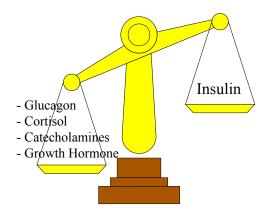


- Clinical judgment always supersedes pathway recommendations - Review all medications, fluids/elctrolytes and procedures for specific contraindications

DIABETIC KETOACIDOSIS GUIDELINES

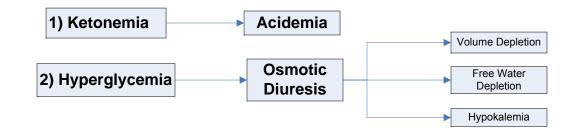
Definition: Metabolic anion-gap acidosis due to elevated serum ketones

PATHOPHYSIOLOGY



Diagnostic Criteria:

- Blood glucose > 250 mg/dL
- Arterial pH <7.3
- Serum Bicarbonate < 18 mEg/L
- Anion Gap > 10
- Ketonuria and/or ketonemia



PROCEED TO

MANAGEMENT

GOALS OF TREATMENT

- Correct ketosis and acidosis with continuous insulin
- Replace electrolyte deficits*
- Replace free water deficit*
- Prevent hypoglycemia
- Determine inciting condition for the DKA
- Correct hyperglycemia (secondary goal)
- When DKA resolved: begin appropriate SQ insulin before stopping Insulin drip

ENSURE:

- Secure airway and adequate ventilation/oxygenation

- Orthostatic hypotension (If not hypotensive)
- Continuous EKG monitoring
- Urine output
- Frequent Vital signs

PLACE:

Adequate IV access (may require 3 ports)

Foley catheter CALCULATE:

- Anion Gap
- Serum Osmolality
- Free Water Deficit
- Corrected Serum Sodium

LABS:

- Basic metabolic panel, Serum phosphate level, hepatic enzymes, A1_C
- beta-HCG. Urine (for women of child bearing age)
- CBC w/differential
- Cardiac enzymes
- Serum ketones/acetone/Beta-hydroxybutyrate
- Venous/Arterial blood gas
- UA/Urine micro/Urine culture

ORDER:

- EKG
- Venous thromboembolism prophylaxis: Heparin 5,000 units SQ BID or TID (unless contraindicated)

INITIAL CARE

CONSIDER, as indicated:

- Further Infectious work up
- Amylase/Lipase to rule out pancreatitis
- Head CT/LP if encephalopathic
- Consider Central access

- Replace volume deficit*

CALCULATIONS

- Anion Gap (AG) [<12-16]:
- $AG = [Na+] [CI^{-} + HCO_{3}^{-}]$
- Serum Osmolality [275-295 mOsm/L]:
- = 2 X Serum Na⁺ (mEq/L) + [Glucose (mg/dL)/18] + [BUN (mg/dL)/2.8]
- Free Water Deficit:
- = Dosing Factor X wt (Kg) X [(Serum Na⁺/140) 1] {Dosing Factor = 0.6 (Male) and 0.5 (Female)}
- Corrected Serum Sodium:

Corrected Na⁺ = Serum Na⁺ mEg/L + (1.6 mEg/L for each 100 mg/dL glucose > 100 mg/dL)

* Patients with ESRD/Anuria may not require volume and K⁺ repletion.

Management of Adult Patients with DKA **Potassium** Insulin IV Fluids - Fingersticks (FS BG) q 1 hour until BG Replacement *Wt < 60 kg may require < 250 mg/dl, stable and no change > 10 smaller volume - Refer to table below % for 3 hours, then FS BG q 2 hour Determine Volume - Serum Chemistry every 4 hours Status Severe Mild Volume Hypovolemia Depletion Regular Insulin: 0.15 Units/Kg as IV Bolus; Then IV infusion @ 0.1 Units/Kg/hr (100 Units/100 mL NS) **Evaluate Corrected Serum Sodium Level** Bolus 1 Liter of 0.9% NS or LR over 15 - 20 mins Start initial infusion 0.9% Corrected Serum [Na⁺] ≥ 140-Corrected Serum [Na⁺] < 140 NS @ 250 - 500 mL/h until volume depletion is mild - If Serum Glucose does not fall by 50 -70 mg/dL 0.45% NaCl @ 100-250 mL/h 0.9% NaCl @ 100-250 mL/h in the next hour: double Insulin Infusion every hour until Glucose Falls by 50-70 mg/dL Serum Glucose Reaches 250 mg/dL Add Dextrose (D₅½NS or D₅NS*) to IVF @ 150 -250 mL/h to maintain serum glucose 150 - 200 mg/dL and continue insulin at same rate Titrate insulin to a minimum 0.1 Units/kg/hr and glucose goal between 150 - 200 mg/dL until ketosis and anion gap resolves. If patient can tolerate PO, encourage consistent carbohydrate diet * Use D₅NS if corrected [Na⁺] ≤ 140 or remains volume depleted Ketoacidosis/ AG persists & FS BG 70 to 150 mg/dL-Ketoacidosis/ AG persists & FS BG < 70 mg/dL-**Normal Anion Gap (AG)** Ketoacidosis/ AG persists & FS BG < 70 mg/dL: - Hold insulin X 15 min & Bolus 1 AMP D50 IVP Ketoacidosis/ AG persists & FS BG 70 to 150 mg/dL: Recheck FS BG if < 70, retreat w/ 1 Start D₁₀W or D₁₀NS @ 150 - 250 mL/h AMP D50 IVP and repeat FS BG and/or consider reducing insulin rate by 1/2. Once FS BG > 70 mg/dL, restart Keep Serum glucose between 150 – 200 **PROCEED** Insulin @ 1/2 prior infusion rate mg/dL Start D₁₀W or D₁₀NS (If volume

POTASSIUM REPLACEMENT

TO PAGE 3

depleted)@ 150 - 250 mL/h

200 mg/dL

Keep Serum glucose between 150 -

down to a minimum of 0.5 unit/hr

If cannot maintain glucose > 150 mg/dL despite D10 and diet then titrate insulin

Serum K+1	Total Replacement Dose ^{2,3} (consider lower dose for renal insufficiency)	Maximum Rate of Infusion	
	HOLD INSULIN		
<u><</u> 3 mEq/L	40 - 80 mEq	- Peripheral Line: 10 mEq/hour	
3.1 – 3.4 mEq/L	40 - 60 mEq	- Central Line: 20 mEq/hour [∆]	
3.5 – 3.9 mEq/L	20 - 40 mEq] ,	
4 – 5 mEq/L ⁴	Add KCI 20 mEq to each liter of IVF	may be exceeded in an adult ICU, ED, OR, PACU	
> 5.5 mEq/L*	No Potassium Replacement	or designated patient care units	

If cannot maintain glucose > 150 mg/dL

despite D10 and diet then titrate insulin

down to a minimum of 0.5 unit/hr

^{*}Check Serum K+ every 2 hours

1 If acidemic, serum K+ may underestimate potassium deficiency

² Please refer to Adult Potassium Replacement Policy: http://www.crlonline.com/crlsql/servlet/crlonline - Can use oral KCl if patient is tolerating enteral

³Refer to Phosphate policy for replacement http://www.crlonline.com/crlsql/servlet/crlonline

⁴IF patient acidemic requires potassium repletion

AG is closed and serum ketosis resolved

Maintain insulin infusion to keep serum glucose 70 – 150 mg/dL (minimum 0.5 Units/hr)

Gap closed and not eating reliably:

Switch to "Insulin drip: Adult General Care Floor: Goal BG 120
 180" (NYP/WC – where available) – Must check for type 1 for all DKA patients

If tolerating oral feeds:

- Discontinue insulin drip 2 hours after administering long-acting SQ insulin

Subcutaneous insulin options (use 1 or 2)

- Calculate total daily dose (TDD): 0.3 Units/kg/day (type 1 & Renal pts) or 0.5 Units/kg/day (type 2):

OPTION #1*

(Preferred)

OPTION #2*

Glargine: 50% of TDD (as above)

For Discontinuation of Drip in AM:

- Pre-breakfast administer both glargine and aspart dose according to pre-meal aspart order set

For Discontinuation of Drip in PM:

 Pre- dinner administer both glargine and aspart dose according to pre-meal aspart order set

NPH: 50 % of TDD (as above)

For Discontinuation of Drip in AM:

 Pre-breakfast administer 2/3 NPH dose and aspart dose according to pre-meal aspart order set

For Discontinuation of Drip in PM:

- Pre- dinner administer 1/3 NPH dose and aspart dose according to pre-meal aspart order set

- * These combinations deliver continuous insulin and prevent recurrent ketosis
- If patient's outpatient regimen was able to achieve optimal glycemic control, consider re-instatement
- Oral agents generally not useful in immediate post-DKA stage

PRIOR TO DISCHARGE:

- Screen and treat for tobacco abuse
- Screen and treat for hyperlipidemia, HTN, microalbuminuria
- Assess peripheral neuropathy w/tuning fork and 10 gram monofilament
- Arrange ophthalmologic/podiatric care as needed
- Referral for outpatient diabetes self-management training
- Screen patient to receive influenza and pneumococcal vaccine
- OOB, d/c foley and unneeded intravenous lines
- If eating reliably can discontinue IV dextrose
- If not volume or free water depleted discontinue IV fluids

- Change fingerstick to qAC and QHS (NYP-WC) with rapid acting insulin meal bolus coverage

- Start consistent carbohydrate diet
- Obtain endocrine consult on all patients on continuous tube feeds or new Type 1 DM and others as needed.
- Nutrition and Diabetes education consult.

Types of Insulin

Types of msum						
Type of insulin	Onset	Peak effect	Duration of action	Dosing time		
MEALTIME INSULIN (SHORT ACTING)						
Aspart (Novolog®) (rapid acting)	5 - 15 min	1 hr	3-5 hrs	Within 20 min, before or after a meal		
Regular (Humulin R®) (short acting)	30 min	2-4 hr	5-8 hr	30 min before a meal		
BASAL INSULIN (LONG ACTING)						
Glargine (Lantus®) (long acting)	1.5-2 hr	No peak	24 hr	Usually q 12 or q 24		
NPH (Humulin N®) (intermediate acting)	1-2 hr	4-12 hr	12-18 hr	Once or Twice daily		

