

Early or delayed sigmoid resection in complicated diverticular disease? A single center experience

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Abstract

Background:

Diverticular disease appears to be one of the most common conditions in the western world. The standard approach in treatment of diverticular disease is a laparoscopic resection, usually after an inflammation free time of 4 to 6 weeks. The aim of this study was to evaluate the timing of operation.

Methods:

61 patients underwent left-sided colonic resection because of diverticular disease between January 2017 and February 2020. 37 patients were treated because of complicated diverticulitis (CDD stage 2a or 2b) either early within 7 days after first symptoms (group A: n = 17) or delayed about 6 weeks after the first contact and conservative therapy (group B: n = 20).

Results:

Overall mortality was 0%. The average operation time was shorter in the early elective group (Group A: 140,4 min vs. Group B: 151,2 min ($p = 0,29$)). The hospital stay (group A: 9,9 d vs. group B: 16,9 d) and the postoperative stay (group A: 4,8 d vs. group B: 8,1 d) was significantly longer in group B ($p = 0,01$). We observed – although not reliable due to low number of patients - more postoperative complications in the delayed group (group A: 5,9% vs. group B: 15,0%) ($p = 0,61$).

Conclusion:

The data in this study confirm the early operation as safe and efficient due to lower costs. We can recommend an early approach in selected cases with the first episode of a complicated diverticulitis.

Background:

Diverticular disease was first described in 1928 by Finny et al. [1]. Its complications continue to be a burden on health care systems. In the United States the most common gastrointestinal tract diagnosis are diverticulitis and diverticular haemorrhage among hospitalized patients [2, 3]. Diverticular disease appears to be one of the most common conditions in the western world. Compared to the 1990's, the incidence of diverticulitis has increased by 50% in 2000-2007 [3]. The prevalence of diverticulosis is about 28-45% and over 60% at the age of 70 years [4]. Age, BMI and male sex are well-known risk factors for a diverticulosis.

Diverticular disease was historically classified by Hinchey et al. [5]. This classification is strongly depending on intraoperative surgical findings or rather on the decision which operation procedure is chosen for different occurrence of diverticular disease. The Hansen-Stock Classification included also chronic diverticulitis and uncomplicated cases and was more commonly used in Europe in the past [6].

Since 2014 a novel classification was introduced according to the Hansen-Stock Classification (classification of diverticular disease – CDD) [4].

The treatment of diverticulitis is still under debate: in uncomplicated diverticulitis a change of paradigm took place in the last years and moved away from automatic treatment using antibiotics [7–9]. While in the past elective surgery was indicated very early after two attacks of uncomplicated diverticulitis, the indication switched to complicated diverticulitis cases regardless of the number of previous attacks. Studies showed that the number of attacks of diverticulitis is not necessarily a predictive factor in defining the suitability of surgery [10]. Only a fraction of 5-7% develops a complicated diverticulitis during recurrent attacks [11, 12]. One of the main questions in surgery is which patients would profit from diverticulitis surgery? It should be considered that surgery carries significant risks in morbidity and mortality.

There are currently two options regarding the time of surgery: Delayed elective variant, in which the operation is done in an inflammation free stadium [13, 14], and the early elective option, in which the operation is performed in the acute inflammation stage [15, 16]. A delayed surgery can lead to more adhesions and fibrosis, which is possibly associated with a higher morbidity. An early operation within the first week after diagnosis was adapted from practice in the therapy of acute cholecystitis [17], although acute cholecystitis and complicated diverticulitis are two complete different entities. Both options have been in concurrent use in the past [14, 18].

The aim of this study was to evaluate the outcome of laparoscopic sigmoid resection for two groups (A and B) retrospectively, differing only in timing of surgery in acute complicated diverticular disease with either abscessing or covered perforation according CDD Stage 2a and 2b [4].

Methods:

After an institutional review board, data were obtained from a retrospective maintained database of our department. 61 patients underwent laparoscopic left-sided colonic resection because of diverticular disease between January 2017 and February 2020. 37 patients were treated because of complicated diverticulitis according CDD stage 2a or 2b. Every patient received a CT scan before therapy to determine the stage according CDD [19]. In case of complicated diverticulitis, the patients were transferred to surgery either early (group A) within the first week after the CT-scan or delayed (group B) about 4 to 6 weeks after the CT scan. A colonoscopy was performed routinely 3 months after the operation in the early group or the day before operation in the delayed patients. The timing of operation (either early or delayed) was left to patients' preferences, clinical manifestation and operation theatre resources. All the patients initially received intravenous antibiotics therapy directly after diagnosis. None of the patients in both groups had previous attacks.

Perforated diverticulitis according stage CDD 2c was excluded from our study as well as chronic diverticulitis or associated fistulas or stenosis (CDD stage 3).

The American Society of Anaesthesiologists (ASA) Score was used to compare the comorbidities of the two groups [20]. The ASA Score was defined by our anaesthesiologic team preoperatively in accordance to patients' physical conditions.

The resections were performed by our surgical team at the academic teaching hospital Feldkirch. The majority of the cases (94,6%) were done in "reduced port" technique using an umbilical single port system (OCTO™ – Port) and an additional 5 mm trocar suprasymphyseal, the minority of the patients (5,4%) were treated with conventional multiport technique with a "Pfannenstiel" incision for specimen retraction. Manual bowel preparation was done in all patients routinely. Severity of complications were graded according the Clavien - Dindo classification for surgical complications [21].

The duration of hospital stay was recorded from first presentation to patient's discharge from hospital. All hospital stays because of the same reason (ICD 10-Code: K57.2-) were added up and resulted in length of hospital stay.

All data were evaluated using Microsoft® Office Excel (Version 2019) and the statistical analyses were performed using Java-based tools. Quantitative datasets were analysed using the two-tailed t-test. We used the chi-square test or, if necessary, the Fisher's exact test for category data. The quantitative data were represented by the average and its corresponding standard deviation. Differences were regarded as statistically significant at $p < 0,05$.

Results:

Data from a cohort with 37 patients were retrospectively examined. All patients received surgery because of complicated diverticulitis, either CDD stage 2a or 2b. The patients were divided in two groups according to the timing of operation. Group A (early resection) consisted of 17 electively operated patients (45,9%), while group B (delayed resection) consisted of 20 cases (54,1%). Patients' characteristics in group A and group B are shown in Table 1.

Table 1

Patient characteristics and indication: Group A: Early resection group; Group B: Delayed resection Group.

	Group A	Group B	<i>p</i> Value
	n = 17	n = 20	
Sex, Male/Female	11/6	9/11	
Age	56,2 (± 11)	59,9 (± 12,2)	0,35
BMI	25,2 (± 2)	25,4 (± 4,2)	0,88
Comorbidities	4 (23,5%)	8 (40,0%)	0,32
Coronary disease	3	3	1,00
Pulmonary insufficiency	1	1	1,00
Adipositas	0	2	0.49
Kidney disease	0	1	1,00
Hypertension	0	1	1,00
Diabetes	0	0	1,00
ASA			
I	3 (17,6%)	3 (15,0%)	1,00
II	11 (64,7%)	10 (50,0%)	0.37
III	3 (17,6%)	7 (35,0%)	0.29
IV	0	0	1,00
V	0	0	1,00
Indication: Classification of diverticular disease-CDD			
2a	5 (29,4%)	3 (15,0%)	0.46
2b	12 (70,6%)	17 (85,0%)	0.43

Group A consisted of 11 males and 6 females with an average age of 56,2 years (± 11). The average BMI was in this group 25,2 (± 2). Comorbidities were recorded in 23,5% (n = 4) of the patients in this group, the average ASA score was 2. In 70,6% (n = 12) of the cases surgery was indicated because of CDD Stage 2b, 29,4% (n = 5) because of CDD stage 2a.

Group B consisted 9 males and 11 females with a mean age of 59,9 years (± 12). The average BMI was in this group 25,4 (± 4,2). Comorbidities were recorded in 40,0% (n = 8) of the patients in this group, 50,0% (n

= 10) were ASA score 2. In 85,0% (n = 17) of the cases surgery was indicated because of CDD stage 2b, 15,0% (n = 3) because of CDD stage 2a.

The data regarding the outcome of both groups are shown in Table 2.

Table 2

Operative Results: Group A: Early resection group; Group B: Delayed resection group.

*Summation of all stays ** According to average stay, assumed tariff = 2300 €/d, complications and complicated cases were not included into the calculation.

	Group A	Group B	p Value
	n = 17	n = 20	
Operation time (min)	140,4 (± 24,6)	151,2(± 38,9)	0,29
ICU time (d)	0	0	
Duration of hospital stay* (d)	9,9 (± 2,4)	16,9 (± 9,6)	0,01
Duration of postoperative hospital stay (d)	4,8 (± 1,2)	8,1 (± 4,8)	0,01
Surgical technique:			
Conventional lapaorscopy	2 (11,8%)	0 (0,0%)	0.23
Reduced Port	15 (88,2%)	20 (100%)	0.23
Conversion to laparotomy:	0 (0,0%)	3 (15,0%)	0,23
Intraoperative complications:	0 (0,0%)	1 (5,0%)	1,00
Postoperative complications:	1 (5,9%)	3 (15,0%)	0,61
Anastomotic leakage	1 (5,9%)	2 (10,0%)	1,00
Anastomotic bleeding	0 (0,0%)	0 (0,0%)	1,00
Intraabdominal bleeding	0 (0,0%)	0 (0,0%)	1,00
Infected haematoma	0 (0,0%)	1 (5,0%)	1,00
Clavien-Dindo classification:			
IIIA	0	1 (3,4%)	1,00
IIIB	1 (5,9%)	2 (10,0%)	1,00
Re-performing surgery (rate)	1 (5,9%)	2 (10,0%)	1,00
Complication management:			
Re-laparocopy + Endo VAC + diverting stoma	1	-	0.46
Hartmann procedure	-	1	1,00
Re-laparoscopy + diverting stoma	-	1	1,00
CT-intervention	-	1	1,00

The average operation time was in group A 140,7 minutes ($\pm 24,6$), and 151,2 ($\pm 38,9$) in group B which was not significant ($p = 0,29$). In both groups no ICU time was necessary. The total hospital stay differs significantly ($p = 0,01$). In group A the total hospital stay was 9,9 days ($\pm 2,4$), in group B 16,9 days ($\pm 9,6$). Also, the postoperative stay was significantly longer in group B than in group A ($p = 0,01$). In group B we observed a median postoperative stay of 8,1 days ($\pm 4,8$), in group A a median postoperative stay of 4,8 days ($\pm 1,2$).

88,2% ($n = 15$) of the cases in group A were operated with reduced port technique, 11,8% ($n = 2$) in conventional multiport laparoscopic technique. In group B 100,0% ($n = 20$) were treated with reduced port technique. We observed a conversion rate of 15,0% ($n = 3$) in group B, no conversions were necessary in group A ($p = 0,23$). We found no intraoperative complications in group A and one patient with a ureteral injury (5,0%) in group B ($p = 1,00$). The postoperative complication rate did not differ significantly in both groups ($p = 0,61$), but we observed more complications in the delayed group. In group A 5,9% ($n = 1$) suffered a postoperative complication, in group B 15,0% ($n = 3$). The anastomotic leakage rate was 5,9% ($n = 1$) in group A and 10% ($n = 2$) in group B, which was not significant ($p = 1,00$). Anastomotic bleeding was not observed in both groups, whereas an infected haematoma occurred in one case of group B. Re-laparoscopy plus a diverting ileostomy and Endo VAC was necessary in the case of group A. A Hartmann procedure was performed in one case of anastomotic leakage of group B, the other leakage could be treated laparoscopically with a diverting ileostomy. A CT intervention was indicated in case of the infected haematoma. No patient died in the course of treatment.

Because more complicated diverticulitis cases according CDD stage 2b occurred in group B, we analysed also both approaches according to their stage of diverticulitis. Subgroup analysis of CDD stage 2a is shown in table 3, CDD stage 2b is shown in Table 4.

Table 3

Subgroup analysis CDD stage 2a: Group A: Early resection group, group B: Delayed resection Group. *Summation of all stays

	Group A	Group B	<i>p</i> Value
	n = 5	n = 3	
Operation time (min)	144,4 ($\pm 15,78$)	158 ($\pm 23,06$)	0,35
Duration of hospital stay*	9,8 ($\pm 1,30$)	20,66 ($\pm 11,01$)	0,05
Duration of postoperative hospital stay (d)	4,4 ($\pm 0,89$)	15 ($\pm 7,93$)	0,02
Postoperative complications:	0 (0,0%)	2 (66,6%)	0,11

Table 4

Subgroup analysis CDD stage 2b: Group A: Early resection group, Group B: Delayed resection Group. *Summation of all stays

	Group A	Group B	<i>p</i> Value
	n = 12	n = 17	
Operation time (min)	138,75 (± 27,97)	150 (± 36,99)	0,38
Duration of hospital stay*	10 (± 2,76)	16,17 (± 9,53)	0,04
Duration of postoperative hospital stay (d)	5 (± 1,34)	6,82 (± 3,00)	0,06
Postoperative complications:	1 (8,3%)	1 (5,8%)	1,00

The average operation time according the subgroup of CDD stage 2a was 144,4 (± 15,78) in group A and 158 (± 23,06) in group B ($p = 0,35$). The total hospital stay was 9,8 days (± 1,30) in group A and 20,66 days (± 11,01) in group B, which was significant ($p = 0,05$). The postoperative stay was 15 days (± 7,93) in group B, whereas in group A the average postoperative stay was 4,4 days (± 0,89) ($p = 0,02$). This is mainly caused by 2 complications which we observed in the delayed group of CDD stage 2a, and consequently not significant ($p = 0,11$).

The average operation time according the subgroup of CDD stage 2b was 138,75 (± 27,97) in group A and 150 (± 36,99) in group B ($p = 0,38$). The total hospital stay was 10 days (± 2,76) in group A and 16,17 days (± 9,53) in group B, which was significant ($p = 0,04$). The postoperative stay was 6,82 days (± 3,00) in group B, whereas in group A the average postoperative stay was 5 days (± 1,34) ($p = 0,06$). In both groups one complication occurred ($p = 1,00$).

Discussion:

Diverticulitis surgery can result in a high morbidity and mortality rate in case of any postoperative complication. In fact of this patients' selection and indication gets even more important. 2,7 million outpatient visits and 200 000 inpatient admissions at a cost of more than \$2 Billion were seen in the United States annually [22–24], diverticulitis is a burden for the health system. The prevalence of diverticulosis between 50–70 years is more than 30% [4, 25, 26] and the incidence of individuals between 40–49 years has risen by 132% between 1980 and 2007 [24, 27].

The surgical standard technique should be a laparoscopic sigmoid resection regardless of the stage of diverticulitis [28, 29]. Whereas two episodes of mild diverticulitis were enough for the indication for surgery in the past, shifted the course of treatment to more conservative therapy regardless of the number of attacks [10, 30–33]. Still in 2015, Schildberg et al. described that 40% of all diverticulitis cases in Germany received an operation, most of these cases were staged as an uncomplicated diverticulitis [34]. Other studies showed that 38% of the patients with recurrent diverticulitis would have preferred an earlier operation time [35]. We know that complication rate varies depending on diverticulitis stage. The risk profile is higher in patients with complicated diverticulitis [15, 36].

The patients' characteristics of our study in terms of female and age are comparable to literature. The operative time, the total hospital stay and the postoperative stay differ to literature. We observed better results in the early operated group. An overall anastomotic leakage rate of 8,1% is comparable to literature. 5,4% occurred in the delayed group. This is may be caused by different study groups, although not statistically significant at this sample size: The delayed group had 85% cases of complicated diverticulitis with a macro abscess (compared to 70% in the early group) and comorbidities were more frequent (40%) compared to the early group (23.5%). In the subgroup analysis the total hospital stay was significantly longer in group B. Also, postoperative stay and the operative time were expanded, but not significant.

The most efficient way of surgical treatment referring to timing of operation in complicated diverticulitis is still under debate. In acute cholecystitis the timing of operation shifted to very early approaches with beneficial outcome [17]. The most recent studies prefer the operation during the inflammation-free interval [13, 14]. It was shown that the minimum safe period between acute inflammation and surgery should be at least 4–6 weeks and this was the time interval we used for the group B [37].

During the study period the decision for surgery was indicated in the same way as the recommendation of guidelines [4]. A CT scan to classify the stage of diverticulitis is necessary. A colonoscopy should be performed in all cases if diverticular surgery is indicated. A recently published systematic review of Koo et al. showed that patients being treated for CT-confirmed complicated diverticulitis malignancies occurred in 6,14% [38]. In case of an early approach preoperative endoscopy is recommended in cancer suspicious cases. In all other ("clear") cases, especially in case of covered perforation, we would suggest the colonoscopy three months after the operation. In delayed cases we performed the endoscopy preoperatively one day before surgery.

At the beginning of 2017 we were very restrictive with the indication for an early approach. With the first "early" cases we operated we started to recognise, that the hospital stays and the postoperative stays were shorter. Even more the intraoperative fibrosis was not that distinct than in the delayed group. The inflammation was in an acute stage, the subjective surgical confidence was higher intraoperatively, separation of the layers appeared easier and this results in a trend to shorter operative time in the early resection group. The stage of inflammation in diverticulitis surgery is the key for safe and successful surgery. Zdichavsky et al. showed in 2013 that in histopathological examination of surgical specimen in early resected patients the stage of inflammation was more acute than in delayed cases [16]. Our intraoperative findings confirmed this study in complicated diverticulitis disease.

We observed – although not significant - more postoperative complications in the delayed group. As mentioned before, this is not significant, but may be a trend for a better outcome in early operated patients. Regardless of the timing for surgery in diverticular disease, the importance for early diagnosis in case of complication and a rapid complication management through experienced colorectal surgeons is generally necessary in colorectal surgery.

A recommendation according to timing of operation complicated diverticulitis cannot be given because of our data. A trend for lower operative time and faster hospital stays are shown in this study. Low number of patients, retrospective analyse are the main limitations of this study. An early operation approach is safe and showed a comparable morbidity in literature as well as in our study [16]. A detailed patient's history is required not to miss past episodes of diverticulitis. In these cases, a delayed operation might be the better approach.

Conclusion:

The indication for surgery in diverticulitis should be considered very carefully. The timing of operation is still under debate. In our study we could show no difference between an early approach or a delayed operation in reference to complications as it was shown in literature in the past. But there was a significant difference in hospital stay which results in more costs in the delayed group. This might be a reason for the consideration for an early approach. A further randomized trial is needed.

Abbreviations

CDD

Classification of diverticular disease

ASA

American Society of Anaesthesiologists

ICD

International Classification of Disease

CT

Computer tomography

BMI

Body mass index

ICU

Intensive care unit

Declarations

Ethics and consent to participate:

Informed consent was not obtained from individual participants included in the study. The study was approved by the local ethical committee of Vorarlberg (EK-0.04-284). The study was retrospective and did not require any referral or vote by the local ethical committee of Vorarlberg.

Consent of publication:

Not Applicable.

Competing interests:

Peter Tschann, Isabella Fleischmann, Daniel Lechner, Benedikt Feurstein, Stephanie Adler, Paolo Girotti, Martin Hufschmidt and Ingmar Königsrainer have no competing interest or financial ties to disclose.

Availability of data and materials:

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Author's contributions:

PT, DL, BF, IF, PG, SA, MH and IK contributed to the study design. PT, DL and BF carried out data acquisition. PT and DL contributed the data analysis. PT drafted the manuscript, PT, DL, BF, IF, PG, SA, MH and IK reviewed the manuscript. All authors have read and approved the manuscript.

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