

Example

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Emergency Medical Services Training

In SB330 enacted by our legislature in 2005, a strong system to treat stroke victims in a timely manner and to improve the overall treatment of stroke victims was ordered. Part of this act is [that](#) a stroke emergency transport plan must be created and include training requirements on stroke recognition and treatment, including emergency screening procedures.

The GETAC Stroke Committee [is](#) cognizant that training and oversight of EMS personnel can be time and resource intensive, [and](#) so recommends the following minimal additions be added to Emergency Medical Service Provider's licensure detailed in the Texas Administrative Code.

- 1) That all EMS providers be trained and use the "Cincinnati Stroke Scale" in the [field](#) assessment of possible stroke victims.
- 2) That all certified EMS providers receive training in the recognition and emergency care of stroke, equivalent to training received in the current "ACLS Case 10 stroke scenarios".
- 3) That EMS providers have documented familiarity with the Stroke Center Certification and the Emergency Transport Protocol in their RAC.
- 4) That recognition and documentation of stroke training be overseen by the Medical Director supervising the EMS personnel.
- 5) That current ACLS certification be recognized as documentation of that training or that alternatively the supervising Medical Director be responsible for the oversight, documentation and attestation of equivalent training on a yearly basis.

Acute Stroke

Learning Objectives:

1. Explain why stroke is a medical emergency.
 2. Describe the pathophysiology of stroke.
 3. Discuss the Emergency Medical response and treatment for stroke.
 4. Describe the 7 D's in the Stroke Chain of Survival.
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- I. **Background:** Stroke is a major public health problem in the United States. Stroke is the third leading cause of death and about every minute, a person in this country has a stroke. Each year about 700,000 strokes occur in the US, 500,000 accounted as new strokes and about 200,000 recurrent strokes. It remains the leading cause of adult disability. Annually, about 150,000 American die from stroke related causes. Those who survive stroke may live with severe disabilities such as paralysis, loss of communication (speech), and memory lapse. The cost of stroke according to American Heart Association statistics is about 57 billion dollars.

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Stroke kills and disables people of all ages, both genders, and all ethnic and racial groups. In terms of prevalence, death and disability rates from stroke are higher among African-Americans than Hispanics and Caucasians. African-Americans are almost twice as likely as Caucasians to die from stroke. In Texas, Hispanic Americans are more likely to have a stroke than non-Hispanic whites. In an area of the United States known as the “Stroke Belt” (of which east Texas is now a part of), the death rate due to stroke is more than 10% higher than it is in other parts of the country. This geographically based higher rate of stroke can be linked to several factors, including:

- a. higher-than-average population of older people,
- b. higher-than-average population of African Americans
- c. dietary factors such as diet high in fat content (a high fat diet is common in the Southern US, and of course contributes to overall vascular disease)

The stroke belt includes the District of Columbia and the states of Alabama, South Carolina, Tennessee, and Virginia. It has also been recently recognized that this Stroke Belt has a “buckle” where there is an even higher incidence of death from stroke. This area includes a 153-county area that stretches from Georgia to North Carolina.

Most stroke patients don’t seek medical help quickly enough to benefit from time-sensitive therapies **such intravenous fibrinolytics (tPA) or endovascular mechanical revascularization techniques**. In general, less than half of stroke patient’s call for medical help within 24 hours of the onset of stroke symptoms and one third don’t seek help for over 2 days. As a general rule, in fact most stroke patients arrive at emergency centers by calling 911- the average time from onset of stroke to arrival at an emergency facility is 12 hours. These delays in seeking emergency care can be attributed, at least in part, to lack of awareness about the symptoms of transient ischemic attack (TIA) or stroke.

II. Pathophysiology of Stroke

Stroke can be defined as the acute onset of a focal, non-convulsive, neurological dysfunction (neurological deficit) lasting more than 24 hours, which results from injury to brain tissue caused by an interruption of cerebral blood flow. When intervening acutely, however, the 24-hour criterion for affirming the diagnosis of stroke cannot be adhered to. One must consider an ongoing ischemic deficit to be a stroke.

The basics!

- a. Brain cells can only survive about 3-4 minutes without **any** blood and oxygen.
- b. The brain is dependent on a steady, constant supply of blood and oxygen in order for proper brain functioning to occur.
- c. The brain is unlike the heart, which can sustain itself for a longer time before cell death occurs.
- d. Time therefore, is brain!

Several processes involving the blood vessels of, or leading to, the brain can be implicated in the cause of stroke:

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- 1) Disease or abnormality in the blood vessels of or leading to the brain. This includes: Atherosclerosis (build-up of fatty deposits on the inner walls of arteries, reducing blood flow and increasing the risk of a blood clot forming and partially or completely blocking blood flow), inflammation, a dissected artery, a developmental malformation, amyloid deposits (protein fibrils that can build up on the inside of the artery wall, reducing blood flow and causing risk of blockage), or an aneurismal dilatation (an aneurysm is a distention in the artery wall where blood builds up).
- 2) Disease or abnormality originating elsewhere in the body. This occurs when an embolus (a clot) forms in the heart or some other part of the circulatory system (i.e. the large vessels of the neck – carotid arteries), and travels to and gets stuck in a blood vessel of the brain.
- 3) Rupture of a blood vessel. This can occur in the subarachnoid space (the space beneath the arachnoid membrane, which is one of the brain's three coverings) or within the brain tissue.
- 4) Inadequate blood flow in the brain. This occurs because something is preventing adequate flow of blood to the brain (narrowed arteries, increased viscosity of the blood, or pressure applied to the artery by brain tumor, displaced cerebral tissue following hemorrhage elsewhere in the brain or following head trauma, or clot that form outside the artery as a result of blood leakage elsewhere in the brain).

The Main types of Stroke are:

- 1) **Ischemic Stroke:** This is also called ischemic cerebral infarction (ischemia is when there is insufficient blood flow to brain tissue, and infarction is the resulting death of brain tissue). Ischemic stroke is caused by a sudden interruption of blood flow that deprives the brain of vital oxygen and nutrient supplies it needs to function. Approximately **80%** of all strokes are caused by ischemia. The two broad categories of ischemic stroke are thrombotic strokes and embolic strokes.
 - a. **Thrombotic strokes** are caused when there is clotting within a blood vessel of, or leading to, the brain. A thrombus is a blood clot which forms over an atherosclerotic plaque on the inner wall of an unhealthy flow vessel; the clot may partially or completely block the flow of blood. When this occurs in a blood vessel of, or leading to, the brain – a thrombotic stroke – parts of the brain will suddenly be deprived of the oxygen and nutrients they need to function. Cerebral thrombosis commonly occurs in individuals over the age of 50, and its risk usually increases with age.
 - b. Embolic strokes, probably less common than thrombotic strokes, are caused when an embolus (a blood clot, a fatty deposit, or other foreign material) travels through the bloodstream toward the brain from some other part of the

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body, and partially or completely obstructs blood flow in a vessel of, or leading to the brain. This blocking of a blood vessel in the brain by an embolus (embolic stroke) causes a sudden deprivation of oxygen and nutrients that the brain needs to function. Embolic strokes often occur abruptly, without warning. Their symptoms can be fluctuating, which may be due to the continuing movement of an embolus within a blood vessel of, or leading to, the brain.

Embolic strokes are seen in young or middle-aged adults, and most often occur in individuals who have preexisting heart disease.

- 2) **Hemorrhagic Stroke**, also called cerebral (hemorrhage is when blood escapes from a ruptured blood vessel), damages the brain by compressing the tissue directly surrounding the hemorrhagic site. Approximately **20%** of all strokes are hemorrhagic strokes. The two forms of hemorrhagic stroke are **subarachnoid hemorrhage** (caused by a ruptured blood vessel in the subarachnoid space) and **intracerebral hemorrhage** (caused by a ruptured vessel inside the brain itself). Hemorrhagic stroke, the most dramatic form of stroke, appears abruptly and its symptoms quickly worsen as the hematoma enlarges and brain tissue is affected. Hemorrhagic stroke can be immediately life-threatening. Hemorrhage inside the brain often tears and separates normal brain tissue. The release of blood into the cavities within the brain that contain cerebrospinal fluid may paralyze vital centers. The most common cause of intracerebral hemorrhage is uncontrolled hypertension.
- 3) **Transient Ischemic Attack (TIA) or “Mini Strokes”** are cerebral events that share the same symptoms with ischemic stroke. The symptoms of TIA however are transient-lasting from a few minutes (usually less than 1 hour) to up to 24 hours (an arbitrary endpoint). TIAs are often ignored by patients because the symptoms tend to go away. It is important to note, however, that while symptoms are present, it is not possible to distinguish a TIA from a stroke. As such, all patients experiencing any brain ischemic deficit should be managed as a likely stroke patient. Moreover, even if symptoms are identified as due to TIA, they are a clear warning sign that an ischemic stroke is likely to occur in the near, possibly very near, future. Up to one third of individuals who experience TIA's will suffer a stroke within the 5 year period following their first TIA. In up to 75% of patients who develop thrombotic strokes, there is a history of previous TIAs. In addition, what may seem like a TIA (because symptoms are fluctuating) may, in fact, already be a full-blown ischemic stroke.

III. Risk factors for stroke – it is important to note that a patient with the following risk factors is more likely to experience a stroke.

- 1) **Hypertension** or High blood pressure – the number one cause of stroke.

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- 2) **Diabetes** – causes small vessel disease and because high blood glucose levels increase the severity and extent of brain damage due to stroke.
- 3) **Cigarette smoking** – which contributes to atherosclerosis in the carotid artery (the main artery supplying blood to the brain). This condition involved the buildup of fatty deposits on the inner walls of arteries, slowing down blood flow and providing prime spots for clots to partially or completely block blood flow to the brain.
- 4) **Cardiovascular disease** – in all its forms, especially atherosclerosis, atrial fibrillation (rapid, irregular heartbeat), myocardial infarction, and rheumatic heart disease.
- 5) **Transient Ischemic Attack (TIA)** – a clear warning of potential ischemic stroke.
- 6) **Age** – the older the person the higher the chance of having a stroke especially with any of the above risk factors.
- 7) **Gender** – men have a higher rate of stroke.
- 8) **Race** – African-Americans have the highest risk, but Hispanic rates of stroke are growing due to the high prevalence of diabetes and hypertension (especially in Texas).
- 9) **Prior stroke** – persons with a previous stroke have a higher risk of stroke.
- 10) **Illicit drug use**, cocaine as an example.
- 11) **Alcohol addiction or abuse**

IV. Signs and Symptoms of TIA and Stroke

When every second counts, it is imperative that EMS personnel quickly recognize the symptoms of stroke. Sudden interruption of blood flow deprives the brain of the oxygen and nutrients it needs to function normally. TIA and ischemic stroke cause immediate and distinctive focal neurological deficits. The particular symptoms of a stroke differ according to the precise location of the ischemia or hemorrhage.

When symptoms are experienced for only a brief period of time (minutes to hours) before disappearing, a diagnosis of TIA should be considered, but the possibility of full-blown ischemic stroke should not be discounted without thorough medical examination. **TIA's even if resolved are an indication for immediate medical attention.** Symptoms of stroke **also** may be fluctuating. Such strokes may be taking a “fluctuating progressive” course and should not be treated with any less urgency than strokes that present with nonfluctuating symptoms. As noted earlier, while symptoms are present, it is not possible to distinguish a TIA from a stroke. Consequently, individuals experiencing any brain ischemic deficit should be considered stroke patients and managed with appropriate urgency.

The distinctive signs and symptoms of stroke occur suddenly and may include:

- Weakness or paralysis of the face, arms or leg, especially on only one side of the body, mouth is drawn to one side, there is a loss of facial expression, and one eye looks more open than the other; possibly a drooping eyelid.

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- Inability to speak or understand speech (aphasia), or distorted speech (dysarthria)
- Other sensory symptoms affecting half of the body, such as numbness.
- Visual loss in one half (or one quarter) of space, or dimming or loss of vision (especially in only one eye), constricted pupils, pupils unequal in size or reactivity, double vision.
- Severe headache with no apparent cause, often accompanied by a stiff neck
- Dizziness, confusion, unsteadiness, or falls with no apparent cause; seizures
- Drowsiness or decreased consciousness
- Other symptoms, such as nausea or vomiting, respiratory distress, unusually flushed or pale skin, loss of bowel and/or bladder control.

V. Evaluating Risk factors, symptoms and physical features of stroke

In assessing a potential stroke, risk factors may provide clues to the types of stroke. Certain symptoms and combinations of clinical signs can also help distinguish among various types of stroke and can indicate lesion location and severity.

Age affects the probabilities of different kind of stroke. Hemorrhagic strokes account for half of all strokes in younger people (who are at greater risk for congenital aneurysms) and only about 25% of strokes in older people. Young people with sickle cell disease are a high risk for ischemic stroke. Hemophilia is a risk factor for hemorrhagic stroke at all ages.

The assessment of level of consciousness, which is an important predictor of short-term survival, can be valuable in distinguishing the type of stroke. A patient with ischemic stroke may be drowsy, but will probably not lose consciousness unless the infarcted area is substantial, and a patient with hemorrhagic stroke is prone to lose consciousness or be semiconscious. This most critical stroke patient is the one who loses consciousness completely or becomes flaccid on the affected side of the body.

Headache may differentiate hemorrhagic stroke from ischemic stroke. Sudden excruciating pain, typically described by the patient as the worst headache in their life, is the classic sign of subarachnoid hemorrhage. Resultant increases in intracranial pressure (ICP) commonly trigger vomiting and/or loss of consciousness. Other signs associated with subarachnoid hemorrhage include stiff neck and photophobia. Although migraines can involve pain that can mimic subarachnoid hemorrhage, migraine headaches appear less abruptly, and often with a characteristic aura.

Gaze deviation help localize a stroke lesion. In a stroke in the right hemisphere, the eyes will look toward the affected side, in this case the right side or toward the "lesion".

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Aphasia may present with either ischemic or hemorrhagic stroke, it is characteristic of left hemispheric lesions of any size. This is because in most people, the speech and language center is located on the left side of the brain. It is unlikely that a person who can understand, remember and respond verbally has significant aphasia. Aphasia should not, however, be mistaken for unresponsiveness, the patient may be responsive to nonverbal stimuli, but unable to comprehend words.

Certain concurrent clinical signs can indicate lesion location.

- A left hemispheric syndrome consists of affected movement, sensation, and vision on the right side of the body, as well as language and speech.
- A right hemispheric syndrome consists of affected movement, sensation, and vision on the left side of the body, as well as spatial relationships and emotional aspects of language.
- A large area of cerebral infarction or a smaller lesion in the white matter or the upper brainstem can result in impaired motor function a large region of the body (paralysis of the face, arm and leg on one side, or complete hemiparesis).

Lesions in the posterior brain (cerebellum or brainstem) can result in double vision, slurred speech, severe imbalance (ataxia), and decreased level of consciousness, including coma.

IV. Overview of **Texas EMS actions in case of Acute Stroke**

Critical Actions of EMS/ACLS providers in the prehospital setting

- 1. recognize the signs of TIA and stroke**
- 2. Perform a rapid neurologic exam that includes the elements of the Cincinnati Prehospital Stroke Scale.**
- 3. Determine (if possible) the time of the symptom onset.**
- 4. Provide rapid transport to an ED capable of caring for patients with acute ischemic stroke.**
- 5. Assess and support cardio-respiratory function as necessary during transport.**
- 6. Perform finger-stick determination (if a part of individual protocols) of serum glucose levels and treat appropriately.**
- 7. Notify the receiving hospital early that a possible stroke victim is in transport.**

Inappropriate Actions of EMS/ACLS providers in the prehospital setting

- 1. Failure to evaluate the patient properly or to recognize the signs and symptoms of stroke.**
- 2. Delay in transporting to the ED or transporting to an ED not capable of treating the patient appropriately.**
- 3. Attempting to treat hypertension in the field.**

It is important to stress that the objective is to rapidly assess, stabilize and support the stroke patient and transport him or her to an appropriate facility that can take care of stroke patients. Remember: TIME IS BRAIN! During

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stroke, brain tissue in the immediate area (called the infarct) die relatively quickly. When they die, these cells set off a “chain reaction” of chemical and electrical events within the brain that imperils a much larger, surrounding area of tissue (called the ischemic penumbra) in the **hours** immediately following the stroke. Every minute that passes during stroke affects the ability of compromised brain cells to recover and function normally. **Depending on the Stroke Center or Facility, protocols for treatment must begin within 3 to 8 hours.**

In the interest of saving time, some of the EMS actions, particularly the finer details of the history-taking and neurological evaluation, can be accomplished en route to the emergency center. The evaluation of the stroke patient, as with any patient, begins by performing a primary patient survey.

This includes:

- **Airway, Breathing and Circulation (ABC’s):** In addition to the usual procedures, position the patient in a supine position, with the head and shoulders elevated to about 30 ° to promote venous drainage and reduce intracranial pressure (ICP). Paralysis of the muscles of the throat, tongue, or mouth can lead to partial or complete upper-airway obstruction. Saliva can pool in the throat and be aspirated. The stroke patient may vomit, and aspiration of vomitus is a concern. Suction of the oropharynx and nasopharynx may be needed. Administer oxygen if the patient is experiencing hypoxia, oxygen SAT less than 95%. Administer O₂ by cannula at 2-3 L/min. Provide positive-pressure ventilation if ventilation is compromised. Advanced airway maneuvers when basic airway management is ineffective. Be aware that trauma may accompany a stroke patient if the patient fell.

Breathing – abnormal respirations are common in comatose patients and signal serious brain damage. Irregular respirations include prolonged pauses, Cheyne-Stokes respirations, or neurogenic hyperventilation. Shallow respirations or inadequate air exchange resulting from paralysis can occur. Rescue breathing, assisted ventilation and supplemental oxygen should begin promptly if needed. Severe brain injuries can lead to respiratory arrest.

Circulation – cardiac arrest is an uncommon complication of stroke, but assess for this early. Cardiac abnormalities are usually related to the development of perfusing arrhythmias or respiratory arrest. Arrhythmias and changes in blood pressure frequently complicate stroke, and monitoring of both BP and cardiac rhythm is part of the early assessments. Hypotension or shock is rarely caused by stroke, so if these clinical problems develop, look for other causes. Hypertension is often present in stroke patients, but it typically subsides and does not require treatment.

- Decisions about the treatment of increased BP should be made in the ED.

Cardiac arrhythmias may point to an underlying cardiac cause of stroke or may be a consequence of the stroke. Bradycardia may indicate hypoxia or ICP.

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- In the event severe stroke damage is indicated by increased ICP and decreased level of consciousness, some doctors may recommend hyperventilation to help reduce ICP. It is recommended that blood pressure not be treated in the field. Note that a rising blood pressure accompanied by a falling pulse rate is indicative of increased ICP, which requires intervention as described above and immediate transport to a hospital that specializes in caring for stroke patients.
- Handle the patient calmly, protect paralyzed extremities, keep patient inactive. Extreme activity can increase intracranial pressure. If trauma is suspected, establish and maintain cervical spine support.
- Perform a quick neurological exam using the Cincinnati Pre-Hospital stroke scale, but if time is an issue, perform this exam en route to the hospital.
- Keep patient warm, but not overly warm – hyperthermia can accelerate brain damage. Keep the patient NPO - do not give the patient anything to eat or drink – paralysis of the pharynx is common and patients may have dysphagia (difficulty swallowing).
- Do not give stimulants and **do not give aspirin.**
- Do not treat high blood pressure in the field.
- Quickly obtain relevant information from the patient (if capable), family, coworkers, friends or witnesses, including whether there has been trauma to the head and neck and ascertaining current medications use (including illegal drugs);ask about aspirin use to that antithrombotic effects may be anticipated. It is recommended that any medications that can be found at the location be collected and transported with the patient. If possible, have someone accompany the patient to the hospital or obtain their telephone number where they can be reached by EC personnel
- The secondary survey focuses on the neurological evaluation, during which the onset and progression of stroke symptoms must be determined and **document. Establish, as accurately as possible, the time of stroke onset.** You could ask questions such as:
 - Did the symptoms appear abruptly or gradually?
 - When was the patient last seen “normal” or without stroke symptoms?
 - What were you doing when the symptoms occurred?
 - Were there any seizure like symptoms occurring during the event?

From the initial interaction with the patient, assess level of consciousness and orientation and, if the patient is conscious, any abnormalities in the patient’s speech. Use the Glasgow Coma Scale to record a baseline measurement to compare against future neurological deterioration during transport and when the patient arrives at the hospital.

- Establish and IV or saline lock, and infuse only normal saline at the “to keep open” rate. Do not administer large amounts of fluid, as it may exacerbate brain swelling.
- Measure blood glucose levels – hypoglycemia may mimic some of the symptoms of stroke. Do not administer dextrose fluids unless the glucose is less than 80.
- If one of the patient’s eyelids is affected, inform the patient first and loosely tape it closed to prevent drying of the eye.
- Transport to an **appropriate Stroke Center or Facility based on the RAC transportation plan.**

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- Notify the “Stroke Team” directly if possible that there is a possible stroke patient en route.
- Transport Code 3 or with the highest level of urgency.

Review of the “7 D’s” of the Chain of recovery for Acute Ischemic Stroke

1. Detection

- This pertains to the onset of stroke signs and symptoms.
- Less than 1 of 10 stroke victims has been educated about the signs and symptoms of stroke.
- Patients who have stroke do not usually feel pain (different from heart attack)
- Mild facial weakness, minor difficulty speaking or slight dizziness or nausea or vomiting, may be signs of stroke.
- More dramatic signs, including paralysis of a hand or arm, disabling vertigo, and loss of consciousness may be observed.
- Mild signs are often unnoticed or ignored.

2. Dispatch – Early Activation of EMS

- Currently half of all stroke victims are driven to the ED by family or friends – they should call EMS instead
- Emergent triage can begin with dispatch and bystanders can be instructed in lifesaving skills.

3. Delivery – excellent prehospital assessment, rapid transport (“Load and Go”) and great field management lead to correct identification of stroke and TIA’s.

- Refer to signs and symptoms of stroke referred to previously.
- Perform the Cincinnati Prehospital Stroke Screening Scale
 - Assess for facial droop – ask the patient to smile or show his or her teeth.
 - Motor arm drift – the patient closes his or her eyes and holds both arms out, look for drift or weakness on the affected side.
 - Speech difficulties – have the patient say “The sky is blue in Texas.”
 - Takes less than one minute
 - Patients with 1 out of 3 findings – as a new event – have a 72% chance of an ischemic stroke.
 - If all three findings are present, the chance of stroke becomes more than 85%!

4. Door – ED Triage

- “Stroke Team” access if available
- Time targets
 - Door to Doctor 10 minutes
 - Door to CT scan 25 minutes
 - Door to CT read 45 minutes
 - Door to treatment 60 minutes

5. Data – ED evaluation and management

6. Decision – specific stroke therapies

7. Drugs – fibrinolytic therapy

VI. Conclusion

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Stroke is a medical emergency. Time is brain! EMS personnel must know the signs and symptoms of stroke in order to properly triage and transport suspected stroke patients to the appropriate designated **Stroke Center or Facility**. Even with an 8 hour treatment window, depending on the Stroke Center or Facility, studies have shown that the earlier the patient receives treatment the better the over all outcome.

References:

1. Case 10 AHA ACLS
2. 2005 AHA Stroke Statistics
3. Part 9: Adult Stroke, Circulation. 2005; 112:IV-III-IV-120.
4. Texas SB 330