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SECTION I

Assessment of Stroke Patients

1 Emergency medical services (EMS): First line of defense against stroke

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Acute stroke management begins the moment the emergency response system is activated. Immediate triage and dispatch of appropriate emergency medical services (EMS) are essential for improving long-term survival. Each minute in which a large vessel ischemic stroke is untreated an average patient loses 1.9 million neurons. On average, it takes prehospital EMS 17–35 min to reach the emergency department (ED) with stroke patients. Hence, an estimated 32–66 million neurons can be lost during transport alone. The concept of the “Chain of Recovery” was developed to improve the care of stroke patients by incorporating prehospital and hospital management. The Chain of Recovery has five distinct components

1. identification of stroke patients;
2. dispatch system by emergency service activation;
3. EMS providers;
4. alert ED and stroke specialists; and
5. diagnosis and treatment.

Each component is essential for the appropriate management of a “brain attack.” The first four components are based in the prehospital setting.

Qualification and classification of EMS personnel

Classification of EMS personnel is related to the extent of training and the direction of the National Registry of Emergency Medical Technicians (NREMT), the Department of Transportation (DOT), the National Highway and Traffic Safety Administration (NHTSA), and emergency physicians. There are some variations between states but the categories of emergency medical technicians (EMTs) include first responders, basic, intermediate, and paramedic. All programs utilizing EMTs have a physician director who is responsible for the medical direction and education of the EMTs. NREMT is the organization responsible for the national examinations, which incorporates a written and practical exam for all levels.

First responders

The first responder course is the EMT – basic course, with the exception of the transportation and equipment section, which is intended for public service (fire and law enforcement) and EMS rescue agencies that may or may not transport patients. The focus of the program is based on assessment, not diagnosis.

EMT – basic

EMT basic training for entry level EMTs incorporates

1. basic life support skills including CPR;
2. principles of general first aid;
3. nonvisualized advanced airway training; and
4. administration of epinephrine, albuterol, aspirin, and glucagons.

EMT – intermediate

EMT intermediate training is for personnel with skills above the basic level. This training incorporates

1. patient assessment;
2. triage principles;
3. management of shock;
4. airway management (comitube and entotracheal intubation after additional training and approval of the medical director);
5. intravenous infusion;
6. performing blood draws; and
7. administration of subcutaneous and selected intravenous medications (epinephrine, 50 percent dextrose, narcan, and albuterol)

Forty-eight hours of continuing education, verified by the medical director, is needed for biennial recertification renewal.

EMT – paramedic

Personnel with skills above the EMT intermediate level are trained for EMT paramedic. Training includes

1. advanced life support;
2. rescue resuscitation and emergency care;
3. administration of IV solutions and parenteral medications;
4. perform CPR and defibrillation of a pulse less nonbreather;
5. gastric and entotracheal intubation (rapid sequence intubation); and
6. EKG interpretation.

Forty-eight-hour DOT curriculum-based continuing education, active ACLS, and CPR status needed for biennial recertification.

Key assessment and management skills for EMS

EMS provides rapid assessment aimed at triaging the individual at home or at the scene of an accident to determine the urgency of the medical condition. In individuals suffering from “brain attack,” the time to the ED is critical.

1. Individuals who are seen in the ED within a 3-hr window are candidates for intravenous (IV) tPA.
2. Reduced time interval from the onset of symptom to arrival at the ED of an individual suffering from stroke will increase the number of probable candidates for IV tPA and potentially reduce disability, institutionalization, and lifetime dollars spent on poststroke-related health care.

EMS routinely rapidly assesses, diagnoses, and prioritizes transport of the individual with a medical condition. Transportation of individuals suffering from trauma and heart attack to the ED is prioritized based on medical necessity for urgent treatment. A similar approach needs to be taken with the individual suffering from a “brain attack” to reduce the time interval from initial call received by the dispatch (detection) to arrival of EMS to the scene (dispatch), to transport to ED (delivery).

1. Any individual with an acute onset of unilateral weakness or speech difficulty warrants triaging as an acute stroke from the initial call to the dispatcher to the arrival of EMS at the scene.
2. Preliminary data collected by the dispatcher will potentially improve time to response and after neurological assessment at the scene confirms the diagnosis, reduce the time to the ED.

Stroke assessment and the concept of the seven Ds of stroke management (Table 1.1) are now integrated into the American Heart Association (AHA) basic life support classes, though continued education is needed nationally for EMS to improve assessment skills and reinforce the necessity for urgency in transport. This will ultimately decrease the time to arrival to the ED. Public education is an additional variable as only 38–50 percent of individuals access the emergency response system at the time of “stroke-like” symptoms.

The goals of the education include

1. EMS dispatchers
 - a. preliminary neurological assessment via phone interview at the time of the initial call in
 - i. key questions
 - acute unilateral weakness
 - acute confusion
 - acute change in speech pattern or quality of speech
 - symptoms under 24 hr
 - b. high-priority status to individuals suffering from “brain attack”

Table 1.1: The seven Ds of stroke management	
Responsibility	Task
General public, Basic Life Support (BLS) providers, EMS	Detection Dispatch Delivery
ED	Door Data Decision Drug

- 2. EMS/paramedics
 - a. education of stroke symptoms, assessment, and current treatment trends
 - b. use of simplified neurological assessment tools aimed at rapid identification of an individual suffering an acute stroke
 - c. documentation
 - i. time of onset
 - ii. time of initial call
 - d. general assessment
 - i. airway
 - ii. glucose evaluation
 - iii. blood pressure
 - e. advance notification of the ED prior to the arrival of the individual.

Assessment tools

Multiple scales have been developed to aid in the rapid diagnosis of stroke. Current tools are a modification of the hospital-based National Heart Institute Stroke Scale (NHISS). Key areas of assessment include face symmetry and motor function (80–90 percent of individuals suffering from a stroke demonstrate unilateral motor weakness) and abnormal speech. In addition, history of event (time of symptoms onset), blood pressure, review of medications, recent events, and blood sugar assist in the differential diagnosis (alcohol or drug intoxication, hypoglycemic states, postictal states, migraine, dementias, and metabolic encephalopathies).

Prehospital assessment tools

The Los Angeles Prehospital Stroke Screen (LAPSS)

The LAPSS is composed of four key history items, blood sugar measurement, and three areas of motor assessment. It was developed in the 1990s

Table 1.2: Los Angeles Prehospital Stroke Scale (LAPPS)

Screening criteria

- 1. Age > 45
 - 2. History of seizures absent
 - 3. Symptom duration < 24 hr
 - 4. At baseline, patient is not wheelchair bound or bedridden
 - 5. Blood sugar between 60 and 400
 - 6. Obvious asymmetry (right versus left)
 - 7. Facial smile/grimace
 - 9. Grip
 - 10. Arm strength
- If 1–5 are yes with asymmetry on exam then LAPPS criteria are met

(Table 1.2). The four key history items are aimed at ruling out potential stroke mimics and consist of

- 1. age > 45
- 2. absent history of seizure
- 3. duration of symptoms < 24 hr
- 4. determines that at baseline the individual was not wheelchair bound or bedridden.

Blood glucose is obtained and a reading of 60–400 eliminates hypoglycemia as a differential diagnosis. On physical exam, LAPSS evaluates for the presence and symmetry of

- 1. facial droop
- 2. grip strength
- 3. arm drift.

LAPPS demonstrated a sensitivity of 91 percent and a specificity of 97 percent for the identification of acute stroke patients. The test can be performed in less than 3 min.

The Cincinnati Prehospital Stroke Scale (CPSS)

The CPSS is a three-item scale based on the National Institutes of Health Stroke Scale (NIHSS). The presence of three components of the NIHSS in the CPSS are

- 1. facial palsy
- 2. arm weakness
- 3. dysarthria

CPSS identified 100 percent of stroke patients (Table 1.3). The scale rates the specific activity as normal versus abnormal and can be performed in less

Table 1.3: cincinnati prehospital stroke scale (CPSS)

Facial droop: Have patient smile, show teeth
Normal: Both sides of face move equally
Abnormal: One side of face does not move or does not move as well as the other

Arm drift: Arms held out straight in front of body with eyes closed for 10 s
Normal: Both arms move equally or not at all
Abnormal: One arm unable to maintain position or drifts compared to the other

Speech: Have patient repeat a phrase
Normal: Patient uses correct words, no slurring
Abnormal: Slurred words, inappropriate words, or unable to speak

Table 1.4: Face Arm Speech Test (FAST)

Speech impairment	Yes	No	Uncertain
Facial palsy	Yes	No	Uncertain
	Left	Right	
Arm weakness	Yes	No	Uncertain
Affected side	Right	Left	

Note: Speech: Assess quality of speech for difficulty articulating (slurring of words) or expressing oneself (word finding difficulties, object identification). Facial movements: Observe for symmetry of movement (ask patient to smile) and document side of asymmetry. Arm movements: Observe for symmetry of movement – ask patient to simultaneously raise arms 90° while sitting/supine; monitor for 5 s. Document the side of drift/weakness.

than 2 min. The test has a sensitivity of >95 percent when performed by EMS. CPSS identifies anterior circulation stroke more accurately than posterior circulation stroke.

The Newcastle Face Arm Speech Test (FAST)

The FAST was developed in the United Kingdom in 1998 and contains three key elements (facial weakness, arm weakness, and speech disturbances) from the CPSS, but avoids the need to repeat a sentence as a measure of speech, using instead an assessment of language ability by EMS during normal conversation with the patient. FAST was designed for assessment of a seated subject and hence does not assess leg weakness (Table 1.4). Inter-rater reliability between EMS and stroke physician was the best for assessment of arm weakness (95 percent).

Emergency medical services (EMS)

9

Medical management on the scene

Blood pressure, fluid, and blood sugar management are the most common issues facing EMS on the scene. Persistently elevated blood pressure may preclude the use of thrombolytics. Systolic blood pressure less than 185 mmHg and diastolic blood pressure less than 110 mmHg are desirable prior to rt-PA infusion.

Intravenous fluid should be administered cautiously. D5W or D5/0.45 saline solution should be avoided. Hypoglycemia in the stroke patient should be diagnosed and managed expeditiously. Administration of glucose to a suspected stroke patient without documented hypoglycemia should be avoided. There is some increasing evidence that hyperglycemia may be associated with worsened neurological outcome.

Summary

Stroke management requires a multidisciplinary approach that starts with dispatch of EMS and goes all the way to rehabilitation. EMS providers are the first responders and could play a major role in improving outcome following acute stroke.

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2 Initial assessment of patients with stroke-like symptoms

Rafael H. Llinas

The clinical bedside evaluation of stroke patients is a vital part of the workup. A detailed history and physical exam is necessary, as localization, etiology, and comorbidities need to be quickly assessed. History and physical exam is vital and is the best way to diagnose stroke imitators.

General medical examination

Stroke is primarily a medical disorder. The causes and risk factors of stroke are the same as the risk of atherosclerotic heart and peripheral vascular disease. Hypertension, diabetes, coronary artery disease, and hyperlipidemia are the main risk factors.

- Initial examination must include a general medical examination (Table 2.1).

General health and appearance

1. A comment on general health, whether the patient is vomiting or in distress can suggest etiology.
2. In general, patients presenting with coma on arrival, vomiting, severe headache, current warfarin therapy, systolic blood pressure >220 mmHg, or glucose level >170 mg/dl in nondiabetic patients are more likely to have a hemorrhagic stroke but these criteria alone are not sufficient to differentiate between ischemic and hemorrhagic stroke.

Vital signs

Vital signs are important to observe carefully. Stroke patients are often, but not always, hypertensive as the brain attempts to increase its own cerebral perfusion. Blood pressure will also be elevated in subarachnoid hemorrhage and intracerebral hemorrhage as the brain attempts to increase the cerebral