Laparoscopic drainage of pelvic abscess: evaluation of outcome

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Objective
The aim of this study was to evaluate the outcome of laparoscopic drainage (LD) of pelvic and paracolic abscesses not amenable to percutaneous or transrectal computed tomography-guided or ultrasound-guided drainage.

Patients and methods
Forty patients presented with a picture of acute abdomen. Radiological diagnosis defined 32 primary intra-abdominal abscesses and eight postoperative (PO) abscesses. After laparoscopic exploration, the abscess cavity was entered, and septa were cut down, drained, and irrigated using normal saline. The source of infection was managed if possible and then drains were inserted.

Results
Thirty-six patients underwent successful LD within a mean operative time of 94.3 min. Four patients required conversion to laparotomy for a conversion rate of 10%. Pain scores showed a gradual significant decrease. The mean duration of peritoneal drainage was 3.7±0.9 days and the mean PO hospital stay was 5.6±1.7 days. Three (8.3%) patients developed PO infection; two patients had a surgical wound infection at the umbilical port site and one patient developed recollection that required second-look LD of pelvic recollection. Two patients were died because of flare-up of an already present medical problem.

Conclusion
LD was a feasible, safe, and effective minimally invasive procedure for primary or secondary pelvic abscesses, with a conversion rate of 10%. No surgery-related mortality was encountered.

Keywords:
acute appendicitis, diverticulitis, laparoscopic drainage, pelvic abscess

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Introduction

Intra-abdominal abscesses continue to be a major source of morbidity and mortality in today's surgical practice. The obscure nature of the underlying conditions and the variable clinical course of the disease may result in a delay in diagnosis and management; such delays usually result in deleterious effects on patients' outcome, increased periods of hospitalization, and healthcare costs.

A better understanding of intra-abdominal abscess pathophysiology and a high clinical index of suspicion should enable earlier recognition, definitive treatment, and reduced morbidity and mortality [1].

Localized intra-abdominal abscesses usually tend to form in relation to the affected viscus, for example, appendicular abscess usually formed in the right iliac fossa in relation to a perforated appendix or tubo-ovarian abscess, which is formed in the pelvis in relation to female adnexae; however, remote abscesses may form at remote sites in the intraperitoneal compartments including the pelvis, right and left paracolic gutters, right and left infradiaphragmatic spaces, Morrison's space, and in between small bowel loops.

Omentum, adjacent viscera, and inflammatory adhesions migrate to the site of infection, producing phlegmon, which functions as a barrier against the spread of infection to other peritoneal spaces. Intraperitoneal abscesses, especially those derived from colonic origins, contain a mixture of aerobic and anaerobic bacteria that stimulate inflammatory cellular and immunological responses to fight infection causing pus formation and abscess expansion. The resulting systemic inflammatory response may cause septic syndrome and multiorgan failure if left untreated.

A proper diagnosis and abscess localization is mandatory for prompt treatment. Percutaneous computed tomography (CT)-guided catheter drainage has become the standard treatment of most intra-abdominal abscesses.

In cases where percutaneous drainage is not accessible or not possible because of the presence of multiple

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abscesses, surgical drainage is an option. The surgical approach may be either laparoscopic or open.

Laparoscopic drainage (LD) for a massive intra-abdominal abscess is minimally invasive, enabling exploration of the abdominal cavity without the use of a wide incision; purulent exudates can be aspirated under direct vision [2]. In addition, laparoscopy can serve to remove the cause of sepsis, for example, perforated appendix, and ruptured colonic diverticulum, if the general condition is favorable.

The current prospective study aimed to evaluate the outcome of laparoscopic management of pelvic and paracolic abscesses not amenable to percutaneous or transrectal CT-guided or ultrasound (US)-guided drainage.

Patients and methods

The current study was carried out at the General Surgery Department, Al-Adwani General Hospital (Taif, KSA) and Benha University Hospital, from June 2013 to December 2015. The study protocol was approved by the local ethical committee. All enrolled patients signed written fully informed consents for diagnostic procedures, surgical decisions, and procedures. The study intended to include patients presenting with clinical and radiological manifestations of lower abdominal intraperitoneal abscesses not amenable to/or failed drainage using percutaneous CT-guided or US-guided drainage and irrespective of being primary or postoperative (PO).

All patients underwent a complete assessment of history including age, sex, calculation of BMI, and presence of associated medical diseases, especially diabetes mellitus. Patients were graded according to the international classification of BMI as follows: underweight (BMI$<$ 18.5 kg/m^2); normal weight range (BMI=18.5–24.99 kg/m^2); overweight (BMI=25–29.99 kg/m^2); and obese (BMI$>$30 kg/m^2) [3,4].

Assessment of history also included the presence of pain and its characteristics including site, referral, duration, and severity. The severity of pain was evaluated using a visual analogue scale (VAS) consisted of 10 points, with 0 indicating no pain and 10 indicating the worst intolerable pain [5]. The presence of nausea, vomiting, diarrhea, vaginal bleeding, or discharge was evaluated. Then, patients underwent a complete clinical examination with a special focus on the abdomen; examination per rectum and vagina was also performed. Thereafter, all patients underwent plain radiography in an erect position if possible and abdominal ultrasonography. CT scanning was performed if possible to ensure proper localization of the lesion and underlying pathology.

All patients received preoperative resuscitation in the form of intravenous fluid transfusion consisting of glucose 5% and lactated Ringer's solution in equal amounts for correction of acid–base and electrolyte disturbances, optimization of hemodynamic parameters, nutritional status, and coagulation profile. Diabetic patients received intensive insulin therapy using regular insulin to adjust random blood glucose to a range of 100–110 mg/dl. Thromboprophylaxis was performed whenever indicated.

All surgeries were performed under general inhalational anesthesia with tracheal intubation. Preoperative intravenous antimicrobial therapy in the form of third-generation cephalosporin and metronidazole infusion was administered. Before induction of anesthesia, intravenous ondansetron (4 mg) and dexamethasone (8 mg) was administered to prevent the development of nausea and vomiting.

Surgical treatment and trocar placement sites were planned and individualized according to abscess location, size, suspected pathology, presence of scars of previous surgery, and suspected sites of inflammatory adhesions. The optical port was inserted by an open technique usually in the supraumbilical position. Insufflation was maintained at 14 mmHg and two to four working ports were inserted under vision according to the condition of the abscess and respecting the concept of triangulation and maintaining the ergonomics of working hands.

Laparoscopic management was started by a thorough exploration of the abdominal cavity and breakdown of adhesions. Omentum, and small and large bowel, usually forming an inflammatory barrier around the abscess cavity, were gently swept away by gentle traction, hydrodissection, and a combination of blunt dissection and cold scissors with electrocoagulation of bleeding points. In certain instances, a harmonic scalpel was used in the presence of tough adhesions. The abscess cavity was entered, samples of pus were collected and sent for bacteriological examination and culture and sensitivity tests, and then the abscess was drained. If multiple loculi were found, septa were cut down if possible to create one locus that was drained. The abscess cavity was irrigated using normal saline. The source

of infection was managed if possible, and then drains were inserted. Before theater discharge, patients were catheterized for follow-up of urine output (UOP). Collected intraoperative data included the feasibility of LD and the conversion rate to open exploration, operative time, the need for blood transfusion, and its amount.

Patients were transferred to the postanesthetic care unit and were maintained on fluid therapy according to hemodynamic parameters, central venous pressure, and UOP. Patients were maintained on intravenous antibiotic therapy and metronidazole infusion if indicated. Patients with a hemoglobin concentration of less than 7 g% or with an intraoperative blood loss of more than 500 ml received packed red blood cells. Patients were monitored noninvasively for blood pressure, heart rate, and respiratory rate, and levels of blood gases and blood pH were also determined. UOP was adjusted at a rate of greater than or equal to 0.5 ml/kg/h.

PO pain was scored using the 10-point pain VAS score at admission to postanesthetic care unit and 6-hourly for the next 24-h. PO analgesia was provided in the form of intramuscular meperidine 50 mg on pain VAS score was greater than or equal to four. The occurrence of PO nausea and/or vomiting was recorded and was managed by an intravenous injection of ondansetron (4 mg). Patients were observed for persistent pain despite provision of analgesia, development or persistence of fever, and/or abdominal signs such as distension, local tenderness, guarding, and delayed return of bowel sound. Time until first ambulation and oral fluid intake, development of PO complications, morbidities or mortality, and duration of PO hospital stay were also recorded.

Results

The study included 40 patients, 25 men and 15 women (mean age: 40.8±6.4 years, range: 27–52 years). Details of patients' enrollment data are shown in Table 1.

All patients presented with a picture of acute abdomen with pain as the most prominent complaint. Pain was throbbing in nature and was mostly localized with signs of peritonism. At admission, the mean pain VAS score was 6.9±1 (range: 4–8). Radiological diagnosis defined 32 primary intra-abdominal abscesses and eight PO abscesses. Details of patients' clinical data and outcomes of preoperative investigations are shown in Table 2.

Laparoscopic dissection of tissues away from the abscess cavity seemed to be dangerous in four cases that were converted to laparotomy for open management, for a conversion rate of 10%. The first case was a woman who developed pelvic collection after a vaginal hysterectomy performed since 12 days; the patient looked toxic and required fluid resuscitation and intraoperative fresh blood transfusion. CT imaging showed a multilocular abscess indenting the rectum and urinary bladder and the contents appeared to be thick. Laparoscopic exploration confirmed CT findings, but dissection was difficult. Open laparotomy enabled abscess drainage and there was rectal communication between the abscess cavity and the rectum; proximal diversion was performed (Hartman's procedure). The patient had a smooth PO course and, after 3-min rectal contrast enema, showed complete closure of the fistulous tract and open closure of diversion was performed.

The second patient had missed perforation during transurethral prostatectomy; a pelvic abscess was secondary to leakage starting during the operation and continued postoperatively. The patient was

Table 1 Patients' data

Data	Findings
Age (years)	
Strata	
<30	3 (7.5)
30–39	14 (35)
40–49	19 (47.5)
≥50	4 (10)
Total	40.8±6.4
Sex	
Male	25 (62.5)
Female	15 (37.5)
BMI data	
Weight (kg)	83.2±16.5
Height (cm)	168.4±2.7
BMI (kg/m^2)	
Strata	
Underweight (<18.5)	4 (10)
Average (18.5–24.99)	5 (12.5)
Overweight (25–29.99)	14 (35)
Obese (30–34.99)	12 (30)
Morbid obese (>35)	5 (12.5)
Total	29.3±5.5
Medical comorbidity	
No	29 (72.5)
Yes	
Diabetes mellitus	8 (20)
Hypertension	4 (10)
Cardiac disease	2 (5)
Chronic renal disease	1 (2.5)
Average/patient	1.4

Data are presented as numbers and mean±SD; percentages are given in parentheses.

catheterized and methylene blue dye was injected into the bladder. Fortunately, the leakage point was identified, the bladder was cautiously dissected, and the fistulous tract communicating the bladder to the abscess cavity was identified and the bladder wall was repaired in two layers. Intestinal loops were found to form a part of the wall of the abscess cavity that was irrigated by saline and drained with peritoneal drainage. On the fifth operative day, ascending cystography was performed to ensure complete closure of the fistula and competent repair. The remaining two patients had acute sigmoid diverticular abscess of Hinchey stages II and III with free perforation and generalized purulent peritonitis. Both patients underwent open drainage and sigmoid resection using Hartmann's procedure.

Table 2 Clinical, laboratory, and radiological data of the patients studied

Data	Findings
Pain VAS scores	
Strata	
4–5	2 (5)
6–7	26 (65)
>7	12 (30)
Mean±SD	6.9±1
GIT manifestations	
Nausea	40 (100)
Vomiting	30 (75)
Diarrhea	15 (37.5)
Constipation	10 (25)
Tenesimus	7 (17.5)
Temperature (°C)	
Strata	
<38	5 (12.5)
38–39	24 (60)
>39	11 (27.5)
Mean±SD	38.8±0.6
Laboratory investigations	
Hemoglobin concentration (g%)	
<8	1 (2.5)
8–10	19 (47.5)
>10–12	17 (42.5)
>12	3 (7.5)
Mean±SD	10.1±1.3
TLC (10^3/ml)	
<15	2 (5)
15–20	11 (27.5)
20–25	15 (37.5)
>25	12 (30)
Mean±SD	22.7±5.4
CRP (mg/dl)	
<24	13 (32.5)
24–36	22 (55)
>36	5 (12.5)
Mean±SD	26.6±7.6
Radiological diagnosis	
Primary	
Appendicular abscess	17 (42.5)
Diverticular abscess	8 (20)
Tubo-ovarian abscess	7 (17.5)
PO	
Appendectomy	3 (7.5)
Hysterectomy	2 (5)
GIT surgery	2 (5)
Urological surgery	1 (2.5)

Data are presented as numbers and mean±SD; percentages are given in parentheses. CRP, C-reactive protein; GIT, gastrointestinal tract; PO, postoperative; TLC, total leukocytic count; VAS, visual analogue scale.

All the rest of the 36 patients underwent successful LD and management (Figs 1–4) within a mean operative time of 94.3±12.1 min (range: 75–120 min). Nineteen patients required an operative time of less than 90 min, but 17 patients required more than 90 min. The mean intraoperative blood loss was 172.5±65.7 ml (range: 100–300 ml). No patient required blood transfusion for intraoperative blood loss, but five patients received a transfusion of freshly donated blood for correction of anemia and to improve their immunity (Table 3).

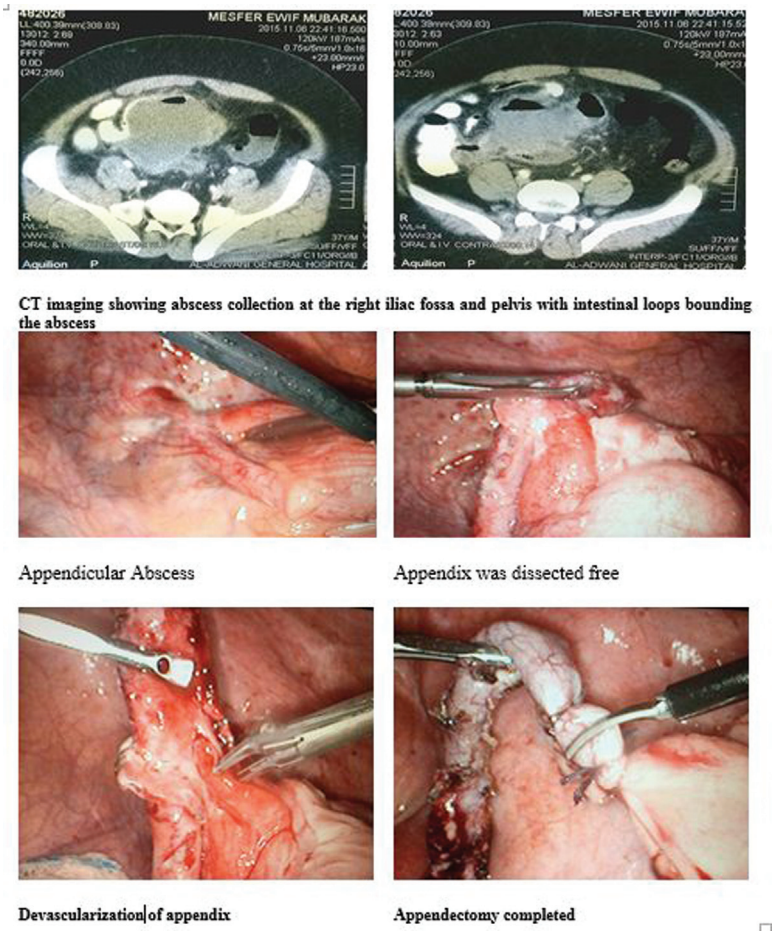
Throughout the immediate PO course, pain VAS scores showed a gradual significant decrease as shown in Fig. 5. All patients tolerated pain during the immediate 6-h PO and no one required rescue analgesia during the first 6-h PO and, thereafter, only 15 patients required rescue analgesia throughout their first 24-h PO. The majority of patients could be mobilized within 4–5-h PO, with a mean duration till first mobilization of 4.3±1 h (range: 3–7 h). The mean time until the first oral intake was 19.4±7.3 h (range: 12–36 h). The mean duration of peritoneal drainage was 8.8±2.7 days (range: 3–14 days), and the mean PO hospital stay was 5.6±1.7 days (range:

Table 3 Operative data for patients who received complete laparoscopic management

Data	Findings
N (%)	36 (90)
Operative time (min)	
Strata	
≤90	19 (52.8)
>90	17 (47.2)
Mean±SD	94.3±12.1
Intraoperative blood loss	
Amount (ml)	
<200	20 (55.6)
>200	16 (44.4)
Mean±SD	172.5±65.7
Need for blood transfusion	
For bleeding	0
Correction of anemia	5 (13.9)
No	31 (86.1)

Data are presented as numbers and mean±SD; percentages are given in parentheses.

Figure 1



Appendicular abscess secondary to a perforated appendix; abscess was drained and appendectomy was performed successfully. CT, computed tomography.

3–9 days). Details of immediate PO data are shown in Table 4.

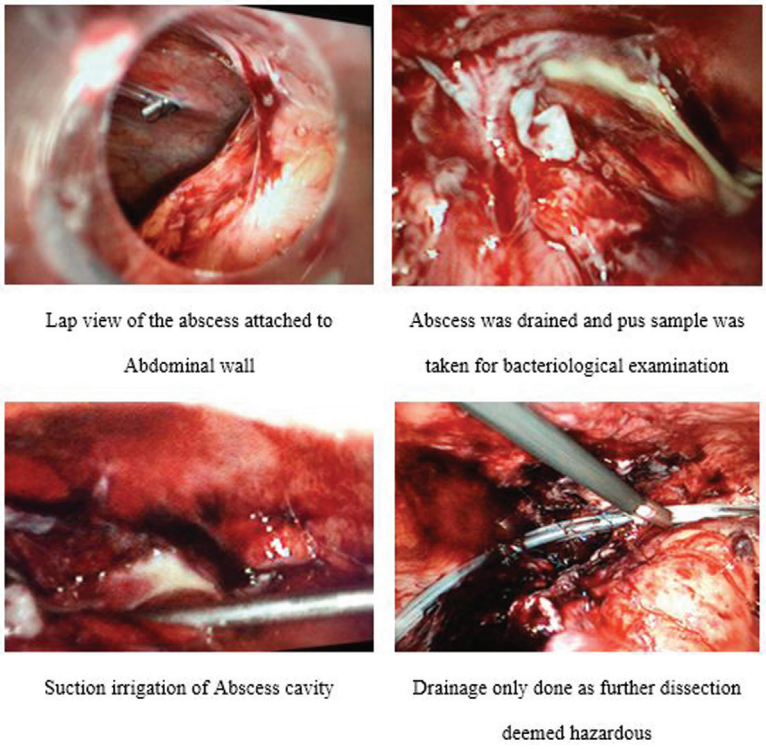
During PO course, three (8.3%) patients developed PO infection; two (5.6%) patients had surgical wound infection at the umbilical port site. Unfortunately, one (2.8%) patient developed recollection that required second-look laparoscopy for drainage of pelvic recollection. Throughout the duration of PO, patients with preoperative medical problems were maintained on their preoperative therapies for strict control, especially for diabetes mellitus. Unfortunately, two patients died during their hospital stay, yielding a mortality rate of 5%. The first patient received laparoscopic management and on the second PO day, developed acute myocardial infarction and required ICU admission, but conservative treatment could not help sustain and the patient died. The second patient underwent laparotomy and developed hyperglycemic hyperosmolar diabetic coma, but unfortunately, did not respond to medical treatment and progressed to acute renal failure and died on the fifth PO day.

Discussion

The results obtained showed the feasibility of LD of pelvic abscess not amenable to US-guided or CT-guided needle drainage with a conversion rate of 10% not only for difficult dissection but also for patients' condition. Moreover, LD was feasible for both primary and PO abscesses; thus, laparotomy was not performed for such cases, especially PO abscesses, because of the presence of intraperitoneal adhesions, and for cases with an appendicular abscess or mass that required only drainage and another setting for management.

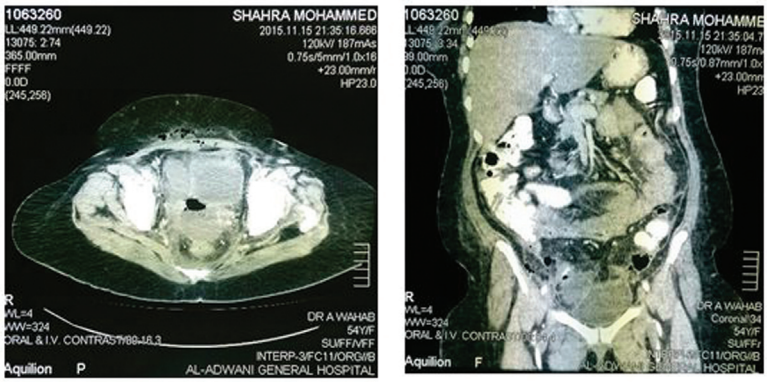
In support of the feasibility and safety of laparoscopic management for patients with complicated appendicitis (CA), Gosemann *et al.* [6] reported a conversion rate of 1.2% and found that laparoscopic compared with open surgery was associated with lower readmission rates for surgical complications in both uncomplicated appendicitis and CA. As another support for the feasibility of laparoscopic management of CA, Kang *et al.* [7] compared conventional versus single-port laparoscopy, and found no difference between both groups in the

Figure 2



Appendicular abscess secondary to a perforated appendix; abscess was drained and appendectomy was postponed.

Figure 3

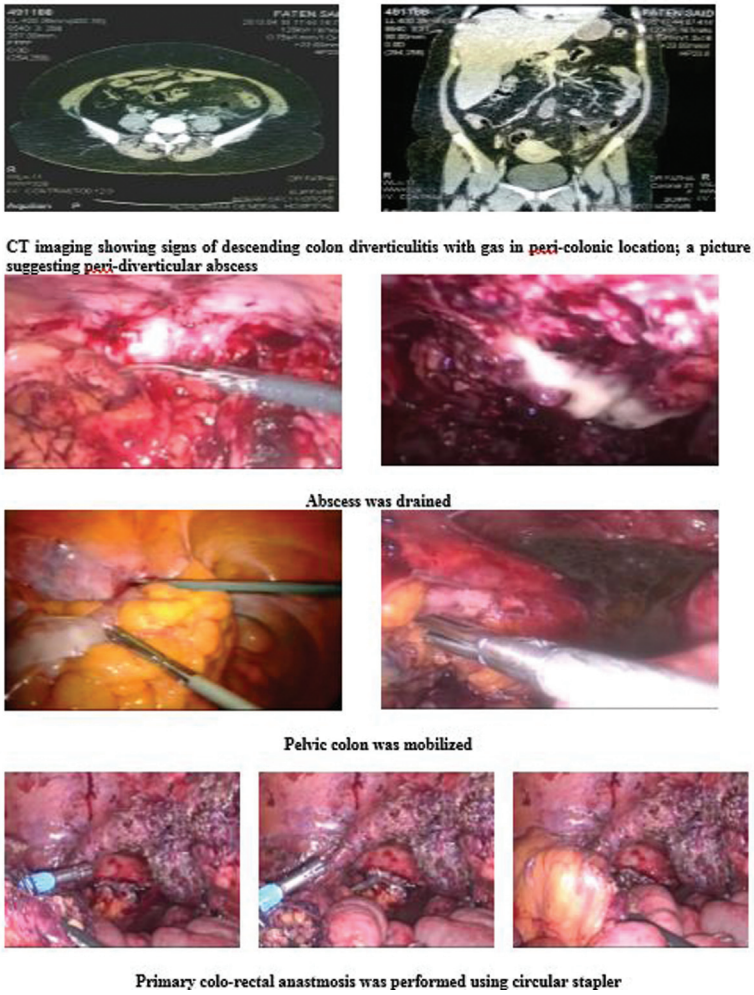


Computed tomography imaging showing posthysterectomy multiple pelvic abscesses, of which one large abscess was located on the right side of the urinary bladder and another large one behind the bladder.

operation time, PO hospital stay, readmission rate, and rate of PO complications, but more patients with CA needed conversion to open surgery with single-port laparoscopy. In contrast, Taguchi *et al.* [8] found that the rate of PO complications, including incisional or organ/space infection and stump leakage, did not differ significantly between open and laparoscopic appendectomy.

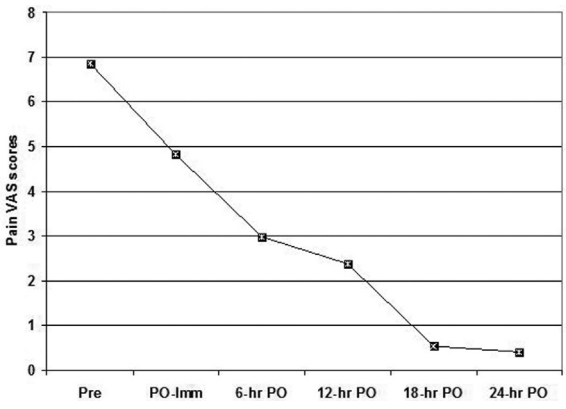
LD provided the studied patients with the routine advantages of laparoscopic surgeries, namely, low PO pain scores and requirement for rescue analgesia, early PO ambulation, and oral intake, with subsequent early return home. In line with these data, Gosemann *et al.* [6] found that laparoscopic compared with open surgery was associated with a shorter length of hospital stay. Also, Çiftçi [9] reported that the VAS of pain was significantly higher in the open appendectomy group at the 1st, 6th, and 12th hour PO, with a significantly higher need for analgesic medication compared with the laparoscopic group, but with no differences between the two groups in terms of morbidity and total complication rates. In contrast, Taguchi *et al.* [8] found no significant

Figure 4



Peridiverticular abscess; abscess was drained and colorectal anastomosis was performed successfully. CT, computed tomography.

Figure 5



Mean pain VAS scores determined throughout 24-h postoperatively compared with the preoperative scores. PO, postoperative; VAS, visual analogue scale.

differences between open and laparoscopic appendectomy in hospital stay, duration of drainage, analgesic use, or parameters for PO recovery, except days required for mobilization.

In terms of diverticular disease, the study included eight patients with complicated acute diverticulitis (AD); six cases were managed laparoscopically and two cases required conversion to open surgery, but all cases were managed uneventfully. These data indicated the safe applicability of laparoscopic management of AD despite the still present controversy on the applicability of LD and/or definitive management for complicated AD, where Royds *et al.* [10] documented that laparoscopic surgery for both complicated and uncomplicated diverticular disease is associated with low rates of PO morbidity and relatively low conversion rates and could thus be considered as the standard of care for diverticular disease. Also, Köckerling [11] reported that LD can be performed safely and act effectively for pericolic and pelvic abscesses (Hinchey stages I and II) and purulent and feculent peritonitis (Hinchey stages III and IV) and Hidaka *et al.* [12] documented that laparoscopic sigmoidectomy and fistulectomy could be performed for

Table 4 Postoperative data for patients (*n*=36) who received complete laparoscopic management

Data	Findings
Pain data	
VAS score	
Preoperative	6.9±1
Immediate PO	4.8±0.7
6-h PO	3±0.8
12-h PO	2.4±1.5
18-h PO	0.5±1
24-h PO	0.4±0.6
Request of rescue analgesia	
Yes	15 (41.7)
No	21 (58.3)
Duration of analgesia (h)	
6	11 (30.6)
12	4 (11.1)
≥18	21 (58.3)
Time till first mobilization (h)	
Strata	
2–3	8 (22.2)
4–5	24 (66.7)
>6	4 (11.1)
Total	4.3±1
Time till first oral intake (h)	
Strata	
12–18	22 (61.1)
>18–24	9 (25)
>24	5 (13.9)
Total	19.4±7.3
Duration of abdominal drainage (days)	
Strata	
3–6	3 (8.3)
7–10	22 (61.1)
>10	11 (30.6)
Total	8.8±2.7
Duration of hospital stay (days)	
Strata	
3–4	11 (30.6)
5–7	18 (50)
8–9	7 (19.4)
Total	5.6±1.7

Data are presented as numbers and mean±SD; percentages are given in parentheses. PO, postoperative; VAS, visual analogue scale.

sigmoidocutaneous fistula with an uneventful PO course.

In contrast, Schultz *et al.* [13] and Vennix *et al.* [14] documented that among patients with perforated diverticulitis and undergoing emergency surgery, the use of laparoscopic lavage versus primary resection did not reduce severe PO complications and led to worse outcomes in secondary end points.

However, recently, in 2016, Rotholtz *et al.* [15] documented that the laparoscopic approach in any kind of complicated diverticular disease can be performed with low morbidity and acceptable conversion rates compared with patients undergoing laparoscopic surgery for recurrent diverticulitis. Also, Bhakta *et al.* [16] reported that in patients with complicated diverticulitis, the overall conversion rate was 12.8%; patients who had conversion to an open procedure had a significantly higher rate of PO complications and concluded that the laparoscopic approach to sigmoid colectomy is safe and preferable in experienced hands.

During PO course, three (8.3%) patients developed PO infection; two (5.6%) patients had surgical wound infection at the umbilical port site and one (2.8%) patient developed recollection that required second-look laparoscopy for drainage. Similarly, Agrawal *et al.* [17], in their series of laparoscopic management of cases of appendicular mass, reported PO complications in 7.69% of patients, of whom 5.76% had a minor wound infection at the umbilical port site and 1.92% had PO pelvic abscess, which was managed with percutaneous aspiration.

Conclusion

LD was a feasible, safe, and effective therapeutic modality for primary or secondary pelvic abscesses. LD is a minimally invasive procedure with low PO morbidities. Laparoscopic definitive surgery could be performed with a conversion rate of 10%. No surgery-related mortality was encountered.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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