

• Question 1

How would you differentiate between diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic syndrome (HHS)?

Correct 

Answer: Both of these conditions will include high levels of blood glucose readings. DKA will exhibit acidosis and urinary ketones while HHS will not. Treatment for each condition is similar with fluid bolus and infusion as well as insulin bolus and infusion.

• Question 2

Juan is a 42 year old male with complaints of nausea and vomiting for 3 days and has been unable to keep anything down in that time. He has not taken any of his medications due to the nausea and vomiting. Your assessment reveals the following data:

Significant History

Type 2 DM x 4 years, HTN

Medications

Lisinopril 10 mg daily

Metformin 1000 mg po daily

Glipizide 5 mg po daily

Physical Exam

Pale, lethargic gentleman

Skin is very dry

VS 94/64 P 112 RR 30 T 99.4 wt 195 pounds ht 5'11 »

Lungs clear bilaterally, rapid respiration

CV : RRR, no murmurs or gallops

Abd: soft, non-tender, positive bowel sounds

Labs:

Hb 146 Hct 58% Cr 4.9 Bun 53 Cholesterol 238

Na 126 K 5.6 CL 95 Ca 8.8 Gluc 722 Phosphorus 5.8

Ketone Moderate AST 248 Alk Phos 132

ABG's

ph 7.01

Pco2 20

Po2 100

Sat 98% (on room air)

HCO3 7.5

What are the appropriate initial orders to treat this patient?

Correct 

Answer: Admission to the ICU

Normal saline IV bolus to counter the vascular dehydration that has occurred.

Bolus insulin dose followed by an insulin drip

Electrolyte and blood glucose monitoring frequently fluid resuscitation and insulin administration.
Bicarbonate is typically not administered unless the pH is below 7
Assess the patient for presence of any infection that may have precipitated this event

- **Question 3**

Juan is a 42 year old male with complaints of nausea and vomiting for 3 days and has been unable to keep anything down in that time. He has not taken any of his medications due to the nausea and vomiting. Your assessment reveals the following data:

Significant History

Type 2 DM x 4 years, HTN

Medications

Lisinopril 10 mg daily

Metformin 1000 mg po daily

Glipizide 5 mg po daily

Physical Exam

Pale, lethargic gentleman

Skin is very dry

VS 94/64 P 112 RR 30 T 99.4 wt 195 pounds ht 5'11 »

Lungs clear bilaterally, rapid respiration

CV : RRR, no murmurs or gallops

Abd: soft, non-tender, positive bowel sounds

Labs:

Hb 146 Hct 58% Cr 4.9 Bun 53 Cholesterol 238

Na 126 K 5.6 CL 95 Ca 8.8 Gluc 722 Phosphorus 5.8

Ketone Moderate AST 248 Alk Phos 132

ABG's

ph 7.01

Pco₂ 20

Po₂ 100

Sat 98% (on room air)

HCO₃ 7.5

What is the "corrected" sodium level for the hyperglycemia? What does this mean and how would it impact your treatment plan for this patient?

Correct 

Answer: The equation for corrected sodium is:

Corrected sodium (mEq/L) = measure sodium (mEq/L) + 0.016 {glucose (mg/dL)-100}.

Juans corrected sodium is 136.

$$126 + 0.016 \{722-100\} = 135.95$$

The measured serum sodium concentration should be corrected for the hyperglycemia by adding 1.6 mEq per L to the measured sodium value.

Corrected serum sodium concentrations of greater than 140 mEq per L and calculated total osmolalities greater than 330 mosm per kg of water are

associated with large fluid deficits.

If the corrected sodium is less than 135 mEq/L, then isotonic saline should be continued at a rate of 250 to 500 mL/ hour. If the corrected sodium is normal or elevate, then IV fluid is generally switched to 0.45 normal saline.

- **Question 4**

A 56 year old male with an acute COPD exacerbation is admitted to the ICU. He has type I diabetes and utilizes NPR and regular insulin twice a day to manage his diabetes. He is currently taking very little orally due to his shortness of breath. What would the best way to manage his diabetes and insulin needs in the ICU?

Correct ✓

Answer: According to the American Diabetes Association (2019) guideline, basal long acting insulin should be administered once a day. Point of care blood glucose testing should be completed at least four times a day with sliding scale insulin coverage. The stress of illness will require the need for insulin but the evolution of the patients condition, varying oral intake, and medications will cause variations in the patients blood glucose. Point of care testing with sliding scale coverage along with basal insulin is the most flexible method to meet the patients insulin needs while in the ICU.

- **Question 5**

A 56 year old male with an acute COPD exacerbation is admitted to the ICU. He has type I diabetes and utilizes NPR and regular insulin twice a day to manage his diabetes. He is currently taking very little orally due to his shortness of breath. What is the blood glucose goal for this patient in the ICU?

Correct ✓

Answer: According to the American Diabetes Association (2019) guideline, pre-prandial blood glucose control of less than 126 is the goal. Post prandial no greater than 180. Hyperglycemia is associated with poor outcomes especially in critical illness. According to the NICE-SUGAR study, patients with goals lower than this (considered intensive insulin therapy) had increased mortality.

- **Question 6**

Juan is a 42 year old male with complaints of nausea and vomiting for 3 days and has been unable to keep anything down in that time. He has not taken any of his medications due to the nausea and vomiting. Your assessment reveals the following data:

Significant History

Type 2 DM x 4 years, HTN

Medications

Lisinopril 10 mg daily

Metformin 1000 mg po daily

Glipizide 5 mg po daily

Physical Exam

Pale, lethargic gentleman

Skin is very dry

VS 94/64 P 112 RR 30 T 99.4 wt 195 pounds ht 5'11 »
Lungs clear bilaterally, rapid respiration
CV : RRR, no murmurs or gallops
Abd: soft, non-tender, positive bowel sounds

Labs:

Hb 146 Hct 58% Cr 4.9 Bun 53 Cholesterol 238
Na 126 K 5.6 CL 95 Ca 8.8 Gluc 722 Phosphorus 5.8
Ketone Moderate AST 248 Alk Phos 132

ABG's

ph 7.01
Pco2 20
Po2 100
Sat 98% (on room air)
HCO3 7.5

What patient education would be important to provide related to sick day management of his diabetes (include management of insulin) ?

Correct
Answer:



- Monitor your blood sugar frequently when you are sick - at least every 4 hours
 - Keep a log of these readings in case you need medical care
 - Take your usual dose of insulin as long as your blood glucose readings do not indicate hypoglycemia
 - Basal insulin should be continued as normal.
 - Call your provider should your blood glucose remain higher than 240 consistently
 - Drink a glass of liquid (non-alcoholic, caffeine free) every hour when sick.
 - Try to intake foods like gelatin, crackers, soup, broth, and applesauce.
 - Check your urine for ketones every 4 hours regardless of blood glucose readings.
 - If your testing indicates a large volume of ketones, contact your provider immediately.

• Question 7

A 37 year old female with a 20 year history of DM is post cholecystectomy with complications. She has been on four time daily blood sugar testing with sliding scale insulin coverage. She is preparing for discharge and wanted to return to her previous blood sugar management. Her pre-hospitalization insulin regime included:

NPH insulin 16 units in AM and 8 units in PM
Regular insulin 8 units in am and 3 units in PM

She resumed this regime 2 days ago. Upon rounding this am, the patient tells the NP that she has woken up feeling awful. She is sweaty and shaky during the night and lethargic in the morning. The NP reviews her blood sugar readings and discovers this:

0300	0700	1200	1700
62	196	109	90
64	203	82	100

What is your working diagnosis for this patient?

Correct Answer:  Nocturnal hypoglycemia

• Question 8

Juan is a 42 year old male with complaints of nausea and vomiting for 3 days and has been unable to keep anything down in that time. He has not taken any of his medications due to the nausea and vomiting. Your assessment reveals the following data:

Significant History

Type 2 DM x 4 years, HTN

Medications

Lisinopril 10 mg daily

Metformin 1000 mg po daily

Glipizide 5 mg po daily

Physical Exam

Pale, lethargic gentleman

Skin is very dry

VS 94/64 P 112 RR 30 T 99.4 wt 195 pounds ht 5'11 »

Lungs clear bilaterally, rapid respiration

CV : RRR, no murmurs or gallops

Abd: soft, non-tender, positive bowel sounds

Labs:

Hb 146 Hct 58% Cr 4.9 Bun 53 Cholesterol 238

Na 126 K 5.6 CL 95 Ca 8.8 Gluc 722 Phosphorus 5.8

Ketone Moderate AST 248 Alk Phos 132

ABG's

ph 7.01

Pco2 20

Po2 100

Sat 98% (on room air)

HCO3 7.5

What is the anion gap? What does this mean and how would it impact your treatment plan for this patient?

Correct 

Answer: The serum anion gap measure the degree of metabolic acidosis and it is calculated as:

$$\text{Serum sodium} - (\text{serum chloride} + \text{bicarbonate}) = \text{AG}$$

Measured sodium is utilized in this formula not the corrected sodium calculated

Juan's AG is 23.5 mEq/L

$$126 - (95 + 7.5) = 23.5$$

Normal range 13 to 10 mEq/L.

The elevated anion gap metabolic acidosis is caused by the production and accumulation of beta-hydroxybutyric and acetoacetic acids. The AG becomes elevated when the excess anions accumulate and are buffered by extracellular HCO₃ (creating the anion gap).

Treatment of DKA should continue until the AG normalizes.

• Question 9

Juan is a 42 year old male with complaints of nausea and vomiting for 3 days and has been unable to keep anything down in that time. He has not taken any of his medications due to the nausea and vomiting. Your assessment reveals the following data:

Significant History

Type 2 DM x 4 years, HTN

Medications

Lisinopril 10 mg daily

Metformin 1000 mg po daily

Glipizide 5 mg po daily

Physical Exam

Pale, lethargic gentleman

Skin is very dry

VS 94/64 P 112 RR 30 T 99.4 wt 195 pounds ht 5'11 »

Lungs clear bilaterally, rapid respiration

CV : RRR, no murmurs or gallops

Abd: soft, non-tender, positive bowel sounds

Labs:

Hb 146 Hct 58% Cr 4.9 Bun 53 Cholesterol 238

Na 126 K 5.6 CL 95 Ca 8.8 Gluc 722 Phosphorus 5.8

Ketone Moderate AST 248 Alk Phos 132

ABG's

ph 7.01

Pco₂ 20

Po₂ 100

Sat 98% (on room air)

HCO₃ 7.5

What is your working diagnosis for this patient?

Correct ✓

Answer: This is a classic presentation of diabetic ketoacidosis (DKA). High level of serum glucose, acidosis, and presence of ketones. It is unknown what this patient's glycemic control was prior to the onset of this illness. But the combination of pre-existing diabetes, lack of medication intake, and the stress of illness can contribute to the development of DKA

• Question 10

Juan is a 42 year old male with complaints of nausea and vomiting for 3 days and has been unable to keep anything down in that time. He has not taken any of his medications due to the nausea and vomiting. Your assessment reveals the following data:

Significant History

Type 2 DM x 4 years, HTN

Medications

Lisinopril 10 mg daily

Metformin 1000 mg po daily

Glipizide 5 mg po daily

Physical Exam

Pale, lethargic gentleman

Skin is very dry

VS 94/64 P 112 RR 30 T 99.4 wt 195 pounds ht 5'11 »

Lungs clear bilaterally, rapid respiration

CV : RRR, no murmurs or gallops

Abd: soft, non-tender, positive bowel sounds

Labs:

Hb 146 Hct 58% Cr 4.9 Bun 53 Cholesterol 238

Na 126 K 5.6 CL 95 Ca 8.8 Gluc 722 Phosphorus 5.8

Ketone Moderate AST 248 Alk Phos 132

ABG's

ph 7.01

Pco₂ 20

Po₂ 100

Sat 98% (on room air)

HCO₃ 7.5

What is the most reliable method of assessing and monitoring the patient's acidosis?

Correct ✓

Answer: Clinical severity of DKA depends on the magnitude of acidosis rather than on hyperglycemia. Therefore, arterial pH is the most accurate and widely used reference for DKA severity. ABGs frequently show typical manifestations of metabolic acidosis, low bicarbonate, and low pH (less than 7.3). However, to save the patient arterial sticks, venous pH is widely used after baseline

assessment of acidosis is done.