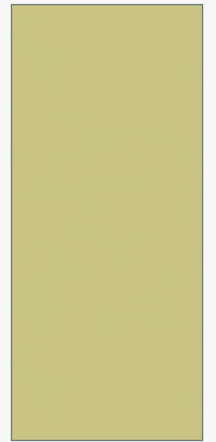


# DIABETIC KETOACIDOSIS (DKA)

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# QUESTION # 1

7 year old boy comes to the ER with a 2 week history of abdominal pain and weight loss. Further history reveals polyuria and polydipsia, with nausea and vomiting over the past 3 days. On physical exam, he is tachycardic and tachypneic with O<sub>2</sub> sat 98% on RA. He also appears lethargic and dehydrated. POC glucose done at the bedside shows glucose of 480. Which of the following is the most initial step in management?

# QUESTION # 1

- A. Give an insulin bolus of 0.2units/kg x1
- B. Obtain blood/urine cultures, and start IV antibiotics
- C. Give a fluid bolus of 10-20 ml/kg
- D. Start insulin infusion of 0.1 units/kg/hr
- E. CT scan of the chest and abdomen

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# FLUID REPLACEMENT

## C) Give a fluid bolus of 10-20 ml/kg

- Patients in DKA have 7-10% fluid deficit (1)
- Fluid deficit is due to osmotic diuresis and GI losses – vomiting/diarrhea
- Initial volume expansion done with isotonic solution - 10-20 ml/kg
- Subsequent fluid replacement with isotonic to  $\frac{1}{2}$  isotonic. No more than 1.5-2 x maintenance rate. Can add dextrose and electrolytes

# INSULIN THERAPY

- Correction of hyperglycemia
- Correction of metabolic (keto)acidosis
- No insulin bolus is required
- Insulin infusion rate of 0.1 unit/kg/hr
- Risk of cerebral edema is decreased by delaying insulin administration for one hour or more after initiation of fluid therapy (2)

*A) Give an insulin bolus of 0.2units/kg x1*

*D) Start insulin infusion of 0.1 units/kg/hr*

# DIFFERENTIAL DIAGNOSIS OF DKA

- DKA can present with high WBC with left shift
- Infection
- Gastroenteritis
- Acute abdomen
- Ingestion

*B) Obtain blood/urine cultures, and start IV antibiotics*

*E) CT scan of the chest and abdomen*

## QUESTION # 2

After the bolus is completed, an insulin drip is started at 0.1 units/kg/hr and MIVF with normal saline is continued. Four hours later, BMP is as follows:

Na 140, K 4.0, Cl 109, HCO<sub>3</sub> 12, BUN 15, Cr 0.98, Gluc 220. AG is 19.

The next appropriate step in management is:



## QUESTION # 2

- A. Stop insulin drip and start subcutaneous Insulin
- B. Start an infusion of Na bicarbonate solution
- C. Give another 10ml/kg fluid bolus
- D. No change in management at this time
- E. Continue insulin drip and switch MIVF to D5  $\frac{1}{2}$  NS + 40mEq KCl

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# INSULIN THERAPY

E) Continue insulin drip and switch MIVF to D5 ½ NS + 40mEq KCl

- Hyperglycemia corrects before acidosis
- Normal serum glucose may not always be accompanied by an improvement in metabolic acidosis
- Insulin infusion is continued if patient is acidotic
- Dextrose is added to prevent hypoglycemia
- KCl is added to prevent hypokalemia

# HYPO/HYPERKALEMIA

- Total body stores of K is depleted - from GI losses and renal losses
- Hyperkalemia – insulin deficiency impairs potassium entry into cells; Hyperosmolality pulls water and potassium out of the cells
- Acidosis also causes trans cellular shifts of K
- Rehydration improves acidosis -> further hypokalemia
- Insulin drives potassium into the cells
- If normokalemic, consider K replacement

# INSULIN THERAPY

- Transitioning to subcutaneous insulin:
  - pH > 7.3
  - Bicarbonate level > 17
  - Anion gap normal @ 12
  - Blood glucose < 200
- Start subcutaneous insulin 1 hr before stopping infusion

*A) Stop insulin drip and start subcutaneous Insulin*

# BICARBONATE INFUSION

- **DON'T DO IT!**
  - Worsens hypokalemia
  - Increases risk of cerebral edema
  - Slows down recovery of ketosis
  - Increases pCO<sub>2</sub> by suppressing hyperventilation
- Exceptions:
  - There is symptomatic hyperkalemia
  - Acidosis is severe enough to cause hemodynamic instability not responsive to other therapeutic measures

*B) Start an infusion of Na bicarbonate solution*

# CEREBRAL EDEMA

- Occurs in 1% of DKA
- Headache, changes in MS
- Signs of impending cerebral herniation: Obtundation, papilledema, bradycardia, apnea
- Neuro checks q1h
- If mental status declines, treat presumptively for cerebral edema using mannitol.
- Also obtain imaging

# CONCLUSION

- Three hours later, pH is 7.34 and BMP shows AG of 12, with bicarb of 19 and K 3.8. Glucose is 180. Pt is able to tolerate po intake. Subcutaneous insulin is started and one hour later insulin drip is discontinued.



# REFERENCES

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