

Hyperglycemic Emergency Management (DKA/HHS¹) - Adult

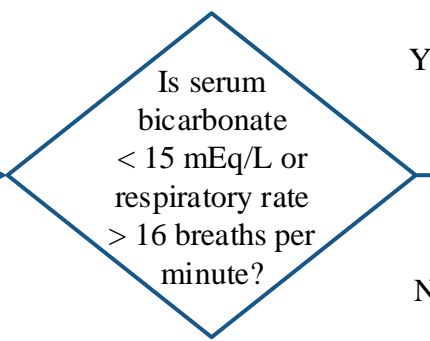
Disclaimer: This algorithm has been developed for MD Anderson using a multidisciplinary approach considering circumstances particular to MD Anderson's specific patient population, services and structure, and clinical information. This is not intended to replace the independent medical or professional judgment of physicians or other health care providers in the context of individual clinical circumstances to determine a patient's care.

PATIENT PRESENTATION

WORKUP/ ASSESSMENT

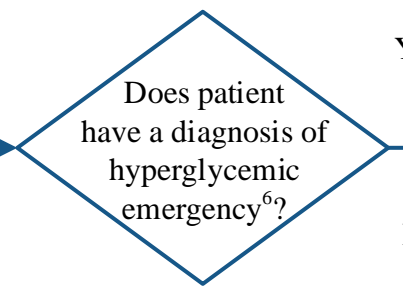
Patient presenting with polyuria, polydipsia, nausea/vomiting, or abdominal pain with or without history of Type 1 or 2 diabetes mellitus

- History and physical
 - Basic metabolic panel, calcium, phosphorus and magnesium every 4 hours
 - Capillary blood glucose every hour
 - Urine ketones²
 - Ionized calcium
 - Diagnostic imaging as clinically indicated
- Note: Interventions³ for urinary output and serum bicarbonate



Obtain arterial blood gas⁴

- Capillary blood glucose every hour
- Assess⁵ the following:
 - Hydration status
 - Electrolyte status
 - Blood glucose
 - Acidosis
 - Calculate anion gap



- Initiate Step 1 of 2: DKA or HHS Hyperglycemia INITIATION order set
- Consult Endocrinology
- See [Page 2](#) for DKA/HHS Management

Continue work up for further treatment or alternative diagnosis

¹ Diabetic ketoacidosis (DKA) and hyperosmolar hyperglycemic state (HHS)

² If urine ketones are positive, send serum beta-hydroxybutyrate, and start treatment pending results

³ Interventions:

- Strict input and output hourly for a total of 4 hours and notify physician if urine output is < 0.5 mL/kg/hour
- Notify physician if serum bicarbonate < 15 mEq/L

⁴ Notify physician if pH < 7.2

⁵ Continue to look for the underlying cause of events

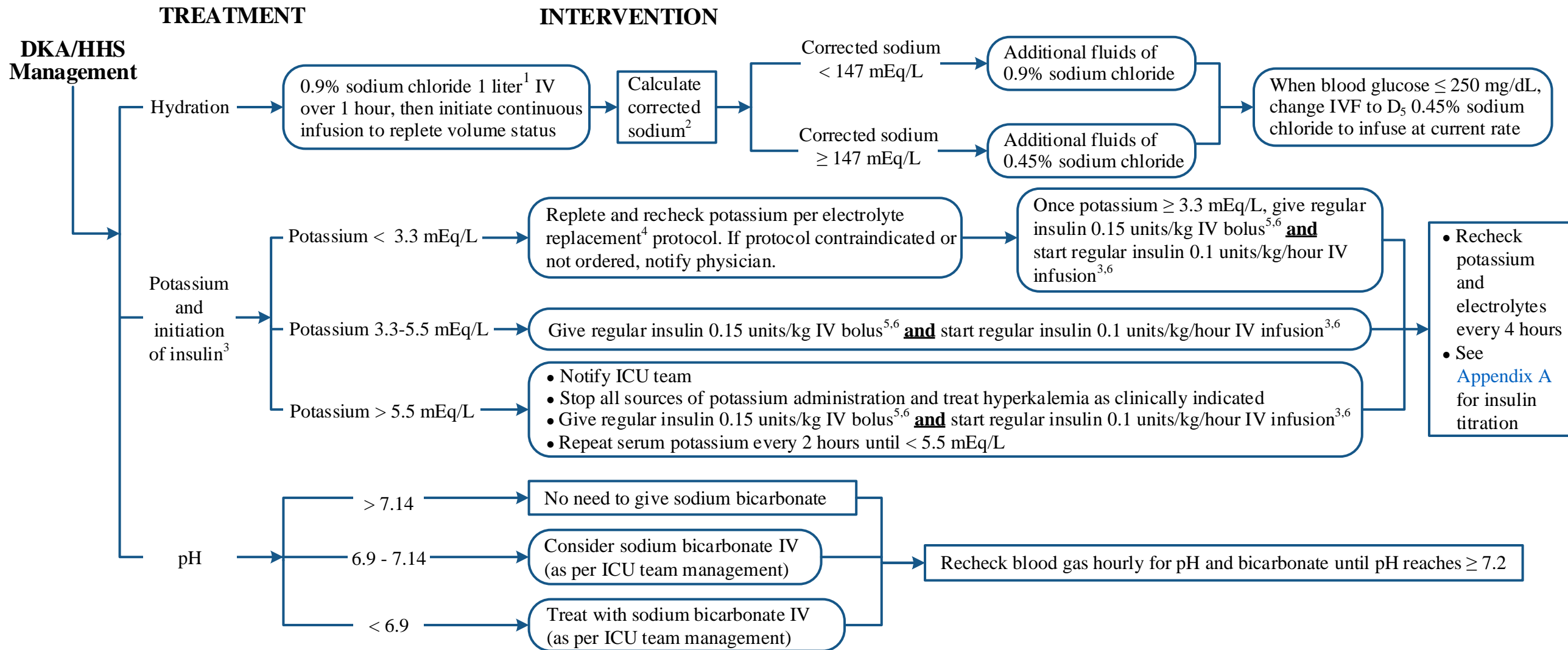
⁶ Diagnostic criteria:

DKA: blood glucose > 250 mg/dL, arterial pH < 7.3, bicarbonate < 15 mEq/L, and moderate ketonuria or ketonemia [Note: Blood glucose may be lower than expected in patients on SGLT-2 inhibitors (e.g., empagliflozin, canagliflozin)]

HHS: blood glucose > 600 mg/dL, arterial pH > 7.3, bicarbonate > 15 mEq/L, and minimal ketonuria and ketonemia

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¹ Consider reduction for patients with heart failure, end-stage liver or renal disease, or > 65 years old

² Calculation for corrected sodium = 0.016 x (measured glucose – 100) + measured sodium

³ Prime all insulin tubing with 25 units of insulin from bag and do not administer via manifold

⁴ Refer to the Critical Care Adult PRN Electrolyte Replacement Orders

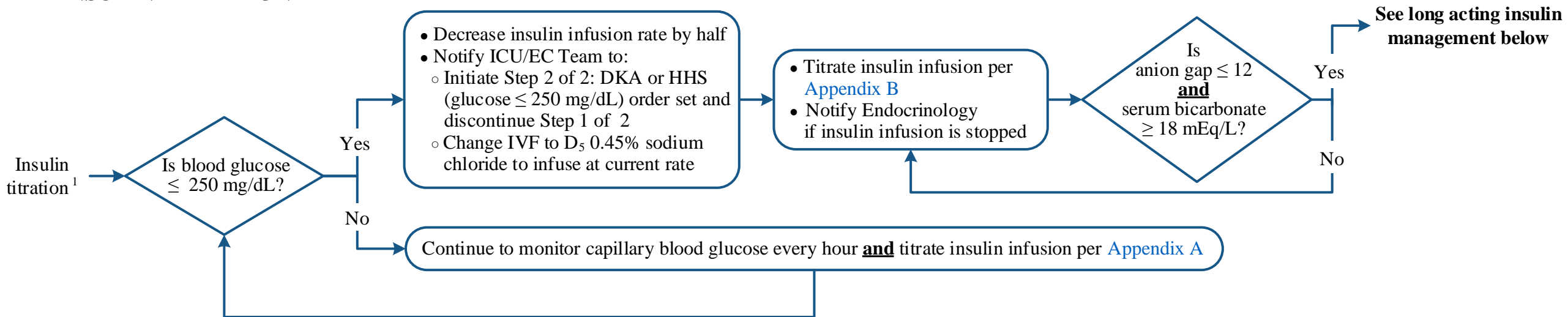
⁵ For insulin management with regular insulin bolus: Usual dose 10-15 units for patients 70-100 kg

⁶ Consider reducing insulin dose for patients with liver dysfunction/failure or renal disease

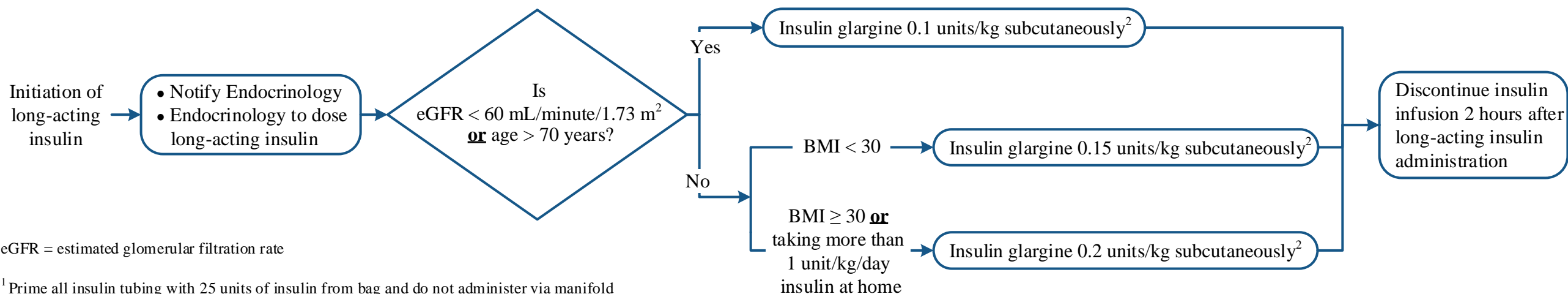
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INSULIN TITRATION



LONG ACTING INSULIN MANAGEMENT



eGFR = estimated glomerular filtration rate

¹ Prime all insulin tubing with 25 units of insulin from bag and do not administer via manifold

² Consider reducing insulin dose for patients with liver dysfunction/failure

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APPENDIX A: Blood Glucose Monitoring and Insulin Drip Management for Blood Glucose > 250 mg/dL

Glucose Level	Intervention	Recheck Glucose
<ul style="list-style-type: none"> Decreased by < 50 mg/dL or increased by any amount And remains > 250 mg/dL 	Double infusion rate	1 hour post change
Decreased by 50-100 mg/dL and remains > 250 mg/dL	Continue current rate	1 hour
Decreased by > 100 mg/dL and remains > 250 mg/dL	<ul style="list-style-type: none"> Decrease rate by half Notify Endocrinology, if infusion stopped 	1 hour post change

Once blood glucose is \leq 250 mg/dL:

- Decrease insulin infusion rate by half **and**
- Notify ICU/EC Team:
 - Initiate Step 2 of 2: DKA or HHS (Glucose \leq 250 mg/dL) order set and discontinue Step 1 of 2
 - Change IVF to D₅ 0.45% sodium chloride to infuse at current rate
- See [Appendix B](#)

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APPENDIX B: Blood Glucose Monitoring and Insulin Drip Titration for Blood Glucose ≤ 250 mg/dL

Note: Check capillary glucose 1 hour after initiating Step 2 insulin infusion and titrate per parameters below.

Glucose Level	Intervention	Recheck Glucose
Decrease > 100 mg/dL at one time	<ul style="list-style-type: none"> Decrease infusion rate by half Recheck capillary glucose in 1 hour 	1 hour
< 70 mg/dL	<ul style="list-style-type: none"> Stop infusion, give D₅₀W 25 mL IV push, and notify Endocrinology Recheck capillary glucose every hour until glucose is > 180 mg/dL and restart infusion at half the previous rate when glucose > 180 mg/dL on 1 measurement 	1 hour
70-90 mg/dL	<ul style="list-style-type: none"> Stop infusion, notify Endocrinology Recheck capillary glucose every hour until glucose is > 180 mg/dL and restart infusion at half the previous rate when glucose > 180 mg/dL on 1 measurement 	1 hour
91-120 mg/dL	<ul style="list-style-type: none"> Decrease infusion rate by half of the current rate and recheck capillary glucose in 1 hour If infusion stopped, notify Endocrinology and recheck capillary glucose every hour until glucose is > 180 mg/dL. Restart infusion at half the previous rate when glucose > 180 mg/dL on 1 measurement. 	1 hour
121-140 mg/dL	<ul style="list-style-type: none"> Decrease infusion rate by 1 unit/hour and recheck capillary glucose in 1 hour If infusion stopped, notify Endocrinology and recheck capillary glucose every hour until glucose is > 180 mg/dL. Restart infusion at half the previous rate when glucose > 180 mg/dL on 1 measurement. 	1 hour
141-180 mg/dL	<ul style="list-style-type: none"> No change in Insulin infusion rate and recheck capillary glucose in 1 hour. If no change in infusion rate needed for 3 consecutive hours, decrease glucose monitoring to every 2 hours. If infusion stopped, notify Endocrinology and recheck capillary glucose every hour until glucose is > 180 mg/dL. Restart infusion at half the previous rate when glucose > 180 mg/dL on 1 measurement. 	1 hour
181-200 mg/dL	<ul style="list-style-type: none"> If glucose increasing, increase infusion rate by 1 unit/hour and recheck capillary glucose in 1 hour If glucose decreasing or the same, continue current rate and recheck capillary glucose in 1 hour 	1 hour
201-250 mg/dL	<ul style="list-style-type: none"> If glucose increasing, increase infusion rate by 1.5 units/hour and recheck capillary glucose in 1 hour If glucose decreasing or the same, continue current rate and recheck capillary glucose in 1 hour 	1 hour
251-300 mg/dL	<ul style="list-style-type: none"> If glucose increasing, increase infusion rate by 2 units/hour and recheck capillary glucose in 1 hour If glucose decreasing or the same, continue current rate and recheck capillary glucose in 1 hour 	1 hour
301-350 mg/dL	<ul style="list-style-type: none"> If glucose increasing, bolus 10 units of regular insulin IV push AND increase infusion rate by 2 units/hour. Recheck capillary glucose in 1 hour. If glucose decreasing or the same, continue current rate and recheck capillary glucose in 1 hour 	1 hour
> 350 mg/dL	<ul style="list-style-type: none"> If glucose increasing, bolus 15 units of regular insulin IV push AND increase infusion rate by 2 units/hour. Recheck capillary glucose in 1 hour. If glucose decreasing or the same, continue current rate and recheck capillary glucose in 1 hour 	1 hour

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SUGGESTED READINGS

- De Beer, K., Michael, S., Thacker, M., Wynne, E., Pattni, C., Gomm, M., . . . Ullah, K. (2008). Diabetic ketoacidosis and hyperglycaemic hyperosmolar syndrome—clinical guidelines. *Nursing in Critical Care, 13*(1), 5-11. <https://doi.org/10.1111/j.1478-5153.2007.00259.x>
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DEVELOPMENT CREDITS

This practice consensus statement is based on majority opinion of the Hyperglycemic Emergency Management work group at the University of Texas MD Anderson Cancer Center for the patient population. These experts included:

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