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MONTEFIORE SUBCUTANEOUS INSULIN DKA PROTOCOL

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Please note that recommendations are changing rapidly and the content of this protocol may not represent the most up to date information. The protocol is updated periodically.

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This is a subcutaneous (SubQ) insulin protocol that replaces insulin drip needs for mild to moderate DKA. Procedures are adapted for COVID-related considerations of minimizing risk to staff while optimizing patient safety and health.

****CALL ENDOCRINE/DIABETES CONSULT SERVICE FOR ASSISTANCE****

DKA Diagnosis and Eligibility for SubQ Protocol:

Does patient meet ALL THREE criteria for DKA?		**Meet all FIVE criteria:**
1. Hyperglycemia: serum glucose or capillary glucose > 250 mg/dL 2. Ketosis: positive serum BHB or urinary ketones 3. Acidemia: blood (venous or arterial) gas pH ≤ 7.3 or serum bicarbonate ≤18 mEq/L	**AND**	1. Blood gas (venous or arterial) pH ≥ 7.0 2. Serum bicarbonate ≥ 10 mEq/L 3. Alert/Awake mental status 4. MAP > 65 after 1L IV fluids 5. K ≥ 3.3 mEq/L

Patient can be treated according to the SubQ Pathway.

EXCLUSION for SubQ Pathway; NEED Insulin Drip

Pregnancy, Altered Mental Status, Acute CHF Exacerbation, Acute Coronary Syndrome, ESRD or CKD Stage 4 or 5, Acute Liver Failure or Cirrhosis, Anasarca, Weight >120 kg, High-dose Corticosteroids, Severe DKA (Serum HC03 <10 mEq/L or pH ≤7.1)

1. Start Basal Insulin Dose (Detemir) STAT and continue q24h (unless last dose within 12 hours):
   - BMI **≤30 OR GFR 15-30 AND no high dose steroids→START 0.15 units/kg Detemir**
   - BMI >30 OR on high-dose steroids AND GFR>30 →START 0.2 units/kg Detemir
   - Call endocrine/diabetes consult team to verify calculated basal insulin doses over 50 units

2. Start Initial Insulin Lispro Loading Dose and Subsequent q4h dosing (STOP when pH>7.3 or serum HC03≥18):
   - Mild to Moderate DKA: Serum bicarbonate > 12 or pH > 7.15→0.2 units/kg loading dose STAT
     - Correctional doses q4h: FS ≥250 mg/dl→ 0.2 units/kg; FS<250 mg/dl→ 0.1 units/kg
   - Call endocrine/diabetes consult team for modified dosing if hypoglycemia occurs. Hold doses for FS<70.

Fluid and Electrolyte Management (see page 2 for more details):

- Hypovolemia: IV Fluids are the mainstay of DKA treatment. Need to give ASAP. Assess volemic status and give 0.5-1L LR or NS bolus up front with maintenance fluids thereafter at lower rate 200-400 ml/hr
- Hypoglycemia or Hypernatremia: For FS<250 or corrected Na>135, start D5 ½ NS at 150-250 ml/hr
- Hypokalemia: DKA is a potassium-deficient state despite nl serum levels. Replete K<5.1, Phos<2, Mg<2

Principles of DKA Monitoring:

- Basic metabolic panel, patient assessment of mental status, and insulin administration should occur **q4h until anion gap has closed**
- Insulin dosing is based on q4h glucose from FS or venous blood
- When possible, more frequent FS (q 2h) is recommended to monitor for hypoglycemia; Patients who are alert and capable can check their BG with their own or hospital-provided glucometer or CGM
- When possible, use long tubing to externalize IV fluids from room, which will also enable timely electrolyte and fluid correction

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Montefiore DKA Fluid & Electrolyte Management

Table 1: Managing Volume

- Assess patient's volume status frequently: severe hypovolemia, mild volume depletion, or volume overload with cardiopulmonary compromise
- Smaller fluid volumes may be required for ESRD/anuric/COVID patients with cardiopulmonary compromise
- Lactated Ringers is the preferred fluid for continued resuscitation, unless hyperkalemic
- NS or LR can be given as bolus or continuous infusion

Volume Status	Orders	Considerations
Severe Hypovolemia	Serum K+ ≤ 5.1, LR @ 500-1000mL/hr Serum K+ > 5.1, NS @ 500-1000mL/hr Until clinically volume resuscitated	Anticipate ICU level of care if refractory to IV fluids
Mild Hypovolemia (calculate corrected Na+) https://www.mdcalc.com/sodiumcorrectionhyperglycemia	**Corrected serum Na < 135** Serum K+ ≤ 5.1 LR@200-400 mL/hr Serum K+ > 5.1 NS@200-400 mL/hr **Corrected serum Na ≥ 135** 1. Change IV fluids to 0.45% saline infusion at 200-400 mL/hr until resuscitation complete 2. For serum Na over 140 calculate free water deficit and carefully replace free water along with IVF	
Volume overload with cardiopulomary compromise	**Discontinue IV Fluid Therapy**	Anticipate ICU level of care

Table 2: Managing Serum Potassium (K+)

- Modifications to recommendations below may be necessary in situations of oliguria or baseline renal insufficiency
- Monitor serum K+ q4 hours while patient is on the pathway and administer doses as recommended below
- Maximum peripheral IV KCl infusion is 10 mEq/hr
- Combination of oral and IV KCl may be used in patients able to tolerate PO

< 3.3 mEq/L	• Hold short-acting insulin until KCl infusion is started • May cause life threatening arrhythmia or respiratory muscle weakness • Administer IV 60mEq KCl rider/piggyback • Consider central line placement for rapid (20 mEq/hr) IV KCl infusion
3.3 - 3.5 mEq/L	**Administer 40 mEq KCl at 10/hr**
3.6 - 5.1 mEq/L	**Administer 20 mEq KCl**
> 5.1 mEq/L	• **Do NOT give any KCl** • Re-check serum K+ q2-4 hours until K < 5.2

Other Notes

Managing other electrolytes

- Urgently replete serum phosphate to > 1 mg/dL with IV therapy (potassium phosphate or sodium phosphate (if hyperkalemic))
- Urgently replete serum magnesium to > 1.2 mg/dL with IV therapy (magnesium sulfate)
- Once minimum goals achieved, replete both phosphate and magnesium to normal levels with either PO or IV as tolerated

Other Calculations

- Anion Gap (Normal 10-14 mEq/L) = ([Na+]) - ([Cl-]) + [HCO3'])
- Corrected anion Gap (for low serum albumin) = [measured AG + (4 - albumin) x 2.5)]
- Corrected Na+ = measured Na+ + 1.6 [serum glucose - 100] ÷ 100
- Free Water Deficit=[dosing factor (0.6 male, 0.5 female) x body weight(kg)] x [(serum Na+ ÷ 140) - 1]

After DKA has resolved, resume routine diabetes inpatient care

- If the patient is eating, patient or staff should check Point of Care (POC) blood glucose (BG) before meals and before bedtime (QAc & QHs) and order prandial (mealtime) insulin
- When necessary, patients can check their BG with their own glucometer and report out to nurse who will input into chart
- If the patient is NPO or on TPN or TEN, check POC BG Q4-6 hours
- Ensure that a daily basal insulin dose is ordered to be administered within 24h of NOW basal insulin dose
- Watch for decreasing insulin requirements as infectious precipitants and glucose toxicity improves