Emergency Medical Education: 20 Questions

20 Questions is a monthly educational resource developed for HCMC EMS paramedics and authored by their medical directors and other subject matter experts. This content is intended for educational purposes only and not intended to be a substitute for professional medical advice, diagnosis, or treatment.

Diabetes and Glucose Disorders

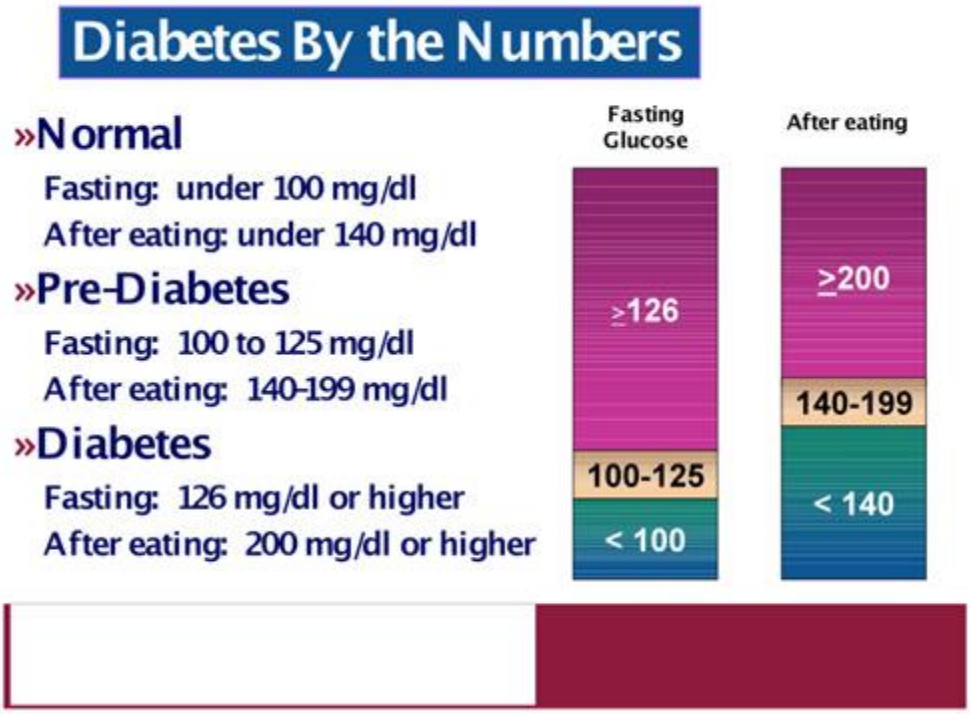
20 Questions about Diabetes and Glucose Disorders

1. You are called for a 'one down', and indeed, find one down. The gentleman has a glucose of 30 on Accucheck. He is a former IV drug user and you cannot find any veins. He smells heavily of alcohol. What therapy is indicated?
2. How fast does it work, and what is the most common side effect?
3. Why will it probably *not* work as well in this patient?
4. A patient describes feeling jittery, sweaty, nervous, and confused just before collapsing before filling his plate at Old Country Buffet. He took his insulin as usual today. What hormone causes most of the symptoms of hypoglycemia?
5. What are some common triggers of a hypoglycemic incident? (and some not so common?)
6. Do you have to be a diabetic to get hypoglycemic?
7. Who is Kussmaul, and how does he breathe?
8. You respond to a patient whose wife suspects that he is in DKA. (What is DKA? What are some common symptoms?)
9. What's the fruity smell on the patient's breath? (Assume that he hasn't been drinking raspberry schnapps.)
10. On a random glucose check, a patient with altered mental status has a blood glucose of 200. Does this patient have diabetes?
11. What is the difference between Type I and Type II diabetes?
12. In an unresponsive patient, what are a few clues to make you suspect hypoglycemia as a cause for collapse?
13. Why will one of these signs probably be irrelevant in a few years?
14. A nursing home patient with dementia has hypotension, low urine output, and a sugar that is HIGH on your glucometer. Besides DKA, what could this patient have?
15. What is appropriate prehospital treatment for both DKA and HHNC?
16. You are called to an unresponsive patient, who is now responsive after IV D50. The patient states that they took triple their dose of 'diabetes pills' because they were running sugars in the 200s. The patient wishes to decline transport and is making a sandwich. What do you think?
17. Can you have DKA with a blood sugar in the 200 range?
18. Why do diabetics develop such nasty foot ulcers and infections?
19. What should you do for a patient with hypoglycemia and an insulin pump?
20. What types of insulin are used for treating diabetes? How long do the effects last?

20 Answers about Diabetes and Glucose Disorders

1. Glucagon – 1mg IM is indicated when IV access cannot be established. This intervention is less effective in children, (the peds dose is 0.5mg/kg to a max of 1mg – note that this is not broken out in the current guidelines, it's quite unlikely that you'd need this for a < 20kg child)

2. Glucagon IM usually has effects within 10-20 minutes, with peak effect at 30-60min. Thus giving it should not stop you from continuing to look for an IV. The most common side effect is nausea and vomiting, occurring in up to 30% of patients.
3. Unfortunately, glucagon depends on a liver store of glycogen to be present, this is generally NOT the case in alcohol-associated hypoglycemia (nor in very small children, whose liver reserves are very small – thus the smaller the child, the higher the risk of hypoglycemia in the face of overdose or severe stress).
4. Epinephrine is the stress hormone that accounts for many of the symptoms of low blood sugar.
5. Missing a meal, energy output above normal for the patient, and changes in insulin dose or other medications are the most common causes. Less commonly, thyroid problems, tumors, poor nutrition, medication changes, changes in renal function or liver function, aspirin use, and rarely, ingestion of Akee fruit (illegal to bring home from Jamaica, by the way, or to sell in the US) may lead to low sugars (as may failure to follow a daily routine due to altered mental status!).
6. No. Non-diabetic hypoglycemia can present in one of two ways, fasting or post-prandial (after a meal). The fasting type may be due to an endocrine problem, a tumor, late pregnancy, liver disease, drugs, shock, or enzyme defects. The after-eating type is usually in patients who have had stomach or intestinal surgery.
7. No idea who Kussmaul was…Luckily, you can still recognize his breathing pattern which is hyperpnea – deep breathing, often rapid. (In contrast to hyperventilating which is rapid but shallow.) This is specifically seen in a patient who has diabetic ketoacidosis and is an effort by the body to get rid of excess acid in the form of CO_2 that is being blown off with the deep breaths.
8. Diabetic ketoacidosis (a.k.a. DKA) is a condition in which a diabetic under stress, often from an infection, heart attack, or other significant cause, begins to use fatty acids for fuel at the command of glucagon produced in the body. Insulin production is suppressed, glucose levels rise, and the fatty acid breakdown leads to ketones. The ketones and excess sugar produced are excreted in large volumes of urine, creating dehydration and more stress. The end result is a patient with lots of glucose, lactic acid, ketones, and very little insulin or body fluid. Common symptoms of high glucose include high fluid and food intake, large urine output (initially), visual blurring (due to dehydration of the lens of the eye from fluid shifts), weakness, weight loss, nausea, vomiting, and abdominal pain (more in children, usually generalized and possibly due to liver inflammation – but not clear).
9. Ketones! Some of the ketones in the blood will make their way to the breath. However, about 20% or so of the population can't smell this odor, which may be a good excuse not to try to smell everyone's breath as a screening tool.
10. Yes. According to the rules, any random glucose greater than 200 qualifies as diabetes, whether the person is under stress or not. A random glucose higher than 150 is very suspicious for diabetes. **See the table below.**



11. Type I diabetics depend on insulin in order to survive. The onset is generally by the teenage years, they are generally on the thinner side, and are likely to get DKA. One of the main problems is not *enough* insulin produced. Type II diabetics do not depend on insulin, though it may be used to control sugar levels when continued poor nutrition and metformin are ineffective. It generally occurs later in life, the patients are generally larger in size, and the main problem is a lack of *response* to insulin produced. Their cells are resistant to insulin so traditional medicine relies on giving them *more* insulin while a better approach is to **avoid the foods that raise blood sugar!** (Interestingly enough, insulin is a growth hormone that stores fat. The lack of insulin is why Type I diabetics are usually lean while Type II diabetics are often obese.)
12. Look for candy in the pocket, a wallet card or medic alert necklace, evidence of subcutaneous injection sites, or scarring of the fingertips/sides of fingers from glucose checks. The absence of these signs should not cause you to abandon checking a sugar on a patient with altered LOC, obviously! (Spotty bruises on the abdomen are usually from injections of one of two medications- insulin or Lovenox. Not to be confused with a seatbelt sign which is usually continuous and/or linear.)
13. Fiber optic technology can determine glucose concentration non-invasively with the detection of light polarization. This technology hopefully will make finger sticks obsolete in the not-to-distant future. (Coupled with an insulin pump, this could result in great glucose control with minimal patient effort!) There is at least one new device scheduled to be launched in 2016.
14. HHNC (hyperglycemic, hyperosmolar, nonketotic coma) (aka: HONK if you drop the hyperglycemic part) – this is a disorder where the body probably experiences a stress (stroke, infection, New Year's on the streets) which raises glucose levels. The body increases urine output but the patient is unable to replace the fluid loss (too sick, demented, etc.). Dehydration stresses the body more, and the cycle continues. Unlike DKA, the patients are rarely acidotic, and are generally not ketotic. Their sugars are on average much higher than in

DKA. In general, HHNC patients are elderly, with renal compromise, and have some sort of barrier to obtaining water for themselves.

15. Fluids. In DKA, the average fluid deficit is 3-5 liters, in HHNC it is 9 liters. However, after the first few liters we want to replace these fluids over some time, so we don't change things too fast. Most of these patients can benefit from normal saline in the field so generally feel free to run in a liter, then back down to TKO (unless hypotensive, of course, in which case, bring it on!).
16. Think twice. Some oral hypoglycemic agents, specifically the sulfonylureas like Glipizide & Glyburide, are very long-acting, and hypoglycemia can continue to occur for up to 24-48h after ingestion. These patients are usually hospitalized on dextrose IV drips. Hopefully, your patient will understand this, if not, consider having him speak with a doc by phone. On the other hand, the most common oral agent is metformin and this drug does not typically cause hypoglycemia.
17. Yes. About 18% of patients in DKA have sugars < 300, and the 200 range occurs, though rarely.
18. Unfortunately, several complications add up to major foot problems. First, diabetics have nerve damage which tends to affect the distal extremities first – the feeling in the feet is especially problematic (sometimes we can even re-locate fractures without anesthesia!), thus they don't feel injury or pain well. Put this together with poor blood supply (due to small vessel damage) and decreased ability to fight infection (poor white blood cell function) and you have a recipe for foot disaster! Up to 1/3 of diabetics with chronic foot infections wind up needing amputation in the end!
19. Treat the patient for hypoglycemia as you normally would. Bring it to the attention of the ED staff. You don't need to turn it off or remove the pump from the patient. Insulin pumps only use long-acting insulin so there will only be minimal effects while you encounter the patient.

20. **See table below:**

Type of Insulin	Examples	Onset of Action	Peak of Action	Duration of Action
Rapid-acting	Humalog (lispro)	15 minutes	30-90 minutes	3-5 hours
	NovoLog (aspart)	15 minutes	40-50 minutes	3-5 hours
Short-acting (Regular)	Humulin R Novolin R	30-60 minutes	50-120 minutes	5-8 hours
Intermediate-acting (NPH)	Humulin N Novolin N	1-3 hours	8 hours	20 hours
	Humulin L Novolin L	1-2.5 hours	7-15 hours	18-24 hours
Intermediate- and short-acting mixtures	Humulin 70/30 Humalog Mix 75/25 Novolin 70/30 Novolog Mix 70/30	The onset, peak, and duration of action of these mixtures would reflect a composite of the intermediate and short- or rapid-acting components, with one peak of action.		
Long-acting	Ultralente	4-8 hours	8-12 hours	36 hours
	Lantus (glargine)	1 hour	none	24 hours