Guideline Name:	**COVID-19 Critical Care Subcutaneous Guideline for Hyperglycemia and/or Mild-Moderate DKA**
Guideline #	**5.2.13**
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Sponsor:	**Diabetes Subcommittee of P&T Committee**
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BWH COVID-19 Critical Care Subcutaneous Insulin Guideline for Hyperglycemia and/or Mild-Moderate DKA

APPROPRIATE PATIENT: Critically ill patient with COVID-19 and 2 consecutive glucoses >200 mg/dL 4 hours apart OR mild-moderate DKA
TARGET GLUCOSE RANGE: 100-200 mg/dL 80% of the time in the last 24 hours (may be individualized)
PURPOSE: Use of aspart q 4h with basal insulin to allow 1) high insulin doses when needed distributed across multiple adjustable doses per day, 2) minimize frequency of glucose monitoring and 3) minimize risk of hypoglycemia

*********IMPORTANT: This protocol should NOT be used for the following patients*********
Patients who are not critically ill and/or eating meals: Please refer to BWH Management of Diabetes and Hyperglycemia in non-ICU patients and Guide to Management of Inpatient Hyperglycemia Pocket Card
Patients who are on > 1 vasopressor: Please refer to BWH Management of Critically Ill Patient and use IV insulin Infusion per BHIP
Severe Hyperglycemic Crisis = DKA with bicarbonate ≤ 10 mEq/L and/or HHS (calculated OSM_{eff} ≥ 320)^: see BWH Hyperglycemic Crisis Management Guideline and EPIC DKA/HHS order set

^Calculated effective osmolality (Osm_{eff})= 2[Na^+] + BG/18 (note: for calculation use measured (not corrected) Na^+)

IF PATIENT MEETS CRITERIA FOR MILD-MODERATE DKA SEE NEXT SECTION

(Glucose >250 mg/dL, ketosis as defined by elevated serum BHB or urine ketones WITH acidosis as defined by bicarbonate 10-18 mEq/L and/or acidemia measured by venous or arterial pH 7.1-7.3)

NON-DKA HYPERGLYCEMIA

Insulin Therapy:

STEP 1: Discontinue ALL prior insulin orders.

STEP 2: Order POC glucose check every 4 hours.

STEP 3: Choose Low, Medium or High dosing strategy. Select patient characteristic and order insulin per the corresponding row (glargine OR NPH *plus* aspart). Start at Low dose for all patients ***EXCEPT*** start Medium dose if patient already received > 0.5 units/kg/day total daily dose of *scheduled or IV* insulin.

STEP 4: Plan for Hypoglycemia Prevention and Treatment. For ANY glucose 71-120 mg/dL: Hold Aspart. Reduce all future scheduled insulin doses by 20%. Start dextrose-containing fluids IF continuous nutrition has been held. **For ANY glucose <70 mg/dL**: Hold Aspart. Give IVP 12.5g D50 and Start dextrose containing fluid until glucose is >120 mg/dL for at least 4 hours. Continue dextrose-containing fluids if continuous nutrition has been held. Reduce ALL future scheduled doses of ALL insulin by 30%.

STEP 5: Place orders using EPIC Adult Basal/Bolus Order set. See below for guidance on How to Write Orders.

STEP 6: Titrate insulin*. If above range (defined above or individualized):* Increase scheduled insulin doses by 20% per dose 1-2 times daily until target range achieved. After 3 or 4 titrations, if still above goal, move to next dosing level.

Low dose strategy: Starts at total daily insulin dose between 0.4 – 0.6 units/kg/day

Patient characteristic	Glargine (Lantus) *	NPH	Aspart fixed dose	Aspart scale q 4h
Prior Diabetes	0.25 units/kg/dose q 24h OR	0.12 units/kg/dose q 12h		Low
No known Diabetes	0.2 units/kg/dose q 24h OR	0.1 units/kg/dose q 12h		Low
High dose steroids[€] or continuous nutrition support		0.15 units/kg/dose q 12h	0.05 units/kg/dose scheduled q 4h	Low

Medium dose strategy: Starts at total daily insulin dose = 0.6 - 1.4 units/kg/day

Patient characteristic	Glargine (Lantus)*	NPH	Aspart fixed dose	Aspart scale q 4h
Prior Diabetes	0.3 units/kg/dose q 24h OR	0.15 units/kg/dose q 12h	0.1 units/kg/dose scheduled q 4h	Moderate
No known diabetes	0.25 units/kg/dose q 24h OR	0.1 units/kg/dose q 12h	0.05 units/kg/dose scheduled q 4h	Moderate
High dose steroids[€] or Continuous nutrition support		0.25 units/kg/dose q 12h	0.15 units/kg/dose scheduled q 4h	Moderate

High dose strategy A. Starts at total daily insulin dose = 1.5 to 1.95 units/kg/day. NOTE: Before moving to High Dose, INJECT INTO NEW subcutaneous injection site. Abdomen (anterior or side) and upper buttock are preferred for best subcutaneous absorption

Patient characteristic	Glargine (Lantus)*	NPH	Aspart fixed dose	Aspart Scale q 4h
Prior Diabetes	0.5 units/kg/dose q 24h OR	0.25 units/kg/dose q 12h	0.15 units/kg/dose scheduled q 4h	**Custom
No known diabetes	0.3 units/kg/dose q 24h OR	0.15 units/kg/dose q 12h	0.1 units/kg/dose scheduled q 4h	**Custom
High dose steroids[€] or Continuous nutrition support		0.25 units/kg/dose q 8h	0.2 units/kg/dose scheduled q 4h	**Custom

High dose strategy B. Starts at total daily Insulin dose = 2.1-3 units/kg/day NOTE: This requires inpatient diabetes consultation. Please page **Unit based Pharmacist, Endocrinology (11519) or DMS (34444)** for starting IV hourly dose. If target glucose not achieved after 36 hours on step 2, consider continuous IV insulin protocol provider adjusted with modified targets and frequency of glucose monitoring.

Patient characteristic	Glargine (Lantus)	NPH	Aspart fixed dose	Aspart Scale q 4h
Prior Diabetes		0.3 units/kg/dose q 8h	0.2 units/kg/dose scheduled q 4h	**Custom
No known diabetes		0.3 units/kg/dose q 8h	0.2 units/kg/dose scheduled q 4h	**Custom
High dose steroids[€] or Continuous nutrition support		0.4 units/kg/dose q 8h	0.3 units/kg/dose scheduled q 4h	**Custom

[*]Glargine is preferred for patients at higher risk of hypoglycemia: GFR <30, Age >75, advanced cirrhosis

[€]High dose steroids: equivalent of >40 mg prednisone, >100 mg hydrocortisone or >6 mg dexamethasone per day

**Custom scale (Correction factor 1:15)
If BG 150-180 mg/dL: 2 units
If BG 181-210 mg/dL: 4 units
If BG 211-240 mg/dL: 6 units
If BG 241-270 mg/dL: 8 units
If BG 271-300 mg/dL: 10 units
If BG 301-330 mg/dL: 12 units
If BG >331 mg/dL: 14 units

How to write insulin orders in EPIC:

Go to order tab, search order **sets** and type “insulin”

Select “Adult Basal/Bolus” order set

Select POC with frequency q 4h (may order as 8am, 12pm, 4pm, 8pm, 12am, 4am which is preferable)

Choose drop-down selection “for patients on TF or TPN” for patients who are currently receiving enteral or parenteral nutrition

Select basal insulin (glargine **OR** NPH). For glargine choose frequency daily (may also order as nightly which is preferable)

For NPH choose frequency q12h (may order as 8am and 8pm which is preferable)

Select nutritional insulin aspart enter dose and select q 4h frequency. In administration instructions add “If glucose less than 120 mg/dL: Hold Aspart and page RC to consider insulin or fluid adjustment”

Select correctional insulin aspart with q 4h frequency (choose scale, low, moderate or custom based on dosing level).

Please note for custom ordering include dosing range 0-14 units and enter 1:15 scale above in dosing administration

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Next page: DKA MANAGEMENT

MILD TO MODERATE DIABETIC KETOACIDOSIS

Please note the subcutaneous insulin protocol replaces IV insulin infusion for mild-moderate uncomplicated DKA and has been adapted for COVID-19. Please contact Endocrine (11519) or DMS (34444) with any questions and see BWH Hyperglycemic crisis guideline for additional reference and use EPIC DKA/HHS order set and select "subcutaneous insulin regimen."

IMPORTANT: Patient must have ALL of the following criteria for mild to moderate DKA: glucose >250 mg/dL, ketosis as defined by elevated serum BHB or urine ketones WITH acidosis as defined by bicarbonate 10-18 mEq/L and/or acidemia by venous or arterial pH <7.1-7.3

THIS PROTOCOL SHOULD NOT BE USED FOR THE FOLLOWING:

Severe DKA or HHS: bicarbonate <10mEq/L AND/OR pH ≤7.1 AND/OR effective osmolality OSM_{eff} ≥ 320

*Calculated Effective osmolality (Osm_{eff})= 2[Na^+] +BG/18 (note: for calculation use measured (not corrected) Na^+)

Patients with the following medical conditions: pregnancy, acute CHF exacerbation, ESRD or CKD stages 4 and 5, acute hepatic failure or decompensated cirrhosis

Fluids and Electrolytes:

IMPORTANT: Hypoglycemia prevention: WITH FIRST BG < 250 mg/dL, change IVF to D51/2 NS at 150-250 cc/hr

Hypovolemia: 0.5-1 L NS bolus with maintenance fluid rate dosed based on physiologic parameters and repletion of intravascular and extravascular volume

Hypernatremia (corrected Na^+ >135): consider change to D51/2 NS at 150-250 cc/hr

Hypokalemia: see table below replete per EPIC K^+ order set

Hyperchloremia and Hypobicarbonemia: consider changing to LR

Potassium Repletion: for initial KCL administration see table below. Monitor K^+ q 4-6 h. For maintenance dosing See EPIC Order for K^+ replacement scale.

Serum K+ (mEq/L)	Peripheral or Enteral	Central
>5 or/ urine output < 0.5 cc/kg/hr	None	None
4-5	10 mEq IV x 2 doses OR 20 mEq enterally	20 mEq IV
3-4	10 mEq IV x 4 doses OR 40 mEq enterally	20 mEq IV x 2 doses
<3	10 mEq IV x 6 doses OR 40 mEq enterally then 20 mEq 2hr after	20 mEq IV x 3 doses

Insulin Therapy:

Administer both long acting insulin (glargine) dosed every 24 hours and rapid acting insulin (aspart), which should be dosed q4 hours

	Subcutaneous rapid acting insulin (aspart) q4 hours	Subcutaneous long acting insulin (glargine) q24 hours
Initial dose	0.3 units/kg/dose **Maximum of 20 units**	If eGFR >40: 0.25 units/kg/dose If eGFR <40: 0.15 units/kg/dose
Subsequent dose	0.2 units/kg every 4 h **Maximum of 20 units**	Re-dose glargine in 24 h based on response to initial dose
Blood glucose < 250 mg/dL	0.05-0.1 units/kg every 4 h and start IV Dextrose containing fluid	Re-dose glargine q 24h based on response to subsequent dose

DKA Monitoring and Transition Recommendations:

Patients will need q4-6h chemistry monitoring (BMP) and electrolyte repletion as above. **When AG < 12 and bicarbonate > 18 mEq/L, transition to non-DKA subcutaneous regimen**. Dextrose may be tapered to off. Please see NON-DKA HYPERGLYCEMIA guide above or pocket card reference guide. For patients **who are not critically ill and/or eating meals:** Please refer to the BWH Management of Diabetes and Hyperglycemia in non-ICU patients guideline.

4/15/2020

How to write subcutaneous insulin orders in EPIC for DKA:

Go to order tab, search order **sets** and type “insulin”

Select “DKA/HHS” order set

Select POC with frequency q4h

Choose drop-down selection “subcutaneous insulin regimen”

Add order for basal insulin glargine and enter dose and choose frequency daily (may also order as nightly which is preferable)
