

Insulin detemir: A long-acting insulin product

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Diabetes mellitus affects a large portion of the U.S. population and carries a high rate of morbidity and mortality for patients afflicted with the disease. Tight metabolic control achieved in part by the use of insulin is the key to preventing and delaying complications in patients with diabetes.¹ Current American Diabetes Association guidelines recommend a goal glycosylated hemoglobin (HbA_{1c}) of <7% in patients with diabetes and state that therapy should be reviewed or changed if values are consistently >8%.² The first insulin product was brought to market in 1923 by Eli Lilly.³ In the 1930s protamine zinc insulin was introduced as the first long-acting insulin, which improved the care of patients with diabetes by reducing the number of daily injections a patient had to administer. The results of the Diabetes Control and Complications Trial in the 1990s demonstrated the importance of tight glycemic control and caused a resurgence of interest in long-acting insulins. Since that time, researchers have been trying to develop insulin products that mimic physiological insulin.⁴ Insulin glargine, a peakless insulin that allows providers to treat hyperglycemia with less incidence of hypoglycemia, received approved labeling from the Food and Drug Administration (FDA) in 2000 and

Purpose. The pharmacology, pharmacokinetics, efficacy and tolerability, safety, drug interactions, dosage and administration, cost, and place in therapy of insulin detemir are reviewed.

Summary. Insulin detemir is a long-acting, neutral, and soluble insulin analogue with a lower within-subject variability of fasting plasma glucose levels than isophane insulin human (NPH insulin) and insulin glargine. The lower within-subject variability of insulin detemir may decrease hypoglycemic events, especially nocturnal events, and may contribute to a decreased incidence of weight gain. In vivo, insulin detemir is 98–99% bound to albumin—one of the mechanisms contributing to its long duration of action. Several open-labeled, randomized, multicenter trials have been conducted comparing the safety and efficacy of insulin detemir to NPH insulin in patients with type 1 or type 2 diabetes mellitus. In most trials, patients were randomized to receive insulin on three different dosing schedules: basal insulin twice daily before

breakfast and at bedtime, basal insulin at 12-hour intervals, or basal insulin before breakfast and dinner. Mealtime insulin was given as part of the basal-bolus therapy. Glycosylated hemoglobin values were similar in patients receiving insulin detemir or NPH insulin. Insulin detemir appears to be well tolerated. The most common adverse effects reported during clinical trials were hypoglycemia, headache, dizziness, and injection-site reactions.

Conclusion. Insulin detemir given once or twice daily as part of basal-bolus insulin therapy is at least as effective as NPH insulin in maintaining overall glycemic control in adult patients with type 1 or type 2 diabetes mellitus.

Index terms: Binding; Costs; Diabetes mellitus; Dosage; Drug administration; Drug interactions; Duration of action; Insulin detemir; Insulins; Pharmacokinetics; Sustained-action medications; Toxicity

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has begun to replace older insulin products (e.g., isophane insulin human [NPH insulin], Ultralente).⁵ In June 2005, FDA approved the labeling for a new basal insulin with protracted action, insulin detemir (Levemir, Novo Nordisk). This article discusses the pharmacology, pharmacokinetics, efficacy and tolerability, safety, drug interactions, dosage and administration, cost, and place in therapy of insulin detemir.

Pharmacology

Insulin reduces blood glucose by decreasing gluconeogenesis and increasing the uptake of glucose by the muscle and adipose tissue. Insulin detemir is a long-acting, neutral, soluble insulin analogue that regulates glucose metabolism by binding to insulin receptors.^{6,7} It differs from NPH insulin and insulin glargine because it does not crystallize or precipitate once injected into subcutaneous tis-

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sue. The crystals or precipitates are responsible for the extended activity of NPH insulin and insulin glargine and are also associated with variability in pharmacokinetic and pharmacodynamic parameters.^{8,9} Insulin detemir forms hexamers at the injection site.⁸ The insulin then dissociates into dimers and monomers before being absorbed into the bloodstream, which allows the solubilized formulation to remain in the depot long enough to bind to albumin.¹⁰ In vivo, it is 98–99% reversibly bound to albumin.⁶ These mechanisms attribute to insulin detemir's long duration of action.

Pharmacokinetics

Insulin detemir produces a more predictable dosing profile than NPH insulin. In studies in healthy volunteers, insulin detemir produced a linear and dose-proportional plasma insulin concentration with a terminal half-life of five to seven hours, depending on the dose.^{6,7} The volume of distribution is approximately 0.1 L/kg and the bioavailability is 60%.⁶ The maximum serum insulin concentration is reached six to eight hours after subcutaneous administration. Because insulin detemir has an onset of action of 1 hour and a mean duration of action of 20 hours after administration of a 0.4-unit/kg dose, the drug may be administered once daily.^{8,11} At higher dosages, insulin detemir's duration of action extends beyond 20 hours.^{7,11} Insulin detemir exhibits within-age and across-age group consistency in its pharmacokinetic profile. The pharmacokinetics of insulin detemir are not altered in patients with hepatic or renal impairment; therefore, dosing should be based on pharmacologic response. The product is negligibly eliminated by dialysis.^{10,11}

Clinical efficacy and tolerability

Several open-label, randomized, multicenter trials ($n > 250$) from 12 weeks to 12 months in duration have

been conducted comparing the safety and efficacy of insulin detemir with NPH insulin in patients with either type 1 or type 2 diabetes mellitus (Table 1).^{12–18} In most trials patients were randomized to receive insulin on three different dosing schedules: basal insulin twice daily before breakfast and at bedtime, basal insulin at 12-hour intervals, or basal insulin before breakfast and dinner. Mealtime insulin, administered as insulin aspart or regular insulin human, was given to patients as part of the basal-bolus insulin therapy (i.e., several daily injections of fast-acting insulin at mealtime [bolus doses], together with one or more injections of long-acting insulin [basal doses]). In each trial, dosages of insulin detemir and NPH insulin were adjusted to achieve target fasting and nighttime blood glucose levels. HbA_{1c}, fasting plasma glucose levels, and blood glucose levels determined at 8 to 10 prespecified times daily were used to measure glycemic control.

HbA_{1c} values, the primary efficacy measure of the trials listed in Table 1, were similar in patients receiving insulin detemir or NPH insulin.^{12–15,17,18} One trial conducted in 595 patients with type 1 diabetes mellitus showed a significant decrease in HbA_{1c} values in patients receiving insulin detemir twice a day compared with those in patients receiving NPH insulin twice a day ($p < 0.001$).¹⁶ To date, no short-term trials in patients with type 2 diabetes mellitus have shown a significant difference in HbA_{1c} values between patients receiving insulin detemir or NPH insulin.^{12,18}

Two long-term clinical trials in patients with type 1 diabetes mellitus showed comparable glycemic control with insulin detemir and NPH insulin within a 12-month period.^{15,19}

Most clinical trials have shown comparable effects of insulin detemir and NPH insulin on fasting plasma glucose levels in patients with type 1 or type 2 diabetes mellitus. A 16-week trial in patients with type 1

diabetes mellitus showed a significant decrease in the glucose levels of patients receiving insulin detemir every 12 hours or before breakfast and at bedtime compared with that observed in patients receiving NPH insulin before breakfast and at bedtime ($p < 0.001$).¹⁴

Overall, studies have shown that insulin detemir provides glycemic control that is similar to, or better than, that provided by NPH insulin in adult patients with type 1 diabetes mellitus.^{13–17,19} Lower within-subject variability in fasting plasma glucose levels, lower frequency of hypoglycemic events, and weight loss have also been observed in patients with type 1 and type 2 diabetes mellitus with insulin detemir in comparison with NPH insulin.^{12–17,19}

Few studies have been conducted in patients with type 2 diabetes mellitus, but data thus far suggest that insulin detemir results in similar glycemic control when compared with NPH insulin.^{12,18} The clinical efficacy of insulin detemir in pediatric and geriatric patients is unknown because of limited data in both patient populations. The majority of studies were conducted in patients with a mean age of 40.^{9,13–17,19}

Fasting plasma glucose levels. Patients with higher fasting plasma glucose levels are likely to experience larger day-to-day fluctuations in glucose levels than those with better glycemic control. This variability should be considered when using fasting blood glucose levels to diagnose diabetes or monitor treatment response. Most trials in patients with type 1 diabetes mellitus and one trial in patients with type 2 diabetes mellitus have shown reduced within-subject, day-to-day variability in fasting plasma glucose levels with insulin detemir compared with NPH insulin, as shown in Table 2.^{12–14,16–18} One double-blind, single-center, parallel-group study in 54 patients with type 1 diabetes mellitus compared within-subject variability of

Table 1.
Clinical Trials Comparing Insulin Detemir with Other Insulin Products^a

Ref.	Study Design	Duration (wk)	No. Pts. (Diagnosis)	Treatment	Baseline Laboratory Values		Study End Laboratory Values	
					Mean $\pm$ S.D. HbA _{1c} (%)	Mean $\pm$ S.D. Fasting Plasma Glucose Concentration (mmol/L)	Mean $\pm$ S.D. HbA _{1c} (%)	Mean $\pm$ S.D. Fasting Plasma Glucose Concentration (mmol/L)
15	OL, PG, MC	52	308 (Type 1 DM)	Insulin detemir (morning and bedtime) + insulin aspart NPH insulin (morning and bedtime) + insulin aspart	8.18 $\pm$ 1.14 8.03 $\pm$ 1.11	11.85 $\pm$ 5.28 11.51 $\pm$ 5.16	7.53 $\pm$ 0.10 ^b 7.59 $\pm$ 0.13 ^b	10.7 ^c 10.8 ^c
16	OL, PG, MC	18	595 (Type 1 DM)	Insulin detemir (twice daily) + insulin aspart NPH insulin (twice daily) + insulin human (soluble)	8.48 $\pm$ 1.12 8.29 $\pm$ 1.19	8.83 $\pm$ 4.31 9.17 $\pm$ 4.07	7.88 $\pm$ 0.05 8.11 $\pm$ 0.05 ^d	7.58 $\pm$ 0.19 8.10 $\pm$ 0.20 ^e
14	R, OL PG	16	408 (Type 1 DM)	Insulin detemir (morning and bedtime) + insulin aspart Insulin detemir (every 12 hr) + insulin aspart NPH insulin (morning and bedtime) + insulin aspart	8.74 $\pm$ 1.20 8.55 $\pm$ 1.20 8.52 $\pm$ 1.19	11.65 $\pm$ 4.61 11.57 $\pm$ 4.65 12.20 $\pm$ 5.49	7.78 $\pm$ 0.07 7.75 $\pm$ 0.07 7.94 $\pm$ 0.07 ^f	8.94 $\pm$ 0.37 9.75 $\pm$ 0.37 11.24 $\pm$ 0.38 ^d
17	R, OL, PG, MC	16	400 (Type 1 DM)	Insulin detemir (morning and bedtime) + insulin aspart Insulin detemir (morning and before dinner) + insulin aspart NPH insulin (morning and bedtime) + insulin aspart	8.13 $\pm$ 1.37 8.01 $\pm$ 1.24 8.08 $\pm$ 1.15	10.63 $\pm$ 4.58 10.00 $\pm$ 4.59 10.65 $\pm$ 4.37	7.65 $\pm$ 0.07 7.67 $\pm$ 0.07 7.73 $\pm$ 0.07 ^g	9.15 $\pm$ 0.36 9.83 $\pm$ 0.35 11.14 $\pm$ 0.35 ^h
13	OL, PG, MC	24	448 (Type 1 DM)	Insulin detemir (morning and bedtime) + insulin aspart NPH insulin (morning and bedtime) + insulin aspart	8.18 $\pm$ 1.14 8.11 $\pm$ 1.12	11.6 $\pm$ 5.21 11.6 $\pm$ 5.27	7.60 $\pm$ 0.09 7.64 $\pm$ 0.10 ⁱ	9.19 $\pm$ 0.44 9.94 $\pm$ 0.52 ^j
12	OL, PG, MC	26	502 (Type 2 DM)	Insulin detemir + insulin aspart NPH insulin + insulin aspart	7.9 $\pm$ 1.3 7.8 $\pm$ 1.3	10.1 $\pm$ 3.32 10.4 $\pm$ 3.42	7.6 $\pm$ 0.1 ^b 7.5 $\pm$ 0.1 ^b	9.7 $\pm$ 0.2 9.6 $\pm$ 0.3 ^k
18	R, OL, PG, MC	22	395 (Type 2 DM)	Insulin detemir + insulin aspart NPH insulin + insulin human (soluble)	8.16 $\pm$ 1.28 8.08 $\pm$ 1.23	NR NR	7.46 7.52 ^l	NR NR

^aDB = double-blind, DM = diabetes mellitus, HbA_{1c} = glycosylated hemoglobin, MC = multicenter, NPH = isophane insulin human, NR = not recorded, OL = open-label, PG = parallel-group, R = randomized.
^bHbA_{1c} was comparable between the two groups on the basis of noninferiority criterion for the insulin detemir set: The upper limit of the 95% confidence interval for the difference in the HbA_{1c} groups was <0.4%.

^c*p* value was not reported; fasting plasma glucose was comparable.

^dFor comparison between or among groups, *p* < 0.001.

^eFor comparison between groups, *p* > 0.05.

^fFor comparison among groups, *p* = 0.082.

^gFor comparison among groups, *p* = 0.64.

^hFor comparison among groups, *p* = 0.006.

ⁱFor comparison between groups, *p* = 0.61.

^jFor comparison between groups, *p* = 0.09.

^kFor comparison between groups, *p* = 0.66.

^lFor comparison between groups, *p* = 0.515.

glucose levels of insulin detemir with those observed with NPH insulin or insulin glargine.⁹ Patients were given 0.4 unit/kg of either insulin detemir, insulin glargine, or NPH insulin under euglycemic clamp conditions for four days to evaluate the pharmacodynamic and pharmacokinetic properties of these medications. Less within-subject variability in blood glucose levels was observed with insulin detemir compared with NPH insulin and insulin glargine, on the basis of the coefficient of variation for glucose infusion rates and maximal serum concentration of insulin detemir, NPH insulin, and insulin glargine. The results of this study suggest that insulin detemir has a more predictable glucose-lowering effect than NPH insulin or insulin glargine. In comparison with NPH

insulin, reduced variability in insulin detemir action has also been shown in children and adolescents with type 1 diabetes mellitus.²⁰

Hypoglycemic events. Insulin is associated with an increased risk of hypoglycemia, especially nocturnal hypoglycemia, as patients try to attain normoglycemia.²¹ The lower within-subject variability of fasting plasma glucose levels patients have with insulin detemir is hoped to reduce the incidence of hypoglycemia.¹² Studies comparing insulin detemir with NPH insulin have shown a lower risk of nocturnal hypoglycemia with insulin detemir (Table 3).^{12,13,16,18,19,22} Studies in patients with type 2 diabetes mellitus have not shown a significantly different risk of overall and nocturnal hypoglycemia between insulin de-

temir and NPH insulin. This may be related to lower occurrences of hypoglycemia in patients with type 2 diabetes mellitus.^{12,18}

In a 12-month open-label, multicenter, parallel-group trial with 308 patients with type 1 diabetes mellitus, fewer overall hypoglycemic events were reported with insulin detemir than with NPH insulin; however, this finding was not statistically significant.¹⁵ This study did show a 32% lower risk of nocturnal hypoglycemia in patients receiving insulin detemir during the 11-month maintenance phase ($p = 0.016$). An open-label, parallel-group, 16-week trial of 408 patients with type 1 diabetes mellitus randomized patients into three treatment groups.¹⁴ These groups included insulin detemir before breakfast and at bedtime, insulin

Table 2.

Within Subject Day-to-Day Variability in Self-Monitored Fasting Glucose with Insulin Detemir (Morning and Bedtime) and Isophane Insulin Human

Ref.	Diagnosis ^a	No. Patients	Mean $\pm$ S.D. Fasting Plasma Glucose (mmol/L)		<i>p</i>
			Insulin Detemir	Isophane Insulin Human	
16	Type 1 DM	595	7.80 $\pm$ 2.60	8.34 $\pm$ 3.04	<0.001
14	Type 1 DM	409	8.26 $\pm$ 2.90	9.05 $\pm$ 3.49	<0.001
17	Type 1 DM	400	8.00 $\pm$ 2.60	8.31 $\pm$ 3.09	<0.001
13	Type 1 DM	448	8.80 $\pm$ 3.37	9.23 $\pm$ 3.78	<0.001
12	Type 2 DM	505	7.50 $\pm$ 1.30	7.60 $\pm$ 1.40	0.021
18	Type 2 DM	395	7.28 $\pm$ 1.20	7.32 $\pm$ 1.50	<0.001

^aDM = diabetes mellitus.

Table 3.

Hypoglycemic Events Reported in Studies with Insulin Detemir and Isophane Insulin Human^a

Ref.	Diagnosis	No. Patients		Total No. Nocturnal Hypoglycemia Events			Total No. Hypoglycemic Events		
		Insulin Detemir	NPH Insulin	Insulin Detemir	NPH Insulin	<i>p</i>	Insulin Detemir	NPH Insulin	<i>p</i>
22	Type 1 DM	57	56	NR	NR	NR	432	577	NR
16	Type 1 DM	289	286	271	608	<0.001	2497	3192	0.036
19	Type 1 DM	154	135	757	934	0.067	4096	5129	0.139
13	Type 1 DM	284	141	923	689	<0.005	7522	4820	0.029
12	Type 2 DM	341	164	166	80	0.95	1218	708	0.48
18	Type 2 DM	185	193	49	82	0.14	269	317	0.65

^aDM = diabetes mellitus, NPH insulin = isophane insulin human, NR = not reported.

detemir every 12 hours, or NPH insulin before breakfast and at bedtime. A significant reduction in the risk of minor nocturnal hypoglycemia (<2.8 mmol/L [50 mg/dL], with or without symptoms) was observed in patients receiving insulin detemir before breakfast and at bedtime compared with those receiving NPH insulin ($p < 0.001$) and compared with those receiving insulin detemir every 12 hours ($p = 0.035$). In another study with three similar treatment groups, the number of nocturnal hypoglycemic effects reported in patients receiving insulin detemir in the morning and with the evening meal was not statistically different from those reported in the other groups.¹⁷ Overall evidence shows that insulin detemir, compared with NPH insulin, provides at least equivalent glycemic control with a reduced risk of hypoglycemia, especially nocturnal hypoglycemia, in patients with type 1 diabetes mellitus. It may be preferable to give insulin detemir before breakfast and at bedtime because of the reduced risk of hypoglycemia.

Body weight. A major deterrent to starting insulin is the risk of weight

gain, which is also associated with poor cardiovascular outcomes.²² Studies have shown that a 2.5% reduction in HbA_{1c} is associated with a 5-kg increase in weight, more commonly occurring in women than in men.³ Studies comparing insulin detemir with NPH insulin as part of basal-bolus therapy with human insulin (soluble) or a rapid-acting analogue have shown insulin detemir to have a favorable effect on weight compared with NPH insulin (Figure 1).^{12,14-19}

Insulin detemir has not been associated with a significant increase in body weight in patients with type 1 or type 2 diabetes mellitus. Significantly less weight gain was seen in patients with type 2 diabetes mellitus receiving insulin detemir than in those receiving NPH insulin over a 22-week period.¹⁸ The mean $\pm$ S.D. weight gains were 0.51 ± 0.22 kg with insulin detemir and 1.13 ± 0.21 kg with NPH insulin ($p = 0.038$). A statistical difference in weight change between patients receiving insulin detemir and those receiving NPH insulin was observed during two 12-month studies in patients with type

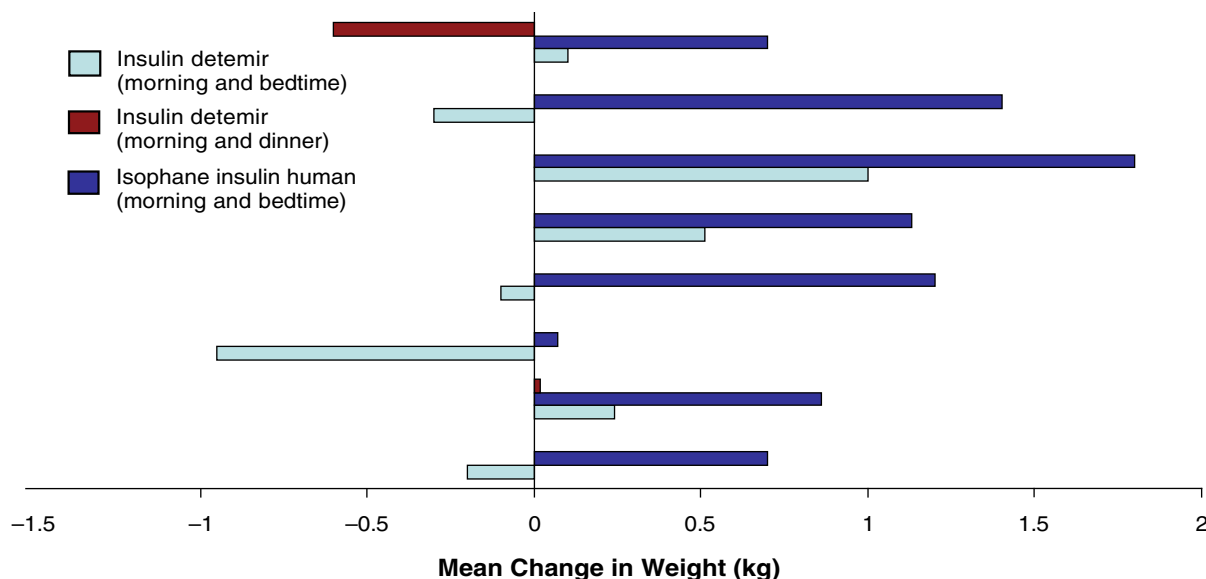
1 diabetes mellitus.^{15,19} One study showed the mean change in weight in the insulin detemir group to be a loss of 0.3 kg compared with a gain of 1.4 kg for the NPH insulin group (baseline-adjusted between-group difference at 12 months, 1.66 kg, $p = 0.002$).¹⁹ The other 12-month trial showed a weight reduction at 3, 6, 9, and 12 months in patients taking insulin detemir compared with patients taking NPH insulin, who had an increase in body weight.¹⁵ When weight data were adjusted for changes in HbA_{1c}, the between-group difference was 1.44 kg ($p = 0.0002$).

The rationale for the lack of clinically relevant weight gain with insulin detemir therapy has not yet been established. It may be attributed to reduced within-subject variability in plasma glucose levels and a reduced risk of hypoglycemic events in patients on insulin detemir, leading to less snacking.⁷

Safety

Overall, insulin detemir is well tolerated in patients with type 1 and type 2 diabetes mellitus. The most

Figure 1. Mean weight change reported in clinical trials in patients taking insulin detemir versus isophane insulin human; $p < 0.05$ for all comparisons.



common adverse effects reported during clinical trials were hypoglycemia, headache, dizziness, and injection-site reactions.⁸ A small number of mild allergic reactions have been reported with the use of insulin detemir.⁷ A type III allergic reaction, characterized by a subcutaneous nodule appearing at the injection site two to six hours after administration, has been reported in one patient.²³

Drug interactions

Although insulin detemir is highly protein bound, no clinically significant drug interactions between insulin detemir and other highly protein-bound drugs, such as warfarin, sodium valproate, and phenylbutazone, have been observed *in vitro*.^{6,7} More studies need to be conducted to determine if drugs such as heparin and catecholamines, which tend to increase levels of free fatty acids, will alter the profile of insulin detemir.⁷ As with all insulin products, patients taking medications that can affect glucose levels, such as corticosteroids, diuretics, and β -blockers, should be carefully monitored.⁶

Dosage and administration

Insulin detemir is indicated for management of hyperglycemia in adult and pediatric patients with type 1 diabetes mellitus and in adult patients with type 2 diabetes mellitus.⁶ The initial dosage recommended for patients with type 1 or type 2 diabetes mellitus beginning insulin therapy is 0.2–0.5 unit/kg/day subcutaneously; the dosage should then be adjusted to achieve glycemic goals.^{8,24} Once-daily dosing of insulin detemir with the evening meal or at bedtime is recommended.⁸ If two doses are given per day, they should be administered approximately 12 hours apart. Patients with type 2 diabetes mellitus who have inadequate glycemic control with an oral agent and those who are insulin naive should be given a dosage of 0.1–0.2

unit/kg subcutaneously once daily or 10 units one or two times daily and adjusted to reach goal glucose levels.⁶ Patients taking other basal insulin therapy can be converted to insulin detemir on a unit-for-unit basis and should keep their current dosing schedule of once or twice daily. Patients switching from twice-daily NPH insulin to insulin detemir should receive 80% of their total daily NPH insulin dose as insulin detemir once daily.²⁴ If patients are receiving more than two doses of basal insulin per day, they should not exceed two doses of insulin detemir per day.^{8,24} Patients receiving premixed insulin should be converted to 50% of their calculated basal dose of insulin to insulin detemir once daily. The insulin detemir dosage should be adjusted to achieve individualized patient target glucose levels.

Unopened vials of insulin detemir should be kept refrigerated at 2–8 °C (36–46 °F) and may be used until the expiration date.²⁵ Vials should be protected from heat and light. However, unopened vials stored at room temperature and opened vials, regardless of storage environment, may be used for up to 42 days. The storage requirements are the same for prefilled syringes and cartridges; however, once in use, these should not be refrigerated. Insulin detemir cannot be mixed with other insulin products and should be a clear, colorless solution. Vials containing sediment should be discarded.⁶

Cost

Cost comparisons are difficult to perform with insulin products because of the differing dosage regimens among patients. There is limited pharmacoeconomic data on insulin detemir and no economic comparisons with NPH insulin or insulin glargine. Insulin detemir is available in a 10-mL vial for a retail price of \$77.99. Insulin detemir is also available in a 3-mL (100 units/mL) FlexPen. A package of five sy-

ringes is \$146.99 retail.²⁶ NPH insulin and insulin glargine are available as 10 mL vials at a cost of \$32.23 and \$71.26, respectively.²⁶

Place in therapy

Patients with type 1 and type 2 diabetes mellitus need medications to help achieve target glucose levels. Patients receiving insulin therapy require basal-bolus regimens to mimic the normal release of insulin. Rapid-acting and long-acting medications have been developed to reproduce the physiological secretion of insulin. Insulin detemir was developed to provide a steady rate of insulin release for a prolonged period of time. Studies in patients with type 1 diabetes mellitus have suggested that insulin detemir may have a more predictable glucose-lowering effect when compared with NPH insulin or insulin glargine.^{12,13} In clinical trials, insulin detemir has been associated with less weight gain^{6,8,12} and a lower rate of nocturnal hypoglycemia when compared with NPH insulin.^{11,19} It does not appear to offer a significant advantage in improving HbA_{1c} over NPH insulin but may offer more predictable glycemic control. Studies comparing the actual reduction of glucose levels and HbA_{1c} values in patients using insulin detemir versus insulin glargine are warranted to determine clinically relevant differences in the two products.

The efficacy of insulin detemir has been shown in trials for up to one year, but currently there is little evidence to justify switching patients from their existing insulin therapy to insulin detemir if they have adequate glycemic control. Insulin detemir should be considered in patients who have had difficulty achieving adequate glycemic control with other insulin therapy, those with frequent episodes of hypoglycemia, or those at high risk of hypoglycemia, especially nocturnal hypoglycemia. The potential reduction in weight or maintenance of current body weight

in patients receiving insulin detemir should also be considered.

Summary

The main goal for patients with diabetes is to attain normoglycemia to prevent microvascular and macrovascular complications. The treatment of diabetes was revolutionized with the introduction of insulin. Since the discovery of insulin, researchers have been searching for a formulation that resembles physiological insulin. Insulin detemir, a long-acting insulin, is an alternative for basal insulin therapy in patients with diabetes. Current research shows comparable findings with NPH insulin for decreasing HbA_{1c} and maintaining glycemic control. Reduced within-subject variability in fasting plasma glucose levels is seen with insulin detemir when compared with NPH insulin. Insulin detemir appears to be as safe as NPH insulin with possibly fewer hypoglycemic events, especially nocturnal events. Reductions in hypoglycemic events may lead patients to adjust their insulin dosage more effectively to attain therapeutic goals. Significant weight gain has not been shown to occur in patients on insulin detemir. Trials greater than one year in duration with insulin detemir have not been published, so long-term effects on morbidity and mortality are unknown. Clinical trials comparing the efficacy of insulin detemir with insulin glargine are also needed.

Conclusion

Insulin detemir given once or twice daily as part of basal-bolus insulin therapy is at least as effective as NPH insulin in maintaining overall glycemic control in adult patients with type 1 or type 2 diabetes mellitus.

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