1. A 75-year-old male with a past medical history of diabetes mellitus and chronic kidney disease (CKD) presents overnight with altered mental status and acute kidney injury. Upon arrival, his blood sugar is 200. His home insulin dose of 15 units "70/30" Novolin BID is ordered with a "now" dose. The patient receives 15 units upon arrival. Two hours later, his AM dose is due, and he receives another 15 units plus sliding scale insulin per protocol for a blood sugar of 179. Two hours later a rapid response is called as patient is found unresponsive and with a blood sugar of 35.

   a. What factors contributed to this patient's hypoglycemic event?

   b. What is the complication from using pre-mixed insulins on admission to the hospital?

   c. The patient's admission weight is 75 kg. Calculate the appropriate admission insulin regimen keeping in mind the patient's co-morbidities.

   d. The patient is NPO given his altered mental status. What should you do now with his insulin regimen?

2. A 19-year-old female presents with DKA. She is appropriately placed on IV insulin infusion with intravenous fluids. Twelve hours later, her anion gap has closed and her blood sugars are ranging between 150 and 200 mg/dl. She is ready for conversion to subcutaneous insulin.

   a. The average hourly rate is 2 units/hour over the last 8 hours and the patient has been eating. Calculate the 24 hour insulin requirement. Calculate the appropriate basal-bolus insulin dosing.

   b. How soon after giving long-acting insulin should the insulin gtt be turned off?

3. A 65-year-old morbidly obese female with type II diabetes mellitus presents with acute COPD exacerbation. She takes U-500 insulin as an outpatient but is not always compliant. Her last A1C was 10.5%. Her blood glucose on admission is 325 mg/dl. She received 125 mg IV solu-medrol in the Emergency Department. Her labs are within normal limits except for her blood glucose.

   a. Should her U-500 insulin be held on admission?

   b. Calculate her basal-bolus insulin dosing regimen based on an admission weight of 112 kg keeping in mind her medical co-morbidities.

   c. Two days into the patient's hospital admission, her blood glucose levels have been consistently > 200 mg/dL. Re-calculate her insulin dosing.

4. A 47-year-old male presents with right lower extremity cellulitis and is admitted to the hospital. He was diagnosed with type 2 diabetes mellitus 5 years ago and his A1C has been increasing over the last year. He is on 20 units of Lantus QHS and Jardiance. His last A1C was 9.5%. He hands you his glucometer and all of his blood glucose levels have been between 100 and 150 mg/dl. He checks his blood sugars fasting and before meals. BMI = 22.

   a. What is the best inpatient regimen for this patient? Calculate his insulin dosing (weight = 80 kg).

   b. What are possible explanations for the discrepancy between his A1C and blood glucose levels?

Answers:

Avanzini, F. et al. and on behalf of the Desio Diabetes Diagram Study Group. Transition from Intravenous to Subcutaneous Insulin. *Diabetes Care.* Jul 2011, 34 (7): 1445-1450.

Question 1:

1a. Novolin 70/30 has an onset of approximately 30-60 minutes and peaks in 2 to 10 hours. His insulin dosing has "stacked" leaving him hypoglycemic 2 hours after his second dose of 70/30. He has AKI on CKD, altering insulin metabolism.

1b. 75 kg x 0.2 units/kg = 15 units TDD; 15 / 2 = 7.5 basal and 7.5 mealtime. 7.5 / 3 = 2.5 units short-acting per meal. Use sliding scale with lowest correction factor.

1c. Hold mealtime insulin. Still give 7.5 units basal insulin and SSI.

Question 2:

2a. 2 units/hr x 24 hours = 48 units. 48 x 0.6-0.8 = 28- 38 units of insulin. Can be used as TDD vs. Basal.

2b. Insulin gtt can be turned off 1 hour after rapid-acting or regular insulin and 2-3 hours after intermediate or long-acting.

Question 3:

3a. Yes, unless you consult Endocrinology at admission.

3b. 112 kg x 0.6 units/kg = 67.2 units TDD; 67.2 / 2 = 33.6 units basal and 33.6 units mealtime; 33.6 / 3 = 11.2 units for meals

3c. Increase dosing by 10-20%. 74 units is increase by 10% of TDD. 74 / 2 = 37 units basal and 37 units mealtime; 37 / 3 = 12

Question 4:

4a. Hold Jardiance. Calculate TDD based on weight. 80 kg x 0.4 units/kg (normal weight pt) = 32 units TDD; 16 units basal and 5 units TIDAC rapid acting, plus sliding scale insulin

4b. Based on reported blood glucose levels, the patient's A1C should be between 6 and 7 (corresponds to blood sugar of 126-154 mg/dL). One explanation could be post-prandial hyperglycemic excursions. Conditions with high red cell turnover, e.g., iron deficiency anemia, and certain hemoglobinopathies can also make A1C falsely high.

How to estimate total daily dose (TDD) insulin based on medical co-morbidities:

- Malnourished, elderly, CKD, ESRD, ESLD – 0.2-0.3 units/kg

- Normal-weight patients, incl. Type I DM – 0.4 units/kg

- Overweight – 0.5 units/kg

- Obese, high-dose steroids, insulin resistance – 0.6 units/kg

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