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An Educational Module To Improve Pre-Hospital Stroke Assessment: Stroke Mimics And The Field Assessment Stroke Triage For Emergency Destination (fast-Ed) Scale

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An Educational Module to Improve Pre-Hospital Stroke Assessment: Stroke Mimics and the Field Assessment Stroke Triage for Emergency Destination (FAST-ED) Scale

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Susan Hunt

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Jessica Coviello, DNP, APRM, ANP-BC

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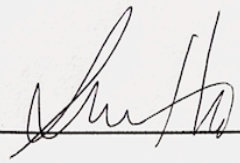
Signed: 

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An Educational Module to Improve Pre-Hospital Stroke Assessment: Stroke Mimics and the Field Assessment Stroke Triage for Emergency Destination (FAST-ED) Scale

ABSTRACT

Introduction: Studies show that up to 30% of acute stroke patients brought to the emergency department (ED) are diagnosed with a stroke mimic. With more stroke systems adopting a prehospital large vessel occlusion (LVO) stroke scale that includes bypass protocol, it is imperative that emergency medical service (EMS) personnel be educated on how to implement the scale, identify stroke mimics, and accurately determine the time of last known well. Studies show that LVO stroke scales demonstrated low specificity when scored by EMS personnel, as compared to those scored by physicians. In 2018 the Massachusetts Office of EMS updated the protocol for acute stroke by implementing the FAST-ED scale. without requiring formal education on the new assessment items.

Purpose: To develop and present an evidence-based, expert validated educational module for Massachusetts EMS on FAST-ED assessment items, common stroke mimics, and determining the time of last known well.

Methods: A didactic and experiential scenario-based educational module was developed following a literature search that included the FAST-ED scale, stroke mimics, and EMS Education. A panel of neurology and EMS experts validated the module, pre and post-test, and the delivery method. Three Western Massachusetts fire departments participated in the Beta Test which included the module presentation with pre and post-tests. Two of the departments participated in post-module focus groups for feedback.

Results: Fifty-six paramedics from three fire stations participated in the Beta Test. Analysis of the test result data showed that there was a significant difference in the educational module pre-test (M=5.4, SD1.14) and post-test (M=9.4, SD1.14) scores; $t(4)=-5.66$, $p=0.005$.

Conclusion: A formal acute stroke education program for prehospital personnel could help increase the efficacy and utility of the newly implemented FAST-ED stroke scale.

Keywords: FAST-ED, prehospital education, acute stroke, large vessel occlusion

Introduction

Stroke is the leading cause of disability, and the fifth leading cause of death in the United States, killing approximately one person every three minutes and forty-two seconds. [1] Approximately 87% of strokes are ischemic; about 40% of ischemic strokes are due to a large vessel occlusion (LVO).[2] The AHA/ASA (American Heart Association/American Stroke Association) updated the guidelines for neuroendovascular therapy (NEVT) in 2015 after overwhelming positive results were reported from five landmark trials.[3] The updated AHA/ASA guidelines include Class I, Level of Evidence A recommendations for NEVT as the standard of care for LVO.[3] The guidelines also recommend that stroke systems of care be reorganized to provide access to NEVT for all eligible patients, which may include bypass protocol and/or air transport.[3] The Field Assessment Stroke Triage for Emergency Destination (FAST-ED) scale is one of the validated scales that are predictive of LVO strokes.

Western Massachusetts has seven primary stroke centers (PSC), with one comprehensive stroke center (CSC), covering an area of over 2800 square miles.[4] The Massachusetts Office of Emergency Medical Services (OEMS) amended the EMS guidelines for treatment of acute stroke, effective April 2018, to implement the FAST-ED scale in place of the FAST scale. The ultimate purpose of implementing the FAST-ED scale is to identify LVO patients for bypass to a CSC for expedited treatment. The new guidelines do not yet include a new destination protocol, which would include bypassing the closest PSC in favor of a CSC for patients with a score equal to or greater than six. No formal education was required or provided for prehospital personnel with the new guidelines.

Background

The FAST-ED scale can be administered in approximately 20 to 30 seconds and is available in an application (app) for ambulance tablets. Both the app and the paper

version of the scale are easy to score, although one study found that "denial" or "extinction" is nuanced and difficult to teach to EMS personnel.[5] At the time of the literature review, the only studies that used EMS personnel to validate an LVO stroke scale involved the Rapid Arterial oCclusion Evaluation (RACE) scale and the Los Angeles Motor Score (LAMS) scale. These studies resulted in specificity percentages ranging from 58% to 68% [5] when scored by EMS. Other studies implementing an LVO scale used emergency department (ED) physicians and nurses (RNs), stroke neurologists, and stroke RNs to score and validate the scales, resulting in specificity percentages ranging from 86% to 90%.[5] The difference in these results suggests that EMS personnel need further education in stroke assessment, scoring LVO stroke scales, stroke mimic education, or all three. Lima et al report that the FAST-ED scale yields a specificity of 89%, [6] though the scale was scored by ED or stroke physicians in their study. No published trials of the FAST-ED scale being implemented by EMS personnel were found in the literature search.

Stroke mimics such as seizure, migraine, and conversion disorder account for up to 30% of patients triaged as acute stroke in the field. [5,7-8] When a stroke system is bypassing patients to a CSC based on a field assessment, these false positives can overload the hub hospital and tie up resources needed for true acute stroke patients. In rural areas of Western Massachusetts, bypassing a PSC for the CSC could strain small town departments and/or volunteer fire departments. Bypassing the closest PSC with a false positive stroke leaves a town with an unnecessary deficit that could be avoided with further education on identifying stroke mimics.

Methods

Population, Setting and Design

The population focus was EMS personnel in Western Massachusetts. Fifty-six firefighter paramedics (two female) from three fire stations participated. The age range

was 21 years to 59 years with a median age of 35. The experience levels ranged from six months as a paramedic to 37 years. The module was designed to be implemented in a classroom setting at the workplace of the EMS personnel. The focus groups were held at two separate fire departments. The design was an interventional study with a pre and post-test. The intervention was a multimodality presentation based on the AHA/ASA 2015 updated guidelines for LVO, [3] the FAST-ED scale and app, common stroke mimics, and determining the time last known well for acute stroke patients.

Literature search

A systematic literature search was completed using the databases PubMed, Scopus, Ovid and Cochrane. The search terms used in reference to the patient population included multiple synonyms including prehospital care, prehospital stroke triage, field assessment, paramedic, EMT, medical transportation, EMS education, ambulance. The search terms for module content included LVO, ELVO, acute stroke, acute ischemic stroke, FAST-ED, stroke mimic. Search terms for the rationale and comparison were encompassed in the prior searches but also included comprehensive stroke center, CSC, bypass (protocol), hospital transfer delay, quality improvement, stroke systems of care, stroke organization, and system delay. In addition, more specific treatment terms such as revascularization, thrombectomy, endovascular treatment, mechanical thrombectomy, neuroendovascular and NEVT were included to target studies that have implemented bypass protocol for these services. The dates used for the literature search went back to the year 2005. The landmark NEVT trials and subsequent American Heart Association (AHA) / American Stroke Association (ASA) recommendations for NEVT were published in 2015, so the focus was on the last five years. The search was expanded to 2005 to include research on stroke systems of care and EMS education methods.

Educational module

The relevant content from the articles was used to create a PowerPoint presentation that included case studies with analysis, demonstration, and scripted role-playing exercises with debriefing. The Poll Everywhere application was embedded in the module to allow active participation through participant's individual cell phones. Additional content on stroke assessment and EMS education was provided through email or direct interviews with experts in those fields. The pre and post-test content was drawn from the completed module and modeled after current stroke multiple choice question banks. Scripts were developed for the two role-playing exercises, as well as an instructor's guide for delivering the module. The final module focused on performing the individual stroke assessment items on the FAST-ED scale, recognizing stroke mimics, and identification of the last known well time of the acute stroke patient. The educational module was designed to be generalizable to Massachusetts as a whole, as well as any stroke system of care proposing to implement the FAST-ED scale.

Expert Panel

Professionals with expertise in stroke assessment, EMS education, and prehospital care were invited to be on a panel to validate the educational module. The panel included stroke neurologists, ED physicians, stroke nurse practitioners, and EMS educators (see Appendix A). Execution of the expert panel assembly and creation of the content rating tool was informed by the instructions crafted by Lazenby et al. [9] Elements of the educational module were extracted from the evidence matrix, placed into categories, and presented to the expert panel to be evaluated for accuracy and relevance. This evaluation included the pre and post-test content, and consideration of the proposed delivery method. Each expert was asked to complete the evaluation individually, using a rating tool specifically designed for this educational module, within a two-week period. Due to this time limitation, experts who responded to the initial request expeditiously were considered more valuable to the module development. Each member of the panel

was provided with precise written instruction on how to complete the rating tool, the due date, the purpose of the validation, the project synopsis and the overall goal.

Experts were asked to review and evaluate evidence-based educational content for acute stroke triage in the prehospital setting, stroke mimic signs and symptoms, and determining the stroke patient's time of last known well. Time of last known well was included after a discussion with stroke neurology advanced practitioners at the CSC in Western Massachusetts revealed that inaccurate times of last known well were frequently received from both EMS and ED personnel. The tool had six categories including acute stroke statistics, time of last known well, stroke mimics, acute stroke versus stroke mimic, FAST-ED assessment items, and EMS education delivery. Each category had multiple relevant sub-category items for a total of 33 items to be scored. Each individual item was evaluated on a Likert-scale for accuracy and relevance. A third column asked if the item should be included. A fourth column was left blank and invited explanation or comment by the expert for each item.

The scoring system for the expert panel rating tool was guided by the research, methods, and recommendations of Polit, Beck, and Owen, to ensure that agreement between experts was greater than chance.[10] The completed rating tools from the seven experts were analyzed by calculating a content validity index (CVI), based on the experts' ratings of individual items. Items with an item-level CVI (I-CVI) of 0.78 or higher for three or more experts were considered as valid content.[10] The expert validated educational module was then sent with relevant supplementary materials to the Western Massachusetts EMS (WMEMS) department to obtain continuing education approval.

Module delivery /Data analysis

The expert validated educational module with continuing education approval from WMEMS was presented to firefighter paramedics at three local fire departments in

Western Massachusetts. The module was a one-hour PowerPoint presentation with interactive participation through the Poll Everywhere application, followed by two scripted roll-playing scenarios. Each participant was given a pre and post-test to evaluate for module effectiveness. The ten-question exam included eight multiple choice questions; four were mini patient scenarios, and four were questions about the individual FAST-ED scale items. There were two True/False questions; one on stroke mimics and one on the FAST-ED scale. The participants were asked to not write their names on the tests, but rather a nickname or identifier known to them, so as to maintain anonymity. At the end of each presentation, the pre and post-tests were matched, scored, and evaluated for score improvement. Two of the groups took part in a brief, post module focus group to provide feedback on the clarity and effectiveness of the teaching method for the population. These sessions were moderated, recorded, and professionally transcribed.

Results

The literature search yielded 42 articles, which were put into an evidence matrix. Utilizing the evidence matrix, relevant content was identified and assigned to the categories of stroke mimic, LVO scale (FAST-ED)/Bypass, or EMS education methods. Literature describing stroke systems of care using an LVO bypass protocol were reviewed for stroke scale accuracy and method of administration, volume and type of stroke mimics, and method of educating personnel on the new scale or protocol. Literature on EMS education was reviewed for evaluation of the effectiveness of the delivery method and the preferred mode of learning for this population.

The expert rating tool was evaluated using line item analysis. The results of this analysis led to the deletion of three items from the education module. After reviewing

comments from each expert, six more items relating to stroke mimics were eliminated from the module content.

The education module pre and post-tests were scored and compared using a paired-samples t-test. There was a significant difference in pre-test (M=5.4, SD1.14) and post-test (M=9.4, SD1.14) scores; t(4)=-5.66, p=0.005. Focus group transcripts were reviewed and relevant comments and suggestions on the module delivery method were categorized and recorded for consideration.

Discussion

The literature review for EMS education informed the theoretical framework for this population. The educational module delivery was based on Challenge-Based Learning (CBL) theory and student-centered learning, which is commonly used in teaching this population.[11] Multiple teaching modalities were implemented including PowerPoint, demonstration, and role-playing scenarios. The educational module included specific instructions for delivery, including the content and scripted scenarios for simulation/role-playing activities. Duckworth states that student-centered learning includes subject (inductive) learning through problem-based learning, case studies, and discovery learning.[12] PowerPoint case studies were followed by multiple choice questions that invited the learner to evaluate the patient situation, and then participate interactively through the Poll Everywhere cell phone application to indicate their answer. Duckworth describes self or active learning as brainstorming and formulating questions, while social or cooperative learning includes simulation and role playing with debriefing.[12] These learning methods were incorporated through question and answer within the module and with the scripted roll-playing activities. The educational module objectives included learning on cognitive, psychomotor, and affective levels as described by Chang et al.[13]

Previous studies that included implementing or validating a new LVO stroke scale used a variety of methods for training personnel that would be assessing and scoring the scale. Several studies used stroke physicians and RNs to review medical records retrospectively and to evaluate patients in prospective studies. Studies that did describe stroke scale education varied in method style, length, and audience. One study delivered a four-hour session for stroke RNs, while another study commissioned a stroke neurologist to present ten individual education sessions to EMS personnel. One study handed out a laminated information card while another offered non-mandatory access to a YouTube video demonstrating the assessment. Most of the reviewed studies, however, did not specify how the new stroke scale or stroke assessment education was presented to personnel. Other studies recommend ensuring that EMS responders have adequate stroke and stroke mimic triage training before implementing changes in acute stroke triage and destination policy.[14-15] Gladstone et al suggest that not adhering to the triage scale protocol, due to habit or lack of time, resulted in increased false positive stroke identification.[15] Lastly, Zhao et al. proposed that EMS personnel should be able to score the triage scale as accurately as physicians before a new LVO stroke triage scale is implemented.[5] While EMS personnel have significantly less training in stroke assessment and will not likely score stroke triage scales as accurately as physicians, the results of this educational module indicate that the gap could be improved with expert validated, evidence-based education designed specifically for this population.

The evaluation of content relevance was used to determine the priority of elements. In addition to the three items eliminated using I-CVI, six addition items were eliminated based on feedback from the experts and from additional research. The evidence obtained through the literature search on EMS education indicated that the module delivery should be interactive to engage this population. The importance of the length of time of the module was discovered through communications with the EMS

coordinators. It became clear in attempts to schedule module presentations, that time was scarce due to multiple shift groups and competing obligations. Comments from the experts suggested that certain items, though accurate and relevant, were too complex for consideration in the prehospital setting, mostly due to insufficient time for EMS assessment. These two factors led to the decision to eliminate detailed education on all but the three of the most common stroke mimics. The final educational module included 24 of the 33 content items, and the presentation time was reduced from 90 minutes to one hour.

The education module pre and post-test results analysis suggest that the module is effective in improving knowledge and awareness of stroke recognition in the field, and comprehension of the FAST-ED scoring items. There is a clear benefit to providing expert validated content to EMS personnel, as it increases their assessment skills, which will lead to more accurate scoring of FAST-ED scale. If the specificity of EMS FAST-ED scoring isn't comparable to the specificity found in the FAST-ED scale validation, implementing a bypass protocol for LVO stroke patients will result in an excess of false positive strokes being brought to the CSC emergency department.

Focus group transcripts included suggestions for modification of the delivery. One suggestion was to include video vignettes to demonstrate the administration of each stroke assessment item on the FAST-ED scale. This was further developed in collaboration with an EMS coordinator at one of the fire stations to design and film the vignettes with EMS personnel inside an ambulance. Most stroke assessment videos use patients in hospital gowns with physicians in white coats. The videos created for this educational module are geared specifically to EMS personnel and are more relatable for this population. Another point from the transcript was appreciation for the explanation, in simple terms, of the assessment items on the FAST-ED scale. The moderator clarified that the issue was not with understanding the language on the FAST-ED scale, but

rather with being able to jog their memory quickly in an emergent situation. When some EMS personnel only see an acute stroke every four to six months, “extinction to bilateral simultaneous stimulation in one sensory modality only” is too difficult to recall quickly. As a result, memory triggers were extracted from the educational module and used as a template to overlay the original FAST-ED scale without altering content. This modified language will allow for easier recall of the assessment items and will be offered to the three fire stations as well as future immersion sites.

Some of the questions from participants in the first two groups led to the addition of supportive content to the module. Participants were curious about LVOs as well as which signs and symptoms emanate from a left-brain stroke versus which are from a right-brain stroke. These questions led to the inclusion of an additional slide, for information only, which showed the vasculature of the large vessels of the brain, and how damage to those vessels affects the body. None of the modifications changed the expert validated content of the module.

It’s important to note that the module stresses that content related to stroke mimics is presented to create a broader base of stroke assessment education for the participant. The module teaches signs and symptoms of common stroke mimics, but that a stroke mimic diagnosis is a diagnosis of exclusion and cannot be done in the field. Participants are taught that a patient with stroke-like symptoms must be transported as an acute stroke. Having education about common stroke mimics will help EMS recognize possible stroke mimic symptoms, relay that information to the accepting ED physician, and possibly lead to a more efficient use of resources in the ED.

Limitations

The educational module was designed to teach EMS personnel how to perform the individual assessment items on the FAST-ED scale and how to recognize common stroke mimics. The simulation/role playing activities were designed to

actively implement assessment skills described in the PowerPoint module. The simulation/role playing was debriefed in class but was not evaluated on paper. The pre and post-test questions were designed to test the participants knowledge of the details of scoring individual items on the FAST-ED test, and identifying specific signs and symptoms of common stroke mimics. As a result, testing of the participants' abilities to accurately score the FAST-ED scale as a whole was not done. Evaluation of ability to accurately score the FAST-ED scale will be developed as an Application Module after immersion of the education module in Western Massachusetts is complete.

Conclusion

The recent NEVT landmark trials demonstrated that patients who received NEVT had an average of 70% chance of improvement in reaching functional independence ninety days post-stroke.[3] To date, inaccurate prehospital stroke triage, interhospital transfer delays, and lack of state destination protocol for acute LVO stroke have prevented equal access to this life saving treatment for many who reside in rural Western Massachusetts. A formal acute stroke education program for prehospital personnel could help increase the efficacy and utility of the new FAST-ED stroke scale implemented by the Massachusetts OEMS. Once bypass protocol for acute LVO strokes is implemented, EMS personnel who have participated in the educational module will be more effective and efficient in treating acute stroke to more of the population, resulting in improved continuity of care, and better outcomes for acute stroke survivors. As systems of stroke evolve with new protocols it is important to improve the prehospital care of stroke patients, which begins with EMS personnel education. Immersion of this module in the prehospital setting will ultimately benefit acute stroke patients and their families in Western Massachusetts, and the state as a whole.

Future

Immersion of the education module is underway in Western Massachusetts. And although the module is not intended to test the ability of EMS personnel to score the FAST-ED scale, we may see evidence of its effect through data collection. EMS personnel have been scoring the FAST-ED scale for acute stroke patients and including it on their run sheets since the inception of the new protocol in April of 2018. Baystate Medical Center in Springfield, Massachusetts is collecting this data and comparing the EMS FAST-ED score with the corresponding NIHSS score performed by the stroke advanced practitioner or neurology attending physician. As immersion of the module continues throughout Western Massachusetts, these comparison scores will continue to be analyzed for improvement. A second Application Module to educate and test the ability of EMS to score the FAST-ED scale (rather than educating on individual items) is in the initial planning stages. Implementation of the Application Module will likely show an even greater congruence of EMS scoring with stroke practitioner scoring of the FAST-ED scale.

Statement Related to Human Subjects: IRB approval was considered but not needed, as this is an educational module developed from a comprehensive literature review. The module was validated by a panel of experts and then piloted for project immersion.

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Appendix A

Expert Panelists

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UCLA Comprehensive Stroke Center

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Appendix A (cont.)

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