THE MEDICAL BULLETIN OF
SISLI ETFAL HOSPITAL

DOI: 10.14744/SEMB.2018.93685
Med Bull Sisli Etfal Hosp 2019;53(4):413–418

Original Research

Is it Necessary to Measure Blood Glucose Level Before and After Colonoscopy in Diabetic and Nondiabetic Patients?

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Abstract

Objectives: The aim of this study was to examine the necessity of measuring the blood glucose level before and after a colonoscopy in diabetic and nondiabetic patients.

Methods: A total of 200 patients who were over the age of 18 with an American Society of Anesthesiologists (ASA) score I-IV and were to undergo an elective colonoscopy procedure were included in this randomized, controlled, prospective trial. In the study group, 100 patients were diabetic and 100 were nondiabetic. Patient age, sex, body mass index, ASA classification, comorbid diseases, daily medications, and the length of preprocedure fasting were recorded. Before the procedure, the capillary glucose level was measured and recorded as an initial value. This glucose assessment was repeated and recorded 15 minutes after the beginning of the colonoscopy and 60 minutes after the procedure. All complications related to the anesthesia or the colonoscopy were recorded.

Results: The sex and age distribution was not statistically significant in a comparison of the diabetic and nondiabetic groups. The body mass index value and presence of comorbid diseases, particularly hypertension, was statistically significantly higher in the diabetic group. There was no significant difference in complications between the groups. The mean fasting time in the diabetic group was statistically significantly shorter than that of the nondiabetics. The blood glucose level of the diabetic patients was consistently higher than that of the nondiabetics.

Conclusion: Blood glucose measurement is necessary for diabetic patients before and after a colonoscopy procedure; however, assessment is not necessary for nondiabetics.

Keywords: Blood glucose; colonoscopy; diabetes mellitus.

Please cite this article as "Sayın P, Türk HŞ, Işıl CT, Bostancı Ö, Altınay M, Oba S. Is it Necessary to Measure Blood Glucose Level Before and After Colonoscopy in Diabetic and Nondiabetic Patients? Med Bull Sisli Etfal Hosp 2019;53(4):413–418".

The prevalence of diabetes mellitus (DM) is increasing worldwide. Insulin levels decrease and insulin resistance increases in response to surgical stress. Thus, the level of glucose increases, and correspondingly, dehydration and electrolyte abnormalities may be observed.[1] Outpatient diagnosis and treatment has become a popular practice because it is less invasive and reduces patient morbidity. Successful results can be obtained with a careful evaluation and approach, even for patients with several comorbidities.[1]

A colonoscopy is an outpatient procedure that requires a substantial period of fasting and intestinal cleansing, which can cause dehydration. A correlation between type 2 DM and colon cancer has been reported. Therefore, a colonoscopy is frequently performed for diagnostic purposes, especially in patients with type 2 DM.[2] Prolonged fasting, bowel cleansing, and discontinuation of current

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Submitted Date: February 15, 2018 **Accepted Date:** March 16, 2018 **Available Online Date:** November 19, 2019

therapy in diabetic patients prior to the procedure may lead to hypoglycemia or hyperglycemia. In addition to strong data indicating that strict glucose control should be performed for diabetic patients who will have outpatient anesthesia, there are also data demonstrating that strict glucose control can have complex results and that repeated blood glucose measurements can lead to increased values.[3–5] However, no evaluations have been conducted that are unique to the management of diabetic patients during a colonoscopy. In addition, determining how the process of colonoscopy preparation affected blood glucose values in nondiabetic patients is of interest.

This study was an analysis of the need for blood glucose value measurement of diabetic and nondiabetic patients before and after a colonoscopy procedure.

Methods

This was a prospective, randomized, controlled study. Approval was granted by the Ethics Committee for clinical investigations (25.03.2014/299) of Şişli Hamidiye Etfal Training and Research Hospital. Written and verbal information about the study was provided to the patients and informed consent was obtained from the participants. The research was performed in the Surgical Endoscopy Unit of the hospital.

In all, 200 patients who had an American Society of Anesthesiologists (ASA) classification I-IV, were over 18 years of age, and were to undergo an elective colonoscopy were included in the study.

Patients under the age of 18; those with active gastrointestinal bleeding, severe heart or respiratory failure, propofol or fentanyl citrate allergy, alcohol or drug addiction, neuropsychiatric disease, use of parenteral nutrition, or pregnancy; and cases that required discontinuation of the procedure due to insufficient colon cleansing or obstruction due to colon cancer were excluded from the study.

A total of 100 diabetic and 100 nondiabetic patients were enrolled after random selection according to the order of their arrival at the endoscopy unit by the endoscopy nurse. The patients were informed verbally and in writing as part of the routine procedure of the colonoscopy unit that they should not consume solid food for 24 hours before the procedure and that they should fast for the final 8 hours, drink a laxative preparation the night before the procedure, and do an enema on the morning of the procedure.

Demographic data of age, gender, weight, height, body mass index (BMI), ASA classification, comorbidities, medications used, and length of fasting were recorded. It was noted that most patients voluntarily fasted for more than 8 hours and that in some cases, wait time for the procedure led to additional fasting time. The capillary glucose level was measured and recorded as an initial value. Patients with a baseline glucose level <60 mg/dL-1 were given 100 mL of 5% dextrose intravenously (IV) and the test was repeated to ensured that they were normoglycemic. Patients with an initial glucose level >200 mg/dL-1 were referred to the endocrinology department for glycemic regulation.

Vascular access was achieved in all cases with a 22-gauge intravenous cannula and 0.9% sodium chloride fluid replacement was performed. The patients were placed in a lateral position in the room where the procedure was to be performed, and electrocardiogram, noninvasive arterial blood pressure, and peripheral oxygen saturation (SPO_2) values were monitored. Three L/minute O_2 was administered using a nasal cannula and 1 mg IV midazolam (demizolam, Defarma İlaç Sanayi ve Tic.Ltd.Şti., Ankara, Turkey) was used as premedication. For deep sedation, 1 mcg/kg fentanyl citrate (Abbott Laboratories, Abbott Park, IL, USA) and 1 mg/kg propofol 1% (Fresenius SE & Co. KGaA, Bad Homburg, Germany) were administered to all patients in both groups.

An Olympus CF-Q160L/I colonoscope (Olympus Corp., Tokyo, Japan) was used to perform the colonoscopy. Capillary glucose measurements were repeated 15 minutes after the beginning of the procedure. At the end of the procedure, patients with an Aldrete recovery score >9 were taken to the recovery room. Glucose measurements were repeated 1 hour after the conclusion of the procedure. Patients with glucose measurements <60 mg/dL-1 in any of the measurements were given 100 mL of 5% IV dextrose, and the measurement was repeated to ensure normoglycemic status. Complications of the anesthesia and procedure were recorded.

Statistical Analysis

In this study, the statistical analysis was performed using NCSS 2007 software (NCSS, LLC, Kaysville, UT, USA). In addition to descriptive statistical methods (mean, SD), repetitive variance analysis was used for multiple groups, the Newman-Keuls multiple comparison test for subgroup comparisons, independent t-test in comparison of binary groups, and a chi-square and Fisher's reality test were used in the comparison of qualitative data. The results were evaluated at a $p<0.05$ level of significance.

Results

A total of 200 ASA I-IV patients over 18 years of age who underwent an elective colonoscopy were included in the study.

There was no statistically significant difference between age and sex distribution in the diabetic and nondiabetic groups. The mean BMI of the patients with DM was significantly higher than that of the patients without DM

Table 1. Demographic data, comorbidities, and complications

	DM (+) (n=100)		DM (-) (n=100)		
	Mean±SD	Min-Max	Mean±SD	Min-Max	p
Age (years)	59.9±9.9	35-87	59.6±12.9	21-84	0.968
BMI (kg/m^2)	29.8±5.4	20-46.6	28.1±4.7	17.7-41.6	**0.024**
	n	%	n	%	p
Gender					
Female	45	50	49	49	1
Male	45	50	51	51	
Comorbidities	51	56.7	36	36	**0.004**
HT	46	88.5	21	63,6	**0.006**
ASA					
I	6	6.7	69	69	**<0.001**
II	73	81.1	27	27	
III	11	12.2	3	3	
IV	0	0	1	1	
Complications	6	6	3	3.3	0.503

ASA: American Society of Anesthesiologists; BMI: Body mass index; DM: Diabetes mellitus; HT: Hypertension.

(p=0.024). The incidence of comorbidities and hypertension among the DM patients was significantly higher than those without DM (p=0.004, p=0.006). There was no statistically significant difference in the distribution of complications between the groups (Table 1). However, the complications seen in each group were different. In the diabetic group, hypoglycemia requiring intervention was determined in 4 patients and hyperglycemia requiring intervention was determined in 2 patients. In the nondiabetic patient group, hypotension was a complication in 3 patients.

The mean length of preprocedure fasting in the diabetic group was significantly lower than the nondiabetic group (p=0.020). Blood glucose measurements of the patients with DM were consistently significantly higher than those of the patients without DM (p<0.001). There was a statistically significant increase in the blood glucose measurements of the patients with DM at the 15th minute compared with the baseline levels, and a statistically significant decrease at the 60th minute compared with the 15th minute blood glucose measurements (p<0.001, p=0.005). There was no statistically significant difference in the mean blood sugar level of the patients with DM at the 60th minute compared with the baseline level. At 15 minutes and 60 minutes, the blood glucose measurements of the patients without DM revealed a statistically significant increase compared with the baseline values and a statistically significant decrease at the 60th minute compared with the 15th minute measurements (p<0.001) (Table 2).

Seven of the patients with DM had type 1 and 93 had type 2 DM. The medications used by the patients are provided in Table 3.

Table 3. Diabetes mellitus type and medications used (n=100)

DM types	
Type 1	7
Type 2	93
Medications	
Insulin	7
Insulin+oral antidiabetic	6
Sulphonylurea	6
Biguanide	65
Alpha glucosidase inhibitor	11
Not treated	5

DM: Diabetes mellitus.

Table 2. Blood glucose change and fasting time

	DM (+) (n=100)			DM (-) (n=100)			
	Mean±SD	Min-Max	Median	Mean±SD	Min-Max	Median	p
Fasting time (hours)	14.5±3.7	7-25	14	16.0±4.5	4-32	16	0.02
BGBaseline	119.0±30	48-191	112	95.6±12	67-124	94.5	<0.001
15 m post procedure	124.1±26	68-203	121	108.6±13	77-142	107	<0.001
60 m post procedure	121.4±28	60-219	120	103.5±16	78-164	100	<0.001
p		<0.001			<0.001		
	DM (+)	DM (-)					
	p	p					
15 m post procedure-baseline BG	<0.001	<0.001					
60 m-15 m post procedure	0.005	<0.001					
60 m-baseline BG	0.021	<0.001					

BG: Blood glucose.

Discussion

It is very important to determine glucose and glycated hemoglobin levels and manage blood sugar in diabetic patients who will undergo surgery. For years, strict control of blood sugar was emphasized, but the ACCORD (Action to Control Cardiovascular Risk in Diabetes) study in 2008 and the NICE-SUGAR (Normoglycemia in Intensive Care Evaluation and Surviving Using Glucose Algorithm Regulation) study in 2009 linked strict glycemic control to increased mortality. Today, it is emphasized that the management of blood sugar fluctuations is more important.[4, 6] The Ambulatory Anesthesiology Association has noted that it is important to evaluate the glucose level in outpatient diabetic patients but suggested that values <180 mg/dL do not require intervention.[1, 7]

The pathophysiology and treatment approaches to type 1 and type 2 DM are different. There has been an increase in the incidence of type 2 diabetes, especially in the elderly and cases associated with metabolic syndrome.[6] In our diabetic study group, there were 7 type 1 diabetic patients.

Treatment strategies for type 2 diabetes include oral antidiabetics, insulin, and combined use of the two. Sulphonylureas are the oldest oral antidiabetic. The most important potential side effect is hypoglycemia. Biguanides, especially metformin, are currently the most commonly used agents. Hypoglycemia is not seen as a side effect. Thiazolidinediones and alpha-glucosidase inhibitors are other oral antidiabetics.[6–9] In our study, 6 of the type 2 diabetic patients were using oral antidiabetic medication with insulin. Of those taking oral antidiabetics, 79.5% were using a biguanide. Five patients were not using any medication.

Insulin is used to treat type 1 diabetes. All of our type 1 diabetic patients were using insulin therapy. Hypoglycemia attacks can occur with prolonged fasting and insulin treatment. When anesthesia is required, the fasting time should be kept short. Therefore, in our study, the fasting period of diabetic patients was found to be shorter. However, the fasting periods recorded were quite long in both groups. Although, in accordance with the routine procedure of the colonoscopy unit, they were instructed verbally and in writing to consume nonsolid food for 24 hours and to fast for only 8 hours before the procedure, patients voluntarily fasted for a longer period, and in some instances the fast was extended due to a delayed procedure.

In diabetic patients, atherosclerosis is associated with an increased incidence of ischemic heart disease, cerebrovascular disease, and hypertension. There is also a tendency for silent ischemia and orthostatic hypotension due to autonomic neuropathy. The prevalence and incidence of liver disease in diabetic patients is also higher than in the general population. Diabetic nephropathy is often accompanied by uncontrolled diabetes.[10, 11] In our study, the incidence of comorbidities, especially hypertension, was greater in the diabetic group than in the nondiabetic group. As a result, the ASA values of the diabetic patients were mostly higher than those of nondiabetic group. This creates an increased risk of complications related to the anesthesia and the procedure. Additional disease was detected in 56.7% of the diabetic group and 36% of nondiabetic group. Hypertension was the most common comorbidity observed in both groups: 88.5% of the diabetic group and 63.6% of the nondiabetic group. Other comorbidities seen in the nondiabetic group were chronic obstructive pulmonary disease and rheumatic diseases, while in the diabetic group, cerebrovascular, nephrological diseases, atrial fibrillation, and heart failure were also observed.

The NHANES (National Health and Nutrition Examination Survey) study results revealed that 90% of patients with type 2 diabetes were obese (BMI >25 kg/m^2). This can lead to difficulty in airway management, increased frequency of sleep apnea syndrome, and difficulty in regulation of diabetes.[12] Similarly, in our study, the BMI of the diabetic group was also higher.

In a meta-analysis examining management of diabetic patients undergoing ambulatory anesthesia, 9 studies involving glycemic control were reviewed and it was determined that there was insufficient high-quality evidence to provide strong recommendations. It was suggested that the primary goal is to avoid hypoglycemia and to maintain blood glucose control.[1] The regular use of medications and keeping a fasting period short are as important as blood sugar level. Dinardo et al.[13] reported that a systematic approach implemented before the procedure in diabetic patients provided a more stable blood sugar level and made procedures safer.

Nonetheless, hyperglycemia or hypoglycemia in diabetic patients after fasting and bowel cleansing remains a risk and can impair metabolic status. Hypoglycemia is a primary cause of mortality in diabetic patients.[6, 9] Anesthesia may suppress the symptoms of hypoglycemia. Is this also a worry for nondiabetic patients? Can prolonged fasting and bowel cleansing be a cause of hypoglycemia in nondiabetic patients? Should we check the blood sugar of both diabetic and nondiabetic patients? Can the general principles of ambulatory anesthesia be applied to a colonoscopy? The answers to these questions have not yet been clarified.

There are data about the course of blood sugar level in diabetic patients and the appropriate approach in outpatient procedures. However, there are not enough studies on a colonoscopy in particular. Takeishi et al.[14] studied 12 patients who used insulin degludec, an insulin analogue which provides a more stable blood sugar level and less hypoglycemia, for 24 hours before a colonoscopy. Although the blood glucose values were elevated before the procedure, the authors reported that the colonoscopy could be generally performed safely. Both the specificity of the agent used and the small number of patients make it difficult to compare these results with the data of our study. In our study, the mean blood glucose level of the diabetic patients before the procedure was 119 mg/dL and 95.6 mg/dL in the nondiabetic patients. These values were 124 mg/dL in the diabetic group and 108 mg/dL in the nondiabetic group at the 15th minute post procedure, likely an effect of surgical stress. At the 60th minute after the procedure, similar measurements were observed in the diabetic patient group, a mean of 121 mg/dL, whereas in the nondiabetic group, higher measurements than the baseline values continued (mean: 103.5 mg/dL). The blood glucose levels of diabetic group were observed to be consistently high in all of the measurements. Minimum values of baseline and endpoint blood sugar of 48 mg/dL and 60 mg/dL, respectively, which indicate hypoglycemia, require intervention in diabetic patients. In the diabetic group of this study, hypoglycemia necessitating intervention was seen in 4 (4%) patients and hyperglycemia requiring intervention was seen in 2 (2%) patients. In the nondiabetic patient group, hypotension was a complication in 3 patients. Kollarits et al.[15] identified hypoglycemia in 3% and hyperglycemia in 2.4% of diabetic patients who underwent eye surgery with local anesthesia.

Chung et al.[16] reported that in an analysis of 1061 patients the absence of preoperative tests such as a complete blood count and measurement of glucose and electrolytes before ambulatory anesthesia applications did not increase adverse events over a 30-day period. Similarly, in our study, the blood glucose was stable in the nondiabetic patient group and the absence of hypoglycemia requiring intervention despite prolonged fasting suggests that glucose measurement is not necessary in nondiabetic patients before the procedure.

Conclusion

In conclusion, glucose measurement should be performed in diabetic patients before and after a colonoscopy; however, it does not appear to be necessary in nondiabetic patients.

Disclosures

Ethics Committee Approval: Approval was granted by the Ethics Committee for clinical investigations (25.03.2014/299) of Şişli Hamidiye Etfal Training and Research Hospital.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship Contributions: Concept – P.S., C.T.I., O.B.; Design – P.S., C.T.I., H.S.T.; Supervision – S.O., O.B.; Data collection &/or processing – P.S., C.T.I., M.A., O.B.; Analysis and/or interpretation – P.S., H.S.T.; Literature search – P.S., H.S.T., S.O.; Writing – H.S.T., M.A.; Critical review – S.O., O.B.

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