

Diverticular disease and posture during defecation : a prospective comparative study

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Abstract

Background and study aims : Although several factors are thought to be responsible for the development of colonic diverticulosis (CD), the underlying pathogenesis is still obscure and needs clarification. The aim of this study was to determine the prevalence, location and clinical features of CD and especially to detect whether there is an association between CD and postures during defecation.

Patients and methods : This prospective study enrolled 757 patients. The subjects were divided into two groups as a diverticulosis group (D group, n:95) and non-diverticulosis group (non-D group, n:662).

Results : The median patient age was 54.9±13.2 years. CD frequency was 12.5% (n:95). The most commonly involved part of the colon was the sigmoid colon (56.8%). Diverticula location was on the left in 45.3% (n:43), on the right in 24.2% (n:23) and on both sides of the colon in 30.5% (n:29). Patients in the D group were older (p<0.001) and were predominantly female (p:0.04). The frequency of sitting during defecation (Western type toilet) was higher in the D group compared to the non-D group (72.2% vs 53.5%; p:0.007). The use-time of a Western-type toilet was longer in the D group compared to the non-D group (p:0.04). In multivariable logistic regression analysis, age and toilet type were independent risk factors for the development of diverticulosis.

Conclusion : Sitting during defecation seems to increase the risk of CD. (*Acta gastroenterol. belg.*, 2018, 81, 490-495).

Key words : diverticula ; colonic diverticulosis ; defecation ; sitting ; squatting ; irritable bowel syndrome, ; constipation.

Introduction

Colonic diverticulosis (CD) is an anatomic abnormality that is frequently detected during colonoscopy or barium studies (1,2). Diverticula occurs as a result of herniation of the colonic mucosa and submucosa through defects in the muscle layer. These types of diverticula are actually pseudo diverticula and occur typically in the left colon (1-3) True diverticula, which usually occur in the right colon area are a herniation of all the colonic wall layers (3).

CD frequently occurs in Western societies. Although the exact prevalence of diverticula is unknown, it has been reported as 10% in adults under 40 years of age and as 50% among those aged over 70 years, which increases with advancing age and has no gender predilection (4-7). Recent studies have shown an increasing prevalence of CD in the whole world due to aging (4-6). Although Western countries have predominantly left-sided CD, Asian countries have commonly right-sided CD (7,8).

Despite the high prevalence, the underlying pathological mechanisms of the formation of CD are still unclear and are considered to be multifactorial (1,4,9). Some factors are suspected, including diet (10,11), genetic factors (12-14), age (1,4), colonic microbiota (15), colonic motility (16-18) and microscopic inflammation (19,20). In addition the relationship between CD and constipation, irritable bowel syndrome (IBS), or dietary habits remains controversial (11,21-24).

Regarding defecation physiology, the anorectal angle is of immense importance as an anatomic factor (25,26). It can change with the habitual bowel emptying in a sitting or squatting position. Increasing the anorectal angle, as in a squatting position, facilitates defecation, whereas reduction of the angle in a sitting posture makes it more difficult. Consequently, excessive straining during bowel emptying increases intra-colonic pressure and may facilitate CD formation (25-33). Traditionally, a toilet type latrine pit in a squatting position has been used for centuries in Turkey. However, for several decades, as the geriatric population growth rate increases, use of a Western type toilet in the sitting position has become more frequent.

Taking the conflicting data into consideration, the aim of this study was to determine the prevalence, location, distribution and clinical features of CD, and to focus on the association between CD and posture during defecation. To the best of our knowledge, this study is the first to evaluate an association between habitual bowel emptying and CD.

Materials and Methods

Patients

This prospective study enrolled 1018 patients who underwent total colonoscopy (caecum intubation) and had adequate bowel preparation in Hacettepe University

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Gastroenterology Department. The main indications for total colonoscopy were: screening for positive hemocult test, positive familial history of colon cancer, constipation and/or diarrhea, personal history of polyps and abnormal bowel habits. Patients with active hematochezia, a previous history of colectomy / intestinal resection, colon and pelvic malignancy, acute or recent colonic diverticulitis, active infectious colitis, ulcerative colitis, Crohn's disease, microscopic colitis, incomplete cleaning of the colon, and other organic gastrointestinal disorders as in previous reports were excluded. Patients who could not answer the questionnaire because of mental retardation or language problems were also excluded.

A questionnaire was used to diagnose IBS and to collect the information before colonoscopy for all patients. IBS and sub-types were defined using Rome III criteria and were classified as IBS on the basis of symptoms in the questionnaire (23). IBS was sub-typed as diarrhea-IBS, constipation-predominant-IBS or mixed IBS (23,34). Constipation was also diagnosed according to Rome III constipation criteria (23).

Before colonoscopy, study nurses recorded the demographic data and information about each patient with a standardized questionnaire, including age, gender, medication history, indication for colonoscopy, body mass index (BMI), education and socioeconomic status, comorbidities such as diabetes mellitus, hypertension, hypothyroidism, previous history of cholecystectomy, appendectomy, smoking and alcohol consumption, presence of constipation and IBS and habitual bowel emptying (sitting or squatting posture). Patients who used a Western type toilet were also asked about duration of use. To minimize the performer bias, questionnaire about the data were recorded by the study nurses before the colonoscopy in the different room. All the endoscopists were informed by study nurses before each procedure. However, the endoscopists were not aware about the questionnaire results before the colonoscopy procedure.

All patients were recommended the same diet regime and bowel preparation beginning 3 days before colonoscopic examination (sennosid capsule + sennosid suspension + sodium phosphate enema). All colonoscopic examinations were performed by 6 colonoscopists. The endoscopists were all blinded to the patients' questionnaire responses. The patient colonoscopic data were recorded, including the presence of one or more diverticula and their localization in the colon, and the presence of hemorrhoids, polyps or other findings. The location of the diverticula was defined as follows: left-sided colon was classified as rectum, sigmoid colon and descending colon; right-sided colon was classified as cecum, ascending colon, and transverse colon.

The demographic findings and frequency of risk factors of both groups were compared to determine any significant differences.

Approval for the study was granted by the Local Ethics Committee (Study No : GO15/56) of Hacettepe

University Hospital, Ankara, Turkey. All the participants gave written informed consent.

Statistical analysis

Data were analyzed using SPSS (Statistical Package for the Social Sciences) version 16.0. Categorical variables (gender, marital status, education status, living area, smoking, alcohol consumption, diabetes mellitus, hypertension, hypothyroidism, cholecystectomy, drug use for constipation, constipation, appendectomy, toilet type, IBS and colonoscopic findings) were shown as percentage (%). BMI and toilet-use duration were showed as mean \pm standard deviation (SD). For categorical variables, the differences between groups were evaluated with the Chi-Square test. The Student's t-test was used for BMI and toilet use duration. The Shapiro-Wilk test was used for the assessment of the normality of data. BMI and toilet-use duration showed a normal distribution. Multivariable logistic regression analysis was used to identify predictive factors of CD. A value of $p < 0.05$ was considered statistically significant.

Results

Study population and demographic findings

A prospective data analysis was applied to 1018 patients who underwent colonoscopy. A total of 261 patients were excluded from the study due to inflammatory bowel disease (n : 66), colon cancer (n : 82), history of bowel surgery (n:83), active hematochezia (n : 2), and other causes (n : 28) (Figure 1). The subjects were divided into two groups, as a diverticulosis group (D group, n : 95) and non-diverticulosis group (non-D group, n : 662). The median age of the 757 included subjects was 54.9 \pm 13.2 years. The male frequency was 44.4% (n : 337) in the study population.

Patients and colonoscopic findings

The frequencies of diseases detected in colonoscopy were as follows: 28.6% polyps, 19.3% hemorrhoids,

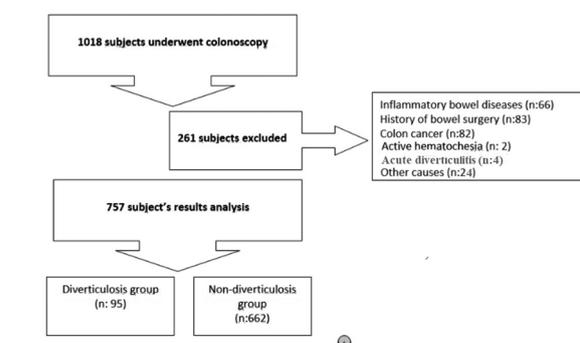


Fig. 1. — Flow diagram for this study.

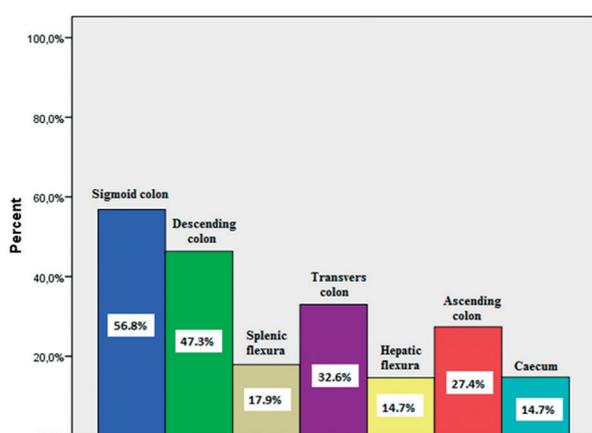


Fig. 2. — Distribution of diverticula in the patients.

2.1% perianal fissure, 0.3% rectal ulcer, 3% non-specific ileitis, 0.9% telangiectasia and 1.2% non-specific colitis. The colonoscopy was reported as normal in 44.6% of the patients. The frequency of CD was 12.5% (n : 95). The sigmoid colon was the most frequently involved colon segment for CD (Figure 2). The localization of CD was mostly left sided; 45.3% (n : 43) on the left side, 24.2% (n : 23) on the right side, and 30.5% (n : 29) on both sides.

Comparisons of demographics between the D group and the non-D group:

There were significant differences between the D group and the non-D group in respect of age, gender distribution and presence of irritable bowel syndrome. Other risk factors were similar between the D group and the non-D group (Table 1).

Comparisons of colonoscopy findings between the D group and the non-D group:

The frequency of hemorrhoids was significantly lower in the D group than in the non-D group (8.4% vs 20.7%, P: 0.03). Polyp frequency in the D group was higher than in the non-D group (40% vs 26.9%, P:0.01).

The relationship between CD, toilet type and IBS:

The frequency of IBS was 10% in the D group, and 21.6% in the non-D group (p : 0.007). IBS types were comparable in both groups. Constipation-type IBS was the most frequent type (50% in D group and 44% in non-D group). The frequency of Western type toilet use was higher in the D group compared to the non-D group

Table 1. — Demographic data of patients with and without colonic diverticular disease

Variables	Diverticulosis group (n : 95)	Non-diverticulosis group (n : 662)	p values
Gender (women), %	55.8	43.3	0.04
Age, years	62.1+11.6	53.8+13.1	<0.001
BMI kg/m ²	27.4 +- 4.2	27.3 +-4.8	0.821
Marital status, %			
Married	82.1	82.8	0.586
Non-married	17.9	17.2	
Education status, %			
Non-education	4.2	5.9	0.411
Primary school	40	41.4	
High school	18.9	23.7	
University	36.8	29	
Living area, %			
Village	8.4	7.5	0.550
City	91.6	92.5	
Smoking, %	21.1	20.8	0.963
Alcohol consumption, %	5.7	7.4	0.526
Diabetes mellitus, %	16.8	17.8	0.813
Hypertension, %	31.6	24	0.119
Hypothyroidism, %	5.3	5.4	0.944
Cholecystectomy,%	16.8	12.1	0.209
Appendectomy,%	6.4	7.1	0.794
Constipation, %	8.5	8.1	0.884
Drug use for constipation, %	9.1	9.5	0.832
History of abdominal surgery, %	35.8	31.4	0.391
History of diverticulitis, %	4.2	-	<0.001
Irritable bowel syndrome, %	10.5	21.6	0.007

Table 2. — Diverticula localizations according to toilet type

Variables	Right	Left	Both Side
Squatting Type Toilet	6 (23.1%)	7 (26.9%)	13(50.0%)
Western Type Toilet	17 (24.6%)	36 (52.2%)	16 (23.2%)
<i>p</i> : 0,028			

Table 3. — Results of multiple logistic regression analysis for colonic diverticular disease

Variables	B	Exp(Beta), 95.0 % CI	P value
Age	0,056	0.945 (0.924-0,967)	0,000
Gender	0.000	1.000 (0.995-1.006)	0.890
Smoking	0.280	0.756 (0.419-1.364)	0.353
Alcohol	0.231	0.794 (0.315- 2.000)	0.625
Diabetes Mellitus	-0.620	1.858 (0.990- 3.489)	0.054
Hypertension	0.007	0.993 (0.587- 1.680)	0.980
Hypothyroidism	0.238	0.788 (0.286- 2.173)	0.646
Cholecystectomy	0.302	0.739 (0.389-1.403)	0.355
Appendectomy	-0.313	1.367 (0.545-3.433)	0.505
Irritable bowel syndrome	-0.623	1.865 (0.915-3.803)	0.086
Toilet type	0.507	0.602 (0.366-0.991)	0.046
Hemorrhoid	-1.017	2.764 (1.265-6.040)	0.011
Polyp	0.196	0.822 (0.507-1.331)	0.425

(72.2% vs 53.5%, P : 0.007). The duration of using a Western type toilet was 14.1 \pm 9.8 years in the D group, and 11.9 \pm 8.3 years in the non-D group (P : 0.04). In the D group, side predilection was different among patients with squatting-type and Western-type toilet users. In patients using squatting-type toilet, there was no side predilection; whereas, the patients using Western-type toilet had left-sided CD predominance (Table-2).

Multivariable logistic regression analysis:

Multivariable logistic regression analysis was performed to detect independent risk factors, including age, gender, smoking, alcohol consumption, cholecystectomy, appendectomy, other abdominal operations other than intestinal surgeries, diabetes mellitus, hypertension, hypothyroidism, constipation, IBS and toilet type (Table 3). Age (p :0.000), and toilet type (p :0.046) were determined as the independent risk factor for CD.

Discussion

The results of this prospective study demonstrated an association between toilet type and CD. Constipation and IBS were not determined to increase CD risk.

To the best of our knowledge, this is the first study to have examined the relationship between CD and toilet types. Western style toilet (in a sitting posture) use is increasing all around the world. With an increased geriatric population, the preference of the Western style

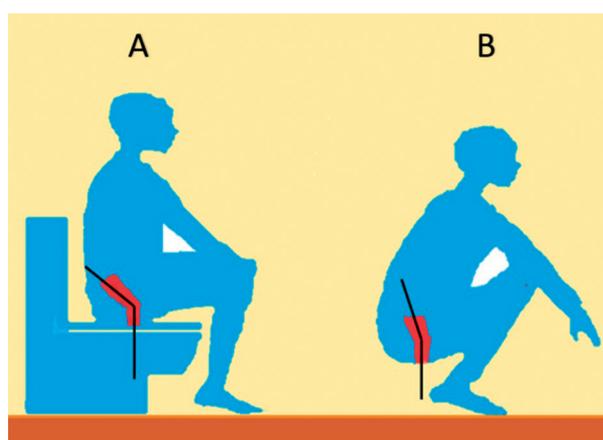


Fig. 3. — The demonstration of defecation in sitting (A), and squatting (B) positions. The anorectal angle during defecation is of immense importance as an anatomic factor. The higher anorectal angle in squatting position (posture for traditional Turkish type toilet) facilitates defecation, whereas reduction of the angle in a sitting position (posture for Western type toilet) leads to excessive straining during bowel emptying and increases intra-colonic pressure that makes defecation more difficult.

to the traditional Turkish toilet (in a squatting posture) is also increasing in Turkey. According to the findings of this study, using a Western type toilet in a sitting position during defecation created a higher risk for the development of CD than using a traditional Turkish type toilet in a squatting position. The risk was also seen to increase with time in patients who subsequently used a Western type toilet. Regarding defecation physiology, the anorectal angle is of immense importance (25,30). The anorectal angle also has a role in regulating intracolonic pressure which is one of the proposed mechanisms for CD formation (25-29,33). Normally, the anorectal angle is between 80° and 110° at rest. During defecation, the pelvic-floor muscles relax and the anorectal angle increases by 15°-20° (30-33). Using a Western style toilet impairs the anorectal angle and hence, does not allow enough relaxation (29). On the other hand, the anorectal angle becomes wider in a squatting position, which makes defecation easier (Figure 3). In addition, the support of the more flexed thigh muscles to the abdominal wall may have a role in intra-abdominal pressure regulation (31-33).

The relationship between CD and IBS or constipation is unclear and contrary results have been reported in previous studies. In the current study, a lower IBS frequency was determined in patients with CD. However, no difference was detected in multivariable logistic regression analysis. Similarly no relationship was determined in the current study between constipation and diverticulosis (35-42).

In concordance with the current study findings, previous studies have shown a significant association between CD and the prevalence of colorectal polyps (8,43-46). Hirata et al showed a 1.7-fold increased risk of

colonic polyps in patients with diverticular disease (47). Such an association may be expected since both occur mostly at an advanced age.

Previous studies reported a probable link between diverticulosis-constipation and constipation-hemorrhoids. Some authors have suggested that constipation causes higher intramural colon pressure and the pressure can lead to hemorrhoids and diverticulosis (42,43,48). Koning MV et al demonstrated a high prevalence of diverticular disease in patients with hemorrhoids (49). On the other hand, another study did not support such an association (50). Interestingly, an inverse relationship was found in our study. Detailed evaluation of hemorrhoids was beyond the scope of the present study, and hence, such association needs further clarification.

More than half of the diverticula were found to be located on the left side of the colon in the current study group. Western studies have reported left side predominance for the location of CD, whereas in Japan most of the CD cases have been reported to be located on the right side (4,7,23). Turkey represents the transition zone and as expected, the distribution was found to be in between western and eastern reports. However, in the present study Western type toilet users had left-sided CD predilection. That finding supports the “anorectal angle and relaxation” hypothesis that we discussed above.

This study had some limitations. A large group of patients was enrolled from mostly symptomatic individuals, so the sample was not representative of the general population and the participating patients were elderly. Patients in the D group were significantly older and it is possible that older patients, who also have more CD, use a sitting position more, rather than a squatting position during defecation. However, the CD risk was higher in patients using a Western type toilet independent of age. Another limitation is that we did not evaluate the role of diet in the present study. Current studies demonstrated that there is a probable association between dietary habits and CD (51,52). However, our study was performed in a single center and our data represent the data of population who have a comparable dietary habits. A multicenter study would be more representative to demonstrate such association between CD and diet.

However, to the best of our knowledge, this is the first study to evaluate the relationship between CD and positions during defecation. It may open the door for future research with a larger cohort to elucidate this and other risk factors.

In conclusion, the results of the current study clearly demonstrated that colonic diverticular disease is correlated with toilet type use. The rapid aging of populations and increasing use of Western type toilets worldwide means that diverticular diseases can be expected to increase in the coming decades.

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