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
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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 pneumonic 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 pneumonic 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 pneumonic 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, pseudoseizures)
- **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.

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.

References

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.cardiascusience.com/AED195 or call Cardiac Science at (888) 402-2484.