Clinical Practice Guideline for Management of Diabetic Ketoacidosis (DKA) in the ED/Inpatient/PICU

Original Publication 2012  Updated 2/14/24  Page 1 of 3

INCLUSION CRITERIA

Suspected new onset diabetic with symptoms such as below OR known diabetic with signs/labs suggestive of DKA:

- Polyuria
- Thirst
- Weight loss
- Vomiting
- Enuresis

Signs/Labs:
- Hyperglycemia (>200)
- pH <7.3
- Dehydration
- Ketonuria
- Rapid &/or deep respirations

WARNING SIGNS OF CEREBRAL EDEMA

- Headache
- Inappropriate slowing of heart rate (>20 beats below baseline) &/or rising blood pressure
- Recurrent vomiting
- Change in neurologic status: restlessness, irritability, increased drowsiness, or incontinence
- Change in neurologic signs: Cranial nerve palsy, or slower pupillary response
- Altered/abnormal respiratory rate

DKA CRITERIA

Mild
- pH 7.2-7.29
- HCO₃⁻/Total CO₂ 10-17

Moderate
- pH 7.1-7.19
- HCO₃⁻/Total CO₂ 5-9

Severe
- pH <7.1
- <5

HYPEROSMOLAR HYPERGLYCEMIC SYNDROME (HHS)

- Aggressive hydration: NS bolus 20 ml/kg, repeat until perfusion improves
- Insulin: may not be initially necessary, lower dose than DKA (0.025-0.05 units/kg/hr)
- Consult Endocrinology
- Admit to ICU

PICU ADMISSION CRITERIA

ANY OF THE FOLLOWING:
- pH <7.1
- K⁺ <3.0 (based on most recently obtained labs)
- Altered mental status
- Severe dehydration

CONSIDER PICU ADMISSION IF:
- Age < 5 years
- Barriers to adequate monitoring/staffing in General Care

IF PATIENT ARRIVES ON FLUIDS FROM OUTSIDE FACILITY OR EMS:
- DO NOT DISCONTINUE INSULIN DRIPS UNTIL PHARMACY DELIVERS INSULIN
- DOCUMENT AMOUNT OF FLUID RECEIVED

TRIAGE HISTORY CONSISTENT WITH INCLUSION CRITERIA

No

CONTINUE TREATMENT AS APPROPRIATE

Yes

RN ASSESSMENT

IF CONCERN FOR CEREBRAL EDEMA, NOTIFY PHYSICIAN IMMEDIATELY

FULL SET OF VITAL SIGNS:
- HR
- PULSE OX
- RR
- TEMPERATURE

ASSESS FOR DEHYDRATION:
- MUCOUS MEMBRANES
- CAPILLARY REFFIL>3 SECOND
- SKIN TURGOR

FLUIDS IF INSULIN KETOSIS

ASSUMPTIONS:
- DRIPS
- NSUTINE
- INSULIN

LENDARDS
- HR
- PULSE OX
- RR
- TEMPERATURE

OBTAIN

LABS:
- CG8
- BMP
- URINALYSIS
- POC GLUCOSE EVERY HOUR
- HgBA1C

OTHER ORDERS:
- CARDIAC MONITORING
- IV ACCESS X 1-2
- STRICT NPO DIET
- REASSESS PATIENT Q 30-60 MINUTES

MANAGE HYPERGLYCEMIA AS APPROPRIATE FOR CLINICAL SITUATION

MANAGE HYPERGLYCEMIA WITHOUT DKA PER ENDOCRINOLOGIST

CONSULT ENDOCRINOLOGY AND ADMITTING SERVICE FOR DISPOSITION

DISCHARGE HOME ONLY WITH ENDOCRINOLOGY APPROVAL

GENERAL CARE AREA ADMIT TO ENDOCRINE SERVICE

ADMIT TO PICU WITH ENDOCRINOLOGY CONSULT

SEE DETAILS FOR IVF AND INSULIN TREATMENT ON PAGE 2

INITIATE TREATMENT FOR DKA:
- IVF
- INSULIN
- CONTINUE MONITORING

Suspect DKA?

No

Suspect Diabetes?

No

Yes

NOTIFY ED ATTENDING
**Clinical Practice Guideline for Fluid/Insulin Management of Diabetic Ketoacidosis (DKA) in the ED/Inpatient/PICU**

**Original Publication 2012**

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### Phase I: Initial Rehydration**

10-20 mL/kg NS over 30 minutes

**Dehydration Persists?**

**Yes**

**Repeat Bolus:**

10-20 mL/kg NS over 30 minutes

If giving greater than 40 mL/kg of bolus fluid, consult endocrinologist

**No**

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### Phase II**

**Replacement with Electrolytes, No Dextrose, Begin Insulin**

<table>
<thead>
<tr>
<th>IV Fluid</th>
<th>Regular Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>No Dextrose</em></td>
<td><em>Regular Insulin</em></td>
</tr>
<tr>
<td>NS + K⁺</td>
<td>Same line or Different IV line</td>
</tr>
<tr>
<td>1½-2 times maintenance</td>
<td>Insulin Solution: Strength: 1 unit/mL in NS drip Rate: 0.1 unit/kg/hr</td>
</tr>
</tbody>
</table>

Nursing: If BG<80 mg/dl, hold insulin and notify physician

Pre-order Phase III dextrose-containing IV fluids to bedside; to be started per provider order when glucose <250 mg/dl

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### Phase III**

**Continue Insulin, Begin Dextrose When BG<250mg/dL**

**Continue Dextrose-Free IV Fluid AND Add Dextrose-Containing IV Fluid**

<table>
<thead>
<tr>
<th>IV Fluid</th>
<th>IV Fluid with Dextrose</th>
<th>Regular Insulin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continue NS + K⁺</td>
<td>D10 + NS + K⁺</td>
<td>Continue Insulin: Strength: 1 unit/mL in NS drip Rate: 0.1 unit/kg/hr</td>
</tr>
</tbody>
</table>

Total fluids at 1½ - 2 times maintenance rate. Dextrose-free and dextrose-containing fluids begin at the same rate. Titrate IV rates to desired serum glucose level, maintaining same total fluid rate.

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**POC Glucose**
- Every 1 hour
- Target BG Range: 100-200 mg/dl

**Vital Signs and Neurovitals (Cerebral Edema)**
- Every 1 hour

**Venous Blood Gas and Chemistry**
- Every 2-4 hours

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**Poor Perfusion Signs**
- Cool extremities
- Capillary refill > 3 seconds
- Hypotension (policy 23.00)

The following symptoms may persist, but not indicative of poor perfusion:
- Elevated heart rate
- Dry mouth
- Sunken eyes

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**IVF for Patients Transferred In**

If patient has received over 30 ml/kg IVF, consider starting replacement fluids at 1-1½ times maintenance.

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**Replacement Fluid Therapy**

- Goal is to re-hydrate patient, correct acidosis, and avoid major fluid shifts
- Provides ability to alter replacement therapy fluids with minimal bag changes without changing the rate of the Insulin therapy

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**Adding Potassium (K⁺)**

Add potassium based on serum K⁺ level:
- K⁺ > 5.5 No K⁺ (Phase I fluids (NS) should continue until the K⁺ level decreases)
- K⁺ 4-5.5 20 mEq/L K⁺ phosphate AND 20 mEq/L K⁺ acetate
- K⁺ < 4 30 mEq/L K⁺ phosphate AND 30 mEq/L K⁺ acetate

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**Initiating Insulin Regular**

- Initiate Insulin after bolus(es) have infused
- If K⁺ < 3.5, start K⁺ prior to initiating insulin
- Prime IV tubing with insulin; let additional 20 ml run out of tubing before connecting to patient/pump (this allows saturation of plastic binding sites)

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**Phase III**

- Start when BG<250 mg/dl
- The K⁺ and Na⁺ content in each bag should be identical to each other

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Clinical Practice Guideline for Ongoing Management of Diabetic Ketoacidosis (DKA) in ED/Inpatient/PICU

**Phase I:** Fluid Rehydration with NS
- If patient is sufficiently stable, consider change to ½ NS after 4-6 hours of Phase III therapy

**Phase II:** Fluid Replacement without dextrose, replace K⁺, begin insulin

**Phase III:** Fluid Replacement adding dextrose, continue insulin and K⁺

**Phase IV:** Reduce sodium content of IV fluid
- If patient is sufficiently stable, consider change to ½ NS after 4-6 hours of Phase III therapy

**Phase V:** Treatment of Persistent Blood Glucose <100mg/dL
- Increase D₁₀ to 100%
- Decrease insulin to 0.05 units/kg/hr; AND/OR
- Insulin and dextrose titration per physician order

**Phase VI:** Transition to Subcutaneous Insulin and Oral Feeds
- Transfer of Care to Endocrinology
- When: Patient ready by clinical assessment (including resolution of lethargy and presence of hunger); AND
  - HCO₃ >15; OR
  - pH >7.29
- Advance oral intake from ice chips to carbohydrate-containing meal as tolerated
- Give Humalog (short-acting insulin based on meal) as discussed with Endocrinology
- Discontinue IV insulin following administration of Humalog

**Criteria to Transition to General Care**
- Clinical appropriateness of transfer will be based on provider discretion

**Discharge Criteria**
- When patient is on subcutaneous insulin regimen and tolerating solid food
- Consider when social and educational needs are met

**Laboratory Tests (Labs)**
- Phosphorus
- Hemoglobin A₁c
- β-hydroxybutyrate

**Antibodies for New Onset Diabetes ONLY**
- Tissue Transglutaminase, IgA [TTGAB]
- Immunoglobulin A Total [IGA]
- Thyroid Peroxidase AB
- Thyroglobulin AB [ATHY]

**Assess Need for Labs**
- If labs not previously drawn, obtain the following upon arrival to inpatient unit (PICU or floor):
  - Phosphorus
  - Hemoglobin A₁c
  - β-hydroxybutyrate

**Nursing**
- If BG<80mg/dl, hold insulin and notify physician

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