

Case Series

Adjusting the Basal Insulin Regimen of Patients With Type 1 Diabetes Mellitus Receiving Insulin Pump Therapy During the Ramadan Fast: A Case Series in Adolescents and Adults

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ABSTRACT

BACKGROUND: Ramadan, the ninth month of the Islamic lunar calendar, is the holy month of fasting for adolescent and adult Muslims. Observance of Ramadan is considered obligatory for every healthy adult Muslim. During this time, Muslims refrain from eating, drinking, smoking, and administering oral or parenteral medications from sunrise to sunset daily for 28 to 30 days.

CASE SUMMARY: We evaluated the need for changes in basal insulin regimen in 5 patients (4 males and 1 female; age range, 15–19 years) with type 1 diabetes mellitus (T1DM) who fasted during Ramadan. The patients were receiving insulin pump therapy with regular human insulin and maintained weekly visits with their endocrinologist at The Chronic Care Center (Beirut, Lebanon). They were instructed to break the fast after any episode of hypoglycemia (finger stick glucose <70 mg/dL) or severe hyperglycemia (finger stick glucose \geq 300 mg/dL or any hyperglycemia associated with presence of urine ketone bodies on urinary dipstick). Blood glucose concentrations did not change significantly with fasting. Finger stick blood glucose taken at 4-hour intervals decreased in the afternoon (at 4 PM) and increased in the evening and morning (10 PM and 8 AM, respectively) during this month in 4 of 5 patients, while no significant change in circadian rhythm of finger stick blood glucose was observed in 1 patient. Based on the investigators' findings, the basal insulin requirement decreased by 5.5% to 25.0% (4 patients) or did not change (1 patient) during the fast. Changes in regimens, based on collaboration between the endocrinologist and diabetes educational nurse, were determined by blood glucose self-monitoring done at 4-hour intervals during the fasting period, pre-Suhur (predawn breakfast), and \geq 2 hours after Iftar (evening fast-breaking meal). No cases of ketoacidosis or severe hypoglycemia were reported.

CONCLUSION: These 5 adolescent and adult patients with T1DM who were using an insulin pump were able to fast during Ramadan without incidences of severe hypoglycemia or ketoacidosis by using close blood glucose self-monitoring and weekly

follow-up with their endocrine team, which consisted of an endocrinologist, a registered nutritionist, and a diabetes educational nurse. (*Curr Ther Res Clin Exp.* 2009;70:29–34) © 2009 Excerpta Medica Inc.

KEY WORDS: type 1 diabetes, Ramadan fasting, insulin pump therapy, blood glucose concentration, diabetes control.

INTRODUCTION

Ramadan takes place in the ninth lunar month of the Islamic year and lasts for 28 to 30 days. Fasting during Ramadan is 1 of the 5 pillars of Islam.¹ Muslims strictly refrain from eating, drinking, smoking, and receiving oral or parenteral medications from sunrise until sunset, which can vary from 11 to 19 hours depending on geographic location and the time of the year that Ramadan occurs.² Two meals per day are eaten during this month, 1 before sunrise and the other after sunset.³ Normally, the fast is not associated with harmful effects. However, in patients with diabetes mellitus (DM), it could lead to serious complications.⁴ For this reason, patients with type 1 DM (T1DM) are exempt from fasting; however, some wish to adhere to the fast.⁵ According to a large multicenter survey, ~79% of patients with type 2 DM (T2DM) and 43% with T1DM were able to fast ~15 days during Ramadan.⁶

There remains a lack of consensus regarding the management of DM during Ramadan. Physicians may advise their fasting patients to adhere to a regimen that includes close self-monitoring of blood glucose and observation by a physician. According to Kassem et al,⁷ an appropriate insulin regimen for fasting patients with T1DM consists of ~85% of their initial total insulin dose, which comprises 70% basal insulin and 30% rapid insulin administered in equal amounts at sunrise and sunset.

With the widespread use of insulin pump treatment in T1DM, patients whose disease is well controlled during prolonged fasting might desire to fast during Ramadan. However, fasting is known to accelerate lipolysis and ketosis and to increase glucagon concentrations, which puts patients with T1DM at risk for hypoglycemia.⁸

The aim of this small case series was to investigate basal insulin adjustment in patients using insulin pump therapy who wished to fast during Ramadan.

CASE SUMMARY

Five patients (4 males and 1 female; age range, 15–19 years) with T1DM who attended The Chronic Care Center in Beirut, Lebanon, a center that specializes in treating children and adolescents with DM, were evaluated. The patients, who were treated with an insulin pump using regular human insulin, chose to fast during the month of Ramadan despite medical advice. All patients gave oral informed consent to participate in the study. An institutional review board waiver was obtained because patients wished to fast during Ramadan under weekly physician supervision. During each visit, the physician reviewed their daily blood glucose levels recorded in diaries as well as the total insulin requirements per day. Doses of basal insulin therapy were adjusted weekly based on patients' glucose control or if any hyperglycemic or hypoglycemic events had occurred. The patients fasted for ~12 hours a day for 4 weeks.

The amount of basal insulin prefast was adjusted weekly by the investigators based on patients' daily finger stick blood glucose control and the occurrence of any adverse events in each patient individually during the fast.

The patients were instructed to measure their blood glucose concentration every 4 hours during the fasting period and ≥ 2 hours after Iftar (evening fast-breaking meal) using finger stick testing. They were instructed to follow a reasonable traditional family Ramadan diet, except for avoiding sweets, excessive intake of carbohydrates, and excessive eating after breaking the fast. The patients were instructed to base their food consumption on carbohydrate counting. They were also instructed to measure ketone concentrations using a urine dipstick with every blood glucose concentration ≥ 300 mg/dL and to immediately break the fast in case of symptomatic hypoglycemia (defined as finger stick blood glucose level < 70 mg/dL with symptoms of tremor, altered mental status and/or confusion, perspiration, or palpitations). Patients observing the fast underwent weekly physician visits. Basal insulin requirement was initially decreased by 20% from the prefast basal insulin regimen and further adjustment was made by the endocrinologist based on the daily blood glucose self-monitoring by each patient.

During the fast, the basal insulin requirement decreased (4 patients) or did not change (1 patient) by 5.5% to 25.0% based on each patient's blood glucose concentration.

Based on clinical observation and collaboration between the endocrinologist and diabetes educational nurse, the bolus doses of insulin remained the same at sunrise and sunset. The percentage change in basal insulin dosing during Ramadan ranged from 0% to -25.0%. The glycosylated hemoglobin (HbA_{1c}) concentration ranged from 6.5% to 7.9% before Ramadan. At the end of Ramadan, the HbA_{1c} concentration ranged from 6.8% to 7.9%, which was not clinically different compared with baseline in any patient. Blood glucose concentrations did not significantly change with fasting (Table). Finger stick blood glucose concentrations taken at 4-hour intervals decreased in the afternoon (at 4 PM), ranging between 72 and 90 mg/dL, and increased in the evening ≥ 2 hours postprandial after Iftar (evening fast-breaking meal)—at 10 PM—ranging between 170 and 273 mg/dL and in early morning (at 8 AM), ranging between 188 and 248 mg/dL in 4 of the 5 patients. There was no significant change in circadian rhythm of finger stick blood glucose in 1 patient whose blood glucose concentrations ranged between 90 and 160 mg/dL.

None of the patients developed ketoacidosis or severe symptomatic daytime or nocturnal hypoglycemia that required IV glucose or IM glucagon administration.

DISCUSSION

In patients receiving insulin pump therapy, the basal insulin regimen during the fast either remained unchanged or decreased by 5.5% to 25.0% of the total prefast regimen. Our finding that HbA_{1c} concentration at the end of Ramadan was not clinically different from baseline is consistent with results from previously published studies in patients with T1DM and T2DM.^{7,9,10} One study⁷ recommended that patients with T1DM who wished to fast be switched to long-acting insulin such as ultralente. The authors indicated that the total insulin dose should consist of ~85% of the patient's initial insulin dose and should be comprised of ~70% ultralente and 30% rapid insu-

Table. Demographic and clinical characteristics of 5 patients with type 1 diabetes mellitus at baseline, during Ramadan, and at the end of the Ramadan fast.

Patient No.	Age, y	Duration of Diabetes, y	Basal Insulin Dose Pre-Ramadan, U	Mean Basal Insulin Dose Adjusted During Ramadan, U	Change in Basal Insulin Dosing During Ramadan Fast, %	HbA _{1c} Pre-Ramadan, %	HbA _{1c} Post-Ramadan, %
1	15	11	32.6	32.6	0	6.9	7.4
2	16	4	41.3	37.4	-9.4	6.9	7.8
3	19	5	29.0	22.0	-24.1	6.5	6.8
4	17	4	21.7	20.5	-5.5	7.9	7.9
5	17	5	56.0	42.0	-25.0	6.9	7.0

HbA_{1c} = glycosylated hemoglobin.

lin, divided equally between Suhur and Iftar. Another study¹⁰ recommended that an appropriate insulin regimen consist of ~70% of the patient's initial total insulin dose comprised 60% insulin glargine and 40% rapid insulin such as lispro or aspart divided equally between Suhur and Iftar. In a recent review of the literature,⁹ fasting during Ramadan was found to be well tolerated in T2DM patients who were compliant with their diet and drug intake. This study also found that in patients with T1DM who wish to fast, it is important to have good glycemic control and that these patients might achieve better control with fast absorption insulin. It also suggested that patients self-monitor blood glucose levels several times a day.

In the present study, each patient's condition was well controlled during and after the Ramadan fast, with mean HbA_{1c} concentrations of 7.0% and 7.4%, respectively. The lack of change in HbA_{1c} concentrations might have been due to the short time frame (28 days) of the Ramadan fast, which is a limitation of this case series and other studies of fasting during Ramadan. The main outcomes of this study were the lack of episodes of ketoacidosis or severe symptomatic daytime or nocturnal hypoglycemia requiring treatment.

Insulin adjustment is not the only factor to consider in maintaining glycemic control. Physicians play a crucial role in advising patients and their families on how to carry out the fasting ritual without causing clinical complications. Nutritional counseling before, during, and after fasting is important in assisting adolescents and adults in maintaining proper growth and nutrition.

This report provides insight into appropriate adjustment of basal insulin dosing in patients with T1DM receiving insulin pump therapy who desire to fast during Ramadan. Based on our clinical experience, we recommend decreasing the basal insulin requirement by 5.5% to 25.0% provided they are under close supervision by their endocrine team (endocrinologist, registered nutritionist, and diabetes educational nurse). Multicenter, controlled trials are needed to further research this issue and provide useful clinical guidelines.

CONCLUSIONS

In this case series, adolescent and adult patients with T1DM who wished to fast during Ramadan were able to do so because, based on blood glucose concentrations on self-monitoring, basal insulin requirements decreased by 5.5% to 25.0% or remained the same. Blood glucose concentrations were relatively well maintained in these patients using self-monitoring by finger stick testing and weekly follow-up with their physicians.

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