Formulary Flash

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Inpatient Insulin Changes Go into Effect September 4

Background

Currently there are two long-acting basal human insulin analogs and two rapid-acting human insulin analogs on the University Health System Formulary:

- Long-acting:
  - Insulin glargine (Lantus®)
  - Insulin detemir (Levemir®)
- Rapid-acting:
  - Insulin lispro (Humalog®)
  - Insulin aspart (NovLog®)

When first added to the formulary, these newer insulins were restricted by P&T to Endocrinology. At the April 2007 meeting, all restrictions were removed.

All insulins are on the "High Alert Medication" list of the Institute for Safe Medication Practices (see page 4 for details). To minimize potential for errors, and to avoid the confusion that could result in adding all four of these insulins to inpatient floor stock, Endocrinology and P&T agreed that only one long-acting insulin, and one rapid-acting insulin need be carried on the inpatient side.

The Purchasing Department used an impartial bid process to determine which insulin analogs would be carried by the inpatient pharmacy to be made floor stock on September 4. The two selected are:

- **Levemir® -- as the long-acting basal insulin**
- **NovoLog® -- as the rapid-acting insulin**

Goals for Inpatient Insulin Therapy

An inpatient insulin protocol is being developed by the Diabetes Division. This protocol will be part of a comprehensive protocol to manage Inpatient diabetes and is designed to improve and standardize therapy based on clinical guidelines and evidence-based practice. Such a protocol will also help the Hospital comply with National Patient Safety Goals established by the Joint Commission.

Short term goals for the inpatient protocol:

- Encourage use of "basal + bolus" therapy with insulin detemir (Levemir®) and insulin aspart (NovoLog®)
- Encourage use of insulin aspart (NovoLog®) for prandial bolus doses and for "corrections" of prandial bolus doses.

Long-term goals for the inpatient protocol:

- **Eliminate traditional monotherapy "sliding-scale" dosing** --as recommended by the American Diabetes Association
- Phase out inpatient use of NPH insulin and 70/30 as basal insulins -- to further reduce the number of floor stock insulins and thus to reduce the potential for medication errors

Regular human insulin will still be used for current "sliding scale" dosing and for insulin drips.

From the American Diabetes Association (ADA) Standards of Medical Care in Diabetes – 2007:

These standards may differ slightly from those that will be adopted later in the protocol. Information in brackets is NOT from the ADA. Until there is a protocol established, these are only guidelines or recommendations for diabetes care in the hospital:

- **Goals for blood glucose (BG) levels:**
  - **Critically ill**: BG levels should be as close to **110 mg/dL** as possible and generally < 180 mg/dL. These patients will usually require IV insulin drips [with standard regular insulin].
  - **Non-critically ill**: **pre-meal** BG levels should be kept as close as possible **between 90-130 mg/dL** depending on the clinical situation; and **[2-hr] post-prandial BG levels should be kept < 180 mg/dL.**

- Scheduled prandial doses should be given [using insulin aspart immediately before each meal when food is in front of the patient]. These doses should be adjusted according to point-of-care glucose levels. **The traditional sliding scale insulin [SS] regimens are ineffective as monotherapy and are not recommended.**
- Using "correction" doses or "supplemental" insulin [aspart] is recommended in addition to scheduled prandial insulin [aspart] and scheduled basal insulin [detemir].[This is known as the basal + bolus regimen and is the recommended alternative to traditional SS monotherapy regimens. A guide for correction doses is in the proposed protocol on the next page]
- **A plan for treating hypoglycemia** should be established for each patient, and all episodes of hypoglycemia should be tracked. [See plan in proposed protocol on the next page].
- All patients with diabetes should have an **HbA1c** obtained for discharge planning if the result of testing in the previous 2-3 months is not available.
- A diabetes education plan including "survival skills education" and follow-up should be developed for each patient.
- Patients with hyperglycemia in the hospital who do not have diabetes should have appropriate plans for follow-up testing and care documented at discharge. Using the HbA1c test may be valuable in diagnosing diabetes in hospitalized patients with hyperglycemia.

Other Important Points from the ADA Standards for Hospitalized Patients

- Hyperglycemia in hospitalized patients may be due to stress, decompensation of type 1 or type 2 diabetes, or may be iatrogenic due to withholding or administration of certain drugs.

- A rapidly growing body of literature supports **targeted glucose control in the hospital setting with potential for improved mortality, morbidity and health care economic outcomes.**

- General Medical and Surgical patients with a **BG > 220 mg/dL have higher infection rates.**

- **Each of the major categories of oral and parenteral alternative anti-diabetic agents has significant limitations and relative contraindications for inpatient use.** Therefore insulin, when used properly, may have many advantages in the hospital setting.
  - Sulfonylureas & meglitinides are relatively contraindicated due to longer action and predisposition to hypoglycemia in patients not consuming normal nutrition.
  - Metformin is restricted to OP use at UHS due to many conditions encountered during an admission that would be considered contraindications because they predispose the patient to lactic acidosis (e.g., CHF or other cardiac disease, hypoperfusion, renal insufficiency, hypoxia, COPD).
  - Thiazolidinediones (TZDs) are not suitable for initiation of therapy during hospitalization because of their delayed onset of effect. In addition, they increase intravascular volume which is problematic for patients predisposed to CHF or to patients experiencing hemodynamic changes that are often part of a hospital stay.
  - Pramlintide & exenatide work mainly by reducing post - prandial hyperglycemia. Thus, they are not appropriate for patients who are NPO or not eating well. Initiation of therapy is also inappropriate due to differences in normal food intake.

- Bedside **BG monitoring recommendations**:
  - For patients who are eating, monitor BG before meals and at bedtime.
  - For patients NOT eating, monitor BG every four to six hours.
  - For patients on continuous IV drip, monitor BG hourly until BG levels are stable, then every two hours.

- Hypoglycemia is the most common adverse effect of insulin therapy. Therefore, it is the leading limiting factor in patients being tightly controlled on insulin therapy. **Thus, standing orders for the management of hypoglycemia are essential.** [See protocol in right-hand column.] Even patients not considered "brittle," will have additional risk factors as inpatients that may lead to hypoglycemia. Those risk factors include:
  - Altered nutritional status; reduction in or no oral intake; emesis; changes in IV rates or in parenteral or enteral nutrition rates
  - Cardiac, renal and/or hepatic disease
  - Malignancy
  - Infection or sepsis
  - Changes in steroid dosing
  - Mental status changes leading to altered ability to self-report symptoms

Important Points from the Proposed Protocol

- Know the nutritional status of the patient
- If patient is eating, start basal + bolus regimen at a TOTAL DAILY dose of 0.5 units per kg (split as follows).
  - Give ½ of the total calculated daily dose as basal insulin detemir and give at 10 pm.
  - Give the other ½ of the total calculated daily dose as insulin aspart divided equally before each meal and given only when the food is in front of the patient.

  For example, for a 160-lb or 72-kg patient, calculated daily dose is 0.5 x 72 = 36 units. So your ordered doses would be:
  - Insulin detemir 18 units every night at 10 pm
  - Insulin aspart 6 units immediately before each meal.
- This dose (0.5 units /kg/day) may be low too low for type 2 diabetics and may require accelerated titration.
- **Adjust basal insulin detemir to maintain fasting BG < 140 mg/dL**
- Suggested **correction dosing for prandial aspart insulin If pre-meal glucose is > 140 mg/dL**

Pre-meal BG (mg/dL)	In addition to scheduled dose calculated above give the following extra Insulin Aspart
141-180	1 extra unit
181-220	2 extra units
221-260	3 extra units
261-300	4 extra units
301-340	5 extra units
341-380	6 extra units
> 380	Call H.O.; **consider insulin drip if two consecutive readings are > 200**

- **If correction doses are frequently required, it is recommended that the scheduled prandial insulin aspart be increased the following day to accommodate the increased insulin needs.**

- ***Management of hypoglycemia:***

BG (mg/dL)	**Action(s)** • Describe all circumstances for all incidents in the nurses' notes. Contributing factors must be noted. (e.g., patient ate only ½ of meal; insulin over-replaced; patient is NPO or off floor when meal tray arrived, etc.)
< 80	• Recheck BG in 30 minutes.
< 60	• Ensure adequate glucose intake. • Give ½ cup orange juice if conscious. • Give 25 mL D50W IV push if patient unable to take PO • Recheck BG every 15 minutes until BG > 80. • Decrease basal and/or scheduled prandial insulin dosing as necessary
< 40	• Give 50 mL D50W IV push • Recheck BG every 15 minutes • If BG is still < 60 repeat 50 mL of D50W IV Push • When BG is > 80 for two readings, notify MD to reassess insulin dosing • Decrease basal and/or scheduled prandial insulin dosing as necessary

FREQUENTLY ASKED QUESTIONS:

- **Why do we have to change what we are doing?**
  - To accommodate newer and better insulin products and to minimize the potential for errors

- **My patient is being admitted and is stable on insulin glargine (Lantus®), what do I do?**
  - Order insulin detemir (Levemir®) while they are in the hospital in the same number of units and the same frequency as the Lantus®; monitor BG levels and **adjust if necessary**. Adjustments due to hospital-related differences in insulin requirements are common
  - OR -- Write order to have the nurse use the patient's own insulin (only if the patient or the family can bring it to the hospital)
  - Give discharge Rx for Lantus® to continue as before or as an adjusted dose

- **My patient did well on insulin detemir and I want to send the patient home on it, but the patient has plenty of Lantus® at home. What do I discharge the patient on?**
  - It would probably be best to allow the patient to use the Lantus®, and be evaluated on an OP basis later

- **Do I do the same if my patient is stable on insulin lispro (Humalog®) or regular insulin before meals? How much NovoLog do I order? And what do I discharge them on?**
  - Yes, same principle as above. Order insulin aspart (NovoLog®) in the same number of units as the Humalog® or the regular insulin before each meal
  - OR -- Write an order to have the patient use their own
  - The discharge prescription is your choice; but consider what the patient has at home

- **So what is wrong with using sliding-scale (SS) insulin regimens?**
  (Direct Quote from ADA Standards):
  - Traditional SS regimens with no basal insulin have been shown to be ineffective as monotherapy in patients with established insulin requirements
  - Often a SS regimen prescribed on admission is not modified throughout the hospital stay – even though requirements do change
  - SS regimens treat hyperglycemia AFTER it has occurred, instead of PREVENTING it. This reactive approach can lead to rapid changes in BG, exacerbating both hyper- and hypoglycemia

- **Why not use insulin aspart for IV drips?**
  (Direct Quote from ADA Standards):
  - The only method of insulin delivery specifically developed for use in the hospital setting is continuous IV infusion using regular crystalline insulin.
  - There is no advantage to using [the rapid-acting] insulin lispro or insulin aspart.

- **What is the best way to transition from IV drip to subcutaneous insulin?**
  - **This takes planning!**
  - Calculate your total daily requirement (TDR) as 80% of the total infused IV in the last 24 hours (if controlled)
  - ½ of that calculated TDR is administered as basal insulin detemir 2 hours before the drip is stopped to avoid rebound hyperglycemia
  - The other ½ of that calculated TDR will be given as insulin aspart DIVIDED into 3 prandial bolus doses

  Here are two scenarios:

  ► To DC an IV Drip <u>late in the evening</u>: in the previous 24 hours, the patient received 30 units in the IV drip. 80% of 30 units = 24 units; so 12 units will be basal insulin and 12 units (divided) will be prandial insulin.
  Give 12 units of basal insulin as insulin detemir 2 hours before stopping the drip and nightly at 10 pm starting the next night
  Give the 12 units of prandial insulin divided as 4 units of insulin aspart three times a day immediately before each meal

  ► To DC an IV Drip <u>early in the day:</u> in the previous 24 hours, the patient received 30 units in the IV drip. 80% of 30 units = 24 units.
  Divide the basal insulin dose into two doses for that first day only. Give 6 units of basal insulin detemir 2 hours before stopping the drip; repeat 6 units that night at 10 pm then give the full 12 units at 10 pm every night starting the next night
  Give the other 12 units divided as 4 units of insulin aspart three times a day immediately before each meal

FREQUENTLY ASKED QUESTIONS (continued):

- **What if my patient is NOT eating, or is on a continuous enteral feeding or parenteral nutrition?**
  - Use insulin detemir as a basal insulin with requirements and daily titration determined by BG monitoring every 4 to 6 hours.
  - The initial dose should be low (10 – 20 units per day) due to the long-action of insulin detemir.
  - If switching from regular insulin added to TPN, give insulin detemir 2 hours before hanging the new bag without insulin.

- **There are so many insulins on the market now; it is very confusing. There is Novolin® and Novolog® and Humulin® and Humalog®. All sound very much alike. What are some easy ways to distinguish them?**
  - A trade name that ends in "**log"** is one of the newer "**analog**" insulins
  - An "**analog**" insulin is **similar in structure** to human insulin
  - A trade name that ends in "**lin**" is one of the traditional forms of insu**lin** products
  - No insulin should be described just as "insulin"… always include its "modifier"
  - A trade name that starts with "**Novo"** is made by the manufacturer **Novo**-Nordisk
  - There are **three Novolin® products** (all are human recombinant DNA origin):
    - Novolin® R – is **R**EGULAR insulin (short-acting)
    - Novolin® N – is **N**PH insulin (also known as isophane insulin which is intermediate-acting)
    - Novolin® **70/30** – is **70**% NPH and **30**% regular insulin
  - There are also four **Humulin®** products (made by Eli Lilly)
    - Humulin® R – is **R**EGULAR insulin
    - Humulin® N – is **N**PH insulin
    - Humulin® 70/30 – is **70**% NPH and **30**% regular insulin
    - Humulin® 50/50 -- – is **50**% NPH and **50**% regular insulin (this product is non-formulary)
  - **NovoLog®** is **insulin aspart** (rapid-acting)
  - **Humalog®** is **insulin lispro** (rapid-acting)
  - There are also **mixes of these two human insulin analogs:**.
    - **Novolin® 70/30** may easily be confused with **NovoLog® Mix 70/30** but there are important differences.
      - As mentioned above, **Novolin® 70/30** is a mixture of NPH and regular insulin
      - **NovoLog® Mix 70/30** – is 70% insulin **aspart protamine suspension** (intermediate-acting) and **30% insulin aspart.** (This product is usually dosed twice daily and does NOT contain insulin detemir.)
    - Eli Lilly makes their **Humalog® Mix 75/25** a different ratio than their Humulin® mixes, making confusion less likely.
      - **Humalog® Mix 75/25** – is **75% insulin lispro protamine suspension** (intermediate-acting) and **25% insulin lispro**. (This product is also usually dosed twice daily and does not contain a long-acting basal insulin.)
    - These new **analog mixes are on the formulary, but restricted to OP** for obvious safety reasons. In addition, **initiation of therapy is restricted to Endocrinology.**

- **What is the basis of these safety concerns?**
  - The Institute for Safe Medication Practices (ISMP) classifies all insulins as "High Alert medications." This is a list of drugs which have **a heightened risk of causing significant patient harm when used in error**. ***Due to the number of insulin preparations, it is essential to identify and clarify the type of insulin to be used.***

References:

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