



Anti-Diabetic Agents: Insulin Degludec

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After completion the learner should be able to:

1. Identify appropriate indications for use of insulin degludec.
2. Relate general characteristics of insulin degludec to specific patient situations.
3. Apply nursing process considerations for insulin degludec to specific patient situations.

Insulin has been an essential component of diabetes management for almost 100 years, and treatment continues to evolve. In the past two decades, significant changes and advancements have occurred in diabetes management. New types of insulin have been developed, and new protocols for insulin use have resulted in improved control of blood glucose in diabetic patients, with the goal of decreasing the risk of diabetic complications. Within the last 2-3 years, several novel forms of insulin have been developed and approved. One of these is insulin degludec, a long-acting insulin analog approved by the FDA in September, 2015. It is marketed as Tresiba, in prefilled pens with concentrations of 100 units/ml and 200 units/ml. It is also available in fixed-dose combinations with insulin aspart (Ryzodeg 70/30) and liraglutide (Xultophy 100/3.6).

Indications

Insulin degludec is indicated to improve control of blood glucose in patients age one year and older having type 1 or type 2 diabetes. It may be used as monotherapy, or in combination with a rapid-acting insulin or oral anti-diabetic agent.

Pharmacodynamics

All types of insulin help circulating glucose molecules to get into the cell for use. Insulin acts on the cell wall to promote movement of glucose into skeletal muscle and fat cells. It also decreases production of glucose by the liver and promotes glycogen storage of excess

glucose. These actions result in a lowering of blood glucose levels.

Insulin degludec has a fairly flat profile with regard to serum drug levels. It is absorbed very slowly from the subcutaneous tissue. This results in sustained and stable serum drug levels, causing a long duration of action for up to 42 hours with no pronounced peaks.

Pharmacokinetics

Absorption: After injection, insulin degludec forms large, stable chemical structures in the subcutaneous tissue. These large chemical structures are absorbed very slowly into the bloodstream, allowing a very long duration of action with minimal peak effects. Compared to other long-acting insulins, such as insulin glargine, this reduces the risk of hypoglycemia, especially nocturnal episodes.

Distribution: Highly protein bound.

Metabolism: Primarily in the liver.

Elimination: Excreted mainly by the kidneys.

Major Interactions

The following medications may affect blood glucose levels. Increased frequency of blood glucose monitoring should be done until drug effects are known.

Drugs that lower blood glucose, such as other anti-diabetic drugs, ACE inhibitors, ARBs, fluoxetine, salicylates and sulfonamides: May increase the effects of insulin degludec, causing hypoglycemia. Decreased insulin dosage may be needed.

Drugs that raise blood glucose, such as corticosteroids, thiazide diuretics and oral contraceptives: May decrease the effects of insulin degludec, resulting in hyperglycemia. Increased insulin dosage may be needed.

Drugs that may either raise or lower blood glucose, such as alcohol, beta blockers, lithium and clonidine: Adjustment of insulin dosage may be needed.

Drugs that may mask symptoms of hypoglycemia, such as beta blockers and clonidine: Increased frequency of blood glucose monitoring should be done.

Glitazones, such as rosiglitazone and pioglitazone: Concurrent use may result in fluid retention and heart failure.

Adverse Effects/Toxicity

The most common adverse effect of any insulin is hypoglycemia, causing symptoms such as tremors, perspiration, hunger, dizziness, irritability and headache. Other effects include allergic reaction, injection site reaction, hypokalemia, peripheral edema, weight gain, headache and upper respiratory tract infection. Localized lipodystrophy, a rare disorder of fat distribution associated with subcutaneous injections, may also occur at injection sites.

Precautions/Contraindications

Insulin degludec should be used cautiously in the elderly, who may be more sensitive to its effects and may have a decreased response to and awareness of hypoglycemia. Caution should also be used in patients with renal or hepatic impairment.

Nursing Process

Assessment

Determine baseline status: A complete physical assessment is necessary for all diabetic patients. The focus of assessment for new diabetics should be on documentation of baseline status for all body systems, as well as any current signs and symptoms of diabetes. Assessment of long-term diabetics focuses on detection and monitoring of the progression of any diabetic complications. Prior to administering any type of insulin, it is important to assess for a history of any allergic reactions to insulin, and use of medications that increase risk for hypo- or hyperglycemia. Assessment of diabetic patients on insulin is an ongoing process. Patient status can change rapidly as the body responds to the effects of insulin and other anti-diabetic drugs. The patient's knowledge of the disease process, drug therapy and lifestyle modifications used in diabetes management should also be assessed to serve as a baseline for patient education.

Identify risk factors: A complete medication history should be taken to identify possible drug interactions. The patient should be assessed for any previous allergic reactions to insulin. Lab results should be assessed for indications of renal or hepatic impairment.

Age-specific considerations: There are no data regarding the safety of insulin degludec during pregnancy. However, the benefits of insulin use during pregnancy are considered to outweigh the risks of high blood glucose and its effects on the

mother and fetus. Insulin is excreted in breast milk in very small amounts, and is not stable taken through the GI system. Therefore, breastfeeding is considered compatible with its use. The safety and efficacy of insulin degludec have not been established in children under the age of one year. This drug is considered safe and effective for geriatric patients, but caution should be used to determine response.

Planning and Analysis

The goal of insulin therapy is to maintain blood glucose levels within target range for the patient, without hypoglycemic episodes, as well as the prevention of diabetic complications.

Intervention

Medication administration: Insulin degludec is administered once daily, subcutaneously. Due to its slow absorption and lack of serum peaks, it does not have to be administered on a rigid schedule each day, as long as there is at least an eight-hour window between doses. The drug must not be removed from the pen with a syringe, diluted, or mixed with another drug. If the patient exhibits signs of hypoglycemia or has a low blood glucose level, the dose should be held and the physician notified.

Observe for therapeutic effects: Measurement of blood glucose levels that are within the target range for the patient is the best indicator of positive therapeutic response. In addition, patients whose glucose levels are well controlled will not exhibit signs and symptoms of diabetes and have fewer complications of diabetes. Frequency of monitoring should be increased with drug or dosage changes, illness and stress.

Observe for adverse effects: Frequent assessment should be done for signs and symptoms of hypoglycemia, hyperglycemia and hypersensitivity reactions. Periodic skin assessment allows for early detection of lipodystrophy.

Patient/Family teaching:

- Take the drug as prescribed each day, using care that the correct pen and dosage are used. Allow at least 8 hours between doses, and rotate sites as instructed.
- The currently-used pen may be stored at room temperature; extra pens should be refrigerated until used.
- Monitor blood glucose as instructed and report abnormalities to the physician.
- Follow recommendations for diet and exercise; avoid use of alcohol while taking the drug.
- Review signs of hypo- and hyperglycemia, and actions to take

Evaluation

Through careful monitoring and education, the nurse can promote safe and effective diabetes management for the patient taking insulin degludec.



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Learning Objectives:

After completion, the learner should be able to:

1. Identify appropriate indications for use of insulin degludec.
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Suggested Adjunct Activities:

1. Invite a pharmacist, endocrinologist or other healthcare professional to present an inservice highlighting use of insulin degludec and its fixed-dose combination drugs.
2. Have the staff compare and contrast clinical implications of patients using different types of insulin and dosing schedules.

Competency Assessment Tool Answer Key:

1. D. long-acting
2. B. 1 year of age and older
3. A. True
4. D. as monotherapy, or in combination with other insulins or oral anti-diabetic drugs
5. A. promotes glycogen storage in the liver
6. C. stable serum drug levels with no pronounced peak over 40 hours
7. C. beta blocker
8. B. False
9. D. all of the above
10. B. pens must be refrigerated at all times



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NAME: _____ DATE: _____ UNIT: _____

Directions: Place the letter of the one best answer in the space provided.

- _____ 1. Insulin degludec is categorized as which of the following types of insulin:
 - A. rapid-acting
 - B. short-acting
 - C. intermediate-acting
 - D. long-acting

- _____ 2. Insulin degludec is indicated for use in patients of which age groups:
 - A. all ages
 - B. 1 year of age and older
 - C. 6 years of age and older
 - D. 18 years of age and older

- _____ 3. Insulin degludec is indicated for treatment of both type 1 and type 2 diabetes.
 - A. True
 - B. False

- _____ 4. Insulin degludec may be used:
 - A. as monotherapy only, as the only anti-diabetic drug used
 - B. only with other types of insulin
 - C. only with oral anti-diabetic drugs
 - D. as monotherapy, or in combination with other insulins or oral anti-diabetic drugs

- _____ 5. Insulin has which of the following effects in the body:
 - A. promotes glycogen storage in the liver
 - B. increases production of glucose by the liver
 - C. decreases movement of glucose into cells
 - D. all of the above

- _____ 6. Because of how it is absorbed from subcutaneous tissue, insulin degludec produces:
- A. a noticeable peak effect about 6 hours after administration
 - B. serum drug levels that rise and fall several times over 24 hours
 - C. stable serum drug levels with no pronounced peak over 40 hours
 - D. a rapid onset and brief duration of action, usually less than 8 hours
- _____ 7. A diabetic patient taking insulin degludec is at increased risk for hypoglycemia and masking of hypoglycemic symptoms if which one of the following drugs is taken concurrently:
- A. thiazide diuretic
 - B. corticosteroid
 - C. beta blocker
 - D. oral contraceptive
- _____ 8. Insulin degludec cannot be used in pregnant and breastfeeding women.
- A. True
 - B. False
- _____ 9. Benefits of insulin degludec for the patient include:
- A. once-daily dosing
 - B. use of a prefilled pen
 - C. flexible administration times
 - D. all of the above
- _____ 10. Education for patients taking insulin degludec includes all of the following EXCEPT:
- A. rotate injection sites to prevent tissue damage
 - B. pens must be refrigerated at all times
 - C. at least 8 hours must elapse between doses
 - D. avoid use of alcohol