



Seattle-King County EMS

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CBT442-EMT12-Neurologic Emergencies

PRINT VERSION

FOR A WEB-BASED TRAINING MODULE

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Introduction

Recent advancements in the acute care of stroke patients are giving hope for restoration of lost neurological function. The key for many stroke patients is getting clot-busting therapy within several hours of the onset of symptoms.

EMS providers are a vital link between the patient and new therapies that can greatly improve the lives of stroke patients. When it comes to strokes, "time is brain cells."

Before You Begin

This is a continuing education and recertification course for EMTs. It covers fundamental EMT-Basic concepts and terminology as well as advanced material. We highly recommend completing the case studies and practice quiz before completing the exam.

We also recommend that you review an EMT textbook chapter covering neurologic emergencies as a refresher before taking the exam; for example: Chapter 15, Neurologic Emergencies in *Emergency Care and Transportation of the Sick and Injured*, 11th edition (AAOS) or Section 4 – Chapter 4, Diabetic Emergencies and Altered Mental Status in Brady 12th Edition.

Practical Skills

To receive CBT or OTEP credit for this course a trained skills evaluator must evaluate your ability to perform the following hands-on practical skills.

Practical Skill Outcomes:

1. Determine whether patient is (SICK/NOT SICK) on initial assessment
2. Conduct a patient history
3. Administer the FAST exam to a patient
4. Recognize symptoms of stroke and need for short scene times
5. Provide emergency care for neurologic emergencies

Objectives

CBT442 is an online EMS continuing education module for EMS providers including first responder and emergency medical technician. After completing this course you will be able to:

Learning Outcomes

1. Identify the major regions of the brain and their functions.
2. Recognize signs and symptoms of seizure disorders
3. Determine appropriate care for migraine headaches
4. Distinguish between the two types of stroke.
5. Determine the underlying causes of an ischemic stroke.
6. Recognize the underlying cause of a hemorrhagic stroke.
7. Pinpoint the signs and symptoms of stroke.
8. Use appropriate application of the FAST exam.
9. Determine the reasons why a stroke patient must be assessed and transported quickly.
10. Identify the steps in the emergency assessment and care for the patient experiencing a stroke.

Terms

Aphasia — Partial or total loss of the ability to articulate ideas or comprehend spoken or written language.

Atherosclerosis - A condition characterized by the deposit of fatty plaques containing cholesterol and lipids on the innermost layer of the walls of large and medium-sized arteries.

Clot-busting therapy -- dissolve blood clots in a procedure termed *thrombolysis*. It limits the damage caused by the blockage of the blood vessel.

Dysarthria - Difficulty in pronouncing words, caused by impairment in the control of the muscles used in speech.

Embolism - A clot that travels from one part of the body to another until it becomes lodged in one of the small arteries of the brain and blocks blood flow.

Expressive aphasia - Aphasia in which the power to communicate by writing, speaking, or using signs is diminished or lost. Also called *motor aphasia*.

Foramen magnum - An opening in the base of the skull through which the spinal cord passes to the cranial cavity and becomes the medulla oblongata.

Hemiparesis - Partial weakness affecting one side of the body.

Hemiplegia - Complete paralysis on one side of the body.

Hemorrhagic stroke - A type of stroke that occurs when a blood vessel bursts inside the brain.

Hyperlipidemia - Elevated blood fat levels, particularly LDL cholesterol.

Infarction - A localized area of cell death due to a lack of oxygenated blood.

Ischemia - A deficiency of oxygenated blood in a body part as a result of a constriction or blockage of the blood vessel.

Migraine headache - Migraines are thought to involve abnormal functioning of the brain's blood vessels. Migraines cause severe pain on one or both sides of the head, upset stomach, and, at times, disturbed vision

Paresis - Slight or partial paralysis.

Receptive aphasia - Aphasia in which the ability to comprehend written or spoken words is diminished or lost. Also called *sensory aphasia*.

Seizure - Uncontrolled electrical activity in the brain, which may produce a physical convulsion or twitching

Status epilepticus – One continuous unremitting seizure lasting longer than 30 minutes or recurrent seizures without regaining consciousness between seizures...always considered a medical emergency.

Stroke (CVA) - A vascular disease that affects the blood vessels supplying blood to the brain. A stroke occurs when a blood vessel bringing oxygen and nutrients to the brain bursts or is clogged by a blood clot or embolus. A stroke can cause neurological deficits.

Thrombolysis - breakdown (*lysis*) of blood clots by use of medications... referred to as clot busting for this reason

Thrombus - A blood clot that typically forms over fatty plaque deposits that form on the inner wall of arteries. This plaque and subsequent narrowing may progress slowly over years, particularly in those patients who smoke or have high cholesterol or high blood pressure.

Transient ischemic attack (TIA) - A disorder of the brain in which brain cells temporarily stop working because of insufficient oxygen causing stroke-like symptoms that resolve completely within 24 hours of onset.

The Brain

Brain

The two parts of the central nervous system are the brain and the spinal cord. The central nervous system is responsible for controlling both the voluntary and involuntary activities of the human body.

The brain is the most highly specialized organ in the body. It is richly supplied with blood and demands an adequate and constant supply of oxygen. There are three regions that are important for you to know: the **cerebrum**, **cerebellum** and **brain stem**.

Drag and drop activity for structures of the brain

Elaboration – Cerebrum, Cerebellum and Brain Stem

Functions such as emotion, thought, vision, movement, sensation and language, reside in the cerebrum. Coordination of body movement is controlled by the cerebellum. The brain stem controls the most primitive functions including respiratory and cardiac functions.

Elaboration – A Tour of the Brain

[Take a tour](#)

American Stroke Association (external link)

Cerebrum

The **cerebrum** is the largest region of the brain and occupies most of the space in the cranium. The cerebrum creates and controls conscious thought, memory, personality, speech, motor function, vision and tactile (touch) impulses.

The left hemisphere usually contains the speech area (even in left-handed individuals, though in a slightly lower percentage).

Cerebellum

The **cerebellum** is located below and behind the cerebrum in the base of the skull. Its primary function is to regulate and coordinate muscle activity and balance through impulses it receives from the eyes, the ears and the peripheral joints and muscles.

Brain Stem

The **brain stem** controls basic functions vital to survival such as digestion, heart function, respiration, glandular secretions and the autonomic nervous system.

It connects the brain to the spinal cord, passing through a hole in the base of the skull called the foramen magnum. Increased intracranial pressure can force the lower brain structures through the foramen magnum and produce herniation syndrome with evidence of brain stem dysfunction.

Drag and drop activity for brain functions and their locations

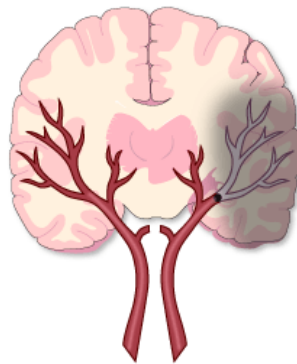
Stroke

Ischemic Stroke

A stroke is a condition in which loss of brain function occurs due to an abnormality of blood circulation to an area of the brain. The two major types of stroke are ischemic (blockage) and hemorrhagic (rupture/bleed).

Elaboration – Ischemic vs. Hemorrhagic Stroke– Dr. Tirschwell
View video of Dr. Tirschwell

An **ischemic stroke** results from either a clot that develops in an artery at the site of the blockage (thrombus) or one that floats to the site to form a blockage from a different part of the body (embolus). This clot prevents oxygenated blood from reaching the downstream brain tissues.



If the initial onset of symptoms is not devastating, the vast majority of ischemic stroke patients survive, but with limited prospects of regaining function unless given clot-dissolving drug therapy within several hours of when the patient was last known to be normal. This time frame starts at the onset of symptoms and must be reliably determined.

Ischemic stroke patients need clot-busting drugs. Thrombolytic drugs are time sensitive and must be given as early as possible.

For strokes of recent onset, the sooner the patient receives definitive treatment the better the outcome. Even if the patient is not eligible for clot-busting drugs; other therapies, some including intra-arterial clot extraction, may be useful.

[View CT image](#) of ischemic stroke
University of Rochester Medical Center (external link)

Cerebral Thrombus

One cause of an ischemic stroke is the formation of a thrombus. A **thrombus** is a blood clot that forms locally near an area of plaque. The clot causes a sudden occlusion of the blood vessel.

In the cerebral arteries when blood flow stops it produces a sudden onset of neurological deficits. Outward signs and symptoms are dependent on which area of the brain is affected.

Elaboration – Causes of a Thrombus

Atherosclerosis is the process of fatty plaque deposits forming on the inner wall of an artery. This narrows the artery slowly over many years, particularly in people with a history of smoking, high cholesterol, high blood pressure or diabetes.

A sudden blockage can occur when the cholesterol-rich plaque ruptures and platelets adhere to the ulcerated surface. This event triggers a number of vascular responses and blood clotting mechanisms.

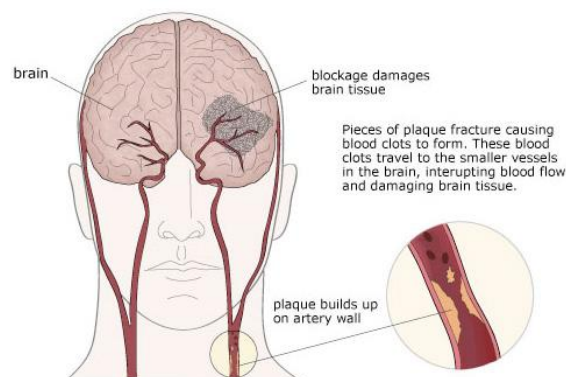
The pathophysiology for thrombosis is the same as in a heart attack and has led to the same diagnostic and therapeutic approaches. These approaches include rapid diagnosis, early attempts to revascularize the ischemic area and preventive measures which control hypertension, hyperlipidemia and thrombosis.

[Cerebral venous thrombosis](#) – Uncommon but Important

MedscapeREFERENCE (external link)

Embolus

Another cause of an ischemic stroke is an embolus. An **embolus** is a clot that forms elsewhere in the body and circulates in the bloodstream until it gets stuck in an artery.



When an embolus blocks an artery, the tissues beyond the plug are deprived of normal blood flow and oxygen. This can cause ischemia and even death of the tissues involved. Clot-busting drugs can help individuals with an ischemic stroke if administered within several hours from time of onset.

Elaboration – Causes of an Embolus

An embolus can affect any part of the body. The most common sites are the legs and feet. When the brain is involved this causes a stroke. When the heart is involved, it is called a myocardial infarction.

An embolus can be a blood clot, fat cells or an air bubble. A common cause of an embolus is when cholesterol builds up in an artery whose inner lining has become thickened or damaged. If part of the cholesterol breaks off, it becomes an embolus.

Emboli commonly form from blood clots in a heart that has been damaged from heart attack or when the heart contracts abnormally from atrial fibrillation. Approximately 20% of ischemic strokes are caused by emboli that come from the heart.

Other causes of emboli include fat cells that enter the blood due to a major bone fracture, infected blood cells, small gas bubbles, or cancer cells that enter the blood stream.

[View photos](#) of cerebral infarctions by emboli (external link: Internet Pathology Lab)

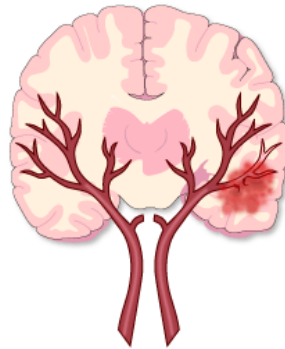
[View animation](#) of embolus formation (external link: doereport.com – requires QuickTime)

Hemorrhagic Stroke

Hemorrhagic stroke results from either a ruptured blood vessel on the surface of the brain (subarachnoid hemorrhage) or within the brain (intracerebral hemorrhage). The effects of a burst blood vessel put pressure against the brain. This prevents oxygenated blood from reaching the cells.

The signs of hemorrhagic stroke can appear rapidly. Many individuals experience a sudden, severe headache due to blood that irritates the brain tissue and increasing pressure on the brain.

The prognosis for hemorrhagic stroke is poor compared to that of ischemic stroke. Approximately 50% of patients who suffer an intracerebral hemorrhage die within the first year after the event. The prognosis for those who survive is variable, depending on the type of hemorrhage (subarachnoid vs. intracerebral), the size, the location and existing medical conditions.



Elaboration – Types of Hemorrhagic Stroke

A *subarachnoid hemorrhage* occurs when a vessel bursts in the outer coverings of the brain within the subarachnoid space. The area rapidly fills with blood. There may be a sudden, intense headache, neck pain and nausea or vomiting. It is often described as "the worst headache of my life."

An *intracerebral hemorrhage* is usually caused by bursting of small blood vessels weakened by years of high blood pressure. Less commonly, it is caused by abnormal tangles of blood vessels called vascular malformations. In this type of hemorrhagic stroke, blood accumulates in the brain tissues and can extend into the space between the brain and the membranes covering it.

View CT image

[Intracerebral hemorrhage](#)

University of Rochester Medical Center (external link)

View CT image

[Subarachnoid hemorrhage](#)

University of Rochester Medical Center (external link)

View CT image

[Subdural hematoma](#)

University of Rochester Medical Center (external link)

Elaboration – Aneurysms

A common cause of a ruptured artery in the brain is an abnormality or weakness in the vascular wall called an aneurysm. This is more likely to occur in patients with existing aneurysms of cerebral vessels (berry aneurysms), hypertension or with congenital malformations of the cerebral blood vessels.

Elaboration – Cushing's Response

Cushing's Response (Cushing's Triad) is a phenomenon in which an increase in intracranial pressure results in an increased blood pressure, a decreased heart rate and irregular breathing.

[View more information](#) on hemorrhagic stroke

NIH – National Institute of Neurological Disorders and Stroke (external link)

[View more information](#) on intracerebral hemorrhage stroke

The Internet Stroke Center (external link)

[View more information](#) on subarachnoid hemorrhage

The Internet Stroke Center (external link)

Transient Ischemic Attack

A **transient ischemic attack** (TIA) is a condition in which brain cells temporarily stop working because of insufficient oxygen. This causes temporary stroke-like symptoms that resolve completely within 24 hours of onset.

TIA's often precede a stroke. At the time of symptoms, it is impossible to distinguish a stroke from a TIA. If the symptoms resolve, the episode is considered a TIA. If the symptoms remain beyond 24 hours it is considered a stroke.

Elaboration – TIA/Stroke...Are They the Same? – Dr. Tirschwell

View video of Dr. Tirschwell – **access video link via EMS Online course**

Elaboration – Time Duration of TIAs

The symptoms of a TIA are rapid in onset. Symptoms generally subside within five minutes and often in less than one minute. Symptoms vary in duration from 2 to 15 minutes, but the vast majority last less than one hour.

[View more detailed information](#) on TIAs (external link)

MedscapREFERENCE

Risk Factors

Elaboration – Risk Factors – Dr. Tirschwell

View video of Dr. Tirschwell – **access video link via EMS Online course**

Factor	Risk
Hypertension	High blood pressure (140/90 mmHg or higher) is the most important factor in stroke.
Smoking	The damage of cigarette smoke to the cardiovascular system increases the risk of stroke just as it increases the risk of coronary artery disease.
Age	The chance of stroke more than doubles for each decade of life past the age of 55. While stroke is common in the elderly, substantial numbers of people under 65 have strokes.
Gender	In most age groups, more men than women have strokes in a given year, the exception to this rule is subarachnoid hemorrhage, the only stroke type more common in women than men. However, women account for more than half of all stroke deaths.
Heredity	The probability of stroke is much higher in families with a history of stroke.
Prior stroke	Previous events increase the risk of another.
Diabetes	Diabetes is strongly connected to HTN and high cholesterol. Vascular injury associated with diabetes increases stroke risk.
Carotid artery disease	A diseased or narrowed carotid artery can become blocked by a blood clot causing a stroke or can be a source of an embolus to the brain.
Heart disease	Abnormal heart rhythms such as atrial fibrillation increase the risk of stroke due to the chance of blood clots being formed, dislodged and traveling to the brain obstructing blood flow.
TIAs	TIAs are strong predictors of stroke. A person who has suffered a TIA is 10 times more likely to have a stroke and develop permanent neurological deficit.

Signs and Symptoms of Stroke

Early detection of the warning signs of a stroke is crucial. The signs and symptoms can vary greatly depending on which part of the brain is affected. In general, these can include the sudden onset of or sudden awakening with:

- paralysis or weakness on one side of the body (hemiplegia, hemiparesis)
- facial droop on one side
- altered level of consciousness (from confusion to unconsciousness)
- change in personality or mood
- headache or dizziness
- impaired speech
- blurred vision
- poor coordination

An altered level of consciousness or coma is more common with hemorrhagic stroke compared to ischemic stroke. Often this is due to an increase in intracranial pressure.

Ischemic vs. Hemorrhagic Stroke – Drag and Drop

Patient Care

Physical Exam

The first step in evaluating a potential stroke patient is to conduct an initial assessment to determine SICK or NOT SICK. A SICK patient is physiologically unstable based on key clinical indicators. A NOT SICK patient is physiologically stable. He or she still may require BLS treatment or ALS evaluation.

A physical exam starts with a set of vital signs to establish a baseline. Look for other explanations of stroke-like symptoms such as trauma, medic alert tags, drug use or diabetes. If available, blood glucometry is an excellent tool to help assess the cause of altered mental status.

An important part of the physical exam is testing neurological function with the FAST...based on the Cincinnati Prehospital Stroke Scale. Additionally, you may check both hands for equal grip strength and check if the individual can push with both feet equally.

Elaboration – Glucose Levels and Stroke – Dr. Tirschwell

View video of Dr. Tirschwell – **access video link via EMS Online course**

Elaboration — SICK vs. NOT SICK

A SICK patient is one who can die quickly unless you initiate aggressive BLS and ALS treatment and rapid transport. This patient appears physiologically unstable as indicated by key clinical signs.

A NOT SICK patient is one who can be ill or injured, but not severely enough to be life threatening. This patient appears physiologically stable and does not need immediate ALS measures at this time. BLS treatment can still be required!

The SICK/NOT SICK choice is a very important medical decision. In some cases, it is a life-saving choice. You should be able to decide within the first minute of contact whether or not the patient is critically ill. You do this by forming a clinical picture. Once the decision is made, responder actions should proceed in a manner appropriate to the patient's condition.

FAST

FAST is based on the Cincinnati Prehospital Stroke Scale and focuses on three symptoms: facial droop (F), arm drift (A), and speech problems (S), with (T) for time. It is accurate in identifying patients with stroke. The results of the test you perform will be used in further diagnosis and treatment at a hospital. An abnormal finding in any of the three tests strongly suggests a stroke.

FAST		
Test	Normal	Abnormal
Facial droop	Both sides of the face move equally	One side of the face does not move as well as the other
Arm drift	Both arms move the same or both arms do not move at all	One arm drifts down compared to the other or one arm does not move
Speech	The patient says correct words with no slurring of words	The patient slurs words, says the wrong words, or is unable to speak
Time	Establish the Time the patient was last known to be normal	

Facial droop is the first test of the FAST Stroke Scale. Ask the patient to show his or her teeth or smile. Watch closely to observe that both sides of the face move equally. The test results are immediately "abnormal" if one side of the face does not move as well as the other.

To test **arm drift**, ask the patient to close his or her eyes and extend both arms straight out for 10 seconds. The palms should be up, thumbs pointing out.

Check **speech**, the third part of the stroke scale, by asking the patient to repeat a simple phrase such as "Firefighters are my friends" or "The sky is blue in Seattle."

Establish the **Time** that the patient was last known to be normal.

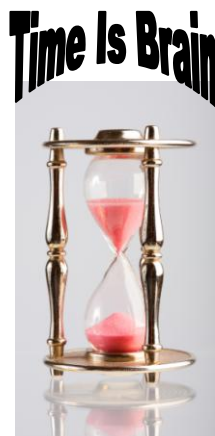
Elaboration – FAST – Dr. Tirschwell

View video of Dr.Tirschwell – **access video link via EMS Online course**

FAST Quiz

Time of Onset

In order to treat an ischemic stroke with clot-busting drugs, it's crucial that hospital staff know the exact time of onset of the symptoms...the time the patient was last known to be normal. Thrombolytic drugs are time sensitive and must be given as early as possible.



You must quickly gather information regarding onset of symptoms from the patient, family members and caregivers. Be aware that from the moment a patient arrives at the hospital it takes time for the stroke team to make an assessment and administer the thrombolytic therapy.

Therefore, if the onset of symptoms was several hours or less prior to your arrival, you will have little time to waste.



Try to determine the precise time of onset of symptoms but keep scene times very short...our goal is 15 minutes

Patient History

Stroke patients frequently report a loss of motor function and/or a change in speech pattern. Additionally, some patients experience an altered level of consciousness. The chief complaint and time of onset are key in the assessment of stroke.

Use the **SAMPLE** technique to determine if there is a history of:

- hypertension
- blood thinners or anticoagulants
- arteriovenous malformation (AVM)
- cerebral aneurysm
- prior stroke

Elaboration – AVM Case Study – August 2011 Case of the Month

<http://www.emsonline.net/cotm/>

Patient History using the SAMPLE technique

SAMPLE	
Symptoms	<p>The symptoms of a stroke are related to the area of the brain that is ischemic. With a hemorrhagic stroke the symptoms are more generalized and usually more severe (for example, unconsciousness and vomiting).</p> <p>The five most common symptoms occur suddenly:</p> <ul style="list-style-type: none">numbness or weakness of face, arm or leg, especially on one sideconfusion, trouble speaking or understandingdifficulty seeing in one or both eyesdifficulty walking, dizziness, loss of balance or coordinationsevere headache with unknown cause
Allergies	May influence drug selection
Medications	Indicate past history, may be a cause of CNS symptoms
Past medical history	Indicates stroke risk factors
Last oral intake	Not important in etiology but may be important in treatment
Events prior	May suggest alternate cause of symptoms. It is imperative to determine the time of symptom onset. Family, friends or care provider may need to provide information about the medical history and current episode.

Care for Stroke

Protecting a patient's airway and ensuring adequate respirations are your most important tasks in caring for a potential stroke patient. Keep the airway open and remove any secretions that can be aspirated.

Provide ventilatory assistance with a bag-valve mask if the patient's breathing efforts are inadequate. Proper positioning is important, depending on the patient's airway needs. Administer oxygen if the patient's oxygen saturation level is below 95% or there are signs of hypoxia.

If the patient is a candidate for clot-busting therapy and it appears he or she will be able to receive the therapy within a several hour time window from onset of symptoms, initiate immediate and rapid transport to an appropriate medical facility.

Elaboration – Field Care– Dr. Tirschwell

View video of Dr. Tirschwell – **access video link via EMS Online course**

Elaboration — Airway and Breathing

A stroke can affect an individual's ability to maintain an open airway and adequate respirations. You must monitor and protect the airway. Administer oxygen via a non-rebreathing mask or assist ventilations with a bag-valve mask if respiratory effort is inadequate.

For the SICK (unstable) and unconscious stroke patient, position in a supine position or in the most appropriate position to control the airway and maintain good ventilation. For a NOT SICK (stable) stroke patient who is alert, consider a position of comfort or position on the back with head and shoulders slightly elevated.

For someone with a decreased LOC, patent airway, adequate ventilations and stable vital signs, consider the recovery position to protect from vomiting. If you choose the recovery position, place the patient affected side down. This allows free movement of unaffected limbs.

In an unconscious patient, watch for a tongue that is blocking the airway. Consider inserting an airway adjunct such as an oral airway if required to maintain a patent airway. Be alert for saliva and other secretions that can be aspirated into the lungs. Suction will also be important as well as proper positioning.

Remove dentures and false teeth, if you believe they will become an airway problem. Place the dentures in a clearly marked property bag or leave them at the patient's home.

Elaboration — Additional Care Measures

Other BLS care measures include:

- request paramedics if indicated (e.g. history of cardiac disease, respiratory distress, airway compromise or unconsciousness)
- protect paralyzed limbs
- monitor vital signs
- maintain normal body temperature
- keep absolutely quiet and handle gently
- avoid unnecessary movement

Elaboration – Oxygen and Stroke – Dr. Tirschwell

View video of Dr. Tirschwell – **access video link via EMS Online course**

Short Scene Times

Victims of stroke often deny or rationalize their symptoms which further delays treatment at the hospital. Patients who can be eligible for clot-busting drugs must be transported to the appropriate hospital immediately. You should notify the hospital that a possible stroke patient is en route so they have time to prepare.

Elaboration – Short Scene Time...Time Lost is Brain Lost – Dr. Tirschwell
View video of Dr. Tirschwell – **access video link via EMS Online course**



When possible...keep scene time to 15 minutes.

[View video](#) on how tPA works to help dissolve clots (external link)

Latest Treatments

tPA is FDA-approved clot-buster medication that may reduce long-term disability for the most common type of stroke. There are also two other types of stroke treatment available that might help reduce the effects of stroke.

Elaboration – Latest Treatments– Dr. Tirschwell
View video of Dr. Tirschwell – **access video link via EMS Online course**

Intra-atrial clot removal

In 2004 the FDA cleared a procedure for patients who are ineligible for IV-tPA or fail to respond to IV-tPA. This technique can be used for patients who are beyond the time window for IV-tPA and it does not have a time limit for its intended use. The intra-atrial clot removal procedure restores blood flow in the larger vessels of the brain by removing blood clots. The system is a tiny cork-screw shaped device that works by wrapping around the clot and trapping it. The clot is then retrieved and removed from the body.

[View video](#) of clot removal (external link)

Revascularization of occluded vessels

This procedure helps restore brain blood flow after an ischemic stroke. The system uses suction to grab blood clots in the brain for treatment of acute ischemic stroke. Previously doctors had limited treatment options with acute ischemic stroke if patients were beyond the time window for intravenous thrombolysis. This procedure is effective if used within eight hours of symptom onset.

[View video](#) of vacuum clot removal (external link)

Seizure Disorders

Seizures

Epilepsy is the neurological condition characterized by sudden and recurrent seizures. There are 1.5-2.7 million people with epilepsy in the United States. Most recurrent seizures can be controlled with proper medications.

A seizure occurs when the neural pathways become disturbed by excessive discharge of electricity in the brain. It is the equivalent of an "electrical storm" in the brain. It can affect a part of the brain or the whole brain itself.

There are many different types of seizures, with symptoms ranging from a brief lapse of awareness, abnormal behavior, tingling or jerking in one part of the body or loss of consciousness with convulsions. Seizures can have many causes, including medicines, high fevers, head injuries and certain diseases

Common causes of seizures include:

- Epilepsy
- Tumor (benign or cancerous)
- Infections such as meningitis, encephalitis or AIDS
- Scar tissue from injury
- Head trauma
- Stroke
- Hypoxia
- Abnormal blood chemistry
- Hypoglycemia
- Poisoning
- Use of illegal street drugs like cocaine or amphetamines
- Drug overdose
- Alcohol/medication withdrawal
- Sudden high fever

[View more information](#) on seizures (external link)

NIH, MedlinePlus

Status Epilepticus

Most seizures last from 30 seconds to 2 minutes and do not cause lasting harm. **Status epilepticus** (SE) is a common, life-threatening neurologic disorder. It is essentially an acute, prolonged epileptic crisis. This type of seizure can last longer than 5 minutes and/or a person has many seizures and does not wake up between them.

Status epilepticus is a medical emergency that requires quick and careful medical treatment and could be deadly if not immediately addressed. Complications that could arise from status epilepticus include:

- airway compromise
- dysfunction of the heart or lungs
- metabolic changes
- increase in body temperature
- irreversible brain injury.

Emergency Care

Basic Life Support care includes:

- Once patient is awake, perform an examination to determine if any injuries occurred or if any neurologic abnormalities exist.
- During the seizure, position the patient on his/her side
- Maintain the airway
- Protect the patient from injury
- During and after the seizure, provide oxygen
- Perform blood glucometry
- Obtain oximetry reading after seizure

The Advanced Life Support indicators include:

- Multiple seizures (status epilepticus)
- Single seizure lasting longer than 5 minutes or more than 15 minutes postictal with no improvement in level of consciousness
- Seizure due to hypoglycemia
- Seizure due to hypoxia
- Seizure following head trauma
- Drug or alcohol associated seizure
- Pregnant female

Headache

Primary (also called tension headache)

The most common type of headache is a tension headache. These are due to tight muscles in the shoulders, neck, scalp and jaw. They are often related to stress, depression or anxiety.

Migraine Headache

A migraine is a very specific type of headache. The pain of a migraine headache is often described as an intense pulsing or throbbing pain in one area of the head.

A migraine headache typically starts with some visual disturbance called an aura. The patient may see spots, dots, sometimes zigzag lines, or a temporary loss of vision. A migraine can last from half an hour to several days. Nausea and vomiting can occur with migraine headaches.



The exact cause of migraine headaches is unknown. However, certain events can trigger migraine headaches. In some individuals, some types of food or drink could trigger a migraine. Other triggers include:

- anxiety
- stress
- lack of food or sleep
- exposure to light
- hormonal changes in women

EMS gets called quite a bit for migraine headaches. Be sure to perform a thorough examination and physical.

Secondary Headaches

Headaches have many causes. Rare causes of headache include:

- Brain aneurysm
- Brain infection
- Brain tumor
- Stroke
- TIA

Any headache with neurologic symptoms – weakness, sensory, altered LOC warrant consideration of ALS. The headache usually develops suddenly and without warning. The patient may say, “This is the worst headache of my life.” Additional descriptions of headache include:

- Starts suddenly and may be severe
- Occurs while lying flat
- Wakes up from sleep
- Gets worse when changing positions...bend, strain, or cough

It is very important for people who are having these type symptoms to get to a hospital as quickly as possible.

Resources

Skills Videos

FAST exam – **access video link via EMS Online course**

Video Case Study – Seizure

Video Case Study – Stroke

Web Sites

American Stroke Foundation

Stroke news for professionals

<http://www.americanstroke.org/>

National Stroke Association

http://www.stroke.org/site/PageNavigator/ALS_Splash_20110907.html

National Institute of Neurological Disorders and Stroke

Extensive links to detailed information on stroke

<http://www.ninds.nih.gov/disorders/stroke/stroke.htm>

Washington University Stroke Center

Excellent resource with current information and image database

<http://www.strokecenter.org/>

Traumatic Brain Injury Resource

Detailed information on the central nervous system

<http://www.neuroskills.com/>

Assessments Quality Improvement Audits

In 2011, the Medical Quality Improvement (QI) section of King County EMS initiated a series of focused EMT QI audits to assess EMT response to various critical conditions. These reviews are conducive in pointing to strengths, as well as areas needing improvement, in patient care. Below is an audit on "Characterizing STEMI Cases in King County" conducted in September of 2011.

Characterizing Suspected Stroke Cases in King County

There are two conclusions from this mini-audit:

1. The age distribution for suspected stroke patients is similar between genders.
2. The primary presentations of suspected strokes are very diverse, ranging from one-sided deficit and slurred speech to blurred vision and high pulse rate.

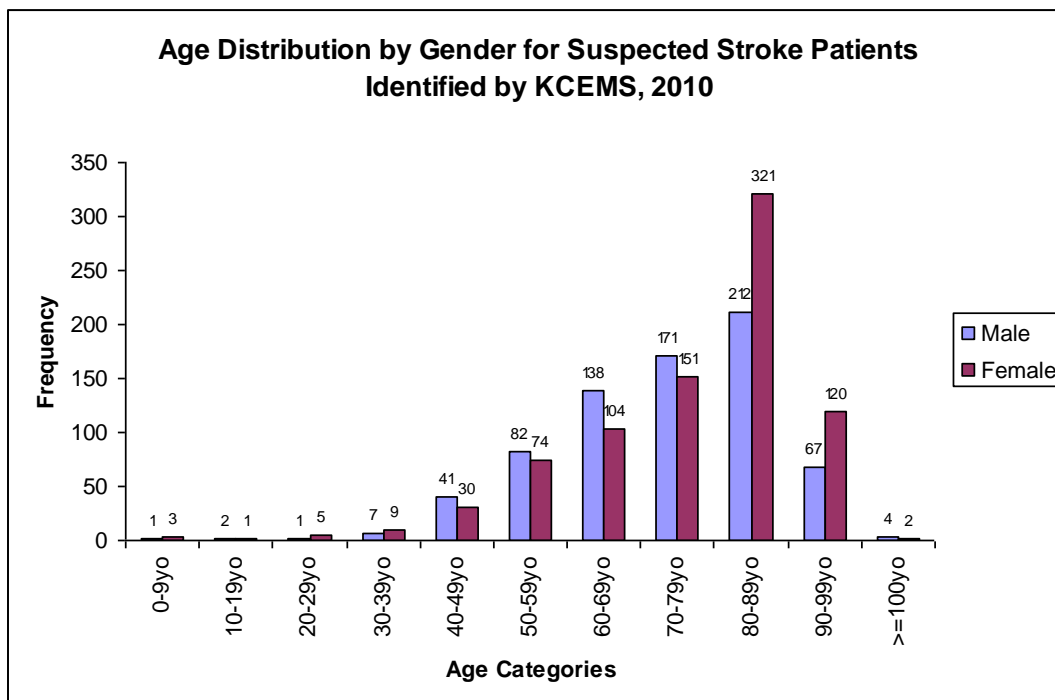
In addition, these are non-confirmed cases of stroke. In the future we will be able to link hospital discharge diagnosis with EMS assessment.

Background:

King County EMS is in the process of establishing a county-wide stroke QI program to monitor and improve the care provided to suspected stroke patients. As we continue to make progress, we were interested in gaining a better understanding of the patient population. We evaluated patients with suspected stroke who were seen by KCEMS personnel from January 1, 2010 to December 31, 2010. We were particularly interested in evaluating the age and gender distributions of patients and the presenting symptoms of these patients.

Age and Gender Distribution Summary:

We reviewed age and gender in all 1,565 suspected stroke cases reported by King County EMS providers in 2010. Age distributions by gender are shown in the graph below. The overall median age was 78 years – 75 years for males and 81 years for females – and 47% of the cases were males.



Chief Complaint Summary:

We also reviewed a random sample of the suspected stroke cases reported in 2010. Fifty-eight MIRFs (4%) were evaluated for the patients' chief complaints. Patients presented with diverse symptoms, such as stuttering/slurred speech, one-sided deficit, confusion, weak limbs, and a decreased level of consciousness. A handful of patients also reported headache, tingling on one side of the body, loss of balance, unresponsiveness, nausea/vomiting, and other primary symptoms as noted in the table below.

Stuttering/slurred speech	16 (28%)
One-sided deficit	13 (22%)
Confusion	13 (22%)
Weak limbs	11 (19%)
Decreased level of consciousness	10 (17%)
Headache	4 (7%)
Tingling one side	4 (7%)
Loss of balance	4 (7%)
Unresponsiveness	4 (7%)
Nausea/vomiting	2 (3%)
Loss of consciousness	2 (3%)
Chest pain	1 (2%)
High blood pressure	1 (2%)
High pulse rate	1 (2%)
Shortness of breath	1 (2%)
Blurred vision	1 (2%)
Seizure	1 (2%)

Establishing a Stroke QI Program:

The Stroke QI program will focus primarily on pre-hospital patient care by reviewing MIRFs and CAD reports for selected cases. We are also working with hospitals to obtain follow-up information, including final diagnosis, treatment and outcome, on suspected stroke patients. These pre-hospital and hospital data will allow us to identify areas for improvement in pre-hospital care.

We are currently working on a pilot QI program with a King County hospital and intend to share results with fire departments. Upon completion of the pilot, we hope to establish an ongoing clinical audit of stroke patients in order to facilitate, when appropriate, rapid hospital initiation of care.

Conclusion: It may be helpful to keep the following points in mind when evaluating suspected stroke patients:

1. The age distribution for suspected stroke patients is similar between genders.
2. The primary presentations of suspected strokes are very diverse, ranging from one-sided deficit and slurred speech to blurred vision and high pulse rate.
3. Implementation of a county-wide Stroke QI Program is in progress to enhance the care provided to stroke patients.

Response to Suspected Stroke in King County

Summary: We reviewed all electronic records of suspected stroke cases in King County for 2010. Sixty-four (5%) were randomly selected for an in depth review of the narrative portion of the MIRFs. We looked for EMT response based on average times on scene, documentation of FAST exam (especially onset of symptoms), documentation of glucometry performed, and documentation of hospital notification. Below is a summary of incident characteristics and EMT response.

I. Incident Characteristics

Number of suspected stroke cases in 2010	1,536
# of cases that were females	811 (53%)
# of cases that were hypertensive (systolic BP>200)	190 (14%)
# of cases that were hypotensive (diastolic BP<60)	88 (8%)

Age distribution of patients	Number of cases
0-29 years	12 (<1%)
30-49 years	84 (6%)
50-59 years	156 (10%)
60-69 years	238 (16%)
70-79 years	312 (21%)
80-89 years	521 (34%)
90+	190 (13%)

Time of Day of Incident	Number of cases
00:00 - 03:59	89 (6%)
04:00 - 07:59	149 (10%)
08:00 - 11:59	397 (26%)
12:00 - 15:59	308 (20%)
16:00 - 19:59	312 (20%)
20:00 - 23:59	135 (9%)

Incident location	Number of cases
Home	1,067 (70%)
Adult home/nursing home	305 (20%)
Medical facility	47 (3%)

II. EMT Response

Documentation of glucometry performed	61%
Documentation of time of onset of symptoms	83%
Documentation of call to hospital	16%
% cases transported by FD	34%
% cases transported by BLS ambulance	53%
% cases transported by ALS	8%
Average time at scene for cases with FD transports	19min. (min <5, max 92)
Average time at scene for cases with private ambulance transport	23 min. (min 5, max 73)

Conclusions: In summary, the response of EMTs to suspected stroke was good and several areas needing improvement were identified. To further improve care we suggest that EMTs:

1. Document in all instances the response to all FAST variables, including the time of onset
2. Perform and document glucometry in all suspected stroke cases
3. Document the time the hospital is notified of an incoming stroke patient
4. Continue to strive for an on scene time of 15 minutes

Next Steps: We are working with hospitals to obtain follow-up information on selected cases. We hope to establish an ongoing clinical audit of stroke patients in order to facilitate, when appropriate, rapid hospital initiation of care.

Summary

The following key points were covered in this module:

The three regions of the brain are the **cerebrum**, **cerebellum** and **brain stem**.

The two basic types of stroke are **ischemic** (blockage) and **hemorrhagic** (rupture).

An ischemic stroke can be caused by a **thrombus** which is a clot that forms in a cerebral artery or an **embolus** which is a clot that travels to the brain.

The **signs and symptoms of a stroke** may include:

- paralysis or weakness on one side of the body
- facial droop on one side
- altered level of consciousness
- change in personality or mood
- headache or dizziness
- impaired speech
- blurred vision
- poor coordination

The three tests of the FAST are **facial droop**, **arm drift** and **speech** with **T for Time**.

In your focused history it is important to determine **time of onset** of symptoms. This helps determine if a patient meets the time window for clot-busting therapy.

Short scene and transport times are vital particularly if the patient waited to call 911 after the onset of stroke symptoms. Note the time the patient was last known to be normal.

Many different types of **seizures**, with symptoms ranging from a brief lapse of awareness, abnormal behavior, tingling or jerking in one part of the body or loss of consciousness with convulsions.

Seizures can have many causes, including medicines, high fevers, head injuries and certain diseases

The most common type of **headache** is a tension headache.

A **migraine** is a very specific type of headache. The pain of a migraine headache is often described as an intense pulsing or throbbing pain in one area of the head

Any headache with **neurologic** symptoms – weakness, sensory, altered LOC warrant consideration of ALS. The headache usually develops suddenly and without warning. The patient may say, "This is the worst headache of my life."