TREATMENT OF PEDIATRIC DIABETIC KETOACIDOSIS (DKA)

EMERGENCY DEPARTMENT MANAGEMENT OF PEDIATRIC PATIENTS IN DKA:

- Obtain height and weight, monitor vital signs, including blood pressure on all patients
- Do a bedside glucose determination
- Assess the degree of hydration and mental status
- Obtain a urine sample for glucose and ketones
- Draw BMP, venous/arterial pH, serum acetone, and CBC
- If signs of circulatory shock are present, give a bolus of normal saline (20 mL/kg)
  - DO NOT give more than one bolus unless evidence of shock persists
- Consult with a pediatric endocrinologist or your pediatric critical care center as soon as possible
- Begin IV maintenance and replacement fluids with normal saline at a rate of 1½ to 2x maintenance fluids (maximum: 3500 mL/m² /day)
- Follow blood glucose every hour
- Follow venous/arterial blood gas at presentation, 2 hours later, then every 4 hours following
- Start 2-bag system of IVF as soon as possible
- Maintain blood sugar between 250 and 300 mg/dL while acidosis is resolving

DO NOTs:

- Do not give more than 20 mL/kg as a single fluid bolus
- Do not give more than a total of 30 mL/kg of bolus fluids unless the patient is in shock
- Do not bolus insulin
- Do not give sodium bicarbonate unless severe acidosis (pH < 6.9) is refractory to fluid and insulin administration
  - Bicarbonate is NOT recommended unless there are ventricular arrhythmias associated with acidosis

Criteria for PICU Admission:

- Arterial pH < 7.3 or venous pH < 7.25
- Altered mental status
- Severe dehydration

Ongoing Management:

- Close neurologic observation to detect any changes consistent with cerebral edema:
  - Severe headache
  - Change in sensorium
  - Change in blood pressure
  - Pupillary abnormalities
  - Bradycardia Posturing
  - Incontinence
- If any of the above signs are encountered, rapid intervention is imperative (intubation, mild hyperventilation, mannitol bolus 0.25 to 0.5 g/kg IV).
- Neuroimaging as soon as patient is clinically stable.
• Follow laboratory parameters:
  o Initial – CBC, CMP with magnesium, phosphorus, amylase, lipase, serum acetone, glycohemoglobin, ABG or VBG
  o If new onset – above labs + serum insulin (prior to starting insulin therapy), islet cell antibody, anti-GAD 65, insulin antibody
  o Blood glucose by meter every 1 hour
  o VBG/ABG with electrolytes at presentation, 2 hours later, then every 4 hours following
  o BMP, magnesium, phosphorus every 12 hours
  o Once bicarbonate reaches 15, recheck serum acetone

• Most patients can be taken off insulin drip and start subcutaneous insulin regimen when all of the following criteria have been met:
  o Ketoacidosis has significantly resolved, arterial pH ≥ 7.3 or venous pH ≥ 7.25 AND serum bicarbonate ≥ 15
  o Patient feels hungry
  o Patient has bowel sounds
  o Patient has stopped vomiting

• Keep the insulin drip running for 30 minutes AFTER the first dose of subcutaneous insulin has been given.
• IVF fluids are generally not needed once DKA is resolved and the patient is transitioned to subcutaneous insulin and oral diet.
• If fluids need to be continued, they should NOT contain dextrose.
1. **Regular Insulin 50 unit/50ml NS** (1 unit/ml); infuse 0.1 unit/kg/hour. (NO BOLUS DOSES)
   
   \[
   0.1 \text{ unit/kg} \times \text{______ kg} = \text{______ ml} \quad \text{divided by 1 unit/ml} = \text{______ ml/hr}
   \]

2. **IV Fluids**
   
   a. Boluses received previously (in ER or pre-hospital) = \text{______ ml}
      
      Boluses received here (usually 20ml/kg NS) = \text{______ ml}
      
      \[
      \text{Total boluses} = \text{______ ml (a)}
      \]
   
   b. Calculate free water deficit from table below.
      
      \[
      \text{______ kg} \times \text{______ ml/kg} = \text{______ ml (b)}
      \]
      
      \[
      \begin{array}{|c|c|}
      \hline
      \text{Degree of Dehydration} & \text{Water deficit} \\
      \hline
      \text{Mild} & 5\% = 50\text{ml/kg} \\
      \text{Moderate} & 8\% = 80\text{ml/kg} \\
      \text{Severe} & 10\% = 100\text{ml/kg} \\
      \hline
      \end{array}
      \]

   c. Calculate remainder of free water deficit; subtract (a) from (b) = \text{______ ml (c)}

   d. Calculate maintenance fluid requirements for next 48 hours
      
      \[
      \begin{align*}
      200\text{ml/kg for first 10 kg} & \quad \rightarrow \quad \text{______ ml (d)} \\
      100\text{ml/kg for next 10kg} & \\
      40\text{ml/kg for kg greater than 20 kg} & \\
      \end{align*}
      \]

   e. Calculate total fluids required for next 48 hr (add (c) + (d)) = \text{______ ml (e)}

   f. Determine **Hourly IV Rate** ((a) divide by 48) = \text{______ ml/hr (f)}

   g. Adjust the rates of two IV solutions (one containing dextrose, one without) based on blood glucose levels. (See table below).

   h. **IF SERUM POTASSIUM IS GREATER THAN 6.5 mEq/L Infuse 0.9% NaCl at calculated hourly rate (f) and recheck potassium in 1 hour.** Once serum potassium is less than 6.5 mEq/L, begin IV fluids as indicated below.

<table>
<thead>
<tr>
<th>Blood Glucose Level</th>
<th>Bag “A” NO DEXTROSE</th>
<th>Bag “B” WITH DEXTROSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater than 350</td>
<td>100% Hourly IV Rate</td>
<td>Zero % Hourly IV Rate</td>
</tr>
<tr>
<td></td>
<td>\text{______ ml/hr}</td>
<td>\text{0 ml/hr}</td>
</tr>
<tr>
<td>301 – 350</td>
<td>75% Hourly IV Rate</td>
<td>25% Hourly IV Rate</td>
</tr>
<tr>
<td></td>
<td>\text{______ ml/hr}</td>
<td>\text{______ ml/hr}</td>
</tr>
<tr>
<td>251 – 300</td>
<td>50% Hourly IV Rate</td>
<td>50% Hourly IV Rate</td>
</tr>
<tr>
<td></td>
<td>\text{______ ml/hr}</td>
<td>\text{______ ml/hr}</td>
</tr>
<tr>
<td>201 – 250</td>
<td>25% Hourly IV Rate</td>
<td>75% Hourly IV Rate</td>
</tr>
<tr>
<td></td>
<td>\text{______ ml/hr}</td>
<td>\text{______ ml/hr}</td>
</tr>
<tr>
<td>Less than 200</td>
<td>Zero % Hourly IV Rate</td>
<td>100% Hourly IV Rate</td>
</tr>
<tr>
<td></td>
<td>\text{0 ml/hr}</td>
<td>\text{______ ml/hr}</td>
</tr>
<tr>
<td>Less than 100</td>
<td>Zero % Hourly IV Rate</td>
<td>HOLD INSULIN &amp; recheck glucose in 30 minutes</td>
</tr>
<tr>
<td></td>
<td>\text{0 ml/hr}</td>
<td>\text{100% Hourly IV Rate}</td>
</tr>
</tbody>
</table>

Physician Signature _______________ Pager __________ Date _______ Time _______

RN Signature _______________ Date _______ Time _______

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**Advocate Christ Medical Center**
Hope Children’s Hospital

**PEDIATRIC DIABETIC KETOACIDOSIS (DKA)**
FLUIDS AND INSULIN ORDERS

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Patient Name: __________________
MR Number: __________________
Patient Number: ________________
OR
Affix Patient Label

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Divider #8