

Early experience with laparoscopic lavage for perforated diverticulitis

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Background: Laparoscopic lavage has recently emerged as a promising alternative to sigmoid resection in the treatment of perforated diverticulitis. This study examined an early experience with this technique.

Methods: The files of all patients with complicated diverticulitis were searched in 34 teaching hospitals of the Netherlands. Patients with perforated diverticulitis treated with laparoscopic lavage between 1 January 2008 and 31 December 2010 were included.

Results: Treatment with laparoscopic lavage was performed in only 38 patients in ten hospitals. Lavage was successful in controlling sepsis in 31 of the 38 included patients, with 32 per cent morbidity (10 of 31 patients) and fast recovery. Overall, 17 of 38 patients developed complications, of whom two had a missed overt sigmoid perforation. Two patients died from multiple organ failure and one from aspiration pneumonia; one other patient died after palliative management of inoperable lung carcinoma. Three patients in whom lavage was successful underwent subsequent sigmoid resection for recurrent diverticulitis. Patients in whom lavage was unsuccessful tended to have more co-morbidities, a higher preoperative C-reactive protein concentration and a higher Mannheim Peritonitis Index.

Conclusion: Laparoscopic lavage for perforated diverticulitis was feasible in the majority of patients, but identification of an overt sigmoid perforation and patient selection are of critical importance.

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Introduction

Perforated diverticulitis is a serious condition that can present as either purulent (Hinchey III) or faeculent (Hinchey IV)¹ peritonitis. Regardless of this classification, sigmoid resection with either end colostomy or primary anastomosis has been the standard treatment. However, these operations are associated with high morbidity and mortality rates, the latter being 27 per cent in a national study of patients with both purulent and faecal peritonitis^{2–3}. In addition, the stoma is never reversed in many patients^{2,3}.

Laparoscopic lavage, originally described in Ireland in 1996⁴, has emerged as a promising alternative to sigmoid resection. A systematic review has shown that, for Hinchey III diverticulitis, lavage leads to low morbidity and mortality rates, while avoiding the creation of a stoma⁵.

However, the available data are derived from small non-randomized studies.

Hinchey II diverticulitis is defined as diverticulitis with a pelvic abscess of at least 5 cm in diameter. Percutaneous drainage is recommended for this condition; surgery is required only when the abdominal abscess is not amenable to percutaneous treatment and signs of sepsis are present^{6–9}. Lavage does not seem to be sufficient for Hinchey IV diverticulitis (faeculent peritonitis). As there is overt communication between the intestinal lumen and the peritoneal cavity, sigmoid resection is recommended to prevent further dispersion contamination⁵.

Laparoscopic treatment, as promoted by the Irish group¹⁰, has been received with both enthusiasm and scepticism in the Netherlands. Convinced by the existing evidence, some hospitals have implemented lavage as a new standard for Hinchey III diverticulitis; others have

been more reluctant, fearing failure of the new strategy. Before the start of the Ladies trial (a large randomized trial investigating the safety and efficacy of laparoscopic lavage for perforated diverticulitis), some surgical units had already started to apply this novel strategy¹¹. The aim of the present study was to report on the results of laparoscopic lavage performed in these centres before the start of the Ladies trial.

Methods

Eligible for this study were patients treated with laparoscopic lavage for perforated diverticulitis in Dutch teaching hospitals before the start of the Ladies trial in the interval from 1 January 2008 to 31 December 2010. Medical records in the 34 hospitals were screened for the diagnosis 'diverticulitis' or 'acute abdomen'. The medical files of these patients were checked for the type of surgery they had undergone. Patients were included if they underwent laparoscopic lavage as the primary treatment for diverticulitis with either free air (Hinchey II or III) and/or with purulent peritonitis (Hinchey III). Demographic data, co-morbidity, American Society of Anesthesiologists (ASA) grade, preoperative white blood cell count, C-reactive protein (CRP) concentration, and results of plain abdominal X-ray and computed tomography (CT) were recorded. The following information was obtained from the operation records: presence of abdominal pus and its location, presence of faeces, presence of overt sigmoid perforation, closure of overt perforation, amount of saline used for lavage and placement of drains. Survival, length of time in the intensive care unit (ICU), antibiotic regimen, and number of complications, diagnostic measures, reinterventions, reoperations and readmissions were recorded. Treatment failure was defined as ongoing abdominal sepsis.

The Mannheim Peritonitis Index (MPI) was used as a predictor of the mortality risk (*Table 1*). The Hinchey classification was used to stratify the patients according to the intraoperative findings: Hinchey II for a large pelvic abscess, and Hinchey III when purulent peritonitis was present.

Data on the following co-morbidities were extracted from the patient's history: cardiovascular morbidity (myocardial infarction, ischaemic attack, aneurysm, atrial fibrillation, thrombosis), pulmonary morbidity (chronic obstructive pulmonary disease), malignancies, organ failure (renal insufficiency, pulmonary insufficiency) and other morbidities (hypertension, diabetes, hypercholesterolaemia).

Table 1 Mannheim Peritonitis Index

Risk factor	Weight
Age (years)	
≤ 50	0
> 50	5
Sex	
M	0
F	5
Organ failure*	
No	0
Yes	7
Malignancy	
No	0
Yes	4
Preoperative duration of peritonitis (h)	
≤ 24	0
> 24	4
Diffuse generalized peritonitis	
No	0
Yes	6
Exudate	
Clear	0
Cloudy, purulent	6
Faeculent	12

The origin of sepsis was always colonic: 0 of 4 points. *Includes kidney failure (creatinine over 177 µmol/l, urea more than 167 µmol/l, oliguria less than 20 ml/h), lung failure (partial pressure of oxygen less than 50 mmHg, partial pressure of carbon dioxide greater than 50 mmHg), shock (hypodynamic or hyperdynamic) and profound intestinal obstruction (paralysis for more than 24 h or complete mechanical ileus).

Results

Thirty-eight patients treated with laparoscopic lavage were identified in ten hospitals. All had clinical evidence of diverticulitis with obvious signs of local or generalized peritonitis. Patient characteristics are shown in *Table 2*. A total of 24 men and 14 women were included, of median age 59 (range 23–79) years. Eighteen patients had one or more co-morbidities. Stratified by the most severe co-morbidity, eight patients had cardiovascular disease (myocardial infarction, stroke, atrial fibrillation and thrombosis), five were previously diagnosed with malignancy, two had pulmonary disease (chronic obstructive pulmonary disease) and three had hypertension. One patient had respiratory insufficiency before surgery. Four patients had undergone previous abdominal surgery not related to diverticular disease. None of the patients had had a previous episode of diverticulitis, although one had been admitted for uncomplicated diverticulitis 7 days before surgery. None of the patients used systemic corticosteroids.

Twenty-eight of the 38 patients had surgery on the day of arrival at the emergency department (*Table 2*). Preoperative imaging revealed free intra-abdominal air in 32 of 35 patients who had CT. At operation a

Table 2 Risk factors for treatment failure

	Overall (n = 38)	Sepsis controlled (n = 31)	Sepsis not controlled (n = 7)
Sex ratio (M : F)	24 : 14	20 : 11	4 : 3
Age (years)*	59 (23–79)	58 (23–79)	66 (39–77)
ASA fitness grade			
I	12	11	1
II	11	9	2
III	12	10	2
IV	3	1	2
Co-morbidities			
None	20	18	2
1	6	4	2
2	6	5	1
> 2	6	4	2
Mannheim Peritonitis Index†	13.3(5.0)	12.6(5.1)	15.0(4.3)
Preop. CRP (mmol/l)†	203(143)	180(123)	322(187)
Preop. WBC count ($\times 10^3/\text{mm}^3$)†	15.4(5.3)	15.8(4.8)	13.5(7.4)
Preop. hospital stay (days)			
0	28	21	7
1	5	5	0
2	2	2	0
> 2	3	3	0
Free air			
No imaging	3	3	0
No	3	2	1
Pericolic	4	4	0
Distant	28	22	6
Operative findings			
Pelvic abscess, diffuse free air on CT (Hinchey II)	5	3	2
Localized cloudy or purulent exudate (Hinchey III)	29	25	4
Generalized cloudy or purulent exudate (Hinchey III)	4	3	1
Overt perforation			
Yes	2	2	0
No	36	29	7

Values are *median (range) and †mean(s.d.). ASA, American Society of Anesthesiologists; CRP, C-reactive protein; WBC, white blood cell; CT, computed tomography.

pelvic or retroperitoneal abscess was found in five patients; local or generalized purulent peritonitis was present in 33 patients, of whom two had overt sigmoid perforation.

The amount of irrigation fluid was reported in 14 patients, in whom a median of 4 (range 3–6) litres of saline was used. The placement of drains was reported in 36 patients: no drains were placed in three, one drain was used in 17 patients, and two in 16. One of the patients required conversion to an open procedure because the left lower quadrant could not be visualized. In both patients with overt sigmoid perforation, the perforation was closed primarily.

The median duration of operation was 68 (range 30–220) min. There were no intraoperative complications. A postoperative antibiotic regimen of cefuroxime and metronidazole was reported in 12 patients. The regimen used in the other patients was unclear or not specified.

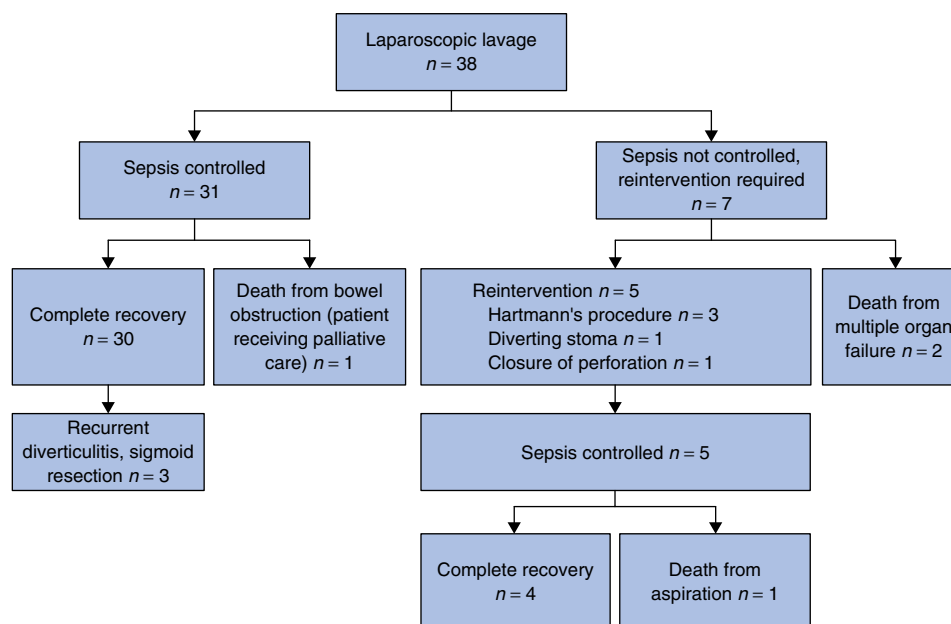
Postoperative outcomes are summarized in *Table 3* and *Fig. 1*. The median length of postoperative hospital stay was 10 (range 4–77) days. Six patients required admission to the ICU, with a median stay of 6 (range 2–46) days. Four patients required readmission to the surgical ward after discharge.

Laparoscopic lavage failed to control sepsis in seven of the 38 patients. Two patients died from multiple organ failure after operation. A laparotomy was performed in five other patients: sigmoid resection and end colostomy in three, a diverting stoma in one and closure of the sigmoid perforation in one. At laparotomy, faeculent peritonitis was found in two patients and purulent peritonitis in one. Intraoperative data were lacking for the other two patients. Abdominal sepsis was controlled in all five patients after the second operation. Nonetheless, one patient died from aspiration during the postoperative course. All patients in whom lavage was unsuccessful developed complications

Table 3 Outcomes of surgery

	Overall (<i>n</i> = 38)	Sepsis controlled (<i>n</i> = 31)	Sepsis not controlled (<i>n</i> = 7)
Laparotomy	5		Hartmann's procedure 3 Diverting stoma 1 Closure of perforation 1
Hospital stay (days)*	10(4–77)	10(4–42)	16 (6–77)
ICU admission	6	2	4
Readmission	4	3	1
In-hospital death	4	1	3
Multiple organ failure	2	0	2
Aspiration	1	0	1
Persistent bowel obstruction	1	1	0
30-day morbidity†	17	10	7
Bowel obstruction	5	3	2
Abdominal abscess	4	2	2
Enterocutaneous fistula	3	1	2
Wound infection	2	1	1
Incisional hernia	2	0	2
Pneumonia	2	1	1
Pulmonary embolism	1	1	0
Burst abdomen	1	0	1
Atrial fibrillation	1	1	0
Recurrent diverticulitis	3	3	
Elective sigmoid resection	2	2	
Emergency sigmoid resection	1	1	

*Values are median (range). †Number of patients with complications. The breakdown describes all complications; some patients had more than one complication. ICU, intensive care unit.

**Fig. 1** Flow chart of clinical outcome

within 30 days (Table 3). No carcinoma was found on histopathological examination of specimens of resected sigmoid.

Lavage was successful in controlling the abdominal sepsis in 31 patients, including two who had an overt sigmoid perforation closed primarily. One patient with

a pre-existing bronchial carcinoma developed persistent small bowel obstruction after surgery; because of the poor prognosis, parenteral feeding was stopped and the patient died. Ten of 31 patients developed complications within 30 days (*Table 3*).

Follow-up visits were reported in 28 patients, a median of 69 (range 12–529) days after surgery. Follow-up was carried out for more than 3 months only when late complications occurred. Two patients underwent elective sigmoid resection for recurrent symptomatic diverticulitis at 6 and 9 months after operation, and one patient required emergency sigmoid resection for recurrent perforated diverticulitis at 12 months.

In 17 of 30 patients who were treated successfully and recovered, follow-up colonoscopy was performed to exclude colonic malignancy; in none of these malignancy was found.

Patient characteristics were analysed to determine predisposing factors for uncontrolled abdominal sepsis (*Table 2*). Patients in whom lavage was unsuccessful were more likely to have co-morbidities, had a higher mean CRP concentration and a higher MPI.

Discussion

Treatment with laparoscopic lavage in the Netherlands was less successful than in the Irish experience; the Irish group reported very promising results with a mortality rate of 4 per cent in a series of 92 patients¹⁰. The present study analysed a retrospective series of patients from ten hospitals. It suffers from all the limitations of retrospective research, especially the risk of patient selection bias. Because of this and the small study size, the results should be interpreted with caution. In this series, two patients (5 per cent) treated with lavage died after surgery and five other patients required further surgery because of ongoing abdominal sepsis. The 31 patients in whom lavage was successful had low mortality and morbidity rates, and a quick recovery.

Selection of patients who would benefit from laparoscopic lavage is probably of utmost importance, with faeculent peritonitis and the presence of overt perforation being absolute contraindications to lavage. The extent of peritonitis could not be analysed in the present study as this was not reported consistently in the operation records. Unsuccessful treatment was associated with higher ASA grade and co-morbidities. Although the MPI has been designed as a predictor of postoperative death in patients with peritonitis, certain elements of the index (higher age, organ failure, concomitant disease, generalized peritonitis, faeculent peritonitis) have been reported

to predict reintervention for secondary peritonitis, as was found here^{12,13}. The preoperative CRP concentration was higher in the group in whom sepsis was not controlled. This is a known predictor of perforated appendicitis¹⁴ and perforated diverticulitis¹⁵; however, it remains unclear whether CRP can predict the success of laparoscopic lavage for perforated diverticulitis.

No randomized studies have been published on this topic. The available evidence is therefore limited to uncontrolled studies with a high risk of selection and publication bias. Most studies have analysed patients with both Hinchey II and Hinchey III and have considered Hinchey II patients as candidates for lavage treatment, without discrimination within this group of patients based on the presence of free abdominal air. This might make the results appear considerably better because Hinchey II diverticulitis is known to be associated with fewer complications than true perforated diverticulitis¹⁶. The present study included patients with purulent peritonitis and/or distant free air only. Laparoscopic treatment does not seem to be appropriate for patients with Hinchey II diverticulitis without free air. These patients can be treated either conservatively or by percutaneous drainage of the pelvic abscess⁶. Laparoscopic lavage is considered to be unsafe for faeculent peritonitis or when an overt perforation is present.

Laparoscopic lavage is a promising novel treatment for perforated purulent diverticulitis. The high morbidity and stoma rates associated with sigmoid resection can be avoided. However, in the present series, mortality and morbidity were high among patients in whom the abdominal sepsis was not controlled. When no clinical improvement is observed within 48 h, (laparoscopic) reintervention is indicated for additional lavage or resection. The study suggests that laparoscopic lavage might not benefit all patients with Hinchey III diverticulitis. It appears that patients with multiple co-morbidities, a high CRP concentration and a high MPI are at risk of failure of lavage. Sigmoid resection as a first step might be the best intervention for these patients, but the mortality rate is high anyway. It remains unproven which risk factors predispose to failure of lavage; the results of four randomized trials addressing this topic are eagerly awaited^{11,17–19}.

Collaborators

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Snapshot Quiz

Answer

Snapshot Quiz 13/28

This 59-year-old patient presented with a 2-week history of increasing right upper abdominal pain, swelling and pyrexia. He had a cholecystectomy 4 years previously. Computed tomography identified a large complex abdominal fluid collection. The perihepatic and intra-abdominal abscesses were drained surgically. A gallstone fragment seen in the abscess cavity was the focus of infection. Although a perihepatic collection of this nature is relatively uncommon, it should be noted as a possible outcome of cholecystectomy even years after the original surgery. It highlights the importance of documentation of spilled stones during surgery and their extraction.