The THAI Journal of SURGERY 2026;47(1):45-51.
Official Publication of The Royal College of Surgeons of Thailand

Review Article

The Current Surgical Management of Complicated Left-Sided Colonic Diverticulitis: Narrative Review Article

Kumar Hari Rajah, MBBS, MS

Taylor's University School of Medicine and Health Science, Selangor, Malaysia

Abstract Acute left-sided diverticulitis represents the most prevalent form of acute diverticulitis and is categorized into two types: complicated and uncomplicated. The surgical intervention for complicated diverticulitis is classified into the Hartmann's procedure or sigmoid resection with anastomosis, accompanied by a protective ileostomy. Damage control surgery is indicated for patients with complicated left-sided diverticulitis who are hemodynamically unstable. Laparoscopic lavage serves as a bridging procedure in cases of complicated diverticulitis with purulent discharge or classified as Hinchy 3, aiming to stabilize the patient for subsequent definitive surgery. This review will examine the surgical management of complicated left-sided diverticulitis, with a focus on Hartmann's procedure and colonic resection with anastomosis. Additionally, we will explore the role of laparoscopic lavage in the context of complicated diverticulitis.

Keywords: Colonic diverticulitis, Hinchey classification, Laparoscopic lavage, Hartmann's procedure, Sigmoid colectomy, Sigmoid diverticulitis, Open surgery

Introduction

Diverticulitis is characterized by the inflammation of diverticula within the colon, with the sigmoid colon being the most affected region. It is classified into uncomplicated diverticulitis, marked by acute inflammation with or without phlegmon, and complicated diverticulitis, which involves diverticular inflammation accompanied by an abscess and perforation, with or without peritonitis. This condition is more prevalent in Western countries, with an incidence rate of 100 to 200 cases per 100,000 individuals. Left-sided colonic diverticulitis predominantly occurs in individuals over the age of 45 years and exhibits an equal prevalence among males and females.[1-4] Risk factors for diverticulitis include a diet low in fiber, cigarette smoking, the use of medications such as steroids and non-steroidal anti-inflammatory drugs (NSAIDs), and obesity. Clinically, it presents as left-sided lower abdominal pain accompanied by fever, and laboratory investigations typically reveal leukocytosis and elevated C-reactive protein (CRP) levels. Computed tomography is the most employed imaging modality for confirming the diagnosis of diverticulitis.[5]

Diverticulitis is categorized according to the Hinchey classification system into four stages: Stage 1,

Received for publication 7 July 2025; Revised 26 September 2025; Accepted 18 December 2025

Corresponding author: Kumar Hari Rajah, MBBS, MS, Taylor's University School of Medicine Clinical Campus, 47500 Sg Buloh, Selangor, Malaysia; Email: kharirajah@yahoo.com.my; Phone number: 0166842637

https://doi.org/10.64387/tjs.2026.276432

characterized by a localized abscess; Stage 2, involving a pelvic, intra-abdominal, or retroperitoneal abscess; Stage 3, defined by purulent, generalized peritonitis; and Stage 4, marked by feculent, generalized peritonitis. The modified Hinchey classification subdivides Stage 1 into Stage 1a, which involves confined pericolic inflammation or phlegmon, and Stage 1b, characterized by a confined pericolic abscess within the sigmoid mesocolon.[6] Managing uncomplicated diverticulitis typically involves a low-fiber diet, analgesics, antipyretics, and the selective use of antibiotics. In contrast, the management of complicated diverticulitis is divided into medical treatment for small abscesses less than 5 cm, which involves the use of antibiotics. Surgical management of complicated diverticulitis may involve performing a Hartmann's procedure or a sigmoid resection with an anastomosis, with or without diversion, depending on the patient's presentation.[7-12]

Laparoscopic lavage can be employed as a bridging procedure for complicated diverticulitis with purulent discharge to stabilize the patient and perform a definitive sigmoid resection later. However, laparoscopic lavage is associated with a high recurrence rate, and the selection of patients for elective surgery later is essential.[13] Laparoscopic sigmoid resection for complicated sigmoid diverticulitis is feasible; however, further studies are needed to validate its use in the emergency management of left-sided diverticular disease. Laparoscopic sigmoid resection for complicated sigmoid diverticulitis is feasible; however, further studies are required to validate its use in the emergency management of left-sided diverticular disease. Laparoscopic sigmoid resection and Hartmann's procedure are performed in selected patients and tertiary high-volume centers, but it is mainly indicated for elective surgical resection.[14]

The surgical management of left-sided colonic diverticulitis has undergone gradual evolution. Hartmann's procedure remains the predominant emergency surgical intervention performed. However, sigmoid resection with a protective ileostomy is increasingly being recognized as a viable option for the emergency management of left-sided colonic diverticulitis. This review article has been conducted to explore the surgical management strategies available for treating left-sided colonic diverticulitis. Additionally, the role of laparoscopic lavage in managing left-sided colonic diverticulitis has been examined. A comprehensive literature review was conducted using PUBMED, the Cochrane Database of Clinical Reviews, Semantic Scholar, and Google Scholar, focusing on clinical trials, observational studies, cohort studies, systematic reviews, and meta-analyses from 1990 to 2025. The search employed the following keywords: "Sigmoid diverticulitis," "Hinchey classification," "Colonic diverticulitis," "Hartmann's procedure," "Sigmoid colectomy," "Laparoscopic lavage," and "open surgery." All articles were restricted to the English language. Additional articles were identified through manual cross-referencing of the literature. Case reports, studies with fewer than 10 patients, and editorials were excluded. The study included adult male and female patients.

Table 1 Showing the Hinchey and Modified Hinchey classification

Hinchey Classification	Modified Hinchey Classification
Stage 1-abscess less than 4 cm	Stage 1a-Confined pericolic inflammation Stage 1b-Confined pericolic abscess less than 4 cm, from the inflammation
Stage 2-abscess more than 4 cm	Stage 2-Diverticulitis with abscess distant from the primary inflammatory site (Intra-abdominal, retroperitoneal, or pelvic)
Stage 3-purulent peritonitis	Stage 3-Generalized purulent peritonitis
Stage 4-feculent peritonitis	Stage 4-Generalized feculent peritonitis

Discussion

The surgical management of complicated left-sided diverticular disease

The World Society of Emergency Surgeons (WSES) has issued guidelines for the management of colonic diverticulitis in acute settings, recommending Hartmann's procedure for critically ill patients and those with multiple comorbidities. For stable patients without comorbidities, sigmoid resection with or without anastomosis is advised. Laparoscopic resection is suggested only if the necessary

equipment and expertise are available.[15,16] The American Society of Colon and Rectal Surgeons (ASCR) advocates for sigmoid resection in the emergency surgical management of acute left-sided colonic diverticulitis, with the choice between anastomosis or stoma being contingent upon patient-specific factors and the operating surgeon's discretion.[17] German guidelines recommend primary resection and anastomosis of the sigmoid colon with a protective ileostomy for patients with acute stable diverticular disease, reserving the Hartmann's procedure for unstable patients.[18] Similarly, the European Association of Emergency Surgeons (EAES) and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) have provided evidence-based recommendations that align with these practices for the surgical management of acute left-sided diverticulitis.[19]

The surgical management of complicated left-sided colonic diverticulitis is contingent upon the patient's stability and the presence of peritonitis. Surgical interventions can be categorized into Hartmann's procedure or sigmoid resection with anastomosis, accompanied by a protective ileostomy. Traditionally, Hartmann's procedure has been the preferred emergency operation, while sigmoid resection is reserved for selected patients. The choice of procedures is typically determined by the operating surgeon.[20,21] A systematic review and meta-analysis conducted by Cirocchi et al. examined the treatment of Hinchey stages 3 and 4, incorporating fourteen studies with a total of 1,041 patients. The findings indicated that patients who underwent sigmoid resection experienced reduced mortality and shorter hospital stays compared to those who underwent Hartmann's procedure.[22] A similar systematic review and meta-analysis by Halim et al. also concluded that primary resection anastomosis was associated with reduced mortality.[23]

Ryan et al performed a systematic review and meta-analysis comparing primary resection and anastomosis versus Hartmann's procedure for the management of acute diverticulitis with generalized peritonitis. Twelve studies with 918 patients were included, of which 367 underwent primary resection and anastomosis, and 551 underwent Hartmann's procedure. There was no difference in the 30-day mortality rate, but the primary resection and anastomosis group was associated with a reduced morbidity and permanent stoma rate.[24] Acuna et al conducted a systematic review and meta-analysis on the operative strategies for perforated diverticulitis. Six studies involving 626 patients were included in this analysis, and the mortality rate between the Hartmann's procedure and primary resection and anastomosis was similar. However, the morbidity and stoma reversal rates were better in the primary resection group.[25] Another systematic review and meta-analysis comparing resection with primary anastomosis vs non-restorative resection for perforated diverticulitis with peritonitis, which was conducted by Gachabayov et al., also concluded that the mortality rate was similar between both groups.[26]

A systematic review on emergency surgery in acute diverticulitis was conducted by Beyer-Berjot et al. The review included seventy-one studies, revealing that patients who underwent Hartmann's procedure experienced poorer long-term outcomes and a higher rate of non-stoma reversal.[27] A prospective, randomized, multicenter trial (DIVERTI) was conducted by Bridoux et al., comparing the Hartmann's procedure with primary resection for generalized peritonitis due to perforated diverticulitis. This study included 102 patients and found that morbidity and mortality rates were similar between the two groups; however, the rate of stoma reversal was 96% in the primary resection group compared to 65% in the Hartmann's group.[28] The long-term outcomes from the prospective multicenter randomized trial (DIVERTI) comparing the Hartmann's procedure and primary resection for perforated peritonitis were examined by Loire et al. Seventy-eight of the one hundred and two patients were followed up for nine years, and the overall survival rate was 76%, with an incisional hernia rate of 52% in the Hartmann's group and 29% in the primary resection group. This study concluded that primary resection did not affect the long-term survival rate.[29] A multivariate logistic regression analysis of the long-term outcomes of primary anastomosis versus Hartmann's procedure for Hinchey 3 and 4 that was conducted by Facile et al also reported the same conclusions.[30]

A systematic review and meta-analysis conducted by Shaban et al. examined the outcomes of perforated diverticulitis with or without anastomosis. The study encompassed a total of 765 patients, of whom 482 underwent the Hartmann's procedure, while 283 underwent primary resection anastomosis. The mortality rate was observed to be 10.6% in the primary resection group, compared to 20.7% in the Hartmann's procedure group. Additionally, the morbidity rate was 41.8% for the primary resection group and 51.2% for those who underwent the Hartmann's

procedure. The study concluded that primary resection anastomosis is a feasible and safe approach for managing perforated diverticulitis.[31]

Minimally invasive surgical management of complicated left-sided diverticulitis

The minimally invasive surgical management of complicated diverticulitis can be categorized into laparoscopic primary resection, anastomosis, and Hartmann's procedure. However, their application in cases of complicated diverticulitis is advised only when the requisite expertise is available. Laparoscopic lavage represents another minimally invasive technique, primarily employed in patients with Hinchey grade 3. It serves mainly as a bridging procedure to stabilize patients, allowing for an elective procedure once their clinical condition has improved.[32] The laparoscopic approach for complicated diverticulitis has been associated with reduced morbidity and mortality compared to the open procedure. Additionally, patients who underwent the laparoscopic approach experienced better outcomes in terms of analgesia use and early ambulation.[33,34]

Laparoscopic lavage drainage was a minimally invasive procedure for patients with Hinchey grade 3 diverticulitis. It involves draining the purulent material in the left iliac fossa and pelvis, performing an abdominal lavage, and placing a drain in the abdomen to allow subsequent drainage of all purulent material. It was used as a bridging procedure to stabilize the patient and perform an elective sigmoid resection later.[35-37] Laparoscopic lavage is associated with reduced morbidity and mortality, but it is associated with a risk of missing sealed perforation, fecal peritonitis, and underlying sigmoid malignancy.[38] The Diverticulitis-laparoscopic lavage versus resection (Hartmann's procedure) or DILALA randomized clinical trial compared laparoscopic lavage with resection for the treatment of perforated diverticulitis by Kohl et al. Eighty-three patients were randomized to forty-three for laparoscopic lavage, and forty underwent the Hartmann's procedure. The patients in the lavage group had a 45% reduced risk of reoperation when compared to the Hartmann's procedure group, and there was no difference in mortality between the groups.[39]

The Scandinavian Diverticulitis trial (SCANDIV) was a multicenter randomized controlled trial conducted across several hospitals in Norway and Sweden. A total of 199 patients were randomized, with 101 undergoing laparoscopic lavage and 98 undergoing colonic resections. The one-year results indicated no significant difference in mortality between the groups; however, laparoscopic lavage was associated with higher rates of deeper surgical site infections and reoperations compared to the surgical resection group.[40] The three-year follow-up of these patients revealed minimal differences in major complication rates, yet the recurrence rate was 21% in the lavage group compared to 4% in the resection group. This trial demonstrated that laparoscopic lavage was associated with a higher recurrence rate.[41]

The Laparoscopic Peritoneal Lavage or Sigmoidectomy for Perforated Diverticulitis with Purulent Peritonitis (LOLA) multicenter randomized trial was conducted in 42 hospitals across Europe. A total of 90 patients were randomized to undergo laparoscopic lavage and sigmoid resection, but due to the high mortality in both the lavage groups, this trial was terminated.[42] A three-year follow-up of 77 patients from the original randomized group, the cumulative morbidity and mortality between both groups were similar, and the reoperation rate was lower in the laparoscopic lavage group. This study concluded that laparoscopic lavage was associated with reduced reoperation rate and stoma formation.[43]

Shaikh et al. conducted a systematic review and meta-analysis to compare laparoscopic peritoneal lavage with surgical resection for the treatment of perforated sigmoid diverticulitis. This study incorporated three studies involving a total of 372 patients. The findings indicated that laparoscopic lavage was associated with a higher incidence of postoperative abscesses, although the mortality rate was comparable between the two groups.[44] Similarly, Cirocchi et al. performed a systematic review and meta-analysis on the same comparison, including three studies with 540 patients. Their results also demonstrated a higher postoperative abscess rate in the laparoscopic lavage group, with no significant difference in mortality rates between the lavage and surgical resection groups.[45] Additionally, a systematic review focusing on laparoscopic lavage for managing Hinchey grade 3 diverticulitis concluded that the recurrence rate was elevated in the laparoscopic lavage group.[46]

Table 2 Shows the complication rates between laparoscopic peritoneal lavage (LPL) and surgical resection for the SCANDIV and DILALA trials.

Study	Study type	Year	N = numbers (%)	Mortality Rate Rate (%)	Complication Rate (%)	Recurrence Rate (%)
Diverticulitis-laparoscopic lavage versus resection (Hartmann's procedure)-DILALA trial-Schultz et al.	Randomized controlled trial	2018	83-total Patients 43-laparoscopic peritoneal lavage (LPL) 40-Hartmann's procedure (HP)	LPL-12 HP-11	LPL-27 HP-20	LPL-28 HP-29
Scandinavian diverticulitis trial (SCANDIV)-Azhar et al.	Randomized controlled trial	2020	199 total patients 101-laparoscopic peritoneal lavage (LPL) 98-Colon Resection (CR)	LPL-32 CR-25	LPL-29 CR-25	LPL-21 CR-4

Damage control surgery for complicated left-sided diverticulitis

Damage control surgery is a multistep procedure employed for patients with complex left-sided diverticular disease who are hemodynamically unstable. This procedure entails the resection of the perforated colon, the creation of stapled-off stumps, and peritoneal lavage. The abdomen is temporarily closed, and the management of sepsis and fluid resuscitation is conducted in the intensive care unit for a period of 24 to 48 hours. Subsequently, the patient is returned to the operating theatre for either anastomosis or stoma formation.[47,48] Sohn et al. analyzed the application of damage control surgery in the treatment of perforated diverticulitis with generalized peritonitis, concluding that it is a safe procedure associated with a reduced morbidity rate.[49]

A systematic review and meta-analysis conducted by Cirocchi et al. examined the role of damage control surgery in the management of perforated colonic diverticulitis. This study incorporated nine studies encompassing a total of 318 patients. The most prevalent category was Hinchey 3, accounting for 68.3% of cases, while Hinchey 4 constituted 28.9%. Resection with primary anastomosis was successfully performed in 62.1% of cases, with a major anastomotic leak rate of 4.7% and a mortality rate of 9.2%. The findings indicate that damage control surgery is a feasible option for managing complicated diverticular disease in hemodynamically unstable patients; however, further research is necessary to assess its efficacy comprehensively.[50]

Conclusion

Complicated left-sided diverticular disease presents a significant clinical challenge, particularly when perforation is involved. The most frequently performed surgical intervention is Hartmann's procedure, which is relatively straightforward for the operating surgeon. However, due to the high rate of non-reversibility associated with the stoma, there is an increasing preference for sigmoid resection and anastomosis with a protective ileostomy. Laparoscopic lavage serves as a crucial interim procedure, facilitating patient stabilization and enabling subsequent resection and anastomosis once stabilization is achieved. Damage control surgery is a viable option only in facilities equipped with robust intensive care unit support. Ultimately, the decision regarding the appropriate surgical approach rests with the operating surgeon.

Conflicts of Interest

There is no conflict of interest.

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