Therapeutic percutaneous ultrasound-guided cholecystocentesis in three dogs with extrahepatic biliary obstruction and pancreatitis

Beth A. Herman, DVM; Robert S. Brawer, DVM; Robert J. Murtaugh, DVM, MS, DACVECC, DACVIM; Susan G. Hackner, BVSc, DACVIM, DACVECC

A 4-year-old 12-kg (26.4-lb) castrated male Jack Russell Terrier was examined at the VCA Veterinary Referral Associates because of vomiting of 1 day's duration. On initial physical examination, the dog was obese (body condition score of 8 on a scale from 1 to 9), febrile (rectal temperature, 39.4°C [103°F]), lethargic, and dehydrated and had signs of moderate to severe abdominal pain. Hematologic abnormalities included neutrophilia (11,480 µneutrophils/µL; reference range, 0 to 300 band neutrophils/µL; reference range, 29 to 291 mg/dL) and high lipase (3,010 µL; reference range, 2,060 to 10,600 neutrophils/µL; reference range, 0 to 4,500 lymphocytes/µL; and mild lymphopenia (560 lymphocytes/µL; reference range, 690 to 4,500 lymphocytes/µL). Serum biochemical abnormalities included high triglyceride concentration (966 mg/dL; reference range, 49 to 156 mg/dL); hypercholesterolemia (240 mg/dL; reference range, 72 to 170 mg/dL); hyperbilirubinemia (9.0 mg/dL; reference range, 0.1 to 0.3 mg/dL); hypercholesterolemia (698 U/L; reference range, 92 to 324 U/L); and high ALP (4,740 U/L), γ-glutamyltransferase (GGT; 80 U/L; reference range, 1 to 12 U/L), alanine aminotransferase (ALT; 230 U/L; reference range, 12 to 118 U/L), and aspartate aminotransferase (AST; 106 U/L; reference range, 15 to 66 U/L) activities. The ultrasonographic appearance of the pancreas was unchanged. Gallbladder volume was estimated at 20 mL by use of volume-analysis software.

The common bile duct could not be imaged.

At this time, extrahepatic biliary tract obstruction (EHBO) was suspected on the basis of the biochemical abnormalities, even though results of ultrasonographic examination were inconclusive. In an attempt to reduce the dog's discomfort and delay surgical intervention, percutaneous ultrasound-guided cholecystocentesis (PUCC) was performed. The dog was anesthetized with propofol (5 mg/kg [2.3 mg/lb], IV), and the ventral aspect of the abdomen caudal to the xiphoid process was surgically prepared. With ultrasound guidance, a 22-gauge, 1.5-inch needle was inserted into the gallbladder by means of the right ventral fundic technique. The needle was attached to two 12-mL syringes via an IV extension set and 3-way stopcock, and bile was aspirated until substantial collapse of the gallbladder wall was seen ultrasonographically. A total of 24 mL (2 mL/kg [0.9 mL/lb]) of thick, black-green bile was obtained.

Following cholecystocentesis, the dog was bright and alert and had a fair appetite and minimal signs of abdominal pain. Two days after PUCC, the serum bilirubin concentration was decreased (4.7 mg/dL), although serum ALP (5,620 U/L), GGT (108 U/L), ALT (350 U/L), and AST (100 U/L) activities and serum cholesterol concentration (755 U/L) were increased or unchanged. The dog was discharged with instructions to feed a low-fat diet exclusively.

Five days after PUCC, the owner reported lethargy of 1 day's duration. On physical examination, the mass in the right cranial portion of the abdomen was still palpable, but no signs of abdominal pain were seen.

From VCA Veterinary Referral Associates, 15021 Dufief Mill Rd, Gahersburg, MD 20878. Dr. Herman's present address is Animal Critical Care and Emergency Services, 11536 Lake City Way NE, Seattle, WA 98125.

Address correspondence to Dr. Herman.

Unauthenticated | Downloaded 09/23/23 11:37 PM UTC
The serum bilirubin concentration (7.2 mg/dL) had again increased, along with serum ALP (6,080 U/L), GGT (122 U/L), ALT (766 U/L), and AST (151 U/L) activities. Hypercholesterolemia (552 U/L) persisted. Ultrasonographic examination revealed moderate distension of the gallbladder (estimated volume, 28 mL) and common bile duct (diameter, 0.5 cm). The dog was anesthetized with propofol, and PUCC was repeated. Thirty milliliters (2.5 mL/kg [1.1 mL/lb]) of thick black-green bile was obtained.

Six days after the second PUCC procedure, the owner reported that the dog's appetite and activity were normal. Serum bilirubin concentration (3.8 mg/dL) had again decreased, although serum activities of ALP (5,960 U/L), GGT (100 U/L), ALT (1,040 U/L), and AST (133 U/L) and serum cholesterol concentration (610 U/L) were largely unchanged. Ultrasonographic examination revealed moderate distension of the gallbladder (estimated volume, 25 mL), and the common bile duct was markedly distended (0.8 cm in diameter at its widest point) and tortuous. The ultrasonographic appearance of the pancreas appeared unchanged, but the peripancreatic tissue was substantially less hyperechoic. A third PUCC procedure was performed, and 18 mL (1.5 mL/kg [0.7 mL/lb]) of dark green bile was obtained. The bile appeared to be less viscous, compared with previous aspirates.

Six days after the third PUCC procedure, icterus was no longer evident. Serum bilirubin concentration (0.9 mg/dL) was substantially decreased, and serum ALP (3,350 U/L), GGT (41 U/L), ALT (462 U/L), and AST (31 U/L) activities had improved. Serum cholesterol concentration (301 U/L) was within reference range.

Twenty-one days after the third PUCC procedure, serum bilirubin concentration (0.3 mg/dL), cholesterol (114 U/L), GGT (9 U/L), and ALT (65 U/L) activities were within reference limits. Eighty-four days after the third PUCC procedure, results of serum biochemical analyses were within reference limits, except for a slightly high serum ALP activity (136 U/L).

A 4-year-old 11-kg (24-lb) castrated male mixed-breed dog was examined because of vomiting of acute onset. Frequent vomiting persisted after 4 days of medical treatment for presumed pancreatitis, and the dog was referred to the Veterinary Referral Associates.

On initial physical examination, moderate dehydration was evident, together with evidence of moderate pain involving the cranial portion of the abdomen. Hematologic abnormalities included leukocytosis (20,000 WBCs/µL; reference range, 4,000 to 15,500 WBCs/µL) and mature neutrophilia (13,860 neutrophils/µL). Serum biochemical abnormalities included mild hyperbilirubinemia (1.0 mg/dL) and moderately increased serum ALP (1,850 U/L), ALT (82 U/L), and AST (209 U/L) activities. Abdominal ultrasonography revealed a thickened hypechoic pancreas with hyperechoic peripancreatic mesentery and a small volume of slightly echogenic peritoneal effusion. Findings were consistent with pancreatitis. The left lobe of the pancreas contained a cavitated region (0.9 × 1.4 cm). Differential diagnoses for this cavitated appearance included pancreatic abscess, pseudocyst, necrosis, and neoplasia. The common bile duct was not imaged.

Initial treatment included IV fluid therapy with a balanced electrolyte solution, a transfusion of fresh-frozen plasma, antimicrobials, heparin, analgesics, and antiemetics. Total parenteral nutrition was added on the second day of hospitalization.

Two days after initial examination, a celiotomy was performed because of ongoing concerns of pancreatic necrosis or abscess. Extensive adhesions identified in the cranial portion of the abdomen were bluntly dissected. The previously identified region in the left limb of the pancreas appeared on gross examination to be necrotic. The common bile duct was unremarkable in appearance, and the gallbladder was readily expressed. The dog recovered from anesthesia without complications.

Four days after surgery, the dog was improved clinically. However, serum bilirubin concentration (4.7 mg/dL); serum cholesterol concentration (407 U/L); and serum ALP (1,280 U/L), GGT (38 U/L), and ALT (386 U/L) activities had increased. Differential diagnoses considered at this time included EHBO, worsening of the pancreatitis, cholecystitis, and inflammatory or bacterial hepatitis.

Seven days after surgery, serum bilirubin concentration (8.3 mg/dL); cholesterol concentration (788 U/L); and ALP (3,650 U/L), GGT (93 U/L), and ALT (788 U/L) activities had further increased. Ultrasonographic examination revealed marked distension of the gallbladder (estimated volume, 45 mL) and common bile duct (diameter, 0.3 cm). The biochemical and ultrasonographic abnormalities were consistent with a diagnosis of EHBO.

The dog was sedated with diazepam (0.5 mg/kg [0.23 mg/lb], IV) and propofol (6 mg/kg [2.7 mg/lb], IV), and PUCC was performed with an 18-gauge, 2-inch, over-the-needle catheter. Forty milliliters (3.6 mL/kg [1.6 mL/lb]) of bile was aspirated. Bacterial culture of a sample of the bile did not yield any growth.

Two days after the PUCC procedure, serum bilirubin concentration (2.8 mg/dL) was substantially decreased. The dog steadily improved clinically and was discharged 3 days after undergoing PUCC. The dog was clinically normal during follow-up examinations 6, 13, and 112 days after the PUCC procedure. During the final follow-up examination, serum bilirubin concentration (0.2 mg/dL); serum GGT (8 U/L), ALT (101 U/L), and AST (28 U/L) activities; and serum cholesterol concentration (184 U/L) were within reference ranges. Serum ALP activity (435 U/L) was slightly high.

A 7-year-old 10-kg (22-lb) castrated male Miniature Pinscher was referred to the Veterinary Referral Associates for evaluation of icterus, vomiting, and inappetence. The dog had been examined by the referring veterinarian 7 days earlier, and high serum ALP activity (576 U/L) and severe hyperglycemia (686 mg/dL; reference range, 70 to 138 mg/dL) were identified. A urinalysis revealed marked ketonuria and glucosuria. A diagnosis of diabetic ketoacidosis had been made, and the dog was treated with fluids IV, antimicrobials, and insulin SC. The ketonuria resolved, and the dog was discharged after 3 days; NPH insulin’ (1.0 U/kg [0.45 U/lb], SC, q 12 h) was prescribed.

Four days after discharge from the referring veterinary hospital, the dog was examined at the referral cen-
ter because of vomiting and icterus. Initial physical examination findings included dehydration, icterus, signs of abdominal pain, and a palpable mass in the right cranial portion of the abdomen. Results of a CBC were unremarkable. Serum biochemical abnormalities included persistent hyperglycemia; severe hyperbilirubinemia (13 mg/dL); hypercholesterolemia (371 U/L); and high serum ALP (10,780 U/L), GGT (290 U/L), ALT (1,650 U/L), and AST (301 U/L) activities. Serum ketone concentration was less than the lower limit of detection. On abdominal ultrasonography, the hepatic parenchyma was hypechoic, the gallbladder was moderately distended (estimated volume, 40 mL), and the cystic and common (diameter, 1 cm) bile ducts were distended. The right pancreatic lobe was hypechoic, and the peripancreatic mesentery was hypechoic.

Severe pancreatitis with secondary EHBO and nonketotic diabetic hyperglycemia were diagnosed. Treatment included IV administration of a balanced electrolyte solution, continuous IV infusion of regular insulin, and total parenteral nutrition.

On the second day of hospitalization, the dog was sedated with butorphanol (0.25 mg/kg [0.11 mg/lb], IV), diazepam (0.4 mg/kg [0.18 mg/lb], IV), and propofol (4 mg/kg [1.8 mg/lb], IV) and PUCC was performed. Twenty milliliters (2 mL/kg) of viscous bile was obtained. Because residual volume of the gallbladder was high and the bile that was aspirated was so viscous, 10 mL of sterile saline (0.9% NaCl) solution was infused into the gallbladder. However, sedation was inadequate to allow reaspiration of the fluid, and the needle was removed. Additional sedation was provided, and PUCC was repeated; an additional 15 mL (1.5 mL/kg) of bile was obtained. No free abdominal fluid was noticed ultrasonographically during or immediately after the second PUCC procedure.

One day following the PUCC procedure, severity of icterus and signs of abdominal pain were decreased, along with serum bilirubin concentration (3.8 mg/dL). Abdominal ultrasonography 2 days after the PUCC procedure revealed an improvement in the appearance of the pancreas and peripancreatic mesentery. A small volume of abdominal effusion was identified. Differential diagnoses for the abdominal effusion included bile peritonitis secondary to PUCC, sterile peritonitis secondary to pancreatitis, and septic peritonitis. Abdominocentesis yielded a modified transudate. Results of cytologic examination of the transudate were mild, active, sterile peritonitis. No bile pigment was evident.

The following day, serum bilirubin concentration (7.3 mg/dL) had again increased and serum ALP (7,400 U/L), ALT (1,000 U/L), and AST (122 U/L) activities had decreased only slightly. Because of concerns regarding the recent development of abdominal effusion despite evidence of improvement in the pancreatitis, exploratory celiotomy was performed.

During surgery, bile staining of the cranial portion of the mesenteric fat was noticed, but no defects could be identified in the gallbladder wall. An enterotomy was performed, and the common bile duct was catheterized. The gallbladder was then lavaged until adequate bile flow was established. The left and right pancreatic lobes were grossly normal, but a 3-cm-long segment in the body of the pancreas was firm.

Two days after surgery, serum bilirubin concentration (2.3 mg/dL) and serum ALP (4,650 U/L), GGT (50 U/L), ALT (391 U/L), and AST (35 U/L) activities had decreased. Serum cholesterol concentration (229 U/L) was within reference range. Four days after surgery, the dog was offered a low-fat diet. Because of continued improvement in serum bilirubin concentration and serum hepatic enzyme concentrations, the dog was discharged 6 days after surgery. During a recheck examination 180 days after surgery, serum bilirubin concentration (0.1 mg/dL) and serum GGT (10 U/L), ALT (84 U/L), and AST (34 U/L) activities were within reference limits. Serum ALP activity (412 U/L) remained slightly high.

In dogs with severe pancreatitis, development of EHBO can pose a therapeutic dilemma because persistent biliary obstruction can result in abdominal pain, bacterial infection, progressive hepatobiliary injury, and, potentially, gallbladder rupture. In most dogs with EHBO secondary to pancreatitis complicates the decision to pursue surgical options, as surgery may exacerbate the pancreatitis and pose additional risks. In people with obstructive jaundice, for instance, perioperative morbidity and mortality rates increase with the magnitude and duration of hyperbilirubinemia.

Preoperative gallbladder decompression has been shown to reduce morbidity and mortality rates associated with biliary surgery in human patients with EHBO, although it is not clear whether the benefits of preoperative decompression are a result of the decompression itself or the delay in surgery, which allows for additional supportive care and medical treatment.

Similarly, findings for the 3 dogs described in the present report suggest that gallbladder decompression may be beneficial in some dogs with EHBO secondary to pancreatitis in which the obstruction does not resolve spontaneously. The diagnostic use of PUCC for collection of bile samples for analysis or bacterial culture has previously been shown to be a safe procedure in dogs.

Two methods for PUCC in animals have been described (a transhepatic approach in the dog, cat, pig, and cow and a ventral fundic approach in cats). The ventral fundic approach, which was used in the dogs described in the present report, uses a ventral transducer location that allows imaging of the gallbladder through the falciform fat. With the transhepatic method for PUCC, the needle passes through a small portion of the liver before entering the gallbladder.

Previous descriptions of PUCC in dogs have reported use of a 22-gauge needle, although use of an 18-gauge needle reportedly did not cause complication in...
In 2 of the dogs described in the present report, a 22-gauge needle was used, and in the third, an 18-gauge catheter was used. In our experience, the viscosity of the bile in dogs with EHBO is difficult. Use of a larger-gauge needle or catheter may facilitate aspiration of viscous bile and increase the rate of aspiration but may increase the risk of subsequent bile leakage. Use of a catheter instead of a needle may theoretically decrease the risk of gallbladder damage. Further investigation of the use of larger-gauge catheters for PUCC is warranted.

Reported complications of PUCC in humans include intraperitoneal bile leakage, hemorrhage, hemobilia, vasovagal reaction, and bacteremia. In people, however, cholecystectomy is often accompanied by other procedures, such as cholecystangiography and cholecystostomy, that may influence the occurrence of complications. To our knowledge, no complications associated with simple PUCC in dogs have been reported, although frequent complications have been reported with catheter placement and contrast studies. In a recent study of PUCC in 12 cats, 1 cat had scant fluid near the gallbladder following PUCC done through a transhepatic approach, but no abnormalities were seen during postmortem examination 7 days later. In the remaining 11 cats, PUCC was performed by means of the ventral fundic approach without complications.

Bile leakage was seen following PUCC in one of the dogs described in the present report. In this dog, however, there was movement of the patient during the procedure, multiple punctures were performed, and saline solution was infused in conjunction with PUCC. In the remaining 2 dogs, follow-up ultrasonographic evaluation did not reveal any evidence of bile leakage. However, the PUCC site was not grossly evaluated, so mild localized bile leakage may have been undetected.

Whether surgical correction is required in dogs with EHBO secondary to pancreatitis and, if so, the appropriate timing for surgery, remain controversial. Surgical intervention has been recommended for dogs with EHBO and chronic pancreatitis and for dogs with pancreatic masses following acute pancreatitis. Although EHBO could potentially cause complications in dogs with acute pancreatitis, there are numerous reasons to avoid or postpone surgery in these patients. In particular, in most dogs with EHBO secondary to pancreatitis, the obstruction resolves spontaneously as the acute pancreatitis improves so that surgery is not required. On the other hand, in those few dogs in which EHBO does not resolve or in which EHBO results in complications, therapeutic PUCC may be useful in relieving gallbladder distension so that surgery can be avoided or postponed until the patient’s condition is more stable.

Percutaneous cholecystostomy catheter placement for continual bile drainage has been described in humans. In contrast, in a report of attempted ultrasound-guided cholecystostomy in 5 dogs, placement of indwelling biliary catheters was unsuccessful. In 1 dog described in the present report, PUCC was performed multiple times. Conceivably, this dog would have been a candidate for a percutaneous cholecystostomy catheter placement if an effective technique for use in dogs had been available.

The small number of dogs described in the present report prevents us from drawing conclusions about any potential benefits of therapeutic PUCC in dogs with EHBO secondary to acute pancreatitis. In all 3 dogs, serum bilirubin concentration decreased substantially following the procedure, and 2 of the 3 dogs did not require surgery. However, because surgery is not required in most dogs with EHBO secondary to acute pancreatitis, whether PUCC had any effect on overall outcome cannot be determined. Nevertheless, we believe that these 3 dogs were improved clinically following PUCC. Thus, findings in these dogs suggest that further study is warranted regarding what role PUCC might have in the management of dogs with EHBO secondary to acute pancreatitis.

References

**Selected abstract for JAVMA readers from the American Journal of Veterinary Research**

Application of a scaling model to establish and validate an interval level pain scale for assessment of acute pain in dogs
Carolyn M. Morton et al

**Objective**—To establish interval level measurement in a prototype composite measure pain scale (CMPS) for assessment of acute pain in dogs and to investigate the scale’s validity.

**Animals**—20 clinically normal dogs, 20 dogs with medical conditions, and 117 dogs undergoing surgery.

**Procedure**—First, a scaling model was applied to the CMPS descriptors to establish weights for each and create a continuous scale. Subsequently, 5 observers independently used the scale to score signs of pain in 4 groups of dogs (control dogs, dogs with medical conditions, and 40 dogs undergoing soft tissue or orthopedic surgery). Scores from each group and from groups of conditions perceived to cause no, mild, moderate, and severe pain were compared. In addition, the scale was applied to 77 dogs undergoing orthopedic or soft tissue surgery and scores were compared with simultaneously derived numeric rating scale (NRS) scores; comparisons were made between surgical groups and with time after surgery.

**Results**—Calculated scale descriptor weights ranged from –2.0 to 2.0 and were transformed to create a continuous scale from 0 to 10. Median CMPS scores differed significantly among the 4 study groups and among pain severity groups and were typically greater with increasing perceived pain severity. Agreement was determined between CMPS and NRS scores, and there was a significant and expected time effect and difference between the CMPS scores of dogs undergoing orthopedic and soft tissue surgery.

**Conclusions and Clinical Relevance**—Results indicate that this interval level measurement scale is a valid measure of acute pain in dogs. (*Am J Vet Res* 2005;66:2154–2166)