

# Basal-Bolus Insulin Regimen Using Insulin Detemir in Type 1 Diabetic Saudi Children

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## Abstract

Five Saudi children with type 1 diabetes mellitus were selected and started on detemir-based basal-bolus insulin therapy. Selection criteria included diabetic children with poor diabetic control and recurrent daytime and nocturnal hypoglycemic episodes. The patients were on conventional insulin therapy that included two injections of insulin per day before shifting them to detemir-based basal bolus insulin regimen. They had type 1 diabetes mellitus for a mean duration of 3 years and were followed on basal-bolus insulin regimen therapy using detemir insulin for a mean duration of 3.5 months. Post basal-bolus regimen, there was no significant change in HbA1c level, however, there was significant reduction in frequency of hypoglycemic episodes. The frequency of hypoglycemic episodes (defined as a blood glucose level of 40 mg/dl or less) ranged from 4 to 9 episodes per month on conventional insulin therapy and dropped to 2-5 per month post basal-bolus therapy. The present study showed that basal-bolus insulin regimen is effective in improving the metabolic control in type 1 diabetic Saudi children. The results of this local experiment are encouraging to implement this mode of intensive insulin therapy in all candidate diabetic Saudi children.

## Introduction

Detemir (levemir®) insulin is a recently approved, long acting insulin analog that is increasingly being used in children and adults with diabetes. It has less pronounced peak and lasts for 18 to 24 hours which allows once or twice daily administration as basal insulin. Several studies showed that detemir-based basal-bolus insulin regimen can reduce the rate of daytime and nocturnal hypoglycemia and improve the blood glucose variability without jeopardizing the glycemic control [1-5].

The aim of this study was to assess the effectiveness and feasibility of basal-bolus insulin regimen using bedtime detemir insulin in combination with pre-meals ultra-short acting aspart (novorapid) insulin in type 1 diabetic Saudi children and to compare it with conventional insulin (CI) therapy. To our knowledge, this is the first trial that describes the use of basal-bolus insulin regimen using detemir insulin in Saudi children and shows its safety and efficacy in improving the fasting blood glucose level, and decreasing the blood glucose variability and the hypoglycemia frequency.

## Case report

Five Saudi children (3 male, 2 female) with type 1 diabetes mellitus were selected and started on detemir-based basal-bolus insulin therapy. Selection criteria included diabetic children with poor diabetic control (HbA1c above 8.5%) who had recurrent daytime and nocturnal hypoglycemic episodes (more than 4 episodes per month). These patients were willing to monitor blood glucose regularly and frequently, motivated to improve blood glucose control, willing to quantify food intake and count carbohydrates. They had adequate family support and were interested in preventing short-term diabetic complications. All patients were on CI therapy that included two injections of insulin per day; NPH (intermediate-acting) and regular (short-acting) insulin before shifting them to detemir-based basal bolus insulin regimen.

All patients were trained by a diabetic dietitian on carbohydrates counting and food nutrition labels reading. Fifty percent of their total caloric intake was from carbohydrates. Total daily carbohydrate intake calculated as grams of carbohydrates was distributed into 3 meals and 3 snacks.

Detemir insulin dose was initially calculated as 50% of the total pre-basal-bolus insulin regimen. One unit of aspart insulin was required to cover for 10 to 15 grams of carbohydrates (meal insulin bolus). Additional aspart insulin doses for high blood glucose correction were required. One unit of aspart insulin was needed to correct for 50-100 mg/dl above 120 mg/dl (correction insulin bolus).

All patients were initially instructed to check blood glucose 8 times per day; pre and post-meals, bed time and in the early morning for the first few days of basal-bolus insulin regimen initiation, and then 5 times of blood glucose monitoring were required. All children were told to fax their blood glucose record sheet to the health care team or phone for consultation whenever having difficulties in controlling blood glucose levels. All children had weekly clinic visits and every 2 months HbA1c monitoring.

Statistical analyses were performed using the paired comparison T test to evaluate the differences between basal-bolus insulin regimen and CI treatment levels of HbA1c, fasting blood glucose levels, and hypoglycemic episodes rate. The tests were two tailed and p value of <0.05 was chosen to indicate significant deviation from the null hypothesis. All patients had type 1 diabetes mellitus for a mean duration of 3 years (range from 2 to 5 years). The age of the children ranged from 7 to 11 years (mean 8.3). They were followed on basal-bolus insulin regimen therapy using bedtime detemir insulin in combination with pre-meals aspart insulin for a mean duration of 3.5 months (range from 3 to 4 months). All children had normal thyroid function tests, anti-celiac disease antibodies, urine micro-albumin and lipid profile.

During the 3 months prior to basal-bolus insulin regimen initiation and on CI therapy, the mean hemoglobin A1c was 8.6 % + 1.2, the mean fasting blood glucose level was 201 mg/dl + 39 the frequency of hypoglycemic episodes (defined as a blood glucose level of 40 mg/dl or less) ranged from 4 to 9 episodes per month (mean 6.8). There were no reports of hypoglycemic convulsive or diabetic ketoacidosis (DKA) episodes. Post basal-bolus regimen and during the last month of treatment, the mean hemoglobin A1c was 8.4 % + 0.7, the mean fasting blood glucose level was 174 mg/dl + 22 and the frequency of hypoglycemic episodes ranged from 2-5 per month (mean 3).

There was no significant change in HbA1c level during basal-bolus insulin regimen in the study group, however, the mean fasting blood glucose level was significantly lower during basal-bolus insulin regimen compared with CI therapy ( $P < 0.001$ ). The range of fasting blood glucose variability was also lower ( $P < 0.001$ ). A significant decrease in the frequency of hypoglycemic episodes was observed ( $P < 0.001$ ). There was no report of hypoglycemic convulsion or coma or diabetic ketoacidosis in children on basal-bolus insulin regimen. There was no significant change in body weight.

## **Discussion**

Several studies showed that intensive diabetes management with MDI or basal bolus insulin regimen provides better glycemic control than CI therapy (1-5). However, the number of Saudi children on MDI or basal-bolus regimen therapy is still small. Lack of medical and family support and public awareness are among the contributing factors for that.

This article reports our experience with 5 Saudi children on basal-bolus insulin regimen that proves that this modality of intensive insulin therapy is extremely effective in treating type 1 diabetic Saudi children especially those with labile unstable brittle diabetes with wide blood glucose variability. Family and psychosocial support is needed for this modality of insulin therapy to succeed.

The mean fasting blood glucose was better on insulin regimen using bedtime detemir and premeals aspart in comparison to CI regimen. The range and variation of fasting blood glucose improved with this new regimen. This observation was reported in recently published studies (5,6). Intensive insulin therapy is usually associated with more frequent simple hypoglycemic episodes; however the frequency of hypoglycemia was less

The glycemic control in the majority of studies involving detemir is comparable to NPH insulin therapy. In our study, we did not observe a change in HgA1C in the patients treated with detemir. This might be due to the short duration of therapy.

## Conclusion

In conclusion, the present study showed that basal-bolus insulin regimen is effective in improving the metabolic control in type 1 diabetic Saudi children. The results of this local experiment are encouraging to implement this mode of intensive insulin therapy in all candidate diabetic Saudi children.

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