Case report: Hyperglicemic iperosmolar state in an obese prepubertal girl with newly diagnosis of type 2 diabetes

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CLINICAL PRESENTATION

A 11years-old Italian severely obese prepubertal female (BMI: 32.4 kg/m2; SDS-BMI: 2.63) was admitted to the emergency department due to worsening dyspnea and chest pain associated with severe polyuria, lethargy and lost weight from (85 kg to 78 kg in 7 days). She has history of severe hypertension treated with amlodipine and bisoprololo and a positive family history of Type 2 diabetes. At admission, she was dehydrated and lethargic, but can be awakened after painful and verbal stimulation, and motor strength was quite.

LABORATORY TEST

Plasma glucose concentration was >600 mg/dL with mild metabolic acidosis at blood gas and Na values were 150 mmol/L.
IA2 and GAD auto-antibodies measurements were negative.
Insulin, c-peptide and HbA1c levels were significanlty high.
Effective serum osmolality >320 mOsm/kg.

HYPEROSMOLAR HYPERGLYCEMIC SYNDROME (HHS)

is a clinical state characterized by

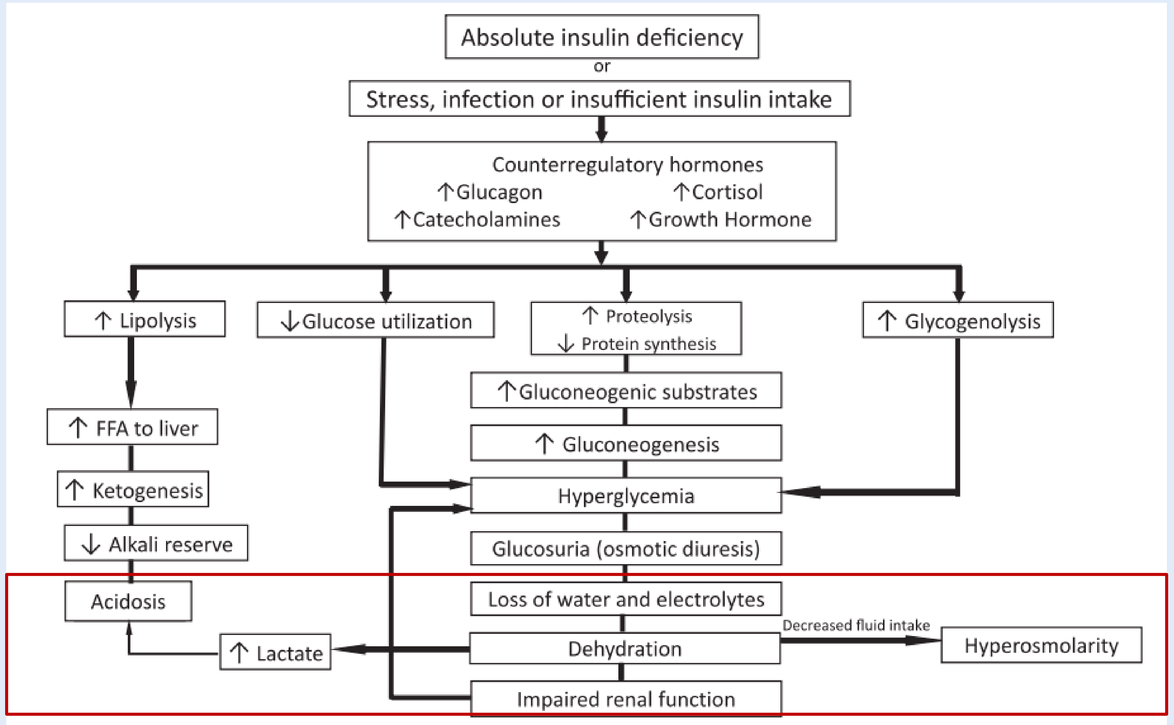
- **Hyperglycemia** (blood glucose 33 mmol/L or 600 mg/dL),
- **Hyperosmolarity** (serum osmolality 320 mmol/kg)
- **Minimal ketonemia**, often described in adults with established diabetes, but rarely described in pediatric age especially in the prepubertal phase.

Additionally, almost 28% of pediatric patients with HHS can also present with concomitant diabetic ketoacidosis (DKA). Due to the high mortality rate and severe complications associated with HHS, it is imperative to distinguish between DKA and HHS as the initial management can highly influence clinical outcomes.

TREATMENT

Rehydratation was started with isotonic saline (0.9% NaCl) infusion and thereafter continued with 0.45% NaCl.
In addition, continuous insulin administration at 0,012 UI/kh/h was introduced with the dosage titrated thereafter to achieve a decrease in serum glucose concentration of 50-75 mg/dl/h.
Basal-bolus insulin administration was started during the third day of admittance.

PATHOPHYSIOLOGY OF DIABETIC KETOACIDOSIS



Wolfsdorf et al. Pediatric Diabetes 2014

	HHS	DKA
Hyperglycemia	+++	+ to +++
Ketosis/Acidosis	–/+	++ to +++
Dehydration	+++	+ to +++
Osmolality	+++ (> 330 mosm/kg)	+ to +++
Electrolyte Deficits	+++	+ to +++

COMPLICATIONS OF HHS

Thrombosis

Rhabdomyolysis

Malignant Hyperthermia

Cerebral Edema

- ***Thromboembolic complications*** occur commonly in HHS, and central venous catheters appear to be particularly prone to thrombosis. Prophylaxis with low-dose heparin has been suggested in adults
- ***Rhabdomyolysis*** may occur in children with HHS, and monitoring of creatine kinase concentration every 2 to 3 hours is recommended for early detection. It may result in acute kidney failure, severe hyperkalemia, and hypocalcemia leading to cardiac arrest, and muscle swelling causing compartment syndrome.
- A malignant hyperthermia-like syndrome of unclear cause has been reported in several children with HHS.
- Central nervous system imaging is necessary for children with altered mental status at presentation of HHS is unclear, given the evidence that CE is rare.

CONCLUSIONS

Althought HHS represent a relatively common condition in adult obese subjects with T2D at onset, the rising prevalence of severe obese and type 2 diabetes in children might be associated in the next future to a parallel increase of its diagnosis in childhood. Therefore new cases and especially pediatric guidelines for most appropriate treatment of this condition are needed.

Zeitler et al. The Journal of Pediatrics 2011

Wolfsdorf et al. Pediatric Diabetes 2014

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Fat, metabolism and obesity

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