

Striking out at Stroke: A Comparative Perspective

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The Case

You and your crewmate are dispatched to a 75-year-old man who collapsed in his kitchen at his home in the country. After a 20-minute journey on blue lights, you arrive at a terraced house to be met at the door by an older woman who says she called because her husband was ill.

The patient is sitting in a chair and looks very worried. Oddly, he states that he's terrified of having a stroke. The history of the presentation that precipitated the emergency call does not cause you or your crewmate to suspect a stroke; it sounds as though he simply fainted while washing the dishes with his wife.

There's no doubt that this patient has significant risk factors; indeed, he has more cardiovascular history than one could imagine, being fitted with an implantable defibrillator and pacemaker and having experienced numerous ACS events, including AMI and CABG, not to mention diabetes and respiratory issues. Despite all this, the patient is very spritely and continues to tell you how worried he is about having a stroke because one of his friends had suffered a stroke and it scared him greatly.

You offer to take him by wheelchair to the ambulance for further assessment, but he says he would prefer to retain his dignity and walk to the ambulance and does so.

Although you have every intention of taking this patient to the hospital, he's explicitly clear that he wants to stay at home. So, you and your crewmate work him up for a full assessment in the ambulance, including a 12-lead ECG. While placing the leads on him, you note his high level of anxiety. Then, suddenly, he goes unconscious again. When you begin to rapidly assess the patient, it becomes immediately obvious that he's suffering a dense hemiparesis (aka, stroke) and that you and your crewmate must act quickly to ensure the best possible outcome.

U.K. Establishes New Pathway

The South East Coast Ambulance (SECAMB) Service in England, covering the three counties of Kent, Surrey and Sussex (situated between London and France), serves a population of 4,500,000 residents over 3,600 square miles. Of the almost half million emergency calls responded to a year, a call every 1.14 minutes, 8,302 of these during 2007 were AMPDS Card 28 Stroke.

Having some of the largest populations in the U.K. over 65 and being a forward-thinking, innovative organization, SECAMB appointed a "Paramedic Stroke Lead" in 2006. Other prominent positions in SECAMB held by paramedics include chief executive officer (Paul Sutton) and clinical director (Andy Newton).

In developing a stroke pathway, SECAMB looked at practices in the U.K. and farther afield, including the U.S. It became clear that there was a need to improve the potential outcome for stroke, and this included the implementation of stroke thrombolysis services across the region.

As the only provider of EMS in the region, SECAMB found itself in an influential position and has worked to not only support acute hospital trusts in implementing their stroke thrombolysis services but also with the rest of the pathway.

Working with a paramedic from South West Ambulance Service NHS Trust (SWAST), Adrian South, SECAMB was able to draw on existing U.K. best practice and develop what they consider to be the best possible prehospital and primary care pathway. They launched this pathway at the HSJ Transforming Stroke Care Conference in September 2007 (see Figure 1, July 2009 *JEMS*, pg.84).

This pathway starts with the emergency medical dispatcher (EMD), who is able to perform a FASTest (i.e., Face, Arms, Speech, Time to act, which is similar to the Cincinnati Prehospital Stroke Scale, or CPSS) on a patient over the phone, pre-alerting the clinicians via the MDT before arrival. Once on scene, the ambulance clinicians perform a FASTest to exclude hypoglycemia or seizures prior to or since the onset of focal neurological symptoms. If the patient fits the algorithm, the ambulance crew pre-alerts the hospital offering the thrombolysis service and "blue lights" the patient to the hospital, something usually seen only in life-threatening cases in the U.K.

Not satisfied with this process, the SECAMB and SWAST team recognized that there was a great deal more to providing good stroke care than thrombolysis alone. A recently published literature review within the U.K. identified 63 out of 1,000 patients treated by thrombolysis who would avoid death/dependency, but this was applicable to only 10% of acute stroke patients. However, of 1,000 patients treated within a multi-disciplinary acute stroke unit, 56 could avert death/disability, and this was applicable to 80% of acute stroke patients.

The result of the Oxford-led EXPRESS study, published in *Lancet* in 2007, clearly demonstrated the benefits of providing specialist TIA clinics, with immediate commencement of preventive therapies. The results strongly support the need to risk-assess patients and stream them

accordingly by all health-care providers, including paramedics, something identified in Quality Marker 5 of the National Stroke Strategy from the U.K. Department of Health in 2007. This part of the integrated pathway allows a consistent approach to be taken with patients, whereby those patients who may benefit from thrombolysis are FASTracked to the waiting acute stroke team and onto CT. Patients with resolved symptoms, are considered for referral to a rapid access TIA clinic using the ABCD2 score. High-risk patients are immediately referred to specialist TIA clinics, and those at low risk are provided with a short course of aspirin and booked into the next available clinic.

This pathway was one of only three finalists in the 2008 National NHS Innovation Awards, for its approach to meeting patient needs and providing a consistent approach to delivering the best possible clinical outcomes.

Stroke Rates in the U.S. & U.K.

In both countries, stroke is the third-leading cause of death, behind heart disease and all forms of cancer, but it's the leading cause of long-term disability.

In the U.S., more than 795,000 people suffer a new or recurrent stroke each year; one-third die, one-third become disabled, and one-third recover. The current cost of stroke in the U.S. is estimated to be nearly \$70 billion per year, according to the Centers for Disease Control and Prevention.

In the U.K., there's a stroke every five minutes, with a 30% mortality rate. A paper entitled "The Economic Burden of Stroke," commissioned by the U.K. government and co-authored by Kings College London in November 2005, showed that the direct health-care costs of stroke in the England are approximately £3.2 billion; when taking into account the informal costs and loss of earnings, the cost rose to more than £7 billion per year.

The document further demonstrated significant monetary savings could be made, with more than 1,000 deaths avoided, if patients were treated in acute multi-disciplinary stroke units and those eligible for thrombolysis treatment were treated accordingly.

In general, about 80% of strokes are ischemic (due to diminished blood supply to a focal area of the brain) and approximately 20% are hemorrhagic (due to rupture of a blood vessel within the cranium). Thromboembolism is the cause of most ischemic strokes. A thrombolytic agent (more specifically, fibrinolytic agent) tissue plasminogen activator (tPA) has given the medical profession an effective therapy to limit the deleterious effects of an ischemic stroke. The decision to administer tPA can be made only after an in-hospital CT scan of the brain, which can reveal whether the stroke is ischemic or hemorrhagic.

Currently, the European and U.S. licenses for intravenous tPA indicate that it must be given within the first three hours. However, with the recent publication of the European based study (ECAS3) in the *New England Journal of Medicine*, the license may be extended to treat strokes that occurred within four-and-a-half hours. The study investigated the clinical outcome of patients given thrombolysis within three to four-and-a-half hours. This study and another study

in process aim to analyze the maximum treatment time, upper age limit and potential for increased risk of tPA-induced intracranial hemorrhage.

The median time in one of SECAMB's hospitals to evaluate a patient in the emergency department (ED) before one can administer tPA is one hour; the quickest time was approximately 30 minutes. Thus, patients must present to the ED within two to two-and-a-half hours of their stroke in order to receive this medication.

Because of this time factor, there's a serious time constraint to consider when dealing with stroke patients. EMS personnel should recognize, stabilize and, without delay, transport a stroke patient with an enhanced sense of urgency. Additionally, the public must improve its knowledge of stroke symptoms and the need to activate EMS. Many people don't know that stroke involves the brain and can't recognize stroke symptoms. Thus, practical and effective implementation of emergency stroke care requires education of: 1) the public, 2) EMS personnel, 3) ED personnel, and 4) hospital-based physicians and allied-health professionals. All four groups must be educated simultaneously for emergency stroke care efforts to be successful.

On Feb. 9, 2009, the U.K. Department of Health launched a national public awareness campaign for stroke, focusing on the FAST tool. This is an extremely high-profile campaign with national TV, radio and other media coverage and a budget of more than £10 million. (Details of the campaign can be found at www.nhs.uk/Actfast.) Early indications are that this campaign has been highly effective and has shown an increase in the region of 100 more emergency calls per week for SECAMB for AMPDS Card 28 Stroke.

Prehospital Assessments

New stroke treatment has defined a critical role for the paramedic. Prehospital assessment is crucial, but its extent may vary. On one hand, urgent transport is the goal because *time is brain*. On the other hand, the more information field providers collect and provide to the ED and the waiting acute stroke teams, the better.

It may be difficult to obtain stroke history from a neurologically impaired patient. It's therefore important to seek information from witnesses, especially regarding the last time the patient was without symptoms. The focus of history-taking should be on whether the patient is a candidate for tPA therapy in the acute setting.

The physical examination must balance the needs for brevity and urgent transport against collecting enough data to assist hospital clinicians. At one end of the spectrum are the prehospital scales: the CPSS used in the U.S. and the FASTest used in the U.K.

FASTest is a brief, basic screening exam endorsed by the American Stroke Association/U.K. National Stroke Strategy/U.K. National Institute of Clinical Excellence Stroke and TIA NICE Guidelines and the U.K. Joint Royal College Ambulance Liaison Committee guidelines group. It includes a validated three-step assessment of Mental and Communication Status, Cranial Nerves, and Limbs (speech, facial droop and arm drift) to identify whether a stroke has occurred and has demonstrated high sensitivity in the identification of anterior circulatory syndromes.

At the other end is the proven and reproducible NIH Stroke Scale used in hospital settings. It requires a more extensive assessment and grades the degree of abnormality. The NIH Stroke Scale helps assess the risk of causing intracranial hemorrhage with thrombolytic therapy (the larger the stroke, the greater the risk), but takes up to 10 minutes to perform and grade.

It's recommend that EMS personnel initially perform the basic three-step CPSS/FASTest with the addition of an assessment of level of consciousness (AVPU). The three-step exam should be performed on scene during the primary survey, after the ABCs are completed, specifically during the D (disability) component. In the U.S., if time is available en route, we encourage performance of the expanded Miami Emergency Neurologic Deficit (MEND) Exam, developed at the Gordon Center for Research in Medical Education at the University of Miami Miller School of Medicine, that incorporates the elements of the Cincinnati and FAST scales and components of the NIH Stroke Scale (but without the intricate scoring mechanism or tools required in the NIH Stroke Scale).

The MEND exam and Advanced Stroke Life Support Course was recently piloted by SECamb and SWAST in the U.K. and was found to have equally effective results as in the U.S. in providing enhanced health-care provider education in stroke/TIA recognition, localizing and acute management.

The recommendation should: 1) ensure that an accurate and easy-to-learn basic screening is carried out immediately; if a stroke is suspected, the paramedic team should "load and go"; 2) allow consistently applied and clinically relevant additional observations that permit paramedics to expand the examination in order to assess stroke severity and identify the stroke syndrome and confidently assess the patient. In the case of TIA, the latter assessment can be used to rule out lasting stroke symptoms that can still be categorized as stroke and therefore require an immediate transportation to the hospital.

ED and stroke unit nurses should also perform the MEND exam as their routine neurologic assessment methodology, because the Glasgow Coma Scale (commonly used by nurses for patients with neurologic illness) does not provide information regarding focal neurologic deficits, and the NIH Stroke Scale's length makes it impractical for routine use outside of specialist stroke services and particularly within a moving ambulance. In the U.K., the Recognition of Stroke in the Emergency Room (ROSIER) scale is used within EDs as a tool to quickly identify patients who may be appropriate for thrombolysis, but it does not specify an assessment methodology.

The importance of conducting these exams at the appropriate time is essential for maintaining a time-conscious approach to stroke care. It allows for the recording of important patient status information via a common communication tool that can be understood by all health-care providers involved in the care of each stroke patient.

Management in the Field

Prehospital providers should keep several management principles in mind when caring for the stroke patient. First, avoid giving glucose except when clinically indicated; use a first-line

treatment for hypoglycemia, titrating to response. Avoid treatment of hypertension, and avoid causing aspiration pneumonia. Hyperglycemia and hypotension may cause the reversibly ischemic penumbra to become irreversibly infarcted tissue, thus cementing the fate of the patient.

Do not elevate the head of an acute stroke patient; a semi-Fowler's position is recommended. Do not allow oral intake too early, because it may result in aspiration pneumonia. Give glucose only if the patient's fingerstick value is < 50 (4 mmols/l U.K.), and consider less invasive measures where your system allows as a first-line treatment, for example glucagon.

In addition, EMS personnel should maintain oxygen saturation of $> 95\%$ with 2L of supplemental oxygen via nasal cannula. Place an IV of normal saline running TKO, but do not make multiple attempts and absolutely do not delay transport. During each minute of an acute stroke, 1.9 million brain cells are lost.

Obtain a history from any witness (including the name and telephone number of the witness), transport the patient and witness (if possible) with urgency to an appropriate health-care facility (i.e., a primary stroke center) and notify the ED/A&E department of a possible stroke patient while en route to the hospital. Perform a brief neurologic examination, but do not permit the performance of the exam to delay patient transport to the hospital.

Your report to the ED should be clear and succinct. It should include a pertinent history (including tPA contraindications), witness information (name and how to contact), and key aspects of the neurological examination (especially level of consciousness, speech and language, visual fields and motor strength). It should use appropriate and common language to describe the findings.

Definitive Therapy

Unless used within the context of locally enhanced guidelines or an ethically approved clinical trial, the use of IV tPA should be limited to patients who are between 18 and 80 years of age, are within three hours of ischemic stroke onset, and have no hemorrhage or non-stroke cause of symptoms on the CT scan. tPA should not be given to patients with rapidly improving or minor symptoms, recent hemorrhage or surgery, history of intracranial hemorrhage, associated head trauma, abnormal clotting time, blood glucose < 50 or sustained hypertension. In addition, most patients with a seizure at symptom onset or previous stroke combined with diabetes will not qualify for tPA. The decision to give tPA should be made with caution in patients with very large strokes (NIH stroke scale > 24).

Conclusion

While configurations of health-care services are significantly different between the U.S. and England, the disease processes of stroke and TIA are identical, requiring the same interventions in the same timeframes. The National Stroke Strategy is the culmination of a huge amount of work for England and Wales, and the Quality Markers set forth a comprehensive stroke improvement plan to work toward in the next 10 years. There are only 11 NHS Ambulance Services in the U.K.; they're large influential organizations capable of bringing consistency of

approach and potentially equitable clinical outcome to the patients they serve. Moreover, the differences in legislation mean that other clinical referral pathways are available to prehospital clinicians within the U.K., which means not all patients have to be admitted to medical care via the ED.

Although thrombolysis in the U.S. has been available to acute stroke patients in greater numbers and for longer than in the U.K., it turns out that both countries_ services can learn from one another, with both countries working hard to deliver world-class outcomes in this important clinical area.**JEMS**

Resources

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