Laparoscopic Lavage with Drainage for Hinchey III Diverticulitis without Colonic Resection: A Prospective Study

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ABSTRACT

Background: *The aim of this study was to define the effectiveness of laparoscopic lavage and drainage without colonic resection for the treatment of Hinchey III Diverticulitis.* ***Materials and methods:*** *This prospective study was done in Ain Shams university hospitals from December 2010 to January 2014 and included 147 patients admitted with diagnosis of complicated diverticulitis, of which 57 patients were Hinchey I diverticulitis, 50 patients Hinchey II, 33 patients Hinchey III and 7 Patients Hinchey IV. Patients with Hinchey III diverticulitis only were included in this study. Follow up was done for one year.* ***Results:*** *33 Patients with Hinchey III diverticulitis underwent Laparoscopic Lavage with drainage, 18.2% of them were Converted to open colonic resection, 9.1% had repair of identified colonic perforation with diverting ileostomy, 3% had repair of burst abdomen, 15.25% necessitated Post-operative CT-guided drainage and 21.2% underwent Re-Lavage* ***Conclusion:*** *Laparoscopic lavage with drainage for Hinchey III diverticulitis is feasible and safe and avoids the complications of colonic resection.*
Keywords: *Laparoscopic lavage – complicated diverticulitis.*

INTRODUCTION

Diverticulosis is the most commonly found abnormality on colonoscopy; however, the true prevalence is difficult to ascertain as the vast majority of those affected are asymptomatic.[1] The approximate prevalence is 33–66%. [2]

Diverticulitis is the most usual complications of diverticulosis, affecting 15-25% of patients. Acute diverticulitis encompasses a variety of conditions, ranging from localized diverticular inflammation to fecal peritonitis[3]. Several classifications have been developed to describe the range of complications in diverticulitis. One of the best known and most widely used was published in Canada by Hinchey in 1978[4] (Table 1) and modified Hinchey by Sher et al. in 1997[5] (Table 2). Unfortunately, these different classifications of diverticular disease have led to conflicting terminology in current literature. Moreover, none of the classifications seem to sufficiently embrace the entire spectrum of the disease. This calls for a thorough review and a new parameter[2].

Diverticulitis generally presents with abdominal pain, typically located in the left lower quadrant and associated with a variable degree of peritoneal irritation, which can range from none to generalized peritonitis. Localized peritoneal reaction with guarding and rebound tenderness may be noted. Fever and elevation of the white blood cell count can aid in the diagnosis when present[6]. The widespread availability of computed tomography (CT) enables stratification of the disease severity of acute complicated diverticulitis.[7]

The surgical management of diverticulitis has undergone significant changes in recent years. For example, not all patients with complicated diverticulitis require surgery[8]. Treatment of diverticular abscesses (Hinchey Grades 1, 2) depends on the size of the abscess. Abscesses <4 cm can most often be treated with antibiotics alone, under strict clinical observation, while those >4 cm are best managed by percutaneous drainage, usually combined with antibiotics. Drains should be flushed several times daily and may be discontinued after a radiological control or when purulent production has ceased. However, percutaneous drainage is not always successful.[9]

In more severe forms, (Hinchey III and IV) surgical resection (Hartmann procedure versus colon resection and anastomosis with or without stoma) is still considered the treatment of choice by most surgeons.[10]

The use of laparoscopy in the emergency setting is not contraindicated and can be a useful therapeutic adjunct. In addition, primary anastomosis in the setting of perforated

diverticulitis appears to be feasible with equivalent results to the standard operation, Hartmann's procedure. [8]

In view of the constantly evolving treatments for this heterogeneous condition, the aim of this study is to highlight the effectiveness of laparoscopic lavage with drainage (first described by Sullivan et., al) to treat Hinchey III diverticulitis. [11]

METHODOLOGY

The study was conducted in Ain Shams University hospitals from December 2010 to January 2014 and included 147 patients admitted with diagnosis of complicated diverticulitis, of which 57 patients were Hinchey I diverticulitis, 50 patients Hinchey II, 33 patients Hinchey III and 7 Patients Hinchey IV.

1- Patients:

Inclusion criteria: Patients with Hinchey III diverticulitis only were included in this study. So the number of patients of our study was 33 patients.

Exclusion criteria: The following patients were excluded:

1. Other classes of diverticulitis other than Hinchey III
2. Patients who had major upper abdominal surgery
3. Patient with contraindications for insufflation as those with severe cardiovascular or respiratory diseases
4. Patients who did not complete one year follow up were excluded.

Diagnostic studies: The selected patients were subjected to:

1. History taking including; eating habits, previous attacks of abdominal pain, co-existing medical disease e.g. Diabetes Mellitus (DM).
2. Complete physical examination: with measurement of vital signs especially fever and tachycardia, local abdominal tenderness and rebound tenderness.
3. Laboratory workup: complete laboratory workup including white cell count, C-reactive protein, ESR, LDH and renal profile (because all patients were subjected to Pelviabdominal CT scan with contrast).
4. All patients above 40 years of age had ECG.
5. Routine Chest X-ray in erect position was done to detect air under diaphragm in Hinchey III (**Figure: 1**).
6. Computed tomography of the abdomen and pelvis with oral and intravenous contrast to diagnose and determine the class of Diverticulitis, where we found free intra-peritoneal air and pockets of fluid collection (**Figures: 2-4**).
7. Colonoscopy was not done in the acute setting. Other preoperative investigations: including chest x-ray and ECG.

NB.: Patients with Hinchey I diverticulitis were treated with conservative management including antibiotics and bowel rest. Those with Hinchey II were subjected to CT-guided percutaneous drainage of pus collections. Patients with Hinchey III were treated by Laparoscopic Lavage with Drainage and were the subjects of our study. Those with Hinchey IV were treated by open colonic resection and stoma (Hartmann's procedure).

All patients included in our study were counseled about the risks and benefits of this procedure, including the potential for conversion to an open procedure, the need for colonic resection, possible stoma, potential complications of the disease and the procedure and recurrent attacks. Informed consent was signed by all patients and the study was approved by our surgical department ethical committee.

2- **Surgical technique:**

After completion of the pre-operative check including the preoperative parenteral antibiotics (3^{rd} generation cephalosporin and metronidazole) and resuscitation, the patient was transferred to the operating room. Compression stockings were applied to the patient's legs. The operation was done under general anesthesia.

If the patient is hemo-dynamically unstable an arterial line and/or a central vein catheter was placed. A Foley catheter and nasogastric tube were inserted. The patient was placed supine on the operating table with the lower limbs spread. The patient was securely strapped to the table at the chest since tilting the table was necessary

The surgeon stands on the right side of the patient. Establishment of pneumo-peritoneum was done by either Veress needle or the visiport. The camera port was placed in right upper quadrant of the abdomen, then 3 more ports were applied; one supra-umbilical and one in right lumbar for

working instruments. One other port was placed in the contralateral side for retraction.

First step was thorough inspection of the whole abdomen to define the pockets and loculations of pus which are usually found in the pelvis, left and right para-colic gutters. The second step was to take down all omental attachment to the colon to gain access to the collections **(figure 5)** and then aspirate all collections using the suction tube (**figure 6**). The third step was irrigation which is carried out in all four quadrants with copious amounts of warmed saline solution until the effluent fluid is clear, without dissecting the sealed perforation. The site of perforation if identified was closed by interrupted stitches laparoscopically and omental patch was applied. A diverting loop ileostomy was performed in case of large perforation. If the source of contamination was not adequately controlled conversion to open was done. The last step was to place drain in the pelvis and at left para-colic gutter. Nasogastric tube was removed at the end of the procedure.

Post-operative management:

The patients were permitted to drink clear fluids as soon as bowel movements had resumed (audible bowel sounds) and proceed to soft and regular diet as tolerated. Antibiotics were continued in the postoperative period intravenously until the patient was afebrile. Postoperative pain medication was given as parental paracetamol and shifted to oral form when the patient resumed oral feeding. Follow up in the early postoperative period by clinical examination: including the subjective feeling of abdominal pain, heart rate for tachycardia, temperature for fever and abdominal tenderness. Daily laboratory investigations included white cell count, C-reactive protein, ESR and LDH. Patients were discharged when they were pain-free, tolerating oral diet, resolving inflammatory markers and drains removed.

Follow up:

A follow up visit was done one week after discharge, with the patient's wounds inspected, with follow up the diet intake, abdominal pain, abdominal tenderness. At 3 months, 6 months and 12 months postoperative, the patients were followed for recurrence of the disease either by symptoms or through high inflammatory markers and at that time Pelviabdominal CT scan with contrast was done. Planning of stoma reversal (if any) after 3 months.

RESULTS

Our Study included 33 patients who were classified as Hinchey III diverticulitis. They underwent Laparoscopic Lavage with drainage. The mean age of our patients was 61.5±17 years, ranging from 41 to 88 years. 21 patients were males (63.6%) and 12 were females (36.4%)**,** 7 patients were diabetics (21.2 %) and 6 patients were obese (18.2%) (**Table 3**) (**Graph 1**).

The operative results showed that Operating time was 70-120 min. 3 patients (9.1%) underwent laparoscopic intra-corporeal stitching of an identified colonic perforation, these patients were subjected to diverting loop ileostomy. 6 patients (18.2%) were converted to open colonic resection (Hartmann's procedure) (**Table 4**).

The post-operative results showed that 5 patients (15.2%) underwent percutaneous CT-guided drainage. 3 of these 5 patients had chest infection they had sub-phrenic collection on CT with pleural reaction with mild effusion and basal lung consolidation. Another 7 patients (21.2%) were subjected to laparoscopic re-lavage with drainage of all pockets, 4 of them improved and 2 needed open Hartmann's procedure. 6 patients (18.2%) had post-operative surgical site infection. 3 patients had UTI (urinary tract infection). The hospital stay was 11±7 days (**Table 5**). Late postoperative follow up showed that 5 patients (15.2%) developed incisional hernia. 5 patients (15.2%) developed recurrent acute diverticulitis. 2 patients (6%) developed adhesive bowel obstruction (**Table 5**).

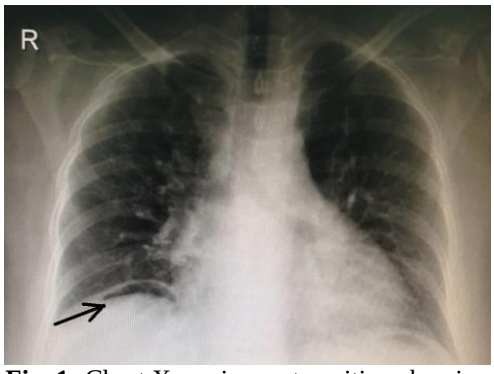


Fig. 1: Chest X-ray in erect position showing right sub-diaphragmatic free air (black arrow)

Fig. 2: CT of the abdomen and pelvis showing free fluid in the Morrison's pouch (black arrow)

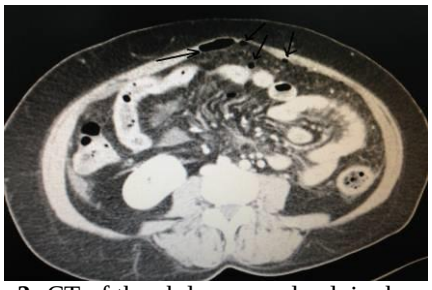


Fig. 3: CT of the abdomen and pelvis showing free intra-peritoneal air (black arrows)

Fig. 4: CT of the abdomen and pelvis showing peri-colonic stranding, peri-colonic free air and fluid collection (black arrows)

Fig. 5: Identification of areas of collection

Fig. 6: Aspiration of all collections using the suction tube

Table (1): Hinchey classification of diverticulitis[4]

Grade	*Classification*
Hinchey I	Peri-colic abscess or phlegmon
Hinchey II	Pelvic, intra-abdominal, or retroperitoneal abscess
Hinchey III	Generalized purulent peritonitis
Hinchey IV	Generalized fecal peritonitis

Table (2): Modified Hinchey classification of diverticulitis[5]

Grade		*Classification*
Hinchey I		Peri-colic abscess or phlegmon
Hinchey II	IIa	Distant abscess amenable to percutaneous drainage
	IIb	complex abscess associated with/without fistula
Hinchey III		Generalized purulent peritonitis
Hinchey IV		Generalized fecal peritonitis

Table (3): Distribution of the studied cases and patients' demographics.

Variables	*No*	*%*
Gender		
Male	21	63.6%
Female	12	36.4%
Age	61.5±17	41-88
Obese	6	18.2%
Diabetic	7	21.2%

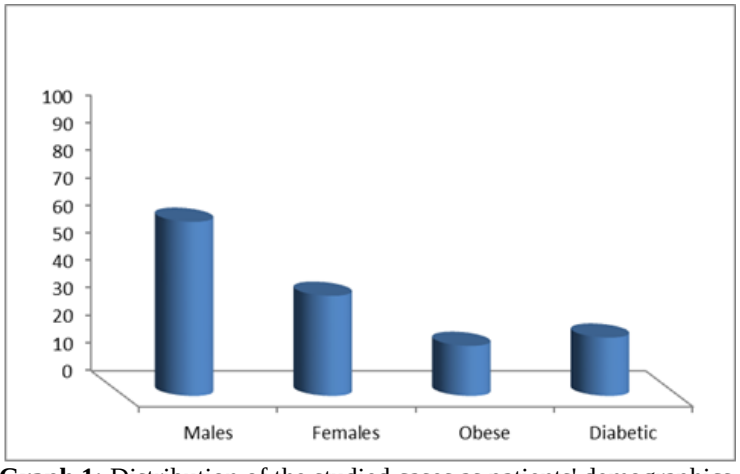
This table shows that the disease has more male predominance.

Table (4): Distribution of patients as regard interventions done

Variables	*No*	*Percentage (95% CI)*
Laparoscopic Lavage with drainage	33	100 (89.6-100) %
Conversion to open colonic resection	6	18.2 (8.6-34.4) %
Diverting ileostomy	3	9.1 (3.1-23.6) %
Repair of burst abdomen	1	3 (0.5-15.3) %
Post-operative CT-guided drainage	5	15.2 (6.6-30.9) %
Re-Lavage	7	21.2 (10.7-37.7)%

Table (5): Distribution of patients as regard post-operative complications

Variables	*No*	*Percentage (95% CI)*
Surgical site infection	6	18.2 (8.6-34.4)%
Chest infection	3	9.1 (3.1-23.6)%
UTI	3	9.1 (3.1-23.6)%
Pulmonary embolism	1	3 (0.5-15.3)%
Incisional hernia	5	15.2 (6.6-30.9)%
Recurrent diverticulitis	5	15.2 (6.6-30.9)%
Bowel obstruction	2	6.1 (1.7-19.6)%
Mortality	1	3 (0.5-15.3)%



Graph 1: Distribution of the studied cases as patients' demographics.

DISCUSSION

The management of diverticular disease in the emergency setting continues to evolve. Hartmann's procedure became a 'gold standard' for perforated diverticulitis when resection was demonstrated to improve survival compared with a defunctioning colostomy alone. However, restoration of intestinal continuity involves a second procedure associated with considerable morbidity and mortality[12]. Laparoscopic lavage has recently emerged as a promising alternative to sigmoid resection in the treatment of perforated diverticulitis[13]

The American Society of Colon and Rectal Surgeons (ASCRS) states: ''The poor quality of the existing literature on peritoneal lavage in aggregate and the inherent selection bias in the literature are major obstacles in advocating the widespread adoption of the laparoscopic lavage,'' and adds, ''The safety of lavage for purulent or fecal peritonitis has not been proven or disproven by the published studies to date.'' [14]

In this prospective study we evaluated the laparoscopic lavage without resection for treatment of Hinchey III diverticulitis. The Operating time was 70-120 min. which is near to recently published DILALA trial[15] which was 28–194 minutes.

Three patients (9.1%) underwent laparoscopic intra-corporeal stitches of an identified colonic perforation, those patients were subjected to diverting loop ileostomy. Roberto et., al [10] reported detection of colon perforation during laparoscopy in 19 patients (19/41, 46.3%) which is higher than our results attributed to minute sealed perforations and small number of patients.

Another 6 patients (18.2%) were converted to open colonic resection (Hartmann's procedure); three of them (9.1%) due to extensive adhesions, two of them due to failed clinical improvement after Laparoscopic re-lavage and one had iatrogenic colonic perforation during dissection. Our conversion rate was comparable to the DILALA trial[15] which reported (21.6%) conversion rate due to technical difficulties or severe intra-abdominal inflammation.

In our study One (3%) morbidly obese patient developed burst abdomen on the 5th post-operative day post conversion to open Hartmann's colectomy due to extensive adhesions. Repair of the burst abdomen was done with tension sutures then transferred to ICU where he developed pulmonary embolism despite DVT (deep venous thrombosis) prophylaxis and the patient died on the 10th day post-operative. On the contrary, the overall mortality in some published reviews was 1.4%[16] which is less than ours, but our results were limited by the small number of cases. Another study by E. Myers et., al [12] reported 3% mortality rate which was due to multi-system organ failure due to severe sepsis which was comparable to our results.

In the early post-operative period 5 patients (15.2%) were not clinically improved (persistent fever and abdominal tenderness) associated with high inflammatory markers, their Pelviabdominal CT showed areas of localized pus collection (in the pelvis and sub-phrenic). Those patients improved after percutaneous CT-guided drainage. three of them had chest infection presented by persistent fever and cough due to sub-phrenic collection with pleural reaction with mild effusion and basal lung consolidation, which improved with the CT-guided drainage together with chest physiotherapy and antibiotics according to culture. Roberto et., al [10] reported that 2.02% of the patients required percutaneous drainage for sepsis due to generalized peritonitis or intra-abdominal/pelvic abscess. These results are less than ours, but again due to small number of cases.

Another seven patients (21.2%) had picture of non-resolving septic condition; their CTs showed multiple areas of pus collections not amenable to percutaneous drainage, these patients were subjected to laparoscopic re-lavage with drainage of all pockets, 5 of them improved and 2 needed conversion to open Hartmann's procedure. 6 patients (18.2%) had post-operative surgical site infection (those who were converted to open colonic resection). 3 patients had UTI (urinary tract infection) presented by dysuria and fever with pus cells in urine and improved on antibiotics according to culture. The hospital stay was 11±7 days which was comparable to the study of Myers et., al[12] who reported median hospital stay of 8 days.

Late postoperative follow up showed that 5 patients (15.2%) developed incisional hernia (those converted to open) identified at 1 month follow up. They underwent elective repair with mesh. 5 patients developed recurrent acute diverticulitis which was mild attack (CT: Hinchey I) they improved on antibiotics and they didn't

deserve admission. Two patients developed adhesive bowel obstruction and they improved on conservative management.

CONCLUSION

Laparoscopic lavage with drainage for Hinchey III diverticulitis is feasible and safe and avoids the complications of colonic resection. It is also associated with reduced recovery time, early return of bowel function, reduced hospital stay and decreased morbidity. Our study was limited due to the small number of cases.

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