

PROCEEDINGS

# DIVERTICULAR DISEASE (DD) OF THE DIGESTIVE TRACT. CLASSIFICATION, TYPES OF COMPLICATIONS, AND TREATMENT

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## ABSTRACT

**INTRODUCTION:** Diverticular disease (DD) of the digestive system is a common disease with an increasing incidence recorded. The most frequently affected anatomical areas are the distal sections of the large intestine, namely the distal colon and sigmoid colon.

**AIM:** The aim of this article is to investigate the frequency of DD, the position of the diverticula, the types of complications and treatment.

**MATERIAL AND METHODS:** The study was single-center, retro- and prospective, covering 1,879 patients hospitalized at the General Hospital in Pleven for the period 01.01.2022–01.06.2023. A total of 66 patients (3.5%) were diagnosed with DD. Both sexes were affected equally.

**RESULTS:** The complications were as follows: bleeding in 39 (59%) patients, and 12 (18%) had the presence of an inflammatory process. Eleven of the patients (16.6%) were operated on. In 27% Hartmann's resection was performed, in 72%—partial resection or hemicolectomy with primary anastomosis. We have no lethal outcomes in the studied patient group. The operated patients were evaluated according to CDD, Modified Hinchey and Hansen-Stock classifications.

**CONCLUSION:** The most frequent factors affecting the incidence of DD are the increased survival rate of the population, inadequate prevention of gastrointestinal tract (GIT) diseases, constipation, disturbances in the dietary regimen. The GIT parts affected by DD in the group of patients was of the Western type, i.e., mainly on the left. The most common complication is bleeding, which in most cases is controlled with medication. Operative treatment was applied in cases of diagnosed peritonitis and/or unsatisfactory result of antibiotic treatment.

**Keywords:** *diverticular disease, diverticulum, bleeding, perforation*

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## INTRODUCTION

Diverticular disease (DD) of the digestive system is a common disease with episodes of recurrence and an increasing frequency recorded. The most common complications associated with diverticulosis are bleeding, especially from diverticula located in the lower parts of the gastrointestinal tract, presence of inflammation, pain, presence of abscesses, fistula, stricture, perforation, and death (1). The



frequent manifestation of any of the complications listed above leads to frequent hospitalizations in the gastroenterological and surgical departments, for the treatment of which significant material resources and specialized personnel are required. The presence of a pain syndrome and the fear of a new outbreak of the disease are the basis of drastic changes in the personal and professional life of the patients, expressed most often in a change in the nutritional and physical activity regimen, psychological changes, and lifestyle changes—all of them mostly with a negative impact (2).

### AIM

The aim of this article is to investigate the frequency of DD, the localizations of the diverticula, and the types of complications and treatment.

### MATERIALS AND METHODS

The study was single-center, retro- and prospective, covering 1,879 patients hospitalized at the University Hospital in Pleven for the period 01.01.2022–01.06.2023. A total of 66 patients (3.5%) were diagnosed with DD.

### RESULTS

#### *Epidemiology, Age Distribution, and Location*

In Western countries, about 45% of the population suffers from diverticulosis. It can affect any part of the gastrointestinal tract and it can occur at any age. In 95% of cases, it is diagnosed in the sigmoid region. According to various clinical studies conducted in Canada and the USA (Medical Center Hospital, San Marino and Massachusetts), an increase in the percentage of the disease was observed in the age groups 18–44 years and 45–65 years (3,4). In the group of patients aged 65–74 and more, there is stabilization of the disease. About 5% of patients under 40 years of age are affected, and over 65% of those over 80 years of age.

In our group of patients, the largest number of affected patients was in the group over 70 years of age—38 (58%). The pathology was poorly represented in the group up to 40 years—only 4 patients (Fig. 1). The age group between 70 and 80, which is also the most numerous, was most significantly affected (Fig. 2). The youngest patient was 18 years old. He was admitted and operated on as an emergency pro-

cedure due to acute appendicitis and there was an intraoperative finding of Meckel’s diverticulum. The oldest patient was 92 years old, admitted with bleeding and diagnosed with a diverticulum of the descending colon.

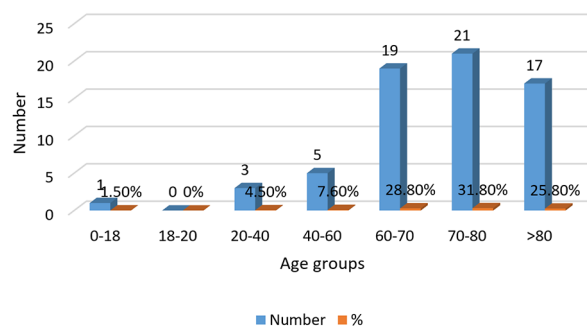


Fig. 1. Distribution of diverticulosis by age.

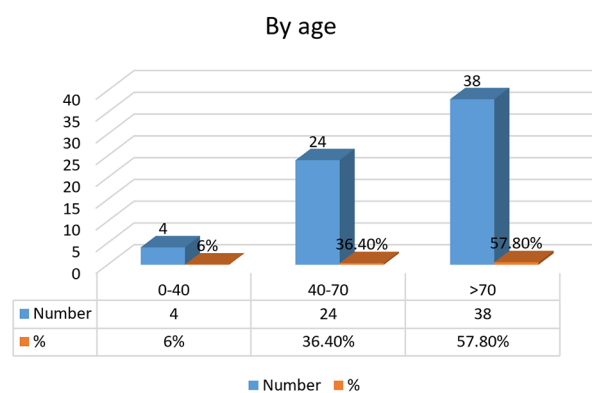


Fig. 2. Frequency of DD in the age groups.

Both genders were affected without any statistically significant difference. The male/female ratio was 30/36. This was observed in the age group with patients aged over 80; one of the reasons being the higher survival rate of female individuals. The reason for the increased incidence of diverticula in male individuals is considered to be a decrease in the amount of testosterone with age, which has a protective role in preventing the strength of the connective tissue of the colon (Table 1) (3,5).

Diverticulosis has its geographic, racial, and anatomical characteristics. It occurs mainly in economically developed areas, such as the USA, Europe, and Australia, and affects approximately 50% of the population over 60 years of age. The percentage of the affected population in African and Asian countries is

Table 1. Distribution of DD by gender.

Age Groups	0–20	20–40	40–60	60–70	70–80	> 80
Female	0	1	3	9	10	13
Male	1	2	2	10	11	4
P < 0.05	0.277	0.458	0.803	0.464	0.448	0.035*

about 0.5%. The main reason for this is the low-fiber diet and lifestyle in the Western world. This hypothesis was confirmed by a study of 1,200 patients from the United Kingdom and Uganda, based on measurement of stool weight, and another study using barium slurry irrigography. It has also been established that in Asians and African-Americans, diverticulosis affects the parts of the large intestine located mainly on the right, while in Caucasians living according to the Western model, the manifestation of the disease is mainly on the left. Due to the spread of the Western way of eating and living in the countries of the East, Nagata et al., Yamamaichi et al. and others, in their studies in Korea, Taiwan and Japan, reported an increase in the cases of diverticulosis with the localization of the diverticula located mainly on the left, i.e., according to the Western model (6,7,8).

In the examined 66 patients, the following localizations were diagnosed (Fig. 3): esophagus—3, duodenum—5, small intestine—5, Meckel's diverticulum—3, large intestine (unspecified)—6, cecum—2, colon acc.—2, colon transversum—4, colon descendens—4, colon descendens and sigma—14, sigma—30.

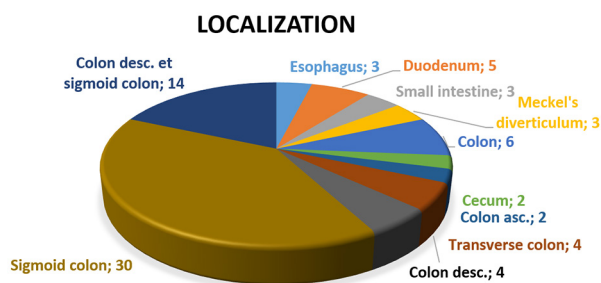


Fig. 3. Localization of diverticula in DD.

The studied patients suffered from Western type diverticulosis disease, i.e., the diverticula were mainly located on the left.

#### Clinical Symptoms and Diagnostic Methods

For the studied period, 62 of the patients were hospitalized for the first time. In 8 patients, the diverticula were asymptomatic and were diagnosed on another occasion, most often during a routine fibrogastroduodenoscopy (FDGS) examination performed at the beginning of the treatment of patients with acute pancreatitis. The medical history of 11 patients reflected the presence of diverticulosis. The most frequent complaints related to the disease are: diverticulum-associated pain in 23 patients, presence of fever in 4, complaint of presence of blood in stools in 39 patients, evidence of constipation in 7, pain along the course of the colon mainly on the left in 12 patients.

The routine diagnostic methods for fibrogastroscopy (FGS), FGDS, fibrocolonoscopy (FCS), rectoscopy, irrigography and CT (native and with contrast) are presented in Table 2. In case of suspected diverticulitis, Crohn's disease and chronic kidney disease (CKD) in the acute phase, FCS is contraindicated and the computerized tomography is the method of choice (9). Ultrasound also has its place in diagnostics, mainly in complicated forms of DD.

There were no significant laboratory tests. In cases of GIT bleeding, there were deviations in the values of Xb, TP and alb, Plt, urea, and in the case of an inflammatory process in the values of CRP, Gra %.

The presence of DD along the course of the GIT, location, size, and presence of complications can be evaluated using contrast-enhanced CT of the abdo-

Table 2. Frequency of diagnosed DB according to the type of instrumental investigation.

Instrumental investigation	FGS	FGDS	FCS	Irrigography	CT	Sonography
Number of patients	1	7	41	1	11	4

men and pelvis using the Classification of Diverticular Disease (CDD), Modified Hinchey (MHC), and Hansen-Stock Classifications (HSC). They also serve to determine therapeutic behavior (Fig. 4) (10,11).

**TABLE 3**  
Known classification systems for diverticular disease/diverticulitis

	Classification of Diverticular Disease (CDD) (4)		Modified Hinchey classification (e31)		Hansen-Stock classification (e32)	
	Type	Definition	Stage	Definition	Stage	Definition
Asymptomatic diverticulosis	Type 0	Identification of diverticula in the colon	x	–	0	Identification of diverticula in the colon
Acute uncomplicated diverticulitis	Type 1a	Diverticulitis without peridiverticulitis	0	Diverticulitis without peridiverticulitis	I	Diverticulitis without peridiverticulitis
	Type 1b	Diverticulitis with phlegmonous peridiverticulitis	Ia	Diverticulitis with phlegmonous peridiverticulitis		
Acute complicated diverticulitis	Type 2a	Diverticulitis with macro-abscess (< 1cm), minimal paracolic air	Ib	Diverticulitis with paracolic abscess	Ila	Diverticulitis with phlegmonous peridiverticulitis
	Type 2b	Diverticulitis with macro-abscess (> 1cm)	II	Diverticulitis with distant pelvic or abdominal macro-abscess	Ilb	Diverticulitis with abscess
	Type 2c1	Free perforation with purulent peritonitis	III	Free perforation with purulent peritonitis	Ilc	Free perforation
	Type 2c2	Free perforation with fecal peritonitis	IV	Free perforation with fecal peritonitis		
Chronic diverticular disease	Type 3a	Chronic symptoms related to diverticulum after acute diverticulitis	–	–	–	–
	Type 3b	Recurrent diverticulitis	–	–	III	Chronic recurrent diverticulitis
	Type 3c	Identification of inflammatory stenoses, fistula, conglomerate tumor	–	–		
Diverticular bleeding	Type 4	Identification of source of bleeding	–	–	–	–

Fig. 4. Diverticulitis classifications according to the German S2k Guideline/ Deutsches Arzteblatt.

Abdominal and pelvic CT was performed in 19 (29%) patients, and 14 (74%) were diagnosed with a form of DD. Four were operated on, in 1 there was a discrepancy in the scan and operative findings.

**Complications**

The most frequent complications of DD are bleeding, inflammation, inflammation with abscess formation, perforation with local or diffuse peritonitis, obstruction. Of the 66 hospitalized patients, 58 (87.88%) were treated for complications as follows: with evidence of bleeding—39 (67.2%), with evidence of diverticulitis—12 (20.69%), with ileus symptoms—7 (12.07%) (Table 5) (12,13).

As can be seen from the Table 3 with increasing age, the number of patients with complications increases, with the age group over 61 being the most

affected. Women are the most affected gender from bleeding. A total of 19 (48.7%) patients from the bleeding group reported being treated with antiplatelets, anticoagulants and NSAIDs due to a concomitant disease: 8 patients took aspirin, 4—clopidogrel, 3—PlakeX, 3—Sintrom, and 1—NSAIDs.

**Treatment**

Of the 66 patients treated, we conservatively managed 49 (74.2%) of the cases, operated on 11 (16.7%) patients, and in 6, the operation was due to another diagnosis and in progress, and we diagnosed the presence of DD.

Patients with bleeding were treated with saline, anticoagulants, correction of the anemic syndrome with erythrocyte mass, and fresh frozen plasma (FFP). After the bleeding stopped, FCS was performed (14).

We treated patients with diverticulitis, but without data on acute surgical abdomen, with double antibiotic therapy—ceftriaxone and metronidazole and low doses of methylprednisolone (20–40 mg/day). In one patient there was data on the process not being completely managed, therefore we did a surgery.

In 2000, the American Society of Colon and Rectal Surgeons decided that all cases of acute inflammation of the diverticula associated with the presence of an abscess, perforation, intestinal obstruction, fistula, or stricture should be surgically treated. Adhering to this guideline and assessing the general condition of each patient, a total of 11 (16.7%) patients were operated on: 1 patient was operated on due to ileus symptoms due to Ca of sigmoid with diverticulosis, 1 was bleeding from Tu process in the cecum, 3 we operated on for diverticulitis without perforation (2 of which had Meckel’s diverticulum),

Table 3. Evaluation of operated patients according to CDD, MHC, HSC

Number of Patients	CDD	Modified Hinchey Classification	Hansen- Stock Classification	Operation Type
1	Type 2b	III	Ilc	Hartmann’s resection
1	0	0	0	Resection with anastomosis
1	Type 2b	III	Ilc	Resection with anastomosis
1	Type 2b	II	Ilb	Hartmann’s resection
10	0	0	0	None

Table 4. Complications of DB by number and sex.

DD with Bleeding (39 Patients)				
Age Groups	Number of Patients	Male	Female	P < 0.05
18–20 y.o.	0	0	0	
21–40 y.o.	0	0	0	
41–60 y.o.	3	1	2	0.674
61–70 y.o.	15	7	8	0.309
71–80 y.o.	12	6	6	0.262
≥ 81 y.o.	9	1	8	0.057*
DD with Diverticulitis (12 Patients)				
18–20 y.o.	0	0	0	
21–40 y.o.	3	2	1	0.245
41–60 y.o.	2	1	1	0.576
61–70 y.o.	2	2	0	0.427
71–80 y.o.	2	2	0	0.427
≥ 81 y.o.	3	1	2	0.236
DD with Symptoms of Obstruction (7 Patients)				
18–20 y.o.	0	0	0	
21–40 y.o.	0	0	0	
41–60 y.o.	0	0	0	
61–70 y.o.	0	0	0	
71–80 y.o.	4	2	2	0.629
≥ 81 y.o.	3	2	1	0.629

and 6 patients were operated on for diverticulitis with perforation (15,16).

The preferred operative approach in the group of DD with perforation and peritonitis was right hemicolectomy with ileotransverse anastomosis for

right-sided diverticulosis and Hartmann's resection for left-sided diverticulosis. In the group of DD without perforation but with evidence of inflammation, two of the patients had inflammation of Meckel's diverticulum and resection of the affected area with

Table 5. Operative treatment in patients with diverticulitis.

Reason	Operation Type				Surgical Complications	
	Right Hemicolectomy	Left Hemicolectomy	Hartmann's Resection A Modo	Resection with Anastomosis	Laparostomy	Relaparotomy
DD with perforation	2	0	4	0	0	0
DD without perforation	0	0	0	3	1	0
DD with obstruction	0	1	0	0	0	0
DD with bleeding	1	0	0	0	0	1







MODIFIED HINCHEY CLASSIFICATION OF DIVERTICULITIS		
STAGE	DESCRIPTION	MANAGEMENT
0	Mild clinical diverticulitis (left lower quadrant abdominal pain, low grade fever, leukocytosis)	Oral Antibiotics
Ia	Confined pericolic inflammation or phlegmon 	Antibiotics +/- CT Guided Drainage
Ib	Confined pericolic abscess	Antibiotics +/- CT Guided Drainage
II	Distant Abscess 	Abcess Drainage
III	Purulent Peritonitis 	Hartmann's Surgery
IV	Fecal Peritonitis 	Hartmann's Surgery

Fig. 5. Modified Hinchey Classification  
(Source: www.openmed.co)

subsequent L-L anastomosis. The third patient underwent laparostomy due to diffuse peritonitis with a duration of more than 72 hours, with resection and anastomosis of the affected area at the first surgery. In the DD bleeding group, a right hemicolectomy was performed, but the patient underwent relaparotomy due to massive bleeding from the drains (17,18).

Fig. 5 shows the recommended behavior according to the MHC for DD with diverticulitis. Our therapeutic behavior was completely different in stages Ia, Ib, and II. The recommended laparoscopically placed drain in Ib and II is not in accordance with the department's policy (19). We have performed all operative interventions using laparotomy. In Table 5, we have presented the patients assessed according to the three classifications and the type of surgery performed.

### CONCLUSION

The most frequent factors influencing the incidence of DD are the increased survival of the population, prevention of GIT diseases, constipation, diet. The parts of the GIT affected by DD in the group of patients was of the Western type, i.e., mainly on the left. The most common complication was bleeding, which in most cases could be controlled with medication. Operative treatment was applied in cases of diagnosed peritonitis and/or in case of unsatisfactory result of antibiotic treatment. Scanographic classifications of DD have their place and are applicable. A drastic difference was found between our surgical behavior in cases of DD with phlegmon and abscess and the one recommended in the literature. No minimally invasive surgery was performed in any of the operated patients.

## REFERENCES

1. Golder M, Ster IC, Babu P, Sharma A, Bayat M, Farah A. Demographic determinants of risk, colon distribution and density scores of diverticular disease. *World J Gastroenterol* 2011;17(8):1009–17. doi: 10.3748/wjg.v17.i8.1009.
2. Oh HK, Han EC, Ha HK, Choe EK, Moon SH, Ryoo SB, et al. Surgical management of colonic diverticular disease: discrepancy between right- and left-sided diseases. *World J Gastroenterol*. 2014;20(29):10115–20. doi: 10.3748/wjg.v20.i29.10115.
3. Weizman AV, Nguyen GC. Diverticular disease: epidemiology and management. *Can J Gastroenterol*. 2011;25(7):385–9. doi: 10.1155/2011/795241.
4. Kozak LJ, DeFrances CJ, Hall MJ. National hospital discharge survey: 2004 annual summary with detailed diagnosis and procedure data. *Vital Health Stat* 13. 2006;(162):1-209.
5. Imaeda H, Hibi T. The burden of diverticular disease and its complications: West versus East. *Inflamm Intest Dis*. 2018;3(2):61–8. doi: 10.1159/000492178.
6. Painter NS, Burkitt DP. Diverticular disease of the colon: a deficiency disease of Western civilization. *Br Med J*. 1971;2(5759):450–4. doi: 10.1136/bmj.2.5759.450.
7. Schauer PR, Ramos R, Ghiatas AA, Sirinek KR. Virulent diverticular disease in young obese men. *Am J Surg*. 1992;164(5):443–6; discussion 446–8. doi: 10.1016/s0002-9610(05)81177-8.
8. Yamamichi N, Shimamoto T, Takahashi Y, Sakaguchi Y, Kakimoto H, Matsuda R, et al. Trend and risk factors of diverticulosis in Japan: age, gender, and lifestyle/metabolic-related factors may cooperatively affect on the colorectal diverticula formation. *PLoS One*. 2015;10(4):e0123688. doi: 10.1371/journal.pone.0123688.
9. Bates DDB, Fernandez MB, Ponchiardi C, von Plato M, Teich JP, Narsule C, et al. Surgical management in acute diverticulitis and its association with multi-detector CT, modified Hinchey classification, and clinical parameters. *Abdom Radiol (NY)*. 2018;43(8):2060–2065. doi: 10.1007/s00261-017-1422-y.
10. Klarenbeek BR, de Korte N, van der Peet DL, Cuesta MA. Review of current classifications for diverticular disease and a translation into clinical practice. *Int J Colorectal Dis*. 2012;27(2):207–14. doi: 10.1007/s00384-011-1314-5.
11. Nagata N, Niikura R, Aoki T, Shimbo T, Itoh T, Goda Y, et al. Increase in colonic diverticulosis and diverticular hemorrhage in an aging society: lessons from a 9-year colonoscopic study of 28,192 patients in Japan. *Int J Colorectal Dis*. 2014;29(3):379–85. doi: 10.1007/s00384-013-1808-4.
12. Zuccaro G Jr. Management of the adult patient with acute lower gastrointestinal bleeding. American College of Gastroenterology. Practice Parameters Committee. *Am J Gastroenterol*. 1998;93(8):1202–8. doi: 10.1111/j.1572-0241.1998.00395.x.
13. Forgey DE. The treatment of diverticulitis of the colon. *Am J Proctol*. 1966 Aug;17(4):278–87.
14. Salem L, Flum DR. Primary anastomosis or Hartmann's procedure for patients with diverticular peritonitis? A systematic review. *Dis Colon Rectum*. 2004;47(11):1953–64. doi: 10.1007/s10350-004-0701-1.
15. Kang JY, Hoare J, Tinto A, Subramanian S, Ellis C, Majeed A, et al. Diverticular disease of the colon--on the rise: a study of hospital admissions in England between 1989/1990 and 1999/2000. *Aliment Pharmacol Ther*. 2003;17(9):1189–95. doi: 10.1046/j.1365-2036.2003.
16. Wong WD, Wexner SD, Lowry A, Vernava A 3rd, Burnstein M, Denstman F, et al. Practice parameters for the treatment of sigmoid diverticulitis--supporting documentation. The Standards Task Force. The American Society of Colon and Rectal Surgeons. *Dis Colon Rectum*. 2000;43(3):290–7. doi: 10.1007/BF02258291.
17. Gervaz P, Ambrosetti P. Critical appraisal of laparoscopic lavage for Hinchey III diverticulitis. *World J Gastrointest Surg*. 2016;8(5):371–5. doi: 10.4240/wjgs.v8.i5.371.
18. Hinchey EJ, Schaal PG, Richards GK. Treatment of perforated diverticular disease of the colon. *Adv Surg*. 1978;12:85–109.
19. Stollman NH, Raskin JB. Diagnosis and management of diverticular disease of the colon in adults. Ad Hoc Practice Parameters Committee of the American College of Gastroenterology. *Am J Gastroenterol*. 1999;94(11):3110–21. doi: 10.1111/j.1572-0241.1999.01501.x.