

## Continuing Education Self-Study Packet

### What's My Name Again? The Confusion Behind Altered Mental Status.

This packet contains materials needed to complete 3 hours of continuing education. Please review the required materials, case studies, and attachments. After reviewing the materials, complete the attached quiz. You must score 80% or higher to obtain credit for this module.

#### Materials:

##### Introduction

Steven "Kelly" Grayson – Assessing Mental Status (EMS World online)

Tracy Evans – Altered Mental Status... What's in a Name? (EMS1 online)

Joseph Mistovich – Beyond the Basics: Interpreting Altered Mental Status Findings (JEMS online)

Warren Porter – Altered mental status (Texas EMS Magazine)

##### Quiz

## Introduction

Our level of consciousness is part of what defines us as a human. The ability to think, make decisions, and be not only aware of our surroundings, but to be self-aware, separates us from the rest of the animal kingdom. For various reasons, our mental status can become compromised. As EMS providers, we are tasked with determining when a patient's mental status is altered from its normal, and to decipher clues as to the etiology of the problem.

The term "altered mental status" is used by medical personnel to describe a multitude of conditions. These may include when a patient is unable to answer simple questions, follow simple directions, or remember what they ate for breakfast. Altered mental status can also mean that a patient is unresponsive to verbal and painful stimuli.

The following articles and case studies discuss some background information on altered mental status. Tips for assessing the patient and treating some of the causes of altered mental status are discussed. As you read the articles, reflect on your experience as a care provider. Try to recall some scenarios where you have dealt with these patients. After you read the articles, would you consider other treatments or assessments for your patients? Review the materials presented, and be prepared to discuss your findings in the second module of this program. Complete the attached quiz and bring it with you to the second module.

# Altered Mental Status... What's In A Name?

**Author:** Tracy Evans, MBA, RN, EMT-P

We use it everyday. We even abbreviate it A.M.S., we throw it out there and other healthcare providers know what we are saying, but what does the term really mean?

It is a state of abnormal mentation. Yeah? So what is that? It has been referred to medically as *acute confusional state*, *clouded consciousness*, *altered state of consciousness*, *delirium*, and we all can relate to "His elevator doesn't reach the top floor", "She's not playing with a full-deck," and "He's out to lunch," to name a few.

## The Continuum:

Consciousness ----- Coma

*Consciousness* is a state of awareness of self and the environment. *Coma* is the opposite of consciousness and is the absence of self and the environment, even when the patient is stimulated by verbal or light pain stimulus. So, altered mental status is everything in between. It always combines a generalized reduction or alteration in the content of consciousness (which is a cortical function) with a reduction in total arousal (which is a brainstem function). In other words, the patient has a deficit in the attention span. The patient may not think clearly or quickly and can be easily distracted. In fact, the patient's orientation or understanding of person, place, and time may be altered and he may be unable to correctly interpret stimuli.

Altered Mental Status can be caused by many things and at 3:00 AM, alone in the back of the ambulance, the best mnemonic out there is "**AEIOU -TIPS**" to help you remember the laundry list of possible causes.

<b>A</b>	Alcohol and other drugs
<b>E</b>	Epilepsy, Endocrine (all types) and Exocrine (liver)
<b>I</b>	Insulin (hypoglycemia or hyperglycemia)
<b>O</b>	Oxygen (hypoxia) Overdose or Opiates (in case you forgot the "other drugs" when you did A)
<b>U</b>	Uremia (renal failure)
<b>T</b>	Trauma and Temperature
<b>I</b>	Infection (sepsis, <a href="#">meningitis</a> )
<b>P</b>	Poisons and Psychiatric
<b>S</b>	Shock, Stroke, Space-occupying <a href="#">lesion</a> (maybe a brain tumor)

## What difference does it make? We can't fix a lot of these things anyway...

Well, it helps in a few ways. First, it helps you appropriately use the tools that you do have: oxygen, fluid boluses, 50% dextrose, and naloxone. It also may help you decided which hospital

to transport to, if you have several options. Finally, it will help you ask the right questions of family and bystanders while you are at the patient's home or office. The family or bystanders may not be immediately available at the hospital to answer questions, so realistically you may be the only source of information at the hospital. Patients with alternations in their mental status are generally poor historians.

**So, let's take a closer look at some of the causes and how they effect the patient.**

### **Alcohol**

Alcohol alone can cause a change in mental status. Initially the intoxicated patient is restless, agitated, and over-stimulated. Then, the depressant effect on the central nervous system occurs and blunts motor coordination and reflexes. If the blood alcohol level keeps rising the patient may experience coma or respiratory arrest. With a decreased level of consciousness, vomitus can occlude the airway and cause death by asphyxiation.

It is also important to assess whether or not the patient has ingested anything more than alcohol, illegal drugs, poisons, or medications. You can only assume that alcohol intoxication is the sole cause of the altered mental status only after you have effectively ruled out every other cause.

### **Epilepsy**

The change in mental status that often follows a [seizure](#) is called the postictal state and is characterized by confusion and perhaps mild combativeness. This is a temporary and in most cases resolves slowly over a relatively short time, but may last for several days. Other physical findings of a recent seizure, in addition to the mental status changes, include loss of continence of bladder and in some cases, bowel, tongue or lip biting.

During a seizure the body switches from the normal aerobic metabolic activity to anaerobic metabolism as a result of increased muscle activity and decreased or absent ventilation. Therefore, seizure activity will result in a metabolic acidosis that is reflected as a decrease in PaCO<sub>2</sub> on blood gas. It can also be detected from venous blood samples drawn in a red top tube.

### **Insulin**

Patients who are diabetic, insulin-dependent or non-insulin dependent, are predisposed to hypoglycemia and hyperglycemia. Overmedication with insulin or oral glucose-lowering medications will result in hypoglycemia. Patients who are suddenly hypoglycemic initially appear as agitated, confused, tachycardic, diaphoretic as a sympathetic response to the drop in blood sugar. If hypoglycemia progresses into an even lower level, the patient may present as lethargic, unresponsive or comatose. Neurologic manifestations may include paresthesias, cranial nerve palsy, transient hypoglycemia, clonus, diplopia, and decerebrate posturing.

**A couple of caveats:**

Patients with hypoglycemia and fever need to be evaluated for infection. Young and inexperienced drinkers may also be hypoglycemic - so check the dextrose.

### **Opiate Overdose**

The opiate syndrome is associated with pinpoint pupils, decreased respiratory drive, blunt or flat affect. Of course, the whole thing is worse with polysubstance use, such as combining alcohol, opiates, barbiturates, or benzodiazepines. Opiates are available on the street as heroin and opium and by prescription as codeine (Tylenol # 3), morphine (Dura-Morph, Oxycontin), meperidine (Demerol), hydromorphone (Dilaudid), hydrocodone (Vicodin, Lorcet, Lortab), oxycodone (Percodan, Percocet, Tylox), propoxyphene (Darvocet, Darvon), and diphenoxylate (Lomotil). Of course, medications reserved for prescription are also available on the street. Naloxone (Narcan) is in your little bag of tricks and acts as an opiate-antagonist to reverse the effects. The duration or half-life of the naloxone is much less than the duration or half-life of the opiates. It may be necessary to re-medicate these patients. Don't forget to reassess. Some of the opiates like diphenoxylate and propoxyphene require higher doses of naloxone to reverse them. If the naloxone is ineffective, the patient may have used more than one drug, and naloxone is ineffective on benzodiazepines and barbiturates.

### **Uremia and Liver Failure**

Uremia is a syndrome of renal failure and includes elevated blood urea and creatinine levels, accompanied by fatigue, anorexia, nausea, vomiting, pruritus, and neurologic changes. Uremia represents the numerous consequences related to renal failure, including retention of toxic wastes, deficiency states, and electrolyte disorders. Remember, the kidneys regulate body fluid volume, solute concentration and dilution, acid-base balance, excretion of waste products, and secretion of hormones that control red blood cell production, blood pressure, and calcium metabolism. Renal failure derails those functions.

An increase in blood urea nitrogen (BUN) and changes in serum osmolality cause a change in mental status. Advanced uremic patients may develop a condition called uremic "frost" in which the high concentration of urea in sweat yields a "frosty" appearance to the skin as the sweat dries. The skin of a uremic patient may also appear as a sallow, yellow color from the collection of carotene-pigments in the skin.

The liver failure patient may appear jaundiced from the inability of the liver to break down bilirubin. The abdomen may be distended with ascites from chronic liver enlargement. Patients may develop a "flapping tremor" seen in the extremities, called *asterixis*, which is a pre-coma condition. This is an ominous sign and is often related to severe hypoxia.

### **Trauma**

Shock comes up later, but this is a good time to bring up head trauma. It should surprise no one that head injuries can result in a change in mental status. Assessment is important and should include a Glasgow Coma Scale score, pupillary response to light. The changes in mental status

can run the gamut from unconsciousness to agitated and combative. *Remember* to suspect spinal cord injury in all unresponsive patients in whom trauma is not ruled out.

## **Temperature**

The hypothalamus is responsible for temperature regulation, so any insult to that part of the brain may interfere with temperature control. The exact mechanism of cerebral dysfunction associated with temperature extremes (too hot or too cold) is unknown. As the core body temperature decreases, cerebral blood flow decreases and mental status changes occur that resemble alcohol intoxication: slurred speech, loss of motor coordination, confusion and lethargy. As the body temperature drops below 85°F, coma occurs and may be accompanied by lethal dysrhythmias.

At the other end of the scale, hyperthermic emergencies are also life-threatening and occur at temperatures above 106°F. The neurologic changes that occur include: hallucinations, agitation, confusion, combativeness, seizure, posturing, and coma. At higher temperatures, the body can no longer sweat, so the patient's are dry to the touch.

## **Infection**

Meningitis, encephalitis, and abscess can all cause changes in mental status. Meningitis can be either viral or bacterial and is an infection of the meninges. Initially the patient will present with a headache and stiff neck with a normal mental status, but will experience a decrease in level of consciousness as the infection worsens.

Encephalitis is an infection that involves the brain parenchyma. It usually affects the temporal lobe but may affect other areas of the brain. With encephalitis comes a rather abrupt onset of confusion and agitation that progresses to disorientation, lethargy, ataxia, seizures and coma. Patients with encephalitis may appear acutely psychotic. Physical and/or chemical restraints may be required and the presence of fever may be the only outward sign.

Brain abscesses may result in confusion and are generally associated with headaches and fever. Other symptoms include focal [neurological](#) deficits and seizures.

## **Poisoning**

Patients can poison themselves and each other with many things. Sometimes the only clues to the toxin are at the scene. That may be the best reason for you to leave the scene quickly, but if you have the chance to search safely, take a moment to search the area for clues. Those clues won't be at the hospital - so you may be the only one who can solve the mystery.

## **Shock**

Shock is the inadequate perfusion of oxygen and nutrients to the tissues. (Remember the O for Oxygen?) The body tries to protect the brain, heart and lungs by shunting blood away from less-critical areas of the body. It is generally believed that a systolic pressure below 80mmHg will cause changes in mental status. Be alert for concomitant causes. The head injured patient may

also have blunt abdominal trauma or a [pelvic](#) fracture. Don't get hung up on the obvious head injury and forget further assessment. Control the ABCD's and complete your assessment. Don't wait for shock to set in - we treat FOR shock and not just shock. Be aggressive and be prepared. Once you get behind the 8 ball, the patient is in big trouble.

## **Stroke**

Stroke can cause a change in mental status -but it does not always. Stroke is a broad term that is used to describe ischemic and hemorrhagic events in the brain that result in decreased perfusion, alteration in function and sometimes secondary injury due to swelling and hypoxia. Remember this because a person may be unable to speak, speak with slurred speech, or may have lost some motor function, but they may be mentating normally. Never assume a patient cannot hear and understand what you are saying.

### **So how do we describe our findings?**

Be as descriptive as possible. Try to elaborate on your findings rather than summarize them in one or two words. State that the person was awake, and oriented to person and place but confused as to time. Avoid giving a Glasgow Coma Scale score as 13, but express where the 2 points were deducted from (Eye opening = 3, Verbal response = 4, Motor function = 6).

### **And what else?**

Aside from affecting your ability to give care, and impeding your ability to gather information, the patient with an altered mental status is a medicolegal challenge. If the patient has an alteration in mental status, he must be treated under implied consent. Be very careful in documenting your assessment and treatment in patients that you transport with mental status changes and in patients who refuse care and you believe to be alert and fully oriented.

## **Treatment**

There is no longer a recipe for treating the patient with Altered Mental Status. The "coma cocktail" is outdated and should be removed from protocols. We are advanced enough to perform thorough assessments and treat the findings.

So, at 3:00 in the morning, when you are sunlight and caffeine deprived, remember "AEIOU - TIPS." In fact, it is helpful the other 23 hours a day as well!

## **References**

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# Assessing Mental Status

by [Steven "Kelly" Grayson, NREMT-P, CCEMT-P](#) and [William E. "Gene" Gandy, JD, LP](#) On Jan 1, 2011

Patients with altered mental status can challenge medics. Managing such patients is fraught with pitfalls that can be medically and legally significant.

## Scenario

You are called to a residence in an upscale neighborhood to assist police where a teenage party has been going on. No adults are present. Called by neighbors because of excessive noise, police found a young female, minimally responsive and possibly overdosed on ETOH/drugs, lying on a sofa and responding only to loud verbal and painful stimuli. Her responses to your questions consist mainly of curses, "Leave me alone," and pushing you away. Her appearance and vital signs are as follows:

- Hot, dry, pink skin;
- Pulse: 126 bpm;
- Respirations: 24/min.;
- BP: 160/120;
- Tympanic temperature: 100.5°F;
- Uncooperative.

## Patient Approach

A patient with an altered level of consciousness should be approached carefully and in a nonconfrontational manner. Patient rapport is essential to obtaining a thorough assessment.

Observation of the patient's surroundings may yield valuable clues. Is there evidence of ETOH or other drug ingestion, such as drug paraphernalia, empty bottles or telltale smells?

Assessment of the patient with altered mental status must include the following key elements:

1. *Level of consciousness.* Is the patient aware of his surroundings?
2. *Attention.* Is the patient able to focus or concentrate on one task at a time, or is he easily distracted?
3. *Memory.* Can the patient record data in the brain and repeat it at will? Thorough assessment of memory includes short-term memory, such as the ability to repeat a sequence of objects several minutes after they are first introduced, and long-term memory, such as the names and birth dates of family members or being able to repeat the alphabet.
4. *Cognitive ability.* Can the patient process abstract thoughts coherently, such as explaining, "Why can't pigs fly?" Can he perform simple math or word problems, such as "Subtract 7 from 100 as many times as you can," or "Spell the word world backward?"
5. *Affect and mood.* Affect is an objective assessment of the patient's demeanor and reaction to

stimuli, while mood is a more subjective assessment of the patient's emotional state. Are both of them appropriate for the patient's current situation?

6. *Probable cause of the present condition.* What is the underlying pathophysiology causing the patient's altered mental state? One commonly used mnemonic is AEIOUTIPS:

- Alcohol, ingested toxins;
- Epilepsy, endocrine, exocrine or electrolytes;
- Insulin;
- Overdose, opioids or oxygen deprivation;
- Uremia;
- Trauma;
- Infection, inherited defects;
- Psychosis, porphyria;
- Stroke, shock, space-occupying lesions.<sup>1,2</sup>

### Assessment

Ask:

1. What's your name?
2. Do you have any medical problems? Are you seeing a doctor? What medications do you take? Can you show them to me? Have you had any alcohol or recreational drugs today?
3. Will you play a game with me? Will you try to remember three things I'm going to tell you? *Book, candle, scissors.* Repeat these to me. [Continue until the patient can repeat the three objects. If he cannot, the test is failed.]
4. Where are you right now?
5. What day is it?
6. What's your Social Security number?
7. What's your birthday?
8. Where were you born?
9. Say your ABCs, starting with G and ending with S.
10. Count backward starting with 13 and ending with 4.
11. Spell *world* backward.
12. What were the three objects I asked you to remember? [book, candle, scissors]
13. Take this sheet of paper in your right hand and read and do what it says. [It says "Close your eyes."]
14. Take the piece of paper I handed you and fold it in half and then in half again, and then place it on the floor (table, etc.).<sup>3</sup> What constitutes failure? Failure of one or more of the tests indicates lack of present mental capacity to make an informed decision about treatment.

Not every case requires the full status exam. But one must *always* document the findings in terms of facts, not conclusions. Rather than documenting conclusions without supporting evidence, such as AAOx4, document your questions and the patient's responses that led to your conclusion.

It's not enough to evaluate a patient's mental status; also take into consideration underlying conditions that may be responsible for the diminished LOC and rule them out.

## Summary

A patient with diminished mental status must be evaluated carefully to rule out organic or traumatic reasons for the condition, as well as to identify possible causes, such as drug ingestion.

Note: Laws allowing law enforcement officers to arrest for mental impairment vary from state to state. Become familiar with your local laws and practices.

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## Assessment Pearls

Never assume your patient is malingering or does not have a legitimate medical complaint. Such assumptions will land you in court in a lawsuit you cannot win.

Measure your patient's current mental status with proven techniques--make no assumptions. Document questions and responses.

The medics in this case determined their patient had not ingested ETOH but had taken several ecstasy tablets given to her by other people. She had no idea of the possible consequences of her ingestion, and she refused to answer questions about her mental or physical status.

Based on her responses and history of drug ingestion, the medics determined this young woman did not have the present mental capacity to understand her condition and make rational treatment decisions. They enlisted the help of the police, who placed her in custody, and treated and transported her upon their order.

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# **Beyond the Basics: Interpreting Altered Mental Status Assessment Findings**

*by Joseph J. Mistovich, MEd, NREMT-P, William S. Krost, BSAS, EMT-P, & Daniel Limmer, AS, EMT-P On Aug 1, 2008*

EMS providers frequently encounter patients who are not alert and present with an altered mental status, meaning their level of brain function is in question. Various physical examination techniques are employed during the assessment to determine the level of cerebral function and integrity of the brainstem. It is important to understand the limitations of these techniques, as well as potential findings that may cause you to erroneously interpret, report and document the level of brain function. This information is often used to identify trends to determine if the patient's condition is deteriorating, remaining the same or improving.

## **ANATOMY OF A CONSCIOUS STATE**

Two structures are responsible for a conscious state: the ascending reticular activating system (ARAS) and the cerebral hemispheres. The ascending reticular activating system is not truly a single tangible anatomic structure; however, it is a network of nerve cells and fibers that extend from the spinal cord through the lower brainstem and continue upward toward the mesencephalon and thalamus. The impulses are then distributed throughout the cerebral cortex. The ARAS continuously receives sensory input that allows the body to remain in a wake or sleep state, remain aware of surroundings and respond appropriately while awake. The ARAS has an effect on both the autonomic nervous and motor systems, which in turn control the body's cardiovascular, respiratory and motor response to external stimuli.

Consciousness requires the patient to have an intact ARAS and at least one cerebral hemisphere. If either the ARAS or both cerebral hemispheres are affected by a particular condition and not functioning properly, the patient will not remain in a wake or alert state. Head injuries, severe cerebral hypoxia or anoxia, central nervous system-depressant drugs and electrolyte disturbances are only a few of the possible factors that would disrupt the function of the ARAS or both cerebral hemispheres and render the patient unconscious.

Several assessment techniques may be used during the physical exam to determine the brain's ability to receive, transmit, interpret and respond appropriately to an external stimulus applied to the body. One of the most common techniques is a painful stimulus applied to a patient who is not alert or not responding to verbal stimuli. The patient's response assists the examiner in determining the extent or level at which the brain is able to function. Continuous reassessment provides valuable input when considering a differential diagnosis; making a decision on providing more advanced emergency medical care; and determining whether your treatment is improving the patient's condition, if the patient is remaining stable or if the condition is deteriorating.

## **AVPU**

The mnemonic AVPU is universally used by EMS personnel at all levels to determine a patient's mental status. Historically, AVPU was used only to assess eye-opening to various stimuli; however, it has evolved to a more general interpretation of patient responses. A refers to alert. An alert patient opens his eyes spontaneously upon your arrival at his side. If the patient is alert, there is no reason to continue with the AVPU assessment. It would be prudent to determine if the patient was oriented to person, place and time.

If the patient does not have spontaneous eye-opening, V is the next step in the AVPU process, which is achieved by using a verbal stimulus in an attempt to get the patient to respond. Historically, the patient was asked specifically to "open your eyes" when applying the verbal stimulus. If eye-opening was attained, the patient was said to have responded to a verbal stimulus. Today, many emergency services providers ask the patient to "squeeze my fingers" or "wiggle your fingers" in place of the traditional eye-opening command. Again, if the patient responds to a verbal stimulus, there is no need to continue.

*P* refers to painful stimulus applied if the patient did not respond to a verbal stimulus. Originally, this test was used to determine if the patient opened his eyes when a painful stimulus was applied. When emergency medical services personnel utilize a painful stimulus, they are watching for any indication of a response, whether it is flexion, extension, withdrawal of an extremity or localization of the pain by attempting to remove it. As evidenced by the numeric rating on the Glasgow Coma Scale (GCS), a higher score is awarded for a more specific response. For example, if the patient wiggles his fingers upon command, he is awarded a 6—the highest score possible. Five points are awarded if he localizes the pain; 4 points are given if he withdraws to a painful stimulus. A higher score on the GCS correlates with better brain function.

If there is no response to a painful stimulus, the patient is said to be unresponsive, which represents the *U* in AVPU. A patient who does not respond to noxious stimuli is considered comatose.

## **MISINTERPRETING NO RESPONSE TO A STERNAL RUB**

Sternal rub is one of the primary methods used by EMS for applying a painful stimulus. This technique is performed by rubbing the knuckles of a closed fist firmly and vigorously on the patient's sternum. Because the stimulus is applied to the core of the body, it is referred to as a central painful stimulus. The intent is to determine the type of response to pain, which will provide an indication of the patient's level of brain function. As previously mentioned, a more specific response, such as reaching up and removing the knuckles from the chest, correlates with a higher level of brain function. If no response is elicited, the examiner would assume the brain function is extremely poor.

Anecdotal reports from neurology nurses and physicians have noted that it may take up to 30 seconds of sternal rub to get a response from the patient. Most emergency service personnel only apply hard knuckle pressure to the sternum for a few seconds. If no response is achieved in this brief period of time, brain function is thought to be poor and mental status is noted as being unresponsive. However, if the sternal rub was applied for 30 seconds, the patient may have actually responded. Thus, no response to a sternal rub that is applied for less than 30 seconds

may provide an inaccurate finding in the mental status. Keep in mind that the sternal rub only needs to be applied until a response is elicited.

In the prehospital environment, it is not realistic or desirable to apply a sternal rub for 30 seconds during the initial assessment. On the scene of an emergency, the entire initial assessment should be performed in less than 60 seconds! Consider an alternative central painful stimulus technique like the trapezius pinch or supraorbital pressure to ensure a more accurate finding during the physical examination.

The trapezius pinch is applied by grasping approximately two inches of the trapezius muscle at the base of the neck between your thumb and index finger. Simultaneously twist and squeeze the muscle firmly and watch the patient's face for a grimace, eye-opening or some other response. Listen for a groan, moan or other incomprehensible sounds or comprehensible words. Watch the extremities for any movement that includes an attempt to remove the stimulus.

To apply supraorbital pressure, it is necessary to locate the bony ridge along the superior border of the orbit that contains the eyeball. Pain and severe discomfort are achieved by applying a straight upward pressure with the tip of the thumb to the midline of the supraorbital bony ridge. Be sure your thumb is on the bony ridge and no pressure is being applied to the eyeball, which can damage the globe or promote a vagal response. While pressure is being applied, watch the patient's face and extremities for a response, or listen for a comprehensible or incomprehensible response.

### **MISINTERPRETATION OF A PERIPHERAL RESPONSE TO PAINFUL STIMULUS**

EMS personnel may elect to apply a painful stimulus to an extremity, which is referred to as a peripheral painful stimulus. The fingernail bed is compressed between the examiner's downward thumbnail pressure and the index finger, or the skin or web of soft tissue between the patient's thumb and index finger is pinched. The response to a painful stimulus applied to an extremity may also provide a finding that can be easily misinterpreted due to a spinal reflex arc.

If a painful stimulus is applied to the extremity and the patient does not respond, one would interpret this as an indication of poor cerebral function. However, if the patient withdrew his arm or leg when the painful stimulus was applied, it would be interpreted, reported and documented as withdrawal to pain. This may be an indication of a higher level of cerebral function and the patient would be awarded a 4 on the Glasgow Coma Scale for best motor response. If the patient responded, the examiner would assume the impulse traveled via an afferent (sensory) nerve fiber to the spinal cord, up a spinothalamic tract to the brain, where the pain impulse was interpreted and an appropriate response was sent down the spinal cord via a corticospinal tract and out to the muscle by an efferent (motor) fiber, causing the patient to withdraw from the pain. Thus, it is assumed from the withdrawal response to painful stimulus that the patient's brain received the impulse, interpreted it correctly and sent down an appropriate response.

The spinal cord has the ability to produce a reflex response when pain is applied to cutaneous sensory receptors in the extremities. When pain is applied to the extremity, the impulse travels via an afferent nerve fiber to the spinal cord, where it triggers a pool of interneurons. These neurons then return the impulse immediately via an efferent (motor) nerve fiber to flexor muscles

in the extremity. The result is withdrawal of the extremity from the painful stimulus. This is often referred to as a spinal reflex arc. Interestingly, the reason for applying a painful stimulus to the extremity is to assess the integrity of brain function; however, in the case of a spinal flexor reflex response, the impulse creating withdrawal of the extremity never traveled to the brain. In this patient, the examiner misinterprets withdrawal of the extremity that was produced by the spinal flexor reflex as being a good sign of cerebral function when the brain never received or invoked the response.

If a spinal flexor reflex is triggered by applying pain to an extremity, the examiner would interpret, report and document the flexion of muscles as an appropriate withdrawal response to pain and award the patient a 4 on the GCS, even though the brain was not involved in the response. Thus, be careful in your interpretation of withdrawal when pain is applied to an extremity. This is contrary to misinterpretation of a lack of response to a briefly applied sternal rub.

### **BLINK TEST**

Some patients encountered in the prehospital setting may fake an unresponsive state for a variety of reasons. Various techniques are used by the emergency personnel to distinguish between a patient faking a coma and one who is truly comatose. A common practice is to drop the patient's hand onto his face. If the hand slips to the side of the patient's face, it is commonly interpreted as a purposeful movement with the intent to not strike the patient directly in the face, which would indicate he is not truly comatose. A patient is thought to be comatose if the hand is dropped directly onto his face with no attempt by him to redirect it. Be cautious when interpreting this response, because there are patients who are intent on making the examiner believe they are unresponsive.

An examination that may be applied to a patient who appears to be unresponsive but is thought to be faking is the blink test. This is performed by snapping your fingers in front of the open eyelid or making a motion with your fingers as if you are going to poke the patient in the eye. If the patient blinks, you may interpret this as a sign that the patient is faking the unresponsive state. The patient who truly is unresponsive cannot see the snapped fingers or fingers coming in to poke his eye; however, he may blink his eyes when these techniques are performed due to a corneal reflex. When air passes over the cornea, the corneal reflex causes the eyelid to blink, even though the patient may not be able to respond to other stimuli. In the blink test, snapping the fingers or movement of the finger toward the eye may cause air to pass over the cornea, eliciting a blink. The examiner may misinterpret this blink as being an indication that the patient can see the fingers and is faking the coma.

### **PALMAR GRASP REFLEX**

The palmar grasp is a primitive reflex that appears at birth and is present until the infant is 5 to 6 months of age. When the palm of the hand is stroked, the infant will close his fingers and grasp the object in his hand. When the back of the hand is stroked, the infant will open his fingers.

An adult patient who is not alert and is being assessed for responsiveness to verbal stimuli might be asked by the examiner to "squeeze my fingers" to determine if he is able to obey the

command. If the patient squeezes or grasps the examiner's fingers, it would be interpreted as a finding that the patient is able to obey commands—a good indication of a higher level of cerebral function.

If an adult patient suffers an injury to the frontal lobe, the primitive palmar grasp reflex may become active once again. If the examiner happens to stroke the palm of the patient's hand as he is asking the patient to "squeeze my fingers," he may trigger the palmar grasp reflex, which might result in the patient unconsciously and lightly grasping the examiner's fingers. This finding would then be misinterpreted as an appropriate response to a verbal stimulus when the patient may truly be unresponsive.

It is important to understand the limitations of certain techniques used in determining the level of responsiveness. The assessment findings can be misinterpreted and provide an erroneous interpretation of brain function. This may impact the differential diagnosis and possibly the emergency care provided to the patient.

CEU Review Form [Beyond the Basics: INTERPRETING Altered Mental Status ASSESSMENT Findings](#) (PDF) Valid until October 6, 2008

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# Altered mental status

by Warren Porter, MS, LP



Illustration photo by Audra Horton.

## Case study

You are called for an unknown medical condition at the local community library. You arrive to find law enforcement already on scene, and they direct you to a woman who is about 45 years old. She is speaking incoherently and appears disoriented to what is happening. She can state her name but doesn't know where she is, and she keeps asking you why you are there.

## Introduction

Altered mental status (AMS) is a complex "condition" with multiple symptoms that can be described as different behaviors or "abnormal responses to normal events." Many times this presentation seems to be a puzzle that is missing a few pieces, and providers must solve the puzzle under all the usual

time constraints. Often, what prehospital providers term as altered mental status is actually a symptom of an underlying condition. Because AMS can be caused by a variety of conditions, it is very important to precisely describe what is observed, so an accurate clinical picture can be pieced together.

## Scene size-up and general impression

Upon arrival at a scene where the patient is presenting with AMS, the first step is scene-size up. As with other calls, begin by looking for potential harm to providers and the patient and gather information on what is happening. If you know en route that the patient has altered mental status, you should be especially alert for hostile or dangerous actions from the patient. If these actions are present, you



should withdraw to safety and seek further assistance.

Once potential dangers have been ruled out, providers should quickly identify any items that indicate possible causes of AMS. These can include glucometers, medications or physical indicators of underlying medical conditions. As you approach the patient, begin to gather information to form a general impression of the patient. You can observe the patient's behavior before you even touch him or her. Based on the patient's actions, you can assess whether he is in danger, whether he poses a threat, or whether he is confused or agitated.

Note any obvious odors coming from the patient, such as acetone breath (which may indicate diabetic ketoacidosis). What does her face look like? Is it anguished, anxious, calm? Anguish or anxiety may indicate distress of some type. Is the patient posturing or does she have an unusual body position? Posturing may indicate traumatic brain injury, an infectious disease process such as meningitis, or stroke. Is the patient still or thrashing about? Uncoordinated movement may indicate hypoxia or a postictal state. Note obvious respiratory patterns and be alert for snoring respirations or loud stridor while approaching. Talk to the patient and determine what her level of response is before you touch her. Does she look up with a purpose, which means she understands you on some level, or does she sit still with no acknowledgement of the activities around her?

### **Initial assessment**

The initial assessment is intended to find immediate threats to the patient's life. Depending on the AMS patient's presentation, the initial assessment may be challenging. AMS patients in particular need a systematic physical exam to help

identify the underlying cause of the altered mental status.

### ***Airway***

The first step of any initial assessment is to assess the patient's airway for patency. Ensure that the patient can maintain his airway either on his own or by using an airway adjunct, such as an oropharyngeal airway (OPA).

### ***Breathing***

Determine whether the patient is breathing and the adequacy of her breathing. Is she breathing in a regular pattern or in an irregular pattern? Different patterns of breathing may indicate different causes of the AMS. The respiratory patterns commonly observed in AMS patients are apneustic, Biot's, Cheyne-Stokes, central neurogenic and Kussmaul's.

- ◆ Apneustic respirations are characterized by long, deep breaths separated by apnea. This is usually indicative of a stroke.
- ◆ Biot's (ataxic) respirations are characterized by a lack of a coordinated respiratory pattern.
- ◆ Cheyne-Stokes respirations are characterized by a regular pattern of shallow breaths building to rapid and deep respirations followed by apnea. This may indicate a stroke or metabolic disease.
- ◆ Central neurogenic respirations are characterized by very deep and rapid respirations, which may mean increased intracranial pressure.
- ◆ Kussmaul's respirations may be very similar to central neurogenic respirations with very deep and rapid respirations, or they may be slower and deep. Regardless of whether slow or rapid, this respiratory pattern may indicate metabolic acidosis, as the body

is attempting to eliminate excess carbon dioxide.

### **Circulation and skin condition**

Is the pulse present in the extremities or only centrally? Is it rapid, slow or irregular? While assessing for a pulse, notice whether the patient is warm, hot or cold. Hot skin may indicate conditions such as sepsis or generalized infection, whereas cooler skin may indicate decreased cardiac output. Remember that skin temperature may be influenced by the physical environment. Pale or cyanotic skin may indicate a respiratory factor in the patient's condition.

### **Vital signs**

As with all patients, after assessing the ABCs, you will assess the patient's vital signs. AMS patients may have variable vital signs. Depending on the medic's level of certification, tools such as cardiac monitors and capnography may be used to assist with vital sign assessment.

### **Mental status**

An important part of the initial assessment is determining a baseline mental status by utilizing the mnemonic AVPU. Is the patient **alert**? Is the patient responsive to **verbal stimulus**? Does the patient respond only to **painful stimuli**? Is the patient **unresponsive**? Another tool that may be utilized, depending on patient presentation, is the Cincinnati Stroke Assessment. Although it may not be *necessary* in all cases, this assessment can easily be included in a general AMS patient assessment. As the patient completes the assessment, his responses can demonstrate cognitive understanding as well as coordination of movement.

### **History**

It's important to obtain a medical history, if you are able, in order to help

determine the underlying cause of AMS. A medical history provides clues to the potential causes and can be obtained from a variety of sources such as family, nearby prescriptions and even bystanders at the scene.

Using the mnemonic SAMPLE can help you determine key elements of the patient's history.

- S** *Signs/symptoms*: What was seen, heard, smelled or observed? Did the patient complain of feeling dizzy or was the patient experiencing shortness of breath prior to the onset of AMS?
- A** *Allergies*: Does the patient have any known allergies to food, insects, medical dyes, plants or medications?
- M** *Medications*: Is the patient on any medications, and if so what are those medications, including herbal supplements? Is the medication new and was there a recent increase or decrease in dosage?
- P** *Past medical history*: What conditions does the patient have? The conditions found may not be "the" reason for the AMS but may lead to what is.
- L** *Last oral intake*: What has the patient recently taken or ingested? Try to determine what liquids (including water), food or medications were last consumed. This knowledge may offer clues to the onset of AMS. For example, a diabetic patient who has not eaten for twelve hours may experience AMS.
- E** *Events leading up to incident*: What was the patient doing that may have caused or helped cause the AMS? If immediate events do not appear to have contributed, try to determine the patient's activities for the past five or six hours.



## Ongoing physical exam

Because of the dynamic nature of AMS it is important to conduct the assessment as an ongoing process. Assess the patient after each intervention so that any subtle changes can be detected and appropriate care can be continued.

## Differential diagnosis

AMS patients should be considered unstable and in need of immediate transport to the closest appropriate facility if the condition cannot be corrected with basic treatments. The underlying causes of an AMS presentation are varied, and several are potentially life threatening. The causes can include structural conditions, metabolic issues, drugs (prescription or recreational), cardiovascular disorders, respiratory diseases and infectious diseases.

One method commonly utilized to remember the causes of AMS is the mnemonic AEIOU TIPS.

- A** Alcohol abuse
- E** Epilepsy, electrolyte, endocrine, encephalopathy
- I** Insulin, intoxication
- O** Overdose (opiates, lead, sedatives, aspirin, carbon monoxide)
- U** Uremia (kidney failure) and other metabolic causes
- T** Trauma, tumor
- I** Infection (encephalitis, meningitis, Reye's syndrome, sepsis)
- P** Poisoning, psychological (hysterical, psuedoseizures)
- S** Shock, sickle cell, subarachnoid hemorrhage, space occupying lesion

The AEIOU TIPS list is extensive, and it is impossible to cover every possibility. But by examining the general categories of the above-listed conditions, it is possible to link common signs and symptoms to aid in

differentiating which condition is the likely cause of the AMS.

## Trauma

Five different head trauma injuries can affect mental status: cerebral concussion, cerebral contusion, epidural hematoma, subdural hematoma and intracerebral hemorrhage. It is very difficult to differentiate between these injuries in the field.

Of those mentioned, the one injury that is especially worrisome is a subdural hematoma. It's a subtle injury where the veins of the arachnoid meninges tear and a very slow hemorrhage occurs. This bleeding may not be apparent for some time. The expanding blood volume is compressed against the skull and pushes downward into the brain, causing herniation.

### *Patient presentation*

The patient may be confused or may initially be cognitively aware and then progress toward AMS. If trauma is suspected, history of the event is important.

### *Patient Management*

If you suspect trauma, apply cervical stabilization and generally give supportive care. Airway management, re-assessments, vital signs and transportation to an appropriate facility are next steps.

## **Structural and cardiovascular disorders**

Because in the field it is difficult to differentiate between structural or cardiovascular issues causing AMS, I will address these issues together: tumor and stroke.

Tumors may grow in any part of the body, but in the closed space of the skull, any growth that displaces brain matter is troublesome. If the brain is herniated, it can put pressure on the brain

stem, affecting functions such as heart or respiratory rate and quality.

Strokes may be hemorrhagic or ischemic, and it may be difficult to differentiate between the two in the field. The principle for treatment is essentially the same for both: thorough assessment, supportive care and transport to an appropriate facility.

Some patients may have a mini-stroke, also known as a transient ischemic accident (TIA)—note that *accident* in the name is a misnomer and is an older term. TIAs may present with stroke-like symptoms, but the symptoms then resolve on their own relatively quickly. These events have a high potential to be precursors for devastating strokes later on. Patients presenting with TIAs should be assessed and treated in the same manner as stroke patients, and if symptoms resolve, the patient should be strongly urged to seek medical care.

Non-stroke cardiac causes of AMS are related to any condition that affects either the physical pumping of oxygenated blood to the brain or impedes the oxygen/carbon dioxide exchange at the alveolar capillaries. This disruption creates a hypoxic or hypercapnic condition (excess carbon) which then brings on an altered mental status essentially as a result of a lack of oxygen to the brain. Non-stroke cardiac conditions can include congestive heart failure (pulmonary edema), cardiac dysrhythmias, cardiomyopathy, cardiac shock (left ventricular failure) and myocardial infarction.

#### *Patient presentation*

Depending where in the brain the tumor or stroke is located, there may be a variety of signs and symptoms. The patient may complain of headache or visual disturbances, or he may have a motor deficit. Additionally, the patient may have irregular breathing patterns.

Other cardiac conditions will present with primary cardiac symptoms mixed with AMS.

#### *Patient Management*

Supportive care, careful monitoring of cardiac status (cardiac monitor and capnography if available) and transportation to an appropriate facility as determined by medical direction are indicated. Do not use dextrose-containing solutions for suspected stroke, as it may worsen cerebral edema. For non-stroke cardiac conditions, reversal of the cardiac condition is the treatment for AMS.

#### *Infectious diseases*

There are three predominant infections that affect the brain: meningitis, encephalitis and cerebral abscess. Meningitis is an infection of the meningeal membrane, which may present with a variety of signs or symptoms, including drowsiness, fever, vomiting, persistent headache, neck pain and/or rigidity, as well as possible intolerance to light and noise.

Encephalitis is an infection of the brain itself. Once the infection gets settled in the brain, the patient will experience brain tissue destruction, which may lead to personality changes, confusion, or complaints of visual disturbances, headache and fever. The patient may also develop seizures, become agitated, or be in a stupor. Encephalitis can also cause neck pain and/or rigidity similar to meningitis. On assessment, the patient may have coordination problems and irregular pupils.

Cerebral abscess is a localized collection of pus within the brain. As the pus accumulates, it pushes onto the brain, compressing brain tissue and blood vessels. The patient may present with AMS and a chronic headache that worsens as intracranial pressure increases.

### *Patient Management*

Supportive care and transportation to appropriate facility as determined by medical direction are the first responses. Some sources may advocate fluid, but it must be noted that fluid administration should be very carefully titrated to prevent overload. Do not use dextrose-containing solutions, as this may worsen cerebral edema.

### *Respiratory diseases*

The respiratory system is not physically attached to the brain, but it can have a direct effect on the brain's normal function by regulating the intake of oxygen and the elimination of carbon dioxide. Respiratory conditions that may cause AMS include COPD, pulmonary hypertension, asthma and pulmonary edema.

#### *Patient presentation*

The patient may present with irregular respiratory patterns, headache, blurred vision, confusion, drowsiness as well as fatigue and weakness.

#### *Patient Management*

Reversing the respiratory distress will improve the oxygen/carbon dioxide exchange and should alleviate the AMS. Respond with careful assessment, cardiac and capnography monitors, if available, and possible ventilatory support.

### *Metabolic disorders*

Metabolic disorders affect a patient's mental status by disrupting the supply of glucose to the brain. Brain cells do not have the ability to store their own glucose (glycogen) and disruption of that supply will result in AMS ranging from confusion to coma. The most common metabolic cause of AMS is diabetes.

Electrolytes also fall in this category, as they are part of the body's regulatory

functions. The two most common electrolytes are sodium, which regulates water within the cell, and calcium, which is used to support the cellular wall and is important to blood clotting and nerve impulse conduction.

#### *Patient presentation*

A patient with a metabolic or electrolyte imbalance may present with confusion, agitation, drowsiness, restlessness, speech pattern disturbances, lethargy, irregular cardiac beats, irregular respiratory patterns and cool/clammy skin. There may also be an acetone odor to the patient's breath.

#### *Patient Management*

Management of this patient begins with the reversal of the underlying problem, careful monitoring and regular assessments. Treatment for electrolyte imbalances is difficult in the field; instead treatment is geared toward correction of cardiac dysrhythmias or other issues and otherwise supportive. Rapid transportation to an appropriate medical facility as determined by medical direction is warranted.

### *Drugs*

A drug (of any category) overdose presents a difficult challenge for EMS providers. Since it is impossible in this article to describe an adverse reaction to every drug, I will describe five common drug categories as a representative sample.

Barbiturates tend to have a sedative effect, making the patient drowsy or uncoordinated. Opiates are narcotics that cause respiratory depression and loss of cognitive function. Tricyclic antidepressants may produce respiratory depression, hallucinations, heart rhythm disturbances and hypotension. Salicylates, such as aspirin, can lead to respiratory disturbances and can result in delirium, hallucinations, seizures, stupor and coma.

### *Patient presentation*

Because of the multitude of drugs, patients may present with any combination of signs and symptoms of AMS from confusion to coma. It is important to expect the unexpected, as the patient's mental status may change rapidly.

### *Patient Management*

Treatment focuses on reversing the underlying drug reaction and is generally supportive. Airway management, assessments and transport to appropriate medical facility as directed by medical direction is warranted.

### **Case study conclusion**

You approach the woman at the library from a point where she can see you. She looks up but without purpose. As you begin the examination, you notice her pupils are irregular, she has very deep and rapid respirations, and she has a slightly slow pulse. Her brother is with her, and you ask for her medical history as you assess

her. Upon questioning, he remembers that she was involved in a motor vehicle crash about three days ago. With the information gathered from the assessment and from her brother, you suspect head trauma as the cause of her altered mental status. You package the woman and transport her to the closest trauma center.

During your next shift you receive word from the hospital that she had a subdural hematoma and she is recovering. They credit you with a good assessment and your suspicion of head injury as critical to her receiving appropriate treatment without delay.

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## **Cardiac Science AEDs recalled**

Cardiac Science Corporation has recalled about 12,000 automated external defibrillators that may fail during a resuscitation attempt. This is a voluntary recall, but all affected AEDs should be removed from service immediately. The AEDs were manufactured between October 19, 2009, and January 15, 2010, and include the following models:

- Powerheart 9300A, 9300E, 9300P, 9390A, 9390E
- CardioVive 92532
- CardioLife 9200G, 9231

Cardiac Science is also contacting customers by letter and affected AEDs will be replaced at no cost. For more information or to find out if an AED is affected by the recall, go to [www.cardiacscience.com/AED195](http://www.cardiacscience.com/AED195) or call Cardiac Science at (888) 402-2484.



Name: \_\_\_\_\_ Date: \_\_\_\_\_

Continuing Education – What’s My Name Again? The Confusion Behind Altered Mental Status.

1. The state of awareness to self and the environment is defined as \_\_\_\_\_.
  - a. Coma
  - b. AVPU
  - c. Alertness
  - d. Consciousness
2. Epilepsy often causes impaired thinking during the \_\_\_\_\_ state.
  - a. Stimulant
  - b. Tonic-Clonic
  - c. Postictal
  - d. All of the above
3. Asking a patient to explain abstract thoughts helps assess cognitive abilities. Which of the following is an example of asking a patient an abstract thought?
  - a. Why can't pigs fly?
  - b. How many people are in this room?
  - c. How many miles from home are you?
  - d. Are those your shoes?
4. The best approach to interaction with confused patients is:
  - a. With a condescending attitude
  - b. Confrontational
  - c. Provocative
  - d. Calm and concise
  - e. Laughing at the patient
5. Fill in the blanks:
  - a. A \_\_\_\_\_
  - b. V \_\_\_\_\_
  - c. P \_\_\_\_\_
  - d. U \_\_\_\_\_
6. Which of the following may produce an inaccurate assessment of mental status while checking for responsiveness to painful stimuli?
  - a. Sternal rub
  - b. Supraorbital pressure
  - c. Trapezius squeeze
  - d. Fingernail pinch
  - e. A and D

This scenario should be used to answer questions 7 - 10.

You respond for the person that is “not acting right.” Upon arrival, you encounter a 20 year old male college student sitting up on a couch. The patient greets you warmly and asks why you are there. The patient’s roommate pulls you aside and expresses concern that the patient has been acting strangely over the last 48 hours, and is concerned for his well-being. The roommate states that this morning there was a loud noise like someone falling in the bathroom. She also mentioned that the patient has barely come out of his room in the last few days, and has not gone outside or eaten. The patient does not have any medical conditions that she is aware of. She does know that the patient broke up with his girlfriend about a week ago. You note no signs of traumatic injury to the patient. Vitals are 110/80, P110, RR22, SAO2 98%. Pupils are PERRL. Skin is normal x3. The patient is A & O x3.

7. Does the patient have altered mental status?

a. Yes

b. No

c. Not enough information provided to answer

You ask the patient how he is feeling, and if he feels as though everything is “OK.” The patient asks you why you were late picking him up for the supermarket, and he explains that without his favorite cereal, his girlfriend will break up with him.

8. Does this patient have an altered mental status?

a. Yes

b. No

c. Not enough information provided to answer

9. Based on the information given, what are several potential causes of the patient's condition?

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You discuss with the patient that you feel he should be evaluated at the ER to make sure that he is OK. He does not wish to be transported and says he needs to stay home to get everything ready to meet his girlfriend's parents. The roommate pulls you aside again and indicates that the patient has met his ex-girlfriend's parents many times, and that they insisted she break up with him.

10. Based on the information given, would it be appropriate to take protective custody of the patient? Why?

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11. Discuss why it is absolutely critical to perform a thorough history & physical examination on a patient with altered mental status.

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12. Many causes of AMS cannot be treated by EMS personnel. Knowing this, why is it important to attempt to determine the etiology of the AMS?

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13. EMS is called for an unresponsive student who “fell out” during detention. Why is it important for EMS providers to conduct a full battery of physical tests to the patient in order to determine the level of responsiveness?

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