteplase [12].

At the time of the study each emergency ambulance had a physician on board. The ambulance physician was generally a specialist or a trainer in one of the following: anesthesiology and intensive care, internal medicine, surgery, traumatology or pediatrics. In September 2016, the ED started a thrombolysis protocol (code stroke) to guide the evaluation and management of patients suspected of having a stroke. The ED staff and the 118-EMS previously received stroke training by means of periodic training sessions, prior to activating stroke unit department. The prehospital emergency medical service can call the senior neurologist directly on a dedicated phone number on in hospital 24 h/7 days basis. The protocol is activated by triage nurses or ED physicians when a patient with suspected stroke was identified within 4,5 hours from symptoms onset. It is an alerting system to the stroke fellow neurological staff**.** Any hospital physician may activate a stroke code if a stroke is suspected based on the symptoms or examination. Emergency department and EMS staff administer the FAST (FACE-ARM-SPEECH-TIME) scale [13] and the Cincinnati pre-hospital stroke scale [14] to detect focal symptoms due to a possible stroke. However, the suspicion of stroke was always confirmed or denied by the emergency operators (118 operation centre or Emergency Room Doctor) who were the effective activators of the stroke code.

Usually, when a patient with a possible stroke is identified in the ED or an inpatient service at our hospital, the referring physicians or nurse activates the stroke team, regardless the time of onset of symptoms. After answering the call, the stroke team's responder establishes whether the symptoms are consistent with a possible cerebrovascular event and if so, how urgently the patient will be seen. Patients are seen immediately (as a stroke code) if they enter within the time window for standard intravenous thrombolysis, or are suitable for endovascular or another acute intervention. Patients with suspected stroke who did not fall within the "therapeutic window", however, were subjected to neurological evaluation, but for them stroke team activation was not foreseen. The SC activities include establishment of an iv line, immediate blood testing (complete blood counts, biochemistries, serum glucose, prothrombin, and activated partial thromboplastin times), 12-lead electrocardiography and non-contrast head Computed Tomography (CT). Computed tomography angiography or Magnetic Resonance Imaging (MRI) is performed only in selected cases. A nurse practitioner on the acute stroke team is responsible for the administration of the National Institutes of Health Stroke Scale (NIHSS) and assessment of the eligibility for iv tPA treatment. An on -call neurologist has to examine each patient in person before the decision to administer thrombolytic therapy. On the basis of our local procedure of stroke management, CT-angiography is performed in patients with NIHSS-score >7 and in those in which a posterior flow insufficiency is suspected. Brain-MRI include diffusion-weighted imaging, FLAIR and gradient echo sequences associated with a cerebral tri-di-mensional time-of-flight magnetic resonance angiography. MRI imaging is performed on 1,5T MRI systems (Magnetom Avanto, Siemens or Aerea, Siemens). The following clinical data were collected by the neurovascular team: patients characteristics, including demographics data, past medical history and treatment, co morbidity conditions treatments and final discharge diagnosis.

The final discharge diagnosis was concluded either immediately after both neurological examination and cerebrovascular neuroimaging or after other relevant investigations.

### Study design

During a 12-month period (September 2016-October 2017) we prospectively registered all consecutive patients for whom a code stroke has been activated. We classified the discharge diagnosis into CVA and into non-CVA (or stroke mimics). Ischemic stroke, TIA, intracranial hemorrhage, cerebral venous thrombosis and neurovascular medullar diseases were classified as cerebrovascular disease. Acute stroke was defined as a rapid onset of focal neurological deficits, lasting longer than 24 hours, with no different cause other than vascular origin [2]. A stroke mimic was suspected when the clinical details did not indicate a vascular etiology, and an alternative diagnosis was established. Data about referrals were prospectively collected on a daily using a predefined questionnaire. The study was conducted in concordance with the Declaration of Helsinki. Due to its observational design, we did not obtain patients' written consent for participation.

### Statistical analysis

Median values and interquartile ranges of the time intervals were used for descriptive statistics because of their non-normal distributions. While making comparisons, we used $X^2$ or Fischer exact test for categorical variables and $t$ test or the Wilcoxon rank-sum test for continuous or ordinal measures. A value of $p < 0.05$ (two sided) was considered statistically significant. A forced entry logistic regression was done to identify independent factors associated with a stroke mimic, and odds ratios (ORs) were calculated using stroke mimic (yes/no) as the dependent variable and the variables that were significant in the univariate model ($p < 0.05$) as the covariates. Variables that were not available for at least 70% of the sample were excluded from the analysis.

## RESULTS

During the 12-month study period, 285 patients were prospectively accrued to this study through the SC protocol. SC has been activated in 126 cases by ED-staff (EDs), in 157 cases by emergency ambulance physicians and only in 2 cases by non-neurological unit cares**.** Stroke was diagnosed in 162 (57%) patients; 138 (48,5%) had ischemic stroke or TIA, while 24

(8,4%) patients had hemorrhagic stroke. The remaining 43% had a descriptive diagnosis classified as "stroke mimics" (See Table 1). For all patients, the median NIHSS score was 10 (range 0-42). Forty-eight (48/123; 39%) of the stroke-mimics had NIHSS <7 compared to 52% of stroke patients; this difference was significant ($p$ = .002). Hundred-thirty-nine (139/285; 48.7%) patients were considered sub therapeutic on anticoagulation; 56,8% patients were never on antiplatelet or anticoagulation; these difference was not significant between the two groups. Comparison between CVA and NCVA group showed some significant demographic and clinical differences (Table 1). In addition, 123 patients referred as non-CVA, regardless of whether have been evaluated by EDs or EMS, including psychiatric disorders (12/123; 9.7%), migraine with aura (6/123; 4.8%), peripheral vertigo (17/123; 13.8%), dementia (5/123; 4%), brain tumor (5/123; 4%), seizures (20/123; 16%), metabolic disturbances (26/123; 21%), syncope (20/123; 16%), iatrogenic altered mental status (8/123; 6,5%), infection (5/123; 4%) and other diseases (6/123; 4,8 %). Discharge diagnosis of the uncorrected diagnoses and of the stroke types are detailed in Tables 2A and 2B. The rate of incorrect CVA referrals was higher between emergency ambulances physicians (EAP) (78/155 or 49%; 95% CI 46-54) and physicians from other EDs (45/126 or 35,7%; 95% CI 28-42) ($p$ = .002). We went to analyze the patients subgroups in relation to the healthcare provider who activated the stroke call; patients of EMS group was older and had a median age of 76 years and were predominantly female. Patients incorrectly referred by EMS more frequently had cardiovascular disease, peripheral vertigo and metabolic disturbances in comparison to patients referred by EDs or other outpatient specialists. Concerning the symptoms, motor deficit, facial palsy and head and gaze deviation were more represented in the patients evaluated by EDs; whereas headache, confusion and sensory illness were significantly more frequent in patients evaluated by ambulance physicians (Table 2A). In the logistic regression, demographic factors (age and sex), symptoms acuity (code stroke) and past diagnoses (paroxysmal peripheral vertigo, cardiologic disorders, metabolic disease), symptoms of onset (headache, altered mental status and sensitivity deficit) were more often associated with an uncorrected diagnosis (Table 3). In was observed that increased higher risk of uncorrected diagnoses in EMS group was associated with sensitivity illness (ORs = 4,6); while headache and altered state of consciousness showed a moderate increase in the ORs (respectively ORs = 2,15 and ORs = 2,24).

Ninety-two of 162 (56,7%) patients with ischemic stroke or TIA were submitted to CT angiography, while MRI was carried on in 19% selected cases. In addition, 14 patients (12%) in the Non-CVA group underwent CT-angiography. Of all the CVA patients studied (n= 162), 49 (30%) patients were eligible for thrombolytic therapy based on the current European License for Alteplase[13] within 4,5 hours of onset.[15] For patients treated with IV tPA, 33% achieved a modified Rankin scale of 0 or 1 at 3 months and 6% suffered a symptomatic intracerebral hemorrhage. Eighteen cases reported an intracranial large vessel occlusion and in twelve patients was performed an endovascular procedure, while in six cases the procedure was not applicable.

**Table 1:** Characteristics of patients with cerebrovascular disease (CVA) and with non-cerebrovascular disease or stroke mimics. Table 1: Main clinical and metabolic features in CVA and Non-CVA groups. Values are expressed as mean (SD) unless otherwise indicated. Figures in parentheses are percentages. P-value of .05 was considered statistically significant.

| | CVA | NCVA | *P* |
|---|---|---|---|
| **N°** | 162 | 123 | |
| **Mean age (y):** mean ± SD | 78 ± 14.3 | 65 ± 13.2 | 0.05 |
| **Women: n°; (%)** | 107 (66) | 74 (60) | 0.01 |
| **Time of onset symptoms:** mean ± SD (hours) | 3.2 ± 1.5 | 3.6 ± 1.8 | NS |
| **NIHSS (< 7): n°; (%)** | 85 (52) | 48 (39) | 0.002 |
| **Diabetes Mellitus: n°; (%)** | 46 (28) | 28 (22) | 0.02 |
| **Hypertension: n°; (%)** | 106 (65) | 62 (50) | 0.01 |
| **BMI:** mean ± SD | 24.2 ± 2.8 | 23.8 ± 2.8 | NS |
| **Hypercholesterolemia: n°; (%)** | 69 (42) | 50 (40,6) | NS |
| **Coronary Heart Disease: n°; (%)** | 28 (17) | 3 (2.4) | 0.001 |
| **Atrial Fibrillation: n°; (%)** | 36 (22) | 19 (15.4) | NS |
| **Smoking Use: n°; (%)** | 6 (4.2) | 4 (3.3) | NS. |
| **Migraine: n°; (%)** | 29 (18) | 24 (19) | NS |
| **Epilepsy: n°; (%)** | 7 (4.3) | 8 (6) | NS |
| **History of psychiatric disease; n°; (%)** | 15 (9) | 14 (11) | NS |
| **Family history of cerebrovascular disease: n°; (%)** | 27 (16.6) | 21 (17) | NS |
| **Medication use: n°; (%):** | | | |
| - ant platelet | 64 (39) | 48 (39) | NS |
| - anticoagulation | 16 (9.8) | 11 (8.9) | NS |
| - none | 80 (50.6) | 64 (59) | NS |

NS: Not significant; CVA: acute cerebrovascular accidents; NCVA: Non-CVA; NIHSS: National Institutes of Health Stroke Scale; BMI: Body Max Index

## DISCUSSION

An efficient stroke alerting system is an advancement in constant evolution; however, determining a stroke vs a stroke mimic could be difficult. During a 1-year period, 285 patients were enrolled prospectively in our stroke care pathway by "stroke code" protocol. In several studies, the rate of incorrect diagnoses is comprised between 14,6% and 38% cases [7-16,17]. The prevalence of stroke "mimics" in our study was higher (43%) to that described in previous studies; however, in detail incorrect diagnoses was found in 35,7%, this rate was similar to the literature data [6-16,17]. when they were only recorded by EDs while rate erroneous diagnoses was significantly higher (49%) when patients were evaluated by EMS. The type of non-

CVA diagnoses was similar to earlier reports associating with diabetes mellitus, cardiovascular disorders and hypertension [6-7,18]. Contrary, in our study patients with migraine with aura, obesity, hyperlipidemia and iatrogenic confusing state were poorly represented. The effect from this literature only confirm that diagnostic accuracy of stroke is lower among subgroups with non-specific or transient symptoms and with past-medical history of epilepsy, migraine or psychiatric disturbance [19]. The most significant predictors for stroke diagnosis were subjective complaint of a weak hand, objective hemiparesis, a normal mental status, atrial fibrillation, previous stroke history, and obesity [7]. On the contrary, when a consultation was called for altered mental status, it was most likely a stroke mimic [20]. Merino et al. [7] suggested that a low rate of stroke mimics is due to the fact that the stroke team is not calling for all potential strokes, whereas a higher rate is linked to the reflection that all patients with neurological symptoms may have a stroke. To our knowledge this study is the first to explore the correctness of the diagnosis after activation of the SC system. Several patients characteristics that the referring physician can ascertain before calling the "stroke team" were associated with increased odds of having uncorrected stroke diagnosis, including demographic information (age and female sex), presenting symptoms as headache, altered state of consciousness and sensibility illness. Recognizing patient characteristics that predict a stroke mimic may be useful when designing research studies that rely on pre-hospital evaluation and telephone triage in potential stroke [21]. In fact, one may argue that the high uncorrected diagnosis rate in our study could be linked to the selection of the patients, which was done according to the data composed by pre-hospital health professionals who are not systematically qualified in the emergency clinical pathways [19]. Using pre-hospital stroke scales (FAST or Cincinnati score) in pre-hospital selection can be helpful to identify neurovascular disorders [22]. Cincinnati and FAST scale are supporting scales mainly used in the pre-hospital identification of patients with suspected stroke (by telephone or in the emergency room). However, the suspicion of stroke was always confirmed or denied by the emergency operators (118 operation centre or emergency room doctor) who were the effective activators of the stroke. According with Goldstein et al. [23] the presence of facial palsy, arm drift, or abnormal speech improved the probability of stroke. In our population, the most frequent factors associated with correct diagnosis were, respectively, the presence of motor deficit, facial palsy, head and gaze deviation. The opportunity to carry out a pre-hospital screening as correct as possible is a critical necessity, thus ensuring appropriate optimization of resources. Cerebral MRI in first intention could be of special interest in patients with acute neurological symptoms to improve diagnoses of CVA [16]. However, MRI may not be available on a 24 h/7 days' basis in all centers, so the diagnosis is mostly based on history and physical examination. In our population MRI of the brain was available only in 19% of the patients to confirm stroke.

Misdiagnosis contributes to medical malpractice in ED and patient harm [24]. The underlying reasons included inadequate history and physical examination, failure to order and correctly evaluate tests, and failure to obtain a consultation [24]. The frequency of misdiagnosis in patients who did not have a neurological consultation is unknown. Moulin et al., tried to

**Table 2:** Clinical characteristic in patients subgroups in relation to healthcare provider who activated the stroke call. Values are expressed as mean (SD) unless otherwise indicated. Figures in parentheses are percentages. P-value of .05 was considered statistically significant.

| **Table 2 A** | **EDs** | **EMS** | ***P*** |
|---|---|---|---|
| **N°** | 126 | 157 | |
| **Mean age (y) SD** | 64 ± 10.6 | 76 ± 10.2 | 0.01 |
| **Women; n°, (%)** | 69 (54.7) | 102 (65) | 0.0001 |
| **Stroke mimics; n°, (%)** | 45 (35,7) | 78 (49) | 0.02 |
| -migraine with aura | | | |
| - peripheral vertigo | 1 (0.8) | 5 (3) | NS |
| - seizures | 3 (2.3) | 14 (8.9) | 0.03 |
| - dementia | 10 (7.9) | 10 (6.4) | NS |
| - cardiologic disorders (syncope) | 2 (1.6) | 3 (1.9) | NS |
| - brain tumor | 6 (4.7) | 14 (8.9) | 0.02 |
| - toxic/iatrogen etiology | 3 (2.3) | 1 (0.63) | NS |
| - psychiatric disorders | 3 (2.3) | 5 (3) | NS |
| - infection | 5 (3.9) | 7 (4.4) | NS |
| - metabolic disorders | 2 (1.6) | 3 (1.9) | NS |
| - others non neurological disorders | 7 (5.5) | 15 (9.5) | 0.03 |
| | 3 (2.3) | 3 (1.9) | NS |
| **NIHSS (< 7) n°; (%)** | 46 (36) | 49 (31) | NS |
| **Onset symptoms** | | | |
| -headaches | 40 (31.7) | 78 (49.6) | 0.002 |
| - vertigo | 36 (28) | 54 (34) | NS |
| - facial palsy | 68 (53) | 64 (40) | 0.02 |
| - hemianopsia | 22 (17) | 24 (15) | NS |
| - head and gaze deviation | 28 (22) | 12 (7.6) | 0.002 |
| - bilateral visual deficit | 22 (17) | 28 (18) | NS |
| - altered state of consciousness | 9 (7) | 23 (14.7) | 0.04 |
| - neuro-psycological disorders | 9 (7.1) | 12 (7.6) | .NS |
| - sensitivity deficit | 52 (41) | 84 (53) | ,04 |
| - motor deficit | 58 (46) | 48 (30) | 0.007 |
| -upper limb ataxia | 22 (17) | 28 (18) | NS |
| - weakness | 62 (49) | 78 (50) | NS |
| **Table 2B** | **EDs** | **EMS** | ***P*** |
| **Stroke type**<br>- Ischemic stroke<br>- Hemorrhagic stroke<br>- Transient ischemic attack | <br>59 (46.8)*<br>10 (7.9)<br>12 (9.5) | <br>54 (34.6)<br>14 (8.9)<br>11 (7) | <br>.04<br>NS<br>NS |

NS: not significant; EDs: Emergency Department Staff. EMS: Emergency Medical Service *Three patients were excluded because ischemic stroke occurred during hospitalization in non-neurological department.

**Table 3**: Logistic regression including factors that were significant in the univariate analysis for entire sample and by location where the patient was initially identified. P-value of .05 was considered statistically significant.

| Variable | All OR (95% CI) | *P* | EDs OR (95% CI) | *P* | EMS OR (95% CI) | *P* |
|---|---|---|---|---|---|---|
| **Age < 70 years** | 0.86 (0.72-1.1) | NS | 1.04 (0.83-1.28) | NS | 0.66 (0.45-1.2) | .05 |
| **Women** | 1.6 (1.35-1.92) | .001 | 1.44 (1.23-1.78) | .002 | 1.48 (0.92-1.65) | .002 |
| **Code Stroke** | 1.55 (1.07-1.46) | NS | 1.20 (0.99-1.44) | NS | 1.75 (1.18-2.58) | .05 |
| **Peripheral Vertigo** | 1.54 (0.67-1.94) | .05 | 0.91 (0.48-1.72) | NS | 3.43 (0.97-6.3) | .05 |
| **Metabolic disorders** | 1.61 (0.81-2.12) | .05 | 0.98 (0.86-1.94) | NS | 2.16 (1.25-3.1) | .04 |
| **Cardiologic disorders** | 2.42 (2.2-3.91) | .001 | 1.96 (1.72-2.4) | .05 | 2.36 (0.96-3.96) | .001 |
| **Headache** | 1.16 (0.8-1.45) | NS | 0.89 (0.66-1.2) | NS | 2.15 (1.42-3.8) | .004 |
| **Sensitivity Illness** | 1.34 (0.62-1.92) | .05 | 1.24 (0.89-1.62) | NS | 4.68 (2.34-9.1) | .02 |
| **Facial Palsy** | 1.50 (1.02-1.93) | .04 | 1.38 (0.92-1.58) | .02 | 0.97 (0.64-1.47) | NS |
| **Head and Gaze deviation** | 1.6 (0.92-2.72) | .03 | 1.66 (1.05-2.1) | .04 | 0.98 (0.78-2.4) | NS |
| **Motor deficit** | 1.82 (1.2-2.3) | .02 | 4.26 (2.2-6.8) | .002 | 1.61 (0.98-2.4) | NS |
| **Altered State of Consciousness** | 1.86 (0.82-2.21) | .02 | 1.36 (0.72-1.56) | NS | 2.24 (1.72-3.1) | .02 |
| **NIHSS (< 7)** | 15 (0.68-2.12) | .05 | 1.26 (1.18-1.82) | NS | 1.36 (0.72-2.2) | NS |

NS: not significant; EDs: Primary Care Physicians. EMS: Emergency Ambulance Physicians

assess the impact of neurology consultants on the outcome of 1679 patients in a ED [25]. Neurological consultations were obtained in 14,7% of all patients. They found that there was a complete change in diagnosis in 52% of cases. Two other studies did not compare emergency physicians *vs* neurologist diagnoses, as categorize the types of department neurological emergencies. Diagnosis in patients with neurological emergencies is thick imperfect. Patients with dizziness, vertigo, headache, and seizure are the most common sources for these mistakes [26-27]. The most common causes of misdiagnosis in our study were knowledge gaps, resulting from instruction deficits about the conditions that were evaluated. A review of malpractice claims found that residents were involved in 56% of the cases and that in 75% of these cases, trainees had the highest contributory rate of any personnel involved [27]. Less than 20% of emergency medicine residencies require a neurology rotation [28]. In our hospital_stroke route, we have incorporate periodic instruction courses for health professionals; new organizational models have been projected consist of periodicals and short periods of training of physicians ambulance in our stroke unit. Further, improved access supportive sophisticate diagnostic tests (i.e. MRI), real time neurology consultation and communicative clearly with patients and other physicians who will be seeing them in follow-up. Our study has some limitations: first, the small sample. Second, in our population, the high number of patients with symptoms and signs suggesting a brain stem lesion, such as vertigo, bilateral visual dysfunction, and lower limb ataxia, could have underestimated the correctness of the diagnoses, because these features were also observed in peripheral vestibular disorder (a common stroke mimic) and, in any case these were equally represented in both groups. In fact, vertebra-basilar stroke/TIA is a common misses diagnose; this is consistent with existing literature that describes the high miss rate of this diagnosis and the difficulty clinical face when making this diagnose [29].

## CONCLUSION

Because stroke is a clinical diagnosis, these data reinforce the need for neurologist, or stroke physician with adequate neurological training, to be involved in the assessment of patients with brain attack; in fact, the mission of our study to promote new organizational models aimed to optimizing resources, improve number of patients recognizing stroke symptoms by the information of the public and provide appropriate training to pre-hospital and emergency personnel. In any case, further studies in larger samples are needed to confirm these data, especially to evaluate the different accuracy diagnostic by pre-hospital screening.

## REFERENCES

1. Jauch EC, Saver JL, Adams HP, Bruno A, Connors BJJ, Demaerschalk BM, et al. American Heart Association Stroke Council; Council on cardiovascular Nursing; Council on Peripheral Vascular Disease; Council on Clinical Cardiology. Guidelines for the early management of patients with acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke. 2013; 44: 870-947.
2. European Stroke Organization Guidelines.
3. Mikulík R, Kadlecová P, Czlonkowska A, Kobayashi A, Brozman M, Svigelj V, et al. Safe Implementation of Treatments in Stroke-East Registry (SITS-EASY). Factors influencing in-hospital delay in treatment with intravenous thrombolysis. Stroke. 2012; 43: 1578-1583.

4. Meretoja A, Strbian D, Mustanoja S, Tatlisumak T, Lindsberg PJ, Kaste M, et al. Reducing in-hospital delay to 20 minutes in stroke thrombolysis. Neurology. 2012; 79: 306-13.

5. Pope JV, Edlow J. Avoiding misdiagnosis in patients with neurological emergencies. Emerg Med Intern. 2012; 2012: 949275.

6. Hand PJ, Kwan RI, Lindley M, Lindley RI, Dennis MS, Wardlaw JM, et al. Distinguishing between stroke and mimic at the bedside: the brain attack study. Stroke. 2006; 37: 769-75.

7. Merino JG, Luby M, Benson RT, Davis LA, Hsia AW, Latour LL, et al. Predictors of acute stroke mimics in 8187 patients reefed to a stroke service. J Stroke cerebrovascular Dis. 2013; 22: 397-403.

8. Gomez CR, Malkoff MD, Sauer CM. Code stroke. An attempt to shorten in hospital therapeutic delays. Stroke. 1994; 25:1920-1923.

9. Dalloz MA, Bottin L, Muresan IP, Favrole P , Foulon S , Levy P, et al. Thrombolysis rate and impact of a stroke code: a French hospital experience and a systematic review. J Neurol Sci. 2012; 314: 120-125.

10. Cocho D, Belvís R, Martí-Fàbregas J, Molina-Porcel L, Díaz-Manera J, Aleu A, et al. Reasons for exclusion from thrombolytic therapy following acute ischemic stroke. Neurology. 2005; 64: 719-720.

11. Leira EC, Ahmed A. Development of an emergency department response to acute stroke ("Code Stroke") Curr Neurol Neurosci Rep. 2009; 9: 35-40.

12. Actilyse. The European Medicines Agency (EMEA).

13. Harbison J, Hossain O, Jenkinson D. Diagnostic accuracy of stroke referrals from primary care, emergency room physicians, and ambulance staff using the face arm speech test Stroke. 2003; 34: 71-76.

14. Kothari RU, Pancioli A, Liu T, Brott T, Broderick J. Cincinnati prehospital stroke scale: reproducibility and validity. Ann Emerg Med. 1999; 33: 373-378.

15. Lees KR, Bluhmki E, Von Kummer R, Brott TG, Toni D, Grotta JC, et al. Time of treatment with intravenous Alteplase and outcome in stroke: an update pooled analysis of ECASS, ATLANTIS, NINDS, and EPITHET trials. The Lancet. 2010; 375: 1695-1703.

16. Hemmen TM, Meyer BC, McClean TL, Lyden PD. identification of Nonischemic stroke mimics among 411 code strokes at the University of California, san Diego, Stroke center. J Stroke Cerebrovasc Dis. 2008; 17: 418-422.

17. Quenardelle V, Lauer-Ober V, Zinchenko I, Bataillard M, Rouyer O, Beaujeux R, et al. Stroke mimics in a stroke care pathway based on MRI screening. Cerebrovascular Dis. 2016; 42: 205-212.

18. Sheng Feng Sung, Mei-Chiun Tseng. Code stroke: a mismatch between number of activation and number of thrombolysis. J of the Formosan Medical Association. 2014; 113: 442-446.

19. Newman-Toker DE, Robinson KA, Edlow JA. Frontline misdiagnosis of cerebrovascular events in the era modern neuroimaging: a systematic review. Ann Neurol. 2008; 64: 17-18.

20. Libman RB, Wirkowski E, Alvir J, Rao TH . Conditions that mimic stroke in the emergency department. Implications for acute stroke trials. Archivies of Neurology. 1995; 55: 1119-1122.

21. Sanossian N, Starkman S, Liebeskind DS, Ali LK, Restrepo L, Hamilton S, et al. Simultaneous ring voile- over- internet phone system enables rapid physician elicitation of explicit informed consent in pre-hospital stroke treatment trials. Cerebrovasc Dis. 2009; 28: 539-544.

22. Kothari R, Hall K, Brott T, Broderick J. Early stroke recognition developing an out-of-hospital NIH Stroke Scale. Academic Emergency Medicine: official journal of the society for Academic Emergency Medicine. 1997; 4: 986-990.

23. Goldstein LB, Simel DL. Is this patient having a stroke? JAMA. 2005; 293: 2391-2402.

24. Kachalia A, Gandhi TK, Puopolo AL, Yoon C, Thomas EJ, Griffey R, et al. Missed and delayed diagnoses in emergency department: a study of closed malpractice claims from four liability insurers. Academic Emergency Medicine. 2007; 49: 196-205.

25. Moulin T, Sablot D, Vidry E, Belahsen F, Berger E, Lemounaud P, et al. Impact of emergency room neurologist on patient management and outcome. Eur Neurol. 2003; 50: 207-214.

26. Hansen CK, Fisher J, Joyce N, Edlow JA. Emergency department of consultations for patients with neurological emergencies. Eur J Neurol. 2011; 18: 1317-1322.

27. Rizos T, Juttler E, Sykora M. Common disorders in the neurological emergency room-experience at a tertiary care hospital. European Journal of Neurology. 2011; 18: 430-435.

28. Stettler BA, Jauch EC, Kissela B, Lindsell CJ. Neurologic education in emergency medicine training programs Academic Emergency Medicine. 2005; 12: 909-911.

29. Edlow JA, Toker DE, Savitz S. Diagnosis and management of cerebellar infarction. Lancet Neurol. 2008; 7: 951-964.

**Cite this article**

*Bosco D, Fava A, Ettore M, Gorgone G, Pantusa M, et al. (2020) Stroke Code Reliability: First Aid Trader and Emergency Physician Mismatch a Prospective Study. J Neurol Disord Stroke 7(2): 1159.*