

RECURRENT HYPOGLYCAEMIA IN TYPE 1 DIABETES MELLITUS RESULTING FROM INTENSIVE ACADEMIC ACTIVITY: AN ILLUSTRATIVE CASE REPORT

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Abstract

*We report a common diabetes management problem illustrated by an adolescent female university student with recurrent episodes of hypoglycaemia on Tuesdays when she has intensive academic activity lasting most of the day. Steps taken to reduce the risk of hypoglycaemia were patient education and empowerment, frequent self monitoring of blood glucose, reduction in insulin dose on Tuesdays and emphasizing availability of ongoing professional guidance and support anytime she may need it. One of the challenges encountered in the management of this patient was her family's inability to afford the cost of basal-bolus regimen or continuous subcutaneous insulin infusion via insulin pump; the two insulin regimens that best fit into university lifestyle. **Conclusion:** Adolescents with diabetes mellitus attending tertiary educational institutions may be at increased risk of hypoglycaemia, particularly on days when they have intensive academic activities.*

key words: Diabetes mellitus, hypoglycaemia, intensive academic activity, student

Introduction

Hypoglycaemia is the most common immediate health problem for young students with type 1 diabetes mellitus (T1DM) [1]. Its occurrence is the consequence of mismatches in insulin dose, food intake, and physical activity [2]. Frequent episodes of hypoglycaemia, even if asymptomatic, can result in hypoglycaemia unawareness and failure of glucose counterregulation, exposing patients to major risk for severe hypoglycaemia [3]. Although

death from hypoglycaemia is uncommon, it is a source of constant fear. It is estimated that 2-4% of individuals with T1DM die as a result of hypoglycaemia [4]. Ryan et al. [5] in their study, involving children and adolescents between the ages of 11 and 18 years, found a significant decline in mental efficiency at blood glucose levels of 3.3 to 3.6 mmol/L (60-65mg/dl). In that study, the measures of mental efficiency that were adversely affected were mental flexibility, planning, decision making, attention to details and rapid response. Thus, avoidance of

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hypoglycaemia (even mild) should be the therapeutic goal.

The severity of hypoglycaemia is classified as mild (blood glucose value between 55 to below 70mg/dl); moderate (blood glucose value less than 55mg/dl but without loss of consciousness); and severe (blood glucose value less than 70mg/dl with loss of consciousness and/or seizure) [6,7]. Hypoglycaemia is most convincingly documented by Whipple's triad: (i) symptoms consistent with hypoglycaemia, (ii) a low blood glucose level and; (iii) relief of those symptoms after raising blood glucose level [4].

It has been documented that the risk of hypoglycaemia is increased with new activities, more sustained or intense activities [8]. Activities and routines of University students are often highly unpredictable, and they may have a greatly varying daily schedules. For instance, on some days the student may need to get up early to attend an 8.00 a.m. class. Regular mealtimes are almost impossible and late night snacks are usually not planned [9]. This student may find himself skipping breakfast because of lack of time. Because of the variability from day to day, the insulin plan chosen by each student must allow for a great deal of flexibility. The two insulin regimens which best fit into college lifestyle are (i) the use of a long-acting insulin (such as ultralente, detemir or glargine) combined with a rapid-onset, short-acting insulin analog (e.g., Lispro) [9] and (ii) the use of continuous insulin infusion via an insulin pump [10]. The second option is largely non-existent in resource-constrained clinical settings such as ours. The adolescent and young adult preparing to go to the university should be independent in diabetes care. Responsible parents and health care providers will do well to provide a review in helping the student make such transition [11]. Students preparing to move to the university need to be reminded to train roommates with

regard to hypoglycaemia, maintain health care and doctor visits, and about special situations like use of alcohol, contraception and dating [11].

The purpose of this case report is to raise the alertness of clinicians on the occurrence of recurrent hypoglycaemia as a result of reduced food intake coupled with sustained physical activity in association with intense academic demand of university education. In addition, we want to emphasize the need to prepare adolescents with diabetes for life in the university.

Case report

H.I. is 16-year old female undergraduate whose type 1 diabetes mellitus was diagnosed 3 years ago. She is on pre-mixed insulin (Humulin 70/30) 42 units before breakfast and 24 units pre-dinner. She has been doing relatively well on this regimen prior to gaining admission into the university. During one of her follow-up clinic visits she complained of repeated episodes of "shakiness and dizziness" over the preceding 5 weeks. Further interview revealed that these symptoms usually occur on Tuesdays at about 1.00 - 2.00 pm. Tuesday is a very busy day as lectures start at 8.00 a.m. and last till 4.00 pm with little or no break in between, resulting in skipping of lunch. In addition, she has to walk briskly to get to the next lecture hall. Her blood glucose levels at these times were on the average 2.9 mmol/L (52mg/dl). She intervenes by taking a tablet of glucose, then return to her room to eat and rest briefly before returning to the classroom. No history of ingestion of alcohol or any other hypoglycaemia-inducing drugs, such as acetyl salicylate, sulfonylurea or metformin on these occasions. No clinical evidence of hepatic, cardiac or renal failure. Her classmates are not aware she has diabetes mellitus because

of fear of stigmatization. She attained menarche at the age of 11 years.

Her anthropometric measurements were as follows: weight 47.5kg (5th percentile); height 162cm (50th percentile); and body mass index (BMI) 18.09kg/m² (15th percentile). Her blood pressure reading was 110/70mmHg (25th percentile for age, sex and height). Other body systems were essentially normal. A diagnosis of recurrent symptomatic hypoglycaemia was made. She was advised to reduce the pre-breakfast insulin dose by 10-20% on Tuesdays and take along with her an apple which she could eat while walking to the lecture hall. Methods of adjusting insulin doses based on blood glucose values and planned daily academic activities were re-emphasized. She was also encouraged to confide to one or two friends with regard to her clinical condition and to seek advice from the diabetic team anytime (by providing more telephone numbers of team members). Subsequent interaction with her over the phone revealed that she no longer had hypoglycaemia symptoms after implementing these lines of advice.

Discussion

The diagnosis of hypoglycaemia in this index case was based on fulfillment of the Whipple's triad [4], including symptoms shakiness and dizziness, blood glucose level in the hypoglycaemic range and the relief of the symptoms after raising blood glucose by taking glucose tablet and a meal.

The clinical data of this patient is interesting and informative and need consideration. On Tuesdays, the lectures start early (8.00 am), increasing the likelihood of the patient skipping her breakfast. In addition, the lectures followed one another, leaving no room for consumption of snack. The result of this scenario is that the influx of exogenous glucose is reduced,

predisposing the student to hypoglycaemia. This student walks briskly from one lecture hall to another, an action representing increased physical activity. It is well established that insulin-independent glucose utilization is increased during exercise [2,4], increasing the risk of hypoglycaemia. The reduced food intake and increased physical activity were the key factors responsible for the hypoglycaemic episodes recorded in our patient. The clinical implication is that these mild episodes of hypoglycaemia are capable of setting up a vicious cycle of recurrent hypoglycaemia-associated autonomic failure. The components of this clinical syndrome are a defective glucose counterregulation and hypoglycaemia unawareness. The defective glucose counterregulation compromises physiological defense while the hypoglycaemia unawareness compromises behavioural defense [4].

Considering that the occurrence of hypoglycaemia as an acute complication of type 1 diabetes is the consequence of mismatches in insulin dose, food intake, and physical activity [2], the management of this index case involved reducing the insulin dose and providing an apple as snack with the aim of balancing the effect of increase in academic (physical) activity. This approach to management was effective. The lesson learnt from this index case is that hypoglycaemia risk factor reduction should include patient education and empowerment, frequent self monitoring of blood glucose, flexible insulin regimens, individualized glycaemic goals, and ongoing professional guidance and support.

The insulin therapy used in the management of the index case needs to be considered. Our patient was managed with twice daily insulin therapy, using pre-mixed insulin (short-acting insulin combined with intermediate-acting insulin) given before breakfast and before

evening meal. One major drawback of this regimen is lack of flexibility with respect to timing and amount of meals [3]. A review of the literature revealed that the two insulin regimens which best fit into college lifestyle are (i) the use of a long-acting insulin (such as ultralente detemir or glargine) combined with a rapid-onset, short-acting insulin analogue (e.g., Lispro) [9]; and (ii) the use of continuous subcutaneous insulin infusion via an insulin pump [10]. The appeal of a basal-bolus regimen from the patient's perspective is decreased episodes of hypoglycaemia and flexibility of schedule and carbohydrate amount of meals [3]. The advantages of continuous subcutaneous insulin infusion via insulin pump is that it allows for increased lifestyle flexibility, reduced blood glucose variability, improved glycaemic control and reduced frequency of severe hypoglycaemia

[3]. However, our patient could not afford the cost (both direct and indirect) of either of these two recommended insulin regimens and was therefore, managed with twice daily insulin therapy. This scenario, clearly illustrates one of the challenges encountered in the management of diabetes mellitus in developing countries; where resources are limited.

In conclusion, adolescents with diabetes mellitus transiting from secondary school to the university (and perhaps, other tertiary educational institutions) are at increased risk of hypoglycaemia, particularly on days when they have intensive academic activities, emphasizing the need for diabetes-care providers to prepare adolescents with diabetes for life in the university and other higher institutions of learning.

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