Laparoscopic Cholecystectomy for Management of Uncomplicated Gall Bladder Mucocele in Six Dogs

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Objectives—To describe a technique for, and outcome after, laparoscopic cholecystectomy (LC) for management of uncomplicated gall bladder mucocele (GBM) in dogs.

Study Design—Case series.

Animals—Dogs (n = 6) with uncomplicated GBM.

Methods—Dogs with ultrasonographic evidence of GBM but without imaging or laboratory signs of gall bladder rupture, peritonitis, or extra-hepatic biliary tract rupture that had LC were included. A 4 portal technique was used. A fan retractor was used to retract the gall bladder to allow dissection around the cystic duct with 5 or 10 mm right-angle dissecting forceps. The cystic duct was ligated using extracorporeally tied ligatures supplemented sometimes with hemostatic clips. A harmonic scalpel was used to dissect the gall bladder from its fossa. The gall bladder was placed into a specimen retrieval bag and after bile aspiration the bag was withdrawn through the 11 mm portal incision.

Results—Five dogs had mild intermittent clinical signs including vomiting, inappetence, and lethargy. All dogs had successful LC without conversion to an open approach. All dogs with clinical signs had improvement or resolution of signs postoperatively. No important perioperative complications occurred and all dogs were alive at a median of 8 months postoperatively (range, 3–14 months).

Conclusions—LC can be accomplished safely and effectively in dogs with uncomplicated GBM.

Clinical Relevance—A minimally invasive approach for cholecystectomy can be used for the treatment of GBM in dogs.

INTRODUCTION

Mucocele formation within the lumen of the gall bladder is an increasingly recognized disease of the extrahepatic biliary tract that can lead to substantial morbidity. It is characterized by the gradual accumulation of large amounts of thick gelatinous bile within the gall bladder lumen. The underlying histologic lesion that leads to formation of a gall bladder mucocele (GBM) has been termed cystic mucinous hyperplasia. Eventually the lumen of the gall bladder becomes distended and vascular compromise, increased intracholic pressure, or some other mechanism may result in necrosis and perforation. Ultrasonographic examination of the gall bladder is characterized by immobile stellate or finely striated bile patterns within the lumen when the mucocele is at an advanced stage. This pattern, often referred to as a “kiwi” gall bladder appears to be pathognomonic for GBM. In the earlier stages of disease, various stages of filling of the lumen with mucus or sludge may be observed ultrasonographically making the diagnosis more challenging.

Several potential complications can occur as a result of GBM. Rupture of the gall bladder leading to bile peri-
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In 2 other dogs that met the inclusion criteria and LC was planned, immediate conversion to an open approach was performed because brown bile pigments were observed on the falciform fat during camera port placement (1 dog) or over the liver and omentum when the laparoscope was inserted into the abdomen (1); LC was not attempted, so these dogs were excluded.

Clinical Findings

Clinical signs evident in 5 dogs were: mild intermittent vomiting (5), inappetence (3), and lethargy (1). The dog without clinical signs was diagnosed with GBM after investigation of increased serum liver enzyme concentrations identified during a preanesthetic check for a dental procedure. Preoperative serum alkaline phosphatase concentration (5/6 dogs; median, 422 U/L; range, 177–1426 U/L) and serum alanine aminotransferase concentrations (3/6 dogs; median, 799 U/L; range, 300–812 U/L) were increased in some dogs. Coagulation panels obtained preoperatively in 3 dogs were normal. Clinical signs or increased liver enzyme concentrations had been noted for 2 weeks to 2 years preoperatively (median, 5 months).

On abdominal ultrasonography, all dogs had biliary mucocoele development. The gall bladder contained large accumulations of thick echogenic sludge in all dogs and 2 had typical radial striations. The gall bladder was somewhat distended in 3 dogs and the common bile duct was mildly distended in 2 dogs but in neither case was extra-hepatic biliary tract obstruction or rupture suspected.

LC Technique

Dogs were administered cefazolin (22 mg/kg intravenously [IV]) at induction and every 2 hours until the end of the procedure. After inducing general anesthesia, abdominal access was obtained using a sutureless modified Hasson technique. Penetration into the peritoneal cavity was confirmed by observation of intra-abdominal fat before trocar placement. A 4 trocar technique was used with a camera portal established 1 cm caudal to the umbilicus using a pyramidal tip 8.5 cm long 11 mm trocar-cannula assembly (Karl Storz Veterinary Endoscopy, Goleta, CA). Pneumoperitoneum was established with CO₂ (maximal pressure, 10–15 mmHg) using a pressure-regulating mechanical insufflator, then a 5 mm, 0°, 29 cm laparoscope (Hopkins II® laparoscope, Karl Storz Veterinary Endoscopy) was inserted into the abdomen. Three instrument portals were established (Fig 1) using 6.5 cm long, 6 mm trocarless threaded cannulas (Ternamian Endotip™ cannula, Karl Storz Veterinary Endoscopy) under direct observation: one 5–8 cm lateral and 3–5 cm cranial to the umbilicus on the left side and 2 located 3–5 and 5–8 cm lateral to the umbilicus on the right side. The right-sided portals were not placed in exactly the same locations in each dog; however, when placing the right-sided portals, care was taken to try and triangulate them around the anticipated location of the gall bladder and place them several centimeters apart so that instrumentation would not come easily into contact during the procedure.

Retraction of the gall bladder with a 5 mm fan retractor (Karl Storz Veterinary Endoscopy) through the left-sided...
instrument portal was used to elevate the gall bladder into a position where the cystic duct was visible. The falciform fat was not removed but the fan retractor had to pass beneath or through the falciform to gain access to the gall bladder from the left-sided port. Five mm (4 dogs) or 10 mm (2 dogs) right-angle dissecting forceps were used to dissect around the cystic duct. In 3 dogs, 3 extracorporeally tied modified Roeder knots of 0 or 2-0 polydioxanone were placed around the cystic duct. In 3 dogs where only 2 ligatures were placed around the cystic duct, ligation was supplemented with 1–2 medium/large hemostatic clips using a reusable multifire 10 mm laparoscopic clip applier (M/L-10 clip applier, Microline Pentax, Beverly, MA). Transection of the cystic duct was performed with laparoscopic scissors between the 2 most distal sutures leaving 1–2 ligatures in place around the cystic duct and 1 in place on the cystic duct junction with the gall bladder. The most distal suture was left long allowing its use in gall bladder manipulation after the cystic duct was cut (Fig 2); however, great care was taken not to place too much traction on this suture because if it loosens or becomes detached bile spillage will occur.

The gall bladder was then dissected from its fossa using a harmonic scalpel (Harmonic ACE™, Ethicon Endosurgery Inc., Cincinnati, OH) and then placed into a specimen retrieval bag (Monarch™, Applied Medical Corp., Rancho Santa Margarita, CA). The retrieval bag was partially retracted through the camera portal (Fig 3) until a small area of the gall bladder could be punctured with a number 11 scalpél
blade to facilitate bile aspiration, within the bag while it was still in the abdominal cavity, using a suction/irrigation device (Flovac, Conmed Endosurgery Inc., Utica, NY). After bile aspiration, the gall bladder and specimen retrieval bag could be pulled through the 11 mm camera portal. A liver biopsy (5 dogs) was collected using laparoscopic 5 mm cup biopsy forceps. The liver specimen, once in the biopsy forceps was gently pulled in a twisting motion from the margin of a liver lobe and the site inspected for hemorrhage. Thorough abdominal lavage of the gall bladder fossa was then performed followed by aspiration of lavage fluid. The abdomen was decompressed by CO₂ release before cannula removal. Portals were closed by single simple interrupted 2-0 polydioxanone sutures in the musculature of the body wall and single simple interrupted sutures of 3-0 polyglecaprone 25 in the subcuticular tissue, and 3-0 nylon in the skin.

RESULTS

Adhesions involving the biliary tract were not found. The gall bladder, after intraperitoneal bile aspiration within the specimen retrieval bag, was withdrawn in the bag through the 11 mm camera portal incision (5 dogs) or through a 10 mm expansion of the camera portal incision (1 dog). Surgical time ranged from 95 to 180 minutes (mean duration of first 4 dogs was 165 minutes; mean duration of last 2 dogs was 95 minutes).

One dog had an increased serum total bilirubin concentration postoperatively (2.9 mg/dL, reference interval, 0.3–0.9 mg/dL) but this returned to within the reference range 2 days postoperatively. Four dogs had serum biochemical results available >2 months after surgery. Serum alkaline phosphatase concentrations had decreased but remained elevated outside the reference range in 3 dogs. Serum alanine aminotransferase concentrations decreased in 3 dogs and remained above the reference range in 3 dogs.

Microbial culture and susceptibility testing from bile samples yielded no growth in 5 dogs and growth of an Enterococcus sp. in 1 dog. GBM was confirmed by histopathology in all dogs. Choleliths were present in the gall bladder of 1 dog. Morphologic features common in liver biopsies were mid-zonal hepatocellular swelling and clearing with ceroid granuloma formation and mild bile duct hyperplasia.

Postoperative Management

No surgical complications occurred and all dogs were discharged. Five dogs went home the day after surgery and 1 dog went home 2 days after surgery. All dogs were administered amoxicillin/clavulanic acid (13.75 mg/kg orally, twice daily for 7–10 days) and either deracoxib (1–2 mg/kg orally once daily) or meloxicam (0.1 mg/kg orally once daily) for 3–5 days. IV fluid therapy was dis-continued after surgery and dogs were fed their normal diet starting the day after surgery. Ursodeoxycholic acid (125 mg orally once daily) administered to 1 dog preoperatively was continued postoperatively. Clinical signs improved or resolved in all dogs in which they were present. At the time of writing all dogs were alive (median, 8 months postoperatively; range, 3–14 months).

DISCUSSION

We report a technique for LC that was performed safely and repeatably in 6 carefully selected dogs with GBM. Case selection in minimally invasive surgery is critical to success. Dogs we considered good candidates for LC are those with GBM not associated with biochemical or imaging evidence of biliary tract rupture or obstruction. Clearly there is some subjectivity in interpretation of imaging and laboratory tests results in ruling out these complications. Early in the disease, the diagnosis is not always unequivocal and diagnosis of associated complications is not 100% sensitive or specific. This limitation was highlighted by 2 dogs that were considered candidates for LC but had biliary tract rupture evident as visible bile within the peritoneal cavity. This observation stresses the importance of being prepared to convert to “open” surgery whenever LC is planned. Perhaps future research will demonstrate the adequacy of laparoscopic intra-abdominal lavage and drainage in dogs where perforation has occurred. A laparoscopic approach described for management of bile peritonitis after blunt liver trauma in humans has had very good results.

Dogs with biliary tract obstruction may also become candidates for LC if minimally invasive common bile duct access can be performed to ensure biliary tract patency. Endoscopic retrograde cholangio-pancreatography (ERCP) has been performed in dogs and may in the future provide a minimally invasive modality for flushing the common bile duct pre- or intraoperatively.

Portal Location

We found a 4 portal technique necessary for LC because use of a left-sided portal 5–8 cm lateral to the midline and 3–4 cm cranial to the umbilicus for insertion of a fan retractor simplified gall bladder manipulation and facilitated observation of the cystic duct, which requires cranial retraction of the gall bladder. Placement of the camera portal at the infraumbilical position yielded good observation of all salient structures. The exact positioning of 2 right paramedian instrument portals is less critical but an attempt should be made to triangulate around the anticipated location of the gall bladder.
Cystic Duct Ligation

Ligation of the cystic artery and duct was achieved using extracorporeally tied modified Roeder laparoscopic slipknots. This is considered important to ensure a safe and secure ligation before transection. A 5 or 10 mm laparoscopic right-angle dissector is an essential piece of equipment for dissection around the cystic duct. In cases with some cystic duct distension, the 5 mm instrument had insufficient length to encircle the duct necessitating use of the 10 mm instrument. In 3 dogs, clips were used to provide additional security. They were not used as the sole method of ligation, because we did not believe that the medium/large hemostatic clips we had available would provide adequate hemostasis and prevent biliary leakage especially when the cystic duct was thick-walled and somewhat dilated. Also we had previously observed postoperative bile leakage from the cystic duct when only clips were used during open cholecystectomy. Despite being more time consuming than clip placement alone, use of the extracorporeally tied ligatures seems justified given that postoperative bile leakage did not occur. Other methods (intracorporeally tied ligatures, larger and more secure clips) may shorten the time required to securely ligate the cystic duct. Because ultrasonic and bipolar vessel-sealing devices are not capable of producing a secure seal of the cystic duct when used alone for cystic duct sel-sealing devices are not capable of producing a secure ligate the cystic duct. Because ultrasonic and bipolar ves-

Outcome

None of the dogs died and morbidity was low. Increased serum total bilirubin concentration occurred postoperatively in 1 dog but returned to normal within 2 days. This finding is difficult to explain but may reflect transient, partial EHBO from bile sludge within the common bile duct. Serum liver enzyme concentrations increased in most dogs postoperatively presumably because of hepatic trauma that occurred during dissection. We have also observed this with open cholecystectomy so it seems unlikely to be specifically associated with laparo-

Complications

Potential complications include bile spillage and inadequate cystic duct ligation. To minimize the latter possibility, we recommend double ligation of the cystic duct with monofilament absorbable suture. In humans, a major complication of LC is iatrogenic damage of the common bile duct, which can easily be confused with the cystic duct especially when there are adhesions. Good knowledge of canine biliary tract anatomy and experience performing open surgical interventions on the extra-hepatic biliary tract is considered mandatory for surgeons planning laparoscopic LC. One major disadvantage of LC is longer surgical time. Open cholecystectomy can be performed by most surgeons more rapidly than the surgical times we report for LC; however, this most likely represents the early stages of learning and surgical time decreased with experience (95 minutes for the last 2 dogs).

Gall Bladder Dissection

After the cystic duct has been ligated, traction on the long end of the cystic duct suture facilitates dissection of the gall bladder from the fossa rather than attempting dissection from the gall bladder apex towards the cystic duct (Fig 2). Although the gall bladder can be grasped with Babcock forceps especially when the gall bladder wall is thick, perforation will result in bile spillage so direct manipulation should be minimized. We found the harmonic scalpel very helpful in minimizing hemorrhage from the hepatic attachments to the gall bladder during dissection. Whereas other vessel-sealing devices or monopolar or bipolar cautery could be used, the fine-tipped harmonic scalpel accomplished both fine blunt dissection and vessel-sealing. Once the gall bladder was dissected free, it was placed in a specimen retrieval bag that was inserted into the abdomen. This step allows bile aspiration without risk of abdominal contamination and facilitates exteriorization of the gall bladder through an instrument portal. It is possible in some cases of GBM that bile consistency may preclude aspiration, in which case retrieval would be made through a slightly enlarged portal incision.

Dogs with GBM are often small breeds with perhaps a predisposition in the Shetland sheepdog. As peritoneal cavity size decreases, laparoscopic technique becomes more challenging because of the close proximity of the instruments. Although we performed successful LC in a 4 kg dog, using 5 mm laparoscopic instrumentation on dogs <4 kg might be more challenging.
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