

DKA Card



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DKA Definition

Glucose > 200 mg/dL **AND**
Moderate to Large Ketonuria (or B-OHB > 3 mmol/L) **AND**
Venous pH < 7.3, Arterial pH < 7.35 or serum tCO₂ or venous
HCO₃ < 15 mEq/L

Therapy:

1. **NS BOLUS** PRN upon arrival to ED
NS 10 mL/kg IV x 1, may repeat with caution.
Goal is to ensure adequate perfusion, not euvoolemia.

2. FLUID MANAGEMENT 2-BAG METHOD

*Defer initiating 2-bag method if serum K > 4.5 mEq/L, consider
NS or D5NS if glucose ≤ 300 mg/dL

Rate:

1.5 - 2x maintenance (MAX rate usually 2x)
Initial IVF for at least 4 - 6 hours.

Corrected Na* should remain normal or move towards normal.
If decreases by > 1 mEq/L/hr or corrected serum sodium is
< 135 mEq/L, evaluate for evolving cerebral edema & follow
neuro exam closely.

IV Fluid Therapy with the 2-bag method:

Bag #1: NS with Potassium Acetate 20 mEq/L and
Potassium Phosphate 20 mEq/L
Bag #2: D12.5W 1/2NS with Potassium Acetate 20
mEq/L and Potassium Phosphate 20 mEq/L

Determining the Infusion Rate:

Infusion rates of both bags are determined using the [DKA 2-Bag
Infusion Rate Calculator]

*may be found in the hyperlink in all DKA Powerplans, BCH
formulary, on eLibrary or Powerchart link

Prescriber should order the fluids once, then modify infusion rates
throughout the course, do not cancel/reorder for each rate
change.

Goal Dextrose Content (used in the calculator)

| Blood Glucose (mg/dL) | Goal Dextrose Concentration |
|-----------------------|-----------------------------|
| >300 | 0% |
| 276 - 300 | 5% |
| 251 - 275 | 7.5% |
| 201 - 250 | 10% |
| ≤ 200 | 12.5% |

Potassium Content: (after voiding)

Goal K* = 3.5 - 4.5 mEq/L

| Serum K* (mEq/L) | K* in IVF (mEq/L) |
|------------------|-------------------|
| ≤ 4.5 | 40 |
| > 4.5 | 0 |

* May add K up to 80 mEq/L if needed for significant hypokalemia but
patient cannot remain on the 2-bag method

3. INSULIN

Do Not give insulin bolus

Insulin infusion: After 1 hr of NS administration, initiate
regular insulin infusion (1 unit/mL in NS) at 0.1 unit/kg/hr*

* For mild DKA (venous pH 7.2 - 7.29, serum tCO₂ or venous
HCO₃ 10 - 15 mEq/L) may use 0.05 unit/kg/hr

Target Blood Glucose: 150 - 250 mg/dL

Most patients require increasing dextrose & potassium
concentrations as the anion gap normalizes.

If BG remains < 200 mg/dL, K* remains < 3 mEq/L (despite goal
dextrose concentration of 12.5% and infusion rate at 2x
maintenance), and anion gap is near to normal, reduce insulin
infusion to 0.075 unit/kg/hr, then to 0.05 unit/kg/hr. Discuss with
endocrine prior to adjusting.

Subcutaneous Insulin: start when:

- Patient can eat & drink
- At mealttime
- vpH > 7.3, tCO₂/HCO₃ > 15 mEq/L and/or anion gap 14
- Give first subcutaneous rapid and long-acting insulin 15 min
pre-meal, stop IVF & insulin drip 30 min after subQ dose
(May need to continue IVF if patient refuses to eat)

Subcutaneous Insulin Regimen:

Total Daily Dose (TDD) (unit/kg/day):

| | No DKA | DKA |
|----------------------|-------------|------------|
| Age < 6y or A1c < 7% | 0.15 - 0.25 | 0.5 - 0.75 |
| Prepubertal | 0.25 - 0.5 | 0.75 - 1 |
| Pubertal | 0.5 - 0.75 | 1 - 1.2 |
| Postpubertal | 0.25 - 0.5 | 0.75 - 1 |

A. Basal - bolus regimen (recommended initial regimen):

~50% of TDD as long acting insulin (Lantus) once daily

~50% of TDD as rapid acting insulin (Humalog) divided in meals

B. Split - mixed insulin regimen:

2/3 TDD QAM (1/3 Humalog + 2/3 NPH)

1/3 TDD QPM (1/3 Humalog Odinner & 2/3 NPH bedtime)

Sliding Scale:

| Humalog | BG 250 - 400 | BG > 400 |
|----------------------|--------------|------------|
| None - Small Ketones | 5-10% TDD | 10-15% TDD |
| Mod - Large Ketones | 10-15% TDD | 15-20% TDD |

IV FLUID LIMITS

| Fluid | PIV Max | CVL Max |
|-----------|----------|-----------|
| Potassium | 80 mEq/L | 200 mEq/L |
| Dextrose | 12.5% | 50% |

Maximum Phosphorous infusion rate: 0.12 mMol/kg/hr

Maximum Potassium infusion rate: (see administration of
supplemental potassium policy)

All patients: ≤ 0.25 mEq/kg/hr (max 7.5 mEq/hr)

> 0.25 mEq/kg/hr (must have continuous ECG monitoring)

ICU/ICP/ED/HemeOnc/HSC: > 0.5 mEq/kg/hr (max 15mEq/hr)

DKA Card continued on next page →

COMPLICATIONS

All patients are dehydrated & depleted of Na^+ , K^+ , Cl^- , PO_4^{3-} , Mg^{2+}

1. Cerebral Edema:

Peak Incidence during first 8-12 hours after initiation of therapy, but can occur as late as 24 hours

Treat Empirically:

- Decrease IV rate, raise HOB @ 30°
- Mannitol 1 g/kg IV over 15 min, follow UOP and VS (BP, HR) for subsequent diuresis. If no response within 20 – 30 min, repeat mannitol, or consider 3% Hypertonic Saline 5 mL/kg over 15 min
- Consider ETT placement for airway control & hyperventilate to pCO_2 pt had prior to intubation – slowly normalize over 12-24 hrs
- Consider STAT head CT once airway is stabilized

Symptoms (in increasing order of importance & severity):

Headache, emesis, increased BP (dBP > 90mmHg), change in level of consciousness/responsiveness, delirium or confusion, unequal or dilated pupils, cranial nerve palsy, papilledema, age-inappropriate incontinence, bradycardia (sustained drop of 20bpm from baseline), respiratory irregularity or arrest, sudden onset of polyuria (from DI secondary to pituitary necrosis)

2. Hypophosphatemia:

Symptoms usually occur when Phos < 1 mg/dL

- ↓ ATP → ↓ cardiac output (CHF) or possible cardiac arrest (< 0.5 mg/dL)
- Decreased Hgb affinity for O_2
- Metabolic encephalopathy (irritability, paresthesias, then confusion, seizure, coma)
- Ileus & dysphagia
- Proximal myopathy
- Hemolysis (if Phos < 0.5 mg/dL)

3. Hyponatremia:

Always use measured sodium. The brain is exposed to the measured sodium (not corrected sodium).

Na^+ 115 - 120 mEq/L: seizure, coma, respiratory arrest
 Na^+ 120 - 125 mEq/L: HA, lethargy, obtundation
 Na^+ 125 - 130 mEq/L: nausea & malaise
 Symptomatic Hyponatremia: infuse 3% Hypertonic Saline 5 mL/kg IV over 15 min. Stop infusion when symptoms resolve.

4. Hypoglycemia

Most patients will eventually require D_{10}W with sodium and potassium @ 2x maintenance. If BG's still < 200 and anion gap is near to normal, reduce insulin infusion to 0.075 unit/kg/hr, then to 0.05 unit/kg/hr. Discuss with endocrine prior to decreasing.

5. Hypokalemia:

Hypokalemia always occurs even with normal serum potassium due to extracellular shift.

Symptomatic Hypokalemia: 0.5 – 1 mEq/kg IV K^+ intermittent dose over 2 hr

Goal K^+ = 3.5 - 4.5 mEq/L

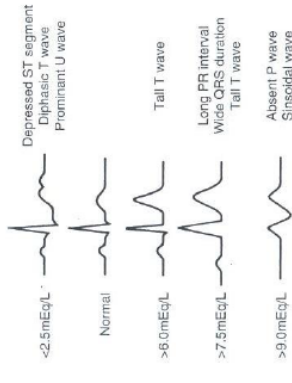
ECG Changes: usually when K^+ < 3 mEq/L

U Waves (best seen in V4 - V6)

Flat T waves (best seen in II & V2)

Long QTc (< 6mo: >0.44sec; Child: >0.43sec; Adult: >0.424sec)

K^+ ECG changes



6. Hypocalcemia:

May result with excess phosphate administration.

Clinical Presentation: ↓ BP, tetany, laryngospasm

Important Values

K^+ :

- K^+ < 2 mEq/L: significant weakness
- K^+ < 3 mEq/L: see "Hypokalemic ECG changes" above.
- K^+ 3.5 - 4.5 mEq/L: goal values
- K^+ 5.5 - 6.5 mEq/L: peaked T waves
- K^+ > 7 mEq/L: wide P waves
- K^+ > 8 mEq/L: absent P waves
- K^+ > 9 mEq/L: A-V Block, VT, V-Fib

Na^+ :

Always use the measured Na^+ since the brain is exposed to the measured Na^+

Na^+ < 130 mEq/L: Nausea & malaise may begin

Na^+ < 120 mEq/L: Seizure, coma, resp arrest

Phos:

Phos < 1 mg/dL: symptoms possible

Phos < 0.5 mg/dL: risk of metabolic collapse

CALCULATIONS

Corrected Na^+ = Na^+ + $[(\text{Glu} - 100)/100] \times 2$

Anion Gap = Na^+ - $(\text{Cl}^- + \text{HCO}_3^-)$ [Normal 8-12]

Osmolality = $2(\text{Na}^+ + \text{K}^+) + (\text{Glu}/18) + (\text{BUN}/2.8)$

* Effective Osmolality = $2(\text{Na}^+ + \text{K}^+) + (\text{Glu}/18)$
 (more relevant in DKA as BUN crosses BB barrier)

GOALS

1. Target blood glucose 150-250 mg/dL
2. Blood glucose should fall 70-100 mg/dL/hr after the first hour
3. Corrected Na^+ should remain normal or trend towards normal
4. Anion gap closes to 14, venous pH rises > 7.3, serum tCO_2 or venous HCO_3^- rises > 15

LABS

Glucometer Q1h while on insulin infusion; then before meals, before bed, Q2am while on subcutaneous insulin

Chem 10, beta-hydroxybutyrate & VBG Q2h while on insulin infusion, then pm while on subcutaneous insulin

Consider continuous etCO_2 or transcutaneous CO_2 while on insulin infusion – it should start low and rise towards 35-45. If drops, check patency of insulin infusion.

Urine ketones initially, no need to follow repeatedly

Other: HgbA1c, consider pancreatic autoantibody panel (refer to CPG for recommendations), TFT's, c-peptide, insulin

ECG