0. Confirm DKA: plasma glucose (PG) ≥11 mmol/L, ketones, capillary pH ≤7.3, HCO₃⁻ ≤15 mmol/L. B

1. Measure body weight (BW) in kilograms ............................................................... (1) _______ kg

2. Establish extent of dehydration (↓ BP, tears, skin turgor, capillary refill; ↑ hematocrit) in mL/kg: C

   infants: children:
   • mild: 5% = 50 mL/kg | 3% = 30 mL/kg
   • moderate: 10% = 100 mL/kg | 6% = 60 mL/kg
   • severe: 15% = 150 mL/kg | 9% = 90 mL/kg .......................... (2) _______ mL/kg

3. Calculate total fluid deficit: multiply (1) × (2) ....................................................... (3) _______ mL

4. Give normal saline (NS) resuscitation bolus only if patient is orthostatic or shocky: D

   • recommended amount: 5–10 mL/kg BW over 1–2 hours, max <30 mL/kg . (4) _______ mL

5. Calculate remainder of fluid deficit after fluid bolus: subtract (4) from (3) ............... (5) _______ mL

6. Calculate maintenance fluid requirements for the next 48 hours: E

   ➔ 200 mL/kg for the first 10 kg BW
   + 100 mL/kg for the next 10 kg BW
   + 40 mL/kg for the rest of BW ................................................................. (6) _______ mL/48 h

7. Calculate total amount of fluid still to be given over 48 hours: add (5) and (6) .... (7) _______ mL/48 h

8. Calculate hourly rate of fluid replacement: divide (7) by 48 ................................ (8) _______ mL/h

9. Use normal saline (NS) as initial replacement fluid, at rate determined in (8). Add KCl 20–40 mEq/L only if hypokalemic and patient has adequate urine output. Continue this for 1–2 hours.

10. After 1–2 hours, make up and start a piggyback insulin drip at 0.05–0.1 units/kg BW/h: F

    • 50 units insulin regular (Humulin® R or Novolin® Toronto) in 500 mL NS or D10/NS
    • run at 0.5–1.0 mL/kg BW/h ................................................................. (10) _______ mL/h

11. Begin "2-bag method" to replace NS G. Y together (a) NS with 40 mEq/L KCl and (b) D10–D12.5/NS with 40 mEq/L KCl. Decrease replacement fluid rate to adjust for insulin drip rate:

    subtract (10) from (8) ........................................................................... (11) _______ mL/h

12. Aim to keep PG ~10–15 mmol/L by titrating the rates of these two solutions, keeping the combined rate at (11) G. Continue this for the next 6–12 hours, monitoring as below in (15) and (16).

**Rationale & Notes:**

APlease note that this protocol is designed as an algorithm for treating the majority of cases of DKA in infants, children and adolescents. It cannot replace careful clinical observation and judgment in treating this potentially very serious condition. If you have questions or problems related to the management of DKA or diabetes, please feel free to contact the BCCH Pediatric Endocrinologist on call.

BHyperglycemic hyperosmolar syndrome should be suspected when there is significant hyperglycemia (>33 mmol/L) and hyperosmolality (>330 mOsm/L) without ketosis or acidosis (bicarbonate >15 mmol/L). A mixed picture of DKA and HHS is possible. Mild hyperglycemia, even with ketones and mild acidosis, can often be managed without IV fluids or IV insulin.

CRapid, deep mouth-breathing (Kussmaul respiration) often dries out the oral mucosa, making the child appear more dehydrated than s/he really is. The hematocrit and other clinical signs noted are more accurate.

DLarge fluid boluses are potentially dangerous and should be administered with caution, unless the patient is truly shocky. Only very rarely will a larger (>20 mL/kg BW) fluid bolus will be required to maintain perfusion.

ESince most patients develop DKA over days, slow metabolic repair is safest. Overhydration may contribute to cerebral edema. Nonetheless, DKA in children often resolves in less than 48 h.

FIV insulin boluses are always contraindicated. Insulin given in the first 1–2 h of DKA repair is thought to increase mortality. This insulin rate fully inhibits ketogenesis and gluconeogenesis and should be maintained if possible. If unable to keep PG >10 mmol/L, drop the insulin rate by 25–50%.

GSince most patients develop DKA over days, slow metabolic repair is safest. Overhydration may contribute to cerebral edema. Nonetheless, DKA in children often resolves in less than 48 h.

HIV insulin boluses are always contraindicated. Insulin given in the first 1–2 h of DKA repair is thought to increase mortality. This insulin rate fully inhibits ketogenesis and gluconeogenesis and should be maintained if possible. If unable to keep PG >10 mmol/L, drop the insulin rate by 25–50%.
13. Re-evaluate appropriateness of replacement fluid type frequently, anticipating the need to add or increase Na⁺, K⁺, dextrose, etc.
   - dextrose: aim to keep the PG ~10–15 mmol/L range
   - sodium: corrected Na⁺ <140 mmol/L or falling: continue NS
     corrected Na⁺ 140–150, stable: switch to ½NS after 4–6 h
     corrected Na⁺ >150, stable: switch to ½NS after 10–12 h
   - potassium: patient urinating: continue KCl 20–40 mmol/L
     may give 50% of K⁺ as acetate or phosphate
   - bicarbonate: NaHCO₃ is not generally recommended

14. Close neurological observation and frequent rousing of the child with finger-pokes to detect any changes consistent with cerebral edema. Follow Glasgow Coma Scale. Severe headache, change in sensorium or BP, dilated pupils, bradycardia, irregular breathing, posturing and incontinence are signs of impending deterioration. Rapid intervention is imperative:
   - airway / breathing / circulation
   - elevate head of bed
   - decrease fluid rate by one-third
   - mannitol (0.5–1 g/kg IV over 20 min) or 3% NaCl (5–10 mL/kg IV over 30 min)
   - consider intubation and mild hyperventilation (keep pCO₂ >22 mg Hg) for impending respiratory failure
   - arrange CT when stable

15. Follow laboratory parameters (use of a flowsheet is highly recommended):
   - follow PG by meter every 30–60 min: does child respond to the poke?
   - follow Na⁺, K⁺, Cl⁻, HCO₃⁻, anion gap, urea, creatinine, capillary pH every 2–4 hours: Ca²⁺, Mg²⁺ and Pi every 2–4 hours if giving phosphate
   - follow (preferably) plasma β-hydroxybutyrate every 2–4 hours or urine ketones with each void

16. Re-evaluate appropriateness of replacement fluid type frequently, anticipating the need to increase or decrease Na⁺, K⁺, dextrose, etc.

Accompanying documents on our website:
- DKA Flowsheet
- DKA Sample Physician Order Sheet
- DKA Nursing Protocol (including the "two-bag" method)
- Pharmacy Recipes for Making DKA Solutions