Management of Postoperative Intraabdominal Abscess in Laparoscopic versus Open Appendectomy

Management of Postoperative Intraabdominal Abscess in Laparoscopic versus Open Appendectomy

SHOGO TANAKA, KANJI ISHIHARA, TAKAHIRO UENISHI, RYOYA HASHIBA, YUKIKO KURASHIMA, KOHICHI OHNO, SAYAKA TANAKA, MASAHIKO OHSAWA, and TAKATSUGU YAMAMOTO

SHOGO TANAKA, KANJI ISHIHARA, TAKAHIRO UENISHI et al. Management of Postoperative Intraabdominal Abscess in Laparoscopic versus Open Appendectomy. Osaka City Medical Journal. 2013, 59, 1-7

Osaka City Med. J. Vol. 59, 1-7, 2013

Management of Postoperative Intraabdominal Abscess in Laparoscopic versus Open Appendectomy

Shogo Tanaka[1)], Kanji Ishihara[1)], Takahiro Uenishi[1)], Ryoya Hashiba[1)], Yukiko Kurashima[1)], Kohichi Ohno[1)], Sayaka Tanaka[2)], Masahiko Ohsawa[2)], and Takatsugu Yamamoto[1)]

Department of Surgery[1)], Ishikiriseiki Hospital; and Department of Diagnostic Pathology[2)], Osaka City University, Graduate School of Medicine

Abstract

Background

Complicated appendicitis (gangrenous or perforated appendicitis) is a risk for postoperative intraabdominal abscess, but management of intraabdominal abscess may differ between laparoscopic and open appendectomy.

Methods

We reviewed 67 patients who underwent appendectomy for complicated appendicitis, including 26 who received laparoscopic appendectomy (LA group) and 41 who underwent open appendectomy (OA group). The operation was performed under general anesthesia in all 26 patients in the LA group and in 10 (24%) in the OA group. Patient characteristics, operative factors, and postoperative complications (especially postoperative intraabdominal abscess) were compared between the two groups. Management of postoperative intraabdominal abscess was also investigated.

Results

Postoperative intraabdominal abscess occurred in 3 patients (12%) in the LA group and in 10 (24%) in the OA group (p=0.23). All 3 patients in the LA group were treated conservatively. Of the 10 patients in the OA group, 6 were treated conservatively, but 4 needed a reoperation, including 3 who had undergone right pararectal skin incision under spinal analgesia and in whom sufficient irrigation was not possible because anesthesia had worn off.

Conclusions

Our results suggest that insertion of abdominal drainage may be appropriate treatment for intraabdominal abscess after laparoscopic appendectomy. Light anesthesia may induce residual abscess in open appendectomy performed under spinal analgesia.

Key Words: Right pararectal skin incision; Median skin incision; Spinal analgesia

Received July 2, 2012; accepted October 16, 2012.

Correspondence to: Shogo Tanaka, MD.
Department of Surgery, Ishikiriseiki Hospital, 18-28 Yayoicho, Higashiosaka City 579-8026, Japan
Tel: +81-72-988-3121; Fax: +81-72-986-3860
E-mail: m8827074@msic.med.osaka-cu.ac.jp

Introduction

Acute appendicitis is a common indication for abdominal surgery with a life-time incidence between 7% and 9%[1], and appendectomy is one of the most common surgical procedures. Open appendectomy (OA) performed through a right lower quadrant incision was first described in 1894[2] and has now been used for more than one century. If necessary, right pararectal or median skin incision is performed for cases with complicated appendicitis (gangrenous or perforated appendicitis). Laparoscopic appendectomy (LA) was first performed by Semm[3] in 1983 and has gradually gained acceptance.

Development of an intraabdominal abscess (IAA) after appendectomy is a rare but serious complication and is associated with significant morbidity. The risk is significantly increased in cases of complicated appendicitis[4-6] and it is unclear whether LA reduces postoperative IAA[7,8]. In this study, we retrospectively analyzed the incidence of postoperative IAA after appendectomy for complicated appendicitis and investigated the management of postoperative IAA.

Methods

A total of 152 consecutive patients underwent appendectomy for acute appendicitis at our institution between January 2006 and December 2011. Of these patients, 67 were pathologically proven to have complicated appendicitis (gangrenous or perforated appendicitis)[4,9]. Clinical records of these 67 patients were retrospectively reviewed. The patients included 37 males and 30 females, and had a mean age of 46.3 years old (range, 9 to 85). At our institution LA is the standard operative procedure for acute appendicitis, and OA is performed when LA would impose an excessive delay for preparation of laparoscopic instruments or summoning of staff members. Thus, of the original 152 patients, LA was performed in 80 patients and OA in 72 patients.

Among the 67 patients analyzed in this study, LA was performed in 26 (LA group), including 1 case with conversion to an open procedure due to hard dense adhesion (this patient was still included in the LA group). The other 41 patients (OA group) underwent OA for the reasons described above, with 22 procedures performed via a McBurney skin incision, 12 with a right pararectal skin incision, and 7 by median skin incision. The type of skin incision was determined by each surgeon based on the position of the appendix, prediction of inflammatory adhesion, and spread of the abscess. The two groups were not selected based on severity of appendicitis.

A standard technique for LA was used with a 12-mm optimal trocar in the infra-umbilical position. Pneumoperitoneum (10 mm Hg) was established with the Hasson technique. Two 5-mm ports were used: one in the left iliac fossa and the other in the suprapubic position. The mesoappendix was coagulated and cut by ultrasonic dissection shears (Harmonic Scalpel, Ethicon Endo-Surgery Japan, Tokyo). A linear stapler (Endo-GIA Roticulator, Covidien Japan, Tokyo) was utilized for transection of the appendix. Thorough irrigation of the cavity was carried out at the end of the procedure in all 26 patients. A drain was inserted from the pouch of Douglas in 15 patients based on the decision of the surgeon. Principally, we inserted the drain when abscess was present at Douglas pouch or right paracolic sulcus in addition to periappendicular space.

OA was carried out under general anesthesia in 10 patients and spinal analgesia in 31 patients. Double ligation of the stump was performed with a silk suture. The stump was

inverted using 3-0 silk. The abdomen and pelvis were irrigated with warm saline including cleansing gauze in procedures performed with a McBurney skin incision, and with warm saline in those with a right pararectal or median skin incision. A drain was inserted from the pouch of Douglas in 30 patients (73%) based on the decision of the surgeon. Principally, we inserted the drain when abscess was present at Douglas pouch or right paracolic sulcus in addition to periappendicular space.

All resected specimens were subjected to histopathologic examination. When possible, patients received 1g of flomoxef 30 min before skin incision and again 3 h after surgery. All patients continued to receive 1g of flomoxef twice daily until 2 days after the operation[10]. Recovery from postoperative fever was defined as a body temperature below 37.0℃ that persisted for 24 h without antipyretic medication. Recovery from postoperative pain was defined as unawareness of the wound and abdominal pain without medication.

Centers for Disease Control and Prevention definitions of nosocomial surgical site infections were used to define wound infection as superficial (skin and subcutaneous) or deep (fascia and muscle) incisional infections[11]. Postoperative abdominal infection was defined when abscess formation was detected by ultrasonography or computed tomography in patients with suspected symptoms and signs, or when purulent discharge from the drain persisted for 2 days or more after surgery[12].

Patient characteristics, operative factors, postoperative course including complications (especially postoperative IAA), and hospital stay were compared between the OA and LA groups. Management and outcomes of patients with postoperative IAA were also investigated. Differences were evaluated by Mann-Whitney U test or Fisher exact test, with a p value <0.05 considered to indicate significance. This study was conducted in accordance with the Helsinki Declaration and the guidelines of the Ethics Committee of our institute. Written informed consent was obtained from each patient or the patient's parents.

Results

Age, gender, body mass index, presence of diabetes mellitus, incidence of past laparotomy, preoperative white blood cell count, and serum concentration of C-reactive protein did not differ between the two groups (Table 1). Two of the 26 patients in the LA group and 11 of the 41 in the OA group were diagnosed with perforated appendicitis. The remaining 54 patients were diagnosed with gangrenous appendicitis. Most patients in both groups had an IAA prior to surgery. Operative time was significantly longer in the LA group ($p=0.03$).

Complication with wound infection occurred in 5 patients in the OA group, but in none in the LA group ($p=0.15$, Table 2). Three patients (2 treated with right pararectal skin incision and one with median skin incision) had superficial wound infections that were treated by opening of the wound. However, one patient with deep wound infection required debridement of necrotizing fascia and subsequent dermoplasty.

The incidence of postoperative IAA did not differ significantly between the two groups. Three patients with postoperative IAA in the LA group were treated conservatively by insertion of a drainage tube during the operation and administration of antibiotics (Table 3). Of the 10 patients with postoperative IAA in the OA group, 6 were treated by administration of antibiotics with or without drainage from the abdominal drain. However, the other 4 patients required a

Table 1. Background and operative factors in 67 patients with complicated appendicitis

Variables	LA group (n=26)		OA group (n=41)		p value
Age (mean±SD)	41.6±19.7		49.4±20.3		0.13
Gender (M/F)	14/12		23/18		>0.99
BMI*	21.8	(20.6-22.9)	22.2	(21.0-23.3)	0.59
Body temperature (˚C)	37.4	(37.1-37.8)	37.8	(37.5-38.1)	0.16
Diabetes mellitus (n (%))	2	(8%)	6	(15%)	0.47
Past laparotomy (n (%))	1	(4%)	2	(5%)	>0.99
WBC count ($\times 10^3/\mu L$)	13.5	(11.7-15.3)	14.7	(13.5-15.9)	0.26
CRP (mg/dL)	9.7	(6.7-12.7)	11.3	(9.1-13.4)	0.40
General anesthesia (n (%))	26	(100%)	10	(24%)	**<0.0001**
Perforated appendicitis (n (%))	2	(8%)	11	(27%)	0.06
Intraabdominal abscess (n (%))	20	(77%)	34	(83%)	0.55
Operative time (min)*	100	(85-114)	83	(76-90)	**0.03**
Bleeding (cc)*	18	(0-37)	74	(23-127)	0.10
Insertion of abdominal drain (n (%))	15	(58%)	30	(73%)	0.29
Subcutaneous drain (n (%))	0	(0%)	4	(10%)	0.15

*Data shown as mean (95% confidence interval). BMI, body mass index; WBC, white blood cells; and CRP, C-reactive protein.

Table 2. Postoperative course of 67 patients with complicated appendicitis

Variables	LA group (n=26)		OA group (n=41)		p value
Wound infection (n (%))	0	(0%)	5	(12%)	0.15
Intraabdominal abscess (n (%))	3	(12%)	10	(24%)	0.23
Ileus (n (%))	2	(8%)	6	(15%)	0.47
Others (n (%))	0	(0%)	3	(7%)	0.28
Readmission (n (%))	0	(0%)	2	(5%)	0.52
Recovery from postoperative fever (days)*	3.3	(2.5-4.0)	5	(3.5-6.6)	0.08
Recovery from postoperative pain (days)*	2.9	(2.3-3.6)	5.5	(3.9-7.1)	**0.02**
Restart of diet (days)*	2.0	(1.5-2.6)	2.8	(2.0-3.7)	0.17
Hospital stay (days)*	7.4	(6.2-8.6)	14.5	(10.5-18.6)	**0.009**

*Data shown as mean (95% confidence intervals).

reoperation, including 2 who needed readmission for delayed occurrence of IAA. All 8 patients who underwent surgery under spinal analgesia showed a tendency for wearing off of the anesthesia at the end of the operation. Recovery from postoperative pain was significantly more rapid in the LA group (p=0.02, Table 2) and the hospital stay was significantly shorter in the LA group (p=0.009).

Discussion

The effectiveness of LA has been shown in terms of shorter hospital stay, rapid postoperative recovery, and better pain control in many studies[13-17]. Our findings in patients with complicated appendicitis were consistent with these studies. The postoperative course after appendectomy for acute appendicitis involves consolidated control of infectious complications, especially postoperative IAA. It is unclear if LA has a benefit of reduced postoperative IAA. This complication rarely occurs in patients with catarrhal or suppressive appendicitis[4,18]; thus,

Table 3. Characteristics of 13 patients who complicated with postoperative intraabdominal abscess

Case	Age	Gender	Group	Anesthesia	Abdominal drain	Operative time (min)	Treatment	Hospital stay (days)
1	33	F	LA	Total	+	70	Conservative	13
2	50	M	LA	Total	+	100	Conservative	9
3	64	F	LA	Total	+	65	Conservative	10
4	44	F	OA (McBurney)	Spiral	−	58	Antibiotics	5
5	61	M	OA (McBurney)	Spiral	+	95	Conservative	77
6	63	F	OA (McBurney)	Spiral	+	80	Conservative	8
7	20	M	OA (Pararectal)	Spiral	+	71	Conservative	15
8	21	F	OA (Pararectal)	Spiral	−	72	Re-operation	35
9	24	M	OA (Pararectal)	Spiral	+	87	Re-operation*	6
10	52	F	OA (Pararectal)	Spiral	+	70	Re-operation*	7
11	55	F	OA (Pararectal)	Spiral	−	95	Antibiotics	22
12	12	F	OA (Median)	Total	+	94	Re-operation	33
13	67	M	OA (Median)	Total	+	59	Conservative	25

*readmission for delayed abscess formation. LA, laparoscopic appendectomy; OA, open appendectomy; and conservative, drainage from abdominal drain inserted during surgery.

complicated appendicitis is one of the risk factors for postoperative IAA[4-6]. The incidence of postoperative IAA after LA for complicated appendicitis was over 20% in the early period of LA[19,20]; however, this incidence has now decreased to 0% to 16.7%[4,21-27], which corresponded with our results. Since methods of irrigation have not changed, this decrease might be due to improved skills with the surgical technique.

Early reports of an increased risk of postoperative IAA after LA compared with OA[7,8,20,25,27,28], prompted Pedersen et al[28] to suggest that patients with complicated appendicitis should be excluded from a laparoscopic approach. However, in recent reports the incidence of postoperative IAA after LA for complicated appendicitis was lower than[18,23] or not significantly different[4,12,24,26] to that after OA, similar to our results. Based on these findings, LA should not be contraindicated for complicated appendicitis.

It is important to develop an improved understanding of the mechanism and appropriate treatment of postoperative IAA. Most postoperative IAAs can be treated by good surgical techniques and proper use of antibiotics[29,30], but some become intractable. In our study, the 3 patients with postoperative IAA in the LA group were treated conservatively by external drainage and use of broad spectrum antibiotics, whereas 4 of 10 patients in the OA group needed a reoperation. During laparoscopy, the abdominal cavity can be irrigated under a good visual field[25]. However, increased use of irrigation fluid, which may produce greater contamination of the peritoneal cavity, or an increase in intraabdominal pressure by pneumoperitoneum may contribute to diffusion of infection[22,25,31]. Therefore, it is likely that IAA formation after LA develops because of missed fluid collection, rather than due to residual abscess cavities, which are rapidly filled by adjacent organs[21]. These findings and our results suggest that insertion of an abdominal drain may facilitate treatment of postoperative IAA when an abscess spreads extensively during laparoscopy despite sufficient irrigation.

In the OA procedures in this study, a good operative field was maintained because the incision was determined based on the position of the appendix or spread of the abscess; however, 4 cases needed a reoperation, including 2 requiring readmission. We suggest that these findings

might be associated with spinal analgesia. In some cases in OA, abdominal pressure tends to increase at the end of the operation because the anesthetic wears off. In such cases, sufficient irrigation and drainage cannot be achieved and this can lead to a residual abscess. In our study, 3 of the 4 patients in the OA group who underwent a reoperation received surgery under spinal analgesia.

The mechanism of postoperative IAA after OA may also differ from that after LA. In principle, if use of antibiotics is ineffective, CT or ultrasonography guided drainage is indicated. However, open drainage is needed if percutaneous drainage cannot be performed[12,32]. Laparoscopic drainage has recently been reported to be a safe and effective treatment for postoperative IAA after LA[33] and may serve as an alternative to open drainage.

Additionally, in another respect, many reports suggested costs for LA are higher than those for OA, which might be influenced by higher expenses for operative instruments and longer operative times[34-37]. We must explain for patients with acute appendicitis preoperatively that clinical outcomes of LA were superior to that of OA, such as earlier recovery from postoperative pain and shorter hospital stay, however, the costs for LA are higher than those for OA.

In conclusion, the incidence of postoperative complication of appendicitis with IAA did not differ significantly between LA and OA. However, in LA, routine abdominal drainage may facilitate treatment of postoperative IAA, and this may contribute to early recovery from postoperative pain and a shorter hospital stay. In OA, light anesthesia, and especially spinal analgesia, may lead to incomplete irrigation and drainage, with resultant residual and delayed abscess formation.

References

1. Addiss DG, Shaffer N, Fowler BS, Tauxe RV. The epidemiology of appendicitis and appendectomy in the United States. Am J Epidemiol 1990;132:910-925.
2. McBurney C. Ⅳ. The Incision Made in the Abdominal Wall in Cases of Appendicitis, with a Description of a New Method of Operating. Ann Surg 1894;20:38-43.
3. Semm K. Endoscopic appendectomy. Endoscopy 1983;15:59-64.
4. Asarias JR, Schlussel AT, Cafasso DE, Carlson TL, Kasprenski MC, Washington EN, et al. Incidence of postoperative intraabdominal abscesses in open versus laparoscopic appendectomies. Surg Endosc 2011;25: 2678-2683.
5. Frazee RC, Bohannon WT. Laparoscopic appendectomy for complicated appendicitis. Arch Surg 1996;131: 509-511; discussion 511-513.
6. Paik PS, Towson JA, Anthone GJ, Ortega AE, Simons AJ, Beart RW Jr. Intra-abdominal abscesses following laparoscopic and open appendectomies. J Gastrointest Surg 1997;1:188-192; discussion 192-193.
7. Hart R, Rajgopal C, Plewes A, Sweeney J, Davies W, Gray D, et al. Laparoscopic versus open appendectomy: a prospective randomized trial of 81 patients. Can J Surg 1996;39:457-462.
8. Minné L, Varner D, Burnell A, Ratzer E, Clark J, Haun W. Laparoscopic vs open appendectomy. Prospective randomized study of outcomes. Arch Surg 1997;132:708-711; discussion 712.
9. Humes DJ, Simpson J. Acute appendicitis. BMJ 2006;333:530-534.
10. Shinagawa N. Antimicrobial prophylaxis in surgery. Jpn J Antibiot 2004;57:11-32. (in Japanese)
11. Horan TC, Gaynes RP, Martone WJ, Jarvis WR, Emori TG. CDC definitions of nosocomial surgical site infections, 1992: a modification of CDC definitions of surgical wound infections. Infect Control Hosp Epidemiol 1992;13:606-608.
12. Khan MN, Fayyad T, Cecil TD, Moran BJ. Laparoscopic versus open appendectomy: the risk of postoperative infectious complications. JSLS 2007;11:363-367.
13. Chung RS, Rowland DY, Li P, Diaz J. A meta-analysis of randomized controlled trials of laparoscopic versus conventional appendectomy. Am J Surg 1999;177:250-256.
14. Garbutt JM, Soper NJ, Shannon WD, Botero A, Littenberg B. Meta-analysis of randomized controlled trials

comparing laparoscopic and open appendectomy. Surg Laparosc Endosc 1999;9:17-26.
15. Golub R, Siddiqui F, Pohl D. Laparoscopic versus open appendectomy: a metaanalysis. J Am Coll Surg 1998;186:545-553.
16. Li X, Zhang J, Sang L, Zhang W, Chu Z, Li X, et al. Laparoscopic versus conventional appendectomy--a meta-analysis of randomized controlled trials. BMC Gastroenterol 2010;10:129.
17. Moberg AC, Berndsen F, Palmquist I, Petersson U, Resch T, Montgomery A. Randomized clinical trial of laparoscopic versus open appendicectomy for confirmed appendicitis. Br J Surg 2005;92:298-304.
18. Masoomi H, Mills S, Dolich MO, Ketana N, Carmichael JC, Nguyen NT, et al. Comparison of outcomes of laparoscopic versus open appendectomy in adults: data from the Nationwide Inpatient Sample (NIS), 2006-2008. J Gastrointest Surg 2011;15:2226-2231.
19. Bonanni F, Reed J 3rd, Hartzell G, Trostle D, Boorse R, Gittleman M, et al. Laparoscopic versus conventional appendectomy. J Am Coll Surg 1994;179:273-278.
20. Horwitz JR, Custer MD, May BH, Mehall JR, Lally KP. Should laparoscopic appendectomy be avoided for complicated appendicitis in children? J Pediatr Surg 1997;32:1601-1603.
21. Allemann P, Probst H, Demartines N, Schäfer M. Prevention of infectious complications after laparoscopic appendectomy for complicated acute appendicitis--the role of routine abdominal drainage. Langenbecks Arch Surg 2011;396:63-68.
22. Gupta R, Sample C, Bamehriz F, Birch DW. Infectious complications following laparoscopic appendectomy. Can J Surg 2006;49:397-400.
23. Khiria LS, Ardhnari R, Mohan N, Kumar P, Nambiar R. Laparoscopic appendicectomy for complicated appendicitis: is it safe and justified?: A retrospective analysis. Surg Laparosc Endosc Percutan Tech 2011; 21:142-145.
24. Kiriakopoulos A, Tsakayannis D, Linos D. Laparoscopic management of complicated appendicitis. JSLS 2006;10:453-456.
25. Krisher SL, Browne A, Dibbins A, Tkacz N, Curci M. Intra-abdominal abscess after laparoscopic appendectomy for perforated appendicitis. Arch Surg 2001;136:438-441.
26. Miyano G, Okazaki T, Kato Y, Marusasa T, Takahashi T, Lane GJ, et al. Open versus laparoscopic treatment for pan-peritonitis secondary to perforated appendicitis in children: a prospective analysis. J Laparoendosc Adv Surg Tech A 2010;20:655-657.
27. Pokala N, Sadhasivam S, Kiran RP, Parithivel V. Complicated appendicitis--is the laparoscopic approach appropriate? A comparative study with the open approach: outcome in a community hospital setting. Am Surg 2007;73:737-741; discussion 741-742.
28. Pedersen AG, Petersen OB, Wara P, Rønning H, Qvist N, Laurberg S. Randomized clinical trial of laparoscopic versus open appendicectomy. Br J Surg 2001;88:200-205.
29. Katkhouda N, Friedlander MH, Grant SW, Achanta KK, Essani R, Paik P, et al. Intraabdominal abscess rate after laparoscopic appendectomy. Am J Surg 2000;180:456-459; discussion 460-461.
30. Krukowski ZH, Irwin ST, Denholm S, Matheson NA. Preventing wound infection after appendicectomy: a review. Br J Surg 1988;75:1023-1033.
31. Cuschieri A. Appendectomy-laparoscopic or open? Surg Endosc 1997;11:319-320.
32. Yong JL, Law WL, Lo CY, Lam CM. A comparative study of routine laparoscopic versus open appendectomy. JSLS 2006;10:188-192.
33. Clark JJ, Johnson SM. Laparoscopic drainage of intraabdominal abscess after appendectomy: an alternative to laparotomy in cases not amenable to percutaneous drainage. J Pediatr Surg 2011;46:1385-1389.
34. Kuwabara K, Matsuda S, Fushimi K, Ishikawa KB, Horiguchi H, Fujimori K. Community-based appraisal of laparoscopic abdominal surgery in Japan. J Surg Res 2011;165:e1-13.
35. Lee HJ, Park YH, Kim JI, Choi PW, Park JH, Heo TG, et al. Comparison of clinical outcomes and hospital cost between open appendectomy and laparoscopic appendectomy. J Korean Surg Soc 2011;81:321-325.
36. McGrath B, Buckius MT, Grim R, Bell T, Ahuja V. Economics of appendicitis: cost trend analysis of laparoscopic versus open appendectomy from 1998 to 2008. J Surg Res 2011;171:e161-168.
37. Sporn E, Petroski GF, Mancini GJ, Astudillo JA, Miedema BW, Thaler K. Laparoscopic appendectomy--is it worth the cost? Trend analysis in the US from 2000 to 2005. J Am Coll Surg 2009;208:179-185 e2.