KRESSER INSTITUTE
FOR FUNCTIONAL AND EVOLUTIONARY MEDICINE

Hypoglycemia - Part Two

The next category of hypoglycemia to consider in the conventional model is hypoglycemia in patients with diabetes and impaired glucose tolerance.

This typically occurs in the postprandial state rather than the fasted state. In conventional medicine, the presence of sympathoadrenal symptoms after meals isn't sufficient to diagnose hypoglycemia. The patient must also have blood glucose below 50 mg/dL within four hours of a meal, symptoms consistent with hypoglycemia, and relief of those symptoms when blood sugar is raised. So, again, we're talking about Whipple's triad.

However, the diagnosis of postprandial hypoglycemia is now controversial, and many clinicians and researchers believe that postprandial hypoglycemia is not a true hypoglycemic disorder. They now refer to it instead of postprandial syndrome.

The diagnostic workup is similar to what you do for fasting hypoglycemia in patients without diabetes. The goal is to document Whipple's triad and demonstrate low glucose below 50 mg/dL at the time symptoms are occurring, within four hours after a meal. The difference is patients with reactive hypoglycemia should be evaluated in the postprandial state after a mixed meal. OGTT, oral glucose tolerance test, is actually no longer recommended as the test for postprandial hypoglycemia for several reasons. One is that there is no correlation between blood glucose concentrations and symptoms during the test. Another is that many patients with postprandial sympathoadrenal symptoms have similar symptoms after the administration of placebo instead of glucose, and a third is that cortisol and epinephrine levels often do not increase when blood sugar levels are low or symptoms are present, which indicates that the fall in glucose is not sufficient for counterregulatory mechanisms to be activated.

While glucometers are not considered to be accurate—they have about a 10 to 15 percent variation per reading—they probably are the most practical way of doing this kind of testing.

Given that postprandial hypoglycemia most often occurs in the context of diabetes and other blood sugar disorders, the causes of it are similar to what we talked about in the hyperglycemia

presentation, so you can refer to that for more detail. However, in patients with diabetes who are taking medication, drug-induced hypoglycemia is something you have to consider. This can occur with a variety of medications as well as insulin, so make sure to take a full medication history during the intake.

TESTS	RESULT	FLAG	UNITS	REFERENCE INTERVAL	LAB
CMP14+LP+TP+TSH+5AC+CBC/D/P...					
Glucose, Serum	**45**	**Low**	mg/dL	65 - 99	01
Specimen received in contact with cells. No visible hemolysis present. However GLUC may be decreased and K increased. Clinical correlation indicated.					
Hemoglobin A1c	**6.0**	**High**	%	4.8 - 5.6	01
Increased risk for diabetes: 5.7 - 6.4 Diabetes: >6.4 Glycemic control for adults with diabetes: <7.0					
Uric Acid, Serum	5.7		mg/dL	3.7 - 8.6	01
Please Note:					01
Therapeutic target for gout patients: <6.0					
BUN	14		mg/dL	6 - 24	01
Creatinine, Serum	0.95		mg/dL	0.76 - 1.27	01
eGFR If NonAfricn Am	96		mL/min/1.73	>59	
eGFR If Africn Am	111		mL/min/1.73	>59	
BUN/Creatinine Ratio	15			9 - 20	
Sodium, Serum	**145**	**High**	mmol/L	134 - 144	01
Potassium, Serum	3.8		mmol/L	3.5 - 5.2	01
Chloride, Serum	102		mmol/L	97 - 108	01
Carbon Dioxide, Total	24		mmol/L	18 - 29	01
Calcium, Serum	8.8		mg/dL	8.7 - 10.2	01
Phosphorus, Serum	3.6		mg/dL	2.5 - 4.5	01
Magnesium, Serum	2.2		mg/dL	1.6 - 2.6	01
Protein, Total, Serum	6.3		g/dL	6.0 - 8.5	01
Albumin, Serum	4.3		g/dL	3.5 - 5.5	01
Globulin, Total	2.0		g/dL	1.5 - 4.5	
A/G Ratio	2.2			1.1 - 2.5	
Bilirubin, Total	0.8		mg/dL	0.0 - 1.2	01
Alkaline Phosphatase, S	63		IU/L	39 - 117	01
LDH	154		IU/L	121 - 224	01
AST (SGOT)	16		IU/L	0 - 40	01
ALT (SGPT)	20		IU/L	0 - 44	01
GGT	19		IU/L	0 - 65	01

In practice, you may see mixed cases where fasting glucose is low, but other blood sugar markers indicate hyperglycemia, so the lab on this slide is a good example. Patient was a 47-year-old male with loose stools, abdominal pain, weight loss, and low energy. He was unaware of any blood sugar issue when he came to see me, and as you can see, his fasting glucose was 45, which is very low, but his hemoglobin A1c was 6.0. Now we know that hemoglobin A1c is not necessarily a reliable marker, but in this case, some of his post-meal blood sugar readings were high, and some of them were low, so his blood sugar was fluctuating wildly. This presentation can occur during the early stages of type 2 diabetes or type 1.5 diabetes, which is adult-onset autoimmune diabetes.

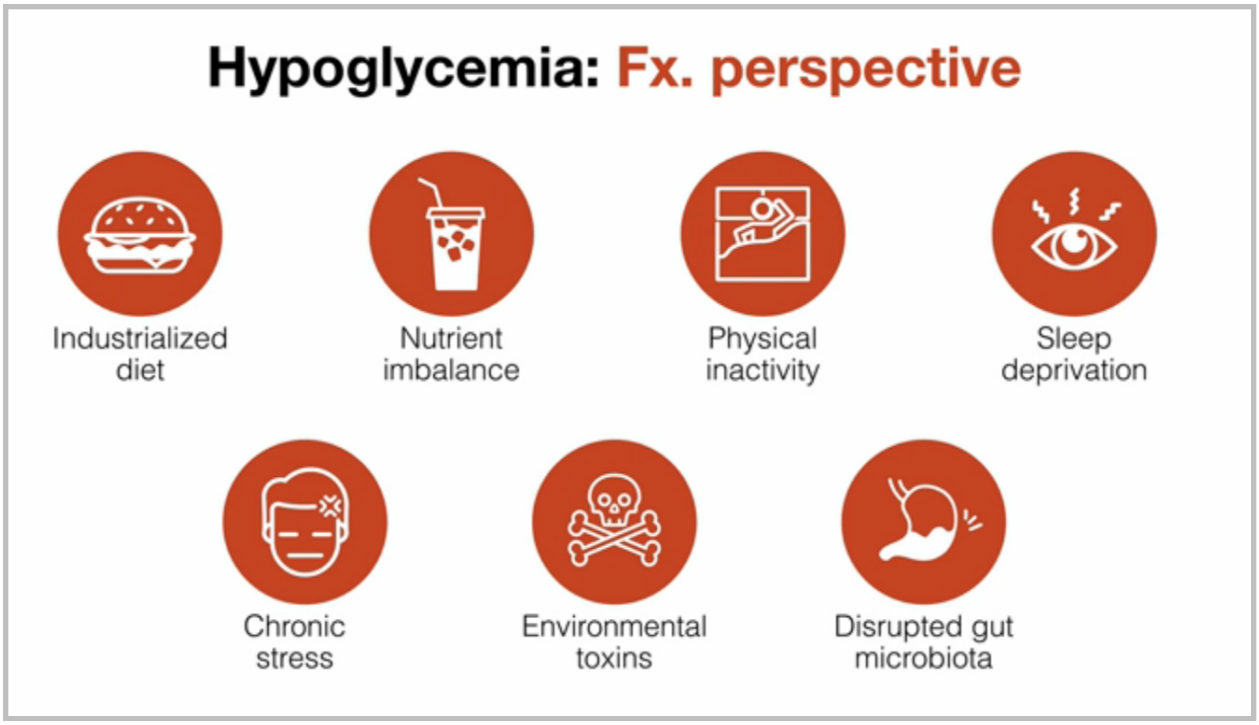
DAY ONE			
# of hours fasted	12		
# of hours slept	8		
quality of sleep	Good. Woke up 1 time		
what you ate for breakfast	Yams, white rice, porriage, 1 egg with no yolk,		
what you ate for lunch	White rice, boiled chicken, cabbage, celery, napa cabbage, carrots		
	Time	Result	How did you feel at the time of measurement (2-3 words)
AM Fasting	8:50am	96	Good
Before Lunch	12pm	111	Good. Rested at home, didn't go out.
After Lunch (45-min)	1pm	110	Good. Rested at home, didn't go out.
After Lunch (1-hour later)	2:10pm	93	Good. Rested at home, didn't go out
After Lunch (1-hour later)	3:10pm	80	Good. Rested at home, didn't go out.
DAY TWO			
# of hours fasted	12		
# of hours slept	8		
quality of sleep	average. not as well as yesterday		
what you ate for breakfast	yams, white rice, porriage, 1 egg with no yolk.		
what you ate for lunch	white rice, boiled chicken, cabbage, celery, napa cabbage, carrots		
	Time	Result	How did you feel at the time of measurement (2-3 words)
AM Fasting	8:15am	88	Good **Good**
Before Lunch	12:10pm	77	Hungry. **Hungry.**
After Lunch (45-min)	1:15pm	134	
After Lunch (1-hour later)	2:15pm	88	
After Lunch (1-hour later)	3:15pm	84	
DAY THREE			
# of hours fasted	12		
# of hours slept	8		
quality of sleep	Not good. Woke up at 4-5am. Noisy neighbors		
what you ate for breakfast	yams, white rice, porriage, 1 egg with no yolk.		
what you ate for lunch	white rice, boiled chicken, cabbage, celery, napa cabbage, carrots		
	Time	Result	How did you feel at the time of measurement (2-3 words)
AM Fasting	8am	69	Hungry. Did not eat ~~Hungry. Did not eat last night.~~ for dinner last night.
Before Lunch	12pm	59	
After Lunch (45-min)	1:10pm	82	
After Lunch (1-hour later)	2:10pm	85	
After Lunch (1-hour later)	3:10pm	90	

Here is the glucometer testing for this patient. Fasting blood sugar is highly variable, as you can see. It was 96 one day; 69 another day, which is borderline low on the functional range; 59 one day before lunch. Then one day after lunch, it went up to 134, which is not outside of the target, but it's getting up there. This patient moved recently in the past five years to the U.S. from China and ate a traditional Chinese diet. As you can see here on the page, this is why this form is so helpful. You ask the patient what he eats, and you see how his blood sugar responds to what he eats. In this case, given the amount of white rice that he eats and his blood sugar fluctuations, it's probably a good idea for him not to do that and to see how his blood sugar changes or stabilizes.

Marker	Value	Functional Range	Lab Range
Glucose	45	75 - 90	65 - 99
Hemoglobin A1c	6.0	4.4 – 5.4	4.8 - 5.6
Uric Acid	5.7	3.7 – 6.0	3.7 - 8.6
BUN	14	13 – 18	6 - 24
Creatinine	0.95	0.85 – 1.1	0.76 - 1.27
BUN/Creatinine Ratio	15	8 – 19	9 - 20
Sodium	145	135 – 140	134 - 144
Potassium	3.8	4.0 – 4.5	3.5 - 5.2
Chloride	102	100 – 106	97 - 108
C02	24	25 – 30	18 - 29
Calcium	8.8	9.2 – 10.1	8.7 - 10.2
Phosphorus	3.6	3.5 – 4.0	2.5 - 4.5
Magnesium	2.2	2.0 – 2.6	1.6 - 2.6
Protein, total	6.3	6.9 – 7.4	6.0 - 8.5
Albumin	4.3	4.0 – 5.0	3.5 - 5.5
Globulin	2.0	2.4 – 2.8	1.5 - 4.5
A/G ratio	2.2	1.5 – 2.0	1.1 - 2.5
Bilirubin, total	0.8	0.1 – 1.2	0.0 - 1.2
Alkaline Phosphatase	63	42 – 107	39 - 117
LDH	154	140 - 180	121 - 224
AST	16	10 - 30	0 - 40
ALT	20	10 - 29	0 - 44
GGT	19	0 - 40	0 - 65
TIBC	245	250 – 350	250 - 450
UIBC	134	150 - 375	150 - 375
Iron	111	85 – 135	40 - 155
Iron saturation	45	15 – 45	15 - 55
Ferritin	372	30 - 150	30 - 400
Cholesterol, total	127	150 - 240	100 - 199
Triglycerides	77	50 – 100	0 - 149
HDL	39	55 – 85	> 39
LDL	73	0 – 175	0 - 99
T. Chol / HDL Ratio	3.3	< 3	0 - 5.0
Triglycerides / HDL Ratio	1.97	< 2	
TSH	1.290	0.5 – 2.5	0.45 - 4.50
T4, total	6.1	6.0 – 12	4.5 - 12
T3 Uptake	34	30 - 38	24 - 39
T3, Total	103	100 – 180	71 - 180
Vitamin D, 25-hydroxy	29.1	35 - 60	30.0 - 100.0

This patient also had low vitamin D and iron overload, both of which can contribute to dysglycemia, as you know. Sodium was slightly high, and that can be caused by dehydration. It's likely unrelated to blood sugar.

Now let's talk about hypoglycemia from a functional perspective. We look at it differently in a number of ways. The first difference is how we view the etiology and pathogenesis. If you go to UpToDate or a similar resource online, it lists the causes of hypoglycemia as what I mentioned earlier: drugs, alcohol, critical illness, malnourishment, tumor, etc. There is no mention of the contribution of modern lifestyle, which is absolutely fundamental, in my opinion. The causes of hypoglycemia, especially postprandial, are virtually identical to the causes of hyperglycemia that were covered in the last presentation.



It's not that the conventional causes aren't valid. They are, but the functional perspective is broader and more inclusive. Many of your patients with hypoglycemia won't have any of the conventional causes at work, but they will have some or most of the ones on this slide. These include industrialized diet, nutrient imbalance, physical activity, sleep deprivation, chronic stress, environmental toxins, and disrupted gut microbiota.

Another difference between hypoglycemia from the conventional and functional perspectives is how it is defined. In conventional medicine, the patient must meet the strict definition of Whipple's triad, which again are symptoms consistent with hypoglycemia, a low plasma glucose concentration measured with a precise method when symptoms are occurring, and then relief of those symptoms after blood sugar is raised. In functional medicine, the definition is similar, but I'm less concerned with seeing a glucose level below the lab reference range. If I see a patient who has symptoms that are consistent with hypoglycemia, and those symptoms are resolved by eating, what do we do if their fasting blood sugar is 70? We should still rule out other conditions that can cause these symptoms, but if we do, I think it still makes sense to treat this patient as if he may

have a blood sugar disorder. This is especially true since treatment in functional medicine involves primarily dietary, lifestyle, and behavioral tweaks and possibly supplements and botanicals that are not likely to have significant side effects. In other words, if someone who didn't have hypoglycemia followed the functional treatment for it, he would likely feel better or unchanged, not worse, so there is very little risk in treatment even if the person doesn't have true hypoglycemia according to the conventional definition.

That said, I wouldn't diagnose functional hypoglycemia based on lab results alone. Those results should accompany symptoms, and those symptoms should resolve with interventions that regulate blood sugar. For example, if a patient has a fasting blood sugar of 70, his other blood sugar markers are normal, and he doesn't have any symptoms of hypoglycemia, I'm not going to be worried about that. I would just say that is good blood sugar control.