



## Seattle / King County EMS

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# CBT/OTEP 443 **Altered Mental States**

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[www.emsonline.net](http://www.emsonline.net)

## Introduction

Consciousness is being awake and aware of your surroundings, thoughts, ideas and emotions. Injury or illness can bring about varying degrees of consciousness ranging from confused to lethargic to unconscious and unresponsive. It is important for an EMS provider to accurately recognize and assess changes in a patient's level of consciousness (LOC).

### Before You Begin

This is a continuing education and recertification course for EMTs. It covers some EMT-Basic concepts and terminology as well as advanced material. We highly recommend completing the case studies and practice exam 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 13 in *Emergency Care and Transportation of the Sick and Injured, 9th edition* (AAOS).

### 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.

- Check pupil response
- Emergency care for a seizure, stroke, overdose or poisoning

### Objectives

CBT/OTEP 443 is an EMT continuing education and recertification course. After completing this course you will be able to:

1. Identify the components of the central nervous system and peripheral nervous system.
2. Identify the four things the brain needs to be conscious and alert.
3. Identify the major causes of altered mentation.
4. Identify the major safety concern associated with overdose patients.
5. Identify the most important element in the assessment of a patient with altered mentation.
6. Identify the essential components of a physical exam required for a patient with an altered LOC.
7. Identify the purpose of checking pupil response.
8. Identify proper emergency care for a patient with an altered mental status.

## Terms

**brainstem** — An area of the brain between the spinal cord and cerebellum. The brainstem controls basic functions that do not require conscious attention such as breathing, digestion and heart activity.

**central nervous system (CNS)** — A division of the nervous system that includes the cerebrum, cerebellum, brainstem and spinal cord.

**cerebrum** — Largest part of the brain. It controls thought, movement, hearing, vision, speech, emotions and personality.

**cerebellum** — A part of the brain also called the “little brain.” It is located below the cerebrum and coordinates involuntary and “primitive” functions such as balance.

**coma** — A state of deep, often prolonged unconsciousness, usually the result of injury or disease, in which a person cannot sense or respond to external stimuli and internal needs.

**neuron** — A specialized type of cell whose main role is to process and transmit information.

**peripheral nervous system** — A division of the nervous system that includes sensory and motor nerves. These nerves originate in the spinal cord and brainstem and run to the body’s organs, skin and muscles.

**postictal state** — The period following a seizure or convulsion characterized by motor weakness, lethargy, confusion and nausea.

**tonic-clonic seizure** — A type of seizure involving the entire body, usually characterized by violent rhythmic muscle contractions and loss of consciousness.

## New Terms

**acidosis** — A condition where there is excessive acid in the blood caused by either a respiratory or a metabolic problem.

**lethargy** — Pertaining to or resembling drowsiness.

**miosis** — Constriction of the pupil of the eye, resulting from a normal response to increased light or caused by certain drugs or pathological conditions.

**reticular activating system (RAS)** — An area of nerves in the brainstem, thalamus and hypothalamus that controls consciousness.

**toxidrome** — A listing of specific signs and symptoms caused by exposure to types of poisons or toxins.

**uremia** — A condition resulting from advanced stages of kidney failure in which high concentrations of urea and other waste products are found in the blood.

## Central Nervous System

The **central nervous system** (CNS) includes the **brain** and **spinal cord**. It helps control all of the body systems and organs.

## Peripheral Nervous System

The **peripheral nervous system** is made up of all the nerves that project out of the brain and spinal cord. It provides direct input to the central nervous system from sensors in the body. Nerves that extend from the spinal cord and control the muscles of the body are called **motor nerves**. Nerves that travel back to the brain and spinal cord and detect sensations of feeling, hot or cold and position are called **sensory nerves**.

The central nervous system receives impulses from the peripheral nervous system. It also sends signals back to the peripheral nervous system.

## The Brain

The brain is the major component of the central nervous system. It has three regions: the **cerebrum, cerebellum and brainstem**. These regions control many things including sleep, emotions, muscle movement, hunger, thirst and memory.

## 4 Things You Need To Be Conscious

The brain needs four basic things to keep you alert and awake: **sugar, oxygen, intact neural pathways and an intact reticular activating system (RAS)**. Anything that disturbs or disrupts any one of these four things can cause an altered LOC.

## Sugar and Oxygen

**Sugar** (in the form of glucose) is the fuel on which the brain runs. **Oxygen** is needed by brain cells to carry out metabolism. The brain is only three percent of the total body weight and yet it uses 25% of its oxygen and 20% of its sugar. This is because there are billions of brain cells (neurons) that are very active and require a constant supply of energy.

The brain is one of the first organs to shut down when either of these two elements is in short supply. A sudden lack of blood flow to the brain or a lack of oxygen will shut the brain down in 5 to 10 seconds.

## Intact Neural Pathways

**Neural pathways** are groups of nerves that run through the brain. They carry signals from the brainstem to various destinations in the brain. These pathways can be disturbed by trauma, tumors, chemicals (drugs) or electrical interference (that which cause seizures). When someone has a seizure, the neural pathways through the brain are disrupted. Stroke, epilepsy and trauma affect neural pathways and can result in an altered LOC.

## Intact RAS

The **reticular activating system** (RAS) is the consciousness center of the brain that maintains wakefulness. It is a small area of nerves in the brainstem, thalamus and hypothalamus that controls consciousness. It is the “power supply” for very a high-powered computer—your brain.

**Altered LOC is a strong indication of insult to the central nervous system**

## The RAS

The RAS is responsible for your being alert and awake. It constantly “pokes a finger” at the cerebrum by sending electrical stimuli to ensure that the cerebrum is attentive to incoming sensory signals.

During sleep, the RAS remains active while the remainder of the brain is “powered down.” If you suddenly awake by a loud noise, the RAS goes into action and sends a signal to wake up the rest of the cerebral cortex. The RAS is the power supply to your central processing unit — the cerebral cortex. The RAS never stops unless it is affected by drugs, stroke or other causes.

Injury to the RAS by overdose, poisoning or trauma can shut off power for the entire brain. Unconsciousness due to an insult to the RAS is a dangerous situation because this area controls basic functions such as heart rate and respirations.

Insults to the RAS can result in an altered mentation. A concussion, and the brief loss of consciousness associated with it, is due to disruption of the RAS.

## AEIOU-TIPS

There are many things that can cause altered mentation. A commonly used mnemonic to help remember the causes is **AEIOU-TIPS**.

## Acidosis/Alcohol

**Acidosis** is the increase in the acid level in the body. Its causes include: diabetes, shock, poisoning, overdose, kidney failure and impaired breathing. It is indicated by a low pH.

Acidosis can occur when a person's ability to exchange air is impaired. Airway obstruction, COPD, chest injury, narcotics or pulmonary edema can increase the amount of carbon dioxide in the body. This causes an altered LOC and also leads to a buildup of acid levels in the blood.

**Alcohol** is a depressant that inhibits the higher thinking areas of the brain. As the blood alcohol level rises, reason and judgment are impaired. The centers that control mood and emotion run amok. Excessive alcohol can depress brainstem activity. An intoxicated patient can progress from stupor to coma to death from respiratory depression and arrest. These people cannot maintain their airway and are in danger of aspirating their saliva or vomitus.

## Epilepsy/Seizures

People with **epilepsy** have a greater tendency to have seizures than the population as a whole. 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 either 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.

## Infection

**Infection** of the central nervous system, such as meningitis or encephalitis, may cause an altered LOC. Infection usually causes high temperatures and inflammation that affect the brain's neural pathways, the brainstem and supplies of sugar and oxygen.

## Overdose

Barbiturates and narcotics (for example, heroin) are drugs that can suppress brainstem function. Many types of **drug overdose** can affect the brainstem. Narcotics can slow the respiratory centers of the brain resulting in a lack of oxygen. Cocaine can produce extreme CNS stimulation resulting in seizures and strokes.

## Underdose/Uremia

Some medical conditions can cause an altered LOC when a person does not take an adequate amount of his or her prescribed medication. Diabetic coma can occur in diabetics who do not take enough insulin. COPD patients can develop an altered LOC from retaining too much carbon dioxide when they do not use medicines delivered by their metered-dose inhaler.

**Uremia** is the presence of excessive wastes in the blood caused by kidney failure. This condition can lead to an altered LOC, but is not commonly seen in the prehospital setting.

## Trauma/Tumors/Temperature

**Trauma** to the head can cause damage to vessels and brain tissue. Increased intracranial pressure may inhibit brainstem function, neural pathways, and oxygen and sugar supplies.

**Tumors** can affect the brainstem, neural pathways and oxygen and sugar supplies.

**Temperature** extremes have a dramatic impact on all four elements of consciousness. Anything that causes a boost in heat production, such as infection, heat stroke, medications (e.g., phenothiazines taken at overdose levels), or drugs (e.g., cocaine or amphetamines) can cause an altered LOC.

## Insulin

The human body breaks down food into sugar (glucose) which is the main fuel needed by the cells. After you eat, the body sends a message telling the pancreas to produce insulin. The pancreas then supplies insulin to the bloodstream. Insulin “unlocks” the body’s cells to let the sugar enter. The cells then use this fuel to function.

The insulin-dependent diabetic produces an insufficient amount of insulin and must inject it on a regular basis. If he forgets to eat, overexerts or takes too much insulin, there is a serious shortage of glucose—a state known as hypoglycemia. The brain, which is very sensitive to sugar supplies, begins to shut down. Another state called hyperglycemia can occur when there is not enough insulin in the blood. Both hypoglycemia and hyperglycemia can lead to an altered LOC.

## Psychosis/Poisoning

**Psychosis** is a mental illness that commonly affects personality, for example, *schizophrenia* and *manic depression*. Some psychotics hear voices or see things that do not exist. *Delirium* and *acute brain syndrome* are specific types of psychoses where the patient displays disorientation, memory-loss, and lapses in consciousness. The patient with psychosis or acute mental disturbance may feign unconsciousness. Common medications for these patients include lithium (Lithobid, Eskolith), risperidone (Rusoerdak) and olanzapine (Zyprexa).

**Poisoning** is another cause of an altered LOC. The mechanism that causes unconsciousness varies greatly depending on the substance. For example, carbon monoxide prevents oxygen from reaching the brain. An overdose of tricyclic antidepressants can cause hypotension, cardiac dysrhythmias and a lack of oxygen and sugar. These overdoses can be accidental or self-inflicted.

Poisoning can occur through ingestion, inhalation, injection and absorption.

### **Ingestion**

Ingestion is the most common form of poisoning. Poisoning by mouth can produce immediate effects such as burns from a cleaning solution or the effects may be delayed for several hours, for example, with some plant ingestions.

### **Inhalation**

Inhalation poisonings result in thousands of deaths each year in the United States. Most of these deaths are the result of exposure to carbon monoxide, a colorless and odorless gas that blocks the body's ability to deliver oxygen to the tissues. Exposure to cleaning products, industrial chemicals and gases also contribute to many injuries and deaths.

Some inhalation poisonings are the result of "huffing," a practice of using solvents, fuel and paints to produce a chemical high. In all of these cases of suspected inhalation poisoning, hypoxia should be suspected and treated aggressively with high flow oxygen.

### **Injection**

Injected poisons enter the body through a break in the skin. This can be caused by intentional intravenous drug use, animal bites or insect bites. By far, the most common cause of injected poisoning is due to insect stings. Stings from winged insects such as bees, wasps and yellow jackets can cause an exaggerated allergic response known as anaphylactic shock.

### **Absorption**

Absorbed poisonings occur when a substance is absorbed through the skin or mucus membranes. The symptoms range from minor, as in the case of poison oak, to severe as in the case of chemical burns or organophosphate poisoning.

Decontamination may be necessary before treatment can begin. Do not apply water to dry chemical substances because this may "activate" the chemical with catastrophic consequences. Wash away wet chemicals and chemicals in the eyes with copious amounts of water or saline.

### **Toxidromes**

A toxidrome is a list of typical signs and symptoms caused by specific poisons. Contacting the Washington State Poison Control (1-800-222-1222) for information, including assistance with poison identification and treatment recommendations can be extremely helpful. There are many potential toxins that can cause poisoning and identification is often difficult. The toxidrome for carbon monoxide poisoning is as

follows:

- Headache
- Tachypnea
- Nausea and vomiting
- Altered level of consciousness
- Pink, flushed mucus membranes
- Coma
- Inaccurate pulse oximetry readings (appear normal even in profound hypoxia)

## Stroke

A **stroke** occurs when a portion of the brain is damaged due to interruption of blood flow. It can be due to rupture (hemorrhage) or blockage of a vessel. Blockage can be caused by atherosclerosis or an embolus. It can cause a lack of sugar and oxygen and affect mentation.

Strokes affecting one side of the brain may cause an altered LOC. Massive strokes involving the brainstem will cause coma. Most strokes caused by artery blockage do not affect LOC; however, the ability to communicate may be affected.

*Transient ischemic attacks (TIAs)* can be thought of as "mini-strokes." The symptoms of these events subside completely within 24 hours.

## Scene Size-up

You should always size up a scene before approaching a patient. Observe the surroundings, the patient's body position, bystanders and other clues that can indicate danger to you, your crew or the patient. Your observations may also provide information about what happened to the patient. Decide if it safe to enter the scene and if you need additional resources.

STAY ALERT! Illegal drugs or alcohol can cause a patient to become aggressive and dangerous.

**The major safety concern associated with overdose and poisoning patients is protecting you and your crew.**

## Baseline LOC

Determining LOC is the single most important element in the assessment of a patient with an altered LOC. Establish a baseline LOC early in the call using the AVPU scale. Monitor a patient's LOC and be prepared to protect the airway.

Document the baseline LOC and subsequent changes. Be specific about what you observe. This helps other healthcare providers diagnose and treat the patient. Repeat LOC checks every few minutes to detect changes and trends.

### Noxious Stimuli

A noxious stimulus, such as pinching the ear lobe, is a test of central nervous system function. Use the test only on someone who does not respond to verbal stimuli. Document the patient's reaction to the stimulus. There are three possible responses to a noxious stimulus:

- Appropriate response (e.g., attempts to push away the stimulus)
- Inappropriate response (e.g., decerebrate posturing)
- No response

### Posturing

Posturing is a term that describes a reaction to a painful stimulus in the unconscious patient. Decorticate posturing occurs when the arms flex and the legs extend. Decerebrate posturing occurs when the arms and legs both extend in response to a painful stimulus. Both are signs of severe intracranial pressure or hypoxia.

### For Seattle/King County EMS providers Only

King County EMS recommends firm pressure on or behind the earlobe to deliver a noxious stimulus. Do not use other methods such as the sternal rub or pressure near the angle of the jaw. These methods can cause complications if there is an underlying injury.

### Focused History

You may arrive at a scene and have no idea why a patient is unconscious. Start looking for clues the minute you arrive, for example...look for a mechanism of injury, pill bottles, syringes, incontinence or other evidence that can help you piece together what happened.

The key to assessing of an altered LOC is collecting a thorough medical history and examining the surroundings for clues about what happened. Remember to look for medic-alert information on necklaces or bracelets.

### Physical Exam

A complete physical exam for a patient with an altered LOC should include:

- Assess LOC \*
- Check vital signs
- Check pupils for size, symmetry and reactivity to light
- Auscultate breath sounds
- Check blood glucose \*\*
- Check oxygen saturation with pulse oximetry \*\*

- \* Using the AVPU or other method
- \*\* If equipped and trained to use.

Consider checking an unconscious patient’s clothing for clues, but watch for needles! Don’t plunge your hands blindly into pockets without feeling the outside first.

General Signs and Symptoms of Overdose		
<b>Altered Mental Status</b>	<b>Respiratory</b>	<b>Cardiovascular</b>
<ul style="list-style-type: none"> <li>▪ Agitation</li> <li>▪ Paranoia</li> <li>▪ Nonsensical conversation</li> <li>▪ Aggression</li> <li>▪ Lethargy</li> <li>▪ Coma</li> <li>▪ Hallucinations</li> <li>▪ Rapid speech</li> </ul>	<ul style="list-style-type: none"> <li>▪ Increased</li> <li>▪ Decreased</li> <li>▪ Apnea</li> </ul>	<ul style="list-style-type: none"> <li>▪ Hypertension</li> <li>▪ Hypotension</li> <li>▪ Tachycardia</li> <li>▪ Bradycardia</li> <li>▪ Arrhythmias</li> <li>▪ Cardiac arrest</li> </ul>
<b>Pupil Reaction</b>	<b>Temperature</b>	<b>Skin Signs</b>
	<ul style="list-style-type: none"> <li>▪ Hyperthermia</li> <li>▪ Hypothermia</li> </ul>	<ul style="list-style-type: none"> <li>▪ Diaphoretic</li> <li>▪ Pale</li> <li>▪ Flushed</li> <li>▪ Cyanotic</li> <li>▪ Look for needle track marks and / or abscesses</li> </ul>

**AVPU**

**AVPU** is a mnemonic for alert, awakens to verbal stimuli, awakens to painful stimuli, and unresponsive. It describes four general levels of consciousness.

**Alert** means a patient is awake and aware of his surroundings. The oriented patient remembers fundamental information about himself: person, place, time, and event.

**Verbal** means that a patient awakens or responds to a verbal stimulus. Use a simple command such as "stick out your tongue."

**Pain** means that the patient awakens or responds to painful stimulus. Take note of the specific response, for example, "purposeful movement of arms" or "patient withdraws from pain."

**Unresponsive** means that the patient does not respond to verbal or painful stimuli.

## Pupil Response

The pupils of the eyes normally constrict when exposed to light. They normally dilate when light diminishes. Pupils should respond briskly and equally to a penlight. An abnormal pupil response may indicate depressed brain function or central nervous system depression or injury.

Shade the eyes with your hand when doing this test in bright light. Record the results of this test—even if it is negative.

## Oculomotor Nerve

The pupils are controlled by the third cranial nerve called the *oculomotor nerve*. This nerve travels a long path to the brain and is easily compressed by swelling of the brain.

## Pupil Size, Symmetry and Reactivity

Pupils			Potential Conditions
size	symmetry	reactivity	
Dilated	Equal	Reactive	<ul style="list-style-type: none"> <li>▪ Hypoxia</li> <li>▪ Alcohol</li> <li>▪ Stimulants (cocaine, meth)</li> </ul>
Dilated	Equal	Unreactive	<ul style="list-style-type: none"> <li>▪ Anoxia (cardiac arrest)</li> <li>▪ Profound alcohol intoxication</li> <li>▪ Seizures</li> <li>▪ Drugs (psychedelics, LSD)</li> </ul>
Dilated	Unequal	Unreactive	<ul style="list-style-type: none"> <li>▪ Stroke (hemorrhagic)</li> <li>▪ Head injury</li> </ul>
Constricted	Equal	Unreactive	<ul style="list-style-type: none"> <li>▪ Opiates (heroin)</li> <li>▪ Barbiturates</li> <li>▪ Brainstem injury</li> </ul>

Note that unequal pupil size may be the result of a birth defect, a previous eye injury, medication or prosthesis (e.g., glass eye). The pupil of a glass eye will not react to light.

## ABCs

You must closely monitor airway, breathing and circulation (the ABCs) in someone with an altered LOC—particularly airway and breathing. You may need to manually hold the airway open, remove obstructions or breath for a patient using a BVM and high-flow oxygen. Consider the use of an airway adjunct if you cannot maintain the airway.

## Oxygen

Oxygen is vital to sustaining normal brain function and maintaining consciousness. Below are some guidelines for administering oxygen in cases of altered mentation.

Condition	Recommended Oxygen Flow Rate
Alcohol Intoxication/ Alcohol Withdrawal	Low flow*
Coma (no trauma)	High flow If respiratory effort inadequate, assist with BVM and high flow
Drug Overdose	Depends on respiratory status
Head Injury	High flow
Headache	Low flow in most cases
Hypoglycemia	Depends on patient needs
Seizure	Low flow (postictal state) High flow for status seizures (status epilepticus).
Stroke	Depends on respiratory status

\*Depends on patient status because alcohol may cause respiratory depression, in which case the patient needs assisted ventilations with a BVM and high flow oxygen.

Remember that unresponsive patients can lose their gag and cough reflexes. Keep the airway clear and open and monitor the airway closely.

## Patient Position

Position the patient with an altered LOC based on his or her physiologic needs and considering the suspected illness or injury.

Condition	Recommended Patient Position
Alcohol Intoxication/ Alcohol Withdrawal	Consider recovery position or supine (if airway can be closely monitored)
Coma (no trauma)	Consider recovery position or supine (if airway can be closely monitored)
Drug Overdose	If unconscious, consider positioning for airway protection (e.g., lateral recumbent).
Head Injury	Immobilize cervical spine and place supine with head of backboard tilted up 15 degrees
Headache	Semi-Fowler's (elevate head and shoulders 30 degrees), if tolerated.
Hypoglycemia	If unconscious, consider positioning for airway protection.
Seizure	If still convulsing, lie on floor and protect from injury. Do not restrain.
Stroke	If conscious, semi-Fowler's. If unconscious, recovery position.

## Summary

The **central nervous system** includes the brain and spinal cord. The **peripheral nervous system** is made of all the nerves that project out of the brain and spinal cord

The four things the brain needs to be conscious and alert:

- Sugar
- Oxygen
- Intact neural pathways
- Intact reticular activating system

Major causes of altered mentation are **AEIOU-TIPS**:

- Acidosis, Alcohol
- Trauma, Tumors, Temperature
- Epilepsy/Seizures
- Insulin
- Infection
- Psychosis, Poisoning
- Overdose
- Stroke
- Underdose, Uremia

The major safety concern associated with overdose patients is **protecting you and your crew**.

The first step in the assessment of a patient with altered mentation is determining **baseline LOC**.

The essential **components of a physical exam** for a patient with an altered LOC:

- Assess LOC
- Check vital signs
- Check pupils for size, symmetry and reactivity to light
- Auscultate breath sounds
- Glucometry
- Pulse oximetry

**Abnormal pupillary response** may indicate depressed brain function or brain injury.

Proper emergency care for a patient with an altered mental status includes the **ABCs**, **oxygen therapy** to meet patient needs and **proper positioning**.