

Current Trends in Surgical Treatment of Complicated Colonic Diverticular Disease

Elena Arabadzhieva,
Sasho Bonev,
Atanas Yonkov,
Dimitar Bulanov,
Vladislav Stoyanov and
Violeta Dimitrova

Department of General and Hepato-pancreatic Surgery, University Hospital "Alexandrovska", Medical University, Sofia, Bulgaria

Corresponding author:
Elena Arabadzhieva

Department of General and Hepato-pancreatic Surgery, University Hospital "Alexandrovska", Medical University, Sofia, Georgi Sofiiski Str. Sofia, 1431, Bulgaria

✉ elena_arabadjieva@abv.bg

Abstract

Background: Colonic diverticular disease is a common disease worldwide. Complicated diverticulitis is determined by presence of perforation, abscess, phlegmon, stricture, obstruction, fistula or hemorrhage, and it is an indication for operative management. Aim: to investigate the types of surgical procedures performed in patients with complicated diverticular disease and to analyze the factors affecting the outcomes. Methods: Between 1999 and 2014, 308 patients with symptomatic and complicated colonic diverticular disease were hospitalized in our department. Of them, 48 patients with complicated colonic DD were surgically treated. Several factors that could influence on choice of surgical strategy were statistically analyzed. Findings: Surgically treated were 38 patients with perforation, 1 patient with diverticular bleeding, 5 patients with fistulas and 4 cases with bowel obstruction based on diverticular disease. Significant factors related to increased postoperative mortality and morbidity are severe comorbidities ($p=0,011$), leukocytosis ($p=0,028$), diverticular perforation ($p=0,01$), type of peritonitis ($p=0,001$), perioperative blood transfusions ($p=0,022$) and hypoproteinemia ($p=0,001$). The lowest percent of postoperative complications (9,1%) after surgical treatment of patients with acute peritonitis Hinchey III is observed in the group with performed resection with primary anastomosis and protective stoma. Conclusion: Surgical treatment of complicated diverticular disease, especially with peritonitis, remains challenge. Increasingly performance of resection with primary anastomosis with or without protective stoma carries into practice in selected patients as an alternative to Hartmann's procedure.

Keywords: Complicated colonic diverticular disease, Perforation, Hartmann's procedure, Primary anastomosis, Protective stoma.

Abbreviations: DD: Diverticular Disease; HP: Hartmann's Procedure

Introduction

Colonic diverticular disease (DD) is a common gastroenterological disease with potentially lethal outcomes. About 10 to 25% of patients develop symptoms and only in 20% there are complications that require emergency surgery [1,2]. Complicated diverticulitis is determined by the presence of perforation, abscess, phlegmon, stricture, obstruction, fistula or hemorrhage [3]. Importance of the disease is obvious from the fact that 1/3 of colostomies and colonic resections are a result from development of acute diverticulitis [4,5]. Perforated diverticulitis is the most common benign cause of mortality in surgery after ruptured abdominal aortic aneurysm [6]. Indications and choice of surgical treatment of complicated acute diverticulitis of the colon are

still controversial. Because of the frequent complications and relatively low percent of reversal after Hartmann's procedure (HP) operations with primary anastomosis with/without protective stoma increasingly get into practice in the recent years [3,5,7]. An alternative technique for surgical treatment of acute diverticulitis complicated with purulent peritonitis was described in the literature – laparoscopic peritoneal lavage [8].

The aim of the study is to investigate the types of surgical procedures performed in patients with complicated diverticular disease and to analyze the factors affecting the outcomes.

Methods

Between 1999 and 2015, 308 patients with symptomatic and

complicated colonic DD were hospitalized in our department. 48 patients were operated due to complicated diverticular disease of the colon, 29 patients underwent elective surgery for colonic diverticulosis and the rest were treated conservatively with antibiotics, parenteral infusions, spasmolytic, percutaneous drainages and etc. Several factors that could influence on the choice of surgical strategy were investigated with SPSS 19.0.1

Results

The objects of the statistical study were the surgically treated patients. Of them, 26 (54, 17%) were men and 22 (45, 83%) - female. The median age of patients with colonic DD was 59 years and 10 months. The most affected were those aged 51-80 years with a peak of 61-70 years. Symptoms were determined by the localization of the process and the type of the developed complication.

Colonic DD complicated with perforation was observed in 38 patients (5 patients with feculent peritonitis, 27 patients with total purulent peritonitis and 6 cases with local purulent peritonitis). In 33 of studied cases perforated diverticulitis was in the left colon. Fistulizing disease was found in 5 patients - colovesical fistula (3 cases) and colocutaneous fistula (2 patients). Bleeding from colonic diverticula was found in 26 patients and only in 1 case the conservative therapy was unsuccessful and the surgery was required. Bowel obstruction requiring surgical intervention occurred in 4 patients with colonic DD. The mechanical stop of the passage was a result from strictures formed by the expansion of fibrous tissue due to frequent acute attacks of the disease and persistent inflammation in the area. Performed surgical procedures are presented in Table 1.

In cases with diverticular perforation limited resection in perforation area with subsequent suture and proximal stoma in our clinic was applied only to 3 patients. Because the involved bowel segment was not removed the technique was used only to reduce the operative trauma in highly risky patients, usually with feculent peritonitis. HP was performed in 15 patients. HP was rarely used in stage II by Hinchey, but sometimes clinical picture and even macroscopic intraoperative findings mimicked malignant process due to the severe inflammatory changes. Colon resection with primary anastomosis was applied in 9 patients. General indication of its performance was the ability to respect the left colon with following extraperitoneal transversorectostomy after the relevant extraperitoneal drainages. Resection of a colon with primary anastomosis and proximal protective stoma was performed in 11 patients, all of whom had purulent peritonitis based on diverticular perforation (stage III by Hinchey). In 2 cases a loop transversostomy was performed. In the remaining 9 cases ileostomy with a catheter tunneled in a seromuscular groove was carried out. The ileostomy was usually removed after the 12th day after the operation. Seven of the patients with performed colostomy (protective or part of HP) for diverticular perforation were re-hospitalized for reversal. Six of the patients were after HP of the colon and in one case loop protective transversostomy was carried out. The time between the urgent operation and reversal in the studied series ranged between 2 and 8 months. Because of the bleeding diverticula of the cecum a right hemicolectomy

was performed in 1 patient. The patients with colovesical fistula underwent an excision of the fistula and suture of the urine bladder. The treatment strategy related to the colon was HP in 2 cases and one patient underwent resection of the sigmoid colon with primary anastomosis. The reversal in the first two patients was performed 3 and 4 months after the first operation. Four patients were hospitalized regarding to bowel obstruction based on colonic DD. One patient underwent right hemicolectomy, the second one - HP, one patient with sigmoid resection, and resection of the sigmoid colon and proximal protective ileostomy was carried out in the fourth case. Early postoperative complications (surgical and nonsurgical) were observed in 14 (29,17%) of the operated patients with complicated DD of the colon - 10 patients with perforation, one with fistula, one with bleeding and 2 cases after the reversal. There was no insufficiency of anastomosis in any patient who underwent resection with primary anastomosis. In the early postoperative period fatal outcome occurred in 6 patients, all of whom had diffuse peritonitis based on diverticular perforation. To identify the factors influencing the results in the early postoperative period several factors were analyzed. Statistically significant were the presence of leukocytosis ($p=0.028$), significant co-morbidities (hypertension, diabetes mellitus, cerebrovascular disease) - $p=0.011$, diverticular perforation ($p=0.01$), the performance of perioperative blood

Table 1 Distribution of the surgical procedures performed for complicated colonic diverticular disease.

Complications of the colonic DD	Surgical procedures	N
Perforation	Resection of the sigmoid colon	3
	Resection of the sigmoid colon. Transversostomy	1
	Resection of the sigmoid colon. Ileostomy	5
	Resection of the sigmoid colon. Meckel's diverticulectomy	1
	Hartmann's operation	15
	Left hemicolectomy	3
	Left hemicolectomy. Transversostomy	1
	Left hemicolectomy. Ileostomy	3
	Right hemicolectomy	2
	Right hemicolectomy. Ileostomy	1
	Suture of the sigmoid colon. Ileostomy	3
Hemorrhage	Right hemicolectomy	1
Ileus	Resection of the sigmoid colon	1
	Resection of the sigmoid colon. Ileostomy	1
	Right hemicolectomy	1
	Hartmann's operation	1
Colocutaneous fistula	Resection of the sigmoid colon. Excision of the fistula	1
	Resection of the transverse colon. Excision of the fistula	1
Colovesical fistula	Hartmann's operation. Excision of the fistula. Sutures of the urinary bladder	2
	Resection of the sigmoid colon. Excision of the fistula. Sutures of the urinary bladder	1

transfusions ($p=0,022$) and hypoproteinemia ($p=0.001$). Patients with diverticular perforation were further divided into groups according to the type of established peritonitis - local, total purulent or feculent. After performed analysis it was found that with spreading of the process, the risk of development of postoperative complications significantly increased ($p=0.001$). In order to select the most appropriate surgical strategy in terms of emergency in regard to diverticular perforation different used procedures were compared in relation to the occurrence of postoperative complications and early mortality (Figure 1). The result was statistically significant - $p=0.006$. The lowest rate of complications (9,1%) was observed in patients who underwent resection with primary anastomosis and proximal protective stoma. Analysis regarding to the early postoperative mortality showed similar results ($p=0.000$). The surgical strategy in patients with acute diverticulitis in stage III by Hinchey is interesting. Postoperative complications were observed in 25% of the operated with resection and primary anastomosis, in 9.1% of cases with primary anastomosis and applied protective stoma and in 41,7% of patients with HP. The number of patients with primary reconstruction of the passage without proximal protection is too low so statistical analysis would not be accurate. So the main comparison was made between cases with HP and those with primary anastomosis and proximal stoma (Figure 2). After separated study of these two groups in regard to postoperative morbidity it was found that the difference between them was statistically significant ($p=0.047$).

Discussion

Despite of the substantial progress in the conservative treatment of diverticulitis the number of patients who require surgery, but not always a matter of urgency, remains significantly high. In literature this percentage varies between 10-30% [9,10]. Patients subject to surgical emergency treatment are usually in serious condition and its treatment remains extremely challenging. The reported mortality rate is 4-16%, reaching 50% in patients with feculent peritonitis due to diverticular perforation [9]. The type of surgery depends on the intraoperative findings with the extent of the inflammatory process and the involved structures, the comorbidities and the experience of the surgeon.

Recently the HP was recommended as "the gold standard" for surgical treatment of complicated diverticulitis in terms of emergency [11]. It presents a resection of the affected segment with secondary restoration of passage usually 6 weeks to 6 months after surgery depending on the degree of inflammation and general condition of the patient [9]. The prevalence of this type of procedure shifted the applied to 1980 delayed resection, known as the three-step technique, that involves drainage and removal of the perforation with proximal stoma followed by a second staged resection of the affected area [4,9]. This change in the approach was due to performance of randomized, multicenter studies showing a higher rate of postoperative complications after three-step technique associated with persistent, smoldering diverticulitis, reoperations and prolonged hospital stay, compared with HP [12].

We consider the suture of the perforation opening with proximal

stoma as an appropriate approach only for patients in extremely serious condition in order to reduce the operative trauma and shortening the operative time. HP has also some significant disadvantages. One of the largest studies including analysis of 54 combined studies investigated a total of 1051 patients showed that HP was related to high postoperative morbidity rate - wound infections in 24 to 29.1%, complications of the stoma 10-12%, anastomosis insufficiency in 30% of cases with reversal and the mortality rate was at 15-30% [3,13,14]. Because of various reasons a reversal after HP would not be performed in 30-70% of the patients which substantially and statistically significantly impaired their quality of life [3,14].

In recent years, a resection with primary anastomosis is discussed as an alternative to HP for cases with acute complicated diverticulitis [14,15]. For the first time in 1955 Gregg presented a series of patients who underwent resection with primary anastomosis [16]. Later Rothenberger and Garcia-Aguilar described relative and absolute contraindications for performing primary anastomosis [17]. The factors on the part of the patient (hemodynamic stability, anemia, nutritional status, immunosuppression), the factors related to the disease process (stage and nature of the peritoneal contamination), and the technical ones must be taken into account by the surgeon in order to precise the suitable for single-stage procedure candidates. European Association of Surgeons Endoscopists recommended one-step operation in acute diverticulitis in the first and second stage by Hinchey, while in third stage it has to be obligatory accompanied by the performance of protective stoma [3,18]. Over the recent years 3 large review comparative studies including patients with advanced diffuse peritonitis (III and IV stage by Hinchey) were presented. It was seen that the one-step procedures were related to significantly lower mortality and morbidity rates in comparison with those with HP [5,7,19]. The data derived from our study showed that the performance of resection with primary anastomosis and proximal protective stoma was the method of choice in selected patients because it did not lead to increased early postoperative mortality and morbidity rates. Insufficiency of anastomosis was not observed in any patient with one-stage procedure. The ileostomy with a catheter tunneled in a seromuscular groove is preferred in the practice of our department. The advantage of this study and respectively of the described method over the performance of loop derivation is the achievement of adequate protection of the colonic anastomosis without need for reoperation for restoration of the passage. Disadvantages of our study are related to its retrospective design and the limited number of patients because we used that technique in the recent years. Laparoscopic intraperitoneal lavage was shown as an alternative technique for operative treatment of acute diverticulitis in Hinchey III [8,20,21]. There are still no clearly defined indications for its performance, because the results of the randomized studies are controversial. The DILALA trial revealed that in the morbidity and mortality rates after laparoscopic lavage did not differ when compared with the Hartmann procedure. Laparoscopic lavage resulted in shorter operating time, shorter time in the recovery unit, and shorter hospital stay [20]. According to LADIES trial, laparoscopic lavage is not superior to sigmoidectomy for the treatment of purulent

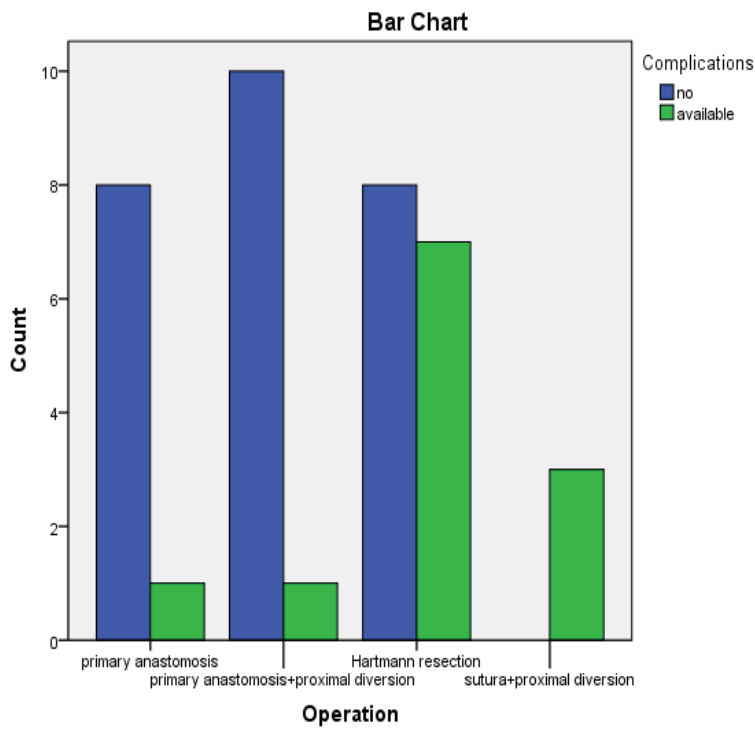


Figure 1 Comparison between different types of surgical procedures performed for diverticular perforation of the colon regarding to postoperative morbidity.

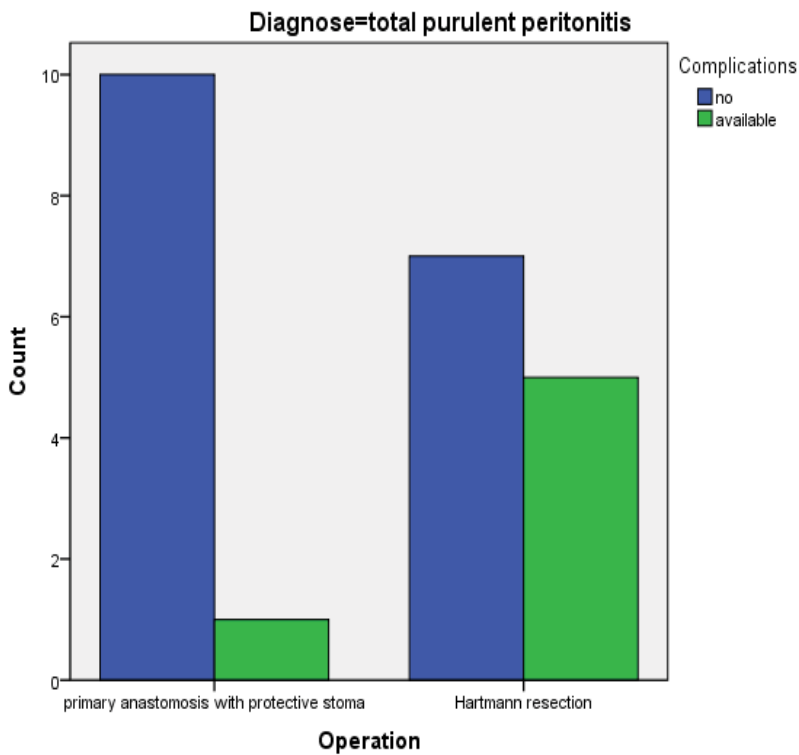


Figure 2 Comparison between HP and resection with primary anastomosis and protective stoma performed for acute diverticulitis Hinchey III, regarding to postoperative morbidity..

perforated diverticulitis [21]. However, the application of this strategy may be optimal in relatively healthy and clinically stable patients. It may be useful for downgrading severity of disease, or providing an opportunity for operative intervention.

Conclusion

Surgical treatment of complicated DD, especially with peritonitis,

remains challenge not only for the high mortality and morbidity rates but for the striving for long-term improvement of the quality of life of the patients. For these reasons the performance of resection with primary anastomosis with or without protective stoma increasingly carries into practice in selected patients as an alternative to HP.

References

- 1 Almy TP, Howell DA (1980) Medical progress. Diverticular disease of the colon. *N Engl J Med*;302:324-331.
- 2 Parks TG (1975) Natural history of diverticular disease of the colon. *Clin Gastroenterol*;4:53-69.
- 3 Bauer V (2009) Emergency Management of Diverticulitis, *Clin Colon Rectal Surg*;22:161-168
- 4 Bordeianou L, Hodin R (2007) Controversies in the surgical management of sigmoid diverticulitis. *J Gastrointest Surg*;11:542-548
- 5 Salem L, Flum DR (2004) Primary anastomosis or Hartmann's procedure for patients with diverticular peritonitis? A systematic review *Dis Colon Rectum*;47:1953-1964
- 6 Klarenbeek BR (2010) Surgical challenges in diverticular disease, Doctoral thesis.
- 7 Constantinides VA, Heriot A, Remzi F, et al. (2007) Operative strategies for diverticular peritonitis: a decision analysis between primary resection and anastomosis versus Hartmann's procedures. *Ann Surg*;245:94-103
- 8 O'Sullivan GC, Murphy D, O'Brien MG, Ireland A (1996) Laparoscopic management of generalized peritonitis due to perforated colonic diverticula. *Am J Surg*;171:432-434
- 9 Baxter N (2004) Emergency Management of Diverticulitis, *Clin Colon Rectal Surg*;17:177-182
- 10 Stollman N, Raskin JB (2004) Diverticular disease of the colon. *Lancet*;363:631-639
- 11 Rafferty J, Shellito P, Hyman NH, Buie WD (2006) Standards Committee of American Society of Colon and Rectal Surgeons. Practice parameters for sigmoid diverticulitis. *Dis Colon Rectum*;49:939-944
- 12 Zeitoun G, Laurent A, Rouffet F, et al. (2000) Multicentre, randomized clinical trial of primary versus secondary sigmoid resection in generalized peritonitis complicating sigmoid diverticulitis. *Br J Surg*;87:1366-1374
- 13 Constantinides VA, Tekkis PP, Athanasiou T, et al. (2006) Primary resection with anastomosis vs. Hartmann's procedure in nonelective surgery for acute colonic diverticulitis: a systematic review. *Dis Colon Rectum*;49:966-981
- 14 Stocchi L (2010) Current indications and role of surgery in the management of sigmoid diverticulitis. *World J Gastroenterol*;16:804-817
- 15 Abdulzahra Hussain, Hind Mahmood, Gokulakrishna Subhas and Shamsi EL-Hasani (2008). Complicated diverticular disease of the colon, do we need to change the classical approach, a retrospective study of 110 patients in southeast England, *World J Em Surg*, 3:5
- 16 Gregg RO (1955) The place of emergency resection in the management of obstructing and perforating lesions of the colon. *Surgery*;27:754-761.
- 17 Rothenberger DA, Garcia-Aguilar J (1998) Diverticular disease of the colon. In: Cameron JL, ed. *Current Surgical Therapy*:173-179
- 18 Breitenstein S, Kraus A, Hahnloser D, Decurtins M, Clavien PA, Demartines N (2007) Emergency left colon resection for acute perforation: primary anastomosis or Hartmann's procedure? A case-matched control study *World J Surg*;31:2117-2124
- 19 Abbas S (2007) Resection and primary anastomosis in acute complicated diverticulitis, a systematic review of the literature. *Int J Colorectal Dis*;22:351-357
- 20 Vennix S, Musters GD, Mulder IM, Swank HA, Consten EC, et al. (2015) Laparoscopic peritoneal lavage or sigmoidectomy for perforated diverticulitis with purulent peritonitis: a multicentre, parallel-group, randomised, open-label trial, *Lancet*.
- 21 Eva Angenete, Anders Thornell, Jakob Burcharth, Hans-Christian Pommergaard, Matthiessen (2014) Laparoscopic Lavage Is Feasible and Safe for the Treatment of Perforated Diverticulitis With Purulent Peritonitis The First Results From the Randomized Controlled Trial DILALA, *Ann Surg*:1-6.

This article is part of the Special Issue entitled -**Advanced Surgical Treatments**, edited by **Dr. Omer Engin**, (Buca Seyfi Demirsoy State Hospital, Surgery Department, Izmir, Turkey) and belongs to Volume S1 of **Journal of Universal Surgery**