

Elective Surgery for Sigmoid Diverticulitis – Indications, Techniques, and Results

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Summary

Diverticulitis is one of the leading indications for elective colonic resections although there is an ongoing controversial discussion about classification, stage-dependent therapeutic options, and therapy settings. As there is a rising trend towards conservative therapy for diverticular disease even in patients with a complicated form of diverticulitis, we provide a compact overview of current surgical therapy principles and the remaining questions to be answered.

Introduction

Diverticulosis of the colon is one of the most common benign lesions of the gastrointestinal tract. Its incidence in the Western world is increasing. Despite its high incidence and of diverticular disease in general, only scant data is available regarding their etiology, spontaneous course, and therapeutic interventions.

For many years recommendations for treatment were based on data gathered prior to the advent of endoscopy and computed tomography (CT). To this day, there is no international consensus regarding a uniform classification of the various subtypes of diverticular disease. Recent CT-based investigations show that the natural course of diverticular disease is much milder and more benign than formerly thought. Many therapeutic strategies once apparently etched in stone, such as mandatory administration of antibiotics for acute diverticulitis, are being increasingly questioned. There is a rising trend toward conservative therapy for diverticular disease. The recommendation to operate on chronic recurring di-

verticulitis after the second inflammatory episode is no longer tenable. Even in patients with a complicated form of diverticulitis, surgery is not always appropriate.

In recent years, new guidelines for the treatment of diverticulitis with therapy algorithms adapted to findings in the current literature have been proposed in both Denmark and the Netherlands [1, 2]. In these guidelines, similar to those from England and the USA, an increasing trend is also evident toward conservative treatment of diverticular disease [3, 4].

The German Society for Digestive and Metabolic Diseases (DGVS) and the German Society for General and Visceral Surgery (DGAV) have therefore combined their efforts and created German guidelines for the treatment of diverticular disease (published as S2k guidelines at the end of 2014) [5].

Indications for Surgical Treatment

The spectrum of therapies for sigmoid diverticulitis ranges from a pure ‘wait and watch’ approach to immediate emergency surgery. Whether surgical treatment is indicated depends on the severity of the diverticulitis, the frequency of recurrences, the patient’s subjective impairment, and any comorbidities and/or medications. The following information is therefore indispensable for determining whether surgery is indicated:

- a precise and comprehensive classification of the disease that can be applied prior to therapy;
- a detailed medical history including frequency of symptoms, form of the disease (acute or chronic), response to treatment, and subjective impairment;
- a complete list of comorbidities and medications.

Only a comprehensive review of all essential information enables a reliable determination whether, and at what timepoint, surgery is indicated. Morphological imaging alone is not sufficient. In accordance with the new S2k guidelines [5], diverticular disease is differentiated into the types shown in table 1.

Uncomplicated Diverticulitis

Uncomplicated diverticulitis (type 1) is present if the patient has the typical clinical signs of diverticulitis (including laboratory findings) and if imaging shows no signs of complications (abscesses, fistula, or perforations). If an uncomplicated form of the disease is present, primary treatment should be conservative [6–9]. Under this regimen, the majority of patients remain free of complications for a short time.

If laboratory findings should show a progression or if clinical symptoms persist under conservative therapy, diagnostic imaging (ultrasound or abdominal CT with rectal contrast medium) should be repeated in order to detect any previously missed or newly arisen complications. If a complication is detected, it constitutes an indication for surgery in accordance with the therapy recommendations for complicated diverticulitis. In some patients, persistent/chronic symptoms with inflammation ('smoldering diverticulitis') [10] develop without demonstration of a complication. Such patients, who are never truly free of symptoms, can also benefit from surgery. However, patients without demonstrable diverticulitis – who thus may have a symptomatic diverticulosis – do not profit from surgery.

Because the annual recurrence risk for successfully treated acute uncomplicated diverticulitis is very low (approximately 2%), and because only a small percentage of these patients must undergo surgery due to diverticulitis over a long-term course (about 10–13%), successfully treated acute uncomplicated diverticulitis is not an indication for surgery [7, 9, 11, 12].

An exception to this rule is constituted by patients with risk factors for recurrence and complications (transplantation, immunosuppression, glucocorticoid intake, collagenoses, vasculitis). If conservative treatment is successful in such a patient, surgery may still be indicated depending on their risk profile. This is because transplant recipients and other patients undergoing immunosuppression (e.g. corticosteroid therapy) [13] have an elevated incidence of acute diverticulitis with a significantly higher mortality (approximately 25%) than does the normal population. They are also at a 2.7-fold greater risk of perforations [14–18].

Complicated Diverticulitis

Widespread unanimity exists that abscesses, fistula, and free perforations are sure signs of complicated diverticulitis (type 2) [8, 19, 20]. If free perforations can be ruled out, and if the patient does not have the clinical picture of an acute abdomen, the patient should be hospitalized and receive primary conservative treatment [2, 10]. The presence of free perforations with the clinical picture of an acute abdomen remains an indication for immediate emergency surgery; however, the question of the proper surgical procedure is open in the individual case [1, 2, 4, 5]. If initial conservative therapy (including interventional abscess drainage) does not succeed in the other patients within 72 h, persistence of the septic focus can be assumed, and surgery with deferred urgency should be performed [21].

Pericolic Abscesses

About 15% of patients with acute diverticulitis have abscesses detected by CT scan [22]. Larger abscesses (e.g. >5 cm) can be treated in principle by percutaneous abscess drainage in combination with antibiotic therapy to avoid the need for emergency surgery [23–25]. Although this represents the current clinical practice with an entirely respectable success, it is supported by only sparse retrospective data.

If initial therapy for acute complicated diverticulitis is successful, the question arises whether elective resection of the sigmoid colon is still warranted. In this regard, only sparse retrospective data is available, too. Analysis of surgical specimens, however, shows that after complicated diverticulitis, at least in pericolic abscesses, permanent structural changes can be expected [26]. Moreover, up to 47% of patients develop secondary complications [27, 28] while more than 40% experience recurrences [8]. The latter are complicated in about 4% of patients [29]. The risk factors for a complicated recurrence of this kind are positive family history of diverticulitis, an affected bowel segment over 5 cm in length, and, especially, a retroperitoneal abscess.

If fistulas or clinically relevant colonic stenoses develop after initial therapy, elective surgery should be performed. Accordingly, especially urinary tract fistulas should be surgically treated to avert the risk of urosepsis [30, 31]. In some patients with greater comorbidity and fewer complications, fistulas in other locations (other bowel segments, skin, or to the vagina of hysterectomized patients) can be treated conservatively or, if appropriate, only by means of a deviation stoma. In the future, such cases should be referred to as representing the chronic complicated type of diverticular disease (type 3c), as is done in the German guidelines for classification of diverticular diseases (GGCDD) (table 1).

The question remains as to the indications for surgery in patients with phlegmonous diverticulitis (type 1b GGCDD). The clinically favorable course of acute diverticular diseases in the phlegmonous stage following conservative therapy speaks against their classification as 'complicated diverticulitis' with confirmed indications for surgery. Kaiser et al. [8] reported on 269 patients with phlegmonous sigmoid diverticulitis, only 15% of whom required initial surgical treatment. The remaining 85% of the patients needed conservative therapy alone. Only 20% of these patients developed a recurrence in the follow-up period, which speaks for the favorable course of the disease. For this reason, there is at present no general recommendation for surgery in this stage of the disease.

Chronic Recurring Diverticulitis

Up to the turn of the millennium, elective surgery for recurrent diverticulitis after the second episode was the generally accepted recommendation [32]. The recommendation was based on the

Table 1. German Guidelines for Classification of Diverticular Diseases (GGCDD)

Type 0	asymptomatic diverticulitis
Type 1	uncomplicated diverticulitis
Type 1a	diverticulitis without (inflammatory) reaction in surrounding tissue
Type 1b	diverticulitis with phlegmon
Type 2	CD
Type 2a	CD with microabscesses (<1 cm)
Type 2b	CD with macroabscesses
Type 2c	CD with free perforations
Type 2c1	CD with purulent peritonitis
Type 2c2	CD with fecal peritonitis
Type 3	chronic DD
Type 3a	symptomatic DD
Type 3b	recurrent diverticulitis without complications
Type 3c	recurrent diverticulitis with complications
Type 4	DD with diverticular bleeding

CD = Complicated diverticulitis; DD = diverticular disease.

more than 40-year-old data of Parks et al. [33–36] regarding the spontaneous course of the disease under conditions at that time. Parks incorrectly assumed an increasing risk of complications and a drop in the response rate to conservative therapy after the second episode [34]. More recent findings have led to the abandonment of this recommendation. Today, the number of episodes alone is no longer regarded as a conclusive indication for surgery. The indication for surgery is currently based on the individual case and takes risk factors, complications, age, severity of episode, as well as the patient's personal circumstances and comorbidities into consideration. Chronic recurrent, uncomplicated diverticulitis (type 3b–c GGCDD) should only be operated on after a careful risk-benefit analysis during an inflammation-free interval. General recommendations for surgery in this stage of the disease should be avoided since the desired goals:

- prevention of diverticulitis-associated septic complications;
- avoidance of emergency surgery;
- avoidance of colostomy; and
- reduction of morbidity and lethality *cannot* be achieved.

More recent data show that an increase in the number of episodes is not associated with an increase in septic complications [12, 37–39]. Perforations, which may require emergency surgery, generally occur as a primary event and/or after the first episode of the disease [40]; thus, surgical prophylaxis cannot be achieved after the second episode [41]. Such emergency procedures, however, have a major influence on morbidity and mortality, as Ritz et al. [40] showed in a cohort of over 900 patients. A major aspect of elective surgery in the chronic recurring form of the disease is the elimination of diverticulitis-associated symptoms.

Therapy Timepoint

The literature contains only sparse data on the optimal timepoint for surgery following primary conservative treatment of a complicated sigmoid diverticulitis. The American Society of Colon and Rectal Surgeons recommends elective resection at 6–8 weeks after the onset of symptoms [4]. Current Danish and Dutch guidelines do not offer definite recommendations regarding the optimal timepoint for surgery [1, 2]. On the whole, however, resections performed in the inflammation-free period (6–8 weeks after onset) yield better results than 'early elective' procedures [21], appearing to have lower rates of anastomotic leakage, wound infection, and conversions to open surgery.

Basic Surgical Principles

The main principle of elective surgical treatment of sigmoid diverticulitis is complete resection of the entire sigmoid colon in order to allow the creation of a tension-free anastomosis in the upper third of the rectum. Removal of all residual diverticula located orally to the anastomosis is not necessary since the number of residual diverticula in the remaining colon does not correlate with the risk of progression or recurrence of the diverticular disease [42]. An important point is the location of the anastomoses in the upper rectum as these have a significantly lower recurrence rate than anastomoses located in the sigmoid colon [43]. The correct aboral resection margin in the rectum can be identified on the basis of the end of the teniae coli.

During diverticulitis surgery some authors preserve the arteria mesenterica inferior (in contrast to the practice in oncological surgery) in order to minimize the risk of anastomotic failure [44] or sexual dysfunction due to intraoperative nerve injury [45], thus optimizing the functional results [46]. Mobilization of the left flexure is up to the surgeon; however, with sufficient length of the colon descends this procedure is not absolutely necessary. Our own experience shows that mobilization of the left colon flexure facilitates placement of a tension-free anastomosis. Placement of a protective ileostoma may be warranted in rare cases with high-risk anastomosis.

The above outlined surgical principles for elective sigmoid colon resection in diverticulitis are generally accepted and hold for both open and minimally invasive surgery.

Minimally Invasive versus Conventional Open Sigmoid Colon Resection

Sigmoid colon resection is a standard procedure for complicated and recurrent sigmoid diverticulitis which is usually performed laparoscopically these days. The available data show that laparoscopic sigmoid colon resection has a shorter operation time, less blood loss, more rapid restoration of enteral motility, less post-operative morbidity, shorter hospital stays, and lower overall costs [47] than conventional open sigmoid colon resection (table 2).

Table 2. Studies comparing elective laparoscopic colectomy versus open colectomy for diverticular disease [47]

Author, year, reference	Study design	Number (open vs. laparoscopic)	Operating time, min	Conversion rate, %	EBL, ml	Bowel activity, days	Postoperative morbidity, %	Length of hospital stay, days
Klarenbeek et al., 2009 [56]	RCT	52 vs. 52	127 vs. 183 ^a	19	200 vs. 100 ^a	NR	28 vs. 22	7 vs. 5
Rau et al., 2011 [48]	RCT	68 vs. 75	140 vs. 180	9	NR	NR	27 vs. 28	10 vs. 9
Gervaz et al., 2010 [57]	RCT	54 vs. 59	110 vs. 165 ^a	NR	NR	4.3 vs. 3.1 ^a	9 vs. 13.5	7 vs. 5 ^a
Gonzalez et al., 2004 [58]	RR	80 vs. 95	156 vs. 170	NR	341 vs. 204 ^b	3.7 vs. 2.8 ^b	32 vs. 19	12 vs. 7
Dwivedi et al., 2002 [59]	RR	88 vs. 66	143 vs. 212 ^a	20	314 vs. 143 ^a	4.9 vs. 2.9	NR	8.8 vs. 4.8

^aStatistically significant.
^bData given as median.
 RCT = Randomized controlled trial; RR = retrospective review; NR = not reported; EBL = estimated blood loss.

The above described advantages of laparoscopic sigmoid colon resection in diverticulitis represent short-term results which clearly support its use as the standard procedure. The LAPDIV-CAMIC trials, however, show that with regard to quality of life and complications 12 months after surgery, it is not superior to conventional open sigmoid colon resection [48].

Results

Between 10 and 25% of diverticulosis patients develop acute sigmoid diverticulitis during their lifetime [47, 49]. 15–20% of patients with acute sigmoid diverticulitis develop significant complications such as perforations, abscesses, fistulas, or stenoses [5, 50]. As in the past, the discussion today regarding the correct therapeutic management of acute sigmoid diverticulitis is controversial, especially in cases where both conservative and surgical therapy are possible treatment options. The goal of every therapy for acute sigmoid diverticulitis should be to achieve long-term freedom from complications as well as an avoidance of recurrences with possible complications such as stenosis or fistula. Both conservative and surgical treatment of acute episodes of sigmoid diverticulitis are primarily effective in a large percentage of patients, and mortality

in both treatment groups is generally low [51]. However, the recurrence rates and especially the rehospitalization rates are higher in patients treated conservatively than in those undergoing surgery [50–52].

Additionally, up to 25% of patients undergoing elective surgery report persistent postoperative complaints [53]. The persistent complaints are attributed to concurrent existing irritable bowel syndrome [54], insufficient specimen length [55], and/or an erroneous diagnosis of indications due to failure to demonstrate acute inflammation.

Conclusion

It remains for a prospective, randomized long-term study to provide conclusive clarification regarding the effectiveness of conservative versus surgical treatment of patients with acute sigmoid diverticulitis.

Disclosure Statement

The authors declare that there are no conflicts of interest.

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