



Current surgical treatment of diverticular disease in the Netherlands

Annelien N Morks, Bastiaan R Klarenbeek, Elvira R Flikweert, Donald L van der Peet, Thomas M Karsten, Eric H Eddes, Miguel A Cuesta, Peter W de Graaf

Annelien N Morks, Thomas M Karsten, Peter W de Graaf, Department of Surgery, Reinier de Graaf Gasthuis, PO Box 5011, 2600 GA Delft, The Netherlands

Bastiaan R Klarenbeek, Donald L van der Peet, Miguel A Cuesta, Department of Surgery, VU University Medical Center, PO Box 7057, 1007 MB Amsterdam, The Netherlands

Elvira R Flikweert, Eric H Eddes, Department of Surgery, Deventer Ziekenhuis, PO Box 5001, 7400 GC Deventer, The Netherlands

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Correspondence to: Bastiaan R Klarenbeek, MD, Department of Surgery, VU University Medical Center, PO Box 7057, 1007 MB Amsterdam, The Netherlands. br.klarenbeek@vumc.nl
Telephone: +31-6-41254152 Fax: +31-20-4444511

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Abstract

AIM: To evaluate the development of diagnostic tools, indications for surgery and treatment modalities concerning diverticular disease (DD) in the Netherlands.

METHODS: Data were collected from 100 patients who underwent surgery for DD in three Dutch hospitals. All hospitals used the same standardized database. The collected data included patient demographics, patient history, type of surgery and complications. Patients were divided into two groups, one undergoing elective surgery (elective group) and the other undergoing acute surgery (acute group).

RESULTS: Two hundred and ninety-nine patients were admitted between 2000 and 2007. One hundred

and seventy-eight patients underwent acute surgery and 121 patients received elective operations. The median age of the 121 patients was 69 years (range: 28-94 years), significantly higher in acute patients ($P = 0.010$). Laparoscopic resection was performed in 31% of elective patients. In the acute setting, 61% underwent a Hartmann procedure. The overall morbidity and mortality were 51% and 10%, and 60% and 16% in the acute group, which were significantly higher than in the elective group (36% and 1%). Only 35% of the temporary ostomies were restored.

CONCLUSION: This study gives a picture of current surgical practice for DD in the Netherlands. New developments are implemented in daily practice, resulting in acceptable morbidity and mortality rates.

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Key words: Diverticulitis; Surgery; Diverticular disease

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INTRODUCTION

Diverticular disease (DD) accounts for 14 000 hospital admissions annually in the Netherlands. The incidence of DD is rising, mainly among younger patients^[1]. The treatment depends on the severity of the disease, vary-

ing from light symptomatic diverticulosis to perforated diverticulitis. For years it was thought that the risk of perforation and other complications increased after each recurrence. Therefore, the American Association of Colorectal Surgeons suggested to perform an elective sigmoid resection after two episodes of acute diverticulitis, after a single episode in young patients or when complications, such as stenosis or fistulae, occur^[2].

However, new insights in the natural course of DD resulted in a more conservative approach. Severe complicated diverticulitis, leading to acute surgical intervention, is most often the primary presentation of the disease^[3]. More recent studies highlight the benign course of recurrent episodes of diverticulitis with a low complication rate in patients treated conservatively for an acute episode of diverticulitis^[4-6]. It is suggested that elective, prophylactic sigmoid resections based on the number of episodes is not always indicated.

New diagnostic tools and therapeutic techniques have improved the treatment of DD. For instance, the ability to treat large abscesses by computed tomography (CT)-guided percutaneous drainage prevents the emergency surgery and can form a bridge to an elective resection when indicated^[7]. The rise of laparoscopic surgery since the 90s resulted in decreased morbidity and mortality rates, making it the preferred approach in elective sigmoid resections^[8].

Whether a laparoscopic approach can also be applied to patients with perforated diverticulitis and generalized peritonitis remains to be confirmed. Laparoscopic sigmoid resection cannot be accomplished completely because of extensive pericolic infiltration and faecal or purulent contamination. Hartmann's procedure is the treatment of first choice for most surgeons. However, several recent studies showed that a primary anastomosis with or without a deviating ileostomy could be performed safely under these circumstances^[9,10]. Even laparoscopic lavage can be a safe alternative for Hartmann's procedure in case of perforated purulent diverticulitis^[11].

The aim of this study is to evaluate development of diagnostic tools, indications for surgery and treatment modalities concerning DD in the Netherlands. We analyzed the results of 299 patients with DD treated in three Dutch hospitals. Since the patients treated for acute diverticulitis have a worse prognosis compared with electively treated patients, we analyzed them in separate groups.

MATERIALS AND METHODS

In January 2008, we collected and pooled the data in the last 100 patients with DD treated surgically in three Dutch hospitals. The hospitals were the VU University Medical Center in Amsterdam, the Deventer Ziekenhuis in Deventer and the Reinier de Graaf Gasthuis in Delft, evenly distributed over the country. Patients were selected using national coding systems (i.e. ICD-9) and the national pathology database (PALGA).

The following data were collected: gender, age, ASA-grade (American Society of Anesthesiologists), type of admission (elective or acute), previous episodes of diverticulitis, results of radiological tests (CT-scan, ultrasound and contrast enemas), operative technique, duration of operation, type of surgeon [gastrointestinal (GI)-surgeon, resident or general surgeon], Hinchey classification^[12], intensive care unit (ICU) admission, complications, creation/restoration of ostomies and mortality. The data were collected in a standardized database by retrospective analysis of the medical records.

Minor complications include urinary tract infections, conservatively treated ileus, small wound infection and/or postoperative delirium. Anastomotic leakages, evisceration, necrotic ostomy, re-operation for other reasons and/or cardiopulmonary distress were considered to be major complications. Mortality was defined as death within 30 d after operation or during initial hospital admission.

Statistical analysis

Data of the three hospitals were combined into one database. Patients were divided into two groups: one undergoing elective surgery and the other undergoing acute surgery. Statistical analysis was performed using SPSS 15.0.1 (SPSS Inc., Chicago, IL, USA). Values were expressed as median and range for continuous variables. Distributions of dichotomous data were given in percentages. Continuous variables with normal distribution were compared using Student's *t* test. Wilcoxon *W* test was employed for continuous variables. Pearson χ^2 test was used for the analysis of discrete variables.

RESULTS

Population

The last 100 patients with DD treated surgically in the three hospitals were included, all were admitted between April 2000 and December 2007. After combining the datasets, one patient was excluded because the indication for surgery was revised. Two hundred nineteen-nine patients with complicated DD were analyzed. Patient characteristics are shown in Table 1. The median age was 69 years (range: 28-94 years), the patients in the acutely admitted group were 8 years older ($P = 0.010$) than the elective group. Only 5% of patients were younger than 40 years and 46% over 70 years of age. The male to female ratio was 42% to 58%. No differences were found in ASA-grade between groups. Sixty percent was of ASA-grade two.

Patient history and diagnostic procedures

Data on history and diagnosis are depicted in Table 1. Over half of the patients (52%) with an acute indication for surgery, had no history of diverticulitis. In the elective group, 54% of patients underwent a sigmoid resection after one episode of diverticulitis, the others had a history of two or more episodes. Conservative treatment

	Acute (<i>n</i> = 178)	Elective (<i>n</i> = 121)	<i>P</i> value
Age (yr)			
median (range)	74 (28-94)	64 (28-88)	0.010
< 40	9 (5)	5 (4)	0.710
> 70	101 (57)	37 (31)	0.000
Gender			
Male	84 (47)	41 (34)	0.022
ASA grade			0.157
I	25 (14)	22 (18)	
II	102 (57)	78 (65)	
III	44 (25)	18 (15)	
IV	7 (4)	3 (2)	
Previous episodes			0.000
0	92 (52)	0 (0)	
1	68 (38)	65 (54)	
2	10 (6)	23 (19)	
≥ 3	8 (4)	33 (27)	
Imaging			
Ultrasound	32 (18)	22 (18)	0.964
CT-scan	103 (58)	98 (81)	0.000
Barium enema	2 (1)	57 (47)	0.000
Colonoscopy	16 (9)	76 (63)	0.000
Hinchey			0.000
I	56 (32)	48 (65)	
II	24 (14)	26 (35)	
III	75 (43)	0 (0)	
IV	19 (11)	0 (0)	
Percutaneous drainage	7 (29)	3 (12)	0.578

CT: Computed tomography.

of a mild episode of diverticulitis usually consisted of dietary advice and sometimes antibiotic therapy. Percutaneous drainage of abscesses was only reported in 20% of Hinchey II patients.

CT-scan seemed the most valuable diagnostic tool in an acute setting, being performed in 58% of patients. In the preoperative work-up for an elective intervention, CT-scan (81%) and colonoscopy (63%) were performed. Severity of the disease was classified by the Hinchey classification, knowing that Hinchey III and IV perforated diverticulitis can only be distinguished during surgery; and 65% of elective patients were Hinchey I and 35% Hinchey II. Indications for elective sigmoid resection were: recurrent episodes of acute diverticulitis, persistent complaints, colovesical or colovaginal fistulae and symptomatic stenosis of the sigmoid colon.

Perforated diverticulitis with generalized peritonitis was the main indication for an acute intervention (Hinchey III 43% and Hinchey IV 11%). Other acute indications were total bowel obstruction, very large or persisting abscesses and failure of conservative treatment. In 54% of the acute patients, surgery was performed on the day of admission, and in 15% the following day.

Operation

Operative data are shown in Table 2. Laparoscopic sigmoid resection was performed in 31% of the elective patients, with a conversion rate of 15%. A deviating ileostomy was created in 12%. There was a wide inter-hospital variety in the preferred elective approach.

	Acute (<i>n</i> = 178)	Elective (<i>n</i> = 121)	<i>P</i> value
Time to acute intervention			
Same day	96 (54)		
1 d	26 (15)		
> 1 d	54 (30)		
Unknown	2 (1)		
Operating time (min)			
mean (range)	125 (30-295)	160 (48-305)	0.000
Operating surgeon			0.000
GI-surgeon	32 (18)	78 (65)	
General surgeon	75 (42)	5 (4)	
Resident	71 (40)	38 (31)	
Surgical approach			0.000
Laparoscopy	8 (4)	38 (31)	
Laparotomy	170 (96)	83 (69)	
Conversion rate	5 (63)	7 (15)	0.000
Surgical procedure			0.000
Resection with primary anastomosis	69 (39)	116 (96)	
Protective ileostomy	10 (14)	9 (8)	
Hartmann's procedure	109 (61)	5 (4)	
ICU admission			0.000
None	48 (27)	86 (71)	
1-2 d	67 (38)	29 (23)	
3-4 d	25 (14)	3 (3)	
≥ 5 d	38 (21)	3 (3)	
Morbidity	107 (60)	44 (36)	0.000
Minor complications	36 (20)	20 (17)	0.177
Wound infection	28 (16)	14 (12)	
Urinary tract infection	8 (4)	6 (5)	
Major complications	71 (40)	24 (20)	0.000
Anastomotic leakage	2 (1)	8 (7)	
Necrotic ostomy	4 (2)	2 (2)	
Cardiopulmonary	29 (16)	5 (4)	
Intraabdominal abscess	8 (5)	1 (1)	
Evisceration	5 (3)	3 (2)	
Other	23 (13)	5 (4)	
Mortality	28 (16)	1 (1)	0.000

ICU: Intensive care unit; GI: Gastrointestinal.

In the acute setting, Hartmann's procedure was performed in 61% of patients. The other patients were treated by means of resection and primary anastomosis, 14% of them received a deviating ileostomy. Laparoscopic approach was attempted in 4% of the patients, with a high conversion rate (63%).

Median operating time in acute operations was significantly shorter than in an elective setting (125 min *vs* 160 min, *P* = 0.000). Results, complications and operating time may largely depend on the operating surgeons, i.e. GI-surgeon, general surgeon or resident. This distribution was determined by the setting in which an operation was performed (acute or elective). Most of the elective surgeries were performed by GI-surgeons (65%), whereas general surgeons and residents (under supervision) performed most of the acute operations (82%). In total, 36% of all interventions for DD were performed by residents, 37% by GI-surgeons and 27% by general surgeons.

Complications and follow-up

The overall morbidity and mortality of the total cohort

were 51% and 10%, respectively, in which elective surgery was associated with significantly better outcomes (Table 2). Following elective surgery, 36% of patients had postoperative complications, 16% having minor and 20% having major complications. After acute operation, the morbidity was 60%, including 20% minor and 40% major complications. The mortality in the acute group was 16% in contrast with 1% in elective group.

Twenty-nine percent of elective patients were admitted to the ICU after operation, 79% of these patients returned to the normal surgical ward within 1 d after operation. In the acute setting, the ICU admission rate was 73%, 48% of the patients stayed in ICU for more than 2 d.

A total of 133 ostomies were created, 86% of which used Hartmann's procedure. Only 35% of these ostomies, 50% of the ileostomies and 33% of Hartmann's procedures were actually reversed. The median interval until reversal was 29 wk (6-213 wk).

DISCUSSION

This study describes the current surgical practice in DD in the Netherlands. DD is associated with substantial postoperative morbidity (51%) and mortality (10%). A morbidity rate of 60% and a mortality rate of 16% are especially high in the acute setting. These numbers are comparable to other recent series, and little improvement has been seen over the past years^[9,13,14]. This could have been expected because acute interventions remained the same for decades, especially the Hartmann's procedure. No apparent reduction of these adverse outcomes has been achieved by improvement in peri-operative care, better patient selection and enhanced guarding on the ICU when needed.

Significantly more complications were seen in the acute group, mostly major complications. Usually a prominent share of morbidity and mortality is accounted for by anastomotic leakages although in this series a low percentage of 5% was found. None of these anastomotic leakages resulted from a primary anastomosis in Hinchey III or IV patients. Moreover, the majority of anastomotic leakages occurred in elective operations (7%) and not in acute interventions (3%). As can be expected, the total number of primary anastomosis was higher in the elective group than in the acute group. Perhaps primary anastomosis in the acute setting was only considered under favorable conditions, resulting in a positive selection bias.

Elective sigmoid resections are progressively approached laparoscopically. It is not only a safe alternative for open techniques, several advantages have been demonstrated in recent trials^[8]. Postoperative pain is reduced, duration of hospital stay is shortened and morbidity rates are decreased. Surprisingly, only 31% of all elective patients in this study underwent a laparoscopic sigmoid resection. This might be explained by differences in laparoscopic experience among different hospitals. In

one clinic, a laparoscopic sigmoid resection is always attempted, whereas the other center has a preference for the open technique. In this context, it has to be realized that the beneficial effects of laparoscopic surgery are exclusively generated in high-volume centers by experienced laparoscopic surgeons. Patients may benefit more from an open sigmoid resection than a laparoscopic approach when the surgeon is at the beginning of his 'learning curve'^[15,16].

More recently, alternatives for Hartmann's procedure have been proposed. The technique of laparoscopic lavage is being evaluated in a prospectively randomized study in the Netherlands and no patient in this study was treated by this promising technique. Furthermore, laparoscopic resection was only attempted in 4% of the acute patients, resulting in a considerable conversion rate (63%). The number of primary anastomoses in the acute setting is increasing, with or without deviating ileostomy. In this series, 39% of the acute patients received a primary anastomosis, which is a substantial rise when compared to 27% in another Dutch study on 291 patients between 1995 and 2005^[17].

New insights in the natural history of DD have resulted in an increasingly conservative approach to this disease. It seems that uncomplicated, conservatively treated diverticulitis has a good prognosis, with a low recurrence rate and a rather benign course^[3-6]. Nevertheless in this series, 48% of the acute patients had an earlier episode of diverticulitis. When considering more than 5 d ICU stay in 21% of the acute patients and a mortality rate of 16%, some of these patients may have benefited from early elective sigmoid resection. Further research of this substantial group might reveal high-risk patients to be associated with a more hazardous course of DD, and certain comorbid conditions (auto-immune diseases and chronic renal failure), medication (steroids and non-steroidal anti-inflammatory drugs) or younger age are suggested factors^[18-20].

In a retrospective multi-center study, bias is unavoidable, and data collection is dependent on the individual search strategies and interpretation of different researchers. In this study, patient data were collected in a standardized fashion in all three hospitals by means of retrospective analysis of the medical records. Because of the deliberate choice to invite three different types of hospitals (university and teaching) in different parts of the Netherlands to participate in the study, extrapolation of the results to a broader perspective seems possible. These results are likely to reflect the national policy on DD.

It seems that Dutch hospitals are up-to-date, new developments are implemented in daily practice, resulting in acceptable morbidity and mortality rates. Indications for elective surgery are based on complaints and complications of DD, and not so much on the number of episodes. Furthermore, when elective surgery is indicated, the laparoscopic approach has been adopted in some hospitals, dependent on the experience of the surgeons.

In the acute setting, Hartmann's procedure is no longer the only option in generalized peritonitis. For further enhancement of the treatment of DD, national audits and prospective trials are needed. We can conclude that DD is a common disease which necessitates surgery in acute as well as in elective settings. Currently, no directives are available concerning best treatment strategies for acute and elective DD. Different treatment strategies are applied leading to an acceptable morbidity and mortality rate.

COMMENTS

Background

Diverticular disease (DD) accounts for 14 000 hospital admissions in the Netherlands annually. The incidence of DD is rising, mainly among younger patients.

Research frontiers

The aim of this study is to evaluate developments in diagnostic tools, indications for surgery and treatment modalities concerning DD in the Netherlands. Therefore, the authors analyzed the results of 299 patients treated for DD in three Dutch hospitals.

Innovations and breakthroughs

Recent studies highlight the usually benign course of recurrent episodes of diverticulitis with low complication rates, in patients treated conservatively for an acute episode of diverticulitis. It is suggested that planned, prophylactic sigmoid resections based on the number of episodes is not always indicated. New diagnostic tools and therapeutic techniques have improved the treatment of DD.

Applications

This study gives a picture of current surgical practice of DD in the Netherlands. New developments seem to be implemented in daily practice, resulting in acceptable morbidity and mortality rates.

Peer review

This article shows the current surgical treatment for DD in the Netherlands. The aims of this work are well delineated; the patients and methods are clearly described and appropriate statistical measures are indicated. The results are well reported and support the aims of the work. Discussion section is concise and well organized.

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