

20 Questions – May 2017 - Coma

1. Your partner is slumped in the passenger seat. Is this a coma?
2. What areas of the brain do you have to shut down to cause a coma?
3. What is a mnemonic to remember the various causes of coma?
4. You respond to a single car accident. The driver is "comatose". What are the two causes of coma that you must always think of and TREAT pre-hospital?
5. This patient does not open his eyes to noxious stimulus, moans intermittently, and is flaccid on the right side. He withdraws to pain on the left side, but does not attempt to reach your hand when you squeeze his trapezius. What is his Glasgow Coma Scale (GCS)?
6. What is "locked-in" syndrome?
7. A patient is comatose after being pulled from a sewer (which smells, not a bit strangely, like rotten eggs). Which 'sewer gas' has these properties?
8. A 12kg child ingested some morphine elixir and is unresponsive. What is the proper dose of naloxone (Narcan), and can you give it on standing orders?
9. What treatment / preventative measure is often omitted in comatose patients? (related to trauma)
10. What new narcotic are we starting to see that requires large doses of naloxone to reverse its effects?
11. When gaze deviation is present in the face of a brain hemorrhage, which way do the eyes look?
12. What area of the brain is often affected when the pupils are pinpoint (and this is not due to narcotics)?
13. What percentage (roughly) of narcotics overdoses have enlarged pupils?
14. On what side does the pupil dilate in relation to an expanding mass (e.g.: epidural hematoma)?
15. What are the key components of the coma physical exam?
16. Who is Cheyne-Stokes, and why does he breathe so funny?
17. What is the onset of metabolic coma like vs. structural?
18. What are Doll's eyes?
19. Which way do the arms move (extensor or flexor) in decorticate posturing? Which has a better prognosis, decorticate or decerebrate?
20. What is eyelid lag?

20 Answers – May 2017 – Coma

1. Coma is defined as a state of unresponsiveness from which the patient *cannot* be aroused by verbal or physical stimulus to produce any meaningful response. So you'll have to check to be sure...
2. A person has to lose either *both cortical hemispheres* of the brain OR the *reticular activating system* (RAS). The RAS is a neural network within the brainstem that regulates sleep and wakefulness. If either of these systems are non-functioning then a person won't be able to respond.
3. TIPS and vowels (AEIOU) is a good way to remember a more in depth list. It's not a complete list, by any means, but should give you a start...
 - o T – Trauma
 - o I – Insulin (hypoglycemia)
 - o P – Poisoning
 - o S – Seizure (and post-ictal)
 - o Stroke
 - o Subarachnoid hemorrhage
 - o A – Alcohol and drugs of Abuse (including narcotics)
 - o E – Endocrine, Electrolyte disorders (e.g.: low sodium)
 - o I – Infection – meningitis and encephalitis
 - o O – Oxygen (hypoxia)

- U – Uremia – most common in renal patients
- 4. Hypoxemia and hypoglycemia are two common correctable causes that you can directly treat in the field. Failure to recognize these two problems pre-hospital will surely result in worsening condition, if not death of the patient. Everything else should be thought of, but is not as critical as making sure the basic fuels are supplied to the brain. Hypothermia and hyperthermia are other possibilities that may require recognition and treatment beginning in the field.
- 5. This patient scores 1 (no eye opening) + 2 (moans) + 4 (nonspecific pain response) = 7. Remember that the Glasgow score is on BEST effort (even a dead man scores points here!). It is crucial, however, to let the ED know that the response was different on the two sides, as it will change the patient's management (hypertonic saline or mannitol is indicated...).
- 6. "Locked-in" syndrome is a rare event where a brainstem event (usually a stroke) results in the disruption of almost all the motor tracts of the body. The brain, however, is completely intact. The only voluntary control these persons have is the ability to blink on command and the ability to look upwards on command. One person so afflicted actually wrote a book using his eyes. *The Diving Bell and the Butterfly* by Jean-Dominique Bauby.
- 7. Hydrogen sulfide is a particular nasty sewer gas that smells like rotten eggs. It is very toxic, acting like a cellular poison much the same as cyanide. Treatment is supportive, except in hospital, where hyperbaric oxygen and sodium nitrite treatments may be used. Multiple other simple asphyxiating gases (like methane) may also be present in sewers. Remember about hydrogen sulfide, your nose adjusts to it very quickly, so decreased odor does NOT mean that it has aired out enough...this has cost many would be rescuers their lives. This is one of the detectable gasses on Fire's 4-gas-detector.
- 8. Naloxone is dosed in peds patients at 0.1mg/kg up to 2mg. Thus, this child should receive 1.2mg of naloxone. This is per standing orders. Also note that the standing orders in adults apply to a patient with a low respiratory rate, and the starting dose is 2mg, you may need to give more (up to 10mg per standing orders).
- 9. Immobilization of the C-spine is commonly forgotten (unless the patient is clearly comatose from trauma). Look carefully at the environment and get as much history as you can to determine whether trauma is possible. For example, man has a syncopal event shaving, falls and smacks head, is unconscious from secondary trauma. Consider spinal immobilization when appropriate.
- 10. Carfentanil – originally created to be used in veterinary medicine as an elephant tranquilizer. This has recently started showing up in MN. It is 100x more potent than fentanyl and therefore, 10,000x more potent than morphine. It only takes 20mcg to kill a human. Case reports suggest that it can take 10-16mg of Naloxone to reverse. We don't carry that much, but don't forget we can always manage the airway (which is more important than naloxone anyway)
- 11. The eyes tend to "look for quiet" – that is, they will wind up looking toward a head bleed or severe stroke (as that area is deadened), and away from a focus of seizure activity.
- 12. Fixed, pinpoint pupils tend to indicate a brainstem lesion – usually a stroke or hemorrhage in the pons.
- 13. Roughly 20%. This is thought to be due to hypoxia, polysubstance abuse, and other factors leading to pupillary dilation. So another one of those signs that, if present, are helpful; if absent, you can't necessarily rule out narcotics.
- 14. The pupil generally dilates on the side of the expanding mass as the pressure drives the brain downward, putting pressure on the 3rd cranial nerve (which controls the pupil). In 15% of cases, though, the pressure occurs at enough of an angle that the opposite 3rd nerve is compressed, resulting in the "wrong" pupil dilating. This is known as Kernohan's notch phenomenon.
- 15. The key parts of the exam are:
 - ABC's
 - Vital signs
 - Motor exam (look for focality)
 - Respiratory function (including pattern and pulse ox)
 - Pupillary exam and eye movements/deviation
 - Secondary survey for trauma / track marks / other clues.

- o *Don't forget that this exam may be CHANGING and that these changes (for better or worse) are critical to understanding how to treat the patient.
16. Cheyne-Stokes breathing is a sign of early brain herniation, and can also be seen in some metabolic causes of coma. It is characterized by cyclical breathing that goes from shallow to deep, then shallow, followed by a short period of apnea. This may be normal in infants and the elderly. This is to a lag in the brain's sensation of the balance of oxygen and carbon dioxide in the blood and therefore respiratory drive. This may not be an effective respiratory pattern, and should probably be assisted. Other strange patterns you may see include central hyperventilation, ataxic breathing (very irregular in rate and depth – ineffective), and apneustic (inspiration is held, then released – may be seen with hypoglycemia as well as stroke).
 17. The key is the history – structural causes of coma present rapidly, and are far more likely to have a focal exam (that is, one area of the body is different than the other) than metabolic causes, which have a more gradual onset and are nonfocal in general.
 18. A normal Doll's eyes response is when the head is rapidly turned, the eyes continue to look in their original direction briefly before catching up with the head and looking forward in the new direction. You may practice this on your partner if they are unconscious, but it is NOT a good idea in the field or even the ED until the cause of the coma is known; as it is not good for C-spine injuries and probably doesn't help patients with cerebral edema either. This is more a test done in the ICU once the coma cause has been dealt with. There are also other ways to test using water within the ears without moving the patient's head.
 19. Decorticate can be remembered because your hands move up to your chest, where the "cor" or heart is. Also, you could remember that when courting someone, you might hold flowers this way for your date. (Unless you're a heel and didn't bring flowers). Generally, the prognosis is better with decorticate



A. Extension posturing (decerebrate rigidity)



B. Abnormal flexion (decorticate rigidity)

Remember that in decorticate posturing the patient reaches for their heart. *Cor* is latin for heart

- posturing.
20. Eyelid lag is almost impossible to fake, so if you suspect psychogenic coma (catatonia) try raising the closed lid (there should not be resistance, obviously), and let it go. The lid in a comatose person closes slowly and gently, most who are catatonic will slam it shut. Also, a person who is truly unconscious will allow their own hand to be dropped on their face. Someone who is catatonic will have their hand fall to the side and it typically won't strike their face. Do continue to assess for ingestion, hypoxemia, glucose level, etc. in these patients, as bizarre behavior may just be bizarre, or may be the sign of a brain disorder for a good, and correctable, reason. Brushing the eyelid to elicit the blink reflex generally indicates a wakeful state as well, but this requires a gentle touch and may not be as consistently elicited.