Colonoscopy in Acute Diverticulitis

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Question 1: Is there any indication to perform total colonoscopy in acute diverticulitis, confirmed by a positive abdominal ultrasound result and accompanied by an elevated C-reactive protein (CRP) value? Is it acceptable or even mandatory to perform colonoscopy when a patient does not adequately respond to treatment? Do atypical diagnostic imaging results in suspected diverticulitis justify colonoscopy?

Börsch: There is definitely no need for total colonoscopy in a case of typical acute diverticulitis. Such a case would present with ongoing left lower abdominal pain and wall tenderness of acute onset, accompanied by some change of bowel habits, either constipation or diarrhea, and possibly by an increase of body temperature. In addition, there would be elevated inflammatory markers such as CRP, and also positive ultrasound findings of bowel wall thickening > 5 mm at the point of maximal tenderness, a hypoechoic reflection of an inflamed diverticulum, and a cap-like hyperechoic peridiverticular inflammatory reaction. In such a patient, treatment tailored to the clinical situation will be initiated and monitored on clinical grounds. If the response to treatment is unsatisfactory, not colonoscopy but abdominal computed tomography (CT) will be the next diagnostic step, or even repeat CT, if this procedure has already been performed initially. In all likelihood, any inadequate response will rather be due to some extraluminal disease complication, which is not, or at least rarely, viewable by the strictly luminal dimension of the endoscopic procedure and which may possibly even be dealt with by a subsequent CT-guided intervention.

An abdominal CT procedure identifying a triad of colonic diverticulae, localized bowel wall thickening > 4 mm, and an increase in soft tissue density within the adjacent abdominal fat is highly sensitive (e.g. 94%) and specific (e.g. 99%) for acute colonic diverticulitis. This leads to an equally high negative predictive value (pV neg) of 94% in a typical clinical 50/50 disease prevalence of acute diverticulitis versus other potential abdominal disease entities. Thus, in the absence of the above mentioned triad, or in atypical findings such as colonic masses, a diagnosis of acute diverticulitis of clinical relevance would be quite unlikely. It is in these cases with atypical imaging results that I would promptly and without any reservations proceed to total colonoscopy after standard colonic preparation. This is justified by a very low endoscopic complication rate, especially endoscopic perforation rate, in acute colonic diverticulitis anyway (see question 2), all the more in a case with highly unlikely acute diverticulitis. With negative or atypical CT findings, colonoscopy might reveal segmental bacterial or viral colitis, non-occlusive colonic ischemia, Crohn’s disease, unclassified colonic inflammatory bowel disease (IBD), or even segmental diverticular colitis, each with quite different therapeutic strategies.

Dormann: Diagnosing diverticulitis usually requires not only clinical but also laboratory test results and diagnostic imaging with sonography and abdominal CT, but not endoscopy [1]. The totality of symptoms (pain), physical examination (left-sided lower abdominal pain), and laboratory values (CRP increase > 50 mg/l) is present in more than 90% of all cases of sigmoid diverticulitis [1]. The compression applied in sonography, which allows the examiner to distinguish between interposed fatty tissue and intestine, can allow the detection of abdominal wall inflammation and con-
firm the diagnosis. When an abscess is suspected, a drain can be placed immediately. Supplementary CT can detect especially extra-luminal structures (mainly air when perforation is suspected) and is also to be used as a method providing objective evidence in complicated procedures. Drainage of interposed abscesses can also be performed. Major diagnostic criteria in imaging procedures are wall thickening, pericolic blurring in the fatty tissue, and detection of the inflamed diverticular area. The results can be improved by rectal contrast agent administration. The sensitivity and specificity for ultrasound alone are 92 and 90%, respectively, and thus are usually sufficient for diagnosis in uncomplicated clinical courses. The use of CT after inconclusive ultrasound findings can increase the sensitivity and specificity to 94 and 99%, respectively [2, 3]. Magnetic resonance imaging is available as a more recent method. The results are still unclear and the method should not be used for routine diagnosis [4]. Endoscopy is not indicated in the acute phase [5]. This is based on the theory that a concealed perforation can be converted to a free perforation by air insufflation; moreover, the examination is impeded by edema and possibly residual contamination. Colonoscopy is generally performed 4–6 weeks after the acute event to rule out malignancy. There is no increased risk of malignancy developing after diverticulitis [1]. In therapy failure or atypical imaging, endoscopic clarification should be performed to rule out further differential diagnoses besides malignancy, including other inflammatory etiology (viral, bacterial, IBD) or vascular reasons (ischemic colitis). In these cases it is often helpful to perform only sigmoidoscopy and, if the findings are clear, to refrain from high colonoscopy in the acute episode [1, 6]. Colon barium enema, an often chosen alternative, should no longer be used for the diagnosis of diverticulitis because of the radiation exposure [6].

**Eckardt:** Patients with a typical clinical presentation of diverticulitis, which is supported by clinical and laboratory findings, should not undergo unnecessary colonoscopy in the acute setting to avoid discomfort and the risk of perforation. However, in the setting of an atypical presentation, such as poor response to treatment, iron deficiency, or weight loss, careful sigmoidoscopy or colonoscopy should be performed, and alternative diagnoses should be sought [5].

**Kiesslich:** Colonoscopy during the acute phase of diverticulitis is not recommended by the experts. The diagnostic algorithm should include: patient with typical symptoms and laboratory findings – abdominal ultrasound – CT scan of the abdomen. Colonoscopy should be performed 4–6 weeks after the acute phase.

**Miehlke:** In the situation of a clinically established diagnosis of acute diverticulitis (typical ultrasound, elevated CRP), I do not see any need or benefit of a complete colonoscopy. If the diverticulitis does not resolve by conservative treatment, I would perform a CT scan to rule out perforation or abscess. If the CT scan is inconclusive or reveals any other unclear finding, I would proceed to colonoscopy if the clinical condition of the patient allows doing so.

**Börsch:** It has to be kept in mind that, in principle, acute colonic diverticulitis is caused by micro- or macroscopic colonic diverticular perforation. The clinical course is then determined by the speed, extent, and quality of the spontaneous biologic repair, or any lack thereof. Thus, the diagnosis of acute diverticulitis implies the presence or recent occurrence of a micro- or macroscopic colonic perforation. From this pathogenetic pathway, a very high complication rate due to an increase of intraluminal pressure by colonic air insufflation has been deduced and admonished in every relevant textbook or atlas of endoscopy or colonoscopy. This, however, has never been substantiated by sound scientific facts. In my personal colonoscopic experience stretching over more than 40 years, with far more than a thousand cases of colonoscopy in acute diverticulitis, the risk of colonoscopy-induced acute abdomen by perforation is in the range of around 1/1,000. In a formal retrospective analysis of 210 own cases with a final diagnosis of acute colonic diverticulitis, of which 155 had been submitted to total colonoscopy, 13 of whom (i.e. 8.4%) even had a small amount of peritoneal gas as detected by CT, a free perforation was not observed. There was only a single case in which a deterioration of the clinical course, though without acute abdomen, as due to a diagnostic colonoscopy, could not be completely excluded, even though a causal relationship was unlikely [7]. The group of Bar-Meir [8] found one free colonic perforation after colonoscopy in a group of 40 patients investigated prospectively. In a second cohort of 39 patients lacking any accumulation of pericolonic gas, no complication was observed.

Also, bland diverticulae by themselves do not show any propensity to perforate during colonoscopy. Thus, the colonic perforation rate did not differ in patients with or without diverticulae [9]. Finally, when applying increasing intraluminal pressure thresholds by intracolonic air insufflation, the colonic serosa and mucosa will tear open well before diverticulae will rupture [10].

In summary, the exact rate of free perforations after colonoscopy in acute diverticulitis is unknown. However, it is by all means much lower than generally anticipated. My personal estimate places the rate between 1 and 5 per thousand procedures, maybe slightly higher than the perforation rate of screening endoscopies, thought to be somewhere between 0.1 and 1 per thousand.

**Dormann:** Colonoscopy makes it possible to determine the cause of abdominal complaints and is the suitable method for lower gastrointestinal bleeding or to rule out a tumor. Besides detecting diverticula, colonoscopy can be performed for differentiation of mucosal inflammatory or polyloid lesions [6]. Colonoscopy is not required to diagnose acute diverticulitis.

Opinions diverge regarding the safety of colonoscopy in acute illness. 1.9% of 54 diverticulitis patients suffered perforation from colonoscopy. The colonoscopies were early elective procedures done at between 4 and 12 days (median 5.8 days). The rate of com-

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complete examinations of 81.7% was markedly lower than in an elective situation [11]. In another study on early (in the first 10 days) versus later (after 6 weeks) colonoscopy in CT-confirmed diverticulitis there was neither an increased rate of perforations nor a diagnostic gain [6, 12]. There may possibly be a benefit for atypical courses with persistent complaints after 1 week of antibiotic therapy or a recurrence within 2 months. A relevant diagnosis, e.g. adenocarcinomas or causes of the perforation, was obtained in 17% of these cases [13].

In summary, because of the limited data the rate of perforations cannot be reliably determined in an early elective procedure; however, an additional benefit of an early examination is not observed. An early elective control should therefore be performed after 4–6 weeks [6]. In individual cases (e.g. for an uncharacteristic clinical picture or course) colonoscopy can be performed in acute diverticulitis if a concealed perforation and abscess formation is ruled out by CT.

**Eckardt:** There is a lack of sufficient data on the risk of endoscopic perforation in the setting of acute diverticulitis. However, considering that a microperforation in a diverticulum is a likely pathomechanism of diverticulitis, the risk of macroperforation by mechanical manipulation or air insufflation must be considered. There is only one study reporting a perforation risk of 1.9% [11]. Special attention must be paid to older patients with concomitant steroid use, as these carry a high risk of perforation.

**Kießlich:** There is no evidence for an increased risk of perforation during complete colonoscopy in the presence of acute diverticulitis. However, pathogenesis of acute diverticulitis includes microperforation of the colonic wall. Thus, colonoscopy is not recommended in patients with known acute diverticulitis. If acute diverticulitis is found by accident, colonoscopy can be completed without any additional requirements.

**Michlke:** The risk for perforation during colonoscopy in the setting of acute diverticulitis is probably low, but may depend on the stage of the disease. To my knowledge, the scientific evidence is scarce and limited to retrospective single-center series reporting perforation rates between 0 and 2%.

**Question 3: Are there typical endoscopic signs of acute diverticulitis? Does the lack of such signs exclude acute diverticulitis?**

**Börsch:** There are typical and even disease-specific luminal endoscopic findings which may be seen in just one diverticulum or several of them. Among these are i) reddening and swelling around diverticulae, ii) a fibrinous or putrid slough covering a diverticulum or surrounding it, iii) a putrid secretion from the base of a presumed diverticulum, or iv) from a peridiverticular mass protruding into the colonic lumen and representing extraluminal abscess formation, or v) induction of such secretion by manipulation via the endoscope, e.g. puncture with a biopsy forceps. Also, vi) a luminal stenosis untypical of IBD or colonic ischemia can be a sign of acute diverticulitis.

Nevertheless, acute diverticulitis is primarily a pericolonic disease. Therefore, endoscopic failure to detect luminal inflammatory changes does not exclude the presence of acute diverticulitis. In our series, we saw normal endoscopic findings in 22 of 114 patients in whom typical CT criteria nevertheless and reliably established acute diverticulitis. However, a miss rate of not visualizing an inflamed diverticulum has to be reckoned with.

**Dormann:** Inflammatory changes of diverticula in endoscopy appear in about 0.8% of colonoscopies without acute diverticulitis being present [5]. Significant luminal changes are secondary in the pathogenesis of diverticulitis as the disease begins with the penetration of bacteria deep inside a diverticulum. The main complications (phlegmones, microperforation, fistula, abscess) lie deeper inside the tissue or are periluminal. Consequently, (extraluminal) diverticulitis, which can only be detected by imaging, can also be present in the case of a negative colonoscopy (see question 1).

**Eckardt:** Because colonoscopy has historically not been used in the setting of acute diverticulitis, the literature on endoscopic aspects is scarce. Diverticula are common and so are inflammatory appearances around them. One study suggests that inflammatory changes in diverticulitis directly affect the diverticular orifice (fig. 1, 2), whereas segmental colitis in association with diverticulosis (SCAD) primarily affects the interdiverticular mucosa (fig. 3) [14]. ‘Normal’ endoscopy makes diverticulitis unlikely, but not impossible, as it is primarily an extraluminal disease.

**Fig. 1.** Severe inflammatory changes directly surrounding a diverticulum with edema and relative stenosis, suggesting diverticulitis.

**Fig. 2.** Mild inflammatory changes directly surrounding a diverticulum as an incidental finding during routine colonoscopy.
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Fig. 3. Mild patchy erythema on the mucosal folds between diverticula (SCAD).

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**Kiesslich:** Diverticulitis is an extraluminal disease. Thus, colonoscopy of the inner wall of the colon cannot exclude diverticulitis. However, ‘classical’ mucosal findings are pus, reddishness, and intramural abscess.

**Question 4: Would sigmoidsoscopy be of value when acute diverticulitis is suspected? After all, interesting or clinically relevant incidental findings such as intramural abscesses may be found and drained.**

**Börsch:** The presumed risk of endoscopy in acute diverticulitis, low as it may be, arises from an increase in luminal pressure possibly causing a ‘blow-out’ free perforation of the colonic wall at the site of an inflamed diverticulum. Any endoscopy in an inflamed bowel, especially in acute diverticulitis, is a ‘difficult’ procedure not suitable for the endoscopic novice. Even so, the amount of air insufflation sufficient to adequately visualize the luminal inflammation during sigmoidoscopy will in all likelihood give rise to equivalent luminal pressure thresholds as would be induced by total colonoscopy after standard bowel preparation, which can also be used advantageously to effectively deflate the colon on retraction.

Thus, there is no indication for routine sigmoidoscopy in the setting of acute colonic diverticulitis. When an endoscopic procedure is warranted as described in question 1, total colonoscopy after standard bowel preparation should be the procedure of choice. Incidental findings of therapeutic value for the management of the current disease episode are quite unlikely and do not justify the very low, but presumably not negligible, endoscopic risk.

**Dormann:** For diagnostic colonoscopy in acute diverticulitis please consult question 2 and the indications discussed there. Sigmoidoscopy is therefore electively dispensable; the decision ‘colonoscopy or no endoscopy’ should be taken.

**Eckardt:** Sigmoidoscopy should be considered when atypical features are present (see question 1). In my opinion, endoscopy has no role in the drainage of intramural abscesses in the setting of diverticulitis.

**Kiesslich:** Sigmoidoscopy is not recommended (as colonoscopy).

**Miehlke:** In my opinion, a sigmoidoscopy also has no place in the primary diagnostic workup of acute diverticulitis, for the same reasons already mentioned. I would consider this procedure only in unclear situations if a complete colonoscopy is not feasible.

**Question 5: Why should a colonoscopy be performed after an episode of acute diverticulitis? After which time interval should it be performed? How do prior colonoscopies influence your decision, e.g., if a patient had screening endoscopy 3 years ago showing diverticula but no polyps or tumor?**

**Börsch:** Given that any symptoms have completely reverted to normal, acute colonic diverticulitis by itself is not a valid indication for subsequent colonoscopy. The large body of scientific evidence, with several important papers having been published in 2014/2015, may best be summarized to the extent that the yield of advanced colonic neoplasia, adenomatous polyps, or hyperplastic polyps in this cohort is roughly equivalent to that detected on screening asymptomatic average-risk individuals. In such once again asymptomatic cases, colonoscopy should be regarded as a screening endoscopy which could safely be performed 4–6 weeks after the acute episode, or at the proper time interval after a previous screening. In the specific patient mentioned here, endoscopy could reasonably be delayed for another 7 years. Incidentally, any episode of diverticulitis might be utilized to remind patients within a specific age range of the merit of colonic cancer screening, and, if previously not done, to offer arrangements for such a procedure.

These suggestions certainly apply to typical left-sided ‘Western-type’ diverticulitis with complete resolution of symptoms after 4–6 weeks, and thus to the vast majority of our local patients. Whether right-sided, proximal ‘Asian-type’ diverticulitis would necessitate other strategies remains to be elucidated.

However, in patients still symptomatic 4–6 weeks after an episode of acute diverticulitis, endoscopy should definitely be offered and performed to look for luminal complications, rule out other disease entities, or, last but not least, serve as a base for a diagnosis of post-diverticulitis irritable bowel syndrome.

**Dormann:** Colonoscopy is recommended after a conservatively treated acute diverticulitis and before a sigmoid resection [6]. It serves to clarify the differential diagnosis of conditions with a sim-
The value of capsule endoscopy has not been proved for this indication, especially as there is always the risk of capsule retention. In 205 patients with CT-supported confirmation of diverticulitis, endoscopy showed adenomas with >50% advanced neoplasias in only 9.3% of patients [15]. The rate of adenomas and carcinomas is lower compared to data of screening colonoscopies. In 100 patients, at least one polyp was detected in 32% of cases, an advanced adenoma was found in only one case, and in no patient was malignancy detected by colonoscopy 4–6 weeks after the end of the hospital treatment for acute diverticulitis [5]. Colonoscopy is therefore not associated with an elevated incidence of malignancy after diverticulitis [16]. A systematic literature search by Sai et al. [17] in order to detect a colon carcinoma up to 24 weeks after CT diagnosis of diverticulitis identified ten studies with 771 documented patients. The rate of identified colorectal carcinomas was 2.1% (95% confidence interval 1.2–3.2%) and thus above the expected prevalence (0.68%) in US citizens >55 years. A recommendation for complete colonoscopy in patients >55 years with clinically overt diverticular disease and without a colonoscopy <5 years previously appears justified [6]. A colonoscopy <5 years previously without evidence of neoplasia primarily indicates no new examination and should only be indicated when there is a risk constellation (e.g., familial history, doubtful previous examination (e.g., contamination)).

**Eckardt:** Recent studies have shown that the risk of neoplasia is low in the setting of uncomplicated diverticulitis [18, 19]. Therefore, colonoscopy should primarily be performed after resolution of complicated diverticulitis or in cases of suspicious radiologic findings, warning signs (such as anemia), a protracted clinical course, and if age-appropriate screening is necessary. Such an approach avoids an unnecessary colonoscopy in a patient who has had a thorough exam within the past 3 years.

**Kiesslich:** Colonoscopy is recommended by all experts after the acute phase of diverticulitis has passed. Rationale for colonoscopy is the risk of colon cancer, which could be the underlying cause of abdominal symptoms.

However, the largest study on this topic could not confirm a substantially increased cancer risk. Thus, complete colonoscopy should be recommended for screening purposes only. Colonoscopy is not necessary if a screening or diagnostic colonoscopy was already performed within the last 3–5 years.

**Miehlke:** After the first episode of an acute diverticulitis I would definitely recommend a full colonoscopy 4–6 weeks later to determine the extension of diverticulosis and to rule out neoplastic lesions. I would also recommend a full colonoscopy after an acute diverticulitis in patients with established diverticulosis if the last colonoscopy was done more than 3 years ago, especially if the quality of this procedure was unclear.

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**Question 6:** How do you react when a (screening) endoscopy reveals the unexpected endoscopic findings of acute diverticulitis? Under what conditions is it necessary to discontinue the investigation, and when should it be completed?

**Börsch:** The detection of endoscopic signs of acute diverticulitis in a screening situation is well known to every experienced endoscopist and may be expected about once in 100 colonoscopies (e.g. 0.8% of 2,566 consecutive colonoscopies performed by Ghorai et al. [12]). However, the underlying inflammation is hardly ever clinically severe or due to complicated diverticulitis, given that a screening situation implies an asymptomatic patient. Also, the vast majority of such patients do not need treatment.

This clearly is a low-risk state, roughly equivalent to a colonic screening situation. The merit of completing the procedure far outweighs the potential risk.

**Dormann:** Inflammatory changes of diverticula in endoscopy occur in about 0.8% of colonoscopies without acute diverticulitis being present [6]. Generally, the examination can be performed without problems if there is no pronounced lumen obstruction. If there is a significant stenosis, it may be necessary to switch to a smaller device or discontinue the examination and repeat it subsequently. The present day use of endoscopes with diameters of 5 mm usually allows the examinations to be terminated or at least the stenotic region to be determined in almost all patients. If this is not possible, the examination should be discontinued and repeated electively in the interval [16].

**Eckardt:** Whether colonoscopy should be completed in the case of an incidental finding of acute diverticulitis depends on the severity of the endoscopic findings and symptoms. My practice is to continue colonoscopy with little air insufflation (I prefer water immersion in this setting [20]) as long as the patient does not complain of major discomfort, and advancement of the endoscope is possible without difficulty.

**Kiesslich:** The prevalence of asymptomatic diverticulitis is about 0.8%. Complete colonoscopy is possible without an increased risk of complication. However, if a stenotic area appears the risks and benefits of complete colonoscopy should be individually specified and advanced endoscopic techniques could be used (e.g. use of small-caliber endoscopes, CO₂ insufflation, etc.).

**Miehlke:** This certainly depends on the severity of the endoscopic manifestation. If the endoscopic findings are mild to moderate and if there is no significant stenosis of the sigmoid lumen I would aim to perform complete colonoscopy. In all other cases I would stop the procedure, initiate or continue conservative treatment, and repeat colonoscopy after resolution of the acute episode.
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