

PROFILE OF PRACTICES AND KNOWLEDGE ON STROKE AMONG POLISH EMERGENCY MEDICAL SERVICE STAFF

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ABSTRACT

BACKGROUND: Stroke is a leading cause of disability and death in both developed and developing countries. While hemorrhagic stroke often necessitates immediate neurosurgical intervention, ischemic stroke is treated with reperfusion therapies such as thrombolysis with intravenous recombinant tissue plasminogen activator (IV rtPA) and early endovascular thrombectomy for broad vessel occlusions.

OBJECTIVES: Early diagnoses, accurate emergency medical services (EMS) dispatch, rapid EMS transfer, and stroke team activation have helped reduce door-to-IV tPA time and continue to be critical in saving time for stroke patients' treatment.

MATERIAL AND METHODS: One reason for prehospital delays may be incorrect qualification by emergency team members due to incomplete medical records and incorrect evaluation of symptoms by dispatchers or paramedics. The dispatcher's precise identification of the report helps them decide on the patient's priority disposal of the ambulance. In comparison, a correct initial diagnosis by paramedics allows the patient to be transported immediately to the destination hospital, i.e., the unit with a stroke unit. Extending the time it takes for the patient to enter the stroke facility due to the patient being moved through stages reduces the probability of successful treatment being introduced significantly.

RESULTS: We hypothesized that paramedics' knowledge of prehospital stroke management protocols would be linked to their clinical experience as well as their stroke preparation.

CONCLUSION: A secondary goal of this study was to evaluate and compare the theoretical knowledge on stroke management among paramedics and identify factors associated with high knowledge. 468 EMS providers agreed to complete a questionnaire that included demographic questions, practical experience questions, and 14 theoretical information questions. Our research found that paramedics in Poland have significant awareness gaps in existing stroke treatment guidelines.

KEY WORDS: prehospital care, stroke, EMS, questionnaire, paramedics

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INTRODUCTION

Stroke is a significant cause of disability and mortality in developed and developing countries [1]. About 80–90% of cerebrovascular incidents are caused by ischemic stroke [2], which the most critical etiologies

include large artery atherosclerosis (macroangiopathy), cardioembolism, and small-vessel cerebral disorder (microangiopathy).

So although hemorrhagic stroke frequently needs immediate neurosurgical intervention, ischemic

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stroke is treated with reperfusion therapies such as thrombolysis with intravenous recombinant tissue plasminogen activator (IV rtPA) and early endovascular thrombectomy for large vessel occlusions. Both methods are intended to recanalize the obstructed artery efficiently, preserve normal blood supply and, as a result, reperfuse brain tissue. Therefore, the central aspect preventing the usage of both thrombolytic treatment and mechanical thrombectomy in ischemic stroke is that both forms of therapy have a brief utilization period.

Early identification, accurate emergency medical services (EMS) dispatch, quick EMS transfer, and stroke team activation have helped to minimize door-to-IV tPA time and remain vital in saving time for the care of stroke patients [3].

Until 2021, the recommended treatment window was limited to 4.5 h for intravenous alteplase and 6–24 h for thrombectomy. Recent experiments have expanded these windows to patients chosen by imaging and have modified the definition from a set to an individual treatment window [4].

Additionally, as the time between the onset of stroke symptoms and the start of treatment increases, cerebral thrombolysis's effectiveness decreases. In mechanical thrombectomy, its drawbacks are the high cost of therapy and the probability of conducting it only in highly specialized facilities and a similarly restricted time window. Unfortunately, in 44 European countries, stroke authorities reported that only 7.3 percent of ischemic stroke cases underwent intravenous thrombolysis (95% CI 5.4–9.1), and 1.9% underwent endovascular therapy [5]. Therefore, the earliest possible completion of therapy and the prevention of undue delays remain a crucial component of clinical success in the stroke's acute phase.

Symptom detection by medical staff

One explanation for the incidence of prehospital delays may be incorrect qualification by emergency team personnel, resulting from inaccurate medical records and inaccurate diagnosis of symptoms by dispatchers or paramedics. The dispatcher's specific identification of the report allows deciding on the patient's priority disposal of the ambulance. In contrast, paramedics' proper initial diagnosis allows the patient to be transported directly to the destination facility, i.e. the unit with a stroke unit. Extending the time, it takes for the patient to reach the stroke facility, resulting from the patient being transferred

across stages, dramatically decreases the likelihood of successful treatment being introduced.

To ensure proper prehospital treatment of suspected brain stroke and transportation to a specialist stroke unit, the Ministry of Health, in collaboration with State consultants in neurology and emergency medicine, issued guidelines on January 24th, 2019 — the so-called „Good praxis in treating patients with suspected brain stroke for medical dispatchers and EMS teams“.

MATERIAL AND METHODS

Study design

The study was approved by the Institutional Review Board of the Polish Society of Disaster Medicine (approval No. 10.10.2020.IRB).

The questionnaire was developed using NB and ŁSz clinical expertise and was validated in a pilot study conducted in December 2020 in Warsaw, Poland. The comments of the participating EMS members were used to improve the wording of some items in the questionnaire and eliminate redundant questions. The pilot study also allowed to determine the time needed to complete the questionnaire.

The final version of the survey asked EMS providers about demographics, their practices — methods to identify stroke, ambulance management, the information they provide for prenotification, how often they prenotify hospital EDs of an incoming suspected stroke patient, and knowledge questions — such as the time windows for IV tPA administration and mechanical thrombectomy, stroke symptoms, and mimics.

The questionnaire consisted of both closed-ended and open-ended questions, using a combination of Likert scales, single- and multiple-choice questions, and free text fields to enable the collection of both qualitative and quantitative data. Participants were scored based on several correct answers. A scoring system was devised, with each correct answer earning one point and no negative marking. Every participant has graded a total score (0 being the lowest and 14 being the highest possible score).

Recruitment

A web link to the survey was sent by e-mail to members of the Polish Society of Disaster Medicine and the promotion of the survey on social media. The

survey was open for six weeks between January 1st, 2021, and February 15th, 2021.

STATISTICAL ANALYSIS

Statistical analysis was performed with the Statistical Package for Social Science (SPSS) version 27.0 software (SPSS, Inc., Chicago, IL, USA). We classified participants into less experienced (up to 10 years of professional experience) and more experienced (10 and more years of professional experience). Descriptive statistics were used to summarize the baseline characteristics of each group. Demographics were categorized by gender, years of experience, workplace, monthly duties, and the number of interventions in stroke patients per month.

Descriptive statistics were used to describe survey responses. Frequencies and proportions were used to describe categorical variables. Responses to open-ended questions were grouped and described using frequencies and proportions.

RESULTS

Demographics, professional experience

A total of 468 EMS providers completed the survey. Of the participants, 239 (51%) were less experienced EMS providers, and 229 (49%) were more experienced. The mean age of the participants was 34 (SD = 7.33) years, and 402 (86%) participants were men, which corresponds to the male predominance in the profession. The majority of participants reported previous attendance to stroke workshops/courses (55%) and performed less than 5 stroke patient interventions per month (64%). Most of the responders work in the ambulance services and have less than 15 duties per month (60%). Demographic and descriptive information are summarized in Table 1.

Confidence level regarding interventions

Regarding confidence level, only 30% of the respondents reported that they felt very confident (value = 5) in their ability to recognize an adult patient in stroke. Table 2 summarizes confidence levels compared to the other neurological conditions.

Practices

Prenotification practice

According to the American Heart Association/American Stroke Association (AHA/ASA) guidelines [6], the

Table 1. Demographic and descriptive information

		n (%)
Gender	male	402 (86%)
	female	66 (14%)
Stroke patient interventions per month	less than 5	300 (64%)
	5 and more	168 (36%)
Has attended workshops/courses on stroke patient management	yes	258 (55%)
	no	210 (45%)
Years of professional experience	11–15 years	126 (27%)
	1–5 years	120 (26%)
	6–10 years	102 (22%)
	more than 15 years	90 (19%)
	less than one year	30 (6.4%)
Workplace	ambulance services	432 (92%)
	other	18 (3.8%)
	ED	18 (3.8%)
Monthly duties	less than 15	282 (60%)
	15 and more	186 (40%)

Table 2. Confidence levels regarding interventions

Confidence	mean (SD)	n
Unconscious patient	4.10 (0.633)	468
Stroke patient	4.25 (0.545)	468
Patient with traumatic brain injury	3.91 (0.629)	468
Patient with epilepsy	4.32 (0.631)	468

SD — Standard Deviation

duty physician, a neurologist of the required facility to whom the patient is delivered, should be told by telephone by the EMS or dispatcher about the patient's age, health diagnosis and symptoms, time of disease, and expected delivery time (prenotification).

Ideally, the EMS can send these details directly to the neurologist on duty as it enables having the most detailed patient records possible at the pre-hospital level.

Prenotification allows pre-registration of patient details in the goal hospital's database system.

These procedures significantly decrease the duration of early hospital administration for a patient with ischemic stroke, allowing the patient to be planned for admission (the so-called stroke alert) and the stroke unit practitioner to schedule advance access to hospital identification, laboratory, and brain imaging test instructions, as well as Ac-

cess to electronically accessible hospital and outpatient medical history. Only 63% of participants who prenotify hospital staff includes all the necessary information listed in the guidelines.

Stroke assessment scales

FAST was the most commonly used stroke assessment tool and is currently supported by national recommendations. Sensitivities for FAST ranged from 0.64 to 0.97 in four trials, with a summary estimated sensitivity of 0.86, according to a new Systematic Review reviewing the accuracy of clinical instruments for acute stroke assessment [7].

Management of hypoglycemia

According to AHA/ASA and European Stroke Organisation (ESO) [6,8], since symptoms of hypoglycemia can resemble those of a stroke, blood glucose should be tested in any patient with a suspected stroke. Hypoglycemia (defined as blood glucose < 60 mg/dL) should be treated in patients with acute ischemic stroke with glucose 20–40% in 25–50 ml infusion [9]. 76.3% of surveyed participants did not know the current recommendations — the most common mistake was the correction of hyperglycemia during ambulance transfer.

Management of hypertension

AHA/ASA and ESO guidelines for prehospital management of stroke highlight that also with systolic blood pressure near 185 mmHg, which can increase door to needle time, paramedics' immediate prehospital antihypertensive care presents a risk of unexpected decreases in blood pressure; thus, elevated blood pressure care in the prehospital period should be avoided. Almost 80% of paramedics could not provide an answer in line with current guidelines — with decreasing hypertension in the prehospital level being the most common mistake.

Knowledge

Respondents performed well on questions testing general knowledge of stroke — etiology, risk factors, pathophysiology, symptoms, types, components of the FAST scale. They also knew the differences between types of facilities that hospitalize stroke patients. An unsatisfactory percentage of respondents gave correct answers to topics related to stroke mimics, time windows for thrombolytic treatment and thrombectomy, and different stages of the survival chain.

Table 3. Summary of practices regarding prehospital management

Practice	Answer	n (%)
Prenotification	always	324 (69%)
	often	108 (23%)
	rarely	24 (5.1%)
	never	12 (2.6%)
Prenotification data	according to the guidelines	294 (63%)
	not according to the guidelines	174 (37%)
Prehospital scale used	FAST	228 (49%)
	not using any	162 (35%)
	both FAST and CPSS	36 (7.7%)
	both FAST and LAPSS	30 (6.4%)
	LAPSS	6 (1.3%)
	both CPSS and LAPSS	6 (1.3%)
Management of Hypertension	not according to the guidelines	376 (80%)
	according to the guidelines	92 (20%)
Management of Glycaemia	not according to the guidelines	351 (76.3%)
	according to the guidelines	111 (24%)

Table 4. Participants performance in individual questions and rates of correct responses

Task	Answer	n (%)
Correctly identified stroke etiology	correct	294 (63%)
	incorrect	174 (37%)
Knew difference between two types of stroke facilities	correct	312 (67%)
	incorrect	156 (33%)
Correctly identified at least 11 stroke symptoms	correct	348 (74%)
	incorrect	120 (26%)
Knew FAST scale components	correct	240 (51%)
	incorrect	228 (49%)
Correctly identified ischemic stroke types	correct	402 (86%)
	incorrect	66 (14%)
Correctly identified components of stroke chain of survival	incorrect	258 (55%)
	correct	210 (45%)
Correctly named at least four-stroke mimics	incorrect	270 (58%)
	correct	198 (42%)
Knew time window for thrombolysis	incorrect	307 (66%)
	correct	161 (34%)
Knew time window for thrombectomy	incorrect	245 (52%)
	correct	223 (48%)
Correctly developed FAST acronym	correct	338 (72%)
	incorrect	130 (28%)

Stroke chain of survival

As with the Chain of Survival, which is used to describe the sequence of events necessary to survive sudden cardiac death [10], the Chain of Recovery is a metaphor for the series of events that must occur during the emergency care of the possible stroke victim to maximize his or her chances of complete recovery [11]. The chain's critical links include the following: 1. Patient or bystander recognition of stroke symptoms; 2. Immediate activation of the Emergency Medical System (EMS) and proper dispatch with pre-arrival instructions; 3. Emergency medical response, assessment, evacuation, and appropriate prehospital care promptly; 4. Prenotifying the receiving stroke center to prepare and mobilize resources; 5. Rapid definitive diagnosis at a stroke center by experienced specialists.

The Chain of Recovery has been renamed the "Stroke Chain of Survival" in American Heart Association publications. The chain is made up of eight links, which are labeled the "Ds of stroke care" (detection, dispatch, delivery, door, data, decision, drug, and disposition) [9].

Stroke mimics

Stroke mimic is a non-vascular disease characterized by acute neurological deficits comparable to those associated with stroke. According to several small studies, up to one-third of patients evaluated acutely by a stroke team and up to 15% of patients treated with intravenous tissue plasminogen activator (t-PA) have such stroke mimics; possible etiologies include seizures, tumors, migraine, infections, delirium, peripheral nerve injuries, multiple sclerosis, and conversion disorders [12–14].

Time window — thrombolysis

Intravenous thrombolysis with alteplase is currently the standard treatment for acute ischemic stroke. IVT with alteplase remains the standard treatment within the 4.5 hours window after symptoms' onset. It is worth mentioning that after the survey was already disseminated, ESO issued the newest guidelines. High-quality evidence was found to recommend intravenous thrombolysis with alteplase to improve functional outcomes in patients with acute ischemic stroke within 4.5 h after symptom onset. Intravenous thrombolysis with alteplase is also recommended in patients with acute ischemic stroke on awakening from sleep, who were last seen well more than 4.5 h earlier, who have MRI DWI-FLAIR

mismatch, and for whom mechanical thrombectomy is not planned [4].

Time window — thrombectomy

Mechanical thrombectomy (MT) is the gold standard of care for acute ischemic stroke (AIS) caused by anterior circulation large vessel occlusion within six hours of symptom onset and can be extended to 24 hours in selected patients [8].

High knowledge factors

To identify potential associations between high knowledge and demographic characteristics, we carried out a linear regression, with the outcome variable of total test score and the explanatory variables of experience, number of stroke interventions per month, previous attendance at workshops, number of monthly duties, and level of self-confidence regarding stroke.

We selected the candidate covariates from the set of collected variables so that there were less than 20% of participants with missing data or variables with less than 5% missing values. The covariates of experience, number of stroke interventions per month, previous attendance at workshops, number of monthly duties, and level of self-confidence regarding stroke were defined a priori based on data from the literature.

Participants were divided into two groups depending on their level of experience. We discovered that paramedics with less than 11 years of experience were more knowledgeable about stroke treatment than their senior colleagues. One potential reason for this disparity is that these junior employees have received their training more recently and up to date with guidelines. Our findings suggest where educational efforts should be focused on the national rising stroke burden and the improving availability of thrombolysis and thrombectomy.

With a 5% risk, by adjusting for the number of stroke interventions per month, previous attendance at workshops, number of monthly duties, and level of self-confidence regarding stroke, there is a statistically significant relationship between total test score and experience. Results of the logistic regression are presented in Table 6.

DISCUSSION

This survey's findings give a brief overview of paramedics' practices and knowledge regarding prehos-

		Experience — less than 11 years (n = 239)	Experience — 11 years and more (n = 229)	n	p	test
Total test score, mean		7.91 (± 2.14)	6.76 (± 2.35)	468	< 0.001	Welch
Age, mean		28.8 (± 3.38)	39.3 (± 6.40)	468	< 0.001	Welch
Gender, n	Male	208 (87%)	194 (85%)	402	0.47	Chi2
	Female	31 (13%)	35 (15%)	66		
Stroke patient cases per month	Less than 5	151 (63%)	149 (65%)	300	0.67	Chi2
	5 and more	88 (37%)	80 (35%)	168		
Has attended workshops/ /courses on stroke patient management	Yes	100 (42%)	158 (69%)	258	< 0.001	Chi2
	No	139 (58%)	71 (31%)	210		
Practice — prenotification, n	Always	165 (69%)	159 (69%)	324	< 0.01	Chi2
	Often	56 (23%)	52 (23%)	108		
	Rarely	7 (2.9%)	17 (7.4%)	24		
	Never	11 (4.6%)	1 (0.44%)	12		
Prenotification data	According to the guidelines	188 (79%)	106 (46%)	294	< 0.001	Chi2
	Not according to the guidelines	51 (21%)	123 (54%)	174		
Management of Hypertension	Not according to the guidelines	203 (85%)	173 (76%)	376	0.011	Chi2
	According to the guidelines	36 (15%)	56 (24%)	92		
Management of Glycaemia, n	Not according to the guidelines	183 (76.5%)	174 (76%)	351	0.055	Chi2
	According to the guidelines	56 (23%)	55 (24%)	111		
Monthly duties	less than 15	144 (60%)	138 (60%)	282	1	Chi2
	15 and more	95 (40%)	91 (40%)	186		
Confidence — stroke, n	3	21 (8.8%)	5 (2.2%)	26	< 0.01	Chi2
	4	157 (66%)	144 (63%)	301		
	5	61 (26%)	80 (35%)	141		
	4	114 (48%)	120 (52%)	234		
	5	95 (40%)	97 (42%)	192		

		Coefficients	p	p global
Professional experience	Ten years and more vs. less than ten years	-1.29 (-1.70; -0.885)	< 0.001	< 0.001
Stroke patient cases per month	Five and more vs. less than 5	0.882 (0.477; 1.29)	< 0.001	< 0.001
Has attended workshops/courses on stroke patient management	No vs. yes	-0.209 (-0.614; 0.196)	0.31	0.31
Monthly duties	15 and more vs. less than 15	0.824 (0.420; 1.23)	< 0.001	< 0.001
Confidence level — stroke	4 vs. 3	0.479 (-0.385; 1.34)	0.28	< 0.01
	5 vs. 3	1.20 (0.294; 2.11)	< 0.01	

pital stroke management. It is the first time a survey of this kind has been conducted in Poland. A few other interventional studies have tried to evaluate and then increase the expertise of the paramedic in a variety of methods, including training programs [15, 16]. The online training intervention conducted in Catalonia was successful in raising EMS professionals' awareness and prenotification compliance at stroke code activation and in achieving widespread adoption of a new prehospital stroke severity assessment scale (i.e., the RACE scale) [17]. In a study conducted by Hsieh et al., the 1-hour course presented basic stroke knowledge, such as stroke epidemiology, symptoms, diagnosis, treatment, and determining onset time [18]. The educational program increased knowledge about stroke and improved the accuracy of triage by dedicated EMS providers. When assessed immediately after the intervention, an educational lecture proved successful in enhancing stroke awareness in a similar study conducted in Dubai [19]. However, there is a need to re-evaluate paramedics' knowledge at regular intervals to determine the need for prehospital stroke management refresher courses.

Limitations of the study

This study has several limitations. Surveys are not knowledge tests, and respondents may not give a survey answer the same consideration that they would give to a knowledge examination; thus, the percentage of correct answers may not accurately reflect the survey participants' knowledge. Furthermore, respondents may provide answers that they believe are correct but do not reflect actual practice. Furthermore, responding to questions in a survey may not accurately reflect how one would respond in the field. The use of a convenience sample, which introduces the possibility of selection bias is another of the study's limitations. If survey participants did not respond because they were unsure of the correct answer, our findings might understate the number of incorrect answers and lack of stroke management knowledge.

CONCLUSION

This study has shown that in Polish paramedics' stroke knowledge is suboptimal and deficient regarding current prehospital guidelines. With recent advances in stroke care and the lack of education on stroke after initial training, it is not surprising

that paramedics are unaware of existing procedures and the vital role they currently play in stroke care. The results of this study indicate the need to change paramedic education, the importance of combining education with prehospital stroke care in stroke detection by paramedics, and the need to prenotify patients within the window of care for thrombolytic and endovascular treatment.

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