

DIABETIC KETOACIDOSIS



Emergency pediatric – PICU division

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Diabetic Ketoacidosis (DKA)

- The most common endocrine condition that a practitioner in a critical care setting likely will see
- Occurs under two general sets of circumstances:
 1. In patients who are known to have diabetes
 2. In patients in whom DKA is the precipitating event leading to diagnosis
- Occurs in 15-70% of children with diabetes as disease onset and in 1-10% of children with previous diagnosis of diabetes



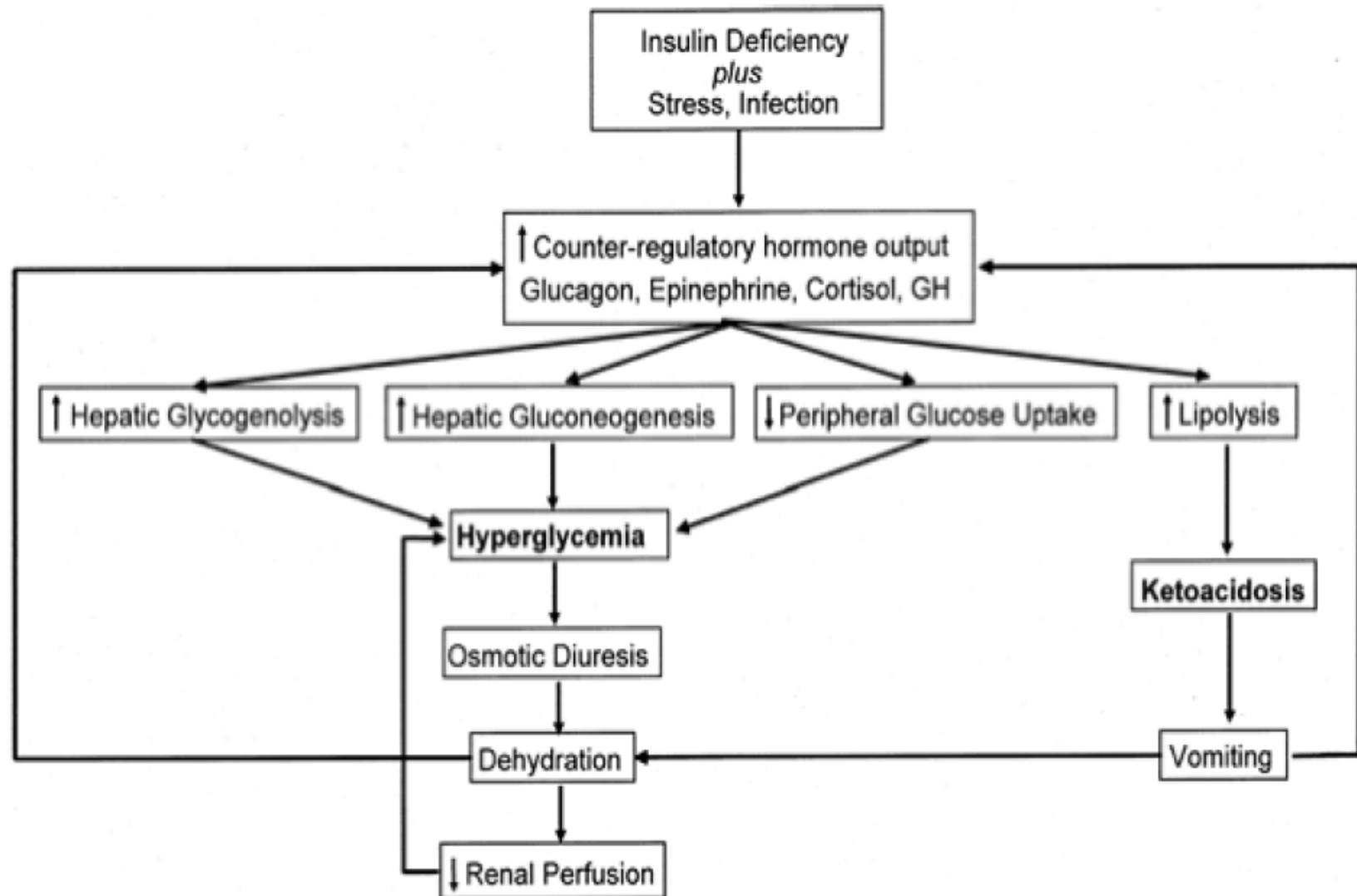
Diabetic Ketoacidosis

- Blood glucose conc > 200 mg/dl
- Ketonemia/ ketonuria
- pH < 7,3

Weinzimer et al. Rogers' textbook of pediatric intensive care. 4th ed. 2008



Pathophysiology



Clinical Presentation



Patient may present with:

- history (previously known diabetes)
- familiar history – polyuria, polydypsia, weight loss
- headache
- abdominal pain
- vomiting
- lethargy
- hyperpnoea

Can present with:

- profound shock
- coma
- respiratory failure
- dysrhythmias

Investigations:

- blood gases including pH
- electrolytes
- urea
- glucose
- osmolality
- ketones
- lactate
- calcium
- magnesium
- phosphate
- serum amylase (may be moderately raised – salivary isoenzyme)

It is important to monitor acid-base status, glucose and electrolytes frequently during the early stages

Management

- Fluid & electrolyte therapy
- Insulin therapy

Hydration

- Rapid replacement of volume if patient is truly in shock
 - 10-20 ml/kg of NS or LR as rapidly as possible until hypotension and perfusion are improved. If patient is not in shock, use 10-20 ml/kg once
 - Continually assess results of fluid boluses and stop once circulatory failure is reversed (to avoid too rapid correction of hyperosmolar state)
 - Be sure to take into account fluids administered prior to transfer and reduce calculated needs by that amount
- Correct remaining fluid deficit over 36-48 hours
- Maintenance fluids must also be provided during this period
- It is usually not necessary to replace urine output, monitor output, and follow hydration status
There are hidden sources of water in DKA from oxidation of glucose and ketones, and ADH is elevated. Osmotic diuresis should subside once glucose is normalized (<180 mg/dl)
- The risk of acute cerebral edema is less if rate of hydration is kept <50 ml/kg/4 hours (even in the initial 4 hours) and <4L/m²/day

Glucose/electrolyte/correction

- Use of bicarbonate is only indicated for patients in shock, unresponsive to fluid resuscitation, or hyperalkemia with ECG changes (1-3 mEq/kg to raise pH to >7,2). Bicarbonate should be administered only when perfusion and ventilation can be assured
- Electrolyte replacement

Insulin administration

- Initial insulin therapy is usually 0,05-0,1 U/kg/hour IV continuous drip (up to 7 U/hour)
 - Standard solution is 50 U regular insulin in 250 ml NS so that 0,1 U/kg/hour=0,2 ml/kg/hour
 - Monitor serum glucose every 30-60 minutes as ordered
 - Serum glucose should not fall faster than 100 mg/dl/hour
- Typically, when blood sugar reaches < 200-300, rather than reducing or discontinuing the insulin infusion, dextrose is added to maintenance fluids until metabolic acidosis and ketonuria are resolved

- Conversion from IV to subcutaneous insulin
Subcutaneous insulin may be considered when
 - Serum glucose falls below 250 mg/dl
 - Acidosis is resolved ($\text{HCO}_3^- > 20$)
 - Ketones are absent
 - ADA PO is initiated
 - There should be a 1-hour overlap between administration of first dose of subcutaneous regular insulin (15-30 minutes if lispro insulin will be given) and discontinuing insulin infusion

- For a child with previously diagnosed diabetes, return to the child's previous insulin regimen, with supplemental rapid-acting insulin for hyperglycemia and/or ketonuria. Insulin requirements may be higher during the first day post DKA
- If patient was not on subcutaneous insulin previously, a typical conversion pattern:
 - Daily requirement of 0,5-1 U/kg/day
 - Divide 2/3 of the dose for AM and 1/3 of the dose for PM
 - Each dose may be split 2/3 intermediate-acting (NPH on lente) and 1/ 3 short-acting (regular or lispro). Supplemental doses of short-acting insulin (generally 10% of total daily dose) may also be used to help stabilize the patient's blood sugar and calculate permanent insulin dose
- Do not treat aggressively during the night or when child is not eating during the day
- Supplemental doses should be approximately 10% to 15% of total daily dose (or 0,1-0,2 U/kg/dose). Humalog insulin, because of its rapid action and short duration, is recommended in this situation



THANK YOU