



YALE-NEW HAVEN HOSPITAL INSULIN INFUSION PROTOCOL



(Revised, November 06)

The following insulin infusion protocol is intended for use in hyperglycemic adult patients in an ICU setting, but is not specifically tailored for those individuals with diabetic emergencies, such as diabetic ketoacidosis (DKA) or hyperglycemic hyperosmolar states (HHS). When these diagnoses are being considered, or if BG > 500 mg/dL, the responsible physician should be consulted for specific orders. Also, notify the responsible physician immediately if the response to the insulin infusion is unusual or unexpected, or if any situation arises that is not adequately addressed by these guidelines. Any patient on an insulin infusion should have frequent measurement of serum electrolyte concentrations, especially potassium.

Initiating the Insulin Infusion

- 1.) INSULIN INFUSION: Mix 1 unit Regular Human Insulin per 1 cc 0.9 % NaCl. Administer via infusion pump (in increments of 0.5 unit/hr.)
- 2.) PRIMING: Flush 20 cc of infusion through all IV tubing before infusion begins (to saturate the insulin binding sites in the tubing.)
- 3.) THRESHOLD: IV insulin is indicated in any critically ill patient with persistent BG \geq 140 mg/dL; consider use if BG \geq 120 mg/dL.
- 4.) TARGET BLOOD GLUCOSE (BG) LEVEL: **90-120 mg/dL**.
- 5.) BOLUS & INITIAL INSULIN INFUSION RATE: If initial BG \geq 150 mg/dL, divide by 70, then round to nearest 0.5 units for bolus AND initial drip rate. If initial BG $<$ 150 mg/dL, divide by 70 for initial drip rate only (i.e., NO bolus.)
Examples: 1.) Initial BG = 335 mg/dL: $335 \div 70 = 4.78$, round \uparrow to 5: 5 units IV bolus + start infusion @ 5 units/hr.
 2.) Initial BG = 148 mg/dL: $148 \div 70 = 2.11$, round \downarrow to 2: start drip @ 2 units/hr (NO bolus.)

Blood Glucose (BG) Monitoring

- 1.) Check BG hourly until stable (3 consecutive values within target range). In hypotensive patients, capillary blood glucose (i.e., fingersticks) may be inaccurate and obtaining blood sample from an indwelling vascular catheter may be preferable.
- 2.) Then check BG Q2 hours; once stable x 12-24 hours. BG checks can then be spaced to Q4 hours IF:
 - a.) no significant change in clinical condition AND
 - b.) no significant change in nutritional intake.
- 3.) If any of the following occur, consider the temporary resumption of hourly BG monitoring, until BG is again stable (2-3 consecutive BG values within target range):
 - a.) any change in insulin infusion rate (i.e., BG out of target range)
 - b.) significant changes in clinical condition
 - c.) initiation or cessation of steroid or pressor therapy
 - d.) initiation or cessation of renal replacement therapy (dialysis, CVVH, etc.)
 - e.) initiation, cessation, or rate change of nutritional support (TPN, PPN, tube feedings, etc.)

Changing the Insulin Infusion Rate

If BG $<$ 50 mg/dL:

HOLD INSULIN INFUSION

Give 1 amp (25 g) D50 IV; recheck BG Q15 minutes.
 \Rightarrow When BG \geq 90 mg/dL, wait 1 hour, recheck BG. If still \geq 90 mg/dL, restart infusion at 50% of most recent rate.

If BG 50-69 mg/dL:

HOLD INSULIN INFUSION

If symptomatic (or unable to assess), give 1 amp (25 g) D50 IV; recheck BG Q15 minutes.
 If asymptomatic, give 1/2 Amp (12.5 g) D50 IV or 8 ounces juice; recheck BG Q15-30 minutes.
 \Rightarrow When BG \geq 90 mg/dL, wait 1 hour, recheck BG. If still \geq 90 mg/dL, restart infusion at 75% of most recent rate.

If BG \geq 70 mg/dL:

STEP 1: Determine the CURRENT BG LEVEL - identifies a COLUMN in the table:

BG 70-89 mg/dL	BG 90-119 mg/dL	BG 120-179 mg/dL	BG \geq 180 mg/dL
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STEP 2: Determine the RATE OF CHANGE from the prior BG level - identifies a CELL in the table - Then move right for INSTRUCTIONS:

[Note: If the last BG was measured 2-4 hours before the current BG, calculate the hourly rate of change. Example: If the BG at 2PM was 150 mg/dL and the BG at 4PM is now 120 mg/dL, the total change over 2 hours is -30 mg/dL; however, the hourly change is -30 mg/dL \div 2 hours = -15 mg/dL/hr.]

BG 70-89 mg/dL	BG 90-119 mg/dL	BG 120-179 mg/dL	BG \geq 180 mg/dL	INSTRUCTIONS*
		BG \uparrow by $>$ 40 mg/dL/hr	BG \uparrow	INCREASE INFUSION by "2A"
	BG \uparrow by $>$ 20 mg/dL/hr	BG \uparrow by 1-40 mg/dL/hr OR BG UNCHANGED	BG UNCHANGED OR BG \downarrow by 1-40 mg/dL/hr	INCREASE INFUSION by "A"
BG \uparrow	BG \uparrow by 1-20 mg/dL/hr, BG UNCHANGED, OR BG \downarrow by 1-20 mg/dL/hr	BG \downarrow by 1-40 mg/dL/hr	BG \downarrow by 41-80 mg/dL/hr	NO INFUSION CHANGE
BG UNCHANGED OR BG \downarrow by 1-20 mg/dL/hr	BG \downarrow by 21-40 mg/dL/hr	BG \downarrow by 41-80 mg/dL/hr	BG \downarrow by 81-120 mg/dL/hr	DECREASE INFUSION by "A"
BG \downarrow by $>$ 20 mg/dL/hr see below†	BG \downarrow by $>$ 40 mg/dL/hr	BG \downarrow by $>$ 80 mg/dL/hr	BG \downarrow by $>$ 120 mg/dL/hr	HOLD INFUSION for 30min, then DECREASE by "2A"

†HOLD INSULIN INFUSION; check BG Q15-30 min; when \geq 90 mg/dL, restart infusion at 75% of most recent rate.

*CHANGES IN INFUSION RATE ("A") are determined by the current rate:

Current Rate (units/hr)	Δ = Rate Change (units/hr)	2Δ = 2X Rate Change (units/hr)
$<$ 3	0.5	1
3 – 6	1	2
6.5 – 9.5	1.5	3
10 – 14.5	2	4
15 – 19.5	3*	6*
20 – 24.5*	4*	8*
\geq 25*	5*	10*

* Depending on the clinical circumstances, infusion rates typically range between 2 and 10 units/hour. Doses in excess of 20 units/hour are unusual, and if required, the responsible physician should be notified to explore other potential contributing factors (including technical problems, such as a dilutional error, etc.)