**Diabetes Case Presentation Answer Key**

1. **AK is a 57-year-old female who has diabetes. She is taking metformin 1000mg po bid and Levemir 20 units under the skin twice daily. One afternoon, she begins to feel shaky, drowsy, and sick to her stomach. She feels like something just isn’t right. What should she do?**
	1. Immediately drink 12 oz of orange juice to bring up blood sugar.
	2. Check blood sugar. If less than 70 mg/dL, drink 8 oz of milk.
	3. Check blood sugar. If less than 70 mg/dL, drink 4 oz of orange juice.

Answer: C

Rationale: It is recommended to check and record one’s blood sugar when signs and symptoms of hypoglycemia are present to ensure safety, appropriately correct blood sugar, and provide the patient’s care team more information to make treatment decisions. If the patient’s blood sugar is <70, 15g of simple, “fast acting sugar” is preferred to quickly increase the blood sugar to a safe range of 80-130. 4oz of orange juice is approximately 15g of carbohydrates/sugar. The ADA recommends the 15-15 rule when experiencing hypoglycemic events with readings <70: have 15g of carbohydrates to raise blood sugar and re-check blood sugar in 15 minutes. If still less than <70, have another serving with complex carbs.

Additional information: https://www.diabetes.org/healthy-living/medication-treatments/blood-glucose-testing-and-control/hypoglycemia

1. **PM is a 45-year-old male who has Type 2 diabetes. He is currently taking only metformin 1000 mg by mouth twice daily. His last A1C was 8.5% and his blood sugar logs reveal consistently elevated blood sugars after meals >200 mg/dL. He doesn’t mind injections; he just wants to “get this under control”. He would prefer an option that does not cause him to gain weight or has a high risk of hypoglycemia because he is a construction worker. What medication should you consider adding?**

Answer: GLP-1 agent

Rationale: Because this patient is already taking the max recommended dose of metformin, which is a first line agent for type 2 diabetes and has an elevated A1C above goal of <7%, he would qualify for an additional agent. Potential second-line agents include: GLP-1, DPP-4, and SGLT-2. All three agents have a low risk of hypoglycemia because they are glucose dependent. SGLT-2s and GLP-1s have a potential to cause weight loss, while DPP-4s are considered weight neutral. Of the three agents, GLP-1s have the highest potential to decrease the A1C (by 0.8-2%) to goal without the need of an additional agent. Because he doesn’t mind injections, GLP-1 once daily or once weekly injection would be an appropriate option.

Additional Information: https://pro.aace.com/pdfs/diabetes/AACE\_2019\_Diabetes\_Algorithm\_03.2021.pdf

1. **Your patient’s A1C was 11.2% with a low c-peptide and a fasting blood sugar of 600, so you have just diagnosed her with Type 1 Diabetes. You would like to start insulin. She weighs 110 pounds (50kg).**
	1. **What dose of long-acting insulin do you start?**

50kg \* 0.1-0.4 units/kg/day = 5 – 20 units of insulin per day

5-20 units \* 50% = 2.5 – 10 units of long-acting insulin per day

Answer = 7 units of Lantus

* 1. **How will you send it over to the pharmacy?**

7 units/day \* 90-day supply = 630 units needed = 0.42 boxes needed = ~ 1 box

100 units/ml \* 15 ml 1,500 units/box

Rationale: In newly diagnosed Type 1 Diabetic patient, a weight-based dosing is used to find their total starting daily dose of insulin. Around 50-70% of this total daily dose will be dedicated to long-acting insulin with the remainder dedicated to meal-time insulin. Because these calculations will produce a range, use clinical judgement to pick a starting dose within that range. After initiation, insulin titration will most likely be needed to determine the best dose. Most pharmacies will not break boxes, so round up to the nearest whole box size.

1. **You have a patient with an A1C of 11.2% and a fasting blood sugar of 300. You diagnose him with Type 2 diabetes and wish to start long-acting insulin. He weighs 220 pounds (100kg).**
	1. **What dose of long-acting insulin do you start?**

Weight based = 100kg \* 0.15-0.2 units/kg/day = 15 – 20 units daily

Empiric based = 10 – 15 units per day

Fasting BG method = 300/18 = 16.67 units ~ 17 units

Quick Weight based = 100kg / 10 = 10 units

Avg of the above = 13 – 15.5 units of long-acting insulin per day

Answer = 14 units Levemir per day

* 1. **How will you send it over to the pharmacy?**

14 units/day \* 90-day supply = 1,260 units needed = 0.84 boxes needed = ~ 1 box

100 units/ml \* 15 ml 1,500 units/box

Rationale: Because these calculations will produce a range, use clinical judgement to pick a starting dose within that range. After initiation, insulin titration will most likely be needed to determine the best dose. Most pharmacies will not break boxes, so round up to the nearest whole box size.

1. **Our Type 1 patient also needs short-acting insulin to cover her mealtimes. Just as a reminder: your patient’s A1C was 11.2% with a low c-peptide and a fasting blood sugar of 600, so you have just diagnosed her with Type 1 diabetes. You would like to start insulin. She weighs 110 pounds (50kg). You have already decided to start her on Lantus 7 units once daily. What dose of short-acting insulin will you start?**

Previously calculated: 50kg \* 0.1-0.4 units/kg/day = 5 – 20 units of insulin per day

Previously calculated: 7 units of Lantus daily

6 units of short-acting insulin (30-50% of TDD)

Answer: 2 units of Apidra three times daily with meals

TDD = 7 + 6 = 13 units daily

Rationale: In Type 1 Diabetes, a 50-70% of the total daily dose of insulin should be dedicated to long-acting (basal) insulin. The remainder of the insulin should be dedicated to short-acting (bolus) insulin divided amongst the mealtimes.

1. **Let’s return to our Type 2 patient. As a reminder, his A1C was 11.2% and he had a fasting blood sugar of 300. You diagnosed him with Type 2 diabetes and started Levemir 14 units under the skin once daily. He weighs 220 pounds (100kg). He is uninsured. He returns to clinic and wishes to start mealtime insulin to better control his blood sugars – blood sugars 2h after meals are always >200. How do you start him on short-acting insulin?**

Current TDD = 14 units of long-acting insulin

Weight Based = 0.1 units/kg/meal \* 100 kg = 10 units/meal

Empiric Based = 5-10 units/meal

Answer: 4 units of Novolg (rapid-acting insulin) with each meal (total of 12 units daily) OR 10 units with the largest meal of the day

Rationale: Since the patient is currently taking 14 units of long-acting insulin, the bolus insulin should ideally not exceed the basal insulin amount in order to achieve the desired 50:50 ration of basal:bolus insulin. Therefore, starting 10 units per meal with an average of 3 meals per day results in 30 units of basal insulin per day, which exceeds the TDD of bolus insulin. When deciding to initiate mealtime insulin, it is important to have a patient centered approach. If the patient does not have a largest meal of the day, starting with 10 units with the largest meal may not be as beneficial as in a patient who only eats one or two meals per day. Dividing the dose amongst the meals or starting with a lower empiric dose may be a good option for this patient as he is basal insulin naïve, on a relatively low dose of bolus insulin, and assumingly eats three meals per day. Clinical judgement is needed to find the best starting regimen of meal-time insulin. Adjustments and titrations can be made every couple of days to find the best regimen based on the patient’s blood sugar. If the patient has a history of lows, especially if they are associated with a mealtime, consider starting with a more conservative dose and titrating up. Doses of mealtime insulin can generally be increased by 10-20% based on pre-meal or post-prandial blood sugars. Once the patient has reached 50 units of basal insulin per day, consider starting bolus insulin if it has yet to be initiated.

1. **Let’s go back to our Type 1 patient. She is currently taking Apidra 2 units with meals and Levemir 7 units in the morning. You’d like to start her on a carb ratio so she can adjust her insulin dose based on what she is eating. How will you do this?**

Rule of 500

TDD of insulin = 7 +2(3) = 13 units

500/13 = 38.4 = ~ 38

Carb ratio = 1:38

Rationale: One unit of insulin will cover 38 carbs. Carb ratios are intended for patients who can accurately and consistently count carbs during meals. Carb ratios can be used when calculated how much insulin is needed to bolus for a given meal.

1. **In addition to the carb ratio, you would like to give her a correction factor (insulin sensitivity factor) to allow her to bring down elevated blood sugars. She is currently taking Apidra 2 units with meals and Levemir 7 units in the morning. How will you do this?**

Rule of 1800

TDD = 7 + 2(3) = 13 units

1800/13 = 138.4 = ~ 138

ISF = 1: 138

Rationale: For every 138 points above blood sugar goal, 1 unit is needed to ‘correct’ the blood sugar. ISF can be used when patient’s blood sugars are above goal before mealtime. The goal is to prevent the patient’s blood sugar from climbing even higher after the meal.

1. **Your patient is currently taking Levemir 34 units under the skin once daily and Apidra 5 units with meals. Pt has a history of hypoglycemia unawareness. What adjustments should you make to their insulin regimen?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fasting | 2 hours after lunch | 2 hours after dinner | Bedtime |
| Monday | 155 |  | 240 | 196 |
| Tuesday | 180 | 202 | 195 | 177 |
| Wednesday |  | 178 |  | 160 |
| Thursday | 140 |  | 235 |  |
| Friday | 158 |  |  | 165 |
| Saturday | 124 |  | 221 |  |
| **Average** | **151** | **190** | **222** | **175** |

Answer option #1: increase Levemir by 4 units to 38 units daily and continue Apidra 5 units with meals.

* May consider breaking the Levemir into BID dosing

Answer option #2: continue Levemir 34 units and increase Apidra to 5-6-6 (2-unit increase).

1. **Your patient is currently taking Basaglar 25 units under the skin every morning and evening and Apidra 12 units with meals. They do not report any hypoglycemic events. What adjustments should you make to their insulin regimen?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fasting | Pre-lunch | Pre-dinner | Bedtime |
| Monday | 135 | 200 | 161 | 147 |
| Tuesday | 127 | 250 | 163 |  |
| Wednesday |  | 195 | 174 | 155 |
| Thursday | 140 | 207 |  | 145 |
| Friday | 120 |  | 140 | 132 |
| **Average** | **130** | **213** | **159** | **144** |

Answer Option #1: Increase Basaglar by 2 units to 26 units BID and continue apidra 12 units with meals.

Answer Option #2: Continue Basaglar 25 units BID and increase apidra to 14-12-12 units.

1. **Your patient is currently taking Lantus 34 units under the skin every evening and Novolog 10 units with breakfast and dinner. What adjustments should you make to his insulin regimen?**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Fasting | 2 hours after lunch | 2 hours after dinner | Bedtime |
| Monday | 114 | 58 (before lunch) |  |  |
| Tuesday | 122 |  |  | 66 (at 3am) |
| Wednesday | 111 | 120 | 132 | 80 |
| Thursday | 95 | 133 | 62 (before dinner) |  |
| Friday | 54 (at 4 am) | 155 | 140 | 100 |
| **Average** | **99** | **116** | **111** | **82** |

Answer: There are multiple reported lows at different times throughout the day. If unexplainable lows, consider decreasing Lantus by 10%. Decrease Lantus to 31 units daily and continue NovoLog 10 units with breakfast and dinner.

**Additional Practice Problems**

1. **A 62 YOF patient calls the clinic reporting 6 pre-lunch lows over the past 2 weeks where she has felt shaking and sweaty. When she checks her blood sugar during these episodes they have been: 68, 72, 69, 74, and 71. The rest of her blood sugar readings have been within goal ranges. After further talking to the patient, you learn that she eats a breakfast of cereal and milk every day. She denies missed doses and changes in her daily routine, diet, or exercise. She is currently taking metformin 1000mg ER BID, Lantus 20 units daily, and Novolog 5 units with each meal. How would you adjust her insulin doses?**
	1. Answer: Decrease breakfast Novolog dose by 2 units. Her new Novolog dose is 3-5-5- units. Continue her other medications. Discuss breakfast choice with patient and encourage her to have a fat, protein, or both with her breakfast. Discuss true lows versus symptomatic lows with the patient and review what to do in both situations.
2. **A 45 YOM with a PMH of T2DM, HTN, and HLD presents to the clinic for a routine A1C check. His A1C came back at 9.8%. He is currently taking metformin 1000mg ER BID, Victoza 1.8mg daily, Jardiance 100mg daily, lisinopril 20mg daily, and atorvastatin 10mg daily. He weighs 90kg. His random BG in clinic was 213. You and the patient decide to start insulin therapy. What dose of long-acting insulin would you choose?**
	1. Answer: empiric dose of 10-15 units daily
	2. Answer: weight-based dose of 0.15-0.2 units/kg \* 90 kg = 13 – 18 units daily
	3. Any U-100 long-acting insulins will work (Lantus, Basaglar, Semglee, Levemir)
3. **A 32 YOF with a PMH of T2DM, AKI, and HTN presents to the clinic for a diabetes follow-up appointment. Her last A1C was 8.2% two weeks ago. At the last appointment, she was started on Ozempic, but recently stopped due to stomach pain and nausea. She is currently taking Lantus 20 units daily, metformin 500mg 2 tablets BID, and Farxiga 10mg daily. Her self-reported fasting blood sugars have been 210, 156, 183, 176, 182, and 192. She sometimes checks in the evening after dinner, and those readings are 200, 198, and 239. The patient is not open to starting any new agents currently, but she is willing to adjust her insulin. How would you adjust her insulin?**
	1. Increase her insulin by 6 units to Lantus 26 units daily. Continue checking BG throughout the day. Educate on signs and symptoms of lows.
4. **A 73 YOM presents with an A1C of 6.9%. He wears a Dexcom continuous glucose monitor which reveals a low of 68 late Tuesday evening. All his other numbers were within desired range. He reported signs and symptoms of blurred vision and fatigue during the low, which he corrected with 6 oz of pop. Upon further questioning, he reveals that he forgot to eat dinner but took his usual dose of insulin on Tuesday night. He reports no other changes to diet or exercise. He is currently taking Basaglar 15 units BID, Humalog 5-6-6 units with meals, metformin 1500mg daily, and Trulicity 1.5mg weekly. How would you adjust his insulin?**
	1. Answer: no adjustments are needed at this time. Counsel the patient on the importance of administering the short-acting insulin with meals. Follow-up in 2 weeks to reassess episodes of lows. If lows persist, consider adjusting his mealtime insulin doses.
5. **You recently prescribed a patient Lantus 20 units daily. How would you order the prescription for the pharmacy to fill for a 90-day supply?**
	1. Answer:

20 units \* 90 days = 1800 = 1.2 = ~2 boxes needed

100 units \* 15 ml 1500

**Additional Resources**

* American Diabetes Association and American Association of Clinical Endocrinology Guidelines
	+ <https://care.diabetesjournals.org/content/43/Supplement_1/S98.full-text.pdf>
* Inulin Initiation and Titration in Type 2 Diabetes
	+ <https://spectrum.diabetesjournals.org/content/32/2/104>
* AACE Comprehensive Type 2 Diabetes Management Algorithm
	+ <https://pro.aace.com/pdfs/diabetes/AACE_2019_Diabetes_Algorithm_03.2021.pdf>
* Antidiabetic Medication Comparison Chart
	+ <https://dhs.sd.gov/docs/Diabetes%20-%20Handout%202%20-%20Antidiabetic%20Medication%20Comparison%20Chart%20-%20Mercurio.pdf>