

## Post-Organ Transplant Insulin Adjustment Protocol

**Patient insulin regimen** NPH once or twice daily with Regular or Humalog in compensatory sliding scale and fixed meal dose \_\_\_\_\_ units.

**Indications:** This protocol gives clinicians the ability to correct a pattern of hypoglycemia or hyperglycemia in patients who are post-organ transplant. Patients are on an insulin regimen using either daily or multiple daily insulin injections, so that out of range blood glucose patterns can be confirmed and insulin can be adjusted. The patient is self-monitoring blood glucose multiple times per day and using NPH and Regular or Humalog insulin. The Regular or Humalog insulin is used as a patient-adjusted compensatory sliding scale according to blood glucose results and may include an added fixed meal dose.

### Goals of Treatment

1. Immediately post-operatively and while glucocorticoids and other transplant anti-rejection drugs are being tapered, an average pre-meal blood glucose target of 150 mg/dl and bedtime goal of 175 to 200 mg/dl is appropriate. Tighter goals can be achieved when anti-rejection drugs have been stabilized (American Diabetes Association goal is 90-130 mg/dl pre-meal, 110-150 mg/dl bedtime at 3 months post transplant).
2. Basal insulin NPH dose should be adjusted first, based on guidelines. When blood glucose averages reflect adequate basal insulin doses, meal insulin (Regular or Humalog sliding scale used pre-meal) can be adjusted.
3. All adjustments in insulin doses are made one at a time to prevent hypoglycemia and to determine appropriate dose response.

### Guidelines

1. Insulin adjustment of basal, and added meal doses of short or rapid acting insulin should be based on at least 3 days of blood glucose patterns and the patient's target blood glucose goals. Target blood glucose goals are specified post-transplant and depend on the time period after surgery and the tapering of glucocorticoids and other transplant ant-rejection drugs. Treat hypoglycemia pattern prior to hyperglycemia pattern. Make adjustment for one pattern at a time.
2. Use the following Insulin algorithm for the adjustment of basal insulin until the patient achieves individual blood glucose target range:

<u>Pt on single dose</u>	<u>If lows (&lt;80) *</u>	<u>If highs (&gt; top of target range) *</u>
≤5 units	decrease by 1 unit	increase by 1 unit
≥5 units	decrease by 20 %	increase by 20 %

\* **Pattern is determined by two or more values out of target range within one week** at the same time of day for hypoglycemia and three or more **out of target range** for hyperglycemia.

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**Table 1**

Pattern Outside the Target Range	Adjust This Insulin Dose
Fasting	Dinner or bedtime intermediate acting or long-acting insulin
Before lunch	Breakfast rapid or short acting meal dose
Before dinner	Lunch rapid or short acting meal dose or AM intermediate
Before bedtime	Dinner rapid or short-acting meal dose
3 am	Dinner or bedtime intermediate or long acting insulin

Rapid acting=Humalog, Novolog, Aspart  
Short acting=Regular

Intermediate acting=NPH, Lente  
Long acting=Glargine, Untralente

3. If patterns of blood glucose emerge that the patient can explain and correct, such as the patient skipped a meal or an insulin dose, insulin need not be adjusted.
4. Determine which insulin is responsible for the out of range pattern. Make sure the patient provides enough blood glucose information to make a decision.
5. Meal insulin doses can be adjusted up or down and should be based on 3-5 day pattern of average blood glucose results. Adjust up by 1 unit meal dose (Regular or Humalog) for every 50 mg/dl above target of 150 mg/dl average pre-meal. Adjust down by 1 unit dose for every 50 mg/dl below target of 150 mg/dl average pre-meal (see Table 1 for insulin time to adjust). Determined dose should be added to the compensatory sliding scale dose.
6. If the patient's steroid dose has been decreased since the last assessed blood glucose record, wait 3-7 days before reassessment again to make any insulin changes.
7. **Hyperglycemia:**
  - Hyperglycemia is expected in this patient population due to steroid and immunosuppressant therapy. Glucocorticoids administered in the morning tend to cause hyperglycemia starting mid-day and continuing until late evening with a trend down overnight. Early post-transplant target blood glucose goals are usually above standard ADA guidelines and become lower as therapy progresses and immunosuppressant doses decrease (see goals of treatment). If the patient's blood glucose is >400 despite insulin adjustment, with polyuria, polydypsia, weight loss and/or moderate or more ketones, immediate treatment is needed by a physician and arrangements should be made accordingly for larger doses of insulin and fluids. During clinic hours the Endocrine referring physician is contacted. For urgent issues after clinic hours contact the Endocrine Fellow on call 1-800-251-DOCS.

**8. Hypoglycemia:**

- If the blood glucose values show a pattern of two or more lows, with mild hypoglycemia (the patient can treat him or herself), use above algorithm to adjust insulin. Assess, teach, and reinforce necessary skills to treat mild episodes.
- If the patient experiences severe hypoglycemia, immediate and more aggressive titration down may be needed. If a single event occurs with an explained cause, such as too much insulin, skipped meal, unplanned exercise, the insulin may not need adjustment. If one or more unexplained severe episodes have occurred, the patient/family is instructed to contact the physician using above guidelines. Document in the patient's record and contact physician immediately. Assess for family's knowledge of glucagon administration and hypoglycemia treatment.

**9. Patient Education:**

- Patients need to be advised about the importance of more frequent testing of blood glucose, with some 0300 readings if hypoglycemia occurs and teach the patient to monitor themselves for hypoglycemia symptoms for the next 24 hrs after an episode of hypoglycemia. If the next hypoglycemia episode is within 24 hrs, glucose levels can drop much lower before hormonal counter-regulation and autonomic symptoms occur.
- Educate the family or significant other in the use of glucagon injection if the patient has a history of severe hypoglycemia or hypoglycemia unawareness.

**10. Follow-up:**

- In all cases, request that the patient call in blood glucose results every 5 to 7 days for further insulin adjustment instructions. Document progress on a Diabetes Encounter Form and Insulin Adjustment Flow Sheet. Keep Transplant Team/Endocrine physician informed of progress to completion. If the patient does not make contact, attempt to call patient three times and document on Diabetes Encounter Form and Insulin Adjustment Flow Sheet. Send follow-up letter to patient. Contact Endocrine referring physician and Transplant Team for further guidance and document plan of care discussed if unable to contact the patient. When the patient has reached blood glucose goals using current insulin regimen, send primary care physician a letter of completion of protocol.

Physician Name (Please print): \_\_\_\_\_

Physician signature: \_\_\_\_\_ Date: \_\_\_\_\_

Approved: \_\_\_\_\_

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**For Office Use Only:**

Practice Name Approved for: \_\_\_\_\_

Physician approving protocol (Please print): \_\_\_\_\_

Signature: \_\_\_\_\_ Title: \_\_\_\_\_

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