

IV Insulin Infusion Protocol for Critically-Ill Adult Patients in the ICU Setting

This algorithm is not intended to be used for those individuals with type 1 diabetes, diabetic ketoacidosis or hyperglycemic hyperosmolar states.

TARGET RANGE FOR GLYCEMIC CONTROL: 80–140 mg/dL (Generally 110 mg/dL)

1. Standard drip 100 units/100 mL 0.9% NaCl.
Approved IV insulins include Regular, aspart and glulisine
2. Start IV insulin therapy when glucose is above target range. Insulin infusions should be discontinued when
 - a. Patient has no history of diabetes and is receiving <1 Unit/hour
 - b. Patient receives 1st dose of SC basal + bridging dose of fast analog or R (see #10)
3. Bolus dose and Initial Infusion rate: Divide initial glucose level by 100, then round to nearest 0.5 units for bolus AND initial infusion rate
 Examples:
 - 1) Initial glucose=326 mg/dL: $326 \div 100 = 3.26$, round to 3.5: IV bolus 3.5 units + start infusion @ 3.5 units/hour
 - 2) Initial glucose=174 mg/dL: $174 \div 100 = 1.74$, round to 1.5: IV bolus 1.5 units + start infusion @ 1.5 units/hour
4. Intravenous Fluids
 - ♦ Most patients will need 5–10 g glucose per hour D5W or D5W $\frac{1}{2}$ NS at 100–200 mL/hour or equivalent (TPN, enteral feeding, etc.)
5. Adjusting the Infusion:
 - ♦ **Algorithm 1:** Start here for most patients.
 - ♦ **Algorithm 2:** For patients not controlled with Algorithm 1, or start here if s/p CABG, solid organ or islet cell transplant, receiving glucocorticoids etc. or patient with diabetes receiving >80 units/day of insulin as an outpatient.
 - ♦ **Algorithm 3:** For patients not controlled on Algorithm 2. NO PATIENT STARTS HERE without authorization from the endocrine service.
 - ♦ **Algorithm 4:** For patients not controlled on Algorithm 3. NO PATIENT STARTS HERE

Algorithm 1		Algorithm 2		Algorithm 3		Algorithm 4	
Glucose	units/h	Glucose	units/h	Glucose	units/h	Glucose	units/h
<60 = Hypoglycemia (See #8 for treatment)							
<70	Off	<70	Off	<70	Off	<70	Off
70–109	0.2	70–109	0.5	70–109	1	70–109	1.5
110–119	0.5	110–119	1	110–119	2	110–119	3
120–149	1	120–149	1.5	120–149	3	120–149	5
150–179	1.5	150–179	2	150–179	4	150–179	7
180–209	2	180–209	3	180–209	5	180–209	9
210–239	2	210–239	4	210–239	6	210–239	12
240–269	3	240–269	5	240–269	8	240–269	16
270–299	3	270–299	6	270–299	10	270–299	20
300–329	4	300–329	7	300–329	12	300–329	24
330–359	4	330–359	8	330–359	14	330–359	28
>360	6	>360	12	>360	16	>360	32

6. Moving from Algorithm to Algorithm:

- ◆ Moving Up: When glucose remains outside the target range after titrating insulin
- ◆ Moving Down: When glucose is <70 mg/dL x 2 or decreases >60 mg/dl in 1 hour

7. Patient Monitoring:

- ◆ Hourly venous (lab) determinations until glucose <450 mg/dL; then capillary glucose (finger sticks) q 1hour until glucose is within goal x 4 hours; then every 2 hours x 4 hours; If stable, decrease monitoring to every 4 hours
- ◆ Hourly monitoring indicated for critically ill patients even if the glucose is stable
- ◆ In hypotensive patients (BP <80/60), capillary glucose values may be inaccurate. Obtain venous blood for glucose determinations
- ◆ If any of the following occur, temporarily resume hourly glucose monitoring, until glucose is again stable (2–3 consecutive values within target range):
 - Any change in insulin infusion rate
 - Significant changes in clinical condition
 - Starting or stopping pressor or steroid therapy
 - Starting or stopping dialysis
 - Starting, stopping or changing rates of TPN, PPN or tube feedings

8. Treatment of Hypoglycemia (Glucose <60 mg/dL)

- ◆ Discontinue insulin drip AND
- ◆ Give D50W IV Glucose 40–60 mg/dL 12.5 g (1/2 amp)
 Glucose <40 mg/dL 25.0 g (1 amp)
- ◆ Recheck glucose every 15–30 minutes and repeat D50W IV as above. Restart insulin drip, one algorithm lower, when glucose >80 mg/dL x 2

9. Notify the physician:

- ◆ For patients not responding to Algorithm 1 or 2.
- ◆ For hypoglycemia which has not resolved after administration of D50W IV and discontinuation of the insulin drip

10. Transition from IV insulin to SC insulin: “Basal-Analog” Method

- a. Calculate Total Daily Dose (TDD) for subcutaneous insulin

$$\text{TDD} = \text{Infusion rate/h} \times 20\text{h}$$

- b. *First* dose SQ insulin includes [basal insulin + bridging dose aspart, glulisine, lispro or R] x 1

1. If patient *will begin eating give*:

- Half TDD as basal glargine, detemir* or NPH* Plus
- Bridging insulin** @ 10% of basal insulin dose
- Stop IV insulin
- Continue primary I.V.

2. If patient *will continue NPO, TPN or tube feeding give*:

- All TDD as basal glargine, detemir* or NPH* Plus
- Bridging insulin** @ 5% of basal insulin dose
- Stop IV insulin and continue primary I.V.

- c. Proceed to “Inpatient Management of Insulin in the Non-Critical Care Setting” algorithm for management of daily basal insulin, prandial + supplemental insulin**

* No evidence-based data on inpatient transition from I.V. insulin to detemir. If detemir is selected, expect to use at least 25% greater dose than glargine. If the dose of detemir is <0.6 units/Kg, use half bid. If NPH is used as a basal insulin the dose is 2/3 of the TDD (whether or not the patient is eating) and is distributed bid as 2/3 A.M. and 1/3 H.S. or may be divided equally and given q 6h.

** R (regular insulin) is not preferred as a bridging or prandial insulin

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