CHEO ED OUTREACH

DIABETIC KETOACIDOSIS GUIDELINES for CHAMPLAIN LHIN USE

1. Initial investigations:

- **Consult CHEO Diabetes Doctor on call**.
- Blood glucose, pH, pCO2, HCO3, Na, K, Cl, urea, creatinine, urine ketones
- If new onset diabetes, include TSH, thyroid antibodies and HbA1c (Note: these will be drawn at CHEO)
- Calculate
  - Anion gap [Na - (Cl + HCO3)] [normal range 12-16]
  - Serum osmolality ([2 x Na]+ glucose) [normal 275-295 mosm/l]
  - Corrected Na: a 3.5 mmol/L increase in serum glucose depresses serum sodium by 1 mmol/L
  - Note: initial corrected serum Na >145 mmol/L has been associated with increased risk of cerebral edema.
- Admission to PICU is recommended for all patients in DKA with pH < 7.1, age <2 years, hypotension or suspected cerebral edema (see item 6). **Contact CritiCall (1-800-668-4357) if considering PICU admission**

2. Monitoring

- Cardiorespiratory monitor and O_2 saturation monitor.
- Hourly monitoring of vital signs (HR, RR, BP), neurovitals and presence of headache is essential. (Refer to section 6 on cerebral edema). Accurate intake and output q1h in PICU and q2-4hr on ward.
- Bedside glucose q1h until dextrose added to iv, then q2h (and 1 hour after any changes in insulin dose).
- Blood gas, glucose, Na, K, Cl, urea, urine ketones, serum osmolality q4h while on insulin infusion, or more frequently as clinically indicated.
- Notify most responsible physician/Diabetologist if measured serum sodium fails to rise as the glucose decreases

- NPO in severe acidosis until nausea subsides - may then have ice chips.
- **Initial fluids:** Normal saline 0.9%

  i) If hypotensive: 10 cc/kg minibolus over 20-30 minutes, then reassess and repeat if still hypotensive. Never leave the iv open and unattended.

  ii) If normotensive:

Weight	**Fluid rate** (equivalent to maintenance + 10% deficit given evenly over 48 hours)
3-9 kg	6 cc/kg/hr
10-19 kg	5 cc/kg/hr
>20 kg	4 cc/kg/hr (to a maximum of 250 cc/hr)

- **Ongoing iv fluid therapy** 0.9% saline with 40 meq/L KCL until dextrose is added (see below).
- Do not insert central venous lines unless all other options have been exhausted .
- Do not add KCl while anuric or K >5.0 mmol/L
- Once acidosis is corrected (HCO3 > 18), can then D/C iv fluids and complete rehydration orally
- **Glucose** should be added to the iv when BG < 15 mmol/L (when adding glucose change to D5/.45NS or D10/.45 NS as required to maintain glucose 10-15 mmol/l). Alternatively, D5NS or D10NS may be used. The goal is to decrease the glucose by not more than 5mmol/L/hour. If BG decreases > 5 mmol/L/hour, increase the concentration of dextrose in the iv solution. If D5NS or D10NS are used, monitor for hyperchloremic metabolic acidosis.
- Follow serum osmolarity with goal of no greater than 2-3mmol/L/hr decrease.

4. Insulin

- Do **not** bolus insulin. Do not start insulin infusion until 1-2 hours after fluids started.
- Dose: 0.1 Unit/kg/hr of Humulin R or Novolin Toronto by constant infusion (dilute with saline to 1 unit/ml and flush the tubing with 5 cc as insulin may be absorbed onto the plastic).
- Once acidosis has corrected (HCO3 >18 mmol/L) titrate insulin infusion by 25-50% q 1-2 hours as needed to maintain BG 6-10 mmol/L.
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DIABETIC KETOACIDOSIS GUIDELINES *(for use at CHEO)*

HCO3	Glucose	Action
<18 mmol/L	<10 mmol/L	Add/increase dextrose
< 18 mmol/L	> 15 mmol/L	Continue insulin, reduce dextrose in iv
≥ 18 mmol/L	<10 mmol/L	Reduce insulin infusion/change to sc insulin
≥ 18 mmol/L	> 10 mmol/L	Reduce dextrose in iv, continue insulin iv/sc

- If acidosis persists beyond 12 hours, rule out hyperchloremic acidosis. Do not withhold transition to subcutaneous insulin if this is the cause
- Subcutaneous insulin should be started at breakfast or supper, once acidosis is corrected and the patient is ready to eat. Call the Diabetologist regarding sc insuln dose.
- Discontinue insulin infusion, routine venous bloodwork and iv fluids at the time sc insulin is given.

5. Bicarbonate

- Do not use bicarbonate.

6. Cerebral Edema

- Patients at increased risk for cerebral edema include:
  - Clinical factors: New onset diabetes, age <5 years, severe dehydration
  - Laboratory results: initial pH<7.1, high urea, initial corrected Na > 145 mmol/L,
  - Treatment factors: failure of the measured Na to rise as the glucose decreases, bicarbonate use, excessive hypotonic fluids administration (conflicting evidence)
- Early warning signs of cerebral edema include headache, irritability or altered behaviour, drowsiness, decreasing level of consciousness, vomiting.
- **SUSPECTED CEREBRAL EDEMA IS A MEDICAL EMERGENCY**. Call CritiCall (1-800-668-4357) if considering PICU admission
- For headache alone:
  - Raise head of the bed to 30°
  - Decrease fluids to maintenance
  - ± 3% saline 5 cc/kg iv over 20 minutes in consultation with PICU attending OR mannitol 0.5 gm/kg iv over 20 minutes
  - ± CT scan at discretion of PICU/ER attending or Diabetologist on call (recognizing that a normal CT scan does not preclude a diagnosis of early CE)
- If GCS < 10:
  - Decrease the iv to maintenance (watch the glucose closely)
  - 3% saline 5 cc/kg iv over 20 minutes ± mannitol 1 gm/kg iv over 20 minutes
  - Be prepared for intubation at the discretion of ICU/Anaesthesia/ER attending. Ventilatory rate following intubation should only be determined in careful consultations with above attendings, in order to maintain pCO2's in a low normal range, thus avoiding possible exacerbation of cerebral edema.
  - STAT CT scan with ICU attending or designate in attendance

Revised April 2008, Updated June 2008,adapted for LHIN Use Oct 2014
CHEO Diabetes Team, PICU, ED