Insulin Therapy in Type 1 Diabetes

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COLUMN ARTICLE

Diabetes mellitus (DM), remains one of the most significant causes of morbidity and mortality. Control of blood glucose levels may decrease the risk of complications. The success depends on the proximity to a regimen that mimics the physiological secretion pattern of insulin.

The aims of the treatment are: decrease glycosylated hemoglobin (HbA1c) level to less than 7% according to American Diabetes Association (ADA), maintain fasting plasma glucose between 4.4 - 10 µmol/L, decreased postprandial blood glucose to less than 10 µmol/L (ADA), control blood lipid levels, maintain good nutritional status and control blood pressure to values less than 130/80 mmHg.

The long action insulins (LAI) are: NPH, Detemir (Levemir[R]) and Glargina (Lantus[R]). These last two are analogues. The fast action insulins (FAI) are: Regular (Actrapid[R]), Lispro (Humalog[R]), Aspart (Novorapid[R]) and Glulisina (Apidra[R]). The last three are also analogues (Figure 1).
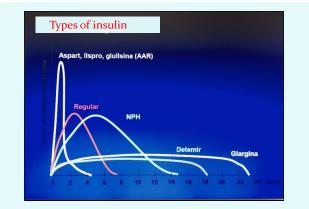

Figure 1: Types of fast and long action insulin.

The advantages of LAI analogues are: improve metabolic control, reduce weight gain, decrease frequency and severity of nocturnal hypoglycemia. On the other hand, when we use FAI analogues, the action profile is more like endogenous insulin, facilitate the application of the bolus / basal regimen, the control of postprandial glycemia is better, the action is quick, and may be administered 5 - 10 minutes before, during or even after meals.

We calculate daily insulin requirements according to the age of patient, pubertal stage, years of disease progression and his weight (Figure 2).

Partial remission: < 0.5 U/kg/day

Pre-puberty: 0.7 a 1.0 U/kg/day

Puberty: 1.0 to 1.5 U/kg/day (insulin resistence)

Post- puberty: 0.7 a 0.8 U/kg/day

Figure 2: Insulin daily requirement.

The daily insulin needs are 50 - 60% of LAI as basal insulin (Glargina or Determir), with 40 - 50% of FAI (lispro/ aspartic acid/glulisina) in a ratio of 0.1 to 0.2 U/kg/dose (max 7 - 10 U/ dose).

If we switch from NPH insulin to Glargina or Detemir, the dose is 80% of the IU given by NPH insulin, to avoid hypoglycemia. Glargina can give in one of these meals: before breakfast, lunch, dinner and at bedtime. Detemir can be used before breakfast or at bedtime.

The FAI, are given 4 times daily, before, during or after breakfast, lunch, snack or dinner.

To adjust the insulin doses, the patient should perform 5 to 6 blood glucose tests per day. If the glucose levels are high, we increase 10% of the dose and after wait a few days to see the results. For a good control, the glucose levels should be around: 4.4 - 7.7µmol/L before meal, 5.5 - 10 µmol/L after meal and less than 4.4 µmol/L during night.

All extra insulin must be given with FAI.

For calculation of the daily insulin, we need to know what is DDTI= total daily dose of insulin (LAI + FAI).

Is also important to understand and know the total amount of insulin necessary to metabolize a quantity of carbohydrate to correct the insulin before meal. This is the so called Rule of 500 = Insulin/ carbohydrate ratio (500/ DDTI).

To calculate the insulin sensibility or how many µmol of glucose reduce after one unit of FAI, we use the Rule of 1800 = Glucose/insulin ratio (1800/DDTI).

To calculate the dose of LAI that we need to increase, maintain or reduce, we count the average of the last 3 days fasting glucose levels. The levels should be between 4.4 µmol/ L – 7.7 µmol/L. In children under 5 years of age, if the level is under 4.4 µmol/L, we decrease 1 unit, but if the patient is older, we reduce 2 units of LAI. If the average is more than 7.7 µmol/L, in under 5 y old patient, we increase 1 unit and for those with more than 5 years of age, we increase 2 units. We maintain the previous dose of LAI, if the patient average is between 4.4 to 7.7 µmol/L.

The family and patients needs to know the Carbohydrate Counting Table, provided by the nutritionist to control their daily amount intake.

Analogs definitely reduce the risk of hypoglycemia and the diabetes patients will have a better quality of life.

If we use correctly the carbohydrate counting, episodes of hypo/hyperglycemia will decrease significantly. The long terms complications will be lower.