The Current Surgical Management of Complicated Diverticulitis: An Update on right-sided and left-sided diverticulitis.

**Abstract**

Acute diverticulitis is a condition that can be divided into left-sided diverticulitis and right-sided diverticulitis. Left-sided diverticulitis is seen in the sigmoid colon and accounts for most cases of diverticulitis in the West. Right-sided diverticulitis is seen in the ascending colon and is predominantly seen in Asia. It can be divided into uncomplicated and complicated diverticulitis. The surgical management of left-sided complicated diverticulitis involves Hartmann’s procedure or sigmoid resection with anastomosis. Laparoscopic lavage is a bridging procedure that is used to stabilize some patients with complicated diverticulitis. Right-sided complicated diverticulitis is treated with right hemicolectomy or ileocecal resection. In this review, we will look at the surgical management of complicated right and left-sided diverticulitis.

Keywords- “Colonic diverticulitis”,” Laparoscopic lavage”, “left-sided colitis”,” Hartmann’s procedure”,” Right hemicolectomy”,” Right-sided diverticulitis”, and “Sigmoid colectomy”.

**Introduction**

Diverticular disease is a common gastrointestinal disorder that is commonly seen in adults and is characterized by a sac-like protrusion of the colonic wall. It is commonly seen in adults above the age of 50 years, and the sigmoid colon is the most common site for patients in the Western population, while the ascending colon is the most common site for patients in Asia. The incidence between males and females is equal, and sigmoid diverticulitis accounts for 60% to 70% of cases of diverticulitis, and ascending colon diverticulitis accounts for 5% to 15% of cases. Diverticular disease can be divided into uncomplicated and complicated diverticulitis(Binda et al., 2019; Hanna & Kaiser, 2021; Kishnani et al., 2022). Some of the risk factors for diverticulitis include an increase in age, male sex, obesity, a diet that is low in fiber and high in fat, and immunosuppression. The clinical presentation, like left-sided abdominal pain, and the presence of leukocytosis are non-specific. Imaging in the form of computerized tomography and ultrasound is used to confirm the diagnosis(Peery, 2021).

Right-sided colonic diverticulitis is commonly seen in younger patients, and the clinical presentation is abdominal pain over the right iliac fossa. It is usually confused with acute appendicitis. The cecum and ascending colon are the most common sites for right-sided colonic diverticulitis. Computerized tomography is usually used to confirm the diagnosis, as blood investigations may only reveal the presence of leukocytosis(Ferrara et al., 2016). The Hinchey classification has staged acute diverticulitis into stage 1, which involves a localized abscess; stage 2, which involves a pelvic, intra-abdominal or retroperitoneal abscess; stage 3, which involves purulent generalized peritonitis; and stage 4, which involves feculent generalized peritonitis. The modified Hinchey classification further subdivides stage 1 into 1a, characterized by confined pericolic inflammation/phlegmon, and 1b, characterized by a confined pericolic abscess within the sigmoid mesocolon. This is used for both right and left sided diverticulitis. (Hawkins et al., 2020).

The Management of left-sided diverticulitis can be divided into non-operative treatment with antibiotics and analgesics for uncomplicated diverticulitis and surgical resection in the form of Hartmann’s procedure or sigmoid resection and anastomosis with a covering ileostomy for complicated diverticulitis. Laparoscopic lavage is another procedure that is performed in patients with complicated diverticulitis (Hinchey 3) to stabilize these patients and perform an elective sigmoid resection later(Collins & Winter, 2014).The treatment of right-sided colonic diverticulitis can also be divided into complicated and uncomplicated diverticulitis, with non-operative treatment being used for uncomplicated diverticulitis. Complicated right-sided diverticulitis involves the use of surgical intervention in the form of right hemicolectomy or ileocecal resection(Lee, 2010; Schultz et al., 2025).

The World Society of Emergency Surgeons, in its guidelines for the management of acute colonic diverticulitis, has recommended that Hartmann’s procedure be performed in unstable, complicated left-sided diverticulitis and sigmoid resection with anastomosis with a covering ileostomy be performed for stable cases. Laparoscopic lavage should only be performed in selected cases. There are no specific recommendations for managing right-sided colonic diverticulitis with the same principles of treatment as for left-sided colonic diverticulitis(Sartelli et al., 2016, 2020). The American Society of Colon and Rectal Surgeons Clinical Practice Guidelines for the management of left-sided colonic diverticulitis have also come out with similar forms of management for both uncomplicated and complicated diverticulitis(Hall et al., 2020). The European Association of Emergency Surgeons(EAES) and the Society of American Gastroenterological and Endoscopic Surgeons(SAGES), in their consensus for the management of acute diverticulitis, have also come out with the same recommendations(Francis et al., 2019).

The surgical treatment of left-sided colonic diverticulitis has undergone a gradual transition. Hartmann’s procedure continues to be the predominant emergency surgical intervention. However, sigmoid resection and anastomosis with a covering ileostomy are increasingly recognized as a viable option for the emergency treatment of left-sided colonic diverticulitis. The surgical management of right-sided diverticulitis is devoid of any guidelines, with the choice of surgical procedure being decided by the treating surgeon.

**Method**

This review explores the surgical management strategies for left-sided colonic diverticulitis and right-sided diverticulitis. We also look at the role of laparoscopic lavage for the management of complicated diverticulitis. A comprehensive literature review was conducted using PUBMED, the Cochrane database of clinical reviews, and Google Scholar, focusing on clinical trials, observational and cohort studies, systematic reviews, and meta-analyses from 1980 to 2025. The following keywords were utilized: “Sigmoid diverticulitis,” “Right-sided diverticulitis,” “Colonic diverticulitis,” “Hartmann’s procedure,” “Sigmoid colectomy,” “Laparoscopic lavage,” “right hemicolectomy, “and “left-sided diverticulitis.” 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, commentaries, and editorials were excluded. The study included adult male and female patients. Pediatric patients were not included in this review.

**Table 1- Comparison of Hinchey and Modified Hinchey classification**

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| **Hinchey Classification** | **Modified Hinchey classification** |
| Stage 1-abscess less than 4cm | Stage 1a-confined pericolic inflammation.  Stage 1b-confined pericolic abscess less than 4cm, from the inflammation |
| Stage 2-abscess more than 4cm | 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 |

**The surgical management of left-sided complicated diverticulitis**

The surgical management of acute left–sided complicated diverticulitis can be divided into Hartmann’s procedure or sigmoid resection with anastomosis with a covering ileostomy. Hartmann’s procedure is the most common procedure that is performed in the emergency setting, with sigmoid resection and anastomosis being performed if the expertise is available(Horesh et al., 2016). Hartmann’s procedure is often associated with increased morbidity and mortality, with the non-reversal of the stoma, and up to 50% of patients ultimately remain with a permanent stoma(Facile et al., 2015; Nally & Kavanagh, 2019). Sigmoid resection with anastomosis with a covering ileostomy is associated with similar morbidity and mortality, but the rate of closure of stoma is higher than Hartmann’s procedure, and it is increasingly being performed for complicated left-sided diverticulitis(Meara & Alexander, 2018). Despite the advantages of performing a sigmoid resection with anastomosis with a covering ileostomy, the Hartmann’s procedure continues to be the most common surgical procedure for complicated left-sided diverticulitis(Khan & Hawkins, 2021).

A systematic review and meta-analysis comparing sigmoid resection and anastomosis with Hartmann’s procedure was conducted by Ryan et al. Twelve studies with 918 patients were included in this study, and the patients who underwent sigmoid resection and anastomosis were associated with reduced morbidity, mortality, and a better stoma reversal rate(Ryan et al., 2020). Another systematic review and meta-analysis, which compared sigmoid resection and anastomosis with Hartmann’s procedure for perforated diverticulitis, was conducted by Gachabayov et al. A total of 1016 patients were included in this study, and the morbidity and mortality were also lower in the sigmoid resection and anastomosis, as well as the stoma reversal rates(Gachabayov et al., 2018). Another systematic review and meta-analysis on perforated diverticulitis that was conducted by Shaban et al also concluded the same(Shaban et al., 2018). A systematic review and meta-analysis of randomized control trials comparing sigmoid resection and anastomosis and Hartmann’s procedure was conducted by Cirocchi et al. They concluded that both surgical procedures were equal in terms of outcomes and could not conclude which was the best surgical procedure(Cirocchi et al., 2018).

Bridoux et al. conducted a prospective multicenter randomized trial (DIVERTI) to assess Hartmann’s procedure with primary anastomosis for perforated diverticulitis. A total of 102 patients were included, and there was no significant difference in morbidity and mortality between the groups. Still, the stoma reversal rate was better in the primary anastomosis group(Bridoux et al., 2017). The long-term outcomes from this prospective multicenter randomized trial were conducted by Loire et al, with 78 out of the 102 patients being followed up for 9 years, and primary resection and anastomosis were associated with reduced overall complications and the need for reoperation(Loire et al., 2021).

**Table 2- Comparison of complication rates between Hartmann’s procedure and Primary Anastomosis, as mentioned in different studies**

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| **Study** | **Study type** | **Year** | **N=numbers** | **Hartmann’s procedure complication rate (%).** | **Primary Anastomosis complication rate (%)** |
| Bridoux et al | Randomized control trial | 2017 | 102 | 39.2% | 44% |
| Loire et al | Prospective study | 2021 | 78 | 30% | 23.7% |
| Facile et al | Retrospective study | 2020 | 131 | 30.3% | 9.2% |

**Laparoscopy and laparoscopic lavage for complicated left-sided diverticulitis**

Laparoscopic lavage for complicated left–sided diverticulitis is used for purulent perforated diverticulitis (Hinchey 3) and it involves drainage of all purulent material, followed by an abdominal wash-out and placement of a drain. This procedure is used to stabilize these patients and allow elective resection to be performed later(Kaushik et al., 2016; Kiely et al., 2021; Marshall et al., 2017; McDermott et al., 2014). Laparoscopic lavage is not recommended for the management of complicated diverticulitis due to the high recurrence rate, the inability to identify a sealed perforation, and the risk of missing a sigmoid malignancy(You et al., 2019).

A systematic review and meta-analysis comparing laparoscopic lavage with surgical resection in the management of acute diverticulitis with peritonitis was conducted by Cirocchi et al. There were no differences regarding the mortality between the groups, but laparoscopic lavage was associated with an increased intra-abdominal abscess rate(Cirocchi et al., 2017). Another systematic review and meta-analysis comparing laparoscopic lavage with surgical resection for acute perforated sigmoid diverticulitis was conducted by Shaikh et al. A total of 372 patients were included in this study, and laparoscopic lavage was associated with a higher intra-abdominal abscess rate and reintervention rate, although the operative time was reduced. There were no significant differences in mortality between the groups(Shaikh et al., 2017).

The Laparoscopic peritoneal lavage or sigmoidectomy for perforated diverticulitis with purulent peritonitis (LOLA) multicenter randomized trial was conducted in forty-two hospitals in 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 (Vennix et al., 2015). 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(Hoek et al., 2022).

The Scandinavian Diverticulitis trial (SCANDIV) was a multicenter randomized controlled trial that was conducted in multiple hospitals in Norway and Sweden. A total of 199 patients were randomized, of whom 101 underwent laparoscopic lavage and 98 colonic resections. The one-year results showed that there was no significant difference in mortality between the groups, but laparoscopic lavage was associated with deeper surgical site infections and reoperation rates when compared to the surgical resection group(Schultz et al., 2017). The follow-up of these patients at three years revealed that there was not much difference with regards to the major complication rates, but the recurrence rate was 21% in the lavage group and 4% in the resection group. This trial showed that laparoscopic lavage was associated with a higher recurrence rate (Azhar et al., 2021). Laparoscopic lavage should be used in selected patients with grade three Hinchey classification, with its aim as a bridge to definitive therapy later. The presentation of the patient and the degree of sepsis are indicators for failure of therapy, and these patients would require surgical intervention(Biffl et al., 2017).

Laparoscopic surgical options are available with the sigmoid resection and anastomosis or the Hartmann’s procedure, which can be performed laparoscopically. These procedures are performed in specific high-volume centers and are done for elective sigmoid resection. The advantages of the laparoscopic method are the reduced morbidity, analgesia usage, and early ambulation, but the operative time is increased, and hence they are not routinely recommended for the surgical management of complicated diverticulitis(Desai et al., 2018; Mbadiwe et al., 2013; Papagrigoriadis & Charalampopoulos, 2025).

**Damage control surgery for complicated left-sided diverticulitis**

Damage control surgery is a multistep procedure that is used for some patients with complicated left-sided diverticular disease who are hemodynamically unstable. It involves the resection of the perforated colon, stapled-off stumps, and peritoneal washout. The abdomen is temporarily closed or left open with closed suction drainage, and control of sepsis and fluid resuscitation is performed in the intensive care unit for 24 to 48 hours. The patient is brought back to the operating theatre to perform either an anastomosis or stoma formation(Cirocchi et al., 2014, 2022). Sohn et al analyzed damage control surgery for the treatment of perforated diverticulitis with generalized peritonitis, and they found that it was safe and a reduced morbidity rate(Sohn et al., 2016).

A systematic review and meta-analysis were conducted by Cirocchi et al on the role of damage control surgery in treating perforated colonic diverticulitis. Nine studies with 318 patients were included in this study. Hinchey 3 was the most common category at 68.3% and Hinchey 4 was 28.9%. Resection with primary anastomosis was achieved in 62.1%, the major anastomotic leak rate was 4.7%, and the mortality rate was 9.2%. This study showed that damage control surgery was feasible in complicated diverticular disease in hemodynamically unstable patients, but further studies were required to evaluate its effectiveness(Cirocchi et al., 2021).

**The Surgical Management of Complicated Right-Sided Colonic Diverticulitis**

Right-sided colonic diverticulitis is predominantly seen in the Asian population, with an incidence of 70% to 80%, while it is rarely seen in the Western population with an incidence of 5% to 20%. The diagnosis is usually confirmed by ultrasound and computerized tomography. There are no specific guidelines for managing right-sided colonic diverticulitis, and it follows the principles of management of left-sided colonic diverticulitis. The management of uncomplicated right-sided colonic diverticulitis is non-operative treatment, and complicated right-sided colonic diverticulitis is managed by surgical resection. Right hemicolectomy or an ileocecal resection is the most common operation that is performed for patients with diffuse peritonitis, while a diverticulectomy is done for patients with localized peritonitis(Epifani et al., 2021; Lauricella et al., 2024; Saad & Saikaly, 2021).

The operative procedures that were performed for right-sided colonic diverticulitis were reviewed by Hildebrand et al. Right hemicolectomy and ileocecal resection were the operations that were performed for complicated right-sided colonic diverticulitis, and the post-operative morbidity and mortality were similar between both types of operations. Right hemicolectomy was the preferred type of operation(Hildebrand et al., 2007). A review of the surgical outcomes from patients who had undergone a colectomy for right-sided colonic diverticulitis was conducted by Schlussel et al. The overall morbidity and mortality were similar between both open and laparoscopic procedures, but postoperative complications were more common in the open procedure(Schlussel et al., 2016). The laparoscopic approach is also feasible for the surgical management of complicated right-sided diverticulitis, as it is associated with reduced morbidity, mortality, and reduced use of analgesia, but the operative time is longer when compared to the open approach(Kwon et al., 2012).

The effect of emergency surgery was compared for right and left-sided colonic diverticulitis by Tsang et al. A total of 360 patients were included in this study, of which 218 had right-sided diverticulitis and 142 had left-sided diverticulitis. The operative morbidity and mortality were higher in patients with left-sided diverticulitis when compared to right-sided diverticulitis(Tsang et al., 2021). A similar retrospective study that looked at the outcomes of left and right complicated colonic diverticulitis also concluded that right-sided diverticulitis was associated with better outcomes when compared to left-sided diverticulitis(Chung et al., 2016; Nguyen et al., 2025).

**Conclusion**

The surgical management of complicated left–sided colonic diverticulitis can be divided into Hartmann’s procedure or sigmoid resection followed by anastomosis with a covering ileostomy. Hartmann’s procedure is still the most common surgical procedure that is performed for complicated left-sided diverticulitis, but sigmoid resection with anastomosis is slowly emerging as a viable option for the management of complicated left-sided diverticulitis due to its higher stoma reversal rate. Laparoscopic lavage should only be used for selected patients due to the high risk of recurrence and reintervention. Damage control surgery is a viable option for patients with complicated left-sided colonic diverticulitis who are hemodynamically unstable, but it requires good intensive care expertise, and this limits its use.

The surgical management of complicated right-sided colonic diverticulitis involves performing a right hemicolectomy or an ileo-cecal resection, and the surgical outcomes are good with a reduced morbidity and mortality. The recurrence rate is also low in right-sided diverticulitis. Due to the absence of any proper guidelines, the surgical management of complicated right–sided colonic diverticulitis is decided by the treating surgeon.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

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