Original Article

Colonoscopy preparation quality in diabetic patients

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Abstract

Aim: Colonoscopy is the established standard method for the evaluation of the colon. It has been reported that diabetes was associated with poor bowel cleansing and colorectal cancer in some studies. We aimed to evaluate the bowel preparation quality of type 2 diabetic and non-diabetic patients.

Material and Methods: I62 diabetic and 65 non-diabetic patients were enrolled in this study and colon preparation quality was evaluated for each segment of colon (right, transverse and left) and total score was obtained according to Boston Bowel Preparation scale.

Results: The successful bowel preparation rates were 64.5% in the diabetics and 75.4% in the non-diabetics, which wasn't statistically significant. Cecal intubation rate was 80.6% in the diabetics, 90.8% in the non-diabetics and mean cecal intubation time was 7.78 min in diabetics, 8.9 min in non-diabetics. There were no significant differences in terms of cecal intubation time, cecal intubation rate and polyp detection rates between groups. We also found that bowel cleansing of right colon and transverse colon in the non-diabetics was superior to diabetics.

Conclusion: Diabetes isn't a negative factor for detection of colonic polyps and isn't associated with inadequate bowel cleansing, but it associated with poor bowel cleansing in right and transverse colon, so physicians must be further careful for the possibility of obscure lesions of right and transverse colon in diabetic patients.

Keywords: Bowel cleansing; constipation; diarrhea; diabetes mellitus

INTRODUCTION

Colonoscopy is considered the current standard method for evaluation of the colon which is established as one of the main diagnostic and therapeutic procedures for colonic disorders. The therapeutic quality and diagnostic accuracy of colonoscopy is associated with the quality of colon cleansing (1-3). The most hampering factors for colonoscopy are poor bowel preparation and patient intolerance to the procedure. Optimal preparation for colonoscopy should provide a thorough cleansing and mucosal clarity (2).

Polyethylene glycol (PEG) is an osmotically balanced electrolyte lavage solution (4). PEG is taken typically as a solution with a 4-liter volume prepared in water in the day before the procedure (4), alternatively divided-dose PEG regimens (2-3 liters given the day before the colonoscopy and 1-2 liters in the morning of procedure) (5-7). Abdominal pain, nausea (with or without vomiting), Mallory-Weiss syndrome, cardiac dysrhythmia, acute pancreatitis, acute colitis and SIADH (syndrome of inappropriate antidiuretic hormone) are among the side effects of PEG, reported rarely (8).

Gastrointestinal (GI) dysfunction is highly prevalent in diabetic patients. Many factors accompanying diabetes could cause GI dysfunction including autonomic neuropathy (9). Oxidative stress appears to be one of the factors underlying the GI complications of diabetes which affects enteric nervous system and leads to autonomic neuropathy (10, 11). GI symptoms including vomiting, nausea, abdominal pain, constipation, diarrhea and fecal incontinence occurs in patients with diabetes mellitus (12-14).

The presence of diabetes mellitus has been reported as a risk factor for poor bowel preparation in a few studies (15, 16). In a study, an inverse association between poor bowel preparation and detection of small colonic lesions was reported (17). Insulin and insulin-like growth factor-1 are growth factors of intestinal epithelial cells, and which stimulates the growth of colon cells, so hyperinsulinemia might induce to intestinal carcinogenesis (18, 19). Recent studies have shown the presence of diabetes mellitus as a potential risk factor for colorectal cancer (20-22) and some studies showed that patients with diabetes mellitus

have significantly poorer bowel cleansing than patients without diabetes (23-25).

The aim of this study was to evaluate the bowel preparation quality in type 2 diabetic and non-diabetic patients undergoing colonoscopy.

MATERIAL and METHODS

Study design
This was a prospective, single center, observational trial. All patients selected from the outpatient clinics of Gastroenterology Department of Dışkapı Yıldırım Beyazıt Education and Research Hospital, consecutively admitted for colonoscopy. Written informed consent was obtained from all patients. This study was reviewed and approved by the local ethical committee.

Patients
Seventy-five diabetic patients with a diagnosis of diabetes mellitus established according to the American Diabetes Association diagnostic criteria (fasting plasma glucose ≥ 126 or 2.hour plasma glucose ≥ 200 during an oral glucose tolerance test) and 75 age and sex matched non-diabetic patients were enrolled in this study. Thirteen patients in diabetic and 10 patients in non-diabetic groups were excluded from the study for various reasons. The exclusion criteria were as follows: chronic liver disease, acute or chronic renal failure, decompensated heart failure, pregnancy, neurologic and psychiatric disorders, previous abdominal operation and electrolyte imbalance. Indications for colonoscopy and gastrointestinal symptoms were recorded for all patients.

At first admission, fasting plasma glucose (FPG), sodium (Na), potassium (K), calcium (Ca), creatinine (Cr) and glycated hemoglobin (HbA1c) levels were determined in all diabetic patients.

Colon bowel preparation
All patients in the study received 4 liters of PEG preparation orally (236g polyethylene glycol 3350, 22.74g sodium sulfate, 6.74g sodium bicarbonate, 5.86g sodium chloride and 2.97g potassium chloride). Two liters were given (250 mL for every ten minutes) during the day before the procedure and 2 liters in the morning of procedure day.

Dietary restrictions were provided as a list and explained to each patient by a clinical nurse. On the day before the procedure a standard diet including low fiber for breakfast, lunch and dinner were allowed, solid food wasn't allowed. All patients were allowed to take clear liquids until 2 hours before the procedure.

Randomization
Study population was divided over control and study groups and then all given an identification number individually. The endoscopists were blinded to group classifications and clinical data.

Evaluation of colon cleansing
All colonoscopies were performed using standard video-endoscopes with a brand and model name of Fujinon Corp., EC-450WL5 (Fujifilm Corporation, Tokyo, Japan).

Colon preparation quality was evaluated for each of the three segments of colon (right, transverse (including the hepatic and splenic flexures) and left) which was scored from 0 to 3 (0: poor, 1: fair, 2: good, and 3: excellent) and total score (TS) ranging from 0 to 9 was recorded according to Boston Bowel Preparation scale (BBPS) (Table 1) (26). Four groups were stratified as in the study of Repici A.et al.: excellent cleansing (TS: 8-9), good cleansing (TS:6-7) poor cleansing (TS:3-5) and inadequate cleansing (TS:0-2) (27). Also total score (TS) ranging from 0 to 9 was divided into two different groups: successful (TS ≥ 6) and failure (TS < 6) based on BBPS (26, 27). Experienced colonoscopist who had performed more than 2000 colonoscopies scored the bowel preparation and recorded the BBPS values.

Table 1. Assessment scale of colon cleansing (Boston Bowel Preparation scale)	
Score	**Explanation**
0	Mucosa was not visualized due to solid stool
1	A part of the mucosa was visualized because of presence of liquid and semisolid stool
2	Minor residual stool, mucosa was seen well
3	No residual stool, mucosa was seen well despite of small parts of stool or liquid

End points
The primary end point was determining the difference of adequate bowel preparation rates between diabetic and non-diabetic groups. Secondary end points were determining differences of mean colonoscopy completion times, mean cecal intubation times and polyp detection rates.

Statistics
Data were statistically analyzed using SPSS for Microsoft Windows 17.0 (SPSS Inc., an IBM Company, Chicago, IL).

We have used Mann-Whitney U Test for comparison of the two independent groups and chi-square test for categorical measures. P values below 0.05 were considered significant in all analyses.

RESULTS

Baseline characteristics
A total of 150 subjects (75 diabetics and 75 non-diabetics) entered into the study. Nine patients (5 diabetics, 4 non-diabetics) were removed from the analysis as they canceled colonoscopy, 7 patients (4 diabetics, 3 non-diabetics) were removed for failure to comply with colon cleansing diet, 5 patients (3 diabetics, 2 non-diabetics) were excluded because of mild adverse events (unable to use all of the preparations due to preparation-related mild nausea), and 2 patients (1 diabetic, 1 non-diabetic) were excluded because of previous colon resection. So the study population consisted of 127 patients, totally.

Table 2. Characteristics of the patients under study			
	Diabetic	Non-diabetic	p value
Number of patients	62	65	-
Age (mean/year)	58.2±9.5	55.1±12.4	0.051
Male : Female (n)	28 : 34	31 : 34	0.77
FPG (mg/dl)	155.7±73.2	90.03±7.74	
HbA1c (%)	7.5±1.1	-	-
Indications for colonoscopy (n)			
Abdominal pain	15	9	
Constipation	15	14	
Diarrhea	8	12	
Rectal bleeding	10	7	
Iron deficiency anemia	7	8	
Screening for colon cancer	2	5	
Inflammatory bowel disease	3	4	
Changes in bowel habit	1	3	
Surveillance for polyp	1	3	
n: number of patients, FPG: Fasting plasma glucose, HbA1c: glycated hemoglobin			

Table 3. Details of bowel preparation quality assessment			
	Diabetic	Non-diabetic	p value
Bowel Preparation Quality, N (%)			
Excellent (BBPS:8-9)	16	27	
Good (BBPS: 6-7)	24	22	
Poor (BBPS: 3-5)	21	15	
Inadequate (BBPS: 0-2)	1	1	
BBPS score per segment, mean ± SD			
Right colon	1.49 ± 0.79	1.82 ± 0.83	0.023
Transverse colon	1.94 ± 0.79	2.29 ± 0.7	0.010
Left colon	2.46 ± 0.62	2.68 ± 0.46	0.094
BBPS Successful cleansing (BBPS≥6), N (%)	40 (64.5%)	49 (75.4%)	0.253
Cecal intubation rate (n, %)	50 (80.6%)	59 (%90.8)	0.167
Cecal intubation time (min)	7.78±5.47	8.9±5.46	0.232
Polyp detection rate (n, %)	9 (14.52%)	9 (13.85%)	1

Sixty two diabetic (34 female and 28 male) and 65 Non-diabetic (34 female and 31 male) patients were enrolled in this study. Mean age of diabetic patients was 58.2±9.5 years and of non-diabetic patients was 55.1±12.4 years. The mean fasting plasma glucose of diabetic patients was 155.7±73.2 mg/dl and mean HbA1c level was 7.5±1.1%. There was no significant difference in the baseline characteristics between groups and no serious preparation-related adverse events among the study participants (p > 0.05). Characteristics of the patients were presented in Table 2.

Assessment of bowel preparation quality

The successful bowel preparation rates (BBPS ≥ 6) were 64.5% in the diabetic group and 75.4% in the non-diabetic group, and this difference has not reached statistical significance. Bowel preparation quality was also evaluated for each colonic segments, a statistically significant difference was found for the right colon (p=0.023) and transverse colon (p=0.010) in non-diabetic group. Cecal intubation rate was 80.6% in the diabetic group, 90.8% in the non-diabetic group and mean cecal intubation time was 7.78 min in diabetics, 8.9 min in non-diabetics. In this study, 17 colorectal polyps were detected in 9 diabetic patients (14.52%) and 16 polyps in 9 non-diabetic patients (13.85%). There were no significant differences in cecal intubation time, cecal intubation rate and polyp detection rates between the two groups (Table 3). Details of bowel preparation quality assessment were provided in Table 3.

Table 4. Subgroup assessment			
	Diabetic	**Non-diabetic**	**p value**
BBPS score per segment, mean ± SD			
Diarrhea			
Right colon	2.31 ± 0.65	1.75 ± 0.94	0.170
Transverse colon	2.38 ± 0.52	2.08 ± 0.79	0.421
Left colon	2.75 ± 0.46	2.36 ± 0.64	0.157
Constipation			
Right colon	1.53 ± 0.83	1.79 ± 0.67	0.325
Transverse colon	1.87 ± 0.74	2.36 ± 0.63	0.072
Left colon	2.29 ± 0.63	2.76 ± 0.33	0.039
BBPS Successful cleansing (BBPS≥6), N (%)			
Diarrhea, n (%)	8 (100%)	6 (50%)	0.042
Constipation, n (%)	8 (53.3%)	12 (85.7%)	0.109

Table 5. The results of the constipation and diarrhea subgroups in diarrhea patients			
	Diabetic	**Constipation**	**p value**
BBPS score per segment, mean ± SD			
Right colon	2.31 ± 0.65	1.53 ± 0.83	0.040
Transverse colon	2.38 ± 0.52	1.87 ± 0.74	0.104
Left colon	2.75 ± 0.46	2.29 ± 0.63	0.098
BBPS Successful cleansing (BBPS≥6), N (%)	8 (100%)	8 (53.3%)	0.052
Cecal intubation rate (n, %)	8 (100%)	12 (%80)	0.526
Cecal intubation time (min)	6.62±2.2	6.75±3.14	0.815

Subgroup assessment of bowel preparation quality

After dividing the patient group over constipation and diarrhea suffering subgroups bowel preparation quality was evaluated by colonic segment, and a statistical significant difference was found only for the left colon (p = 0.039) in constipation subgroup. The successful bowel preparation rates (BBPS ≥ 6) were 100 % in the diabetic patients with diarrhea and 50% in non-diabetic patients with diarrhea subgroup, and a statistically significant difference (p=0.042) was found between groups (Table 4). There were no differences in cecal intubation time, cecal intubation rate and successful bowel preparation rates (BBPS ≥ 6) but only a statistical significant difference was found for the right colon (p=0.040), evaluating segmentally, between diarrhea and constipation (Table 5).

DISCUSSION

Age and sex have been identified as a confounding factor for colon cleansing in various studies (2, 28, 29). In our study, mean age of diabetic patients was higher than non-diabetic patients, but this has not reached at statistically significance.

The presence of diabetes mellitus was proposed as a risk factor for poor bowel preparation in a few studies (15, 16, 23, 25). Recent studies have shown that hyperinsulinemia may induce to intestinal carcinogenesis (18, 19), and the presence of diabetes mellitus as a potential risk factor for colorectal cancer (20-22), so bowel cleansing is also more important in diabetic patients than normal population.

In several studies, inadequate bowel cleansing rates range from 20% to 38% (30-32). In our study, successful bowel preparation rate was found 75.4% in non-diabetic patients and 64.5% in diabetic patients in accordance with the literature, however when we analyzed each of the three colonic segments, we found that the right and transverse colon cleansing rates in diabetic patients were worse than the controls, on the other hand there was no difference in the left colon. While the difference is not determined by the total score of BBPS, right and transverse colon cleansing were found to be poor in the diabetic patients compared to control group. This situation gain importance in patients with possibility of premalignant or malignant lesions in these anatomic segments, which may lead to waste of time in diagnostic process. Consequently obscure lesions may lead to an increased risk of undetectable malignant lesions in right and transverse colon in diabetic patients, so we need a new colon cleansing protocol that allows better bowel preparation in right colon and of course all colonic segments, in diabetic patients. We have additionally analyzed cecal intubation rate, polyp detection rate and cecal intubation time as another criteria for assessment of adequate colon cleansing and there was no difference between two groups. As a result, in spite of the difference in the transverse and right colon there was no difference between the two groups with all other criteria.

Few studies have been performed on bowel preparation in type 2 DM patients. Some published studies reported that the quality of bowel preparation in non-diabetic patients better than the diabetics (23-25). Taylor et al. showed that patients with diabetes have significantly poorer bowel preparations with PEG solutions than non-diabetic patients (62% vs 97%) (25). Ozturk et al. concluded that diabetic patients with autonomous neuropathy have poorer bowel preparation than diabetic patients without autonomous neuropathy and non-diabetic patients (23). Another study was performed on bowel preparation with sodium phosphate solution in 50 diabetic and 50 non diabetic patients conducted by Ozturk et al. which showed that diabetic patients have significantly poorer bowel preparations with PEG solutions than non-diabetic patients (70% vs 94%) (24).

When patients were divided into 2 subgroups as diarrhea and constipation, we found that only the left colon cleansing in diabetic patients worse than the controls in constipation subgroup, whereas significant difference was not observed in diarrhea subgroup. The successful bowel preparation rate was higher in diarrhea subgroup than the constipation subgroup.

Motor abnormalities affect the small and large intestine and lead to diarrhea and constipation in diabetic patients (13, 33). Rapid transit may be one mechanism for diarrhea in diabetic patients (33) and which may be cause of successful cleansing in diarrhea subgroup. Also delayed transit may lead to stasis with development of constipation (33).

We analyzed each of the three colonic segments in diarrhea and constipation subgroups only in diabetic patients (control group has been excluded) and we found that the right colon cleansing in diarrhea subgroup better than the constipation subgroup, on the other hand there was no difference in the transverse and left colon. These differences between groups for each colonic segment may be due to motor abnormalities effecting distinctly for each colonic segments in diabetic patients.

One can ask whether diabetes could affect each colonic segment distinctly. Investigating this there is a need for further studies to answer this question

CONCLUSION

In summary; we found that there were no differences between diabetic and non-diabetic patients in terms of cecal intubation time, cecal intubation rate and successful bowel preparation rates. In our study, statistically significant difference was observed only between the three colonic segments individually, but this condition did not affect the evaluation criteria of bowel cleansing according to the total score of BBPS. As a result, we showed that diabetes is not a negative factor for detection of colonic polyps and which is not associated with inadequate bowel cleansing, but the right and transverse colon cleansing rates in diabetic patients were worse than the controls, so diabetes is associated with poor bowel cleansing in right and transverse colon and therefore the physicians must be further careful for the possibility of right colon and transverse colon malignancy in diabetic patients.

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