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Evolving Approaches in Left-Sided Colonic Diverticulitis Management- A Systematic narrative Review of Surgical and Non-Operative Strategies

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Abstract

Colonic diverticulitis is a common disease affecting the colon and can lead to significant complications. This review compares surgical and non-surgical treatment options for left-sided diverticulitis. Following the Joanna Briggs Institute (JBI) guidelines and PRISMA standards, a systematic narrative review was conducted. Literature from 2015 to 2026 was systematically searched in PubMed, Google Scholar, Embase, Scopus, Web of Science, and CINAHL databases using the PICO framework, focusing on adult patients aged 18 and above with left-sided diverticulitis and outcomes related to laparoscopic surgery, Hartmann's procedure, primary anastomosis, and conservative management. Fourteen studies met the inclusion criteria and were critically appraised by the JBI. Data were organized by theme and analyzed for recurrence, complications, quality of life, hospitalization, and pain management efficacy. The review indicates a preference for minimally invasive, personalized treatments that lead to better outcomes. Benefits of laparoscopic approaches include less pain, quicker recovery, improved quality of life, and lower stoma rates. When suitable patients were selected, the primary anastomosis group showed better functional outcomes compared to the Hartmann's procedure group. Overall, individualized treatment approaches are associated with safer, more effective long-term management of diverticulitis.

Keywords: left-sided diverticulitis, laparoscopic surgery, Conservative management, Hartmann procedure, Primary anastomosis

1. Introduction

Diverticulitis is a condition characterized by inflammation of diverticula, which are mucosal protrusions from the colon at sites where the wall is weak [1, 2]. This particular site was chosen because diverticulitis occurs in the sigmoid region and the descending colon of Western populations, where intraluminal pressure is highest [2, 3]. The prevalence of diverticular disease is around 50% among Western populations aged 60 years and older, and it poses a major economic burden as well as a considerable healthcare challenge worldwide [4]. Acute diverticulitis hospitalizations in the United States alone number more than 300,000 [5, 6]. The occurrence worldwide has been increasing over time, and cases in people under 50 years represent a paradigm shift for diverticulitis, as it is typically accepted to be an elderly disease [7]. Identified factors include low dietary fiber, sedentary lifestyle, obesity, smoking, and chronic use of non-steroidal anti-inflammatory drugs (NSAIDs), all of which are linked to an increased risk of diverticulitis and complications [8]. A strong association with family history suggests that susceptibility pathways, such as gene mutations, should be further studied in people with a positive family history [9]. These multifactorial risk determinants underscore the need for individualized, evidence-based treatment plans for the management of the acute presentation and prevention of recurrence in left-sided colonic diverticulitis.

Left-sided colonic diverticulitis results from inflammation or infection of diverticula primarily located in the sigmoid and descending colon [10]. Beyond the typical presentation, patients may exhibit diarrhea, vomiting, or other bowel and urinary symptoms, depending on involvement of additional pelvic structures [11]. Computed tomography[11] (CT) is the primary modality for assessing severity, with several classification systems in widespread use, including the modified Hinchey, World Society of Emergency Surgery (WSES), and American Association for the Surgery of Trauma (AAST) classifications [12]. Covino et al. (2021) demonstrated comparable predictive performance of these systems across different patient cohorts for complications, reintervention rates, and mortality risk [13]. Both the modified Hinchey and AAST classifications are recommended for their superior ability to forecast the need for surgical intervention and the likelihood of major complications, outperforming the WSES grading [14]. Tochigi et al. (2018) identified Hinchey's grades II-IV, encompassing abscess formation, purulent peritonitis, and fecal peritonitis, as indicative of colonic diverticulitis necessitating prompt surgical management [15]. The distinction between uncomplicated and complicated disease significantly influences treatment

pathways, including antibiotic selection, timing of surgical intervention, and long-term disease monitoring [1].

The management of left colonic diverticulitis has changed significantly in recent decades, shifting from traditional aggressive surgery to individualized, evidence-based therapies [16]. Current approaches [16]recognize that factors such as disease severity, comorbidities, and surgical team expertise influence treatment decisions [17]. The Association of Coloproctology of Great Britain and Ireland recommends using decision-making frameworks rather than relying solely on standard surgical methods [18]. Williams et al. (2024) noted that treatment choices at different stages of disease severity are guided by validated risk classifications, such as the modified Hinchey, AAST, and WSES [4]. Kumano et al. (2023) found that laparoscopic lavage has complication rates comparable to colon resection, with benefits including lower rates of stoma formation and improved quality of life (QoL) [19]. Additionally, Cirocchi et al. (2018) observed that primary anastomosis has become increasingly common, replacing the Hartmann procedure, especially with the availability of safer postoperative medications [20]. Landmark trials such as the AVOD and DIABOLO studies have supported the omission of antibiotics in uncomplicated diverticulitis, thereby shifting antibiotic stewardship [21, 22]. Overall, these evolving perspectives emphasize a patient-centered approach that prioritizes quality of life, reduced morbidity, and personalized treatment options. Treatment of uncomplicated diverticulitis has similar results for antibiotic based or non-antibiotic based management according to Balk et al. (2022) [22].

Despite significant advances in the treatment of left-colon diverticulitis, several key clinical research questions remain unanswered. A major limitation is the lack of uniform criteria for elective surgery, including the optimal timing for resection after onset or complicated episodes [23]. There is also limited comparative long-term data on the outcomes of various surgical approaches, including NOSE colectomy, Hartmann surgery, and primary anastomosis [24]. Classification systems, such as the modified Hinchey, WSES, and AAST classifications, also vary, complicating disease severity assessment and treatment [25]. Moreover, most studies focus on short-term postoperative results and lack sufficient data on patient-centered outcomes, quality of life, recurrence, and functional recovery [26]. Evidence supporting individualized, non-operative treatment is limited, particularly for selective antibiotic avoidance and recurrence risk stratification [27]. This review addresses these gaps by assessing surgical vs conservative treatment, clinical

outcomes and quality of life measures, and identifying evolving trends that enable better standardized, patient-oriented management strategies for left-sided colonic diverticulitis.

The purpose of the study was to assess differences in recovery following laparoscopic versus open surgery for left-sided colonic diverticulitis. It also compares Hartmann's surgery and primary anastomosis with respect to complications-related death and permanent stoma formation.

2. Materials and Methods

2.1. Study Design

The study is a narrative review to investigate the change in surgical and non-operative strategies in the management of left-sided colonic diverticulitis. Literature was systematically and comprehensively searched ensuring that the evidence synthesis was structured and systematic, and methodologically consistent. Electronic databases, the major ones being PubMed, Google Scholar, Embase, Scopus, Web of Science, and the CINAHL were consulted to locate relevant peer-reviewed research studies conducted during the period 2015–2026. Medical Subject Headings (MeSH), keywords, and Boolean operators that were embodied in the search strategies covered the topic of diverticulitis management, Hartmann's, primary anastomosis, recurrence of disease, complications, and quality of life outcome. Patients were included in the study if they met the following criteria: adult age, left-sided diverticulitis, and were free of chemotherapy for malignant disease. Randomized controlled trials, cohort studies, observational studies, clinical guidelines and comparative surgical studies were included.

2.2. Search Strategy

The selected time frame of 2015 to 2026 encompasses a critical decade characterized by substantial advancements in the management of left-sided colonic diverticulitis. During this period, significant progress was made in minimally invasive colorectal surgical techniques, optimized recovery protocols, and evidence-based non-operative treatment strategies. By 2015, numerous large randomized controlled trials and updated clinical guidelines began to question traditional treatment approaches, such as routine antibiotic therapy and the Hartmann procedure, thereby favoring a more individualized management plan. Adopting this time frame allows for the integration of the most current evidence, clinical recommendations, and emerging surgical and non-surgical approaches pertinent to contemporary diverticulitis management.

This review has only included 14 studies for the following reasons: firstly, methodological quality and the relevance of the study to the management of left-sided colonic diverticulitis; and secondly, from the clinical point of view. It also stressed the importance of high quality evidence including randomized controlled trials, multicenter cohort studies, prospective observation studies, and validated clinical studies which facilitate not only scientific rigor but also applicability. Specific focus has been directed towards clinically significant outcomes, including outcomes of postoperative complications, stay at the hospital, and quality of life, thus reinforcing the evidence base of modern diverticulitis treatment regimens.

The review incorporated various research designs such as randomized controlled trials, retrospective cohort studies, prospective observational studies, multicenter prognostic studies, clinical follow-up studies and comparative surgical trials. Randomized controlled trials were an improved piece of evidence as they reduced the level of bias and offered a high-level comparison of operative and conservative interventions. Cohort and observational studies provided useful real-life clinical information on the recurrence, complications and long-term outcome of left-sided diverticulitis management. Surgical trials of laparoscopic technique and primary anastomosis vs the procedure proposed by Hartmann provided a better understanding of the safety of the procedures and their patient-centered outcomes.

These included studies and had a broad geographical spread as they included studies that were carried out in the Netherlands, Sweden, Norway, Belgium, Canada, Spain, France, Turkey, Italy and the United States. The utility of the study findings regarding the management of left-sided colonic diverticulitis was enhanced as a result of the inclusion of studies under consideration of multiple healthcare systems and international populations. The variation of patient demographics, surgical competency, institutional practices and treatment protocols permitted the appraisal of management approach in different clinical environments.

Major biomedical and multidisciplinary databases such as PubMed, Google Scholar, Embase, Scopus, Web of Science and CINAHL were searched to have a comprehensive literature search on the topic of the management of left-sided colonic diverticulitis published between 2015 and 2026. The concept-based strategy was used in developing keywords and Medical Subject Headings (MeSH). Some general terms were used, such as “left-sided diverticulitis”, “laparoscopic colectomy”, “Hartmann’s procedure”, “primary anastomosis”, “non-operative management”,

“antimicrobial therapy” and “quality of life”. Boolean strings were employed in the literature search to define searches that were broad yet tailored to the databases to maximize sensitivity with the appropriate part of the relevance. The most commonly used keywords were: “left-sided diverticulitis”, “left colonic diverticulitis”, “sigmoid diverticulitis”, “acute diverticulitis”, “laparoscopic surgery”, “laparoscopic colectomy”, “laparoscopic lavage”, “open surgery”, “Hartman procedure”, “primary anastomosis”, “conservative management”, “non-operative management”, “antibiotic therapy”, “antibiotic avoidance”, “stoma”, “hospital stay”, “quality of life” and “classification system”. The publication language was in English and the complete text was used for filters applying the criteria.

2.3. Inclusion and Exclusion Criteria

The inclusion criteria in this review included studies published between 2015 and 2026 that evaluated contemporary management strategies for left-sided colonic diverticulitis. Qualified studies involved randomized controlled trials (RCTs), cohort, case-control, clinical trials (Phase I-IV), clinical studies and evidence-based clinical guidelines. Research has been done on both open and conservative surgery procedures, including whether to perform open or laparoscopic surgery, use Hartmann or anastomosis, and treat with or without antibiotics. Only articles reporting clinically relevant outcomes (such as length of hospital stay, postoperative complications, quality of life, morbidity, mortality, recurrence rates) were included. It was determined that only English-language articles focusing on adult patients and full-text and indexed in certain data banks would be eligible. Only studies published after 2015 and available in English and studies in right-sided diverticulitis, pediatric studies, studies in animals, review articles, editorials and letters to the editor were excluded, as these did not contain their own data. Non-English articles as well as articles without sufficient clinical data and without full text or institutional database access were also excluded.

2.4. Study Selection Process

The study selection process was conducted based on the PRISMA framework, including identification, screening, eligibility evaluation, and final inclusion stages. The relevant records were statistically retrieved in several databases, with the following removing of duplicate citations (Figure 1). The PRISMA selection process must indicate that the selection of those retrieved was independently carried out by two reviewers following removal of duplicates in the same manner

as using a reference-management software, and manual verification. The titles and abstracts were pre-screened for eligibility criteria, and then full-text screening of potential articles was included if appropriate. Disagreements were addressed through consultation between the reviewers, and any unresolved disputes were sent to a 3rd reviewer for final decisions. Justifications for exclusion were recorded on the full text level, such as irrelevant outcomes, inadequate methodology, etc., and contradiction data. This step helped to conduct an ethical process, reduced the chances for selection bias, and made the eligibility decision repeatable (Figure 1).

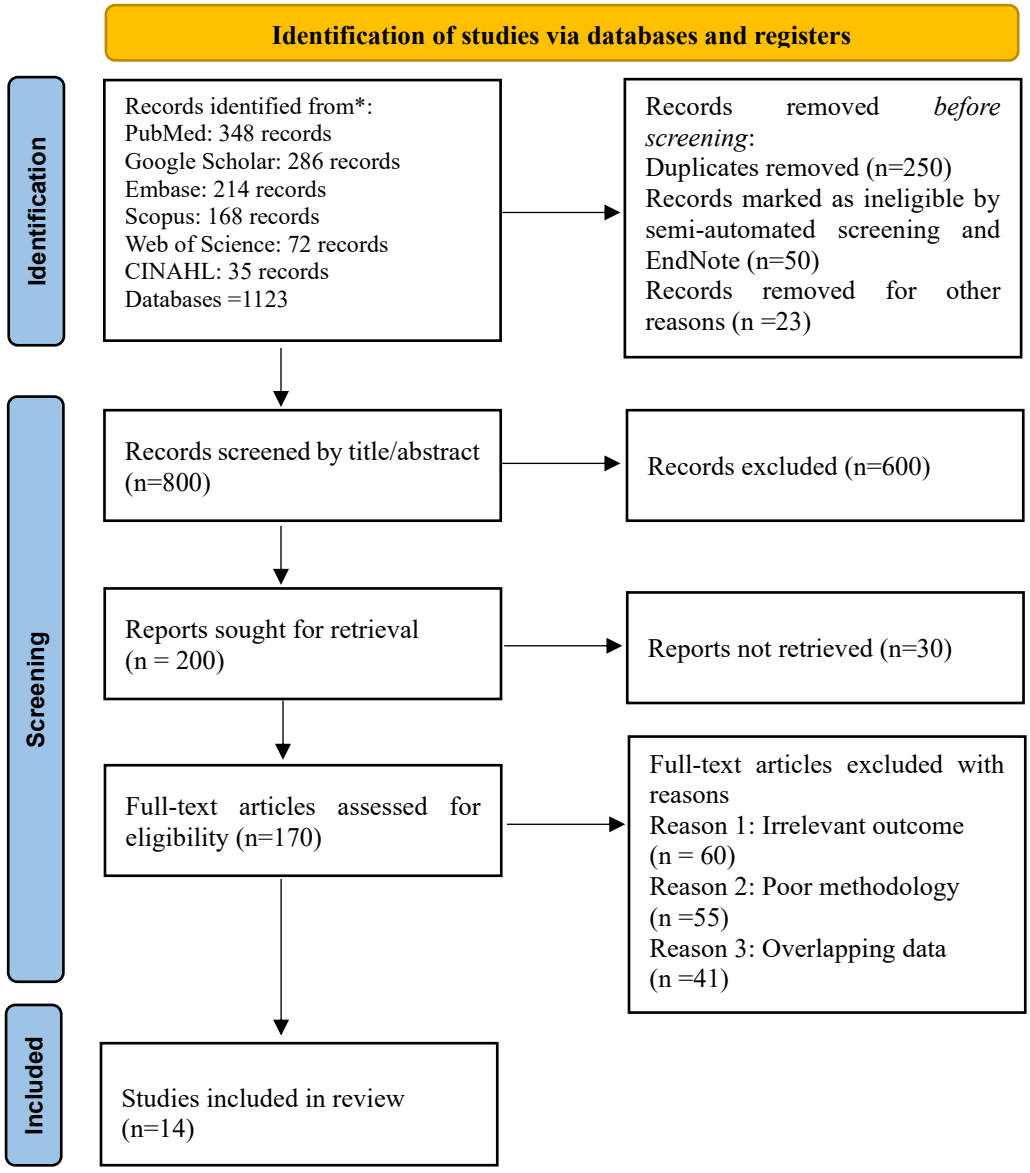


Figure 1: Prisma Flow Chart

2.5. Data Extraction and Synthesis

This narrative review on the management of left-sided colonic diverticulitis can be viewed through the PRISMA flow chart, which shows that there is a systematic and transparent process in the identification, screening, assessment, and selection of studies. In the identification phase, 1,123 records in total were retrieved using various electronic databases, including PubMed (348), Google Scholar (286), Embase (214), Scopus (168), Web of Science (72) and CINAHL (35). Duplicate studies were eliminated before screening (n=250), with further records being eliminated by semi-automated screen sort and EndNote filtering due to ineligibility or overlap of records. More so, 23 studies were filtered out under other predefined reasons, thus leaving 800 records to pass over to title and abstract screening.

At the screening stage, 800 records with titles and abstracts were screened in accordance with the pre-set inclusion and exclusion criteria related to the management of left-sided diverticulitis between 2015 and 2026. A total of 600 studies were excluded as they did not meet the eligibility criteria, including studies that were not related to the topic of interest, studies that had not used a clinical design, studies that focused on diverticulitis in the right side portion, animal studies, conference abstracts and articles that lacked sufficient clinical data. As a result, 200 of those reports were requested to get the full-text retrieval. Nevertheless, 30 of those reports failed to be accessed due to the lack of accessibility, the non-availability of the entire content of most of the reports, or the absence of complete publication information.

During the eligibility and inclusion stage, the other 170 full-text studies were thoroughly methodologically and relevantly examined. Among them, 155 studies were left out due to certain reasons such as irrelevant outcomes (n=60), poor methodological quality (n=55), and overlapping/duplicate data (n=41). After critical appraisal and synthesis of evidence, 14 studies were finally included in the final review. The selection process led by PRISMA ensured that the transparency of the methods used in this review was high, the selection bias was minimized and that the evidence synthesis used in this review was reliable and reproducible (Figure 1).

2.6. Data Analysis

A structured thematic approach was used to synthesize evidence regarding surgical and non-operative treatments for the treatment of left-sided colonic diverticulitis. The data was subdivided by the following characteristics of the study: severity of the disease, nature of treatment, outcomes

of therapy, recurrence, complications, emergency surgery, stoma creation and quality of life. Evolving trends identified through the comparative interpretation were: Selective Non-Antibiotic Therapy, Laparoscopic vs Open Procedures, Hartmann's Procedure (HP) vs Primary Anastomosis (RPA), Risk-Based Surgical Decision Making, and Timing and Indications for Elective Surgery. It also revealed gaps in classification systems and follow-up periods, in the reporting of outcomes, which stressed the necessity of standardization of classification and reporting of results.

2.7 Ethical Considerations

The review was carried out within the framework of relevant ethical standards of evidence synthesis and academic integrity. The patient was not directly recruited and subjected to the intervention or collection of identifiable personal data; thus, no formal approval of an ethical committee was necessary. Ethical issues were concerned with ensuring transparency, accuracy, and objectivity in the entire review process. To prevent incidents of plagiarism and violation of intellectual property, proper citation and recognition of all original authors and sources were made. Results of the reporting of the findings adhered to evidence-based review principles that create a balance in the interpretation of both surgical and non-operative outcomes of management without misrepresentation or data alteration.

2.8 Table of Findings

Table 1: Study Characteristics

Author(s)	Year	Country	Aim of the Study	Research Design	Participants	Main Findings
Cremonini et al. [28]	2024	Italy	To compare the three most used classification systems for acute left-sided colonic diverticulitis—modified Hinchey, AAST, and WSES—in predicting clinically relevant outcomes and guiding management decisions.	Retrospective multicenter prognostic study conducted across four academic medical centers. Adult patients admitted from 2014 to 2021 with CT-confirmed left-sided acute colonic diverticulitis	597 adult patients with acute left-sided colonic diverticulitis and admission CT imaging. Median age was 65 years; 57% were female. Conservative management was used in 41%, while 59% required intervention.	Acute left-sided colonic diverticulitis severity was well-defined using all three classifications and treatment outcome was also predicted in this multicenter cohort. When compared to lower scores on the Modified Hinchey, AAST and WSES, a higher score indicated significantly greater need for intervention, complications, major complications, reintervention and longer hospital stay. Of the two instruments, AAST was better for predicting need for intervention, and modified Hinchey most useful for predicting major complication.

Sağıroğlu et al. [29]	2021	Turkey	To identify clinical, biochemical, demographic, and lifestyle factors predicting severity, progression, emergency surgery requirement, and recurrence risk in acute left colonic diverticulitis.	Multicenter observational study conducted in five university-affiliated research and training hospitals in Istanbul.	144 adult patients older than 18 years were admitted with acute left colonic diverticulitis between December 2017 and June 2019.	In this study, clinical and laboratory parameters are able to predict the severity and progression of acute left colonic diverticulitis. An increased respiratory rate, procalcitonin, total bilirubin, direct bilirubin, CRP, neutrophil percentage (neutrophil percent), and absolute neutrophil count (ANC) were found to be associated with severe disease, especially Modified Hinchey 4. Most patients received conservative therapy and those who developed an abscess or peritonitis, septic shock or failed medical therapy underwent percutaneous drainage or surgery.
Isacson et al. [21]	2019	Sweden	To assess the long-term safety and outcomes of avoiding antibiotics in CT-confirmed acute uncomplicated left-sided colonic diverticulitis among patients previously enrolled in the AVOD randomized controlled trial.	Long-term follow-up of the AVOD randomized controlled trial. Medical records were reviewed for recurrence, complications, diverticulitis-related surgery, and colorectal cancer.	556 of 623 original AVOD trial patients were followed up, representing 89.2% follow-up, with a median follow-up duration of 11 years.	Antibiotic treatment of uncomplicated left sided colonic diverticulitis is safe in avoiding antibiotic use. There was no difference between the two groups in terms of recurrence rates (31.3% in both groups; p=0.986). The rate of complications was comparable 4.4% without antibiotics and 5.0% with antibiotics; p=0.737. Surgery rates were also comparable, 6.2% versus 7.1%; p=0.719. Colorectal cancer occurred in 0.4% versus 2.1%; p=0.061. The results of this study support selective non-antibiotic therapy for diverticulitis with no complications which is confirmed by a CT scan.
Azhar et al.[30]	2021	Sweden and Norway	To compare 5-year outcomes of laparoscopic peritoneal lavage versus primary colon resection for acute perforated purulent left-sided diverticulitis.	International, multicenter, randomized clinical trial conducted in 21 hospitals. Patients with suspected perforated diverticulitis requiring urgent surgery and CT-confirmed	145 patients with confirmed perforated purulent diverticulitis, Hinchey stage less than IV. Final long-term analysis included 73 lavage patients and 69 resection patients; median	The morbidity and mortality for both laparoscopic lavage and resection were not different in the long-term followup of 29% versus 25% (p=0.58) and 32% versus 25% (p=0.36), respectively. Lavage resulted in a decrease in stoma prevalence among survivors (8% vs 33%, p=0.002), an increase in diverticulitis recurrence (21% vs 4%, p=0.004) and an increase in

					follow-up was 59 months.	reoperation during urostomy care (26% vs 12%, p=0.03).
Milsom et al. [31]	2022	USA	To compare the clinical performance of THUNDERBEAT and LigaSure energy devices in laparoscopic left colectomy for conditions including diverticulitis	Prospective randomized controlled trial conducted in a single academic center	60 adult patients undergoing left laparoscopic colectomy (including diverticulitis cases)	Both also showed similar successful results and safety, and no differences were seen with regard to operation time, complication and recovery rates in left-sided labial surgeries. THUNDERBEAT demonstrated increased versatility, such as in tissue dissection and manipulation. Although not unique to diverticulitis, the results indicate the added value of advanced energy devices to improve the efficiency and safety of surgical procedures used for the treatment of left-sided colonic diverticulitis.
Daniels et al. [32]	2017	Netherlands	To compare observational management versus antibiotic therapy for a first episode of CT-confirmed, uncomplicated left-sided acute diverticulitis	Multicenter open-label randomized controlled trial conducted across 22 clinical centers with intention-to-treat and per-protocol analyses	528 patients with first-episode CT-proven uncomplicated left-sided acute diverticulitis	The study highlighted that observational management, without antibiotics, was effective in left-sided, uncomplicated acute diverticulitis as well. Patients treated with antibiotics tended to stay in the hospital longer and not use unnecessary antibiotics. Results suggest conservative management via antibiotics in selected patients in clinically stable condition, and encouraging individuals to take preventive action in acquiring individualized solutions that are supported by evidence in uncomplicated left-sided colonic diverticulitis.
van Dijk et al. [33]	2018	Netherlands	To evaluate the long-term outcomes of omitting antibiotics in patients with first-episode uncomplicated left-sided acute diverticulitis	Follow-up analysis of the multicenter DIABOLO randomized controlled trial comparing observational management versus antibiotic therapy over 24 months	528 patients with CT-proven primary, uncomplicated left-sided acute diverticulitis	The study showed that withholding antibiotics in left-sided acute diverticulitis didn't increase the risk of recurrent diverticulitis at late follow-up. Recurrence or complications were more likely in younger patients or those with severe abdominal pain. Recommendations based on the findings include an attitude of selective antibiotic avoidance in (slightly) clinically stable patients and a multispecialty approach to longitudinal monitoring of the

						treatment of left-sided colonic diverticulitis.
Golda et al. [34]	2018	Spain	To compare surgical decision-making and outcomes between colorectal specialized surgeons (CS) and general surgeons (GS) in managing left colonic perforation due to diverticulitis or malignancy	Retrospective observational cohort study conducted at a tertiary referral center (2004–2015). Surgical approaches, including Hartmann's Procedure (HP) and resection with primary anastomosis (RPA) ± covering ileostomy (IL), were analyzed	190 patients with left colonic perforation; 129 cases due to diverticulitis and 61 due to malignant perforation. 112 operated on by colorectal surgeons and 78 by general surgeons.	The study proved that colorectal surgeons had a preference for primary anastomosis with or without diverting ileostomy for left-sided colonic perforation much more than general surgeons did, which meant that a reliance on Hartmann's procedure was reduced. The permanency of the stoma and mortality rates were higher in the case of Hartmann's procedure. As time went on, general surgeons became more commonly accustomed to the reconstructive methods the colorectal surgeons offered.
Patel et al.[35]	2020	Netherlands	To determine whether elective sigmoid resection or conservative management provides better long-term quality of life in patients with recurrent diverticulitis or persistent abdominal complaints following an episode of left-sided diverticulitis.	Multicenter randomized controlled trial (DIRECT Trial) with 5-year follow-up. Patients were randomized to elective sigmoid resection within 6 weeks or conservative management.	Adults aged 18–75 years with recurrent left-sided diverticulitis (>2 episodes within 2 years) or persistent abdominal complaints for more than 3 months after objectively confirmed diverticulitis.	For patients with recurrent or persistent symptoms after an episode of left-sided diverticulitis, patients with elective sigmoid resection had better long-term QOL compared with conservative treatment. The surgical group had significantly better GIQLI scores at 5-years follow-up. Overall, the study argues the case for proceeding with elective surgery in a limited number of patients with recurrent disease or persistent symptoms, highlighting the need for a personalized approach during the treatment of left-sided colonic diverticulitis.
Sebastián-Tomás et al.[36]	2022	Spain	To validate the World Society of Emergency Surgery (WSES) classification for guiding management decisions in acute left-sided colonic diverticulitis.	Prospective single-center observational study using a database of patients with ultrasound- and CT-confirmed acute left-sided	230 patients with confirmed acute left-sided colonic diverticulitis.	The study demonstrated that the WSES classification could be a useful tool to facilitate management decisions in acute left-sided colonic diverticulitis, especially for outpatient versus inpatient management. Stage 0 and stage 1A disease were very responsive to outpatient treatment. The clinical features, laboratory test results,

				colonic diverticulitis.		therapeutic approaches and prognosis were found to be significantly different between the stages of WSES. Some stage 2A patients needed to be drained or had an emergency need for surgery, while others who were stage 2B were treated conservatively.
Almalki et al. [37]	2020	Canada	To evaluate whether a positive family history of diverticulitis is associated with recurrent diverticulitis and complicated recurrence after successful nonoperative management of left-sided diverticulitis.	Retrospective cohort study with prospective telephone follow-up conducted at two McGill University-affiliated tertiary hospitals (2007–2017)	433 immunocompetent patients with CT-proven left-sided diverticulitis managed nonoperatively; 173 had a positive family history, and 260 had no family history. Median follow-up was 40.1 months.	The study showed that having a positive family history of diverticulitis was a major factor in the likelihood of experiencing recurrent and complicated diverticulitis following nonoperative management of left-sided diverticulitis. Patients with a family history were almost four times more likely to have a recurrence and had significantly higher rates of complicated recurrence and multiple recurrence. Recurrence risk further increased if there was involvement of first degree relatives or if more than one family member had an individual affected. Those patients who had a family history also had fewer, and a younger, abscesses.
van de Wall et al. [38]	2017	Netherlands	To compare elective sigmoidectomy with conservative management in patients suffering from recurrent diverticulitis or persistent abdominal complaints after left-sided diverticulitis, and determine which strategy provides better quality of life.	Open-label, multicentre randomized controlled trial conducted in 24 teaching and 2 academic hospitals. Patients were randomized to elective laparoscopic sigmoidectomy or conservative management.	109 patients aged 18–75 years with recurrent (≥3 episodes within 2 years) or persistent symptoms after confirmed left-sided diverticulitis. Fifty-three patients were assigned to surgery and 56 to conservative treatment.	In patients with recurring or persistent symptoms of diverticulitis in the left colon, the DIRECT trial showed that elective sigmoidoscopy made life more enjoyable than conservative treatment. Surgical patients had higher GIQLI and EQ-5D scores at 6 months and lower scores of abdominal pain at 6 months. Recurrent complaints resulted in surgical intervention in almost a quarter of conservatively treated patients. The surgeries were successful and benefits for patients, but there were side effects, including leaks of the gastrointestinal sections, or anus and rectum (anastomosis).

Rottier et al. [39]	2019 *	Netherlands	To determine the incidence, timing, and risk factors for progression from CT-proven uncomplicated left-sided diverticulitis to complicated diverticulitis, and to identify patients who may require closer observation or alternative management strategies.	Observational cohort study using pooled data from two Dutch cohorts, including retrospective and randomized trial datasets.	1,087 patients with CT-confirmed left-sided uncomplicated acute diverticulitis (Hinchey Ia). Patients were followed for 3 months after presentation to assess progression to complicated disease.	The study found that uncomplicated left-sided diverticulitis often has a benign course – just 4.9% of patients actually develop complications within three months. Of all infectious complications, most such problems, such as perforation and abscess, were noted within the first 10 days after diagnosis. Independent predictors for progression were ASA classification III/IV, symptoms longer than 5 days before admission, vomiting and elevated CRP level >140mg/L.
Wolthuis et al. [40]	2015	Belgium	To compare postoperative pain, analgesia requirements, inflammatory response, anorectal function, and cosmetic outcomes between laparoscopic natural-orifice specimen extraction (NOSE) colectomy and conventional laparoscopic colectomy in patients with left-sided colonic diverticulitis.	Prospective single-blind randomized clinical trial conducted at a single tertiary center. Patients were randomized to laparoscopic NOSE colectomy or conventional laparoscopic colectomy.	40 patients undergoing elective laparoscopic left-sided colectomy; 20 assigned to NOSE colectomy and 20 to conventional laparoscopic colectomy.	The trial showed that in a left-sided diverticular disease, laparoscopic NOSE colectomy significantly reduced postoperative pain and the use of analgetics compared to conventional laparoscopic colectomy. Compared to the group receiving no treatment with the medication, patients in the NOSE group used less of the medication morphine analogue, less epidural analgesia and less paracetamol. However, inflammation markers (CRP and IL-6) were elevated following the NOSE surgery; however, the minimally invasive extraction technique led to decreased discomfort and cosmetic concern after surgery without increasing morbidity.

3. Results

3.1. Laparoscopic vs Open Procedures

Laparoscopic surgery has become more common in treating left-sided diverticulitis because of its minimally invasive nature and reduced recovery time. In a study by Cremonini et al. (2024), 597 patients were assessed, and the study indicated that minimally invasive interventions were more widely used for severe diverticulitis, with a 49% surgical subgroup that included laparoscopic

surgery, despite the fact that 29% of the patients in this subgroup were converted. Cremonini et al.'s (2024) study demonstrated that disease severity was associated with more interventions, more complications, more reinterventions, and longer hospital stay. Additionally, the study noted that classifications made using CT, like AAST and modified Hinchey, were effective for guiding the operative decision and discussions of which would be the big problems. Wolthuis et al. compared surgeries for the removal of the specimen via a natural orifice using the laparoscopic approach (NOSE) with traditional laparoscopic colectomy [40]. Patients undergoing NOSE colectomy used postoperative piritramide analgesia 5%, compared to 50% for patients undergoing other colectomy procedures ($p=0.003$); used epidural analgesia in the postoperative period 116 ml, versus 221 ml for patients undergoing other colectomy procedures ($p<0.001$); and took paracetamol 11 g, compared to 17 g for other colectomy patients ($p<0.001$). Patients in the NOSE group were also less likely to report pain one week after discharge – just 5% of patients in the NOSE group reported pain, versus 75% for the conventional group. In addition, with a long follow-up of 11 years, the AVOD long-term randomized trial by Isacson et al. (2019) confirmed that conservative treatment and minimally invasive treatment of uncomplicated diverticulitis appeared to be equally successful, with no significant differences in recurrence, complications, surgical procedures, or quality of life [21]. All of these findings suggest an advantageous effect of laparoscopy or minimally invasive procedures on postoperative outcome, pain, quality of life, and selective surgery for left-sided diverticulitis.

3.2. Hartmann's Procedure (HP) vs Primary Anastomosis (RPA)

For complicated left-sided colonic diverticulitis that requires surgical drainage, Hartmann's Procedure (HP) is the most commonly done resection procedure, and Resection with Primary Anastomosis (RPA) is the second most frequently performed surgical drainage procedure. Today, more and more patients experience better recovery and easier times in the postoperative phase, in addition to the reduction in the creation of permanent stomas, have helped primary anastomosis to gain increasing acceptance. Azhar et al. (2021) conducted a randomized clinical trial (SCANDIV) of 145 patients with perforated purulent diverticulitis to colon resection over a median of 59 months [30]. There was no significant difference between both groups' severe complications (29% to 25%, P=.58) and death (32% to 25%, with a P value of .43). Importantly, stoma prevalence was still significantly less across the whole cohort (8% vs. 33% persisting stoma prevalence in survivors, P=.002). These findings were an indication that decisions regarding the risk of

recurrence, the burden of a stoma and the life quality after surgery should be informed. Milsom et al. (2022) studied the use of advanced energy devices in the laparoscopic left colectomy for diverticulitis versus malignancy. [31]. The statistically determined difference of 14 minutes between the THUNDERBEAT device and the LigaSure device in operative dissection time in this randomized trial with 60 patients was not significant. THUNDERBEAT showed better scores for versatility of tissue manipulation and dissection, especially in the retroperitoneum and momentum dissection ($p=0.040$ and $p=0.007$, respectively). The studies reviewed collectively indicate that in an appropriately selected patient population, RPA with modern laparoscopic methods may yield better functional outcomes, decrease permanent stoma placement and a reasonable complication rate when compared to traditional Hartmann's procedures.

3.3. Timing and Indications for Elective Surgery

Van de Wall et al. (2017) conducted the DIRECT randomized trial, demonstrating that elective laparoscopic sigmoidectomy was associated with significantly improved quality of life in patients experiencing recurrent symptoms or persistent disease[38]. Surgical patients showed higher scores on the GIQLI and EQ-5D scales and reported less abdominal pain at six months post-surgery compared to those receiving conservative treatment. Similarly, Patel et al. (2020) found that these benefits persisted over the long term, with patients who underwent elective sigmoid resection exhibiting notably better GIQLI scores after five years of follow-up[35]. While these findings support the primary goals of elective surgery—namely symptom management and quality of life enhancement—they do not advocate for surgery solely to prevent complications. Careful patient selection is critical when considering elective intervention. Most uncomplicated cases do not require routine surgery, as research by Rottier et al. (2019) indicates that only 4.9% of patients with uncomplicated diverticulitis progressed to complicated diverticulitis within the first three months. Elevated CRP levels above 140 mg/L, presence of vomiting, or ASA classification III/IV significantly increase the risk of progression, guiding clinicians toward earlier surgical consideration and closer monitoring in high-risk individuals. Additionally, Sebastián-Tomás et al. (2022) emphasized the value of the WSES classification system in guiding treatment decisions, noting that stage 0 and 1A cases often respond well to outpatient conservative management, whereas stage 2A may require drainage or emergency surgery[36]. Furthermore, Almalki et al. (2020) identified a positive family history as a significant factor linked to recurrence and complicated recurrences following conservative management, underscoring the importance of

individualized long-term surgical planning. Golda et al. (2018) reported better outcomes with surgical techniques such as primary anastomosis compared to Hartmann's procedure, particularly in carefully selected patients[34].

3.4. Classification Systems

The most common classifications of diverticulitis include the American Association for the Surgery of Trauma (AAST), the World Society of Emergency Surgery (WSES), and the modified Hinchey classification, with the latter being the oldest and most widely used. The impact of the WSES, modified Hinchey, and AAST classification categories on clinical decision-making and individualized treatment strategies in acute left-sided colonic diverticulitis is shown in Figure 2. The WSES classification focuses on staging and is useful for deciding between outpatient and inpatient care. Sebastián-Tomás et al. (2022) have shown that those with WSES stages 0 and 1A disease have been effectively managed conservatively in outpatient settings, whereas those in stage 2A often require outpatient percutaneous drainage or emergency surgery due to larger abscesses and advanced inflammation [36]. Use of the modified Hinchey classification is useful in assessing perforation severity and determining who will benefit from urgent surgical management. In the Hinchey Ia group, the overall course was favorable for conservative treatment; however, Hinchey patients with elevated CRP, prolonged symptoms, vomiting, and ASA III/IV status were more closely monitored due to the risk of progression [41].

Figure 2. WSES, Modified Hinchey and AAST classifications [28].

WSES		Wasvary's Modified Hinchey		AAST	
0	Thickening of the wall, increased density of the pericolic fat	0	Mild, non-complicated Acute Colonic Diverticulitis	I	Local disease; confined to the organ; minimal abnormality
1a	Small pericolic air bubbles or some pericolic fluid without abscess	1A	Confined pericolic inflammation—phlegmon	II	Local disease; confined to the organ; severe abnormality
1b	Abscesses <4 cm (without distant free air)	1B	Confined pericolic abscess (within sigmoid mesocolon)	III	Beyond the organ; locally advanced only
2a	Abscess >4 cm (without distant free air)	2	Pelvic, distant intra-abdominal, or intraperitoneal abscess	IV	Beyond the organ; regional extension
2b	Distant air (>5 cm from inflamed bowel segment)				
3	Diffuse fluid without distant free diffuse air	3	Generalized purulent peritonitis; free air	V	Beyond the organ; widespread involvement
4	Diffuse fluid with distant free diffuse air	4	Fecal peritonitis		

The AAST classification system classifies the severity of the injury and increases the prediction of the treatment needs. A higher AAST and higher modified Hinchey grade were found to be significantly correlated with higher rates of complications, reintervention, mortality, and longer length of hospital stay. Furthermore, Almalki et al. (2020) noted that the number of recurrences was substantially higher in those with a positive family history after conservative management, urging risk-stratified long-term management that goes beyond the classification staging [37]. The Hinchey classification, first proposed in 1978, was initially designed for intraoperative assessment of patients with perforated diverticulitis. It categorized the disease into four stages: I – pericolic abscess, II – pelvic, intra-abdominal, or retroperitoneal abscess, III – generalized purulent peritonitis, and IV – fecal peritonitis. Trying to solve the limitations of the Hinchey system, modern versions of anterior classifications have been created, incorporating radiologic aspects. The AAST classification is an anatomic based grading scale based primarily on CT findings and allows for preoperative stratification. It ranges from Grade I (mild, confined disease) to Grade V (generalized fecal peritonitis), providing a useful risk stratification tool that correlates well with surgical outcomes. Similarly, the WSES classification system was developed by the World Society of Emergency Surgery as a CT-driven tool. It simplifies the evaluation of acute left-sided colonic diverticulitis (ALCD) into uncomplicated and complicated forms. Complicated stages of diverticulitis are subdivided based on features that include abscess size and presence of distant air. It works flexibility in a wide range of clinical indications because it can be modified for both CT

and ultrasound. The WSES classification has been proven to be clinically useful for guiding clinical decisions, especially when deciding the level of intervention and for determining eligibility in outpatient management. When all three systems were analyzed comparatively, modified Hinchey, AAST, and WSES have demonstrated similar effectiveness in predicting adverse effects such as complications, need for intervention, and mortality rates [20, 36]

3.5. Quality of Life After Diverticulitis

The trials AVOD and DIABOLO have the potential to significantly question the unnecessary use of antibiotics in uncomplicated diverticulitis. The same results at five- and ten-year follow-up in rates of recurrence, complicating events, and surgical intervention support efforts to promote antibiotic stewardship. It may be a paradigm shift when it comes to the treatment of diverticulitis, with the potential of diminishing the impacts of antibiotic resistance and Clostridioides difficile infection, as well as the risks for healthcare expenses. But it will take care in choosing patients and monitoring them closely to use these conclusions, especially of course, since it is known that complications do occur when these approaches are applied. Specific risk factors for complications (ASA classification ≥3, symptom duration of >5 days, vomiting, and CRP level of >140 mg/L) and recurrence (positive family history) allow for the use of more patient-centred strategies in the management of diverticulitis. The results indicate that risk stratification should be applied in immediate management and long-term surveillance strategies. A strong family history/recurrence risk relationship is particularly notable, whereby the more closely related to the affected individual, the more likely they are to be affected. These imply further potential sites of pathogenesis in diverticulitis, genetic or environmental, that need to be examined. Long-term outcomes of patients with uncomplicated diverticulitis are good, but evaluation is important when symptoms are ongoing and in those who consider elective surgery for those with recurrent or chronic diverticulitis. Evaluation of classification systems showed that they were equally effective in identifying complications, and the AAST and WSES classifications tended to be more statistically accurate. The comparative analysis of the three classification systems (AAST, WSES and modified Hinchey) showed that they resulted in a similar effectiveness in predicting complications, WSES and AAST in particular being more statistically accurate. Both AAST and modified Hinchey classifications had superior accuracy to foretell the necessity of surgery as well as major complications. Imminent refinement of classification tools to better address anatomic severity and functional outcomes/patient-reported outcomes may improve the clinical levels of value of the

instrument and help to correlate treatment with long-term outcomes. Therefore, a multidisciplinary approach by gastroenterologists, surgeons, primary care physicians and mental health professionals might be helpful in the treatment of patients with complex and/or chronic symptoms.

4. Discussion

Although acute diverticulitis is a frequently encountered pathology, treatment has seen only minor revisions in the past decade. When judging how to treat acute diverticulitis, the benefits must be weighed against the notably higher recurrence rate and the fact that many patients eventually undergo sigmoid resection during follow-up. This indicates that while laparoscopic lavage may postpone definitive surgery and avoid temporary stomas, it should not be regarded as a permanent solution for all cases of perforated purulent diverticulitis. The use of laparoscopic lavage, as discussed by Gregori et al. (2019), suggests that experienced surgeons should reserve this procedure for Hinchey III peritonitis cases, with reliable CT monitoring [42]. When comparing different laparoscopic techniques—such as single port, multiport, or natural orifice specimen extraction (NOSE)—the evidence presents a complex picture. There is no clear consensus on whether single or multiport laparoscopy offers operational advantages beyond improved cosmetic outcomes. According to Azhar et al. (2021), the choice between these techniques should be based on surgeon expertise and patient preferences for cosmesis rather than presumed clinical superiority [30]. Similarly, Milsom et al. (2022) found that NOSE colectomy provided significant benefits in postoperative pain management compared to conventional laparoscopic colectomy [31]. However, increased inflammation levels may indicate underlying tissue damage that remains unseen and problematic. Overall, while certain technical differences in laparoscopic procedures may offer specific advantages in particular contexts, they do not necessarily demonstrate overall superiority.

The evidence showcases a compelling case for a paradigm shift away from Hartmann's procedure and towards primary anastomosis in selected cases. The large multicenter study revealing higher complication rates and 30-day mortality with Hartmann's procedure is of particular concern. The findings suggest that many patients never achieve stoma reversal after HP, making primary anastomosis a potentially more favorable option. Hallam et al. (2018) mentioned that colorectal specialists more frequently choose to perform primary anastomosis than general surgeons, with better outcomes, including lower anastomotic dehiscence rates [43]. The tendency to perform Hartmann's procedures in the non-working hour interval and for higher-risk patients (ASA≥3,

qSOFA≥2) indicates that logistical factors and surgeon preference, rather than outcomes centered on patient well-being, may be dictating surgical decisions. Perrone et al. (2024) study emphasizes the need for advanced training in emergency colorectal surgery and standardized protocols to optimize patient assessment and selection for primary anastomosis versus Hartmann's procedure [44]. The DIRECT trial provides compelling evidence supporting elective surgery for QoL improvement in carefully selected patients. The significantly better QoL scores post- surgery compared to conservative management represent meaningful clinical improvements. Nevertheless, the negative outcomes, like anastomosis leak rate, should not be overlooked in patient selection and in optimization of the operative technique during surgery to reduce the impact of those drawbacks on QoL and symptom relief [38]. The guidelines by ASCRS and ESCP are both based on the same basic idea of "individualized decision making" for elective surgery, but there are significant differences in the recommendations when considering management after a complicated diverticulitis with the presence of an abscess. The ESCP guideline development process involved extensive discussion of this topic, acknowledging recurrence rates of 25-30% but emphasizing that routine resection would subject the majority of patients to unnecessary surgery [41, 45].

These findings are similar when compared with other studies in terms of recurrence rates, complications, and surgery necessity at long-term follow up and support efforts to reduce antibiotics. Zullo et al. (2019) published an important paradigm shift in the treatment of diverticulitis which also decreases the risk of antibiotic resistance, Clostridioides difficile, and decreased healthcare costs [46]. However, applying these to patients is a challenge that must be approached with careful patient selection and monitoring, especially when considering complications associated with their use. Identification of certain risk factors for complications (ASA classification ≥3, symptom duration >5 days, vomiting, and raised levels of CRP of >140mg/L) and recurrence (positive family history) allows more patient-oriented approaches to the management of diverticulitis. The results of Peery et al. (2021) indicate that risk stratification should help informing both the short- and long-term management and surveillance strategies [47]. An important feature was the high family history/recurrence risk correlation, with an increasing number of relatives affected raising this risk. This indicates genetic and/or environmental causes behind the pathogenesis of diverticulitis which may need further study. Long-term QoL following uncomplicated diverticulitis is good, but when there are persistent signs or symptoms or recurrent or chronic disease, careful appraisal of each case is crucial, especially in the context of elective

surgery. The classification systems (AAST, WSES and Modified Hinchey) had comparable accuracy predicting complications. Daniels et al. highlighted the fact that both AAST and modified Hinchey classification were accurately used in predicting surgical necessity and major complications with better accuracy [32]. Refining classification tools to incorporate anatomic severity and long-term anatomic, as well as patient-reported, outcomes will improve their clinical usefulness and better match treatment with improved long-term outcomes. Therefore, a multi-disciplinary approach incorporating gastroenterologist(s), surgeon, primary care physician, and mental health specialist may be advantageous for patients with complex or refractory symptoms.

4.1 Limitations

There are several limitations in the review that should be considered when interpreting the results. The studies varied in study design, patient populations, operative techniques, follow-up duration, and outcome assessment, making direct comparisons between studies difficult. Although a number of RCTs and multicenter cohort studies were considered, a proportion were retrospective and observational, which can lead to selection bias and unmeasured confounding. There may also have been variation in definitions of 'recurrent' and 'complicated' diverticulitis and in the instruments used to assess quality of life, which could have contributed to inconsistent findings. Language and publication bias may have occurred in the review, as only full-text articles published in English were included. In addition, variations in health-care systems, surgeons' experience, and health-care facility characteristics between countries can reduce the generalizability of the results. Finally, because this is a narrative review, results could not be compared statistically, and pooling was not performed.

4.2 Recommendations

According to the results, large multicenter randomized controlled trials on all Hinchey classification stages comparing surgical and non-operative treatments systematically should be undertaken. Specific reporting systems that combine AAST, modified Hinchey, and WSES classification should be used throughout the institutional diverticulitis management research. Long-term follow-up studies with data from patients between two years' post-stoma creation are called for and needed to better examine recurrence rates, quality of life outcomes and rates of stoma reversal after both methods of management. Global development and validation of evidence-based antibiotic stewardship protocols for uncomplicated left-sided diverticulitis in a

variety of healthcare settings and patient populations should be developed. Patient-centred shared decision-making programs that allow for complex decisions regarding surgical or conservative management should be included in institutional guidelines based on disease severity and profile of comorbidities. A systematic study should be conducted focusing on the role of minimally invasive laparoscopic techniques (laparoscopic lavage, single incision techniques), in particular in complicated diverticulitis presentations. There should be comparative cost-effectiveness analyses of surgical and non-operative management pathways performed for diverticulitis cases in the absence of complications and those with complications. There are high-level consensus recommendations that guidelines from ESCP, ASCRS, and WSES need to be harmonized into a single platform for better evidence-based management of left-sided colonic diverticulitis.

5. Conclusions

The treatment of left-sided colonic diverticulitis has tended toward more personalized, evidence-based, and patient-centered considerations for the patient, rather than the traditional approach of operation whenever it can be avoided. The current literature has validated selective non-operative management of uncomplicated diverticulitis, such as the use of safe and appropriate alternative steps to antibiotics for clinically stable patients, and minimally invasive laparoscopic surgical techniques have been shown to enhance postoperative recovery, decrease pain, and improve quality of life for patients undergoing surgery for diverticulitis. Primary anastomosis is becoming the preferred surgical option over Hartmann's procedure in selected patients of low risk with emergency surgical management due to its lower incidence of permanent stoma, good functional recovery and decreased long-term morbidity. Hartmann's procedure is still relevant in hemodynamically unstable cases and complications such as significant comorbidities and/or severe peritonitis. In addition, classifications such as modified Hinchey, AAST, and WSES still have value in clinical practice, particularly for severity assessment, operative strategy, risk stratification, and prediction of operative intervention and complications.

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Informed Consent Statement: Regarding the fact that it did not involve gathering data directly from patients we did not need informed consent papers.

Data is available upon request: Data is not associated with the specific report.

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References

1. Brown, R.F., et al., *Diverticulitis: a review.* JAMA, 2025. **334**(13): p. 1180-1191.
2. Qaseem, A., et al., *Diagnosis and management of acute left-sided colonic diverticulitis: a clinical guideline from the American College of Physicians.* Annals of internal medicine, 2022. **175**(3): p. 399-415.
3. Long, B., J. Werner, and M. Gottlieb, *Emergency medicine updates: Acute diverticulitis.* The American journal of emergency medicine, 2024. **76**: p. 1-6.
4. Williams, S., et al., *Diverticular disease: update on pathophysiology, classification and management.* Frontline Gastroenterology, 2024. **15**(1): p. 50-58.
5. Kumar, R.R. and J.A. Michel-Ruddy, *Diverticular disease.* Appendix, Colon, and Rectum, 2024: p. 143.
6. Hanna, M.H. and A.M. Kaiser, *Update on the management of sigmoid diverticulitis.* World journal of gastroenterology, 2021. **27**(9): p. 760.
7. Tutan, M.B. and D. Tutan, *A bibliometric analysis of diverticulitis: global trends and future directions.* Updates in Surgery, 2026: p. 1-10.
8. Strate, L.L. and A.M. Morris, *Epidemiology, pathophysiology, and treatment of diverticulitis.* Gastroenterology, 2019. **156**(5): p. 1282-1298. e1.
9. Humphrey, H.N., et al., *Genetic, epigenetic and environmental factors in diverticular disease: systematic review.* BJS open, 2024. **8**(3): p. zrae032.

10. Tursi, A., et al., *Colonic diverticular disease.* Nature Reviews Disease Primers, 2020. **6**(1): p. 20.
11. Gunby, S.A. and L.L. Strate, *Acute colonic diverticulitis.* Annals of internal medicine, 2024. **177**(3): p. ITC33-ITC48.
12. Tiralongo, F., et al., *Acute colonic diverticulitis: CT findings, classifications, and a proposal of a structured reporting template.* Diagnostics, 2023. **13**(24): p. 3628.
13. Covino, M., et al., *Development and validation of predictive assessment of complicated diverticulitis score.* Journal of Personalized Medicine, 2021. **11**(2): p. 80.
14. Inaba, K., et al., *Evidence-based, cost-effective management of acute diverticulitis. An algorithm of the Journal of Trauma and Acute Care Surgery emergency general surgery algorithms work group.* Journal of Trauma and Acute Care Surgery, 2025. **99**(1): p. 24-28.
15. Tochigi, T., et al., *Management of complicated diverticulitis of the colon.* Annals of gastroenterological surgery, 2018. **2**(1): p. 22-27.
16. Argiolas, V., L. Zorcolo, and A. Restivo, *Principles of surgical treatment*, in *Colorectal Imaging*. 2025, Elsevier. p. 17-36.
17. Van Dijk, S., et al., *Conservative treatment of acute colonic diverticulitis.* Current Infectious Disease Reports, 2017. **19**(11): p. 44.
18. Miller, A.S., et al., *The Association of Coloproctology of Great Britain and Ireland consensus guidelines in emergency colorectal surgery.* Colorectal Disease, 2021. **23**(2): p. 476-547.
19. Kumano, K., et al., *A comparative study of stoma-related complications from diverting loop ileostomy or colostomy after colorectal surgery.* Langenbeck's Archives of Surgery, 2023. **408**(1): p. 139.
20. Cirocchi, R., et al., *Perforated sigmoid diverticulitis: Hartmann's procedure or resection with primary anastomosis—a systematic review and meta-analysis of randomised control trials.* Techniques in coloproctology, 2018. **22**(10): p. 743-753.
21. Isacson, D., et al., *Long-term follow-up of the AVOD randomized trial of antibiotic avoidance in uncomplicated diverticulitis.* Journal of British Surgery, 2019. **106**(11): p. 1542-1548.
22. Balk, E.M., et al., *Diagnostic imaging and medical management of acute left-sided colonic diverticulitis: a systematic review.* Annals of internal medicine, 2022. **175**(3): p. 379-387.

23. Khan, R.M.A., S. Hajibandeh, and S. Hajibandeh, *Early elective versus delayed elective surgery in acute recurrent diverticulitis: a systematic review and meta-analysis.* International Journal of Surgery, 2017. **46**: p. 92-101.
24. Horesh, N., et al., *Meta-analysis of randomized clinical trials on long-term outcomes of surgical treatment of perforated diverticulitis*. 2023, LWW. p. e966-e972.
25. Ebersole, J., et al., *Comparison of American Association for the Surgery of Trauma grading scale with modified Hinchey classification in acute colonic diverticulitis: a pilot study.* Journal of Trauma and Acute Care Surgery, 2020. **88**(6): p. 770-775.
26. Lin, M. and S.R. Raman, *Evaluation of quality of life and surgical outcomes for treatment of diverticular disease.* Clinics in colon and rectal surgery, 2018. **31**(04): p. 251-257.
27. Peery, A.F., *Management of colonic diverticulitis.* bmj, 2021. **372**.
28. Cremonini, C., et al., *What are the differences between the three most used classifications for acute colonic diverticulitis? A comparative multicenter study.* Journal of Trauma and Acute Care Surgery, 2024. **96**(2): p. 326-331.
29. Sağıroğlu, J., et al., *Factors predicting severity level, progression and recurrence risk of acute left colonic diverticulitis in Turkey: A multicenter study.* Turkish Journal of Trauma and Emergency Surgery, 2021. **27**(1): p. 132.
30. Azhar, N., et al., *Laparoscopic lavage vs primary resection for acute perforated diverticulitis: long-term outcomes from the Scandinavian Diverticulitis (SCANDIV) randomized clinical trial.* JAMA surgery, 2021. **156**(2): p. 121-128.
31. Milsom, J.W., et al., *A pilot randomized controlled trial comparing THUNDERBEAT to the Maryland LigaSure energy device in laparoscopic left colon surgery.* Surgical Endoscopy, 2022. **36**(6): p. 4265-4274.
32. Daniels, L., et al., *Randomized clinical trial of observational versus antibiotic treatment for a first episode of CT-proven uncomplicated acute diverticulitis.* Journal of British Surgery, 2017. **104**(1): p. 52-61.
33. Van Dijk, S., et al., *Long-term effects of omitting antibiotics in uncomplicated acute diverticulitis.* Official journal of the American College of Gastroenterology| ACG, 2018. **113**(7): p. 1045-1052.
34. Golda, T., et al., *From colorectal to general surgeon in the management of left colonic perforation: a cohort study.* International Journal of Surgery, 2018. **55**: p. 175-181.

35. Patel, S.V., et al., *Evidence-based reviews in surgery long-term outcome of surgery versus conservative management for recurrent and ongoing complaints after an episode of diverticulitis: five-year follow-up results of a multicenter randomized controlled trial (DIRECT-Trial).* Annals of Surgery, 2020. **272**(2): p. 284-287.
36. Sebastián-Tomás, J.C., et al., *How to strengthen the management of acute diverticulitis: the utility of the WSES classification—a prospective single-center observational study.* European Journal of Trauma and Emergency Surgery, 2022. **48**(5): p. 4283-4291.
37. Almalki, T., et al., *Family history is associated with recurrent diverticulitis after an episode of diverticulitis managed nonoperatively.* Diseases of the Colon & Rectum, 2020. **63**(7): p. 944-954.
38. van de Wall, B.J., et al., *Surgery versus conservative management for recurrent and ongoing left-sided diverticulitis (DIRECT trial): an open-label, multicentre, randomised controlled trial.* The Lancet Gastroenterology & Hepatology, 2017. **2**(1): p. 13-22.
39. Rottier, S.J., et al., *Complicated disease course in initially computed tomography-proven uncomplicated acute diverticulitis.* Surgical Infections, 2019. **20**(6): p. 453-459.
40. Wolthuis, A., et al., *Randomized clinical trial of laparoscopic colectomy with or without natural-orifice specimen extraction.* Journal of British Surgery, 2015. **102**(6): p. 630-637.
41. Schultz, J., et al., *European Society of Coloproctology: guidelines for the management of diverticular disease of the colon.* Colorectal Disease, 2020. **22**: p. 5-28.
42. Gregori, M., et al., *Laparoscopic lavage and drainage for Hinchey III diverticulitis: review of technical aspects.* Updates in surgery, 2019. **71**(2): p. 237-246.
43. Hallam, S., B. Mothe, and R. Tirumulaju, *Hartmann's procedure, reversal and rate of stoma-free survival.* The Annals of The Royal College of Surgeons of England, 2018(0): p. 301-307.
44. Perrone, G., et al., *Goodbye Hartmann trial: a prospective, international, multicenter, observational study on the current use of a surgical procedure developed a century ago.* World Journal of Emergency Surgery, 2024. **19**(1): p. 14.
45. Hall, J., et al., *The American Society of Colon and Rectal Surgeons clinical practice guidelines for the treatment of left-sided colonic diverticulitis.* Diseases of the Colon & Rectum, 2020. **63**(6): p. 728-747.

46. Zullo, A., et al., *Paradigm shift: the Copernican revolution in diverticular disease.* Annals of Gastroenterology, 2019. **32**(6): p. 541.
47. Peery, A.F., A. Shaukat, and L.L. Strate, *AGA clinical practice update on medical management of colonic diverticulitis: expert review.* Gastroenterology, 2021. **160**(3): p. 906-911. e1.