UNC SCHOOL OF MEDICINE

# Diabetic Ketoacidosis

**Diagnosis/Lab abnormalities with DKA**

| | |
|---|---|
| Hyperglycemia | >300 mg/dl (may be < 200 mg/dl in pregnancy) |
| Arterial pH | < 7.3 |
| HCO3 | < 15mEq/L |
| Serum acetone | positive |
| Anion gap | > 12 mEq/L |
| Osmolality | > 280 mOsm/kg |

**Initial labs (q 2 hours during acute care)**

| | |
|---|---|
| Capillary glucose (q 1 hr) | Creatinine |
| Serum ketones | Na, K, Cl, $HCO_3$ |
| Urinalysis/culture | CBC with differential |
| Arterial blood gas | Anion gap/Osmolality |

## Maternal assessement

- H&P
- IV access x 2
- VS q 15-30 min
- O2 saturation monitoring
- Place Foley
- ICU as indicated
- VTE prophylaxis
- Evaluate for etiology; investigation as indicated with possible
  - Urine culture
  - Chest XR
  - Amniocentesis

## Volume Replacement

Estimated deficit: 100-150 ml/kg

Goal replace: 75% in 24 hours
25% in 24-48 hours
Goal urine output: > 50 ml/hr

**Initial**
0.9% NaCl at 1000 ml/hr
x 2 hours

2 hours

IVF based on corrected Na:
If >= 140 mEq/L: 0.45% NaCl
If < 140 mEq/L: 0.9% NaCl
250-500 ml/hr

Serum glucose < 250 mg/dl

Change IVF to :
D5 0.45% NaCl at 250 ml/hr
Continue x 24-48 until deficit replaced

## Insulin Therapy

glucose goal post DKA
100-150 mg/dl

**Initial IV bolus 10-15 units regular insulin**

**Start IV regular insulin infusion:**
a) 0.1 units/kg/hr IV
- goal decrease serum glucose by 50-75 mg/dl/hr
- if not at goal in one hour, increase infusion rate to 0.2 units/kg/hr
- glucose < 200mg/dl, decrease infusion to 0.05 u/kg/hr

b) use computer algorithm directed IV insulin infusion

Intermittent sc dosing can be started after correction of DKA, and tolerating po
Continue IV insulin x 2 hours after first long acting insulin dose

## Electrolyte replacement

Repeat electrolyte labs q 2 hours

**Potassium**

Goal K 4-5 mEq/L

K 3.3-5.3 mEq/L, add 20-30 mEq to each liter of IVF

K > 5.3, repeat q 2 hours until < 5.3

**Bicarbonate**

If pH < 7.0:
$NaHCO_3$ (50mEq = 100 mmol) in 500 cc 0.45 NaCl with 20 mEq KCL over 2 hours
Repeat q 2 hours until pH > 7.0

if pH > 7.0
$NaHCO_3$ is not indicated

## Fetal assessment

- Lateral uterine displacement
- $O_2$ therapy
- Gestational age specific fetal monitoring; continuous fetal monitoring in setting when fetal intervention considered

Continue above until resolution of DKA defined as:
blood glucose < 200 mg/dl AND two of: bicarbonate >=15mEq/L, venous pH> 7.3, AG <=12mEq/L; fluid deficit replaced

Calculations:
Effective serum osmolality (mOsm/kg) = {2[measured Na(mEq/l)] + [glucose (mg/dl)]/18}
Corrected Na (mEq/L) = measured Na + 0.016 * (glucose mg/dL − 100)
Anion gap = Na – (Cl + HCO3)

References:

*Critical Care Obstetrics, Sixth Edition*. Edited by Jeffrey P. Phelan, Luis D. Pacheco, Michael R. Foley, George R. Saade, Gary A. Dildy, and Michael A. Belfort. © 2019 John Wiley & Sons Ltd.

Diagnosis of DKA

**Joint British Diabetes Societies**

- Blood glucose over 198 mg/dL (11 mmol/l) or known diabetes mellitus
- Venous pH less than 7.3 and/or bicarbonate ($HCO3^-$) below 15 mmol/l
- Ketonemia 3 mmol/l and over, or significant ketonuria (more than 2+ on standard urine sticks)

The presence of one or more of the following may indicate severe diabetic ketoacidosis:

- Blood ketones over 6 mmol/L
- Venous/arterial pH below 7.1
- Bicarbonate level below 5 mmol/l
- Anion gap above 16 (anion gap = $[Na^+ + K^+] – [Cl^– + HCO3^–]$)
- Glasgow Coma Scale (GCS) less than 12, or abnormal AVPU (Alert, Voice, Pain, Unresponsive) scale
- Oxygen saturation below 92% on air (assuming normal baseline respiratory function)
- Systolic blood pressure below 90 mmHg
- Pulse over 100 or below 60 bpm
- Hypokalemia on admission (under 3.5 mmol/l)

**American Diabetes Association**

- Blood glucose over 250 mg/dl (13.9 mmol/L)
- Arterial pH less than 7.3
- Serum bicarbonate below 15 mEq/l
- Moderate degree of ketonemia and/or ketonuria

Severity

| Severity | Arterial pH | Bicarbonate (mEq/L) | Anion gap | Mental status |
|---|---|---|---|---|
| Mild | 7.25-7.3 | 15 - 19 | >10 | Alert |
| Moderate | 7-7.24 | 10 < 15 | >12 | Drowsy |
| Severe | < 7 | <10 | >12 | Stupor |

*Pregestational diabetes mellitus*. ACOG Practice Bulletin No. 201. American College of Obstetricians and Gynecologists. Obstet Gynecol 2018;132:e228–48.

*Continuous fetal heart rate monitoring commonly demonstrates minimal variability and may have late decelerations in the setting of contractions. However, this pattern usually resolves as the maternal condition improves, and delivery is rarely indicated.*

*obtain arterial blood gases to document degree of acidosis present, measure glucose (in addition to hourly capillary blood glucose ketones), and serum ketones electrolyte levels obtained at 1- to 2- hour intervals*

da Veciana, Margarita. *Diabetes ketoacidosis in pregnancy*. Seminars in Perinatology 2013; 37:267-273

Sibai, Baha, Viteri, O. Diabetic ketoacidosis in pregnancy: Clinical expert series. Obstet Gynecol 2014;123:176-78.

*acute diabetic ketoacidosis, the ketone body ratio (3-b-hydroxybutyrate:acetoacetate) rises from normal (1:1) to as high as 10:1*

*the fluid deficit is typically 100 mL/kg of body weight,60 which is equivalent to 6–10 L based on maternal weight*

Revised 3/26/19 BG

These algorithms are designed to assist the primary care provider in the clinical management of a variety of problems that occur during pregnancy. They should not be interpreted as a standard of care, but instead represent guidelines for management. Variation in practices should take into account such factors as characteristics of the individual patient, health resources, and regional experience with diagnostic and therapeutic modalities.


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