

PEDIATRIC MILD DIABETIC KETOACIDOSIS (DKA) SUBCUTANEOUS INSULIN TREATMENT PROTOCOL

Inclusion Criteria:

1. Ketosis: serum beta-hydroxybutyrate > greater than 1
2. Acidemia: pH greater than or equal to 7.2
3. Hemodynamically stable: NOT critically ill, NO concern for cerebral injury

Exclusion Criteria:

1. Moderate to Severe DKA (indicated by pH <7.2)
2. Hyperosmolar DKA or HHS requiring insulin infusion (indicated by Serum Osmolality greater than 320)
 - a. Calculated Serum Osmolality: $(2[\text{Na}^+] + \text{Blood Glucose}(\text{mg/dL})/18 + \text{BUN}(\text{mg/dL})/2.8)$
3. Point of Care Blood Glucose (POC BG) and correction insulin more frequently than q4h

GENERAL CONCEPTS

- The Pediatric Mild Diabetic Ketosis protocol is intended ONLY for pediatric patients with mild diabetic ketosis who meet inclusion criteria (see above). The treatment goals for this protocol are: reverse ketosis, resolve hyperglycemia, achieve anion gap (AG) of less than 12, and attain metabolic control. DKA causes anion gap metabolic acidosis due to production of ketoacids (beta-hydroxybutyrate & acetoacetate), causing extracellular shift and osmotic diuresis.
- Acidosis will correct with treatment
- Administration of bicarbonate is not recommended unless symptomatic hyperkalemia is present or CPR/resuscitation is necessary. It may increase risk for cerebral injury, worsen intracellular acidosis and hypokalemia
- Cerebral injury is the leading cause of morbidity and mortality in DKA
- Total body stores of all electrolytes (Na, K, Phos, Mag) are low in DKA due to renal losses
 - Na corrected = $\text{Na measured} + 1.6 \times [(\text{Glucose}-100)/100]$; should normalize with treatment
 - Serum K may be high/normal/low, but total body stores are low
 - Low Phosphorous can lead to poor oxygen delivery to tissues

** For patients with known diabetes that use an insulin pump: please ensure that the insulin pump and infusion site are disconnected from the patient.

MANAGEMENT

- Use actual body weight for fluid calculations (not ideal body weight)
- Initial bolus: 20 ml/kg NS over 30 minutes. Can be repeated if evidence for inadequate organ perfusion on reassessment.

1. INSULIN

- Subcutaneous (SubQ) insulin should be used concurrently with large volume IV fluid and potassium replacement similar to that recommended in UCDMC Pediatric DKA insulin infusion protocol.
- Basal insulin to be given as soon as possible if new diagnosis of diabetes or missed dosing for known diabetes.
 - For known diabetes patients who have not missed their basal dosing, next dose should be given per home dosing regimen.
- Use basal insulin dose of 0.3 units/kg for new diagnosis
- Rapid-acting insulin (bolus BG correction) to be given every 4 hours as needed for POC BG greater than 150mg/dL. For POC BG less than 150 mg/dL, HOLD bolus insulin dose
- Suggested bolus insulin dosing:
 - Patient weight less than 30kg:
 - 0.5 unit insulin per 50 mg/dL greater than 150 mg/dL
 - Patient weight 30-50kg:
 - 1 unit insulin per 50 mg/dL greater than 150 mg/dL
 - Patient weight greater than 50kg:
 - 1 unit insulin per 35 mg/dL greater than 150 mg/dL
 - Patient with known or suspected type 2 diabetes or insulin resistance:
 - 1 unit insulin per 25 mg/dL greater than 150 mg/dL
- POC BG to be completed every 4 hours
 - Exceptions:
 - POC BG must be checked 2 hours after first dose of rapid-acting insulin
 - If POC BG less than 100 mg/dL, check every 30 minutes until POC BG greater than 100 mg/dL
 - If POC BG is less than or equal to 70mg/dL, treat hypoglycemia IV FLUIDS

2. FLUIDS

- Give one-time Normal Saline bolus of 20mL/kg, then:

Blood glucose (mg/dL)	BAG #1 0.45% NaCl with 20mEq KCl Rate (% of total)	BAG #2 D5 0.45% NaCl with 20mEq KCl Rate (% of total)
greater than or equal to 250	100%	0%
Less than 250	0%	100%

- Dextrose-containing fluids will need to be given once POC BG less than 250mg/dL to help resolve

ketosis.

- For hypoglycemia prevention, continue dextrose containing fluids until standard SQ insulin regimen is initiated.
- Continue dextrose containing IV fluids until resolution of ketosis even if blood glucose rises above 250 mg/dL.
- Serum sodium should be corrected for hyperglycemia
 - For each 100 mg/dL glucose greater than 100 mg/dL, add 1.6 mEq to actual serum sodium value
- For potassium within normal range or lower & normal kidney function, give potassium containing fluids (see table above).
- Do not start the potassium-containing fluids if:
 - K greater than 5.5 on admission. If K greater than 6, obtain ECG
 - Urine output/renal function have not been ensured

3. DIET

- Patients should be maintained NPO until ketosis resolves

4. MONITORING

Admission	Q4h	Q6h	Q12h
VBG BMP, Mg, Phos Beta-Hydroxybutyrate (BHB) Hemoglobin A1c Diabetes antibodies (new onset only)	POC BGC *check POC glucose 2 hours after first dose of rapid-acting insulin	BMP – q6h x 2 then q12h	BMP VBG BHB

TRANSITION TO HOME SUBCUTANEOUS INSULIN REGIMEN

- Criteria:
 - Mental status remains normal
 - Able to tolerate PO intake
 - AG less than 12 and/or bicarbonate greater than or equal to 17mEq/L
- Process:
 - IVF should be discontinued once standard SQ insulin regimen is initiated.
 - Discontinue all previous insulin orders and order home insulin regimen
 - Allow the patient to start eating; if transition does not align with a meal time, give a sugar free or low carb snack (less than 5g carbohydrates)
- Monitoring:
 - Transition to new lab frequency
 - POC BG- before meals, nightly, 0200, and PRN hypoglycemia symptoms
 - PRN UA for ketones if POC BG <350 mg/dL and/or nausea/vomiting

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