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ORIGINAL RESEARCH ARTICLE

Laparoscopic surgery for colovesical fistula associated with sigmoid colon diverticulitis: a review of 39 cases

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Abstract:

Objectives: Colonic diverticular disease is widespread in Western countries and its associated with aging. In Japan, diverticulitis and colovesical fistula are also occurring more frequently. Colonic resection for diverticula-related fistulas is frequently technically demanding because of associated acute or chronic inflammation. We evaluated the safety and efficacy of a standardized laparoscopic procedure. Methods: Data from 39 consecutive patients who had undergone laparoscopic surgery for colovesical fistula between October 2006 and August 2017 were retrospectively reviewed. Results: The patients' median age was 60 years and comprised 35 men and four women. Sigmoidectomy was performed in 33 patients, Hartmann's procedure in four, and anterior resection in two. The median operative time was 203 minutes and estimated blood loss 15 mL. There were no intraoperative complications or conversion to open surgery. No patients required bladder repair; three had minor postoperative complications, and none had recurrent diverticulitis or fistula at a mean follow-up of 5.1 years. Conclusions: The magnified vision and minimal invasiveness make a laparoscopic approach the ideal means of managing colovesical fistula. To our knowledge, this is the largest study of colovesical fistula managed by a standardized laparoscopic procedure.

Keywords:

laparoscopic surgery, diverticular disease, diverticulitis, colovesical fistula, bladder

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Introduction

Colovesical fistula (CVF), a relatively rare condition, can be caused by sigmoid diverticulitis, Crohn's disease, colon cancer, radiation, and trauma. Diverticular disease of the sigmoid colon accounts for about two-thirds of CVF cases[1]. Recently, the incidence of sigmoid colon diverticulosis and CVF have been increasing in Japan because of westernized dietary habits and aging of the population[2,3].

Because fistulas rarely close spontaneously, surgery is required. Open procedures have generally been performed; however, there have been recent reports of successful laparoscopic treatment[4-6]. Published series on the feasibility of laparoscopic surgery for CVF have been small or have reported high conversion rates. At our institution, we perform laparoscopic colorectal surgery routinely. It provides a better view than open surgery, even in a narrow pelvis, so we can perform more precise procedures. We have performed over 5,000 laparoscopic surgeries for colorectal cancer from 1998 to May 2017.

To our knowledge, no large studies have yet described the impact and efficacy of laparoscopic surgery for CVF with a low conversion rate. Here we report a large series of CVF patients managed by a standardized laparoscopic procedure.

Methods

Ethical approval

All study procedures complied with the ethical standards

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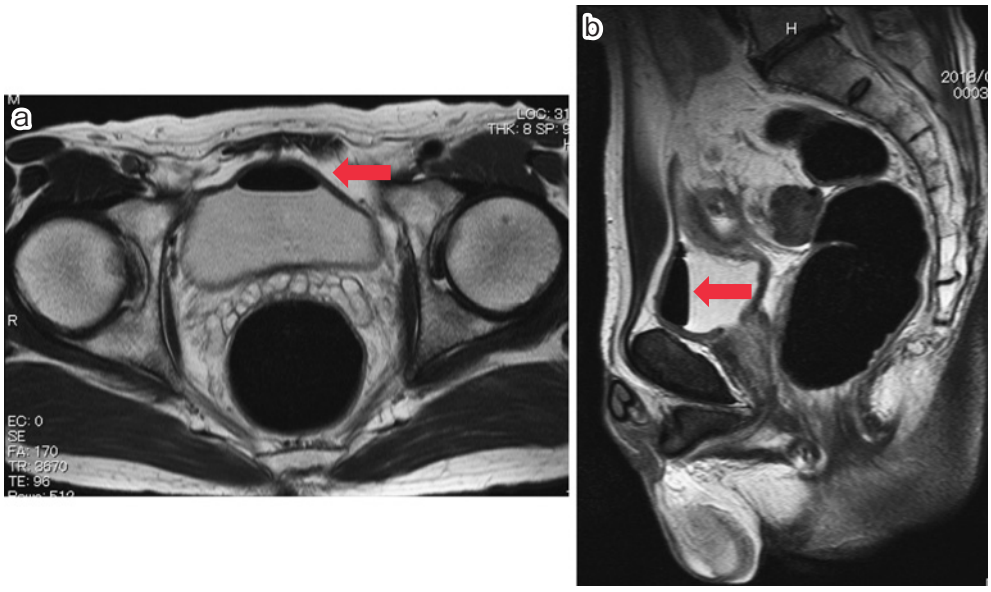

Figure 1. MRI (T2) showed the free air in the bladder (arrow).

of the institutional and national research committees and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all study participants.

Data collection and analysis was approved by the Institutional Review Board of Toranomon Hospital. From October 2006 to August 2017, 39 consecutive patients had undergone laparoscopic surgery for CVF. In our institution, basic indications for laparoscopic surgery for diverticula-associated fistula are no evidence of fecal peritonitis, ileus, or septic shock. Data on age, sex, body mass index (BMI), American Society of Anesthesiology classification, operation duration, blood loss amount, conversion to open surgery, postoperative time to flatus, oral intake, hospital stay, 30-day morbidity and mortality, and pathology were retrospectively collected. Intraoperative complications, such as bowel injury, bleeding, and anastomotic problems, were recorded. Bleeding was recorded as a complication when additional treatment, such as blood transfusion or conversion to open surgery, was required. All patients had undergone preoperative colonoscopy, CT (computed tomography), and MRI (magnetic resonance imaging) to confirm CVF and exclude colon cancer (Figure 1). Cystoscopy was also performed on all patients to confirm patency of both ureteral orifices and exclude urological malignancy. Additionally, surgery was performed at least four weeks after resolution of acute diverticulitis.

Surgical procedures

All surgeries were performed or supervised by surgeons who were board-certified by the Japan Society for Endoscopic Surgery.

Laparoscopies were performed using five ports. First, the sigmoid colon was detached from the bladder using electric cautery. If the Douglas pouch could be preserved, the fistula was encircled with cotton tape (Figure 2). Abscess cavities formed by diverticulitis are always located between the colon and bladder, whereas abscess cavities rarely form in association with fistulas caused by colorectal cancer because they are usually the result of direct invasion. Our cumulative experience has indicated that fistulas caused by sigmoid diverticulitis result from spreading pericolic inflammation that forms an abscess cavity, eventually penetrating the bladder. Thus, sigmoid colon diverticula characteristically connect to the bladder through an abscess cavity. For this reason, the best way to divide the colon and bladder is to incise the abscess cavity; identifying this structure using electric cautery with sharp dissection is the most important aspect of CVF surgery. Sites where purulent discharge leaks from the abscess cavity via the bladder wall can be detected by injecting normal saline into the bladder (Figure 3). There is no need to repair the bladder wall if the abscess cavity is dissected between the colon and bladder, followed by medial-to-lateral retroperitoneal dissection of the mesocolon and early division of the artery (at the origin of the inferior mesenteric artery). The left ureter, gonadal vessels, inferior mesenteric plexus, and superior hypogastric plexus were identified and preserved. In patients with severe inflammation, left or bilateral ureter stents were sometimes inserted to facilitate ureter identification. Rectal dissection down to the level of the anterior peritoneal reflection was then performed. When the intraperitoneal inflammation was so severe that it prevented performing the pelvic procedure, proximal colon transection was performed as the initial step, providing a

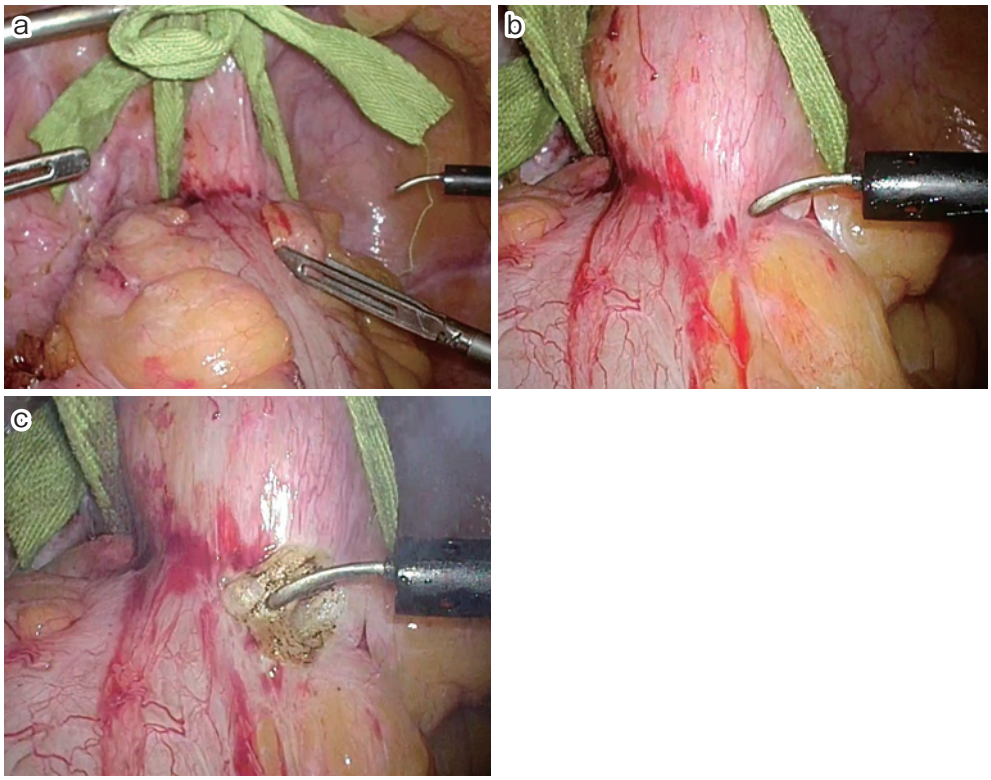

Figure 2. The fistula was encircled with cotton tape.

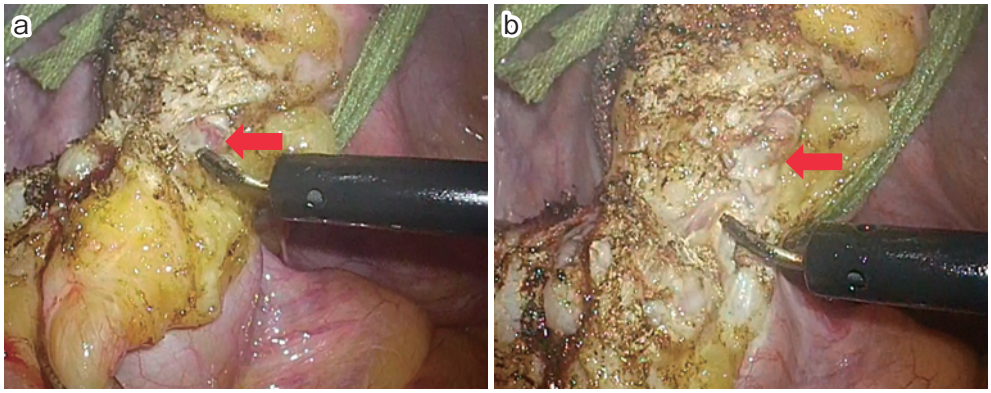

Figure 3. Open abscess cavity indicating purulent discharge (arrow).

good view of the left pelvic wall, which is generally difficult to dissect in the presence of severe inflammation. The splenic flexure was also mobilized to facilitate tension-free anastomosis and complete resection for diverticulosis. An Endo GIA™ (Medtronic, Dublin, Ireland), usually one with a purple cartridge, was used to transect the sigmoid colon; the operator introduced the Endo GIA™ through the right lower port to the colon resection line. In most cases, the resection was performed with one cartridge. The specimen was then extracted through the navel port, which was extended to about 4.5 cm. The wound was protected with a SurgiSleeve™ wound protector (Medtronic), and the anvil of the circular stapler placed. The colon was then returned to the abdominal cavity, and a pneumoperitoneum reestablished. The rod of a PROXIMATE® Curved Intraluminal Stapler (ECS series; Ethicon Endo-Surgery, Cincinnati, OH, USA) was then inserted transanally and the rectal wall pierced. The anvil was applied to the rod and the stapler closed thoroughly, taking care not to tuck in adjacent tissue, and then fired.

After completing closure by a double-stapling technique, about 250 mL normal saline was injected via a urinary catheter to test the bladder wall for leakage. Provided the right space, that is, the abscess cavity between the colon and bladder, had been dissected, there was generally no need to repair the bladder wall (Figure 4). Usually, diverting stomas

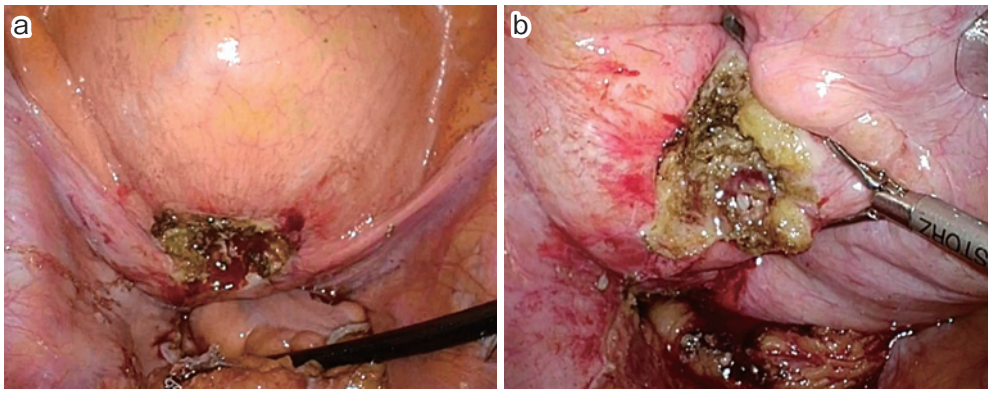

Figure 4. Normal saline was injected via a urinary catheter to test the bladder wall for leakage.

Table 1. Patiens' Baseline Demographics.

	Number (%) (n = 39)
Age (years) (range)	60 (32-84)
Male/female ratio	35 (90%) : 4 (10%)
Body mass index (kg/m^2) (range)	21.7 (15.6-36.4)
Prior abdominal surgery	12 (31%)
American Society of Anesthesiology (ASA) classification	
Class I	11 (28%)
Class II	18 (46%)
Class III	6 (15%)

Table 2. Intraoperative Outcomes.

	Number (%) (n = 39)
Surgical procedure	
Sigmoidectomy	33 (85%)
Hartmann's operation	4 (10%)
Low anterior resection	2 (5%)
Splenic flexure mobilization	25 (64%)
Initial proximal colon transection	6 (15%)
Intraoperative complications	0
Conversion to open surgery	0

was also unnecessary if the above procedures had been performed. The nasogastric tube was removed immediately postoperatively. The bladder was decompressed with a 14Fr urinary catheter for five days and then removed without a cystogram. A pelvic drain was placed routinely for five days.

Results

The 39 study patients' clinical characteristics are summarized in Table 1. Their median age was 60 years (range 32-84 years), and 35 (90%) were men. The most common presenting symptom was pneumaturia (49%), followed by urinary tract infection (44%), diverticulitis (21%), and fecaluria (8%). When the diverticulitis was the most active, the Hinchey classification 1 was 31 (79%) patients and 2 was 8 (21%) patients, respectively[7]. Median BMI was 21.7 kg/m^2 (range 15.6-36.4 kg/m^2). Twelve (31%) patients had a history of abdominal surgery. Intraoperative outcomes are summarized in Table 2. Sigmoidectomy was performed in 33 patients, Hartmann's procedure in four, and anterior resection in two. Hartmann's procedure was used for two patients with severe adhesions and in two others who were in poor general condition. Two patients underwent anterior resection because of extensive pelvic floor inflammation. The median operative time was 203 min (range 91-587 min) and median blood loss 15 mL (range 0-569 mL). Splenic flexure mobilization was performed in 25 (64%) patients and initial proximal colon transection in six (15%). A left ureteral stent was used in 22 patients (56%) and bilateral stents in two (5%). There were no intraoperative complications or conversion to open surgery; all bladder leakage tests were negative. No bladder wall repairs were required. The two patients who had undergone anterior resection both required covering ileostomies because of inflammed, fragile tissues; however, no covering ileostomies were required for those who underwent sigmoidectomy.

Postoperative outcomes are summarized in Table 3. There were no hospital deaths or 30-day mortality. The overall morbidity rate was 13%. The Clavien-Dindo classification was used to grade complications[8], the common complications of which were surgical site infections. Three patients had minor postoperative complications, comprising a postoperative abscess in one and superficial wound infection in two. Two patients had postoperative anastomotic bleeding without anastomotic leakage. Malignancy was excluded by pathological examination of resected specimens in all cases. The median time to flatus and oral intake were one day (0-2) and two days (2-8), respectively. The median length of postoperative stay was 11 days (8-22). No patients had recurrence of sigmoid diverticulitis or fistula at mean follow-up of 5.1 years.

Table 3. Postoperative Outcomes.

	Number (%) (n = 39)
Complications	
Postoperative abscess	1 (3%)
Superficial wound infection	2 (5%)
Anastomotic bleeding	2 (5%)
Ileus	0
Anastomotic leakage	0
Total	5 (13%)
Grade	
Grade I	0
Grade II	3 (8%)
Grade IIIa	2 (5%)
Grade IIIb	0
Grade IV	0
Total	5 (13%)

The Clavien-Dindo classification was used to grade complications.

Discussion

CVF was first reported by Cripps in 1888 and is a well-recognized complication of diverticulitis[9]. Diverticular disease of the sigmoid colon accounts for about 70% of CVF cases; the incidence of CVF in patients without diverticular disease is reportedly 1%-2%[1]. The incidence of sigmoid colon diverticulosis has been increasing in Japan because of Western dietary patterns, including reduced fiber intake, less active lifestyles along, ongoing industrialization, and an aging population[10]. Consequently, CVF incidence has also been increasing[2,3]. Its incidence is estimated to be approximately three times greater in men than in women because of the interposition of the uterus between the sigmoid colon and bladder[11]. In our study, there were 35 (90%) men and four women, two of whom had previously undergone hysterectomy.

There are no CVF diagnostic criteria: diagnoses are based on symptoms and finding free air in the bladder on imaging studies. Urologic symptoms, such as pneumaturia, fecaluria, and urinary tract infection, are more common than abdominal symptoms because the pressure is higher in the colon than in the urinary tract system[11]. Bladder air was detected in 74% of our patients by CT and in 92% of them by MRI, which thus proved the more sensitive. Although CT is less sensitive for detecting CVF than MRI, it plays an important role in assessing pelvic inflammation and determining the most appropriate timing for surgery. We found that the adequate timing of CVF surgery was at least four weeks diverticulitis resolution, when the inflammatory changes have improved, making the operative process easier. However, we need to further consider the appropriate timing of surgery after diverticulitis resolution.

Previous studies have reported that laparoscopic surgery is a safer and more appropriate procedure for diverticular disease than open surgery considering its lower overall morbidity and complication rates[12]. Moreover, the Sigma trial, a randomized controlled trial[13] that compared laparoscopic versus open surgery for symptomatic sigmoid diverticulitis reported lower complication rates, shorter hospital stay, and improved quality of life in the laparoscopic group at the six-week and six-month follow-up visits. This trial also demonstrated that laparoscopic sigmoid resection is preferable to open sigmoid resection because the former has a 27% lower total postoperative morbidity rate. Thus, laparoscopic surgery's usefulness for diverticular disease has been well-established[14]. However, this is not yet true of laparoscopic surgery for CVF, which is considered a technically complex and challenging procedure.

Currently, CVF is usually managed by open surgery because the required procedures, such as fistula removal, bladder wall management, splenic flexure mobilization, and primary anastomosis in the presence of acute or chronic inflammation, are considered difficult[15]. CVF was considered a contraindication for laparoscopic colorectal surgery; however, several recent studies have reported its efficacy and safety[12,16-19]. Since the first report, in 1994, of laparoscopic surgery for diverticula-related CVF, a few more studies comparing open and laparoscopic surgery have been reported[20-22], and some have reported that laparoscopic surgery for CVF is feasible and safe in expert hands[4-6,20]. The effectiveness of laparoscopic surgery is thus clear; however, the reported rate of conversion to open surgery has been high, ranging from 18.7% to 61%[4,23,24]. Furthermore, in various reported series, conversion rates have been higher when laparoscopic colorectal surgery was performed for inflammatory diseases rather than malignancy[23,25-27]. Clearly, laparoscopic procedures with high conversion rates may not achieve early recovery and low morbidity.

To the best of our knowledge, our study is the largest laparoscopic surgery in diverticula-associated CVF thus far reported. In our series, in which complete laparoscopic surgery was performed in all patients, there was an extremely low conversion rate, unlike previous studies. We attribute this to our adherence to a standardized surgical technique. Difficulties frequently encountered when performing diverticular disease surgery are that inflammation makes tissues fragile and prone to bleeding, and dissection is difficult because of large amounts of exudate. However, laparoscopy has the advantage of providing magnified vision, enabling precise performance of the procedure. We perform sharp dissection using electric cautery, rather than blunt dissection. Magnified vision and sharp dissection have advantages when dissecting hard, fragile and inflamed tissues, translating into low conversion rates. Marney et al.[5] have also reported that with increasing experience, laparoscopic techniques can achieve low morbidity rates.

We wish to stress two important aspects of our standardized laparoscopic CVF procedure and its low conversion rate: the fistula removal technique and strategy for bladder wall management. First, if a fistula has been caused by malignancy, en bloc or expanded resection is generally needed. Therefore, in such cases, the abscess cavity should not be opened and the fistula should be resected as the final step of the procedure using a no touch isolation technique. Unlike in patients with malignancy, early division of the fistula is permissible in those with diverticula-associated CVF. In our more recent cases, we have actively encircled the fistula early if we could access the Douglas pouch. Early division of the fistula enables us to extend the sigmoid colon and provides a good view of the pelvis, facilitating a safer and easier procedure.

Second, there is no consensus about bladder wall management in CVF repair. Many techniques for bladder management have been reported, including Foley catheter drainage only, simple closure of the fistula, an omental patch to close the bladder defect, and partial or total cystectomy depending on the individual characteristics in each case[28-30]. Recent studies have shown that early removal of the urinary catheter does not increase morbidity, whereas long-term catheterization has a high risk of urinary tract infection. Furthermore, the type of bladder management and urinary drainage chosen affect postoperative hospital stay. If the fistula has been caused by colorectal cancer, en bloc resection of the urinary bladder is necessary, whereas in patients with the benign condition of diverticula-associated CVF, the bladder should be completely preserved. We perform sharp dissection closer to the sigmoid colon than to the bladder wall until we reach the abscess cavity. We emphasize that the correct dissected space, which is the abscess cavity, obviates the need for bladder repair and enables early catheter removal, thus reducing the risk of urinary tract infection. We routinely perform bladder leak tests; a negative test indicates the dissection layer is ideal and there is no need for bladder repair. No previous reports have utilized bladder leak tests. The technique of injecting normal saline via the urinary catheter is essential and important in deciding on bladder management. Thus far, we have withdrawn the catheter on the fifth postoperative day; however, we plan to reduce this interval.

The present study had some limitations in that it was a retrospective analysis of a small cohort in a single institution. However, despite these limitations, our results suggest that laparoscopic surgery for CVF is safe and feasible. Our procedure for total laparoscopic surgery obviates the need for bladder wall repair and, thus far, has required no conversions to open surgery. To date, this is the largest series of laparoscopic surgery for diverticula-associated CVF.

We have demonstrated that laparoscopic surgery for CVF is technically feasible, with a low conversion rate and no need for bladder repair. Because of its magnified vision and minimal invasiveness, a laparoscopic approach appears to be the ideal surgical choice, especially for CVF. However, the present study is too small to draw a definite conclusion on the safety of laparoscopic surgery for CVF. Further large-scale investigations are warranted.

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Conflicts of Interest

There are no conflicts of interest.

Author Contribution statement

KT, HK, SM performed the surgery. KT, TT, YH, ST, and JM took charge of postoperative care and prepared the manuscript. ST, YH, JM, and HK assisted in drafting the manuscript and reviewed the article. All authors read and approved the final manuscript.

References

1. Young-Fadok TM, Roberts PL, Spencer MP, et al. Colonic diverticular disease. Curr Probl Surg. 2000 Jul; 37(7): 457-514.
2. Ishikawa S, Kato J. Epidemiology of diverticular disease of the colon in Japan. J Jpn Soc Colo-proctol. 2008; 61(10): 1010-4.
3. Manabe N, Haruma K, Nakajima A, et al. Characteristics of Colonic Diverticulitis and Factors Associated With Complications: A Japanese Multicenter, Retrospective, Cross-Sectional Study. Dis Colon Rectum. 2015 Dec; 58(12): 1174-81.
4. Bartus CM, Lipof T, Sarwar CM, et al. Colovesical fistula: not a contraindication to elective laparoscopic colectomy. Dis Colon Rectum. 2005 Feb; 48(2): 233-6.
5. Marney LA, Ho YH. Laparoscopic management of diverticular colovesical fistula: experience in 15 cases and review of the literature. Int Surg. 2013 May; 98(2): 101-9.
6. Tomizawa K, Hanaoka Y, Toda S, et al. Clinical study of vesicosigmoidal fistula due to sigmoid colon diverticulitis treated laparoscopically. J Jpn Soc Endosc Surg. 2012; 17: 753-9.
7. Hinchey EJ, Schaal PG, Richards GK. Treatment of perforated diverticular disease of the colon. Adv Surg. 1978; 12: 85-109.
8. Dindo D, Demartines N, Clavien PA. Classification of surgical complications: A New Proposal with Evaluation in a Cohort of 6336 Patients and Results of a Survey. Ann Surg. 2004 Aug; 240 (2): 205-13.
9. Cripps WH. Passage of air and feces from the urethra. Lancet 1888; 2: 619.
10. Heise CP. Epidemiology and pathogenesis of diverticular disease. J Gastrointest Surg. 2008 Aug; 12(8): 1309-11.
11. Nishimori H, Hirata K, Fukui R, et al. Vesico-ileosigmoidal fistula caused by diverticulitis: report of a case and literature review. J Korean Med Sci. 2003 Jun; 18(3): 433-6.
12. Cirocchi R, Farinella E, Trastulli S, et al. Elective sigmoid colectomy for diverticular disease. Laparoscopic vs open surgery: a systematic review. Colorectal Dis. 2012 Jun; 14(6): 671-83.

13. Klarenbeek BR, Veenhof AA, Bergamaschi R, et al. Laparoscopic sigmoid resection for diverticulitis decreases major morbidity rates: a randomized control trial: short-term results of the Sigma trial. Ann Surg. 2009 Jan; 249(1): 39-44.

14. Klarenbeek BR, Bergamaschi R, Veenhof AA, et al. Laparoscopic versus open sigmoid resection for diverticular disease: follow-up assessment of the randomized control Sigma trial. Surg Endosc. 2011 Apr; 25: 1121-6.

15. Comparato G, Pilotto A, Franze M, et al. Diverticular disease in the elderly. Dig Dis. 2007; 25: 151-9.

16. Melchior S, Cudovic D, Jones J, et al. Diagnosis and surgical management of colovesical fistulas due to sigmoid diverticulitis. J Urol. 2009; 182(3): 978-82.

17. Rafferty J, Shellito P, Hyman NH, et al. Standards Committee of American Society of Colon and Rectal Surgeons Practice parameters for sigmoid diverticulitis. Dis Colon Rectum. 2006 Jul; 49(7): 939-44.

18. Martel G, Bouchard A, Soto CM, et al. Laparoscopic colectomy for complex diverticular disease: a justifiable choice? Surg Endosc. 2010 Sep; 24(9): 2273-80.

19. Kohler L, Sauerland S, Neugebauer E. Diagnosis and treatment of diverticular disease: results of a consensus development conference. The Scientific Committee of the European Association for Endoscopic Surgery. Surg Endosc. 1999 Apr; 13(4): 430-6.

20. Pokala N, Delaney C, Brady K, et al. Elective laparoscopic surgery for benign internal enteric fistulas: a review of 43 cases. Surgical Endosc. 2005 Feb; 19(2): 222-5.

21. Abbass MA, Tsay AT, Abbas MA. Laparoscopic resection of chronic sigmoid diverticulitis with fistula. JSLS. 2013 Oct; 17(4): 636-40.

22. Tam M, Abbass M, Tsay A, et al. Outcome of colonic fistula surgery in the modern surgical era. Tech Coloproctol. 2014 May; 18 (5): 467-72.

23. Vargas HD, Ramirez RT, Hoffman GC, et al. Defining the role of laparoscopic assisted sigmoid colectomy for diverticulitis. Dis Colon Rectum. 2000 Dec; 43(12): 1726-31.

24. Laurent SR, Detroz B, Detry O, et al. Laparoscopic sigmoidectomy for fistulized diverticulitis. Dis Colon Rectum. 2005 Jan; 48 (1): 148-52.

25. Bordeianou L, Rattner D. Is laparoscopic sigmoid colectomy for diverticulitis the new gold standard? Gastroenterology. 2010 Jun; 138(7): 2213-6.

26. Casillas S, Delaney CP, Senagore AJ, et al. Does conversion of a laparoscopic colectomy adversely affect patient outcome? Dis Colon Rectum. 2004 Oct; 47(10): 1680-5.

27. Tekkis P, Senagore A, Delaney C. Conversion rates in laparoscopic colorectal surgery: a predictive model with 1253 patients. Surg Endosc. 2005 Jan; 19(1): 47-54.

28. Scozzari G, Arezzo A, Morino M. Enterovesical fistulas: diagnosis and management. Tech Coloproctol. 2010 Dec; 14(4): 293-300.

29. Rao PN, Knox R, Barnard RJ, et al. Management of colovesical fistula. Br J Surg. 1987 May; 74: 362-3.

30. Steele M, Deveney C, Burchell M. Diagnosis and management of colovesical fistulas. Dis Colon Rectum. 1978 Jan; 22(1): 27-30.

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