Surgical challenges in diverticular disease

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Chapter | 2

Indications for elective sigmoid resection in diverticular disease

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Abstract

Introduction

In order to prevent an acute operation, classical indications for elective sigmoid resections concerning diverticulitis have usually been based on the number of recurrent episodes. Since 2005 these indications have been challenged, primarily because the majority of patients first present themselves with acute complications at their first episode

Methods

Between 1990 and 2000, a cohort analysis was conducted involving all patients admitted to the VU University Medical Center with the diagnosis of diverticulitis, with a follow up until January 2009. In order to identify those patients who might benefit from elective sigmoid resection, several risk factors were analysed.

Results

Of 291 patients examined, 111 (38%) were treated conservatively and 180 (62%) underwent surgery, of which 108 acute and 72 elective.

The conservatively treated episodes of diverticulitis showed a recurrence rate was 48% (88 patients).

Indications for elective surgery were: recurrent attacks of diverticulitis with persistent complaints (36%), complaints of stenosis (40%), fistula (14%), persistent abscesses (3%) and recurrent diverticular bleeding (7%). Of the 74% of the patients approached laparoscopically, the overall morbidity was 22% with no mortality.

The main indication for an acute operation was perforation with general peritonitis, holding for 57% of the acutely operated patients. Other indications were: abscesses (22%), stenosis with obstruction (11%), failure of conservative therapy (6%) or diverticular bleeding (4%). Hartmann's procedure was the most frequently performed procedure (58%). This acutely operated population was associated with high morbidity (56%) and mortality (13%), perforation leads to 10% mortality and other causes to 3%.

Of those patients undergoing acute surgery, 20% had a previous history of diverticulitis. Moreover, risk factor analysis showed that those patients having one or more of the following indications: (1) using immune suppression therapy, (2) having chronic renal failure or (3) collagen-vascular diseases, had a significant five-fold greater risk (36% versus 7%) of a perforation in recurrent episodes of diverticulitis.

Conclusion

In the treatment of diverticular disease, indications for an elective sigmoid resection should not be based on the number of episodes only. Clear indications for elective sigmoid resections are complaints of stenosis, fistulas or recurrent diverticular bleeding. Furthermore, an elective sigmoid resection might be justified in high-risk patients following a conservatively treated episode of diverticulitis, who use immune suppression therapy, have chronic renal failure or collagen-vascular diseases.

Introduction

Diverticular disease of the sigmoid colon is a major problem in modern, western healthcare. Incidence-rates are rising, mainly among young patients.[1] The treatment of diverticular disease depends on the severity of the disease, varying from light symptomatic diverticulosis to perforated diverticulitis. Mild cases of diverticulitis such as phlegmon or small abscesses (Hinchey I) can be treated conservatively, with or without antibiotics and diet changes.[2] Larger abscesses (Hinchey II) can be relieved by CT-guided percutaneous drainage.[3] After a successful conservatively treated episode, there are risks of complications, such as stenosis or fistulas to hollow organs (bladder or vagina). A purulent (Hinchey III) or fecal (Hinchey IV) peritonitis results from a perforation and is associated with high morbidity and mortality (10-15%). In these severe circumstances acute surgical intervention is warranted. The standard treatment of choice has been Hartmann's procedure, but recently primary anastomosis or laparoscopic lavage are increasingly used.[4]

In 2000, the American Society of Colon and Rectal Surgeons (ASCRS) presented practice guidelines for preventing the sequence leading to perforated diverticulitis at a recurrent episode. The advice entailed performing an elective sigmoid resection after the occurrence of two episodes of acute diverticulitis (Hinchey I and II), after a single episode in young patients or when complications occur, such as stenosis or fistulas.[5] These guidelines were based on the following assumptions: (1) recurrence rate after every episode is at least 33%; (2) every recurrence means a higher risk on perforation and other acute complications; and (3) complicated diverticulitis is associated with high morbidity and mortality. Therefore, an elective sigmoid resection could prevent mortality and permanent colostomy.[6] Recently, these recommendations have been challenged because new data on the natural history of diverticulitis has shown that most perforations do not occur after recurrences, but at the first attack of acute diverticulitis. Furthermore, conservative management of recurrent non-perforated diverticulitis is associated with

low rates of morbidity and mortality.[7-9] In 2006, these new insights resulted in a revision of the ASCRS guidelines, advocating a more individual and conservative approach.[10]

Currently it seems clear that those patients once treated conservatively for acute diverticulitis and having complaints of stenosis or fistulas to hollow organs, are good candidates for elective surgery. Also, an elective sigmoid resection should be performed in patients with recurrent diverticular bleeding. When surgery is contemplated, the number of attacks of acute diverticulitis seems less important than the severity of complaints and associated patient risk factors. Age and certain comorbid conditions may be associated with a more hazardous course of diverticular disease. Patients older than 70 years have higher mortality rates, although this seems not to be an independent factor.[11] Furthermore, a more aggressive approach in young patients remains controversial, but there might be an advantage in early elective resection after conservatively treated diverticulitis. Because of a longer life-span, there will be a higher cumulative risk of complicated episodes. There is conjecture that over 30% of patients sooner or later will be in need of an acute surgical intervention.[12] Moreover, the presence of comorbidity, such as chronic renal failure, diabetes mellitus, collagen-vascular diseases or use of steroids and NSAIDs (non steroids anti-inflammatory drugs), have been associated with an important increase in perforation rate and mortality in diverticular disease.[13]

The aim of this retrospective cohort study is to first analyze the data on the natural history of diverticulitis and second to identify clinical risk factors that may be associated with a more hazardous course of diverticular disease. In this high-risk population, morbidity and mortality might be decreased by early elective sigmoid resection.

Methods

Between 1990 and 2000, a cohort analysis was conducted on patients admitted to the VU medical centre with the diagnosis diverticulitis. Follow up was retrospectively completed until 2009. The population was checked for completeness using the VU University Medical Center diagnosis coding system (ICD-9). Patient identifiers were scrambled, rendering an anonymous dataset considered within the public domain.

The population was divided into three groups receiving either: (1) conservative treatment (CT); (2) elective operative treatment (EO), or (3) an acute operation (AO). Extensive demographic data was collected (i.e. age, gender, comorbidity) on each group. During each admission intervention-data was noted: type of intervention, surgical as well as medical (i.e. open/laparoscopic resection, percutaneous drainage of abscesses, use of antibiotic therapy); complications; and length of stay (LOS).

In an attempt to predict a more hazardous course of diverticular disease, the following potential risk-factors were collected: age < 40, age > 70, American Society of Anaesthesiology grade (ASA) > 2, Body Mass Index (BMI) > 25, cardio-vascular disease, chronic renal failure, collagen-vascular disease (i.e. rheumatoid arthritis, Wegener's vasculitis), diabetes mellitus, immune suppression therapy, New York Heart Association classification (NYHA) > 2, pulmonary disease, and smoking. A more hazardous course of diverticular disease was defined as perforated diverticulitis (Hinchey III and IV), because this complication accounts for nearly 90% of total mortality in diverticular disease.[7]

A SPSS-database was created for statistical analysis. Pearson Chi-Square tests were used to evaluate univariate relations. Logistic regression analysis was performed using the backward conditional method, to see if there are inter-variable relations.

Results

A database was composed of all patients admitted to the VU University Medical Center with the diagnosis diverticulitis between 1990 and 2000. This population of 291 patients consisted of 121 (42%) male patients and 170 (58%) female patients, the average age was 66 (27-93). Overall mortality was 6% (18 patients) and morbidity 26% (76 patients). This population was divided into three groups (as specified above), according to treatment. Patient characteristics are presented in Table 1.

Conservative treatment (CT)

The CT group consisted of 111 patients (38%) with a male-female ratio of 48 to 63. Average age was 68 (29-93). Most patients (91; 82%) suffered only one episode, 17 patients (15%) had two episodes and only three (3%) had three or more episodes. 96 patients (86%) had a flegmon without complications (Hinchey I), nine (8%) suffered from a paracolic abscess (Hinchey II). Six patients (5%) with a perforation (Hinchey III or IV) refused surgical treatment and accounted for the mortality of 4% (4 patients).

Elective operative treatment (EO)

The EO group consisted of 72 patients (25%) with a male-female ratio 31 to 41. Average

Table 1 Patient characteristics

		CT (n = 111)	EO (n = 72)	AO (n = 108)
Male - female ratio		48 – 63	31-41	42-66
Age (years)		68 (29-93)	62 (27-85)	67 (42-66)
Number of episodes	1	91 (82%)	26 (36%)	86 (80%)
	2	17 (15%)	26 (36%)	12 (11%)
	3 or more	3 (3%)	20 (28%)	10 (9%)
Hinchey classification	I	96 (87%)	57 (79%)	22 (21%)
	II	9 (8%)	13 (18%)	24 (22%)
	III or IV	6 (5%)*	2 (3%)	62 (57%)
Surgical treatment	LSR		53 (74%)	12 (11%)
	OSR		18 (25%)	33 (31%)
	HP		1 (1%)	63 (58%)

* = Refused surgical treatment; LSR = Laparoscopic sigmoid resection with primary anastomosis; OSR = Open sigmoid resection with primary anastomosis; HP = Hartmann's procedure

age was 62 (27-85). Some patients (26, 36%) suffered only one episode before an elective sigmoid resection was indicated, 46 patients (64%) had recurrent episodes of diverticulitis, 26 patients (36%) had two episodes and 20 patients (28%) had three or more. Indications for elective sigmoid resection were: recurrent attacks with persistent complaints (26 patients; 36%), complaints of stenosis (29 patients; 40%), colo-vaginal or colo-vesical fistulas (11 patients; 14%), persistent abscesses (2 patients; 3%), and recurrent diverticular bleeding (5 patients; 7%). Most patients underwent a laparoscopic sigmoid resection (53 patients; 74%), 18 patients (25%) were treated by means of an open resection and in one patient (1%) a Hartmann's procedure was performed. There was no mortality in the EO group and the morbidity rate was 22% (16 patients), as shown in Table 2. Distribution of the severity of the disease in the last prior episode was Hinchey I in 79% (57 patients), Hinchey II in 18% (13 patients) and Hinchey III in 3% (2 patients).

Acute operative treatment (AO)

There were 108 patients (37%) in the AO group, male-female ratio of 42 to 66 and an average age of 67 (34-93). The majority of patients came forward with the indication of an acute operation at their first episode of the disease (86 patients; 80%), the other 22

Table 2 Complications after surgery

		EO (n = 72)	AO (n = 108)
Overall morbidity		16 (22%)	60 (56%)
Overall mortality		0 (0%)	14 (13%)
Minor complications		12 (17%)	32 (30%)
	Wound infection	9 (13%)	13 (12%)
	Pneumonia	1 (1%)	13 (12%)
	Deep vein thrombosis	1 (1%)	0 (0%)
	Urinary tract infection	1 (1%)	2 (2%)
	Other	0 (0%)	4 (4%)
Major complications		6 (8%)	35 (32%)
	Anastomotic leakage	4 (6%)	9 (8%)
	Intra-abdominal abscess	0 (0%)	6 (6%)
	Evisceration	0 (0%)	7 (7%)
	Necrotic stoma (n = 71)	0 (0%)	3 (3%)
	Anastomotic stenosis	1 (1%)	0 (0%)
	Post-operative hemorrhage	0 (0%)	3 (3%)
	Cardiac ischemia	0 (0%)	1 (1%)
	Respiratory insufficiency	1 (1%)	5 (5%)
	Acute renal failure	0 (0%)	1 (1%)
Late complications		5 (7%)	15 (14%)
	Incisional hernias	5 (7%)	11 (10%)
	Ileus	0 (0%)	2 (2%)
	Stoma complications (n = 71)	0 (0%)	2 (3%)
Re-operations		7 (10%)	31 (29%)

Morbidity and mortality rates are reported per patient.

patients (20%) had a previous history of conservatively treated diverticulitis.

Surgical indications were in most cases a perforation with a purulent or fecal peritonitis (62 patients; 57%); other indications being: abscesses (24 patients; 22%), obstruction or

stenosis (12 patients; 11%), failure of conservative treatment (6 patients; 6%) or diverticular bleeding (4 patients; 4%). Most patients were treated by a Hartmann's procedure (63 patients; 58%), but in 45 patients a sigmoid resection was performed with primary anastomosis (33 open and 12 laparoscopically). In eight patients with a primary anastomosis, a protective ileostomy was created. From the total of 71 ostomies (Hartmann's procedure and protective ileostomies) only 40 (56%) were finally taken down.

In the group of 22 patients (20%) with recurrent diverticular disease, 12 patients had one previous episode of diverticulitis and ten patients had two or more previous episodes. Ten patients came forward with a perforation (Hinchey III or IV), other indications were abscesses in five patients (Hinchey II), sigmoid obstruction in two patients, persistent diverticular bleeding in two patients, and conservative failure in the other three patients.

The morbidity rate was 56% (60 patients) with a mortality rate of 13% (14 patients). Perforated disease accounted for 11 of these deaths (10%), the additional 3% being the result of other acute complications such as abscesses or bowel obstruction. Complications of surgical treatment are depicted in Table 2.

Risk factor analysis

The following potential risk-factors were collected in an attempt to predict a more hazardous course of diverticular disease: age < 40, age > 70, ASA > 2, BMI > 25, cardio-vascular disease, chronic renal failure, collagen-vascular disease, diabetes mellitus, immune suppression therapy, NYHA > 2, pulmonary disease and smoking.

First, a univariate analysis of the total cohort was performed to analyse associations between comorbidity and perforated diverticulitis (Table 3). Significant risk-factors obtained were: an ASA-grade higher than two, immune suppression therapy, chronic renal failure and collagen-vascular diseases. No significant associations could be found when all indications for acute interventions were considered, including perforations, abscesses, obstruction or stenosis, failure of conservative treatment and diverticular bleeding.

Second, in order to select candidates for early elective or preventive surgery, recurrent disease must be taken into account. Univariate analysis was done on factors influencing the risk of perforation in those patients with recurrent episodes of diverticulitis. In this population there were 88 recidivist patients (CT 20 patients, EO 46 patients and AU 22 patients) with recurrent disease following a conservatively treated episode of diverticulitis. Also in this group significant higher perforation rates in patients having collagen-vascular diseases, chronic renal failure or high age were found (Table 4). At recurrence, immune suppression therapy seemed not to be a significant predicting factor for perforated diverticulitis. However, to rule out possible overlapping patients, one group was formed on the basis of three factors: immune suppression therapy, collagen-vascular diseases and chronic renal failure. The result was that the association remained apparent, even demonstrating a fivefold (36% versus 7%; p .002) higher risk on perforation at recurrence.

To rule out any confounding factors, a logistic regression analysis was performed of the total cohort (Table 5). According to the backward conditional method, non-significant risk-factors were filtered out in 11 steps. In this multivariate analysis only immune suppression therapy and chronic renal failure could maintain significance as the higher risks for perforated diverticulitis.

Table 3 Univariate analysis of risk-factors for perforation (Total 291 patients)

	Risk factor	No risk factor	P-value
Age < 40	3 / 11 (27%)	67 / 280 (24%)	.799
Age > 70	35 / 129 (27%)	35 / 162 (22%)	.273
ASA > 2*	28 / 88 (32%)	42 / 203 (21%)	.041
Collagen vascular disease*	17 / 42 (41%)	53 / 249 (21%)	.007
BMI > 25	38 / 162 (24%)	19 / 85 (22%)	.845
Cardiovascular	29 / 119 (24%)	41 / 172 (24%)	.917
Diabetic	6 / 32 (19%)	64 / 259 (25%)	.457
Immune suppressive therapy*	13 / 29 (45%)	57 / 262 (22%)	.006
NYHA > 2	16 / 53 (30%)	54 / 238 (23%)	.248
Pulmonary	9 / 41 (22%)	61 / 250 (24%)	.734
Chronic renal failure*	12 / 16 (75%)	58 / 275 (21%)	.000
Smoking	14 / 68 (21%)	56 / 223 (25%)	.445
High-risk*	**27 / 59 (46%)**	**43 / 232 (19%)**	**.000**

* = Significant risk factors. High-risk is considered the high-risk group consisting of collagen vascular disease, immune suppression therapy and/or chronic renal failure per patient

Table 4 Univariate analysis of risk-factors for perforation (Recurrences in 88 patients)

	Risk factor	No risk factor	P-value
Age < 40	2 / 6 (33%)	8 / 82 (10%)	.079
Age > 70*	0 / 29 (0%)	10 / 59 (17%)	.019
ASA > 2	5 / 23 (22%)	5 / 65 (8%)	.068
Collagen vascular disease*	4 / 11 (36%)	6 / 77 (8%)	.005
BMI > 25	6 / 56 (11%)	2 / 25 (8%)	.705
Cardiovascular	6 / 36 (17%)	4 / 52 (8%)	.192
Diabetic	0 / 8 (0%)	10 / 80 (13%)	.288
Immune suppressive therapy	1 / 6 (17%)	9 / 82 (11%)	.672
NYHA > 2	2 / 12 (17%)	8 / 76 (11%)	.533
Pulmonary	1 / 13 (8%)	9 / 75 (12%)	.651
Chronic renal failure*	3 / 3 (100%)	7 / 85 (8%)	.000
Smoking	2 / 25 (8%)	8 / 63 (13%)	.531
High-risk*	**5 / 14 (36%)**	**5 / 74 (7%)**	**.002**

* = Significant risk factors. High-risk is considered the high-risk group consisting of collagen vascular disease, immune suppression therapy and/or chronic renal failure per patient

Discussion

The indications for elective sigmoid resections when treating diverticular disease are evolving. Recent publications show that perforations due to diverticulitis or other acute surgical indications occur more often in patients without a history of diverticular disease, suggesting that elective surgery may be unnecessary after conservatively treated diverticulitis. Moreover, the course of diverticular disease after conservative treatment tends to be mild with very low complication rates.[7,14-16] Therefore, when surgery is contemplated, indications for elective sigmoid resections should not be based on the number of episodes alone, but on the severity of complaints and associated patient risk factors. Clearly, indications for elective sigmoid resections remain in the case of complaints of stenosis, doubt about cancer, presence of fistulas to a hollow organ, and recurrent diverticular bleeding.

In this study, mortality rate after perforated diverticulitis was 10%; for the remaining 3% mortality, other indications for acute interventions, such as abscesses and colon obstruction, were responsible. These figures concur with the series published by Chapman et al.,[7] who presented mortality rates of 12% for perforation and 1% for abscesses in the total cohort. These high mortality rates stress the importance of defining risk factors, which might be associated with perforated diverticular disease. Several factors have been suggested, such as the age of patients, chronic renal failure, diabetes mellitus, collagen-vascular diseases or use of corticosteroids and NSAIDs, associated with perforation rates as well as mortality.[11,12,17,18] In our univariate and multivariate analysis of the total cohort, significantly higher perforation rates were found in those patients who use immune suppression therapy, have chronic renal failure or collagen-vascular diseases. After a successful conservatively treated episode of diverticulitis, 88 patients (48%) had recurrent disease. Analysing this subgroup, one or more of these three risk-factors increased perforation rate by a fivefold (36% versus 7%; p .002).

The negative effect of immune suppression therapy (95% corticosteroids) on the natural course of diverticulitis could be explained by the associated membrane atrophy of the bowel, impairment of the immune response to infection and furthermore the masking of abdominal symptoms in a novice diverticulitis.[17] The effect of collagen-vascular diseases on perforation rates should partly be found in the use of NSAIDs. In this study almost all patients with collagen-vascular diseases suffered from rheumatoid arthritis (93%), in which NSAIDs were the first treatment of choice.[19] These drugs reduce prostaglandin synthesis in the bowel, which impairs the maintenance of an effective mucosal barrier. In addition NSAIDs may cause topical mucosal damage, increasing colonic permeability as well.[20] In case of progressive rheumatoid disease, usually other immune suppressants are prescribed, which forms a significant overlap with our immune suppression therapy group (52%). In the event of chronic renal failure, the explanation for high perforation rates could be found in the generalized increase of inflammatory response, due to decreased clearance of proinflammatory cytokines, decreased levels of antioxidants, and the increased presence of other comorbid conditions.[21-24]

A limitation of this study is its retrospective analysis, in which bias lies in wait. These problems could be eliminated by a randomized trial. Yet, a randomized study comparing elective surgery and conservative treatment will probably not be feasible.

In conclusion, elective sigmoid resection should therefore be restricted, and only considered for use in complicated cases, such as stenosis, fistulas to hollow organ, or

Table 5 Multivariate analysis by a logistic regression model of risk-factors for perforation (Total 291 patients)

		Odds-ratio	P-value	95,0% C.I.	
Start of analysis	Age < 40	,680	,679	,109	4,246
	Age > 70	1,055	,886	,508	2,188
	ASA > 2	1,000	,999	,344	2,911
	Collagen vascular disease	,972	,961	,317	2,982
	BMI > 25	1,727	,145	,828	3,602
	Cardiovascular	,632	,258	,285	1,399
	Diabetic	,178	,025	,040	,801
	Immune suppressive therapy	3,034	,094	,829	11,099
	NYHA > 2	1,289	,657	,420	3,956
	Pulmonary	,669	,448	,238	1,886
	Chronic renal failure	20,419	,000	4,923	84,692
	Smoking	1,163	,716	,516	2,624
	Constant	,189	,000		
End of analysis	Immune suppressive therapy*	2,934	,026	1,136	7,576
	Chronic renal failure*	16,161	,000	4,490	58,164
	Constant	,237	,000		

* = Significant risk factors

recurrent diverticular bleeding. Furthermore, a significant five-fold higher risk on perforation may hold for high-risk patients following a conservatively treated episode of diverticulitis, who use immune suppression therapy, have chronic renal failure or collagen-vascular diseases. Such high-risk patients should be considered good candidates for an elective sigmoid resection when considering the very low mortality rates after elective surgery, that is 0% in this series and 1% in the recently published Sigma-trial.[25] Questions arise on what to do with the majority of the patients, having one of these risk-factors and asymptomatic diverticular disease? In order to adopt an adequate policy, these risk-factors and their consequences must be quantified by epidemiological studies.

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