

 <p>CLINICAL PRACTICE PROTOCOL</p>	Clinical Protocol: Critical Care: Insulin Infusion Guideline (Adults)	
	Approval Date: <i>July 2, 2019</i>	Pages: <i>1 of 4</i>
	Approval By: <i>Professional Advisory Committee Standards Committee</i>	Supersedes: <i>New</i>

1. PURPOSE AND INTENT

This guideline is designed to ensure the adequate and safe administration of an Insulin infusion for a target blood sugar (BS) of 5-10 mmol/L. Included in this guideline are parameters for frequency of monitoring and glucose administration in the event of hypoglycemia and subsequent monitoring parameters.

If other target ranges are ordered, the principles of this guideline may still apply however the specific values would change.

2. PRACTICE OUTCOME

The maintenance of blood glucose levels in the range of 5-10 mmol/L in patients has been shown to reduce morbidity among critically ill patients regardless of whether or not they have a history of diabetes mellitus. Data suggests sternal wound infections may be reduced in cardiac surgery patients by control of perioperative blood glucose levels.

3. BACKGROUND

Insulin is a high risk medication which can produce severe patient morbidity and potential mortality. Severe hypoglycemia may result when Insulin is infused especially in critically ill patients. The guideline has been designed to avoid severe hypoglycemia. Nursing staff is to ensure Insulin infusions are not continued at the same dose if the intravenous glucose source dose/rate changes or during cyclic enteral/parenteral feedings.

4. GUIDELINES

PART A: MANAGEMENT OF HYPERGLYCEMIA

4.1 A physician's order is required to initiate an Insulin infusion and then titrated to effect according to this guideline.

4.2 An insulin infusion is **NOT** recommended in patients who are eating or receiving bolus feeds.

4.3 An Insulin infusion is only to be administered by direct continuous infusion pump using safety software (e.g., Colleague Guardian) and non-ported solution set. It is never to be piggybacked (run as a secondary medication line above the large volume infusion pump).

4.4 If initiating an Insulin infusion, ensure a maintenance source of carbohydrate/dextrose is being delivered as ordered by physician and reassess daily.

4.5 Depending on the blood glucose level, start the Insulin infusion as follows:

Initial Blood Glucose	Begin Insulin Infusion At:
< 10 mmol/L	No Insulin
10 - 11.9 mmol/L	2 units/h
> 12 mmol/L	4 units/h

Note: A dedicated pump channel is to be used to administer an Insulin infusion.

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4.6 If the blood glucose level is outside of the 5-10mmol/L range, the Insulin infusion may be adjusted up or down as indicated. If there is a 50% or greater drop in blood glucose after an adjustment, the Insulin infusion is to be decreased by 50% and blood glucose level rechecked within 15-30 minutes. If there is a 50% or greater increase in blood glucose after an adjustment, consult physician for further orders.

4.7 Upon initiation of the Insulin infusion, the bedside/point of care blood glucose is to be **checked hourly until blood glucose is between 5-10mmol/L**. Following this:

- If Insulin infusion rate and carbohydrate/glucose supplement remains unchanged for 2 hours, monitoring frequency can be decreased to every 2 hours (q2h).
- If Insulin infusion rate remains unchanged and blood glucose level is stable after two measurements q 2h x 2 (4 hours), monitoring frequency can be decreased to q4h.
- **Resume** hourly checks of blood glucose if there is an Insulin infusion dose/rate change, blood glucose reading greater than 15mmol/L and/or there is an initiation, change or discontinuation of enteral or parenteral sources of carbohydrate/dextrose.

Note: Maximum dose of Insulin by this guideline is 20 units/h. If higher doses are required they are to be ordered by a physician.

4.8 Assess serum glucose, sodium chloride and total carbon dioxide upon initiation of Insulin and daily. Serum potassium is to be assessed upon initiation of Insulin and daily. However, if Insulin infusion rates are greater than 6 units/h please refer to suggested monitoring in 5.7.

4.9 If there is a planned reduction/discontinuation of enteral or parenteral sources of carbohydrate/dextrose, reduce the Insulin infusion by 50% 1 hour prior to the planned discontinuation/reduction. Increase monitoring of blood glucose to q1h.

4.10 If there is a 50% or greater drop in blood glucose after an adjustment, the Insulin infusion is to be decreased by 50% and blood glucose level rechecked within 15-30 minutes.

4.11 If there is an abrupt or unplanned discontinuation of enteral or parenteral sources of carbohydrate/dextrose (e.g. feeding tube or central venous access device is inadvertently pulled) then:

- stop the Insulin infusion and have the physician reassess when the infusion is to be restarted
- obtain a physician's order for substitute carbohydrate source (e.g. D10W)
- increase blood glucose monitoring to q1h

Note: A "Trauma Cocktail" infusion (D5W + Bicarb) is considered a source of carbohydrate/dextrose and at higher rates (e.g. 200mL/h) can contribute significant amounts similar to total parenteral nutrition.

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PART B: MANAGEMENT OF HYPOGLYCEMIA

4.11 If blood glucose reading is less than 4.0 mmol/L and:

4.11.1 *If decreased level of consciousness:*

- stop the Insulin infusion
- administer 50 mL D50W (see Parenteral Drug Monograph for administration)
- notify physician
- recheck blood glucose within 15-30 minutes

4.11.2 *If patient is alert and interactive:*

- stop the insulin infusion
- administer 16 grams of fast acting oral (e.g. 4 glucose tablets, 1 small container (180 mLs) of juice or 3 packs of sugar dissolved in water).
- notify physician
- recheck blood glucose within 15-30 minutes

5. CONSIDERATIONS:

- 5.1. Sensitivity to Insulin improves as patient condition stabilizes. Therefore, the need for Insulin usually decreases as the ICU/CCU stay progresses. If blood glucose starts to fall, even though the blood glucose remains in “normal range”, Insulin doses may need to be reduced by approximately 20% (e.g. if Insulin was running at 2 units/h and the blood glucose is falling, reduce the infusion by 0.5 units/h to a final rate of 1.5 units/h).
- 5.2. Increased body temperature can result in increased Insulin requirements, particularly if caused by an infection. Insulin requirements are expected to decrease as the infection improves and temperature returns to normal. Decreased body temperature such as with Targeted Temperature Management, in some patients may also significantly alter Insulin requirements. Closer monitoring of blood glucose is required.
- 5.3. For ‘Volume based feeding schedules’ in tube fed patients, some consideration is to be given to the increased volume of tube feed being administered over a shorter period of time. Check the blood glucose level within 1 hour of tube feeding and then re-adjust the Insulin infusion rate upward as necessary for the same blood glucose target level of 5 – 10 mmol/L. Once the normal tube feed rate is resumed or stopped, immediately decrease the Insulin rate back down to its initial value and repeat blood glucose level in 1 hour.
- 5.4. If the Insulin infusion is discontinued, the blood glucose is to be checked within 1 hour. If the blood glucose remains stable, then can be monitored q4h and prn.
- 5.5. Glucocorticoids (steroids) increase Insulin resistance. The dose of Insulin may need to be titrated upward, whenever such treatments are initiated.

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- 5.6. Some medications (e.g. catecholamines like epinephrine and norepinephrine) will increase blood glucose levels. More Insulin may be required when these medications are initiated and less Insulin required when they are titrated down or discontinued. Blood glucose levels are to be checked frequently every 30 minutes to 1 hour when these medications are being initiated, titrated or discontinued.
- 5.7. High doses of Insulin infusion (> 6 units/h) may lead to hypokalemia. Potassium levels are to be checked more frequently until stable. If the Insulin is stopped, potassium levels can increase. Caution must be exercised if potassium has recently or is still being administered when the Insulin infusion is stopped or the infusion rate has been significantly reduced. Potassium infusions are NOT to be administered during the first four hours after discontinuation of Insulin infusions unless potassium levels are being closely monitored and the serum potassium is less than 4.0 mmol/L. Caution is to be taken with the administration of red packed cells which can increase potassium levels and the potential for hemolysis (i.e. CRRT, valve surgery and IABP).

Suggested monitoring of potassium levels while on Insulin infusions:

Insulin Infusion Rate Units/hour	Frequency of Potassium (K ⁺) Monitoring
Greater than 6 units	Q 6 hours x 4
4-6 units	Q 12 hours x 2
Discontinued but K ⁺ replacement within last 2 hours	Q 4 hours x 1

6. REFERENCES:

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