Laparoscopic Lavage Versus Primary Resection for Acute Perforated Diverticulitis

Review and Meta-analysis

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Objective: To compare clinical outcomes after laparoscopic lavage (LL) or colonic resection (CR) for purulent diverticulitis.

Background: Laparoscopic lavage has been suggested as an alternative treatment for traditional CR. Comparative studies to date have shown conflicting results.

Methods: Electronic searches of Embase, Medline, Web of Science, and Cochrane databases were performed. Weighted mean differences (WMD) were calculated for effect size of continuous variables and pooled odds ratios (POR) calculated for discrete variables.

Results: A total of 589 patients recruited from 3 randomized controlled trials (RCTs) and 4 comparative studies were included; 85% as Hinchey III. LL group had younger patients with higher body mass index and lower ASA grades, but comparable Hinchey classification and previous diverticulitis rates. No significant differences were noted for mortality, 30-day reoperations and unplanned readmissions. LL had higher rates of intraabdominal abscesses (POR = 2.85; 95% confidence interval, CI, 1.52–5.34; $P = 0.001$), peritonitis (POR = 7.80; 95% CI 2.12–28.69; $P = 0.002$), and increased long-term emergency reoperations (POR = 3.32; 95% CI 1.73–6.38; $P < 0.001$). Benefits of LL included shorter operative time, fewer cardiac complications, fewer wound infections, and shorter hospital stay. Overall, 90% had stomas after CR, of whom 74% underwent stoma reversal within 12-months. Approximately, 14% of LL patients required a stoma; 48% obtaining gut continuity within 12-months, whereas 36% underwent elective sigmoidectomy.

Conclusions: The preservation of diseased bowel by LL is associated with approximately 3 times greater risk of persistent peritonitis, intraabdominal abscesses and the need for emergency surgery compared with CR. Future studies should focus on developing composite predictive scores encompassing the wide variation in presentations of diverticulitis and treatment tailored on case-by-case basis.

Keywords: perforated diverticulitis, purulent, laparoscopic lavage, colonic resection, hinchey classification, trials

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Colonic diverticular disease is a common condition with an estimated annual hospital admission rate of 209 per 100,000 adults in Europe.[1] Up to 35% of patients will have perforated disease with purulent or fecal contamination, classified as Hinchey III or IV, respectively.[1–4] Historically, the open Hartmann's procedure was the most commonly performed operation in these patients with high rates of morbidity (25%–75%) and mortality (2%–30%).[5,6] Furthermore, less than 50% of patients would ever have their stoma reversed.

Since the mid-1990s, alternative approaches to perforated diverticular disease have been adopted increasingly, including colonic resection (CR) with primary anastomosis with or without defunctioning stoma, and nonresectional strategies such as laparoscopic lavage (LL) and drainage. A retrospective population study[7] using the Irish national database found that 17% (427/2455) of patients who underwent surgery for diverticulitis between the years 1995 and 2008 were managed by LL alone. These patients had a shorter length of hospital stay and lower complication rates than those undergoing open resectional surgery. In 2008, a prospective multi-institutional study conducted by Myers et al,[8] managed 92 out of 100 patients presenting with perforated diverticulitis and generalized peritonism by LL alone. The overall postoperative morbidity and mortality rates were only 4% and 3%, respectively.

To date, 3 randomized controlled trials and 4 comparative studies comparing LL with CR (open or laparoscopic Hartmann's or resection with primary anastomosis with or without defunctioning stoma) for acutely perforated diverticulitis have reported their results.[9–16] In this article, we present the results of a systematic review and meta-analysis of these studies.

METHODS

Literature Search Strategy

An electronic search was performed using Embase, Medline, Web of Science, and Cochrane (2014 Issue 3) databases from January 1990 to December 2016, to identify studies comparing LL with CR for acute perforated diverticulitis. The search terms ''diverticular disease,'' ''perforated,'' ''diverticulitis,'' ''laparoscopic lavage,'' ''peritoneal lavage,'' ''Hartmann's,'' and ''primary resection'' and Medical Subject Headings (MESH) ''diverticular disease'' (MESH), ''diverticulitis'' (MESH), ''laparoscopic lavage'' (MESH), and ''resection'' (MESH) were used in combination with the Boolean operators AND or OR. The electronic search was supplemented by a hand-search of published abstracts from meetings of the Surgical Research Society, the Society of Academic and Research Surgery, the Association of Surgeons of Great Britain and Ireland, Association of Coloproctologists of Great Britain and Ireland, American Society of Colon and Rectal Surgeons, Society for Surgery of the Alimentary Tract, Association of Laparoscopic Surgeons of Great Britain and Ireland, Society of American Gastrointestinal and Endoscopic Surgeons and European Association of Endoscopic Surgeons from 2000 to 2016. The reference lists of articles obtained were also searched to identify further relevant citations. Finally, the search included the Current Controlled Trials Registry (http://www.controlled-trials.

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com), clinicalTrials.gov, and the Cochrane Database of Controlled Trials. Two authors (MP and SRM) independently performed the searches and abstracts of the citations identified were scrutinized to determine eligibility for inclusion in the meta-analysis.

Publications were included if they were randomized controlled trials, case-matched controlled studies or comparative studies, in which patients underwent LL or CR with categorization by Hinchey classification and included at least 10 cases per group. Primary resection consisted of either a Hartmann's procedure or CR with or without defunctioning stoma and could be performed open or laparoscopically. Studies were excluded if they were noncomparative, did not include a LL group or the main indication for surgery was not diverticulitis.

Outcome Measures

Patient demographics including age, sex, body mass index (BMI), ASA (American Society of Anesthesiologists) grade and Hinchey scores were compared between the 2 groups (LL vs CR) to ensure that the influence of confounding variables was limited within the meta-analysis. Operative and postoperative outcome measures analyzed were mortality (30-day, 90-day, and at 12 months), reoperation (30-day, 12-months), stoma rates, cardiac and pulmonary complications, thromboembolic events, wound infection, intraabdominal sepsis, length of hospital stay, and unplanned readmissions. The rate of stoma closure and elective sigmoidectomy within 12-months follow up was also reported. The SCANDIV[10] and DILALA[11,12] trials reported on quality of life at 90-days and 12 months, respectively.

Statistical Analysis

Data from eligible trials were entered into a computerized spreadsheet for analysis. Statistical analysis was performed using StatsDirect 2.5.7 (StatsDirect, Altrincham, United Kingdom). Weighted mean difference was calculated for the effect size of LL on continuous variables. Pooled odds ratios (POR) were calculated for the effect of LL on discrete variables. All pooled outcome measures were determined using random-effects models as described by DerSimonian Laird.[17] Heterogeneity among trials was assessed by means of the Cochran's Q statistic, a null hypothesis in which $P < 0.05$ is taken to indicate the presence of significant heterogeneity.[18] The Egger test was used to assess the funnel plot for significant asymmetry, indication of possible publication biases. Outcomes reported in all 3 RCTs were included in a subset meta-analysis.

RESULTS

A total of 8 articles (7 studies) were included in this meta-analysis: 3 randomized controlled trials (RCT) and 4 nonrandomized comparative studies comparing LL with CR for acute perforated diverticulitis. The short- and long-term outcomes from the DILALA (DIverticulitis-LAparoscopic LAvage vs resection)[11,12] trial were published in 2 separate articles but all results obtained from the same study population. Figure 1 shows the Preferred Reporting Items for Systematic

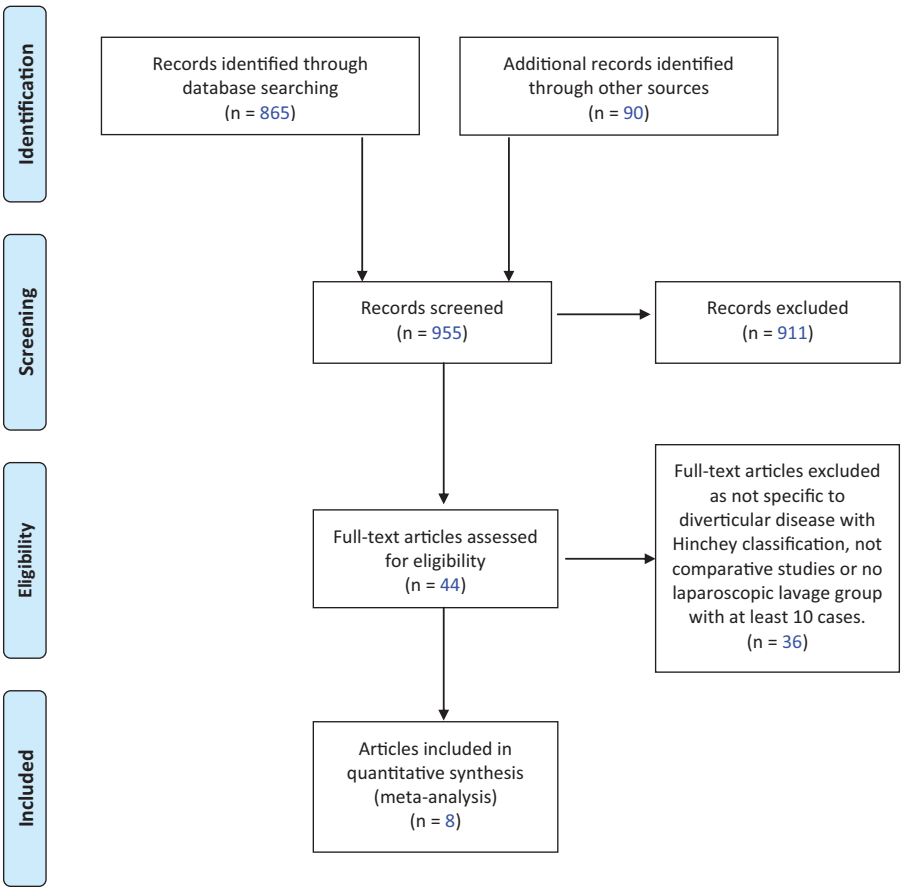


FIGURE 1. Preferred Reporting items for systematic reviews and meta-analysis (PRISMA) flow diagram for the literature search.

TABLE 1. Study Design

Study	Design	Trial Name	Number of Recruiting Centers	Total Patients Recruited		Number of Patients Used in Outcome Analysis		Type of Primary Resection	Primary Outcome
				LL	CR	LL	CR		
Vennix et al[9]	RCT	LADIES – LOLA group	42	47	43	46	42	laparoscopic or open, Hartmann's or primary anastomosis	Composite endpoint: any major morbidity or mortality
Schultz et al[10]	RCT	SCANDIV	21	101	98	74	70	laparoscopic or open, Hartmann's or primary anastomosis	Severe postoperative complications within 90 days (Clavien-Dindo >3a)
Angenete et al[11]; Thornell et al[12]	RCT	DILALA	9	43	40	43	40	open Hartmann's	Reoperations within 12 months
Karoui et al[13]	Comparative (prospective lavage group, retrospective resection group)	–	3	35	24	35	24	open primary anastomosis with defunctioning ileostomy	Not specified: Operative details and complications, postoperative mortality and morbidity, late complications, LOS
Liang et al[14]	Comparative (prospective)	–	1	47	41	47	41	laparoscopic Hartmann's	Not specified: Operative details and complications, postoperative outcomes, morbidity and mortality, LOS
Gentile et al[15]	Comparative (retrospective)	–	1	14	16	14	16	open Hartmann's	Not specified: Operative details, postoperative outcomes, morbidity and mortality rates
Catry et al[16]	Comparative (prospective)	–	2	15	25	15	25	laparoscopic or open primary anastomosis with defunctioning ileostomy	Overall 30-day or inhospital postoperative morbidity

CR indicates colonic resection; DILALA, diverticulitis-laparoscopic lavage vs resection; LADIES, laparoscopic peritoneal lavage or resection for generalized peritonitis for perforated diverticulitis; LOLA, laparoscopic lavage; LL, laparoscopic lavage; LOS, length of stay; RCT, randomized controlled trial; SCANDIV, Scandinavian diverticulitis trial.

TABLE 2. Patient Characteristics

	LL	CR	POR or WMD	95% CI	*P*	Heterogeneity Cochran Q *P*	Egger Bias *P*
Age, mean	61.7	64.3	−3.356	−5.382 to −1.330	0.001	<0.001	0.023
BMI, mean	28.2	26.6	1.516	0.134–2.899	0.032	<0.001	0.594
ASA grade, %							
I/II	70.4	59.1	1.860	0.917–3.774	0.086	0.007	0.148
III/IV	29.6	40.9	0.576	0.342–0.969	0.038	0.143	0.213
Hinchey classification, %							
I–II	6.9	8.6	0.812	0.338–1.951	0.641	0.601	–*
III	85.8	84.0	1.222	0.749–1.994	0.422	0.866	–*
IV	7.3	7.4	0.967	0.498–1.876	0.920	0.538	–*
Previous episodes of diverticulitis, %	23.3	25.9	0.829	0.555–1.239	0.361	0.471	0.988
Previous abdominal surgery, %	31.1	32.2	0.884	0.511–1.531	0.660	0.188	0.398

ASA indicates American Society of Anesthesiologists; BMI, body mass index; CI, confidence interval; CR, colonic resection; LL, laparoscopic lavage; POR, pooled odds ratio; WMD, weighted mean difference.

*Too few strata for Egger bias calculation.

Reviews and Meta-analyses (PRISMA) flow diagram for the literature search. From a total of 589 patients recruited, results were reported on 532; 274 managed by LL and 258 who underwent CR (Table 1),[9–16] because of the exclusion of Hinchey IV cases, patients lost to follow up and incorrect diagnoses at the time of surgery. Approximately, 19% (49/258) of CRs were performed by laparoscopic surgery, whereas the rest adopted the open technique.

Characteristics of Studies

Table 1 outlines the study designs for the 7 studies, including the type of CR performed and the stated primary outcomes. The studies took place in 8 different countries: (i) Norway and Sweden for the SCANDIV trial;[10] (ii) Italy, Belgium, and Netherlands for LOLA;[9] (iii) Sweden and Denmark for DILALA;[11,12] (iv) Italy for Gentile et al;[15] (v) USA for Liang et al,[14] and (vi) France for Catry et al[16] and Karoui et al[13] Overall, patients were recruited between 1991 to 2015. Two RCTs (SCANDIV and DILALA) reached completion, whereas the LOLA group of the Ladies trial[9] was terminated early because of safety concerns after the third planned interim analysis of 75 patients, with significantly higher short-term morbidity and reintervention rates in the LL group.

Outcomes Reported

All studies reported on the number of participants, mean or median age, male to female ratio, subdivision into Hinchey classification grade and the type of operation performed.[9–16] BMI was reported as mean ± SD or median with range in all articles except Karoui et al[13] in which 8 (23%) patients had BMI > 30 in the lavage group and 4 (17%) in the resectional group. Gentile et al[15] stated mean ASA scores, whereas Catry et al[16] reported cases with ASA ≥3 and a breakdown of patient number and percentage for each ASA grade I to V was outlined in the other 5 studies.[9–14] There was considerable variation in terms of reporting patient preoperative comorbidities that were either listed as individual disorders,[11,12] grouped as comorbidity,[14,15] use of Charlson Comorbidity Index,[10] or focused mainly on previous abdominal surgery and episodes of diverticulitis.[9,10,13,16] Likewise, the primary and secondary outcomes also differed between the studies in terms of actual variables measured but also the time interval at which outcomes were reported. All articles reported mortality inhospital or within 30 days. Three studies reported 90-day mortality[10–13] and 5 up to 12 months[9,12,13,15,16] after surgery. Stoma rates during the index admission were reported by all studies; however, rates of stoma closure and elective sigmoidectomy for the LL group patients within 12 months were available for all studies except the SCANDIV[10] trial (90-day outcomes). The SCANDIV[10] and DILALA[11,12] trials reported on quality of life at 90 days and 12 months, respectively.

Study Results

Table 2 outlines patient demographics. The mean age ranged from 56 to 70 years, and overall more females (54%) were recruited than males. The combined mean BMI range was 25 to 31 kg/m^2 and the majority of patients had an ASA grade of I or II (58.7%). Meta-analysis of patient characteristics showed no statistical difference between the LL and CR groups in terms of Hinchey classification, previous episodes of diverticulitis and previous abdominal surgery. However, patients in the LL group were younger (WMD −3.356 years, 95% CI −5.382 to −1.330, $P = 0.001$), with reduced proportion of ASA III-V grade patients (POR 0.576, 95% CI 0.342–0.969, $P = 0.038$) and a higher BMI (WMD 1.516 kg/m^2, 95% CI 0.134–2.899, $P = 0.032$) compared with the CR group.

Table 3 shows the postoperative clinical outcomes. A total of 19 patients (9 LL group; 10 CR group) died within 30 days of surgery, whereas 51 patients (36 LL; 15 CR) required emergency reoperation within 30 days and 33 patients (20 LL; 13 CR) had unplanned readmissions within 90 days. The odds of developing postoperative intraabdominal abscess were almost 3 times greater in the LL group compared with the CR group (Fig. 2A), and had higher rates of peritonitis after the primary surgery (Fig. 2B). Emergency reoperations between >30 days to 1 year after the first operation are also significantly more frequent with a POR of 3.321 in the LL group. The LL group had a significantly shorter operative time, fewer cardiac complications after surgery, and fewer wound infections, and shorter length of hospital stay (Table 3).

Overall, 90% of patients had a stoma after CR as either an end colostomy or defunctioning ileostomy; 74% of whom underwent stoma reversal within 12 months. Approximately, 14% of patients in the LL group also required a stoma, with 48% return of gut continuity within 12 months, whereas another 36% underwent elective sigmoidectomy.

Subset analysis including only outcomes from the 3 RCTs demonstrated largely similar results, with the LL group having significantly increased rates of postoperative intraabdominal abscess

TABLE 3. Postoperative Outcomes

Discrete Outcomes							
	%					Heterogeneity Cochran Q	Egger Bias
	LL	CR	POR	95% CI	*P*	*P*	*P*
Mortality							
30-day	3.3	3.9	0.863	0.315–2.363	0.774	0.507	0.516
90-days	3.6	5.7	0.464	0.040–5.325	0.538	0.113	–*
1 year	6.5	11.6	0.581	0.249–1.354	0.208	0.608	0.808
Emergency reoperations							
30-day	13.1	5.8	2.474	0.900–6.801	0.079	0.080	0.721
>30-day to 1 year	20.8	6.7	3.321	1.730–6.376	<0.001	0.984	0.541
Readmissions							
Unplanned	13.2	9.7	1.503	0.570–3.964	0.410	0.338	–*
Severe complications†	29.8	19.2	1.816	0.927–3.555	0.082	0.166	0.711
Pneumonia	5.7	5.5	1.068	0.426–2.677	0.888	0.355	0.834
Cardiac complications	6.1	14.2	0.374	0.175–0.796	0.011	0.942	–*
DVT†	0.9	1.4	0.624	0.118–3.294	0.579	0.526	–*
Wound Infection	1.2	10.7	0.151	0.052–0.434	<0.001	0.647	0.567
Intraabdominal abscess	16.5	6.6	2.846	1.516–5.344	0.001	0.478	0.211
Peritonitis after surgery	8.4	0.4	7.801	2.121–28.692	0.002	0.517	0.301
Cancer identified after surgery	7.4	3.3	2.324	0.795–6.793	0.123	0.960	–*

Continuous Outcomes							
	Mean ± SD, min					Heterogeneity Cochran Q	Egger Bias
	LL	CR	Pooled WMD	95% CI	*P*	*P*	*P*
Operative time	80 ± 12.3	159±22.7	−78.503	−104.830 – −52.175	<0.001	<0.001	0.528
Length of hospital stay	8.6 ± 1.6	17.0±3.4	−8.303	−12.526 – −4.081	<0.001	<0.001	0.031

CI indicates confidence interval; CR, colonic resection; DVT, deep vein thrombosis; LL, laparoscopic lavage; POR, pooled odds ratio; WMD, weighted mean difference.
*Too few strata for Egger bias calculation.
†Severe complications termed as Clavien-Dindo >IIIa.

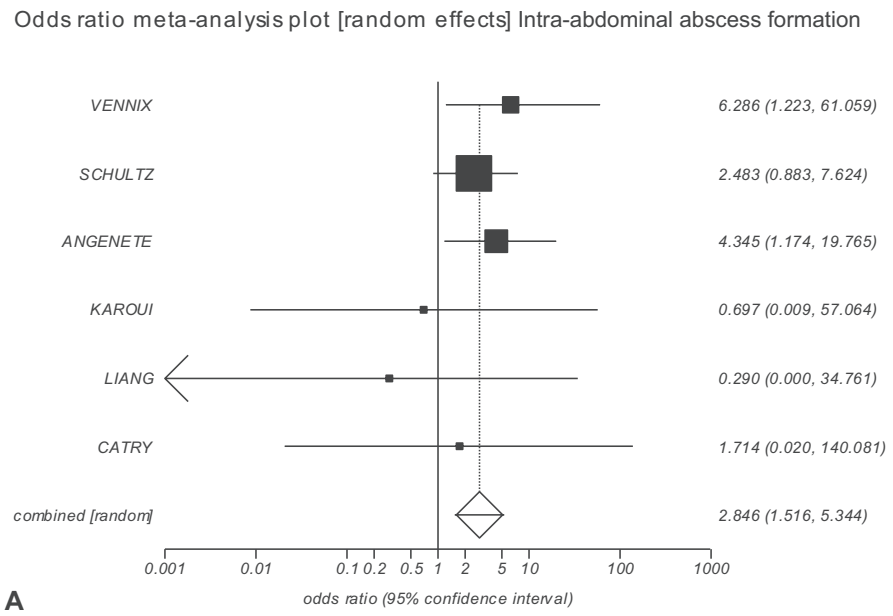
but shorter operative time, fewer cardiac complications after surgery, and fewer wound infections. However, in contrast to the pooled analysis, length of hospital stay and occurrence of postoperative peritonitis remained nonsignificant in this subset RCT analysis (supplementary material, http://links.lww.com/SLA/B207).

No statistically significant difference in global quality of life was found between the 2 groups in 2 trials.[10–12]

DISCUSSION

The optimal management of purulent perforated acute diverticulitis (Hinchey III) has been the focus of much debate. Multicenter RCTs (Ladies trial,[9] SCANDIV,[10] and DILALA[11,12]) and 4 comparative studies[13–16] investigating LL versus CR for acute perforated diverticulitis were included in this meta-analysis. Heterogeneity in trial methodology, reported outcomes, and timing of outcomes was present among studies. Patients with high ASA grades tended to be excluded and, according to our results, those undergoing lavage were younger, had lower scoring ASA and higher BMI; thus providing a potential selection bias within this group. In the SCANDIV trial,[10] all patients with feculent peritonitis underwent a resection, whereas in the DILALA[11,12] and Ladies trials[9] patients were randomized and included in the study only after diagnostic laparoscopy and confirmation of Hinchey III. The SCANDIV trial[10] authors did in fact report that major disagreements between trial monitors and investigator were on Hinchey grading, which led to a change of grade in 17% of patients. This may be because of accidental human errors in grading appropriately, but may also reflect inadequacy of the Hinchey classification as being 'too simple' to cover the full range of presentations of diverticular pathology.

Further, there was no evidence or attempt to standardize the operations performed. Different volumes of saline were used to perform the lavage, with most studies using 3 to 6 L until the fluid returned clear, but in Karoui et al's study,[13] a mean volume of 15 L (range 9–25 L) was used. It is also unclear exactly how much mobilization of bowel and omentum surgeons actually performed during the LL to ensure a thorough washout to prevent inter-loop and pelvic abscesses from forming. Whether surgeons actively searched for a diverticular perforation +/− sutured the hole closed during the LL also varied greatly between cases. In the SCANDIV trial[10] a 'monitoring' surgeon reviewed all operation notes but the individual operating surgeon's level of competence and experience was not assessed, nor was a minimum requirement of cases performed or surgical credentialing process before entry into the trial requested or undertaken. Also, in all studies the oncall surgeon was not necessarily specialized in colorectal surgery. Although this practice is a reflection of what occurs in the wider surgical community, in the context of a surgical trial and scientific investigation, the aim is to identify the true benefits and risks of a technique, which should not be confounded by the technical ability of the surgeon. Furthermore, the studies include operations performed over a 24-year period during which minimally invasive techniques and surgeons' laparoscopic skills have improved greatly. Only 19% of the CRs were performed by laparoscopic surgery. As suggested in the review by Markar et al,[19] inclusion and exclusion criteria for eligibility should be established for participating surgeons, and not just for patients. Thus, future RCTs should include an assessment of surgical performance as an important aspect of study design to reduce variation in clinical outcomes. Credentialing surgeons through procedural volume and operative reports, and standardization of surgical



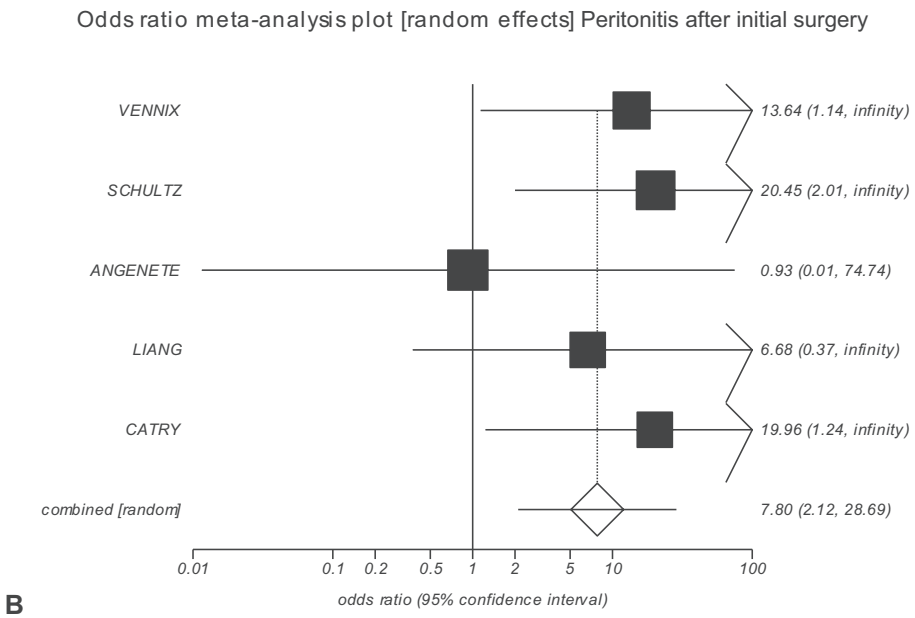


FIGURE 2. Forrest plots of postoperative abdominal sepsis: (A) Intraabdominal abscess formation—increased in the laparoscopic lavage group (POR 2.846, 95% CI 1.516–5.344; $P = 0.001$); (B) Peritonitis after initial surgery–increased in the laparoscopic lavage group (POR 7.801, 95% CI 2.121 –28.692; $P = 0.002$).

techniques should become part of the quality assurance process for any trial even in an emergency setting.

A different primary endpoint was selected for each trial (Table 1), which is reflected by the seemingly contradictory findings of the studies and contributed to the early termination of the LOLA study.[9] Unlike the DILALA trial,[11,12] which categorized reversal of Hartmann procedure but not radiological abscess drainage as a reoperation, in LOLA[9] a composite end point of major morbidity and mortality within 12 months was examined leading to significantly higher rates in the LL group at interim analysis and hence early termination of the trial. It is interesting to note that although 90% of patients in the resection group had a stoma, 74% of these were reversed within 12 months. However, 14% of patients in the lavage group also needed a stoma, but a lower percentage (48%) was reversed in 12 months. The stoma in the lavage group is likely to have been unplanned and occurred after a complication or worsening diverticulitis, hence the possibility of reversal may be diminished. Approximately, 36% of patients in the lavage group also underwent a further operation as an elective sigmoidectomy. Therefore, successful cases of LL will avoid stoma formation, which is welcomed by many patients. However, this needs to be counterbalanced by the risk of recurrent attacks and potentially further surgery in the long term.

Results from the meta-analysis suggest that LL significantly increases the risk of persistent and recurrent intraabdominal sepsis

with abscesses and peritonitis requiring emergency reoperation after 30 days. This is a serious concern and safety issue as patients appear to be undertreated and left vulnerable to ongoing sepsis, considerable morbidity and further attacks.

As stated by Gervaz et al,[20] 3 main limitations to the lavage technique include (i) the risk of missing a persistent (incompletely sealed) perforation—30% of cases; (ii) the risk of missing fecal peritonitis enclosed within the sigmoid loop—10% of cases; and (iii) the risk of missing sigmoid carcinoma—10% of cases. Likewise, the 2 principle reasons for emergency reoperations after LL included intraabdominal sepsis with peritonitis and/or abscesses or colorectal cancer. In the CR group, the commonest reasons for a return to theatre were wound dehiscence, anastomotic leak and bowel obstruction. Zeitoun et al[21] noted a similar problem in a large, multicenter trial in France between 1989 and 1996 comparing open lavage, drainage, and a defunctioning stoma (without resection) to open Hartmann's procedure. The researchers concluded that patients who underwent the sigmoidectomy had a better outcome as sepsis was controlled more effectively. It could therefore be deduced that LL treats the consequence but not the cause of the problem and hence places the patient in a more unpredictable position with the risk of ongoing sepsis and recurrent or chronic disease in the future.

Two key questions that arise from the evidence available so far are: (i) Is LL considered damage control or definitive surgical treatment? (ii) Should treatment options be dictated by the Hinchey classification, or is this approach too simplistic? Part of the challenges in recruiting and conducting surgical trials on purulent diverticulitis may reflect the inadequacy of using a single classification to determine the operative approach. Perhaps studies should instead focus on developing a composite predictive scoring system that encompasses a broader number of factors from patient characteristics, comorbidities, clinical presentation and degree of sepsis/peritonism, and radiological findings. The responsible surgeon takes all these features into account (which usually occurs in clinical practice) to aid in the decision as to which surgical approach would be most appropriate for that individual patient. In some patients, a similar approach to damage control trauma surgery or initial laparoscopic lavage may be attempted, followed by repeat surgery 24 to 48 hours later if required. While in other patients, with an obvious colonic perforation or suspicion of cancer, immediate resection is more likely. This is similar to the approach taken by the American Society for Colon and Rectal Surgery (ASCRS) in their most recent guidelines on elective surgery after recovery from conservatively treated acute diverticulitis, whereby they recommend making decisions on a 'case-by-case' basis.[22]

In conclusion, diverticular disease involves a wide spectrum of presentations in a diverse population of different age groups and comorbidities. Laparoscopic lavage for Hinchey III diverticulitis may offer certain benefits and avoids stoma formation in most patients, but also appears to be associated with increased risk of prolonged intraabdominal sepsis. Primary resection, on the other hand, removes the diseased segment and potential cancer if present, but does require a further operation to reverse the stoma. Future trials must provide surgical quality assurance with clear detailed consensus on the operative techniques, especially with regards to the extent of mobilization and management of a visible colonic hole during laparoscopic lavage. One solution that fits all is unlikely to work. Instead, surgeons must be equipped with all of the various approaches and apply these on a case-by-case basis.

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