Complicated diverticular disease: the changing paradigm for treatment

Doença diverticular complicada: alterando o padrão de tratamento

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A B S T R A C T

The term "complicated" diverticulitis is reserved for inflamed diverticular disease complicated by bleeding, abscess, peritonitis, fistula or bowel obstruction. Hemorrhage is best treated by angioembolization (interventional radiology). Treatment of infected diverticulitis has evolved enormously thanks to: 1) laparoscopic colonic resection followed or not (Hartmann's procedure) by restoration of intestinal continuity, 2) simple laparoscopic lavage (for peritonitis +/- resection). Diverticulitis (inflammation) may be treated with antibiotics alone, anti-inflammatory drugs, combined with bed rest and hygienic measures. Diverticular abscesses (Hinchey Grades I, II) may be initially treated by antibiotics alone and/or percutaneous drainage, depending on the size of the abscess. Generalized purulent peritonitis (Hinchey III) may be treated by the classic Hartmann procedure, or exteriorization of the perforation as a stoma, primary resection with or without anastomosis, with or without diversion, and last, simple laparoscopic lavage, usually even without drainage. Feculent peritonitis (Hinchey IV), a traditional indication for Hartmann's procedure, may also benefit from primary resection followed by anastomosis, with or without diversion, and even laparoscopic lavage. Acute obstruction (nearby inflammation, or adhesions, pseudotumoral formation, chronic strictures) and fistula are most often treated by resection, ideally laparoscopic. Minimal invasive therapeutic algorithms that, combined with less strict indications for radical surgery before a definite recurrence pattern is established, has definitely lead to fewer resections and/or stomas, reducing their attendant morbidity and mortality, improved post-interventional quality of life, and less costly therapeutic policies.

Key words: Diverticulitis. Hemorrhage. Abscess. Inflammation. Therapeutics.

INTRODUCTION

Diverticular disease is defined as the presence of diverticules, in reality, *pseudo*diverticules, sac-like protrusions of the colonic mucosa and submucosa through muscular layer weakness defects in the colonic wall, typically where the vasa recta penetrate. When inflammation sets in (called "diverticulitis"), the inflamed diverticules will remain so in three out of four patients while complications will arise in approximately one fourth of patients. The term "complicated" diverticulitis should be reserved for patients who present with bleeding, abscess, peritonitis, fistula or bowel obstruction. Complications can be immediate or long-term. Immediate complications include infective complications ranging from local abscess formation to peritonitis, obstruction, fistula formation, and, more rarely, hemorrhage[1]. Several authors [2,3] consider that all diverticulitis bouts represent, by definition, perforation, which can be a micro or macroperforation. Whether they evolve toward a more serious complication or not depends on the magnitude of the perforation, the amount, nature and location of spillage of intestinal contents, and the local mechanisms with which the body defenses react. Abscesses are in fact considered as the result of micro-perforation and/or walled-off micro or macro-perforations. Infection can also spread locally to neighboring structures such as the ovary, the scrotum, or even the hip joint, or travel via the portal vein to cause pylophlebitis and, ultimately, hepatic abscess formation. Uncontained perforations result in peritonitis, classically subdivided into purulent and fecal peritonitis. Obstruction can be caused by pseudotumoral formation of the colonic wall, compression from abscess, inflammatory adhesions to nearby bowel responsible for early obstruction, or more rarely, strictures or bands created by any of the above, leading to progressive fibrosis and late obstruction. Fistulas occur in 10 to 15% of patients with diverticulitis, most commonly involving the bladder [4,5], but also include colovaginal (typically in the hysterectomized woman [6], colocutaneous, and coloenteric fistulas. Hemorrhage can be chronic giving rise to anemia, or brutal, with exteriorization of blood per anus (hematochezia).

Treatment of some of these complications is straightforward and has not changed for decencies. Other aspects of treatment have evolved as new technology has become available to therapeutic teams dealing with surgical emergencies in complicated diverticular disease.

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Management paradigms for complications such as hemorrhage, localized abscess and generalized peritonitis have changed enormously in the last twenty years: minimally invasive treatments of other complications, such as hemorrhage and infective complications (abscess, phlegmon, peritonitis), calling on procedures including percutaneous embolization, percutaneous drainage and surgical procedures are the basis for this review.

Hemorrhage

Diverticular disease remains among the most common causes of massive lower gastrointestinal bleeding, accounting for 30–50% of cases, enhanced by non-steroidal anti-inflammatory drugs in nearly 50% of patients. Bleeding from diverticular disease is usually painless, of abrupt onset, and requires either transfusion or operation in up to one third of patients[7]. About three cases out of four are self-limiting, but bleeding recurs frequently. The problem is to locate the exact site of bleeding in order to propose minimally invasive therapy before undertaking a radical solution such as resection. Three methods are available including nuclear scintigraphy, interventional radiology and colonoscopy. Their sensitivities in detecting the source of bleeding decrease in that order, but only the two latter methods offer some form of treatment. Nuclear scintigraphy is rarely used to guide surgical intervention, but can be of help when bleeding is intermittent.

Radioisotope scanning (ideally with 99m technetium-labeled sulfur colloid): Bleeding can be detected at rates as low as 0.1 mL/min.

Because of a longer circulating half-life, 99m technetium-labeled sulfur colloid scans can be repeated within 24–36 hours.

Emergency angiography and/or colonoscopy constitute the first line diagnostic/treatment options. Selective angiography is positive when the bleeding rate is at least 1.0–1.3 mL/min. Angiography allows interventional hemostatic therapy (vasopressin, somatostatin), successful in more than 90% of cases. Embolization for lower gastrointestinal bleeding is most effective for the treatment of diverticular bleeding and according to a meta-analysis in 2005[8], embolization for diverticular bleeding can be successful in 85% of patients. However, caution is warranted if further surgery is needed as the risk of ischemia and anastomotic leakage has not been fully investigated in this therapeutic sequence.

Colonoscopy performs best when bleeding is mild, moderate or has stopped, usually within 12–24 hours after bleeding has ceased, sometimes as an outpatient procedure. Moreover, colonoscopy is useful to exclude neoplasms (32%) and carcinoma (19%) as the source of bleeding[3]. In other settings, emergency colonoscopy after aggressive bowel lavage [9,10] allows therapeutic interventions such as local injection of epinephrine or sclerosant or thermocoagulation, and can be helpful in tattooing the lesion in view of future surgery.

Surgery to arrest bleeding can be indicated either after successful but temporary arrest (recurrence) of bleeding (after one or more of the above mentioned methods) or as an urgent procedure. Successful urgent surgery for diverticulum-related bleeding is directly related to whether the site of bleeding has been found preoperatively. In most cases, however, this is not the case, and indications for urgent surgical intervention include: Hemodynamic instability, unresponsive to conventional resuscitation techniques; transfusion of > 2000 mL of blood, and recurrent massive hemorrhage.

As in the preoperative setting, once again, the major problem is correct intraoperative localization of the source of bleeding. Even when preoperative localization has been successful, rebleeding, as in endoscopic treatment, can occur from another site. Most often, however, precise localization is difficult and imprecise. Surgical intervention in this setting ends in (blind) resection, often repeated, and sometimes finishes in total or near total colectomy, obviously a disproportionate measure.

Infectious complications

Several classifications have been developed to describe and guide the management of the range of infectious complications in diverticular disease. Probably one of the best known and most widely used is that set forth by Hinchey in 1978[11]. Of note, this classification was based essentially on intraoperative findings, and did not take into account any preoperative information (no sonography or CT findings) and cannot be used in the absence of interventional or surgical therapy.

A wide array of modifications have followed including those proposed by Sher[12], Wasvary[13], Kohler[1], Hansen[14], Ambrosetti[15], and Kaiser[16]. However, these classifications have created conflicting terminology and, concentrate on different aspects of the disease, perhaps leaving aside some important considerations for the best-adapted therapeutic scheme. Sher *et al.* [12] modified Hinchey's class II (deep pelvic abscess) to individualize distant abscesses amenable to percutaneous drainage (IIa) from complex abscesses associated with fistula (IIb). Wasvary *et al.* [13] added a stage 0 to define uncomplicated diverticular disease and subdivided Hinchey I into confined pericolic inflammation or phlegmon and colonic wall thickening with pericolic soft tissue modifications (Stage IA), different from pericolic or mesocolic disease abscess. The EAES consensus conference, known under the publication of Kohler *et al.*[1], introduced complications other than perforation, including bleeding, strictures, fistula with other organs, and obstruction. With the advent of CT scan, enhanced by intravenous or intralumenal contrast material, Ambrosetti *et al.*[15] and Kaiser *et al.*[16] added their modifications, introducing a precise preoperative evaluation and severity status.

However, two major therapeutic advances have taken place in the last two decencies: 1) the advent of

laparoscopic surgery, leading first, to the possibility of colonic resection followed or not (Hartmann's procedure) by restoration of intestinal continuity, with less morbidity and mortality[17,18], and second, to proposing simple laparoscopic lavage for peritonitis, and not necessarily followed by resection[19,20]; 2) the change of indications from proposing elective colectomy after the 2nd flare (1st for the young and high risk patients (renal failure, collagen-vascular disease, immunocompromized patients), to waiting until ulterior and definite recurrence patterns or diagnostic findings point to a reasonable indication [21-23].

With these modifications in mind, Klarenbeck *et al.*[24], in a complex but complete classification, combining clinical, radiological and treatment characteristics, propose to divide diverticular disease into three categories, stage A is uncomplicated diverticular disease, stage B, chronic complicated disease, and stage C, acute complicated disease.

The justification of using the laparoscopic approach for colectomy in diverticular disease was studied by two randomized controlled trials comparing open with laparoscopic resection for sigmoid diverticular disease [17, 18]. The first compared 52 patients in each arm (total = 104), while the second compared 59 laparoscopic vs. 54 open resections (total = 113). The main endpoint was the number of patients with one or more complications in the first and the VAS pain score in the second. All patients had sustained at least two flares in each group. Both studies were methodologically unique in that both the patients and the investigators evaluating outcome were blinded to the arm in which the patient was randomized (blinding was ensured by covering the abdominal incisions with an opaque wound dressing). In both studies, laparoscopic sigmoid resection took longer to perform, and was associated with less complications, better quality of life and, in one of the two, with less blood loss[17] or less postoperative ileus [18]. While the former found a significant difference in favor of laparoscopy as concerns postoperative pain (not the main endpoint), the difference was marginal in the second (main endpoint). In the long-term outcome for 105 of the original 133 patients in the latter (25) (93%, LAP = 54, OP = 51), there was a marginal difference in overall satisfaction with the cosmetic aspect of the scar. There were no other statistically significant differences found between the two groups, and specifically in the incisional hernia rate, the overall satisfaction of the operation or median hospital cost (including reoperations for hernias). The authors concluded then that both open and laparoscopic approaches for sigmoid resection achieve good long-term results in terms of gastrointestinal function, quality of life, and patients' satisfaction. Significant long-term benefits of laparoscopic surgery are restricted to cosmesis only.

In 1996 the late Gerry O'Sullivan and his group from Dublin[19] published the outcome of eight patients with perforated sigmoid diverticulitis treated simply by laparoscopic lavage (7 without abdominal drainage). This innovative procedure heralded a new therapeutic paradigm for Hinchey III perforated diverticular disease. This same team then published the results of a series of 100 patients[20]; eight had feculent peritonitis and underwent an open Hartmann's procedure, while the remaining 92 patients were managed by laparoscopic lavage only. Morbidity and mortality rates were 4 and 3 per cent, respectively. Two patients required postoperative intervention for a pelvic abscess. Only two patients re-presented with diverticulitis at a median follow up of 36 (range 12–84) months. In a systematic review[26], the authors analyzed two prospective cohort studies, nine retrospective case series and two case reports totaling 231 patients. Most (77%) patients had purulent peritonitis (Hinchey III). Laparoscopic peritoneal lavage successfully controlled abdominal and systemic sepsis in 95.7% of patients. Mortality was 1.7%, morbidity 10.4% and only four (1.7%) of the 231 patients required a colostomy. The authors concluded there are not yet any methodologically high quality studies on laparoscopic peritoneal lavage for patients with perforated colonic diverticulitis. The papers published to date do, however, show promising results, with high efficacy, low mortality, low morbidity and a minimal need for a colostomy (less than 2%). Moreover, less than 40% of patients require resection after simple lavage for the acute perforation. Mutch[27] concluded in an editorial that while the laparoscopic approach with simple lavage appears feasible, the indications for simple lavage and drainage should be limited to hemodynamically stable with generalized peritonitis. Hemodynamically stable patients with localized peritonitis can be treated with a high rate of success with appropriate percutaneous drainage, antibiotics, and nutritional support.

There are currently at least three randomized trials underway comparing laparoscopic lavage with resection (with or without resection) for generalized peritonitis originating from perforation: the LAPLAND (Irish) [28] trial, the LADIES (Netherlands)[29] trial and the DILALA (Scandinavia)[30] trial. The first compares laparoscopic lavage with Hartmann's Procedure or primary resection of the diseased segment and anastomosis (surgeon's choice), the second compares laparoscopic lavage with Hartmann's procedure or resection anastomosis for generalized purulent peritonitis (randomization 2:1:1, respectively) on one hand, and Hartmann's procedure and resection and primary anastomosis for feculent peritonitis, on the other, while the third compares laparoscopic lavage with resection without anastomosis (Hartmann's procedure). The main outcome measure is operative and in-hospital mortality within the first postoperative year, the combined number of mortality and major morbidity, twelve months after initial surgery, and the number of operations within the first postoperative year, respectively. Results are eagerly awaited.

In the meantime, it seems reasonable to propose the following therapeutic indications for complicated diverticular

disease. Diverticulitis (inflammation) may be treated with antibiotics alone, antibiotics and anti-inflammatory drugs, combined with bed rest and hygienic measures[3, 31]. However, recurrence has been noted to be frequent after cessation of anti-inflammatory treatment[32]. Antibiotics are not warranted for uncomplicated diverticular disease[33].

Diverticular abscesses (Hinchey Grades I, II) may be initially treated by antibiotics alone and/or percutaneous drainage, depending on the size of the abscess. Most authors treat abscesses less than 3-4 cm with antibiotics alone. Abscesses greater than 4 cm are best treated by percutaneous drainage[34,35], but some reports indicate that even percutaneous drainage is not always successful [36].

Generalized peritonitis by perforation may be treated by the classic Hartmann procedure, or exteriorization of the perforation as the site of diversion, but several reports indicating that primary resection with or without anastomosis, with or without diversion, have extended the list of potential operations[37-40]. As stated above, laparoscopic management by simple lavage, usually even without drainage, is rapidly becoming the favored therapeutic option in selected cases.

Feculent peritonitis is a traditional indication for Hartmann's procedure, but reports of primary resection followed by anastomosis, with or without diversion are accumulating. Laparoscopic lavage represents another alternative under investigation bringing with it the advantages of less parietal insult and potentially less parietal morbidity (not yet proven), as well as reducing the need for colectomy, and/or colostomy.

Other complications

The indications and techniques for treatment in acute obstruction depend essentially on whether the cause of obstruction is nearby inflammation, or adhesions, amenable to treatment without resection, or to pseudotumoral formation, manageable by resection only. Patient status and the degree of distension of the bowel proximal to the obstacle are other factors to consider. Usually, fecal loading proximal to the stricture is cumbersome and might be reduced by on-table colonic lavage (via appendicostomy or terminal enterotomy) before entertaining resection and anastomosis. When the grossly dilated colon is deemed unsuitable for anastomosis, or the patient unfit (elderly, immuno-compromized, or very sick), Hartmann's procedure, a two-staged operation (diversion only in the initial operation) or endoscopically placed endolumenal stent are the possible options. However, the latter is fraught with potential re-obstruction and perforation [41].

Chronic strictures, fistula or phlegmon without acute obstruction usually are treated with elective resective surgery. Distinguishing a sigmoid stricture secondary to chronic diverticulitis from carcinoma may be difficult, if not impossible, especially when the stricture presents acutely as large bowel obstruction. In patients fit for surgery, sigmoid colectomy with primary anastomosis, ideally performed laparoscopically, is the treatment of choice. A temporary diverting stoma, ileostomy or colostomy, has its partisans.

Colectomy for fistulas and phlegmon can be challenging situations and special attention must be paid when dissected in the severely modified Toldt fascia not to injure the ureter[42]. While laparoscopic management remains the ideal in many minds, several authors have underlined the higher conversion rates and longer operating times [36,41,43,44]. Hand-assisted dissection may be of help for those who are familiar with its use.

CONCLUSION

In conclusion, the multiple facets of complicated diverticular disease lead to varied indications. Ever evolving technical progress has led to propose minimal invasive therapeutic algorithms that, combined with less strict indications for radical surgery before a definite recurrence pattern is established, has definitely lead to fewer resections and/or stomas, reducing their attendant morbidity and mortality, improved post-interventional quality of life, and less costly therapeutic policies. The outcome of ongoing trials comparing simple laparoscopic lavage to radical treatment as well as the role of anti-inflammatory, anti-immunitary (31, 32) and/or antibiotics in the therapeutical armamentarium[36,45] should provide at least some of the missing answers.

R E S U M O

O termo diverticulite "complicada" é reservado para a doença diverticular complicada por sangramento, abscesso, peritonite, fístula ou obstrução intestinal. A hemorragia é melhor tratada por angioembolização (radiologia intervencionista). O tratamento de diverticulite infectada evoluiu enormemente graças a: 1) ressecção laparoscópica do cólon seguida ou não (procedimento de Hartmann) pelo restabelecimento de continuidade intestinal, 2) lavado laparoscópico simples (peritonite + / - ressecção). A diverticulite (inflamação) pode ser tratada somente com antibióticos, anti-inflamatórios, combinados com repouso e medidas de higiene. O abscesso diverticular (Hinchey graus I, II) pode ser inicialmente tratado somente com antibióticos e / ou drenagem percutânea, dependendo do tamanho do abcesso. A peritonite purulenta generalizada (Hinchey III) pode ser tratada pelo clássico procedimento Hartmann, pela exteriorização da perfuração, como se fosse um estoma, pela ressecção primária com ou sem anastomose, com ou sem desvio do trânsito e, por último, a simples lavagem laparoscópica, geralmente, sem drenagem. A peritonite por fezes (Hinchey IV), uma indicação para o tradicional procedimento de Hartmann, também pode se beneficiar da ressecção primária seguida de anastomose, com ou sem desvio e lavagem laparoscópica. A obstrução aguda (inflamação local, ou aderências, formação

pseudotumoral, estenoses crônicas) e fístula são, na maioria das vezes, tratadas por ressecção, preferencialmente, laparoscópica. Algoritmos terapêuticos pouco invasivos combinadas com indicações menos rigorosas para a o emprego da cirurgia radical antes de um padrão definido de recorrência, estão estabelecidos, ocasionando um número menor de ressecções e / ou estomas, reduzindo a morbidade e a mortalidade, melhorando a qualidade de vida após a intervenção, e geram uma tratamento menos dispendioso.

Descritores: *Diverticulite. Hemorragia. Abscesso. Inflamação, Terapêutica.*

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