J Vet Clin 28(6) : 555-561 (2011)

Journal of Veterinary Clinics
www.ksvc.or.kr

Single Incision Flexible Endoscopic Cholecystectomy in Dogs : Feasibility Study

So-Yeon Lee, Beom-Jun Shin and Seong Mok Jeong[1]

College of Veterinary Medicine · Research Institute of Veterinary Medicine, Chungnam National University, Daejeon 305-764, Korea

(Accepted: Dec 13, 2011)

Abstract : Laparoscopic surgery is a well-established alternative to open surgery across disciplines. However, in veterinary medicine, laparoscopic surgery in dogs was rarely reported because of small abdominal size for multiple ports insertion. The concept of single-incision laparoscopic surgery (SILS) is to perform the entire laparoscopic operation through a single incision rather than conventional multiple small skin incisions. Indirect evidence of potential benefits of SILS, decreases operative morbidity related to reduction in port size, already exists. Therefore, this study was performed to evaluate the safety and feasibility of the modified form of SILS using flexible endoscope in Cholecystectomy before clinical adoption. A 2 cm single periumbilical incision was performed, and flexible endoscope was introduced into the abdominal cavity. A laparoscopic grasper was inserted into the abdominal cavity for the traction of gall bladder. Cystic duct and artery were ligated by 5 mm Hem-o-lok®. Then, gall bladder was dissected and resected from the liver with 5 mm Autonomy Laparo-Angle Maryland dissector and endoscopic needle knife. Resected gall bladder was wrapped by using specimen pouch and was retrieved through abdominal incision from the cavity. All three gall bladders were successfully removed. Hematological changes were not observed during examination periods. No leakage sign was identified at necropsy. The flexible endoscope, as distinct from conventional rigid laparoscope, allows the visualization from various angles and the wide range of motion, result in less crowding.

Key words **:** Single-port surgery, flexible endoscope, cholecystectomy, dog.

Introduction

Cholangitis and gallstones are common in people and laparoscopic cholecystectomy has become a routine procedure in human medicine over the last 30 years (24). In cats and dogs, conditions treated by cholecystectomy include necrotizing cholecystitis (8), gall bladder trauma or neoplasia, symptomatic cholelithiasis (13,20), and gall bladder mucocele (GBM) (1,3,24,41). Uncomplicated GBM are probably the most suitable cases for laparoscopic cholecystectomy. Although a recent report highlighted the successful medical treatment of two dogs with GBM, most investigators agree that cholecystectomy is the treatment of choice for GBM, due to the significant morbidity and mortality associated with cases that develope bile peritonitis or extrahepatic biliary obstruction (EHBO) as a consequence (1,26,40). Another possible indication for laparoscopic cholecystectomy is symptomatic cholelithiasis without common bile ducts tones or associated EHBO, which occur less frequently. However, care must be taken not to overlook stones that are residing in, or moving into and out of the ductal system (24).

Traditionally, laparoscopic cholecystectomy has been performed with four ports (10,13). There has been a trend toward minimizing the number of incisions and ports required and this had led to the description of three and two port techniques of laparoscopic cholecystectomy (18,33,38).

Minimal access surgery allows operations to be performed while minimizing the trauma of the access required for an open operation (7). This has been shown to be safe and effective as well as leading to reduced postoperative pain, shortened hospital stay, and faster recuperation and return to normal function (19,21). The reduction in external scarring also leads to an improved cosmetic result. Minimal access techniques have affected many area of surgery, with laparoscopic procedures now becoming the expected standard of treatment for many elective and acute surgical conditions (7).

The demand to develop even more minimally invasive surgical techniques in order to enhance the advantages of laparoscopy remains strong. This demand has led surgeons to seek to minimize the number and the size of incisions, or in the case of natural orifice transluminal endoscopic surgery (NOTES), to eliminate skin incision altogether. The hope of these more minimally invasive procedures is that they will also lead to minimal or no post-procedural while improving cost-effectiveness and patient safety (5). The first transgastric appendectomy and the first cholecystectomy via a natural orifice were reported in human patients (23,24). As a bridge between traditional laparoscopy and NOTES, recent focus has been on the development of single incision laparoscopic surgery (SILS) to

[1]Corresponding author.
E-mail : jsmok@cnu.ac.kr

further minimize the invasiveness of laparoscopy by reducing the number of incisions, and hopefully the pain and complication associated with them. SILS was described as early as 1992 by performing a single-puncture laparoscopic appendectomy and in 1997 by performing a laparoscopic cholecystectomy via two transumbilical trocars and three transabdominal gall bladder stay sutures (28,31). These innovations, either exclusively or in a hybridized fashion, have now been applied to a wide variety of surgical procedures.

In veterinary medicine, as laparoscopic procedures become more popular and surgeons' experience increases, there is a natural trend toward the development of more complex surgery (24). Nowadays, ovariectomy, ovariohysterectomy, adrenalectomy and cholecystectomy have been described in veterinary medicine (26,29). In a prior study, researcher reported that the laparoscopic group experienced fewer postoperative complications such as pneumonia, sepsis, and wound infections and reduced pain, and a more rapid return to normal activity (9, 11,22,25,39).

However, typically for veterinary patient, a four-port technique is generally used for laparoscopic surgery. As this technique is comprised of 5~10 mm laparoscope, three to four trocar-cannula assemblies and various instruments, there is suitable for medium and large sized dog (24). And, traditional SILS is difficult to attain critical views of tissue dissection because of limited instrument and field of view. Therefore, when considered laparoscopic cholecystectomy or SILS in small to medium sized dog, develop in new surgical technique is necessary to replace conventional laparoscopic surgery.

The purpose of this study is evaluating the feasibility of single incision flexible endoscopic cholecystectomy (SIEC) in three dogs.

Materials and Methods

Animals

This study was approved by Chungnam National University Animal Care and Use Committee. Three intact male Beagle dogs (mean age: 24 months, body weight: 10.8 kg, 10.5 kg and 9.6 kg, respectively) were used in this study. All dogs had no remarkable clinical findings on general physical examination.

Preoperative Preparation

Based on routine surgical preparation, dogs were fasted for 12 hours before the surgery. Water was provided until 2 hours before the surgery. Physical examination and blood examination were performed on the day before surgery.

Anesthesia

Atropine sulfate (0.04 mg/kg, SC, Atropine sulfate®, Daihan Pharm. Co., Korea) was administered as a premedication. Cefazolin (20 mg/kg, IV, Cefazolin®, Kukje Pharm. Ind., Korea) was administered as prophylactic antibiotics. Anesthesia was induced with propofol (6 mg/kg, IV, Anepol®, Hana Pharm. Co., Korea) and maintained with isoflurane (Forane®, Choongwae Pharm. Co., Korea) under pure oxygen.

Disinfection

Each dog was positioned on dorsal recumbency and abdominal region was prepared aseptically. Endoscope was disinfected with 1% dipotassium peroxodisulphate (Virkon®, Antec TM, International - A DuPont Co., England).

Surgical Procedure

Handmade single-port system was made with two of 5 mm and one of 12 mm trocars (B5ST and B12LT, Endopath® Xcel™, Ethicon Endosurgery Inc, USA) and surgical glove was aseptically prepared (Fig 1). A single 2 cm of periumbilical incision was made sharply with scalpel, the soft tissue was bluntly dissected to the fascia and incision of linea alba was made by scalpel and metzenbaum scissors. Handmade single-port system attached to the abdominal wall with the aid of wound retractor (C8312 Alexi® wound retractor, Applied Medical, USA, Fig 2A). And then, a pnumoperitonium was established using a mechanical CO_2 insufflator making sure that intra-abdominal pressure did not exceed 5 mmHg.

Aseptically prepared single-working channel endoscope (Scope: EG-250HR2, Processor: EPX-201H, Fujinon™, Fuji Photo Optical CO LTD, Japan) was inserted into abdominal cavity though the 12 mm trocar. Once inserted, the gall bladder was identified and for the better visualization of cystic duct and artery, laparoscopic grasping forcep (FG49L-1, Olympus Optical LTD, Japan) was used for the traction of gall bladder (Fig 2B, 2C). The 5 mm automatic endoscopic Hem-o-lok applier (Hem-o-lok®,TFX Medical, Ltd., UK) was inserted through the 5 mm trocar and cystic duct and artery were triple ligated with 5 mm clips and transected by L-knife (KD-620LR, Olympus Optical LTD, Japan) through working channel of the endoscope (Fig 2D, 2E). Blunt dissection was begun using rotating Maryland dissector (LA1201-01 Maryland dissector, Autonomy™, Laparo-Angle™, Cambridge Endoscopic Devices Inc.,

Fig 1. Photograph of handmade single-port system. The three trocars attached to the surgical glove served as three working channels.

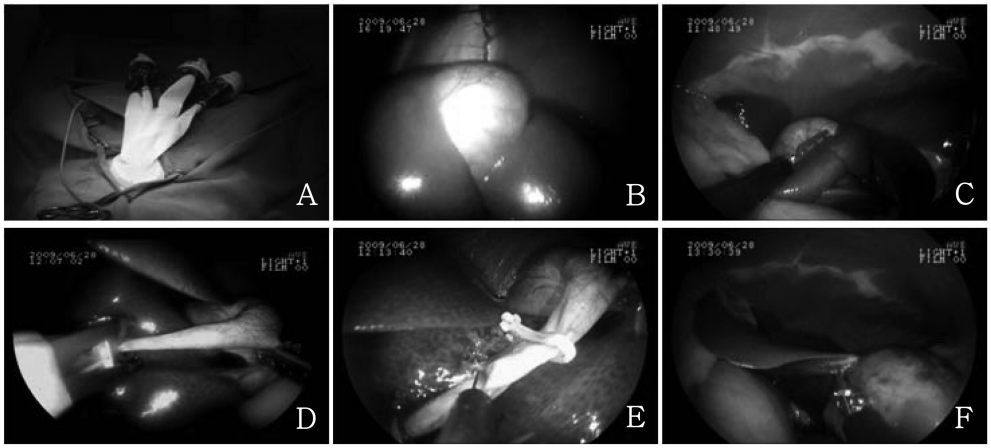

Fig 2. Intra-operative image of single incision flexible endoscopic cholecystectomy: Handmade single-port system was attached to the abdominal cavity (A). Endoscope was inserted into abdominal cavity, and gall bladder was identified immediately (B). Traction of gall bladder was performed for the better visualization of cystic duct and artery (C). Cystic duct and artery were ligated with 5 mm clips (D). Transsection of the cystic duct and artery by L-knife (E). Blunt dissection was performed using rotating Maryland dissector and L-knife (F).

USA) and gall bladder was dissected free from liver (Fig 2F). Gall bladder was wrapped by specimen pouch (KGL-101-S Lap Bag®, Sejong Medical Inc., Korea) and was removed with handmade single-port system.

An endoscope was advanced to the operating site to evaluate the bile leakage or hemorrhage.

The operative filed was irrigated with normal saline (Choongwae 0.9% Normal saline Sol®, Choongwae Pharm Co., Korea) and lavaged. Abdominal wall and skin was closed routinely.

Postoperative Treatment

Dogs were fasted for 24 hours after the procedure and 5% Hartmann-dextrose solution (60 ml/kg/day, IV, CJ Hartmann-D Sol®, CJ Pharm., Korea) was given for 24 hours. Postoperative care included: surgical site dressing 1 time a day for 7days, cefazolin (20 mg/kg, IV, q12hr, Kukje Pharm. Ind., Korea) for 7days. Meloxicam (0.2 mg/kg, PO, q24hr, Metacam®, Boehringer Ingelheim, USA) was used for postoperative analgesia.

Assessment parameters

Intra-operative observation

Surgical time, surgical bleeding and bile leakage were observed. Surgical time was divided into: total surgical time, surgical time until the gall bladder resection and time for the gall bladder dissection.

Post-operative observation

General postoperative conditions (e.g. pain, appetite and activity) were monitored throughout for seven days of experimental period after operation.

Hematology and serum chemistry

Complete blood counts (WBC, RBC, Hematocrit and Hemoglobin) and serum chemistry (alkaline phosphatase; ALKP, gamma-glutamyltransferase; GGT, aspartate aminotransferase; AST, alanine aminotransferase; ALT) were performed on preoperative, postoperative day (POD) 1, 3, 5 and 7 to evaluate blood loss, inflammation and elevation of hepatic enzymes after the surgical procedure.

Gross examination

On POD 8, gross examination was done to assess following: gall bladder resected site, adhesion with surrounding tissue, confirmation of Hem-o-lok®clips at the cystic duct and postoperative complication such as peritonitis.

Statistical Analysis

Hematological and serum chemical values were analyzed by one-way ANOVA (SPSS for Window, 12.0.1, SPSS Inc. USA). All data expressed as mean ± standard deviation. The values of $P < 0.05$ were considered significant.

Results

Cholecystectomy was successfully accomplished in all cases and all animals survived throughout the experimental period.

Intra-operative observation

Total surgical time of individual dogs was 154 minutes, 141 minutes and 64 minutes, respectively. In dog 2, gall bladder dissection time was markedly decreased than dog 1. In dog 3, time B and time C were decreased simultaneously.

Intra-operative bleeding was observed in all dogs, but it appeared to be minimal that occurred by traction of gall bladder and bile leakage was observed in one dog (Dog 2). But, bleeding or bile leakage of all dogs was not observed after removal of gall bladder (Table 1).

Table 1. Intra-operative parameters during single incision endoscopic cholecystectomy in dogs

Dog	Surgical Time (minute)			IO-B[d]	IO-L[e]	PO-B[f]	PO-L[g]
	Time A[a]	Time B[b]	Time C[c]				
1	154	62	78	Minimal	None	None	None
2	141	112	12	Minimal	Moderate	None	None
3	64	20	31	Minimal	None	None	None

[a]Total surgical time
[b]Surgical time until the gall bladder resection
[c]Surgical time for the gall bladder dissection
[d]Intra-operative bleeding
[e]Intra-operative bile leakage
[f]Bleeding after gall bladder resection
[g]Bile leakage after removal of gall bladder

Table 2. Hematology data in single incision flexible endoscopic cholecystectomy in dogs (n = 3)

	POD* 0	POD 1	POD 3	POD 5	POD7
WBC ($\times 10^3$/mm^3)	9.2 ± 4.5	15.4 ± 2.0	10.4 ± 0.4	8.7 ± 0.3	6.3 ± 0.4
RBC ($\times 10^6$/mm^3)	6.2 ± 0.4	5.5 ± 0.2	6.0 ± 0.3	5.9 ± 0.2	6.2 ± 0.1
Hematocrit (%)	41.3 ± 3.1	35.5 ± 0.3	39.3 ± 0.6	37.0 ± 1.4	38.5 ± 2.9
Hemogloblin (g/dl)	13.7 ± 4.8	14.1 ± 0.2	13.2 ± 2.0	12.2 ± 3.0	14.4 ± 0.5

Data are expressed as mean ± SD
*Postoperative day

Table 3. Serum chemistry in single incision flexible endoscopic cholecystectomy in dogs (n = 3)

	POD 0	POD 3	POD 5	POD 7
ALKP[a] (U/l)	80.0 ± 35.0	147.0 ± 14.0	157.0 ± 57.3	115.0 ± 39.4
GGT[b] (U/l)	2.7 ± 0.6	5.0 ± 1.7	6.7 ± 0.6	4.5 ± 0.7
AST[c] (U/l)	30.3 ± 1.2	61.7 ± 20.1	35.7 ± 13.4	46.3 ± 8.1
ALT[d] (U/l)	< 0	143.7 ± 70.7	165.0 ± 0.0	84.3 ± 43.1

Data are expressed as mean ± SD
[a]ALKP (alkaline phosphatase) : 14-224 U/l
[b]GGT (gamma-glutamyltransferase) : 1.0-14.0 U/l
[c]AST (aspartate aminotransferase) : 7-84 U/l
[d]ALT (alanine aminotransferase) : 4-125 U/l

Post-operative observation

All of dogs showed good appetite and activity. In addition, post-operative pain was not observed.

Hematology and serum chemistry

In the hematological and serum chemical examination, post-operative values of WBC, RBC, hematocrit, hemoglobin, ALKP, GGT, AST and ALT levels were not significantly different (Table 2, 3).

Gross examination

On observation of gall bladder resection site on POD 8, gross liver damage and other complications (i.e. hemorrhage, inflammation, bile leakage and adhesion) were not shown (Fig 3A). And all of 5 mm Hem-o-lok® clips were well placed at the ligation sites (Fig 3B).

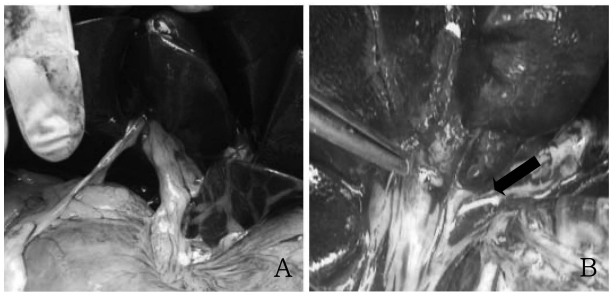

Fig. 3. Post mortem gross examination of peritoneal cavity on POD 8. Liver damage and other complication were not observed (A). 5 mm Hem-o-lok®clips were well placed and were adhered to omentum at the ligation sites (arrow) (B).

Discussion

In this study, we successfully performed single incision flexible endoscopic cholecystectomy (SIEC) in 3 dogs. After recovery from the anesthesia, no significant pain on surgical site was observed and all dogs showed normal activity. Previous study reported that the size and numbers of the port are closely related to postoperative pain and complication (6). By considering such factors, animals' postoperative condition can be improved directly. Minimal abdominal incision was proved to

bring advantage not only for the pain itself, but also for immunological aspect (4, 27).

A complete gall bladder excision was completed in all dogs. In dog 2, gall bladder dissection time was markedly short, but total surgical time was not decreased due to the moderate bile leakage. However in dog 3, total surgical time was severely decreased than in dog 1 and dog 2 due to surgical experience. And, it was not observed intra-abdominal complication like peritonitis, hemorrhage and bile leakage at gross examination after POD 7.

Several important intraoperative complications are possible during SIEC. Accordingly, hematology, serum chemistry and necropsy were also conducted to evaluate safety and feasibility of SIEC in this study.

In this study, there was observed mildly increased WBC level in POD 1 based on hematology. However, the value was gradually decreased on POD 3, 5 and 7. This demonstrate that there was no postoperative complication related with peritonitis or sepsis. There were no significant change of RBC, hematocrit and hemoglobin between the preoperation and postoperation values. These results showed that it was not occurred pre and postoperative hemorrhage during SIEC. The preoperative and postoperative levels of ALKP, GGT, AST and ALT have been investigated in various studies to determine the physiological basis of hepatic malfunction (2,14,15,16,28,35,36). Especially, knowing the fact that normal portalvenous pressure is between 7-10 mmHg and about half of the hepatic blood flow comes from the portal venous system, 14 mmHg of pneumoperitoneum created with CO_2 is stated to be the major cause of transient hepatic ischemia during laparoscopic cholecystectomy (16,17,29,35,36). And, Hasukicetal in their randomized study comparing the effects of low and high pressure pneumoperitoneumon liver functions, state that AST and ALT elevations were significantly higher in patients operated under high pressure (14 mmHg) pneumoperitoneum than those under low pressure (7 mmHg) (16). Morinoetal investigated the duration of pneumoperitoneum at constant pressure and found that when the duration of operation exceeds 60 minutes, elevationin AST and ALT levels become more significant (28).

Comparing the liver enzymes, there were evaluated to examine effects of low pressure pnemoperitoneum and liver tissue damage caused by biliary tract manipulation. ALKP, GGT, AST and ALT levels were not elevated significantly after SIEC. Therefore, SIEC under low pressure (5 mmHg) pnumoperitonium demonstrated that did not affect liver enzyme level (ALKP, GGT, AST and ALT). Especially, although it was low pressure pnumoperitonium compared to traditional laparoscopic surgery, the flexible endoscope was able to provide a perfect view of the intraperitoneal cavity and enable the easy identification of the gall bladder.

We used the "handmade single-port system", which consist of two of 5 mm and one of 12 mm trocars and a surgical glove. This system allows simultaneous passage of several instruments through one small incision. The devices minimizes the incision site up to 2 cm, which is needed to pass at least two 5 mm laparoscopic instrument and one endoscope at the same time. Thus, it decreases the risk of operative site herniation after surgery.

In this study, to avoid internal collision and to increase instrument' range of motion, we decide to introduce the flexible endoscope instead of rigid laparoscope. The use of flexible endoscopic in SILC has not been described in small to medium sized dogs. Moreover, the most important advantages of the single incision surgery using a flexible endoscope compared to laparoscope are able to directly and straightly approach the gall bladder, which results in simplifying the procedures for cholecystectomy. The single-working channel of flexible endoscope enabled use of another surgical device without the need for another port.

Moreover, the Maryland dissector which could be flexed at its tip had enabled to simplify a better side view of the operating field and facilitate the procedure during dissection of gall bladder.

Performing surgery with flexible endoscope is a relatively new skill for the veterinary surgeon, and the available tools were not designed for complex surgical tasks. However, further instrument and accessory improvement will increase acceptance of cholecystectomy using a flexible endoscope. This procedure may also be easily converted to a standard laparoscopic surgery, with no need for a change in operative position.

In conclusion, single incision endoscopic flexible cholecystectomy in dogs by periumbilical approach seems to be a technically feasible and safe procedure. SIEC could be a less invasive alternative to the conventional four-port laparoscopic cholecystectomy in small to medium sized dogs.

Acknowledgement

This study was supported by the Kerea Research Foundation Grant funded by Kerean government (KRF-2008-313-E00645).

References

1. Aguirre AL, Center SA, Randolph JF, Yeager AE, Keengan AM, Harvey HJ, Erb HN. Gallbladder disease in Shetland sheepdogs: 38 cases (1995-2005). J Am Vet Med Assoc 2007; 231: 79-88.
2. Andrei VE, Schein M, Margolis M, Rucinski JC, Wise L. Liver enzymes are commonly elevated following laparoscopic cholecystectomy: is elevated intra-abdominal pressure the cause? Dig Surg 1998; 15: 256-259.
3. Besso JG, Wrigley RH, Gliatto JM, Webster CR. Ultrasonographic appearance and clinical findings in 14 dogs with gallbladder mucocele. Vet Radiol Ultrasound 2000; 41: 261-271.
4. Boni L, Benevento A, Rovera F, Dionigi G, Di Giuseppe M, Bertoglio C, Dionigi R. Infective complications in laparoscopic surgery. Surg Infect (Larchmt) 2006; 7: S109-111.
5. Chamberlain RS, Sakpal SV. A comprehensive review of single-incision laparoscopic surgery (SILS) and natural orifice transluminal endoscopic surgery (NOTES) techniques for cholecystectomy. J Gastrointest Surg 2009; 13: 1733-1740.
6. Cheah WK, Lenzi JE, So JB, Kum CK, Goh PM. Ran-domi-

zed trial of needlescopic versus laparoscopic cholecystectomy. Br J Surg 2001; 88: 1017-1018.
7. Chow A, Purkayastha S, Paraskeva P. Appendicectomy and cholecystectomy using single-incision laparoscopic surgery (SILS): The first UK experience. Surg Innov 2009; 16: 211-217.
8. Church EM, Mathleson JR. Surgical treatment of 23 dogs with necrotizing cholecystitis. J Am Anim Hosp Assoc 1988; 24: 305-310.
9. Culp WTN, Mayhew PD, Brown DC. The effect of laparoscopic versus open ovariectomy on post-operative activity in small dogs. In: Proceedings of the 2008 ACVS Veterinary Symposium. San Diego; 2008: P6.
10. Cuschieri A, Dubois F, Mouiel J, Mouret P, Becker H, Buess G, Trede M, Troidl H. The European experience with laparoscopic cholecystectomy. Ann J Surg 1991; 161: 385-387.
11. Devitt CM, Cox RE, Hailey JJ. Duration, complications, stress and pain of open ovariohysterectomy versus a simple method of laparoscopic-assisted ovariohysterectomy in dogs. J Am Vet Med Assoc 2005; 227: 921-927.
12. Eich CS, Ludwig LL. The surgical treatment of cholelithiasis in cats: a study of nine cases. J Am Anim Hosp Assoc 2002; 38: 290-296.
13. Giacomo U, Alfonso MM, Gioacchino C, Gaspere G, David B, Arianna CS. Laparoscopic cholecystectomy: European position versus American position. Revisata de Ciencia de Saude de Macau 2002; 3: 32-34.
14. Giraudo G, Brachet CR, Caccetta M, Morino M. Gasless laparoscopy could avoid alterations in hepatic function. Surg Endosc 2001; 15: 741-746.
15. Hasukic S, Kosuta D, Muminhodzic K. Comparison of postoperative hepatic function between laparoscopic and open cholecystectomy. Med Princ Pract 2005; 14: 147-150.
16. HasukiĆ S. Postoperative change in liver function test: randomized comparison of low- and high-pressure laparoscopic cholecystectomy. Surg Endosc 2005; 19: 1451-1455.
17. Jakimowicz J, Stultiëns G, Smulders F. Laparoscopic insufflation of the abdomen reduces portal venous flow. Surg Endosc 1998; 12: 129-132.
18. Kagaya T. Laparoscopic cholecystectomy via two ports, using the "Twin-Port" system. J Hepatobiliary Pancreat Surg 2001; 8: 76-80.
19. Keus F, de Jong JA, Gooszen HG, van Laarhoven CJ. Laparoscopic versus open cholecystectomy for patient with symptomatic cholecystolithiasis. Cochrane Database Syst Rev 2006; 4: CD006231.
20. Kirpensteijin J, Fingland RB, Ulrich T, Sikkema DA, Allen SW. Cholelithiasis in dogs: 29 cases (1980-1990). J Am Vet Med Assoc 1993; 202: 1137-1142.
21. Kuhry E, Schwenk W, Gaupset R, Romild U. Bonjer J. Long-term outcome of laparoscopic surgery for colorectal cancer: a Cochrane systematic review of randomized controlled trials. Cancer Treat Rev 2008; 34: 498-504.
22. Lee J, EI-Tamer M, Schifftner T, Turrentine FE, Henderson WG, Khuri S, Hanks JB, Inabnet WB. Open and laparoscopic adrenalectomy: analysis of the national surgical quality improvement program. J Am Coll Surg 2008; 206: 953-959.
23. Marescaux J, Dallemagne B, Perretta S, Wattiez A, Mutter D, Coumaros D. Surgery without scars: report of transluminal cholecystectomy in a human being. Arch Surg 2007; 142: 823-826.
24. Mayhew PD. Advanced laparoscopic procedures (hepatobiliary, endocrine) in dogs and cats. Vet Clin North Am Small Anim Pract 2009; 39: 925-939.
25. Mayhew PD, Brown DC. Prospective evaluation of two intracorporeally-sutured laparoscopic gastropexy techniques compared to laparoscopic-assisted gastropexy in dogs. In: Proceedings of the 2008 ACVS Veterinary Symposium. San Diego; 2008: p22.
26. Mayhew PD, Mehler SJ, Radhakrishnan A. Laparoscopic cholecystectomy of uncomplicated gall bladder mucocele in six dogs. Vet surg 2008; 37: 625-630.
27. McGee MF, Schomisch SJ, Marks JM, Delaney CP, Jin J, Williams C, Chak A, Matteson DT, Andrews J, Ponsky JL. Late phase TNF-alpha depression in natural orifice translumenal endoscopic surgery (NOTES) peritoneoscopy. Surgery 2008; 143: 318-328.
28. Morino M, Giraudo G, Festa V. Alterations in hepatic function during laparoscopic surgery. An experimental clinical study. Surg Endosc 1998; 12: 968-972.
29. Neudecker J, Sauerland S, Neugebauer E, Bergamaschi R, Bonjer HJ, Cuschieri A, Fuchs KH, Jacobi CH, Jansen FW, Koivusalo AM, Lacy A, McMahon MJ, Millat B, Schwenk W. The European Association for Endoscopic Surgery clinical practice guideline on the pneumoperitoneum for laparoscopic surgery. Surg Endosc 2002; 16: 1121-1143.
30. Pelaez MJ, Bouvy BM, Dupre GP. Laparoscopic adrenalectomy for treatment of unilateral adrenocortical carcinomas: techniques, complications and results in seven dogs. Vet Surg 2008; 37: 444-453.
31. Pelosi MA. Laparoscopic appendectomy using a single umbilical puncture (minilaparoscopy). J Reprod Med 1992; 37: 588-594.
32. Pike FS, Berg J, King NW, Penninck DG, Webster CR. Gall bladder mucocele in dogs: 30 cases (2000-2002). J Am Vet Med Assoc 2004; 224: 1615-1622.
33. Poon CM, Chan KW, Lee DW, Chan KC, Ko CW, Cheung HY. Two-port versus four-port laparoscopic cholecystectomy. Surg Endosc 2003; 17: 1624-1627.
34. Reddy N, Rao P. Per oral transgastric endoscopic appendectomy in human. Abstract presented at 45th Annual Conference of the Society of Gastrointestinal Endoscopy of India; February 28-29, 2004; Jaipur, India.
35. Saber AA, Laraja RD, Nalbandian HI, Pablos-Mendez A, Hanna K, Changes in liver function tests after laparoscopic cholecystectomy: not so rare, not always ominous. Am Surg 2000; 66: 699-702.
36. Sakorafas G, Anagnostopoulos G, Stafyla V. Elevation of serum liver enzyme after laparoscopic cholecystectomy. N Z Med J 2005; 118: U1317.
37. Tan M, Xu FF, Peng JS, Li DM, Chen LH, Lv BJ, Zhao ZX, Huang C, Zheng CX. Changes in the level of serum liver enzymes after laparoscopic surgery. World J Gastroenterol 2003; 9: 364-367.
38. Trichak S. 3 port v/s 4 port cholecystectomy. Surg endosc 2003; 17: 1434-1436.
39. Walsh PJ, Remedios AM, Ferguson JF, Walker DD, Cantwell S, Duke T. Thoracoscopic versus open partial pericardectomy in dogs: comparison of post-operative pain and morbidity. Vet Surg 1999; 28: 472-479.

40. Walter R, Dunn ME, d' Anjou MA, Lecuyer M. Nonsurgical resolution of gallbladder mucocele in two dogs. J Am Vet Med Assoc 2008; 232: 1688-1693.

41. Worley DR, Hottinger HA, Lawrence HJ. Surgical management of gallbladder mucoceles in dogs: 22cases (1999-2003). J Am Vet Med Assoc 2004; 225: 1418-1422.

개에서 단일 통로 유연 내시경 담낭 절제술 : 유용성 연구

이소연 · 신범준 · 정성목[1]

충남대학교 수의과대학 · 동물의과학 연구소

요 약 : 본 연구에서는 중·소형견에서 1개의 복강경 통로를 통한 내시경적 담낭 제거술을 실시함으로써, 개에서 최소 침습적 수술로 담낭 절제술을 실시할 수 있는 방법을 확립하기 위하여 실시하였다. 실험 동물로 총 3마리의 수컷 비글견 (10.3 ± 0.62 kg)을 이용하였으며 배꼽 주위에 하나의 절개창을 만든 후 단일 통로 내시경 시스템을 장착하였다. 이 시스템을 통해 내시경과 Maryland 복강경용 겸자로 담낭을 견인, 제거하였다. 3마리 모두 성공적으로 담낭 절제술을 실시하였으며, 수술 후 감염과 같은 합병증은 발생하지 않았다. 또한 술전, 술후를 비교한 혈액, 혈청 검사상에서도 특이적인 소견은 관찰되지 않았다. 술후 7일 후에 이루어진 부검 소견에서도 출혈 및 담즙의 유출 및 복막염 등과 같은 부작용은 관찰되지 않았다. 따라서 본 연구를 통해, 단일 통로를 이용한 내시경 유도하 담낭 절제술은 중소형견에서 실시할 수 있는 복강 수술 방법 중 최소한의 절개를 통해 비침습적으로 이루어질 수 있는 유용한 수술 방법이라 할 수 있다.

주요어 : 단일 통로, 내시경, 담낭절제술, 개