**Purpose**

To provide physicians and nurses at Cleveland Clinic Abu Dhabi (CCAD) with a protocol for using intravenous insulin infusion to treat adult patients with hyperglycemia, except critically ill patients post cardiac surgery. **For critically ill patients post cardiac surgery, use Insulin Infusion Protocol for Post Cardiac Surgery Glycemic Control.** **For patients with diabetic ketoacidosis or hyperglycemic hyperosmolar state, use Insulin Diabetic Ketoacidosis or Hyperglycemic Hyperosmolar State Protocol, respectively.**

**Protocol**

1. Ordering
   1. This protocol will be initiated by a provider order.
   2. Subsequent orders specified by the protocol will be entered by a nurse as ‘per protocol’.
   3. Subsequent orders not specified in the protocol will require a provider order.
2. Insulin protocol
   1. Intravenous regular insulin infusion is recommended if random blood glucose is greater than 13.8 mmol/L (250 mg/dL) on two consecutive measurements.
   2. Goal blood glucose is 7.8-9.8 mmol/L (140-176 mg/dL).
   3. Patient must be nothing by mouth (NPO) or receive continuous enteral or parenteral nutrition. Insulin infusions are not appropriate for those taking scheduled meals or tube feed boluses.
      1. If enteral or parenteral nutrition is stopped, decrease insulin infusion by 50% and monitor blood glucose every 1 hour until blood glucose is > 4.4 mmol/L (> 80 mg/dL) for 3 consecutive levels, then check blood glucose every 2 hours.
   4. Monitor patient's blood glucose every 2 hours.
      1. Sampling site and lab analysis should remain consistent.
   5. Calculate the initial bolus using the patient's weight, 0.05 units/kg, to a maximum of 5 units.
   6. Calculate initial infusion rate using the patient’s weight, 0.05 unit/kg/hour, to a maximum of 5 units/hour.
   7. Adjust the infusion rate based on the previous blood glucose, current blood glucose and current infusion rate per adjustment table.
   8. If blood glucose <3.8mmol/L (<70 mg/dL)
      1. Stop the insulin infusion
      2. Give 50 mL of 50% Dextrose
      3. Notify provider
      4. Obtain blood glucose every 15 minutes until blood glucose >3.8mmol/L (>70 mg/dL) for three consecutive measurements and then check blood glucose every 2 hours.
   9. If blood glucose decreases >1.6 mmol/L (>=30 mg/dL) and blood glucose is 3.9-4.3 mmol/L (71-79 mg/dL)
      1. Stop the insulin infusion
      2. Give 25 mL of 50% Dextrose
      3. Notify provider
      4. Obtain blood glucose every 30 minutes until blood glucose >4.4 mmol/L (>80 mg/dL) for three consecutive measurements and then check blood glucose every 2 hours.
      5. If blood glucose increases to >8.3 mmol/L (>150 mg/dL) restart insulin infusion at half the previous rate without a bolus, and recheck blood glucose every 2 hours.
   10. Notify provider if insulin infusion is >15 units/hour or if blood glucose is not controlled by the protocol.
   11. After holding the insulin infusion, monitor blood glucose every 2 hours times 2.
       1. If blood glucose remains < 8.3 mmol/L (<150 mg/dL), contact provider for frequency of blood glucose monitoring
       2. If glucose ≥ 8.3 mmol/L (≥ 150 mg/dL) and insulin infusion has been stopped ≤ 24 hours, restart insulin infusion at half the previous rate without a bolus. Check blood glucose every 2 hours.
   12. Criteria for transition to subcutaneous insulin:
       1. Insulin infusion has been off or rate ≤ 1 unit/h
       2. Blood glucose < 10.0 mmol/L (180 mg/dL) for > 6 consecutive hours
   13. Transition to subcutaneous insulin:
       1. Give short-acting insulin 60 minutes PRIOR to stopping the insulin infusion
       2. Give long-acting insulin 90 minutes PRIOR to stopping the insulin infusion.
       3. Most patients will require long-acting insulin in addition to supplemental short-acting insulin. Please contact provider for orders.
3. Adjustment table

|  |  |  |  |
| --- | --- | --- | --- |
| **Blood Glucose** | **If blood glucose decreases ≥1.6 mmol/L (≥30 mg/dL) since previous level** | **If blood glucose is stable since previous level change <1.6 mmol/L (< 30 mg/dL)** | **If blood glucose increases ≥1.6 mmol/L (≥30 mg/dL) since previous level** |
| ≤3.9 mmol/L (<70 mg/dL) | Stop insulin infusion and start hypoglycemic protocol. Notify provider. | Stop insulin infusion and start hypoglycemic protocol. Notify provider. | Stop insulin infusion and start hypoglycemic protocol. Notify provider. |
| 3.9-4.3 mmol/L (70-79 mg/dL) | Stop insulin infusion and start hypoglycemic protocol. Notify provider. | Hold insulin infusion and recheck glucose every 2 hours. If glucose ≥ 8.3 mmol/L, restart insulin infusion at half the previous rate without a bolus. | Hold insulin infusion and recheck glucose every 2 hours. If glucose ≥ 8.3 mmol/L, restart insulin infusion at half the previous rate without a bolus. |
| 4.4-6.5 mmol/L (80-119 mg/dL) | Hold insulin infusion and recheck glucose every 2 hours. If glucose ≥ 8.3 mmol/L, restart insulin infusion at half the previous rate without a bolus. | Hold insulin infusion and recheck glucose every 2 hours. If glucose ≥ 8.3 mmol/L, restart insulin infusion at half the previous rate without a bolus. | Hold insulin infusion and recheck glucose every 2 hours. If glucose ≥ 8.3 mmol/L, restart insulin infusion at half the previous rate without a bolus. |
| 6.6-7.7 mmol/L (120-139 mg/dL) | Decrease rate by 50% | Decrease rate by 50% | Decrease rate by 25% |
| 7.8-9.8 mmol/L (140-170 mg/dL) | Decrease rate by 50% | Continue current rate | Continue current rate |
| 9.9- 11 mmol/L (180-199 mg/dL) | Decrease rate by 50% | Increase rate by 25% | Increase rate by 25% |
| 11.1- 12 mmol/L (200-219 mg/dL) | Decrease rate by 25% | Increase rate by 25% | Bolus 2 units and increase rate 25% |
| 12.1-14 mmol/L (220-249 mg/dL) | Continue current rate | Bolus 2 units and increase rate 25% | Bolus 4 units and increase rate 25% |
| 14.1-16.5 mmol/L (250-299 mg/dL) | Continue current rate | Bolus 4 units and increase rate 50% | Bolus 6 units and increase rate 50% |
| 16.6-19 mmol/L (300-349 mg/dL) | Continue current rate | Bolus 6 units and increase rate 50% | Bolus 8 units and increase rate 50% |
| 19.1-22 mmol/L (350-400 mg/dL) | Continue current rate | Bolus 8 units and increase rate 50% | Bolus 10 units and increase rate 50% |
| >22 mmol/L (>400 mg/dL) | Notify provider | Notify provider | Notify provider |

**Oversight and Responsibility**

1. Respiratory & Critical Care Institute
2. Department of Pharmacy
3. Department of Endocrinology, Diabetes, and Metabolism
4. Quality & Patient Safety Institute

**Definitions**

1. None

**References**

1. Cleveland Clinic Intensive Care Unit Insulin Protocol

**Institute / Department / Committee Involved in Procedure Development / Revision**

1. Department of Endocrinology, Diabetes, and Metabolism
2. Respiratory & Critical Care Institute
3. Department of Pharmacy
4. Quality & Patient Safety Institute

**Contact for Questions / Clarifications**

1. Physician, Endocrinology
2. Pharmacotherapy Specialist
3. Institute Chair, Quality & Patient Safety Institute

**Related or Supporting Documents**

1. None

**Abbreviations**

1. CCAD – Cleveland Clinic Abu Dhabi
2. NPO – Nothing by mouth