

# Question

19 year old girl presents to the emergency department with altered mental status. She has had worsening polyuria and polydipsia for 7 days since starting risperidone 2mg orally once every evening for the diagnosis of schizophrenia. Her only other medications are metformin 1,000 mg orally twice per day and glimepiride 1 mg twice daily. On physical examination, her temperature is 37.2 degrees is 130 beats/min and blood pressure is 108/75 mm Hg. Capillary refill is 3 seconds and extremities are cool.

Laboratory results show:

- Serum glucose, 955 mg/dL (53.0 mmol/L)
- Sodium, 157 mEq/L (150 mmol/L)
- Potassium, 4.2 mEq/L (4.2 mmol/L)
- Bicarbonate, 23 mEq/L (23 mmol/L)
- Urine ketones, negative

# Answers

Of the following, the MOST important first treatment to initiate for this patient is an intravenous

- A. half-normal saline (0.45% saline solution) bolus of 20 mL/kg
- B. insulin bolus of 0.25 units/kg
- C. insulin drip at 0.05 units/kg per hour
- D. normal saline bolus 20 mL/kg, repeated as needed to restore circulatory support
- E. normal saline bolus limited to 10 mL/kg over 1 hour
- F. Insulin drip of 0.1/kg/ hr

## Correct Answer

- A. half-normal saline (0.45% saline solution) bolus of 20 mL/kg
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# Explanation

- The adolescent girl in this vignette with type 2 diabetes, very elevated glucose, and normal bicarbonate level is experiencing hyperglycemic hyperosmolar syndrome (HHS)
- HHS in adolescents is often associated with psychiatric conditions with intake of atypical antipsychotics resulting in worsening of the insulin resistance
- Hyperglycemic hyperosmolar syndrome commonly occurs after prolonged and gradually increasing polyuria and polydipsia, resulting in profound dehydration, with fluid losses estimated to be twice those seen with diabetic ketoacidosis (DKA).
- Case fatality rates have been reported to be as high as 30%.

# Explanation

- The mainstay of treatment for HHS is fluid resuscitation, as the degree of dehydration is more profound than that seen in DKA.
- The goal of initial fluid therapy is expansion of the intravascular and extravascular volume and restoration of normal renal perfusion.
- Vigorous fluid replacement is recommended, with rates of **fluid replacement more rapid than those recommended for DKA**. Fluid resuscitation that is not aggressive is associated with an increased risk of complications.
- **Increased mortality is observed in patients with unreversed shock over the first 24 hours of admission who had received less than 40 mL/kg of intravenous fluids over the first 6 hours of treatment.**
- **Aggressive isotonic fluid replacement is recommended initially to restore perfusion, even if hypernatremia is present, followed by more hypotonic (0.45%-0.75% saline solution) fluids**
- Note that in DKA initial fluid is isotonic saline 10 ml/kg over 1 hour

# Explanation

- Ketosis in HHS is usually minimal in HHS. If acidosis occurs it is usually a result of lactic acidosis
- In contrast to the recommended management of DKA, insulin administration should be withheld until initial fluid resuscitation has been accomplished and the serum glucose concentration is no longer decreasing from rehydration alone.
- When insulin treatment is begun, continuous administration at 0.025 to 0.05 units/kg per hour is recommended initially. The dose should then be titrated to achieve a decrease in glucose concentration of 50 to 75 mg/dL per hour (2.7-4.1 mmol/L per hour).
- Insulin therapy should be suspended if the glucose concentration drops more than 100 mg/dL per hour (5.5 mmol/L per hour).
- Insulin administration as a bolus is never recommended.

## References

- Zeitler P, Haqq A, Rosenbloom A, Glaser N; Drugs and Therapeutics Committee of the Lawson Wilkins Pediatric Endocrine Society. Hyperglycemic hyperosmolar syndrome in children: pathophysiological considerations and suggested guidelines for treatment. *J Pediatr*. 2011;158(1):9-14
- ISPAD Clinical Practice Consensus Guidelines 2014 Compendium