Emergency Surgery in Acute Diverticulitis: A Systematic Review

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BACKGROUND: Acute diverticulitis is a common disease with public health significance. Many studies with a high level of evidence have been published recently on the surgical management of acute diverticulitis.

OBJECTIVE: The aim of this systematic review was to define the accurate surgical management of acute diverticulitis.

DATA SOURCES: Medline, Embase, and the Cochrane Library were sources used.

STUDY SELECTION: One reviewer conducted a systematic study with combinations of key words for the disease and the surgical procedure. Additional studies were searched in the reference lists of all included articles. The results of the systematic review were submitted to a working group composed of 13 practitioners. All of the conclusions were obtained by full consensus and validated by an external committee.

INTERVENTIONS: The interventions assessed were laparoscopic peritoneal lavage, primary resection with anastomosis with or without ileostomy, and the Hartmann procedure, with either a laparoscopic or an open approach.

MAIN OUTCOME MEASURES: Morbidity, mortality, long-term stoma rates, and quality of life were measured.

RESULTS: Seventy-one articles were included. Five guidelines were retrieved, along with 4 meta-analyses, 14 systematic reviews, and 5 randomized controlled trials that generated 8 publications, all with a low risk of bias, except for blinding. Laparoscopic peritoneal lavage showed concerning results of deep abscesses and

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unplanned reoperations. Studies on Hinchey III/IV diverticulitis showed similar morbidity and mortality. A reduced length of stay with Hartmann procedure compared with primary resection with anastomosis was reported in the short term, and in the long term, more definite stoma along with poorer quality of life was reported with Hartmann procedure. No high-quality data were found to support the laparoscopic approach.

LIMITATIONS: Trials specifically assessing Hinchey IV diverticulitis have not yet been completed.

CONCLUSIONS: High-quality studies showed that laparoscopic peritoneal lavage was associated with an increased morbidity and that Hartmann procedure was associated with poorer long-term outcomes than primary resection with anastomosis with ileostomy, but Hartmann procedure is still acceptable, especially in high-risk patients.

KEY WORDS: Colorectal surgery; Diverticulitis; Peritoneal lavage; Sigmoid colectomy.

Acute diverticulitis is common disease with major public health implications. Indeed, the prevalence of diverticulosis increases from 5% at 40 years of age to 60% at 80 years of age, and 20% of patients with diverticulosis will eventually present with acute diverticulitis.[1] In 20% of cases, acute diverticulitis is complicated by an abscess or perforation and may lead to surgery in an emergency setting. Until recently, publications on that matter lacked randomized controlled trials (RCTs) and meta-analyses, and the management of complicated diverticulitis has dramatically changed over time.[2]

The last French guidelines were published in 2006.[3] In Hinchey III diverticulitis, the choice between primary anastomosis with or without defunctioning ileostomy and the Hartmann procedure (HP) depended on patient location and general conditions, and in Hinchey IV diverticulitis, the HP was the gold standard. The question of laparoscopic peritoneal lavage (LPL) had not been addressed.

Since 2006, several publications presenting a high level of evidence have been published on acute diverticulitis, especially with regard to emergency surgery. The French Health High Authority therefore initiated an update of the guidelines, and this systematic review was conducted from this perspective. The primary objective of this systematic review was to compare the surgical options (LPL, primary anastomosis, and HP) for acute diverticulitis in terms of morbidity and mortality. The secondary objectives were to compare these emergency procedures in terms of long-term stoma rates and quality of life (QoL).

MATERIALS AND METHODS

The review was planned, conducted, and reported in adherence with Preferred Reporting Items for Systematic Reviews and Meta-Analyses standards of quality for reporting systematic reviews and meta-analyses.[4]

Study Identification

We sought to include all original studies dealing with emergency surgeries for diverticulitis, including case series, single cohort studies, and comparative studies, whether randomized or not. A strategy was designed (Appendix 1, Supplemental Digital Content 1, http://links.lww.com/DCR/A894) to search Medline, Embase, and the Cochrane Library using search terms (Medical Subject Headings terms and equivalent free-text terms) for the disease and the intervention. The beginning date cutoff used was January 2006 (ie, publication time of the previous French guidelines), and the last date of the search was July 31, 2017. Additional studies were searched on Web sites containing guidelines, Web sites of relevant learning societies (Appendix 2, Supplemental Digital Content 1, http://links.lww.com/DCR/A894), and in the reference lists of all included articles.

Exclusion Criteria

Editorial letters, technical notes, nonsystematic reviews, didactic notes, and non-English– or non-French–language publications were excluded. Studies including <10 patients were also excluded. Studies assessing right-sided diverticulitis were excluded.

Study Selection

One reviewer (L.B.-B.) screened all of the titles and selected studies based on titles and/or abstracts. Studies that met the defined inclusion criteria were selected for review. If it was not clear from the abstract whether a study fulfilled the inclusion criteria, the full article was reviewed.

The results of the systematic search were submitted to a working group, along with a conclusion proposal written by the reviewer, and then debated during a 1-day meeting. This working group included 1 French Health High Authority project manager and 13 practitioners. Conclusions were then submitted to 42 external individual reviewers using Delphi methodology, which consisted of an anonymous 1-round rating of each conclusion, using a 1 to 9 Likert scale. When conclusions did not reach >95% of 5 to 9 answers, they were rewritten by the working group during a second meeting, taking into account the reviewers comments.

Data Extraction

The following data were extracted: the type of emergency surgery performed, that is, open sigmoid resection with

colorectal anastomosis with or without protective stoma, open sigmoid resection with end colostomy (HP), LPL, laparoscopic sigmoid resection with colorectal anastomosis with or without protective stoma, or laparoscopic HP; the type of study, that is, guidelines, meta-analyses, systematic reviews, RCTs, non-RCTs, or cohort studies; and the end point(s) of the study, that is, the morbidity, mortality, stoma rates, length of hospital stay, QoL, recurrence, and costs.

Assessment of Methodologic Quality

The instructions given in the Cochrane Library[5,6] were followed for methodologic quality and bias assessment. Subsequently, the generation of the allocation sequence, the allocation concealment, the blinding, and follow-up were examined. Trials were considered to have a low risk of bias if the above 4 methodologic qualities were adequate. Because the study was a systematic review but not a meta-analysis, the heterogeneity of the studies was not determined.

RESULTS

Description of Studies

We identified 528 potentially relevant articles from the database research. We retrieved 246 articles for abstract screening and 145 articles for more detailed evaluation. From these, we identified 61 appropriate articles for systematic review and found 4 articles through the references of the retrieved articles. Finally, 65 articles were included in this review (Fig. 1). Five guidelines[7–11] were retrieved, along with 4 meta-analyses,[12–15] 14 systematic reviews,[1,16–28] and 5 RCTs,[29–33] generating 8 publications.[29–36] All of the prospective studies were valid in terms of follow-up quality, and all of the RCTs presented with the following items of validity: randomization with allocation sequence and allocation concealment and quality of follow-up. Hence, all were deemed to have a low risk of bias except for blinding.

Laparoscopic Peritoneal Lavage

LPL is a conservative alternative to urgent resection in Hinchey III diverticulitis, as well as Hinchey I and II diverticulitis, after failure of medical treatment[23,37] to avoid stoma creation or even elective sigmoid colectomy, which is performed in 38% to 51% of cases after LPL.[21,23] The first nonrandomized series showed promising results,[31–41] namely a reduced length of stay (LOS) and similar morbidity. Before 2015, 6 systematic reviews and no meta-analyses were published.[21–25,27] There were no RCTs, and most series were retrospective.

Since 2015, 3 RCTs[29–31] and 2 meta-analyses[14,15] have been published (Table 1). The LADIES trial (LOLA group) compared LPL with urgent sigmoid colectomy (USC),

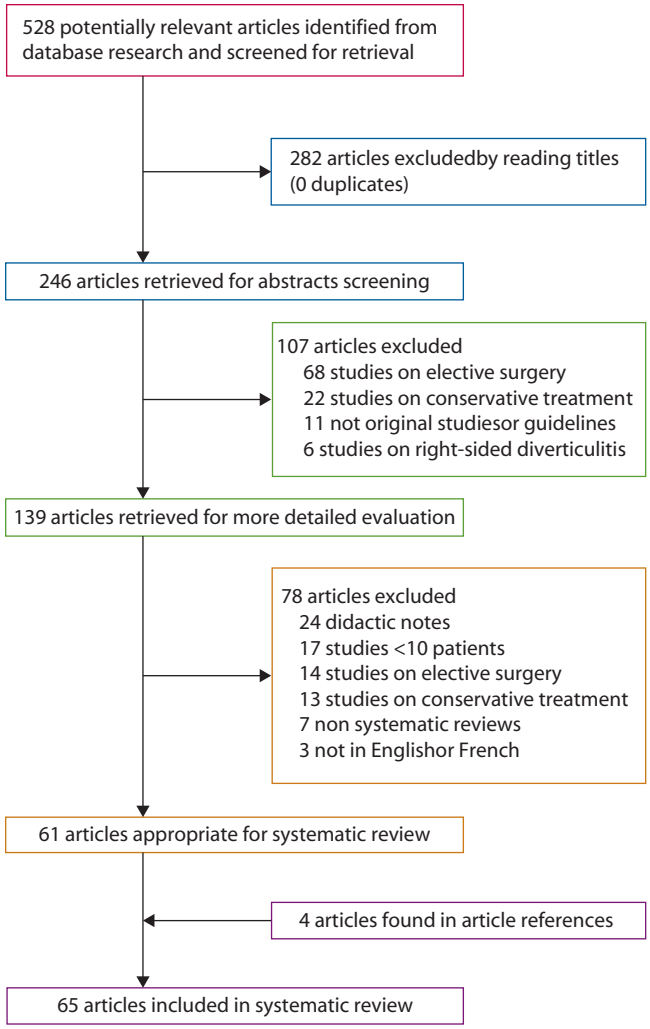

FIGURE 1. Study flow for emergency surgery for the treatment of acute diverticulitis.

either by the HP or primary resection with anastomosis (PRA) with or without defunctioning ileostomy (PRA±I), in Hinchey III diverticulitis.[29] The primary end point was a composite criterion combining major morbidity and 1-year mortality. This trial was prematurely terminated because of an increased rate of events in the LPL group after the inclusion of 90 patients in 42 centers: namely, the 30-day morbidity (LPL 39% vs 19%; $p = 0.043$) and the reoperation and abscess drainage rates (39% vs 5% ($p = 0.011$) and 20% versus 0% ($p = 0.0027$)). However, the 30-day mortality was comparable, as were the primary end point (OR = 1.28 (95% CI, 0.54–3.03); $p = 0.52$), 1-year mortality (8.9% vs 14.3%; $p = 0.43$), and QoL.

The Scandinavian Diverticulitis trial[30] (199 patients/21 centers) randomized LPL and USC in Hinchey III diverticulitis. The primary end point was the 90-day morbidity, which was comparable between groups (LPL 30.7% vs USC 26%; $p = 0.53$). Secondary end points included the operative time, which was reduced in the LPL

TABLE 1. Randomized controlled trials and meta-analyses assessing laparoscopic peritoneal lavage in acute diverticulitis

RCTs	Year	Patients, N/ centers, N	Hinchey grade	Intervention vs controls	Primary end point	Results of LPL
Vennix et al[29] LADIES trial, LOLA group	2015	90/42	III	LPL vs resection (HP or PRA±I) (2:1:1 randomization)	Composite end point (1-y major morbidity + mortality)	Early discontinuation for increased short-term morbidity (39% vs 19%; $p = 0.043$); composite score: LPL 67% vs 60% ($p = 0.52$), mortality 9% vs 14% ($p = 0.43$)
Schultz et al[30] SCANDIV trial	2015	199/21	III	LPL vs resection (HP or PRA±I) (1:1 randomization[a])	90-d major morbidity	Major morbidity: LPL 31% vs 26%, $p = 0.53$; reoperation: LPL 20% vs 6%, $p = 0.01$; mortality: LPL 14% vs 12%; $p = 0.67$
Schultz et al[34] SCANDIV trial	2017	199/21	III	LPL vs resection (HP or PRA±I) (1:1 randomization[a])	90-d major morbidity (1-y results)	Major morbidity: LPL 34% vs 27%, $p = 0.32$; deep sepsis: LPL 32% vs 13%, $p = 0.006$; unplanned reoperation rate: LPL 27% vs 10%, $p = 0.01$; stoma LPL 14% vs 42%, $p < 0.001$
Angenete et al[31] DILALA trial	2016	83/9	III	LPL vs HP (1:1 randomization)	1-y reoperation rate (short-term results)	Short-term reoperation rate: LPL 13% vs 17%, $p = 0.63$; reduced operative time: $p < 0.0001$; morbidity: NS
Thornell et al[35] DILALA trial	2016	83/9	III	LPL vs HP (1:1 randomization)	1-y reoperation rate	Reduced 1-y reoperation rate: LPL 28% vs 63%, $p = 0.004$; morbidity: NS; mortality: NS
Gehrman et al[36] DILALA trial	2016	83/9	III	LPL vs HP (1:1 randomization)	1-y reoperation rate (1-y medical costs)	Reduced costs: –8983€ at 1 y; –19,794€/expected life-years
Angenete et al[14]	2017	358/3[b]	III	LPL vs resection (HP or PRA±I)	1-y reoperation rate	Reduced 1-y reoperation rate, risk ratio = 0.54 (95% CI, 0.38–0.76)
Shaikh et al[15]	2017	372/3[b]	III	LPL vs resection (HP or PRA±I)	Adverse events	Increased risk of deep abscess, OR = 4.12 (95% CI, 1.89–8.98), $p = 0.0004$; increased risk of percutaneous drainage, OR = 5.41 (95% CI, 1.62–18.12), $p = 0.006$; comparable major morbidity, OR = 1.87 (95% CI, 0.68–5.12), $p = 0.23$

RCT = randomized controlled trial; LPL = laparoscopic peritoneal lavage; HP = Hartmann procedure; PRA±I = primary anastomosis with or without ileostomy; LADIES = XXXXX; LOLA = XXXXX; SCANDIV = Scandinavian Diverticulitis; DILALA = XXXXX; NS = not significant.
[a]The choice between HP and PRA±I was left to the operator.
[b]Data show patients, n/studies, n.

group ($p < 0.001$), the 90-day mortality (LPL 13.9% vs USC 11.5%; $p = 0.67$), and the QoL and LOS, both of which were comparable. However, other secondary end points were found to have worse results in the LPL group, namely the 90-day reoperation rate (20.3% vs 5.7%; $p = 0.01$) and the rate of secondary peritonitis (12% vs 0%; $p = 0.03$). Hence, the authors did not recommend LPL. At 1 year, the Scandinavian Diverticulitis trial[34] found comparable morbidity and mortality between groups. However, LPL was associated with more severe sepsis and more unscheduled operations. Finally, there were fewer stomas at 1 year in the LPL group (14% vs 42%; $p < 0.001$), whereas there were 73.5% in the HP group and only 26.5% PRA±I in the USC group.

The third RCT was the DILALA trial, which included 3 publications[31,35,36] with short- and long-term results. This trial randomized Hinchey III diverticulitis for LPL or HP, with 83 patients included in 9 centers. The primary end point was the 1-year reoperation rate, including elective sigmoid colectomies after LPL and continuity restoration after HP. This primary end point was significantly higher after HP (28% vs 63%; $p = 0.004$).[35] For the secondary end points, short-term morbidity was comparable between groups, as was the short-term reoperation rate

($p = 0.63$).[31] At 1 year, morbidity, mortality, and QoL were comparable, whereas cumulative LOS was reduced after LPL (risk ratio = 0.65 (95% CI, 0.45–0.94); $p = 0.047$).[35] Finally, a medico-economic analysis performed at 1 year favored LPL.[36] Some choices were questionable in this trial. First, HP was always performed in the case of resection, whereas the available data favored PRA±I in Hinchey III diverticulitis.[16,17,31,33,37] Second, most reoperations consisted of scheduled continuity restoration in the HP group (84%), whereas reoperations in the LPL group were mainly unplanned.

Two meta-analyses assessed LPL[14,15] using the 3 trials above. The main finding of the first meta-analysis[14] was a lower rate of 1-year reoperation after LPL (risk ratio =0.54 (95% CI, 0.38–0.76)). However, this was not clearly defined in the original publication rate of the LOLA trial, and the drawbacks of choosing HP in the DILALA trial are explained above. Moreover, this meta-analysis did not provide heterogeneity tests and was based on only 3 trials with different designs. The second meta-analysis[15] found no differences in terms of mortality or major morbidity. However, LPL was associated with an increased risk of postoperative abscess and percutaneous drainage (OR = 4.12 (95% CI, 1.89–8.98); $p = 0.0004$; OR = 5.41 (95% CI, 1.62–18.12); $p = 0.006$).

Two studies have assessed the risk factors for LPL failure.[42,43] Swank et al[42] reported the presence of comorbidities, as well as an elevation of the C-reactive protein or of the Mannheim peritonitis index, whereas Radé et al[43] reported an ASA score >2. Rogers et al[44] found the following independent risk factors for postoperative mortality: an age >65 years (OR = 4.1; $p < 0.001$) and the presence of a chronic disease, namely, a rheumatologic disease (OR = 7.3; $p < 0.05$) or a chronic renal disease (OR = 8; $p < 0.001$). In conclusion, LPL is not a good option for the surgical management of Hinchey III/IV diverticulitis.

Sigmoid Colectomy: PRA±I or Hartmann?

Since 2006, 2 meta-analyses have compared PRA±I with the HP,[12,13] as well as 2 RCTs[32,33] (Table 2) and 9 nonrandomized studies.[45–53] Six systematic reviews have also addressed this question,[1,16–20] and all concluded that PRA±I was superior to HP in the treatment of Hinchey III and IV diverticulitis. Biondo et al[19] specified that HP was restricted to patients with a bad prognosis. For guidelines, most concluded that the type of procedure depended on septic parameters (especially septic shock),[10,11] whereas in the Danish guidelines the choice between PRA±I and HP was not settled in Hinchey IV diverticulitis.[8]

A meta-analysis by Constantinides et al[12] included 15 studies composed of 963 patients. Mortality was similar in PRA±I and HP in the case of Hinchey III/IV diverticulitis (14.1% vs 14.4%; OR = 0.85 (95% CI, 0.36–2.01); $p = 0.71$), as well as operative time and LOS. However, there were fewer wounds and deep sepsis in the case of PRA±I (OR= 0.42 (95% CI, 0.20–0.90); $p = 0.02$; OR = 0.43 (95% CI, 0.19–0.97); $p = 0.04$). The second meta-analysis[13] was composed of 9 studies: PRA±I significantly reduced both mortality ($p = 0.02$) and LOS ($p < 0,001$), whereas the morbidity was similar between groups ($p = 0.30$).

Two RCTs compared PRA with ileostomy (PRAI) and HP in Hinchey III/IV diverticulitis.[32,33] In both trials, there were no upper limits of age for inclusion, and neither hemodynamic instability nor comorbidities were noninclusion criteria. Binda et al[32] conducted an international trial involving 14 centers that was prematurely terminated for low accrual rate: 90 patients were included (Hinchey III 80%/Hinchey IV 20%) instead of the 600 scheduled. There were no differences in terms of mortality (PRAI 2.9% vs HP 10.7%; $p = 0.25$), cumulative mortality (eg, for resection and continuity restoration (CR), PRAI + CR 5.9% vs HP + CR 12.5%; $p = 0.47$), and morbidity (PRAI 35.3% vs HP 46.4%; $p = 0.38$). Oberkofler et al[33] conducted a 4-center trial of which the primary end point was the cumulative morbidity of resection and CR. It was also discontinued for decreasing accrual rate. Sixty-two patients were included (Hinchey III 75%/Hinchey IV 25%), and 10% of patients in the PRAI group underwent HP. The cumulative morbidity was similar in both groups (PRAI + CR 84% vs HP + CR 80%; $p = 0.81$), as was the mortality ($p = 0.70$). The number of complications per patient was higher after HP ($p = 0.004$), as was the operative time ($p = 0.002$). Interestingly, 90% of PRAI had CR versus 57% of HP ($p = 0.005$). In terms of the initial intervention, there were no differences between groups. These results must be cautiously interpreted considering the lack of power of these prematurely terminated trials.

Two studies compared both procedures according to a propensity score.[45,46] Constantinides et al[45] included 415 patients treated either electively or in the emergency setting in 42 centers. Patients who underwent HP were older and more vulnerable. After adjustment according to the ASA score, HP was associated with higher morbidity for both surgical (OR = 1.9 (95% CI, 1.1–3.3); $p = 0.025$) and medical complications (OR = 2.1 (95% CI, 1.1–4.0); $p = 0.026$) but had no impact on the overall mortality (OR = 1.8 (95% CI, 0.7–4.4); $p = 0.22$). However, in the prospective study of Zingg et al,[46] which included 111 consecutive patients and used a propensity score, there were no differences between HP and PRA±I in terms of morbidity or mortality, and there were less prolonged stays after HP ($p = 0.015$) based on the median LOS.

The other studies included 2 American national program studies[47,48] based on >60,000 cases of perforated diverticulitis. None of these studies provided data on the intraoperative findings, namely, the Hinchey grade. The first study showed that PRAI was an independent protective factor of mortality and morbidity compared with

TABLE 2. Randomized controlled trials and meta-analyses assessing the use of primary anastomoses in Hinchey III/IV diverticulitis

RCTs	Year	Patients, n/ centers, n	Hinchey grade	Intervention vs controls	Primary end point	Results of PRAI
Binda et al[32]	2012	90/14	III/IV	PRAI vs HP	Adverse events	Morbidity PRAI: 35% vs 46%, $p = 0.38$; mortality PRAI: 3% vs 11%, $p = 0.25$; mortality PRAI+CR: 6% vs 13%, $p = 0.47$
Oberkofler et al[33]	2012	62/4	III/IV	PRAI vs HP	Cumulative morbidity (ie, resection + CR)	Cumulative morbidity PRAI+CR: 84% vs 80%, $p = 0.81$; cumulative mortality PRAI+CR: 9% vs 13%, $p = 0.70$; CR rate PRAI>HP: 90% vs 57%, $p = 0.005$
Constantinides et al[12]	2006	963/15 (RCT = 0)[a]	I–IV	PRAI vs HP	Mortality	Comparable mortality in Hinchey >II: 14.1% vs 14.4%, OR = 0.81 (95% CI, 0.36–2.01); decreased wound abscess: OR = 0.42; decreased deep sepsis: OR = 0.43
Cirocchi et al[13]	2013	1041/9[a,b]	III/IV	PRAI vs HP	Mortality	Decreased mortality: OR = 0.38 (95% CI, 0.17–0.85), $p = 0.02$; decreased LOS: $p < 0.001$; comparable reoperation rate: $p = 0.30$

RCT = randomized controlled trial; HP = Hartmann procedure; PRAI = primary anastomosis with ileostomy; CR = continuity restoration; LOS = length of stay.
[a]Data show patients, n/studies, n.
[b]Nine studies compared HP with PRAI among the 14 included studies.

HP.[47] However, the rate of deep abscess, as well as LOS and cost, favored HP. Tadlock et al[48] compared HP, PRA, and PRAI and found no differences among groups in terms of mortality and global morbidity. The remaining studies assessing morbidity and mortality included the following. A retrospective study[49] compared the CR of HP and PRAI in 158 patients: HP was associated with less CR (HP 45% vs PRAI 74%; $p = 0.027$), a longer time to CR (HP 9.1 vs PRAI 3.9 mo; $p < 0.001$), and a higher CR morbidity (HP 35% vs PRAI 7%; $p < 0.001$). One small, sample-sized retrospective study[50] assessed PRA without ileostomy and defined a *low-risk group*, as follows: age <80 y, ASA score <4, Acute Physiology and Chronic Health Evaluation II score <5, and Hinchey grade <III.

The available studies assessing QoL have reported disparate results. Constantinides et al[51] showed no differences between HP and PRA±I in 188 patients undergoing urgent or elective surgery. Vermeulen et al[52] assessed only urgent surgery and found a poorer QoL with HP ($p = 0.02$). Finally, a retrospective study compared PRA, PRAI, and HP in Hinchey III/IV diverticulitis,[53] with PRAI obtaining the best quality-adjusted life-years, mainly because of morbidity and mortality results.

Two studies assessed the risk factors for mortality in emergency surgery.[54,55] The independent risk factors were corticosteroid therapy, ASA score >3, age ≥80 years, Hinchey IV, high creatinine level, denutrition, recent radiotherapy, loss of autonomy, ascites, and dyspnea. Morris et al[56] retrospectively identified independent risk factors for mortality in perforated diverticulitis, including chronic renal disease (OR = 18.7 (95% CI, 1.6–211.4)), ASA score >2 (OR = 6.3 (95% CI, 2.6–15.2)), advanced age, and chronic nonsteroidal aromatase inhibitor treatment. Thresholds of 65 and 80 years were found to be significant. Constantinides et al[57] assessed the accuracy of the Physiological and Operative Severity Score for the Enumeration of Mortality and Morbidity (POSSUM) and colorectal-POSSUM scores: only the colorectal-POSSUM had a good correlation with mortality in urgent surgery.

Two studies assessed urgent surgery for diverticulitis management in immunosuppressed patients.[58,59] In the largest study, Al-Khamis et al[58] compared 596 immunosuppressed patients with 3675 immunocompetent patients. Immunosuppression was an independent risk factor for mortality (OR = 1.79 (95% CI, 1.17–2.75)) but not for major morbidity (OR = 1.2 (95% CI, 0.94–1.53)). Finally, only 1 review and 2 noncomparative small sample-sized series assessed the role of damage-control surgery in acute diverticulitis, showing its feasibility in cases of septic shock, but without demonstrating benefits over HP.[26,60,61]

In total, the results of recent meta-analyses and RCTs on Hinchey III/IV diverticulitis indicated in the short term similar morbidity and mortality and reduced LOS with HP. In the long term, more definite stoma, along with a worse QoL with HP and finally a higher morbidity with CR after HP, was indicated.

Urgent Sigmoid Colectomy: Open or Laparoscopic Approach?

Limited data are available for studying the laparoscopic approach for the acute treatment of diverticulitis. Current guidelines and systematic reviews state that laparoscopy should be restricted to selected cases in expert centers.[8–10,27,28] Ten original studies have assessed laparoscopy in the emergency setting. Two small retrospective series compared laparoscopy and open surgery in Hinchey I/II cases, with unfavorable outcomes after conservative treatment.[62,63] Both showed the same benefits of laparoscopy as in the elective setting (lower morbidity, less blood loss, reduced time to a solid diet, and reduced LOS). Three studies focused on Hinchey III/IV,[64–66] including 1 retrospective (n = 184) and 2 prospective feasibility studies with conversion rates of 0% to 50%, a 2% to 23% morbidity, and a 0% to 3% mortality.

Five studies included all of the Hinchey grades.[67–71] The highest level of proof study compared >1000 patients undergoing open (94%) and laparoscopic (6%) HP.[67] After adjustment with a propensity score, laparoscopy and open surgery produced the same postoperative results. However, the main drawback of this study was that the Hinchey grades were unknown. The other studies found that the laparoscopic approach was feasible, but the repartition of Hinchey grades between groups was either different (more Hinchey I/II in the laparoscopic group) or unknown.

In summary, patients who fail nonoperative treatment of Hinchey I/II diverticulitis are candidates for either laparoscopic or open colonic resection, but there are insufficient data to fully support the use of laparoscopy for colonic resection in Hinchey III/IV diverticulitis. Moreover, as explained above, LPL is not a good option for the surgical management of Hinchey III/IV diverticulitis.

CONCLUSION

Many publications of importance have been published since 2006 on the surgical management of acute diverticulitis. LPL has been assessed by RCTs and meta-analyses with concerning results: indeed, some RCTs were prematurely closed because of inferior and troubling outcomes with increased 30-day morbidity including deep-seated intra-abdominal abscesses and unplanned reoperations. In Hinchey III/IV diverticulitis, PRAI is a satisfying option in low-risk patients (stable hemodynamics, ASA score ≤3, and absence of immunosuppression) and may be performed with superior results than HP. However, the available RCTs were composed of few Hinchey IV cases; the LADIES trial (DIVA group) should address this question.

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