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Acute Complications Associated with Fasting in Patients with Diabetes During Ramadan: Assessment and Prevention

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Abstract

Serious complications associated with fasting in patients with diabetes during Ramadan are hypoglycemia, hyperglycemia, diabetic ketoacidosis (DKA)/ HHS, dehydration, and thrombosis. Inappropriate adjustment of medication, lifestyle, physical activities are soul contributors to such conditions. Hyperglycemia may result from excessive reduction of dosage of medications, an increase in food and/ or sugar intake. Risk for DKA is increased due to inappropriate reduction of insulin dosages particularly in patients with type 1 diabetes who fast. Patients with moderate to severe hyperglycemia (average blood glucose 150-300 mg/dl) before fast, renal insufficiency, advanced micro-/macrovascular complications and other comorbid conditions are at increased risk to develop DKA or HHS. Dehydration is common in hot-humid climates. Limited fluid intake during prolonged fast, excess hard physical activity, hyperglycemia also contribute to such condition. Increased blood viscosity secondary to dehydration may enhance the risk of thrombosis. Management components to minimize acute complications are risk quantification, empowering people with diabetes with Ramadan focused education, frequent blood glucose monitoring, appropriate advices on nutrition and exercise advice, appropriate drug, and dose modification, addressing comorbidities and personal circumstances.

Keywords: Ramadan Fasting; Acute Complications; Diabetes

Abbreviations: DKA: Diabetic Ketoacidosis; HHS: Hyperosmolar Hyperglycemic State; MR: Modified Released; DPP 4i: Dipeptidyl Peptidase-4 Inhibitor; SGLT 2: Sodium Glucose Cotransporter 2; GLP 1 RA: Glucagon Like Peptide-1 Receptor Agonist

Introduction

Major complications associated with fasting in patients with diabetes during Ramadan are hypoglycemia, hyperglycemia, diabetic ketoacidosis/ HHS, dehydration, and thrombosis [1]. Among diabetic people who fast during Ramadan, the rate of hypoglycemia is found to be 1.6 times higher compared with non-fasting periods [2]. The extensive EPIDIAR study showed a 5-fold increase in the incidence of severe hyperglycemia requiring hospitalization during Ramadan in patients with type 2 diabetes (from 1 to 5 events/100 people/month) and an approximately 3-fold increase in the incidence of severe hyperglycemia with or without ketoacidosis in patients with type 1 diabetes (from 5 to 17 events/100 people/month) [3]. Patients with diabetes, especially those with type 1 diabetes, who fast during Ramadan, are at an increased risk for development of DKA, particularly if they are grossly hyperglycemic before Ramadan [1,3]. Limitation of fluid intake during the fast, especially when prolonged, is a cause of dehydration particularly in hot and humid climate and when duration of fast is prolonged in some geographical areas.

Hypoglycemia

The EPIDAR study [3] showed that fasting during Ramadan are associated with increased risk of severe hypoglycemia (defined as hospitalization due to hypoglycemia) some 4.7-folds in patients with type 1 diabetes (3 to 14 events/100 people/month) and 7.5-folds in patients with type 2 diabetes (0.4 to 3 events/100 people/month). Inappropriate adjustment of medication and lack of lifestyle adjustment during Ramadan are main contributors to development of such condition [3]. Excessive and inappropriate physical activities may also contribute to development of hypoglycemia [1].

Hyperglycemia

Long-term mortality and morbidity studies in people with diabetes, such as the UKPDS, demonstrated the link among hyperglycemia, microvascular complications, and macrovascular complications. [4]. Glycemic control in patients with diabetes who

fasted during Ramadan may deteriorate, improve, or show no change [5-8]. Hyperglycemia may result from excessive reduction of dosage of medications in fear of hypoglycemia [3]. However, there is no information linking repeated yearly episodes of short-term hyperglycemia and diabetes-related complications during Ramadan fasting. An increase in food and/ or sugar intake in fear of hypoglycemia and regional food habit also significantly increases rates of severe hyperglycemia [3].

Diabetic Ketoacidosis

The risk of diabetic ketoacidosis (DKA) is thought to be higher during Ramadan as fasting may contribute to hypo-insulinemia, hyperglucagonemia, ketones body formation and eventually development of DKA [9]. Risk for DKA is further increased due to inappropriate reduction of insulin dosages considering risk of hypoglycemia [1]. Patients who have moderate to severe hyperglycemia (average blood glucose 150-300 mg/dl) before fast, renal insufficiency, advanced micro-/ macrovascular complications and other comorbid conditions are also at increased risk to develop DKA or HHS during Ramadan fast [1,3]. Acute infection may result into stress induced rise of catecholamines and steroid; along with inappropriate dose reduction it may result into hyperglycemic crises [1].

Dehydration and Thrombosis

Dehydration may become severe in hot and humid climates and among individuals who perform hard physical labor. In some geographical areas, people must observe prolong fast during Ramadan which may contribute to development of dehydration. Also, hyperglycemia may result into osmotic diuresis, volume, and electrolyte depletion. Orthostatic hypotension may develop in patients with autonomic neuropathy. Patients with diabetes exhibit a hypercoagulable due to increase in clotting factors and impaired fibrinolysis. Increased blood viscosity secondary to dehydration may enhance the risk of thrombosis [1].

Prevention Measures to Avoid Acute Complications Associated with Fasting in Patients with Diabetes During Ramadan

The key components needed to be addressed to minimize acute complications related to diabetes during Ramadan fasting are risk assessment, providing structured Ramadan focused education to people with diabetes, frequent blood glucose monitoring, appropriate and individualized advise of nutrition and exercise, appropriate drug and dose modification, and addressing comorbidities and personal circumstances [1,3,9].

Risk Assessment

Those diabetic patient with very high risk and high risk should be recommended not to fast [10]. If they still insist to fast during Ramadan, they should be provided with adequate knowledge about risks. Emphasis should be given to frequent capillary blood glucose monitoring practice. Ramadan focused assessment program should be started three months (at least 1 month) prior to beginning of Ramadan. Those with moderate or low risk may also develop similar complications if they do not comply with proper guidance [10].

Ramadan-Focused Diabetes Education:

Patients should be empowered with the knowledge with recognizing symptoms of hypoglycemia, hyperglycemia, and other acute complications three months (at least 1 month) prior to beginning of Ramadan [10].

Self-Monitoring of Blood Glucose (SMBG)

Patients should monitor their blood glucose levels multiple times daily for early detection of glycemic swings and minimize complications. This is critical particularly in patients with type 1 diabetes and in patients with type 2 diabetes who require insulin. Patient should do frequent SMBGs in the first few days of fast to become aware of their glycemic profile with changed meal intake and altered dosage of medications. Thereafter frequency of testing can be reduced [1]. SMBG should be done prior to Suhoor, 2 to 4 hours after Suhoor, between 11 am to 2 pm, before Iftar and 2 hours after Iftar. SMBG Self-monitoring of blood glucose (SMBG) does not invalidate religious fast [11]. Low risk patients should also perform SMBG during pre-Suhoor, midday, preiftar and whenever symptoms of hypoglycemia or acute illness occur [11].

When to Break Fasting

Patients should break the fast if

- blood glucose is 300 mg/dL (16.7 mmol/L)
- blood glucose is <70 mg/dL (3.9 mmol/L)
- if they feel unwell
- symptoms of hypoglycemia
- during acute illness

Diet Plan

Dietary recommendations should be individualized and tailored to patients' lifestyle requirements, age, comorbidities, and other medical needs [12]. Adherence to diabetic diet is vital during Ramadan to avoid hypoglycemia, hyperglycemia, and dehydration. Excessively eating when the fast is broken and inappropriate dose modifications of medicines should be avoided [1]. Calories should be divided into adequate amount between Suhoor, iftar and if necessary, 1–2 snacks. Meals should be balanced, with 45–50% carbohydrate, 20–30% protein and

Maintaining Hydration

Hydration should be maintained between meals by drinking water and non-sweetened beverages [1]. Iftar should begin with water and 1–2 dates to raise blood glucose [10]. The dosage of

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antihypertensive medications should be adjusted to prevent hypotension.

Exercise

Normal levels of physical activity can be maintained. If Tarawaih prayer is performed, it should be considered as a part of daily exercise. Excessive physical activity should be avoided, particularly during few hours before Iftar [1].

Drug and dose modification

The choice of oral anti-diabetic drug (OAD) should be individualized during fasting. Insulin secretagogues have higher risk of hypoglycemia than the insulin sensitizers. Second generation Sulfonylurea (Gliclazide, Gliclazide MR, Glimepiride) are preferred due to low risk of hypoglycemia compared to first generation, while dose and timing of OAD should also be changed during Ramadan. Metformin, meglitinides, acarbose, thiazolidinediones, DPP 4i is regarded as safe and total dose can be kept unchanged. With SGLT 2 inhibitors, Extra water should be ingested during non-fasting periods. It should not be used in elderly, patients with renal impairment, in conditions that may lead to hypotension and in patients taking diuretics [10,13,14]. During Ramadan fasting, GLP 1 RA as pre-Ramadan dose [10]. Patients at very high/high risk are recommended to avoid fasting while treating with insulin. It is recommended to switch the pre-Ramadan morning dose of insulin to Iftar and to reduce the pre-Ramadan evening dose and switch it to Suhoor. Analog insulins are preferred over conventional insulins due to lower risk of hypoglycemia. Analog basal-bolus regimen is the safest regimen to be used during Ramadan fasting [10,15].

Conclusion

People with diabetes specially who are categorized as very high risk and high risk are very prone to develop acute complications during if they fast at Ramadan. Those with moderate or low risk may also develop similar complications if they do not comply with proper guidance. Preventive measures based on focused Ramadan education program, lifestyle modification, meal and drinks adjustment and appropriate drug-dose modification can lessen the burden and help people with diabetes to observe safe fasting during Ramadan.

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