Extrahepatic biliary tract obstruction (EHBO) is a common problem in dogs. Causes can be divided into extraluminal (e.g., pancreatitis, adjacent neoplasia), intraluminal (e.g., cholelithiasis, inspissated bile), and intramural (e.g., cholangitis, mucinous gallbladder, neoplasia) obstructions.1 EHBO due to pancreatitis is a well-recognized and serious complication in dogs, with variable recommendations made for either medical stabilization or surgical decompression.2–8 Obstructive jaundice has potentially multiple harmful effects both locally, with increased risk of bacterial cholangitis and hepatic injury, and systemically, secondary to the impact of endotoxemia on the cardiovascular, pulmonary, and coagulation systems; gastrointestinal integrity; and renal function.10–12

Surgical decompression of EHBO has historically been associated with increased mortality risk, with the largest case series showing a mortality rate of 28%5 and 53%7 for dogs undergoing extrahepatic biliary tract surgery irrespective of cause. A recent publication8 also suggested that some dogs do not require surgical decompression, with 79% of dogs surviving with medical management of EHBO due to pancreatitis.

Treatment of EHBO in people varies according to cause and includes endoscopic retrograde cholangiopancreatography, endoscopic stent placement, and sphincterotomy,13–16 many of which are not readily available in veterinary medicine.6,17–20 The authors’ observations have been that while some dogs only require medical monitoring with EHBO due to pancreatitis, there is a subset that require surgical decompression and that this subset improves quickly postoperatively with few complications. With this in mind, the primary objective of this study was to...
describe the morbidity and mortality of dogs with EHBO due to pancreatitis treated medically or by surgical decompression. Additional objectives were to assess for markers, including the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) that may help with prognostication.

Methods

Medical records of dogs treated for extrahepatic biliary obstruction due to pancreatitis at the Animal Referral Hospitals (Brisbane, Sydney, and Canberra) between January 2015 and December 2021 were evaluated retrospectively. Search terms used to identify cases included pancreatitis, extrahepatic bile duct obstruction, extrahepatic biliary obstruction, EHBO, EHBD, cholecystoduodenostomy, cholecystojejunostomy, cholecystoenterostomy, biliary stent, bile duct stent, and choledochal stent. To be included, dogs had to have relevant clinical signs, expected clinicopathologic abnormalities, pancreatic changes on imaging consistent with pancreatitis, and common bile duct distention. The diagnosis of pancreatitis was based on a combination of appropriate clinical signs such as hyporexia, vomiting, lethargy, abdominal pain, pyrexia, and jaundice; laboratory findings including a hepatopathy, elevated ALT, and ALP; and ultrasonographic findings such as an enlarged, hypo- or hyperchoic pancreas, poor pancreatic margination, hyperchoic adjacent mesentery, and local effusion. Serum snap or specific canine pancreatic lipase (cPL) or 1,2-o-dilauryl-rac-glycero glutaric acid-(6′-methylresorufin) ester (DGGR) lipase assay results were documented, but an abnormal result wasn’t mandatory for a diagnosis of pancreatitis. The diagnosis of EHBO was based on hyperbilirubinemia and common bile duct dilation (> 3 mm) detected sonographically, by CT scan or surgically. Patients were excluded if they had other causes of EHBO, such as neoplasia, cholelithiasis, foreign body, or gallbladder mucocele. The minimum required follow-up was survival to discharge, euthanasia, or death.

Data extracted from the medical records included age, sex, breed, clinical signs at presentation, concurrent disease, results of clinicopathologic testing, and imaging findings. PLR and NLR were calculated using the first hematology profile obtained after presentation. The patients were assessed for systemic inflammatory response syndrome (SIRS) at initial presentation, with SIRS defined as ≥ 2 of the following criteria: heart rate > 120 beats/min, respiratory rate > 20 breaths/min, temperature < 38 °C or > 39.2 °C, WBC < 6 X 10^9/L or > 16 X 10^9/L, or > 3% bands. The maximum total bilirubin (TBIL) and ALT were documented, and the time from maximum TBIL until 25% reduction was assessed.

The length of medical management was defined as either the number of days of medical management prior to surgery for those surgically treated or the number of days of medical management until discharge for those medically treated, including any days of medical management prior to referral. The surgical findings and procedures performed, presence of intra- or postoperative complications, and microbiology and histopathology results were documented.

Recovery was assessed by documenting the time to return to adequate function, which was defined as resolution or marked improvement in clinical signs, with patients being managed at home; approximating their preillness quality of life, possibly still receiving medication; and being counted from the first documented clinical signs and from the time of surgery. Short- and long-term survival (defined as 2 months and 1 year, respectively) were assessed. Patients were classified as nonsurvivors if they were documented to have died due to EHBO. The 2-month and 1-year survival included mortalities of any cause. The type of medical treatment, including blood product administration, was documented.

Minor complications were defined as those not requiring additional medical or surgical treatments to resolve, whereas major complications were defined as those requiring additional treatment to resolve. Survival times and cause of death were determined by information in medical records or through communication with referring veterinarians or clients.

Statistical analysis

For continuous variables, descriptive statistics were summarized using means, SDs, and medians. Categorical variables were summarized as frequencies and percentages. Analyses were conducted comparing 2 treatment groups as well as survivors versus nonsurvivors. Initial exploratory analyses showed that many of the quantitative variables used in the analyses had skewed distributions. Due to this and the relatively small sample sizes (mostly under 30 patients), a nonparametric approach for these comparisons was adopted (medians test - χ² and P value quoted). Categorical variables were compared using a χ² test, and when cell sizes were < 5, Fisher exact tests were used. Time-to-event analyses were summarized using Kaplan-Meier charts and tested using log rank tests. All analyses were conducted using Stata (version 17; Stata Corp LLC). In accordance with the scientific standard, results that yielded as P < .05 were considered statistically significant.

Results

Forty-one cases met the inclusion criteria, including 19 dogs treated surgically and 22 treated medically. There were 3 Labrador Retrievers, 3 Cocker Spaniels, 3 Border Collies, 2 Jack Russell Terriers, 2 Siberian Huskies, 2 Cavalier King Charles Spaniels, 2 Bull Terriers, 2 Poodles, 1 Pug, 1 Great Dane, 1 Pomeranian, 1 Curly Coated Retriever, 1 Whippet, 1 Fox Terrier, 1 Miniature Schnauzer, 1 Dalmatian, 1 Basenji, 1 Rhodesian Ridgeback, 1 Australian Bulldog, 1 Shih Tzu, and 10 mixed breeds. The median age was 8 years (range, 3 to 13 years) and 9 years (range, 1 to 16 years) for surgically treated and medically treated patients, respectively. There were 25 males (23 neutered) and 16 females (15 spayed).

The most common presenting clinical signs were hyporexia (n = 41), vomiting (41), lethargy (39),
abdominal pain (32), jaundice (25), and pyrexia (15). Less common were diarrhea (n = 7) and regurgitation (2). Eight dogs had concurrent disease, including diabetes (n = 2), epilepsy (2), cardiac disease (2), hyperadrenocorticism (1), adrenal tumor (1), and aspiration pneumonia (2).

Twenty-two of 29 (75%) dogs had abnormal snap cPLI, spec cPLI, or DGGR lipase, supporting a diagnosis of pancreatitis. Twenty-six dogs had coagulation testing using prothrombin time (PT) and activated partial thromboplastin time (aPTT) and 3 were abnormal, with 2 dogs having significant prolongation of both PT and aPTT and 1 dog having normal PT but significantly prolonged aPTT.

All dogs had an abnormal pancreas on imaging, most commonly on ultrasound (n = 39), 1 on CT scan and ultrasound and 1 on CT scan alone. Ultrasound findings reported included a pancreas that was enlarged (n = 30), hypoechogenic (28), hyperechogenic (3), had hyperechogenic foci (4), mixed echogenicity (2), unclear margins (6), hyperechogenic adjacent mesentery (26), local lymphadenomegaly (4), local effusion (6), gastroduodenopathy (8), pancreatic mass (4), distended gallbladder (15), dilated intrahepatic ducts (1), and common bile duct distention (36). Twenty-two of 22 (100%) medically treated dogs had a common bile duct diameter > 3 mm. Fourteen of 19 (74%) surgically treated patients had a common bile duct > 3 mm, and 1 had hepatic duct dilatation documented sono graphically. This patient and the remaining 4 dogs had common bile duct distention identified surgically.

There was no difference in the common bile duct diameter between the medical (mean, 7.2 mm; range, 3.4 to 11 mm) or surgical (mean, 7.1 mm; range, 3.4 to 19 mm) groups or between survivors (mean, 7 mm; range, 3.4 to 19 mm) and nonsurvivors (mean, 7.7 mm; range, 4.7 to 11 mm).

All patients had hepatic enzyme elevations on biochemical analyses, and there was no significant difference in the maximum TBIL between those medically treated (mean, 155.9 umol/L; range, 28 to 366 umol/L) and those surgically treated (mean, 180 umol/L; range, 70 to 288 umol/L) or between survivors (mean, 166 umol/L; range, 28 to 288 umol/L) and nonsurvivors (mean, 170 umol/L; range, 63 to 366 umol/L). Similarly, there was no significant difference in maximum ALT between the medically treated (mean, 1,947.5 U/L; range, 50 to 5,540 U/L) and surgically treated (mean, 1,847.6 U/L; range, 235 to 4,375 U/L) groups or between survivors (mean, 1,868 U/L; range, 50 to 4,989 U/L) and nonsurvivors (mean, 2,027 U/L; range, 132 to 5,540 U/L).

NLR was not significantly different between the medically treated (mean, 9.67; range, 0.97 to 31.48) and surgically treated (mean, 7.88; range, 0.45 to 18.63) groups or between survivors (mean, 8.3; range, 0.45 to 31.38) and nonsurvivors (mean, 10.69; range, 2.1 to 22.7). There was no significant difference in the PLR between the medically treated (mean, 293.7; range, 10.5 to 939) and surgically treated (mean, 245.07; range, 27.9 to 400) groups or between survivors (mean, 257.39; range, 10.5 to 1,069) and nonsurvivors (mean, 322.07; range, 93.3 to 524).

Medical management entailed antimicrobial therapy in 37 cases, with a combination of antimicrobials used in most cases (n = 31). All patients received fluids IV, antiemetics (maropitant, ondansetron, and/or metoclopramide), proton pump inhibitors (esomeprazole and omeprazole), and analgesia (various opioids, lignocaine, and ketamine). Other treatments included liver protectants (s-adenosylmethionine and silybin [n = 8]), s-adenosylmethionine and silybin and ursodeoxycholic acid [4], ursodeoxycholic acid [4], corticosteroids [5], and blood product administration [whole blood transfusion; 1].

Fifteen dogs had cholecystoenterostomies, including 12 cholecystoduodenostomies and 3 cholecystojejunostomies. Three had exploratory surgery, 1 had a pancreatic abscess drained, a small defect in the duodenum sutured, and the common bile duct catheterized and flushed; 1 was exploratory, and the decision was made to euthanize on the basis of severity of findings; 1 had the common bile duct flushed and pancreatic mass biopsied. Only 1 dog had a choledochal stent placed. The median cholecystoenterostomy stoma size was 3 cm, with a range of 1.2 to 5 cm.

All surgical patients had visual confirmation of pancreatitis causing EHBO. The common surgical findings reported were an abnormal pancreas (n = 16), distended biliary tract (12) or gallbladder (10), pancreatic mass (8), adhesions (5), pancreatic abscess (1), and purulent pancreatic exudate (3). Pancreatic biopsies were attempted in 10 patients; 7 had chronic pancreatitis, 1 had acute pancreatitis, and 2 had absent pancreatic tissue, with one showing steatitis and the other reactive lymph node. Nine dogs had liver biopsies, and the most common histologic finding was cholangiohepatitis with cholestasis (n = 8), followed by cholestasis with mild chronic hepatitis (1). Thirteen dogs had cultures obtained (9 bile, 3 bile and liver, and 1 pancreatic abscess), 2 of which had a positive bacterial culture. One bile sample cultured a single organism (Enterococcus casseliflavus), and another bile sample cultured 3 organisms (Escherichia coli, Enterococcus, and Clostridium perfringens).

There was no significant difference in the time from maximum TBIL to 25% reduction between the medically treated (median, 2 days; range, 1 to 11 days) and surgically treated (median, 1 day; range, 1 to 10 days) groups. There was no difference in the number of patients meeting SIRS criteria between the medically treated (17/20 [85%]) and surgically treated (11/15 [73%]) groups or between survivors (20/22 [74%]) and nonsurvivors (7/8 [87%]).

The time to return to adequate function was similar between the medical (mean, 16.3 days; 95% CI, 11.3 to 21.3 days) and surgical groups (mean, 19.9 days; 95% CI, 16.9 to 23 days; Figure 1). There was no difference in the length of medical management between the medically treated (mean, 10.8 days; 95% CI, 7.6 to 14.1 days) and surgically treated (mean, 10.1 days; 95% CI, 6.1 to 14.1 days) groups or the length of hospitalization between those treated medically (mean, 5.2 days; 95% CI, 3.6 to 6.9 days) and those treated surgically (mean, 5.6 days; 95% CI, 4.6 to 6.7 days; Figure 2).
The median follow-up was 26 months (range, 4 to 80 months) for surgically treated dogs and 23 months (range, 1 to 75 months) for medically treated dogs. Eighteen of 19 (94.7%) surgical patients survived to discharge, 18 were alive at 2 months, and 15 were alive at 12 months. Twenty of 22 (90.9%) medical patients survived to discharge, 12 were alive at 2 months, and 11 were alive at 12 months.

The proportion of patients alive in the surgical versus medical treatment groups at 2 and 12 months was significantly different \( (P = .009) \) and \( P = .046 \), respectively. Two dogs in the medical group were euthanized in hospital, one due to disseminated intravascular coagulation and multiple organ dysfunction and the other due to worsening hyperbilirubinemia, suspect disseminated intravascular coagulation and gastrointestinal hemorrhage, and anemia. One dog was discharged and reported to be improving at 2 rechecks with resolution of hyperbilirubinemia at the second recheck, then was lost to follow-up before 2 months. One dog survived to discharge, was reported to be recovered at 40 days postadmission, then was euthanized 2 months postadmission for unknown reasons. One dog survived to discharge, was reported to have recovered, and then presented dead on arrival 3.5 months later. Five dogs were discharged and then euthanized due to EHBO, with persistent or worsening hyperbilirubinemia and persistent clinical signs such as hyporexia, lethargy, abdominal pain, and weight loss, 2 at 3 days postdischarge and 1 each at 11, 17, 22, and 49 days. One dog died due to congestive heart failure 14 months later, and 1 was euthanized for unknown reasons 25 months later. Four of 18 surgical patients had major complications, with 3 developing a cholestatic hepatopathy 1, 2, and 4 times that resolved with antimicrobials; 1 had regurgitation due to esophagitis postoperatively; and one of the dogs that developed a cholestatic hepatopathy also had postoperative hemorrhage that did not require a blood transfusion.

The mean survival time of dogs treated surgically was 49.2 months (95% CI, 33.5 to 64.9 months), and the mean survival of those treated medically was 33 months (95% CI, 17.4 to 48.6 months). There was no statistical difference \( (P = .09) \) in long-term survival between the treatment groups (Figure 3).

The optimal treatment for pancreatitis-associated biliary obstruction in animals is controversial, as it has been in humans. Biliary obstruction secondary to pancreatitis may be transient and surgical intervention not indicated in these patients. Surgical treatment may be inherently risky in a compromised patient, and there may be long-term complications associated with certain procedures, such as biliary rerouting and biliary stenting.3,12,25 Some of these

**Discussion**

This study of 41 dogs with pancreatitis and EHBO reported a higher survival rate of 94% for those treated surgically \( (n = 19) \) compared to prior studies focusing on surgical management of pancreatitis and EHBO.3–5,7,24,25 We also reported a lower survival rate of 57% for those treated medically, compared to 2 recent studies in which survival of those treated medically was 78%8 and 94%.26
issues have been overcome in human medicine with
the advent of more advanced diagnostics and less
invasive endoscopic and laparoscopic interventions;
however, controversy remains over the timing of
such interventions and the benefit of biliary decom-
presion prior to more definitive surgical therapy. 15,27

Of 82 dogs with pancreatitis-associated biliary
obstruction, across 10 studies, treated surgically by
multiple modalities including cholecystoenterostomy,
choledochal stent, cholecystostomy tube, percuta-
naneous ultrasound-guided cholecystocentesis, and
exploratory laparotomy with pancreatectomy, pan-
creatic abscess debridement, and common bile
duct flushing, 53 (65%) dogs survived, with individu-
al report mortality rates ranging from 13% to 75%. 3,5-
8,24,25,28,29 In this report, of 19 dogs undergoing sur-
genous hepatic biliary obstruction secondary
to pancreatitis, 18 (95%) survived to discharge.
All 15 dogs treated by cholecystoenterostomy survived.
The 1 nonsurvivor was euthanized intraoperatively
due to severe pancreatitis, biliary obstruction, and
a necrotic gallbladder that precluded biliary diversion.
These 18 patients were still alive at 2 months. At 1
year, 15 of 18 were still alive, with the 3 deaths being
due to hepatobiliary disease.

Of those treated medically, 20 of 22 (91%) sur-
vived to discharge; however, only 12 of 21 (57%) were
alive at 2 months, with 6 being euthanized due to
EHBO, up to 7 weeks post discharge. This result is very
different from that of a recent study, in which 31 of 33
(94%) of medically managed dogs with pancreatitis-
associated biliary obstruction survived to discharge. 3
Follow-up was more limited in this study, although 1
patient was mentioned to have returned for pancre-
atitis-associated biliary obstruction twice in the next
year, responding to medical management, and 5 dogs
were reported to live for years post discharge. Only 4
dogs in that study were treated with biliary decom-
presion, 1 by cholecystoenterostomy and 3 by percu-
naneous ultrasound-guided cholecystocentesis, and
50% died. 28 In another recent study 28 of 45 dogs with
pancreatitis and EHBO, a higher percentage of pa-

tients treated surgically (87%) survived to discharge,
compared to those treated medically (70%); however,
of those surviving to discharge, the median survival
time was not significantly different between treat-
ment groups. Comparison between the medical man-
gement provided in these 2 studies with the current
study is difficult, with no study having standardized

treatments, although treatments appear similar, con-
sisting of crystalloid fluids, antimicrobials, analgesics,
antiemetics, and gastroprotekants. 3,8,26

Overall survival, which was survival to discharge,
in the above-mentioned studies was 76% and 79%, 8,26
while survival to discharge was 93% and 73% at 2 months
in this study. The proportion of dogs treated medically
surviving to 2 months was 57%. Survival to discharge
was not considered an appropriate indicator of survival
in the current study, as several dogs were discharged
only to be euthanized soon after. Two months was se-
lected for the short-term follow-up because it may be
several weeks before patients succumb to their condi-
tion or a postoperative complication. 5 The choice for
treatment or decision to euthanize may be heavily im-
pacted by owner finances, which would in turn impact
survival data.

The grading of severity of pancreatitis in humans
is based on presence of organ failure and local com-
plications such as peripancreatic fluid accumulations
and pancreatic necrosis. The severity grade correlates
with risk of mortality and indicates which patients
should be transferred to an ICU or tertiary center. 30,31
There is no equivalent classification scheme or scor-
ing system in animals; however, a variety have been
proposed. 32–34 Further research is needed to validate
the usefulness of such scoring systems in predicting
outcome in dogs and cats with pancreatitis.

Appearance of the pancreas at surgery can be
deceptive, with 8 dogs in this study described as
having a pancreatic mass at surgery, which was
shown histologically to be inflammatory and not
neoplastic. Of the pancreatic biopsies attempted in
this study, 7 showed chronic pancreatitis, 1 acute
pancreatitis, and the other 2 contained fat or lymph
node. A study 28 in which 15 dogs underwent surgery
for pancreatitis and biliary duct obstruction reported
3 pancreatic biopsies, 1 of which was chronic pan-
creatitis and 2 with no significant lesion. In another
report 2 of 7 dogs with chronic pancreatitis, all dogs
had pancreatic masses identified at surgery and 6
had pancreatic biopsies, confirming pancreatitis and
not neoplasia as suspected in all.

Biliary stasis is a reported risk for biliary infec-
tion, 11 but of the 16 cultures obtained in this study,
only 2 were positive. In a study 28 of 34 dogs under-
going biliary surgery, 4 of which had pancreatitis and
EHBO, 24 dogs had bacterial cultures of bile, abdom-
inal fluid, or liver, resulting in a positive culture in
33%. In another study 28 of 60 dogs undergoing biliary
surgery (12 with EHBO secondary to pancreatitis),
27 of 54 (50%) cultures were positive.

The low positive bacterial cultures in our cases
may have been due to antimicrobial treatment prior
to sample collection but could also be due to sample
collection technique. A recent study 35 of cats with
supportive cholangiohepatitis found improved bac-
terial detection with consolidation of samples for
culture including samples of biliary debris, cen-
trifuged bile sediment, gallbladder mucosal scrapings,
and crushed choleliths, as these sources would more
likely harvest bacterial biofilms. Additionally, they
demonstrated an uneven distribution of bacterial in-
fected within the hepatobiliary system and identi-
fied that cultures underestimate bacterial infection
when compared to immunohistochemical techniques
such as lipoteichoic acid immunohistochemistry and
toll-like receptor expression immunohistochemistry
to detect gram-positive bacterial cell wall and gram-
negative bacterial endotoxin exposure. 35

The decision to pursue surgical intervention for
pancreatitis associated biliary obstruction is made
on a case-by-case basis and is in part based on per-
ceived severity of the condition and persistence of
biliary obstruction. There is limited information on
minimally invasive techniques for biliary drainage
in dogs, with only a few studies with small numbers

Unauthenticated | Downloaded 08/19/24 05:58 PM UTC
reporting on the outcome of treatment of pancreatitis and biliary obstruction with either ultrasound-guided percutaneous biliary drainage\textsuperscript{4,5,12} or tube cholecystostomy.\textsuperscript{20,26,38} There are anecdotal reports of dogs with pancreatitis and biliary obstruction treated medically or with biliary rerouting or stenting, and the consensus is that many dogs with pancreatitis and biliary obstruction can be managed medically. An older study\textsuperscript{29} reported a mortality rate of 50% in dogs with pancreatitis and EHBO treated with choledochal stent placement, but a recent study\textsuperscript{30} reported 13 of 15 (87%) surgically treated dogs surviving, with 11 of those dogs having choledochal stents placed. Neither study reported long-term follow-up of stented dogs assessing for known complications of stenting such as bacterial cholangitis.\textsuperscript{13,39}

The results of this study show that surgery is a viable therapeutic option for dogs with biliary obstruction secondary to pancreatitis. The mortality rate of those treated surgically was much lower than previously reported, and there was no difference in the long-term survival between those treated surgically and medically. The concern over long-term complications is a valid one; however, out of 18 dogs with a follow-up period ranging from 4 to 70 months, only 5 patients experienced postoperative complications and not all of these could be definitively attributed to the effects of the surgery. The major risk appears to be bacterial cholangitis postoperatively, and cognizance of this risk allows for early identification of this complication, which is manageable with antimicrobials.

The NLR and PLR are biomarkers that aid in prognostication in inflammatory, neoplastic, and cardiovascular conditions in people.\textsuperscript{21} The role of neutrophils in immunity is well-known, and while platelets are better known for their role in hemostasis, they are also a critical part of the immune system with various actions including stimulation and attraction of WBCs.\textsuperscript{40} Neutrophils and platelets are increased in inflammation, and multiple studies have demonstrated the correlation between peripheral lymphopenia and the severity of acute pancreatitis in people.\textsuperscript{41} The NLR and PLR have been assessed as prognostic indicators in dogs and cats with neoplastic and inflammatory conditions, and a recent study\textsuperscript{22} of dogs and cats with pancreatitis showed elevated NLR and PLR in animals with pancreatitis versus controls, increased NLR in cats with pancreatitis and prolonged recovery, and a significant increase in the PLR in dogs and cats with pancreatitis and prolonged recovery. Unfortunately, NLR and PLR showed no difference between those treated surgically and those treated medically or between survivors and nonsurvivors in this study.

There were no prognostic indicators that were useful to predict the need for surgery or that were predictive for complications. There was no difference in maximum bilirubin, maximum ALT, common bile duct diameter, or the presence of SIRS between the medically or surgically treated groups or between survivors and nonsurvivors. This is consistent with previous studies\textsuperscript{23,26} that also found no correlation between these variables and severity of condition or outcome. There was also no significant difference in the length of hospitalization, number of days of medical management, or time to return to adequate function between the medical and surgical groups. When assessing the time to return to adequate function using the starting time point of surgery, there was still no difference between the groups. The details of most patient recoveries are limited due to the retrospective nature of this study, and a prospective study with regimented follow-up and objective or specific monitoring with owner questionnaires may detect a difference in the quality and speed of recovery between the treatment groups.

There were major limitations in this study, including those inherent in all retrospective studies, such as reliance on information in clinical records that may be incomplete or lacking the desired information, lack of standardized treatments, predefined treatment end points, and inadequate or variable follow-up intervals. The diagnosis of pancreatitis is known to be challenging, with no test being 100% sensitive, and while the surgical patients had visual and sometimes histological confirmation of the diagnosis, the medically treated dogs did not have this definitive diagnosis. The cause of death was based on clinician assessment in the clinical record but may be inaccurate, and no patients underwent a postmortem. Additionally, the reasoning behind the decision to pursue surgery wasn’t always discernible and only general assumptions regarding the reasons such as clinician preference, client decision after both surgical and medical management were offered, perceived severity of the condition, and perceived lack of response to medical therapy.

Another factor limiting any conclusions drawn from this study was the heterogeneity of decompression techniques. The decision to include multiple methods of decompression was influenced by past studies\textsuperscript{42} that have found similarly poor outcomes between the modes of decompression used and the desire to describe the outcome for as many dogs as possible, acknowledging that different surgeons will have preferences for particular techniques and because the aim of this study wasn’t to prove the superiority of one decompression technique over others. Further research is needed to determine which patients are best managed medically versus surgically, what constitutes failed medical management, and the optimum time for surgical intervention, but until more advanced diagnostics are readily available, it may remain a decision that is heavily impacted by clinician opinion.

Given the opportunity for bias and incorrect assumptions in a retrospective study such as this, it isn’t possible to derive any firm conclusions or make any recommendations regarding optimal management of EHBO due to pancreatitis. The mortality rates reported in this study provide a different perspective on the management of pancreatitis and biliary obstruction and perpetuate the debate over how to best treat this condition. Some patients may require surgical intervention to recover; however, the method to determine which patients are best managed by surgery remains unclear.
In conclusion, the optimal management for pancreatitis-associated biliary obstruction remains unknown. The results of this study suggest that given the potential negative impacts of biliary obstruction, both locally and systemically, until minimally invasive interventions such as endoscopic retrograde cholangiopancreatography become available, alleviation of biliary obstruction via surgical decompression may be a reasonable therapeutic option.

Acknowledgments
The authors declare that there were no conflicts of interest.

References