

Current Concepts in Hepatobiliary Surgery



Harry W. Boothe Jr, DVM, MS

KEYWORDS

- Hepatobiliary surgery • Hepatic mass lesions • Liver biopsy • Partial hepatectomy
- Cholecystectomy • Cholecystoenterostomy • Choledochotomy

KEY POINTS

- Knowledge of the anatomy of the liver and biliary tract helps minimize complications associated with hepatobiliary surgery.
- Information important for planning partial hepatectomies to treat hepatic masses includes distribution of mass lesions; histologic diagnosis; and patient oncotic, blood typing/cross-matching, and coagulation status.
- Goals of extrahepatic biliary surgery include confirmation of the underlying disease process (eg, biliary mucocele, cholecystitis, and bile duct obstruction; trauma; or leakage) establishment of a patent biliary system, and minimization of perioperative complications.
- Veterinary patients undergoing either extensive liver resection or correction of biliary tract obstruction or leakage tend to have an extensive list of risk factors associated with the primary condition and the surgical procedure.

INTRODUCTION AND ANATOMIC CONSIDERATIONS

Hepatobiliary surgery in dogs and cats may be used to investigate or treat various conditions of the liver and biliary tract including persistent hepatic disease, hepatic abscessation, hepatic mass lesions, gallbladder mucocele, cholecystitis, biliary leakage, and extrahepatic biliary obstruction. Surgical procedures performed include hepatic biopsy, partial hepatectomy, cholecystotomy, cholecystectomy, cholecystoenterostomy, and choledochotomy. Although liver transplantation is not currently performed clinically in dogs and cats, information gleaned from its use in research dogs has provided valuable information to the clinical veterinary surgeon.¹ Knowledge of the anatomy of the liver and biliary tract helps minimize complications associated with hepatobiliary surgery.

The author has nothing to disclose.

Wilford and Kate Bailey Small Animal Teaching Hospital, Department of Clinical Sciences, College of Veterinary Medicine, 1220 Wire Road, Auburn, AL 36849-5540, USA

E-mail address: boothhw@auburn.edu

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The liver is the largest gland in the body and has exocrine (bile) and endocrine function. It is divided into four lobes (left, right, quadrate, and caudate), four sublobes, and two processes by deep fissures. The left hepatic lobe, comprised of the left lateral and medial sublobes, which may be joined by a bridge of liver tissue dorsally, forms nearly one-half of the total liver mass. The right hepatic lobe is smaller than the left and has the right lateral and medial sublobes. The right lateral lobe is often fused to the right medial lobe and the caudate process of the caudate lobe. The right medial lobe is variably fused to the quadrate lobe. The quadrate lobe lies almost on the midline, and its lateral aspect forms one side of the gallbladder fossa. The caudate lobe is composed of the caudate and papillary processes and the connecting isthmus. The isthmus is located between the dorsally located caudal vena cava and the more ventral portal vein. The caudate process forms the most caudal portion of the liver, whereas the papillary process lies in the lesser curvature of the stomach.² From a surgical perspective, the liver may be grouped into three subdivisions: left (left lateral and medial lobes) comprising approximately 44% of liver volume, central (quadrate and right medial lobes), and right (right lateral and caudate lobes), each comprising about 28% of liver volume.

The portal vein provides the functional blood supply to the liver. It divides into left and right branches in the dog, with the left branch supplying the central and left divisions. The feline portal vein divides into right, left, and central branches. The hepatic artery provides nutritional supply to hepatic parenchyma and bile ducts.¹ Each canine sublobe is supplied by a single hepatic artery and at least one lobar portal vein.³

The biliary system begins at the hepatic canaliculi, with up to eight hepatic ducts, although three or four hepatic ducts was more commonly observed, joining to form the bile duct.⁴ The initial hepatic duct to enter the bile duct usually is the right medial hepatic duct.⁴ The gallbladder is connected to the bile duct via the cystic duct, which tends to be greater than 5 mm long in most dogs.⁴ After passing intramurally within the duodenum for approximately 2 cm, the bile duct opens approximately 3 to 6 cm aborad to the pylorus.

LIVER BIOPSY CONSIDERATIONS

Indications and Contraindications

Diagnosis of most liver diseases requires histopathologic examination of liver tissue.⁵ Diffuse liver diseases may be sampled randomly, but focal lesions require careful selective sampling.⁵ Ideally, the patient's coagulation status should be assessed before a liver biopsy is performed.⁵ Significant bleeding complications have been observed in dogs and cats with thrombocytopenia (platelets $<80 \times 10^3/\mu\text{L}$) undergoing ultrasound-guided liver biopsies.⁶ The liver may be evaluated via fine-needle aspiration (cytology) or biopsy (histopathology). Ultrasound-guided fine-needle aspirations for cytologic examination of the liver have been shown to have serious limitations when used to identify the primary disease process in dogs and cats with clinical evidence of liver disease.⁷ Hepatic cytologic samples are more reliable for diffuse hepatic disease, especially neoplasia, and less reliable for inflammation, necrosis, and hyperplasia.⁸

Technique

Liver biopsies are performed frequently and use various techniques in dogs and cats, including needle core, laparoscopic, and surgical biopsy. An ideal liver biopsy should be of proper size and taken from a location that represents the primary liver pathology.⁵ Samples from multiple lobes are often preferred. In addition to tissues for histopathology, samples may also be obtained for microbiologic testing or quantification of

copper or other metals.^{5,9} Comparison of needle and wedge hepatic biopsy techniques has been made.¹⁰ Ultrasound-guided percutaneous techniques using a needle core biopsy are one option for sampling the liver. Findings in needle biopsy samples taken with ultrasound guidance or at laparotomy concurred with the definitive diagnosis in 48% of dogs and cats in an earlier study.¹⁰

Laparoscopic liver biopsies may be obtained from grossly abnormal areas of the liver, particularly near the periphery of the liver lobes. Advantages of laparoscopic biopsy over laparotomy sampling include lower patient morbidity and decreased infection rate, postoperative pain, and hospitalization time.^{5,11}

Surgical methods of sampling the liver include ligature (suture) fracture or guillotine technique and biopsy punch technique. Surgical liver biopsies should be taken early during the laparotomy to minimize hepatocellular changes from prolonged anesthesia or manipulation of intestine.¹² Advantages of surgical biopsy techniques include enhanced exposure and ability to manipulate tissues, obtain large sample sizes, and monitor biopsy sites for bleeding.⁵ Hepatic biopsies obtained via laparotomy are the largest of any of the methods described and should provide adequate tissue for various analyses.^{5,9}

The ligature (suture) fracture or guillotine technique is performed on the periphery of a liver lobe, with variably sized samples obtained (**Fig. 1**). Use of a pretied ligating loop to obtain liver biopsies was found to be versatile and safe in dogs.¹³ The biopsy punch technique results in collection of partial-thickness samples (ie, less than half the thickness of the lobe) of liver, usually from its ventral surface.³ Lesions located away from the periphery of the liver may be sampled using the biopsy punch. Hemostasis is provided by suture (ligature fracture technique), omental coverage of the biopsy site (either surgical biopsy technique), electrocoagulation (either technique), or gelatin sponge (either technique).

Complications

Hemorrhage is the most frequently described complication, although abscessation of an hepatic biopsy site has been reported and observed by the author.¹⁴

HEPATIC ABSCESSATION

Hepatic abscessation in dogs or cats is reported relatively uncommonly, with middle-aged to older dogs and cats usually being described.^{3,14,15} Abdominal ultrasonography is a relatively sensitive tool for diagnosis. Solitary hepatic abscessation may

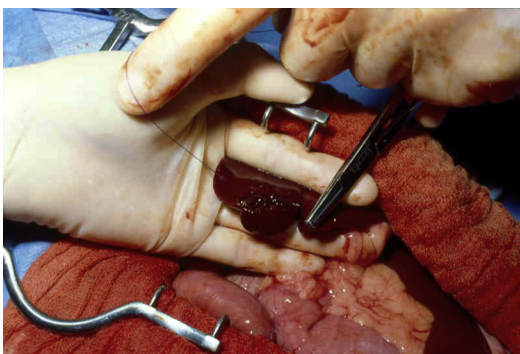


Fig. 1. A biopsy of the liver is obtained using the ligature fracture (guillotine) method. The isolated portion of liver distal to the suture material (2-0 PDS) is excised using scissors.

be more common in dogs than in cats.¹⁴ Microbiologic sampling often yields variable isolates, although *Escherichia coli* is frequently found.

Technique

Diagnostic and treatment principles include complete evaluation to determine any concurrent disease process (eg, neoplasia) and the extent and number of abscesses, use of appropriate broad-spectrum antimicrobials, and possibly surgery. Surgical intervention involves partial hepatectomy or drainage procedures (eg, omentalization). Hepatic abscessation in dogs does not seem to have an anatomic site predilection or to be associated with neoplasia, whereas cats have their right hepatic lobes more commonly affected. Multiple abscess sites and concurrent hepatobiliary neoplasia are more likely in cats.¹⁵

HEPATIC MASS LESIONS

Primary hepatic neoplasia is reported to occur in 0.6% to 2.6% of dogs and 1.5% to 2.3% of cats, with biliary neoplasia seen less frequently.³ Four general types of primary hepatobiliary neoplasia are described: (1) hepatocellular, (2) cholangiocellular, (3) neuroendocrine, and (4) mesenchymal. Primary hepatic neoplasms in dogs can be classified and differentiated using immunohistochemical stains as markers representative of hepatocytic and cholangiocytic lineages.¹⁶ Metastatic tumors of the liver are more common than primary tumors, with approximately 30% of dogs having hepatic metastatic tumors. The presence of hepatic masses may be noted on abdominal ultrasonography, although advanced imaging (eg, computed tomography or MRI) provides information to help discern tumor location, distribution, and potentially differentiate malignant from benign masses.³ Determination of specific tissue types is facilitated by fine-needle aspiration of cells or needle core, laparoscopic, or surgical biopsy. Reported rates for correct diagnoses of hepatic masses range from up to 50% for fine-needle aspiration to 70% for needle core samples.³

Hepatocellular Tumors

Hepatocellular tumors are the most common primary hepatic tumor of dogs, representing 50% to 70% of all nonhematopoietic neoplasms (Fig. 2). Three forms of hepatocellular tumors are described: (1) massive (61%), (2) nodular (29%), and (3) diffuse (10%). Metastasis is more common with nodular or diffuse forms (93%) than with the massive form (36%). Anatomic distribution of lesions with the massive form is



Fig. 2. Omental adhesions are dissected from this massive hepatocellular carcinoma present in the left lateral lobe of a 12-year-old Labrador retriever.

approximately 67% in left lobes, 15% in central lobes, and 18% in right lobes. Hepatocellular tumors with hepatic progenitor cellular characteristics tend to be poorly differentiated and aggressive in behavior.¹⁶ Hepatocellular tumors are reported less commonly in cats, representing less than 25% of primary hepatic neoplasms. Hepatocellular adenomas are more common than carcinomas in cats, whereas hepatocellular carcinomas in dogs are seen twice as frequently as are hepatocellular adenomas.

Surgical resection is the preferred treatment of massive hepatocellular carcinoma in dogs, generally carrying a favorable prognosis.³ Because of likely incomplete surgical resection and high metastatic rate, surgery is not a good option for nodular or diffuse forms of hepatocellular carcinoma in dogs.³ Surgical challenges presented by central or right-sided masses are usually greater than those presented by left-sided masses.

Cholangiocellular (Bile Duct) Tumors

Cholangiocellular tumors account for approximately 30% of primary hepatic tumors in dogs. Cholangiocellular carcinomas are thought to be derived from differentiated mucin-producing cholangiocytes, normally present in larger bile ducts. Bile duct tumors tend to exhibit infiltrative growth, vascular invasion, and intrahepatic or distant metastasis.¹⁶ Most canine cholangiocellular carcinomas are intrahepatic in location. Massive and nodular types occur with relative similar frequency, with diffuse types being less common. Bile duct tumors are the most common primary hepatic neoplasm in cats, with the benign adenoma, biliary cystadenoma, being about twice as common as cholangiocellular carcinomas (Fig. 3).³ Benign bile duct tumors in cats have a better prognosis than malignant forms.

Neuroendocrine Tumors

Neuroendocrine tumors account for approximately 15% of canine and 4% of feline primary hepatic tumors.³ They are thought to be derived from pre-existing neuroendocrine cells in the biliary epithelium.¹⁶ Neuroendocrine carcinomas are aggressive tumors and are associated with a poor prognosis.³ Diffuse liver involvement and peritoneal carcinomatosis are frequent features of canine neuroendocrine carcinoma. More feline neuroendocrine carcinomas are extrahepatic in location, with involvement of the bile ducts or gallbladder being observed.³

Mesenchymal Tumors

A variety of mesenchymal tumors of the liver in dogs and cats have been described. They account for approximately 10% of primary hepatic neoplasms in dogs and cats.³ Primary hepatic hemangiosarcoma may be seen in dogs and cats, but less



Fig. 3. Partial hepatectomy of the left medial lobe in an 18-year-old domestic shorthair cat (DSH) revealed biliary cystadenomas.

commonly than the metastatic form from spleen or other organs.³ Other primary hepatic mesenchymal tumors include leiomyosarcoma, osteosarcoma, and fibrosarcoma.

PERIOPERATIVE CONSIDERATIONS FOR PARTIAL HEPATECTOMY

Although research dogs have been shown to tolerate extended hepatectomy, with up to 90% of the hepatic mass being excised, partial hepatectomy in clinical patients usually involves removal of one or two hepatic lobes.¹⁷ Information important for planning partial or complete hepatic lobectomies includes distribution of mass lesions; histologic diagnosis; and patient oncotic, blood typing/cross-matching, and coagulation status. Using a team approach to provide patient care in the perioperative period seemingly has beneficial effects. The team usually consists of two experienced surgeons and one anesthetist. Planning by the team should include having appropriate fluid and blood products available, proper patient instrumentation for anesthetic monitoring, presurgical calculation of the trigger point of blood loss for administration of blood products, having special surgical equipment available, and an immediate postoperative patient management strategy. Having specific information about location of the mass (ie, left, right, or central) helps make presurgical planning more accurate and appropriate.

Indications

Partial hepatectomy is performed for smaller, more peripherally located lesions. Complete hepatic lobectomy is technically easier to perform on the left hepatic lobes, because of their more accessible hilus.

Technique

Adequate exposure is essential to success of hepatic lobectomy surgery. Extension of the ventral midline abdominal approach through or along the xiphoid process and through the ventral diaphragm into the thoracic cavity or paracostally on the affected side may improve access to the affected hepatic lobe. Assess extent of adhesions to surrounding tissues and proximity of the mass to the hilus. Transect ligamentous attachments to the affected lobe. Ligate branches of the portal and hepatic veins and hepatic artery and hepatic ducts to the affected hepatic lobes. When central lobes are affected, confirm the location of the portal vein branches to the right and left divisions, because these branches need to be preserved. Confirm the proximity of the caudal vena cava and bile duct to the affected lobes. Initiate parenchymal dissection, using fingers or suction tip as close to the hilus as required to achieve a grossly normal margin of hepatic tissue, if possible. Achieve hemostasis of the exposed hepatic parenchyma before final transection of the mass, because traction on the affected lobe enhances visibility of the excision site. No significant bleeding should be noted from the cut surface of the liver after partial or complete hepatic lobectomy.³ Confirm patency of the bile duct and portal venous and hepatic arterial branches to remaining hepatic lobes. Lavage the peritoneal cavity with warm saline before closure to remove dislodged blood clots. Postoperative management should include appropriate analgesic administration, attention to blood volume and oncotic status, and conscientious antimicrobial therapy.

Complications and Management

Possible complications of partial or complete hepatic lobectomy include hemorrhage and trauma, including occlusion, of the biliary tract or portal vasculature to the remaining liver. Hemorrhage is a common and occasionally life-threatening complication of

hepatic surgery.¹⁸ Hepatic vascular anatomy presents challenges in hemostasis.¹⁸ Most of the blood flow to the liver is via large, thin-walled branches of the portal vein. Additionally the right liver lobes are adhered to a lengthy section of the caudal vena cava.¹⁸ Dissection around the caudal vena cava or portal branches may result in brisk hemorrhage. Fracture or incision of hepatic tissue causes parenchymal bleeding that is challenging to control, even with stapling or vessel sealing equipment.¹⁸ Options for achieving hemostasis include one or more of the following: direct pressure; use of topical hemostatic agents; hemostatic clips; ligations; stapling equipment (eg, thoracoabdominal stapler with vascular cartridge); and electrosurgical devices, including vessel sealing systems.

Direct pressure is the simplest technique to address parenchymal hemorrhage during liver surgery.¹⁸ Pressure with a moistened laparotomy sponge can be applied to the traumatized liver surface for several minutes. Slowly remove the sponge to avoid clot disturbance.¹⁸ Various topical hemostatic agents (eg, gelatin sponge, oxidized regenerated cellulose) can help achieve hemorrhage control from the hepatic parenchyma. Hemostatic clips are more easily placed than ligatures, because they require less dissection and are easier to place in deep, confined locations.¹⁸ Proper selection of clip size and good application technique are essential to avoid clip dislodgement.¹⁸ Length of the compressed clip should be two to three times the diameter of the vessel.¹⁸ Direct vascular ligation placement (eg, on the lobar portal and hepatic veins and hepatic artery) is more versatile and effective than is an encircling ligature around the base of the liver. Encircling ligatures are only recommended for use in small dogs and cats and for removal of left hepatic lobes.¹⁸

Use of stapling equipment is usually an efficient process, although challenges associated with its use in partial hepatectomy surgery include limited accessibility of the area to be stapled and dimensions (width and thickness) of the hepatic tissue to be divided. Stapler use does not require blunt dissection of hepatic tissue or isolation of specific lobar vessels and hepatic ducts.¹⁸ A variety of electrosurgical units may be used during partial hepatectomies. Bipolar or monopolar handpieces may have applicability to hepatic lobectomies. Vessel sealing systems (eg, LigaSure [Covidien, Minneapolis, MN]) are effective on arteries up to 5-mm diameter and veins up to 7-mm diameter.¹⁸ Collagen and elastin are effectively melted, creating a permanent seal after a single application.¹⁸ Other vessel sealing technologies used in hepatic surgery include an ultrasound-activated scalpel or LASER [Aesculight, LLC, Woodinville, WA] energy systems.

EXTRAHEPATIC BILIARY SURGERY AND POTENTIAL COMPLICATIONS

Goals of extrahepatic biliary surgery include confirmation of the underlying disease process (eg, biliary mucocele, cholecystitis, and bile duct obstruction, trauma, or leakage), establishment of a patent biliary system, and minimization of perioperative complications.¹⁸ Confirming the extent (partial vs complete) and the cause of biliary obstruction in dogs and cats is challenging and frequently involves multiple diagnostic modalities. Although information gained from serum biochemical testing results and abdominal ultrasonography is helpful in assessing the extrahepatic biliary tract, hepatobiliary scintigraphy may be needed to differentiate biliary obstruction from hepatocellular disease or damage and determine whether biliary tract dilation indicates a resolved or ongoing obstruction.^{19,20} Fashioning a rational plan to treat biliary obstruction is best accomplished by knowing the cause, extent, and likely duration of the obstruction (Fig. 4). Information from experimental dogs suggests that delaying primary surgical repair of an obstructed bile duct for at least 10 days after onset of obstruction may be appropriate because of wound healing considerations.²¹

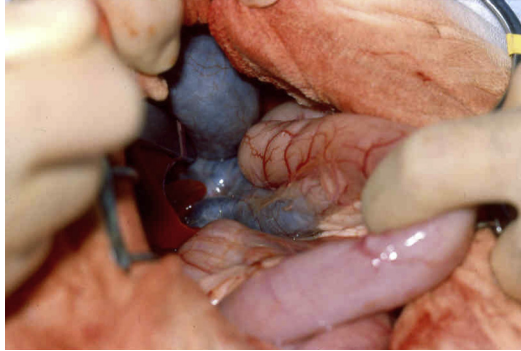


Fig. 4. This dilated biliary tract was observed in a 5-month-old Boxer with biliary obstruction caused by intestinal pythiasis.

Leakage from the biliary tract results in bile peritonitis. Bile salts are toxic to tissue, resulting in permeability changes and necrosis.¹⁹ Although nonseptic bile peritonitis has a milder clinical course than septic bile peritonitis, timely exploration and correction of the source of bile leakage is indicated.¹⁹ Successful primary repair of ruptured bile ducts has been reported in dogs.²² However, treatment of bile duct leakage may be more predictably managed with biliary rerouting and ligation of the bile duct because of the technical challenges and complications of primary repair.¹⁹ Surgical options relating to the extrahepatic biliary tract include cholecystectomy; cholecystotomy; biliary rerouting procedures, including cholecystoenterostomy (cholecystoduodenostomy or cholecystojejunostomy) and choledochoduodenostomy; and use of tube or stents in the gallbladder (cholecystostomy tube) or bile duct (choledochal stents).

The gallbladder wall does not seal well immediately after cholecystocentesis or cholecystotomy, and repair of hepatic, cystic, or bile ducts is technically demanding and characterized by a high rate of failure, in part because of ischemic damage to the bile duct.^{19,23} Tubes or stents in the extrahepatic biliary tract usually are placed surgically, rather than endoscopically, in dogs and cats.

Potential complications of extrahepatic biliary surgery include hemorrhage, dehiscence and leakage (bile peritonitis), obstruction of the bile duct, stricture of the biliary enteric anastomotic stoma, ascending cholangiohepatitis, recurrent cholelithiasis, and altered gastrointestinal physiology.^{19,24}

Cholecystectomy

Indications

The most common surgical procedure performed on the gallbladder of dogs and cats is cholecystectomy. The most common indication for cholecystectomy in the dog is biliary mucocele (**Fig. 5**). The primary indication for feline cholecystectomy is necrotizing cholecystitis, although cholecystectomy for cholelithiasis has been reported (**Fig. 6**).²⁵

Technique

The relative difficulty associated with cholecystectomy in dogs and cats pertains, in part, to the extent of adhesion formation between the gallbladder and surrounding tissues (eg, liver, greater omentum, falciform ligament) and the status, including integrity, of the gallbladder (**Fig. 7**). Cholecystectomy is usually performed via laparotomy in dogs and cats, although a laparoscopic procedure has been described in dogs.²⁶

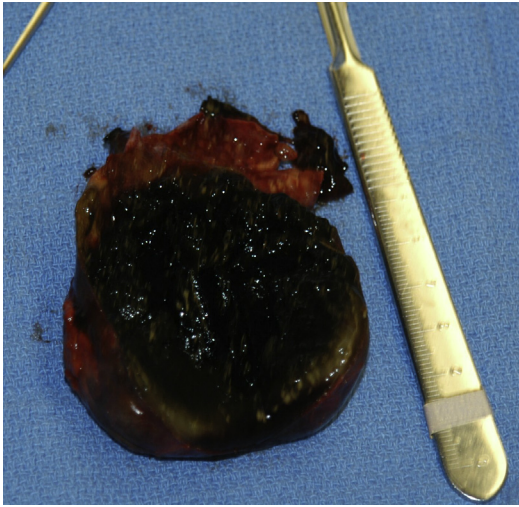


Fig. 5. A gallbladder from a 3-year-old Shetland Sheepdog with a biliary mucocele has been incised to reveal its contents.

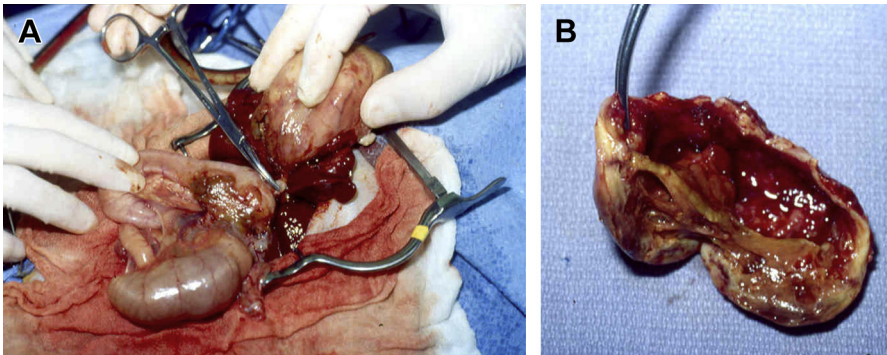


Fig. 6. (A) Cholecystectomy is being performed in a 13-year-old DSH with necrotizing cholecystitis. Note evidence of adhesion formation between the gallbladder and proximal duodenum. (B) The diseased gallbladder has been incised to reveal its mucosal surface.

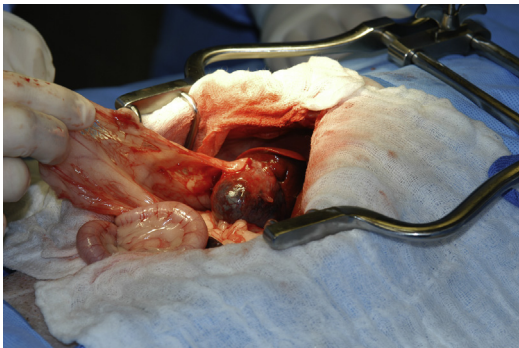


Fig. 7. Omental adhesions to the gallbladder are evident in this 3-year-old Shetland Sheepdog with a biliary mucocele.

Dissect the gallbladder from the hepatic fossa using blunt and sharp dissection. Achieve hemorrhage control of the hepatic fossa via local pressure, electrosurgery, and topical hemostatic agents. Ensure patency of the bile duct by passing a catheter (eg, 5F red rubber catheter) through the bile duct in a normograde (preferred technique) or retrograde fashion. Retrograde catheter passage requires a duodenotomy to access the duodenal papilla. Dissection to the level of the cystic duct usually reveals the cystic artery, which is ligated or occluded collectively with the cystic duct with an appropriately sized vascular clip. Confirm hemostasis and perform intraperitoneal lavage before closure.

Cholecystotomy

Indications

Cholecystotomy occasionally may be performed to obtain full-thickness biopsies or mucosal cultures of the gallbladder, explore the gallbladder or cystic duct, remove choleliths or sludge in an otherwise normal gallbladder, or normograde flush the bile duct.¹⁹

Technique

Pack off the gallbladder and incise it at its apex. Evacuate contents and flush the gallbladder and cystic and bile ducts. Retrograde flushing of the bile duct via the duodenal papilla helps ensure evacuation of the entire biliary tract. Close the incision with a simple continuous pattern using synthetic monofilament absorbable suture material.³ Cover the incision with greater omentum.

Cholecystoenterostomy/Choledochoduodenostomy

Indications

Surgical treatment of extrahepatic biliary obstruction or leakage may include cholecystoenterostomy. Creating a connection between the lumen of the gallbladder and either the duodenum or jejunum is achieved. Although reconstruction of the bile duct has been successfully performed experimentally in dogs using various materials, treatment of a clinical patient with bile duct obstruction or leakage often includes a biliary enteric anastomotic procedure in concert with ligation of the bile duct.^{27,28} Alternatively, primary bile duct repair or choledochotomy are potential options.

Technique

Cholecystoduodenostomy is generally accepted as the most physiologic technique to achieve biliary enteric anastomoses in dogs and cats.²⁹ Dissect the gallbladder from the hepatic fossa taking care to preserve the cystic artery. Position the gallbladder adjacent to the antimesenteric aspect of the duodenum without obstructing the cystic duct, and create matching incisions in the wall of the gallbladder and the duodenum. Appose mucosal surfaces of the gallbladder and duodenum using a simple continuous pattern of 4-0 synthetic absorbable suture material or a surgical stapling device to create the stoma. Stoma size should be greater than or equal to 2.5 cm in length to prevent stricturing and minimize ascending cholangiohepatitis. If tension is noted during attempted mobilization of the gallbladder, a cholecystojejunostomy may be the preferred technique. If the bile duct has dilated because of partial or complete obstruction at its duodenal termination, choledochoduodenostomy or reanastomosis of the bile duct to an unaffected portion of the duodenum may be an option.³⁰

Choledochotomy/Choledochal or Cholecystostomy Tubes

Choledochotomy and placement of choledochal tubes has been reported in dogs and cats.^{22,31,32} Closure of the choledochotomy is achieved over a red rubber catheter of

appropriate diameter (usually 5–8F catheter) using either synthetic monofilament absorbable or nonabsorbable suture material. Suture used is often 3-0 or 4-0 in size, with a simple interrupted or continuous pattern. Suturing the tube to the duodenal wall may extend the duration of stenting. Removal of the stent may be achieved endoscopically.

Indications

Obstructive cholangiolithiasis or pancreatitis is the usual inciting reason for placement of choledochal tubes. Cholecystostomy tubes provide temporary diversion of bile from the gallbladder to a closed collection system.³ Such tubes are considered only when the gallbladder wall is deemed to be healthy.³

Technique

Tube placement may be accomplished via laparotomy or laparoscopic-assisted. Insert a pigtail or Foley catheter into the apex of the gallbladder and place a purse-string suture around the base of the catheter to minimize leakage. Exit the abdomen just caudal to the costal arch, and secure the tube to the skin using a friction suture. Attach the tube to a sterile collection system.

OUTCOMES FOR PATIENTS UNDERGOING HEPATOBILIARY SURGERY

Information regarding outcome is available for selected hepatobiliary surgical procedures.^{3,14,15,18,19,25,29,31–34} Veterinary patients undergoing either extensive liver resection or correction of biliary tract obstruction or leakage tend to have an extensive list of risk factors associated with the primary condition and the surgical procedure. Anesthetic management of the dog or cat with hepatobiliary dysfunction tends to be challenging, in part because hepatic disease impacts many body functions. Dogs undergoing cholecystectomy were not shown to have any greater number of anesthesia complications than were dogs that underwent other hepatic surgeries.³⁵ Dogs or cats with hepatic mass lesions have oncologic and perioperative factors that influence prognosis.

SUMMARY

Surgery of the liver and extrahepatic biliary tract presents technical challenges to the veterinary clinician. Such challenges include gaining access to the lesion; dealing with highly vascular, friable hepatic tissue; potentially difficult-to-heal tissue (eg, extrahepatic biliary tract); and the impact of the primary condition on the patient's response to surgery. Enhancement of outcome and minimizing potential complications can be achieved by performing accurate preoperative patient assessment and treatment, using a team approach to the surgery and perioperative care, demonstrating flexibility to change intraoperative plans, and following a comprehensive postoperative management plan.

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