**Abstract**

**Title**

Cholecystectomy in 23 cats (2005-2021)

**Objectives**

To describe the clinical presentation, treatments and long-term outcomes following cholecystectomy in cats.

**Study Design**

Clinical retrospective study.

**Animals**

Twenty-three client-owned cats.

**Methods**

Medical records of all cats undergoing cholecystectomy between 2005 and 2021 at a single referral hospital were retrospectively reviewed. No cats were excluded. An owner questionnaire assessed long-term outcomes.

**Results**

Vomiting, jaundice and abdominal pain were the most common clinical signs; median duration of signs was 4 days (range, 1 - 21). Cholelithiasis (17) was the major indication for cholecystectomy followed by cholecystitis (4). Intraoperative hypotension (19) and postoperative anemia (14) were commonly encountered. Nine cats required a postoperative blood product transfusion. Cardiopulmonary arrest and death occurred in 5 cats. Eighteen cats (78.3%) survived to discharge. Long-term follow-up (>60 days) was available for 16 cats at a median of 1003 days (range, 81 - 4995). Fifteen cats survived over 6 months with 8 cats (44.4%) surviving over 3 years. The most common short- and long-term postoperative complication was vomiting. Owners assessed postoperative outcome as excellent in all cats and quality of life as excellent (7) or good (2).

**Conclusion**

The most common indication for cholecystectomy was cholelithiasis. Perioperative complications were commonly encountered. Perioperative mortality rate was 21.7%. Long-term owner evaluation of clinical outcome was considered excellent.

**Clinical Significance**

Cats undergoing cholecystectomy for non-neoplastic causes can have a favorable prognosis for recovery and quality of life. Concurrent extra-hepatic biliary duct obstruction is not a contraindication for cholecystectomy provided that patency of the common bile duct is restored.

**Introduction**

Cholecystectomy is infrequently performed in the cat. It is indicated for treatment of various pathologies affecting the gall bladder. When concurrent extrahepatic biliary duct obstruction (EHBDO) is present, cholecystectomy is only performed once the patency of the common bile duct (CBD) has been confirmed. A major indication for performing a cholecystectomy in the cat is cholelithiasis.1-4 Choleliths are rare in cats and account for less than 1% of feline hepatobiliary disease cases.5 Choleliths have been identified in all parts of the biliary tract including the intrahepatic biliary ducts, cystic duct, CBD and at the sphincter of Oddi (SOD).6 Other indications for cholecystectomy include cholecystitis,7 biliary mucocele,8 neoplasia of the gall bladder9,10 or trauma.11

Morbidity and mortality rates are considered high following feline extrahepatic biliary tract surgery.4,12-14 Mortality following extrahepatic biliary tract surgery in cats has been reported to be 40-50%4,13,14 compared with 28% in dogs.15 The cause of EHBDO has been associated with postoperative survival with Mayhew et al. reporting up to 100% mortality rates in cats undergoing biliary tract surgery for neoplastic causes as opposed to a 40% mortality rate when surgery was performed for other indications.13

Outcomes of cholecystectomy in cats are limited to single case reports or small case series.2-4,7,9-10,13 In one study, cholecystectomy was performed for obstructive cholelithiasis in 5 cats, 4 survived and were all alive at a mean follow-up time of 22 months.3

The objectives of this study were to describe the indications, clinical findings, treatments, complications and outcomes in a larger population of cats undergoing cholecystectomy. Our main hypothesis was that, in the absence of neoplastic disease, cholecystectomy in the cat is associated with better outcomes compared to previous reports and in particular that mortality rates would be less than 40%.13

**Materials and Methods**

This retrospective study used anonymized clinical data and was approved by the social science research ethical review board of the Royal Veterinary College, University of London (approval no.: URN SR2020-024).

 Surgical records from The Queen Mother Hospital for Animals, Royal Veterinary College

were searched from January 2005 to January 2021 to identify cats that had undergone cholecystectomy. Case records were reviewed for clinical history; signalment; physical examination findings including temperature, body weight and body condition score (1-9); diagnostic test results including preoperative hematology, serum biochemistry, coagulation profile, and diagnostic imaging findings; time from presentation to surgery; surgical treatment; concomitant surgical procedures under the same general anesthetic; surgical and anesthetic time; time in the intensive care unit (ICU); survival time from surgery to discharge; postoperative treatments; and bacteriology and histopathological results. According to Leveille et al, the CBD was considered dilated if >4mm.16 The reason for cholecystectomy was determined on the basis of clinical, diagnostic, surgical and histopathological findings. Medications administered intraoperatively, including treatments for hypotension and blood product transfusions, were recorded. Intraoperative hypotension and postoperative hypotension were defined as a non-invasive ultrasonic Doppler flow systolic blood pressure (SBP) of <100 mmHg.17 Postoperative anemia was defined as a packed cell volume (PCV) of less than 25% following surgery.

Outcomes and complications were divided into those that occurred intraoperatively, postoperatively prior to hospital discharge and following discharge, which were divided into short- and long-term. Short- and long-term postoperative complications were defined as any complication that occurred following discharge until 60 days postoperatively and after 60 days postoperatively, respectively. Complications were classified as minor (not requiring additional surgical or medical treatment), major (requiring additional medical or surgical management) or catastrophic (resulting in permanent disability, death or euthanasia).18 Post-discharge follow-up was obtained by review of electronic patient records from the referral hospital and referring veterinary practice. In addition, owners were asked to complete a telephone questionnaire (Supplement I). If a cat was deceased, the date and reason, if available, were recorded and the owner was not contacted.

 Data analysis was performed using descriptive statistics. Categorical data was expressed as the total number count of individuals in a specific group. Continuous data were expressed as a median and range. Statistical analysis was not performed due to the small population size.

**Results**

**Demographics and preoperative findings**

Twenty-three cats had a cholecystectomy performed. Breeds included domestic shorthair (11), Burmese (4), Siamese (3) domestic longhair (2), Maine Coon (1), Turkish Van (1) and British shorthair (1). There were 8 neutered male cats and 15 neutered female cats. Median age at presentation was 12 years (range, 8 months to 17 years). Median body weight was 3.5 kg (range, 2.5 - 7.9) and median body condition score 5/9 (range, 2 - 8).

Median duration of clinical signs at time of presentation was 4 days (range, 1 – 21). Vomiting was the most common clinical sign reported in 21 cats. Other clinical signs reported were icterus (17), abdominal pain (13), lethargy (12), anorexia (10) and hyporexia (8). A combination of clinical signs was reported in most. Pyrexia (>39.1°C [102.4°F]) was recorded in 6 cats and hypothermia (<37.2°C [99°F]) in 2 cats. Hematological abnormalities included lymphopenia (10), neutrophilia (9) and anemia (4) (Table 1). Serum biochemistry showed increased alanine aminotransferase (20), hyperbilirubinemia (18), hypercholesterolemia (14), increased alkaline phosphatase (11) and increased creatinine kinase (10).

All cats had an abdominal ultrasound performed. The most common abnormalities described were CBD distention (19), cholelithiasis (17), gall bladder distension (12), dilated intrahepatic bile ducts (10), thickened gall bladder wall (9), diffusely hyperechoic liver (8), small volume of peritoneal fluid (7), changes consistent with pancreatitis (5) and generalized thickening of the gallbladder and CBD (4). The median CBD diameter was 9 mm (range, 4 - 15). The CBD had a diameter of ≥5mm in 20 and a diameter of 4mm in 2 cats. In the cats with cholelithiasis, the median diameter of the choleliths measured was 5.8 mm (range, 2 - 10). Seven had a single cholelith while 10 had multiple identified. The most common cholelith position was at the major duodenal papilla (14), followed by the CBD (3). Three cats had radiographic studies performed. Two cats had abdominal radiographic studies consistent with cholelithiasis. One cat had a positive contrast cholecystogram to confirm EHBDO due to lack of visible CBD compression identified on abdominal ultrasound.

**Intraoperative findings and surgery**

Time from presentation to surgery ranged from < 24 hours to 7 days. Fourteen cats underwent surgical management <24 hours following presentation while 4 cats had surgery between 24-48 hours. Five cats were unsuccessfully medically managed for 2 to 7 days prior to surgery, with one cat acutely deteriorating due to septic biliary peritonitis 6 days following presentation.

The causes of EHBDO requiring cholecystectomy were cholelithiasis (17), cholecystitis (3), cholecystitis with triaditis (1), obstructive cystic duct lesion (1) and cystic duct rupture due to abdominal lacerations from a dog bite (1).

All surgeries were performed by or under the direct supervision of an ECVS board certified or RCVS specialist surgeon. Median anesthetic time and surgical time were 230 minutes (range, 145 – 280) and 130 minutes (range, 65 – 220), respectively. A duodenotomy was performed to assure patency of the CBD in 20 cats. In all 20 cats, catheterization and retrograde CBD flushing was performed. In 4 of these cats antegrade flushing was also performed following cholecystectomy. A choledochotomy was performed in a total of 8 cats to remove an obstructing cholelith that would not dislodge despite flushing. It was performed in 3 cats where a cholelith was identified ultrasonographically in the CBD and in 5 cats where a cholelith had been identified ultrasonographically at the major duodenal papilla. In 2 separate cats a sphincterotomy was performed to aid in cholelith removal at the major duodenal papilla. A 2.5Fr, 3Fr and 4Fr silicon catheter were placed in the CBD to act as a stent in 3 cats and were secured to the adjacent duodenal wall with 2 partial thickness simple interrupted monofilament absorbable sutures. The cystic duct was closed by placement of one circumferential suture (5), double circumferential sutures (2), two transfixing sutures (2), one transfixing suture (1) or in a simple continuous pattern (1). Following ligation, the free end of the cystic duct was oversewn in a simple continuous pattern in 7 cats. Suture material used to ligate the cystic duct included polydioxanone (8), polypropylene (3) and polyglactin 10 (1). The abdominal cavity was lavaged with sterile saline in 20 cats. The surgical procedure was documented as being uncomplicated in 17 cats. Concomitant procedures included: liver biopsies (20) esophagostomy tube (11), multiple biopsies (14; small intestine [10], pancreas [7], spleen [1]), gastrostomy tube (2) peritoneal drain (Jackson Pratt; 1).

Intraoperative hypotension was recorded in all cats with an available anesthetic record (19). Anaesthetic management and treatments for hypotension were the choice of the individual anaesthetist responsible for each cat, who were all acting under the supervision of a board-certified anaesthetist. There were no defined protocols in place for these cats. Intraoperatively cats received a fresh frozen plasma (FFP) transfusion (3), a xenotransfusion (1) and a bovine hemoglobin-based oxygen-carrying infusion (1; Oxyglobin; Dechra). Intraoperative drugs administered included intravenous colloidal fluid products (7), noradrenaline (6) and dopamine (1). Twelve cats continued to be hypotensive in the immediate postoperative period (within 12 hours), 3 cats maintained normotension while no records were available for 8 cats. Postoperative PCV was available in 17 cats, median postoperative PCV was 17% (range, 9 - 44). Fourteen cats experienced postoperative anemia. Nine cats required a postoperative blood product transfusion including FFP (1), xenotransfusion (3) and feline whole blood (8; 3 of which had prior xenotransfusions). One cat that experienced perioperative anemia received Oxyglobin postoperatively. Six cats received the blood product transfusion <24 hours postoperatively, while 3 cats had transfusions at 2, 4 and 5 days postoperatively, respectively.

Sixteen cats received perioperative antibiotics including amoxicillin clavulanic acid (14) or cefuroxime (2), which were continued postoperatively following discharge in all cats based on bacterial culture and sensitivity results. Twelve cats received hepatic support medications postoperatively (ursodeoxycholic acid and s-adenosylmethionine with silybin). Median duration of ICU hospitalization following cholecystectomy was 3 days (range, 1 - 7). Eighteen cats survived to discharge. Median time to discharge following surgery was 7 days (range, 2 - 14).

**Postoperative management and outcomes**

Cholelith analysis was available in 6 cats: calcium carbonate (4), calcium oxalate (1) and proteinaceous material (1).  Histopathological evaluation was available for the gall bladder (21), the liver (18), intestine (8), pancreas (7) and spleen (1). The most common histopathologic changes of the gall bladder included suppurative neutrophilic cholecystitis (8) and lymphoplasmacytic and neutrophilic cholecystitis (7). The most common liver histopathologic changes included chronic-active diffuse lymphoplasmacytic and neutrophilic cholangiohepatitis (10) and suppurative neutrophilic cholangiohepatitis (7). Aerobic and anaerobic bacterial culture and antimicrobial susceptibility testing from either gall bladder, bile, cholelith or liver was performed in all cats. Fifteen cats had a positive bacterial culture, with 5 culturing multiple species. *Escherichia coli* (8) and *Enterococcus faecalis* (3) were the most common isolates identified. Multi-drug resistant bacteria were identified in 10 cats, however, only 4 were resistant to penicillin antibiotics.

Referring veterinarian postoperative reexamination was performed at a median of 17 days (range, 11 - 25). Five cats had a postoperative examination at the authors institution, median 20 days (range, 9 - 26). Median time to repeat postoperative hematology and serum biochemistry was 24 days (range, 13 - 60) (Table 1). Total bilirubin and alanine aminotransferase were improved in all cats and within the normal reference intervals in 7/9 and 3/8 cats, respectively. Repeat abdominal ultrasonography, between 20 and 28 days postoperatively, was performed in 3 cats. The diameter of the CBD was improved, but still dilated (>4mm), in all cats, while calculi were present in the CBD in 2 cats. Two of these cats had a temporary biliary stent placed at surgery, no stent was identified on the postoperative ultrasound of either case at 20 and 28 days postoperatively.

Follow-up was available for 18 cats at a median of 870 days (range, 14 - 4995). Nine cats were alive at the time of the study, 5 were euthanized and 4 were lost to further follow-up. Fifteen cats (83.3%) survived over 6 months with 8 cats surviving over 3 years (44.4%). Five were euthanized at a median of 895 days postoperatively (range, 14 - 4995). Euthanasia was performed in 3 cats for reasons unrelated to the biliary surgery. Cervical T-cell lymphoma was diagnosed in a 15-year-old cat; euthanasia followed 218 days postoperatively. One cat was euthanized for an unknown reason at 895 days postoperatively. One cat was euthanized due to acute onset dyspnea at 1628 days postoperatively. Two cats were euthanized for causes suspected to be related to biliary obstruction. One cat was euthanized 14 days postoperatively following intermittent vomiting and acute clinical deterioration. Further details for the decision to euthanize this case were unavailable. One cat was euthanized at 4995 days postoperatively due to a 14-day deterioration due to suspected biliary obstruction. For 4 cats, only the date of last presentation to the referring veterinarian was available and these cats were lost to further follow-up at a median of 1332 days (range, 51 - 2504).

 Of those cats that survived to discharge, 9 owners of cats who were alive at the time of the study were contacted at a median of 844 days postoperatively (range, 81 - 1350). The overall outcome of the surgery was described as excellent by all owners. The cats’ quality of life was described as excellent in 7 and good in 2 cats that continued to experience intermittent vomiting long-term.

**Complications**

No minor intraoperative complications occurred. Major intraoperative complications occurred in 19 cats, with 6 experiencing multiple: hypotension unresponsive to crystalloid fluid therapy requiring colloid, vasopressor or blood product transfusion (14), hemorrhage (6), hypotension responsive to crystalloid fluid therapy only (5).

Minor postoperative complications prior to discharge included perioperative anemia not requiring blood product transfusion (5). Major postoperative complications prior to discharge occurred in 19 cats, with 9 experiencing more than one: perioperative anemia requiring blood or oxygen product transfusion postoperatively (9), continued postoperative hypotension (12), nausea warranting the use of antiemetics (7). Respiratory arrest occurred on recovery from anesthesia in one cat and successful resuscitation followed. Five cats experienced cardiopulmonary arrest (CPA) in the immediate postoperative period which were classified as catastrophic postoperative complications prior to discharge. All 5 cats experienced intraoperative hypotension. Two of these cats experienced continued postoperative hypotension despite the introduction of vasopressive agents. Four cats suffered CPA at 1, 2, 4 and 7 hours postoperatively, respectively. One case was dyspneic and pneumothorax was diagnosed. The cat never recovered following extubation and was euthanized.

 Nine cats had no short-term postoperative complications. Nine cats experienced short-term postoperative complications. Minor short-term postoperative complications were seen in 2 cats, both of which experienced vomiting. Major short-term postoperative complications occurred in 7 cats  with 2 cats experiencing two major complications: constipation (3), vomiting (2), feeding tube stoma site infection (2), diarrhea (1) and minor wound dehiscence of the surgical incision (1). One cat experienced vomiting and constipation. A catastrophic short-term complication occurred in one cat; acute clinical deterioration resulting in euthanasia. Short-term complications occurred at a median of 12 days postoperatively (range, 11 - 26) and were all treated medically.

Long-term follow-up was available for 16 cats at a median of 1003 days (range, 81-4995). Six cats had no long-term postoperative complications. Seven cats experienced long-term postoperative complications at a median of 128 days postoperatively (range, 63 - 864) and all were medically managed. Minor long-term postoperative complications occurred in 3 cats including vomiting (3) and hyporexia (1). Major long-term postoperative complications occurred in 5 cats, with all experiencing more than one: vomiting (4), diarrhea (3), lethargy and pyrexia (2) and hyporexia (1).

**Discussion**

In the presented group of cats undergoing cholecystectomy, cholelithiasis was found to be the main indication for the procedure. Furthermore, perioperative mortality (21.7%) was found to be lower than previously reported13 although both perioperative (hypotension, anemia) and postoperative complications (vomiting) were commonly identified.13 When cats survived to discharge, owner-assessed postoperative and long-term outcomes were considered excellent in most cats. We therefore accept our hypothesis.

The age and breed of cats presenting for cholelithiasis in this study was consistent with previous studies.12,19 Clinical signs reported in this study were consistent with those previously reported for EHBDO.5,13,14 The median duration of clinical signs in this study was 4 days. One study of cats presenting with EHBDO showed a significant difference between the duration of clinical signs of cats presenting with choleliths (6 days), compared to those presenting with an inflammatory cause (22 days) or neoplasia (21 days).19 It could be proposed that the shorter duration of clinical signs observed in this study led to more favorable outcomes than previously reported and that earlier intervention could be recommended, similar to cases of gall bladder mucoceles in dogs.20 In this study 19 cats had a dilated CBD (5mm).16 A CBD diameter of ≥5 mm has been shown to be consistent with EHBDO in up to 97% of obstructive cases in one study, suggesting surgical intervention.19

Positive hepatobiliary cultures were recorded in a high proportion of cats in this study, with *Escherichia coli* being the most common isolate, consistent with previous reports.7,21 Choleliths predominantly consist of calcium carbonate, bilirubin or combinations of these.1-3,19 The reason for cholecystectomy in one cat was an obstructive cystic duct lesion, the cat suffered CPA and death postoperatively; histopathology was not obtained.

Choledochal stents were placed in 3 cats in this study. Choledochal stenting has been described previously for the treatment of feline EHBDO due to pancreatitis.22 Caution has been advised when placing stents in cats with thick bile or when biliary sludge is present as this may predispose to rapid postoperative stent obstruction.22 Intermittent vomiting was reported as a postoperative complication in 2 cats of that study.22 One cat of the present study experienced long-term intermittent vomiting following temporary stent placement.

Cholecystectomy in the cat is invariably associated with intensive postoperative management as demonstrated in this study with many requiring intensive care and postoperative transfusions. Intraoperative hypotension and persistent or refractory postoperative hypotension is common in feline biliary tract surgery.13,14 In this study, intraoperative hypotension occurred in all cats with an available anesthetic record and postoperative hypotension was recorded in 12 cats (52.2%). Ultrasonic Doppler flow has been shown to be a poor estimator of systolic blood pressure in anesthetized cats.23 It is likely that Doppler flow overestimated SBP and that true SBP was lower than measured. It could be hypothesized that once intraoperative hypotension was identified it may have been more difficult to treat than if it had been identified earlier. Postoperative hypotension in dogs has been associated with outcome following cholecystectomy with those experiencing postoperative hypotension being 20 times less likely to survive.24 All 6 cats that suffered CPA on recovery experienced intraoperative hypotension which continued into the immediate postoperative period. The high incidence of intraoperative hypotension and reduced vasopressor responsiveness during biliary surgery is multifactorial. Experimental ligation of the canine biliary duct has been shown to cause decreased vascular responsiveness to vasopressive agents, suggested to be partly due to the release of nitric oxide causing sustained vasodilation.25,26 Two cats in this study received Oxyglobin due to refractory hypotension. Oxyglobin scavenges nitric oxide and its use is warranted in patients experiencing continued hypotension despite aggressive vasopressor treatment.27,28

Perioperative mortality was 21.7% in this study, which is similar to historic canine reports.29 However, it is higher than more recent reports of mortality in larger canine cohorts following cholecystectomy (7-19.6%).20,24,30 The perioperative mortality rate is significantly lower than that previously reported (40%) for feline biliary tract surgery for non-neoplastic causes.13 The higher mortality rate previously described is likely attributed to biliary diversion procedures being the most common surgery performed in that study which are known to have higher mortality rates.13,14 In the present study, of those surviving to discharge, 83.3% survived over 6 months, in contrast to Buote et al. in which only 42.9% of cats undergoing cholecystoenterostomy that survived to discharge lived over 6 months.14 This favorable prognosis may, in part, be due to the lack of neoplastic etiologies in our cohort and due to the fact that biliary diversion procedures were not included. Furthermore, while cholecystectomy has been shown to damage pericholedochal nerves resulting in impaired function of the SOD,31 the physical barrier of the sphincter remains intact; unlike cholecystoenterostomy procedures where this physical barrier is no longer present, leaving the biliary tract open to bacterial colonisation.14,32

Complications following cholecystectomy in this study were consistent with those previously described.3,4,13 Additional complications reported include cholecystitis, cholangiohepatitis and recurrence of EHBDO.4,13 Vomiting was the most common postoperative complication in the cats of this study. However, the authors cannot directly relate the complications experienced by the cats of this study, such as vomiting or constipation, with the cholecystectomy procedure itself. Of those that experienced vomiting >60 days (7), 3 cats had pre-existing medical conditions. Two cats had a one-year history of pancreatitis while one was previously diagnosed with bacterial cholangitis and pancreatitis. The latter cat was diagnosed with continued choledocholithiasis 433 days postoperatively. It could be proposed that those cats presenting with pre-existing conditions are predisposed to continued long-term clinical signs postoperatively; however, further studies are warranted to conclude this.

Although the follow-up in this study was not standardized, the results provide evidence that the long-term prognosis following cholecystectomy can be excellent, with at least 8 cats (44.4%) surviving over 3 years. Previous reports of cholecystectomy in cats are limited to smaller case series and case reports.1-4,7,9-10,13 The indication for cholecystectomy, in these papers, included cholelithiasis,1,2,3,13 biliary tract rupture11 and neoplasia9,10 involving the gall bladder. Similar to this study, follow-up in those papers was variable,2-4,7,9-10,13 with some cats deteriorating postoperatively and others showing no recurrence of clinical signs at follow-up, with up to 6 years follow-up reported in one cat.13 The current study is the largest study of cholecystectomy in cats and to the authors’ knowledge the first study to include owner assessed outcomes. This study importantly highlights that cats can have an excellent long-term prognosis following cholecystectomy.

Limitations of this study included its retrospective nature, small patient population, lack of standardization or procedural protocols and the occasionally incomplete medical records. The decision to administer a blood product, vasopressor or Oxyglobin was at the discretion of the primary clinician or anesthetist and was not standardized. Given the small population size, statistical analysis was not performed. The measures of outcomes were based on a subjective non-validated questionnaire which could have led to an incorrect owner perception. The long follow-up could have resulted in recall bias, resulting in less reliable owner assessments. Additional prospective studies are warranted to identify possible risk factors associated with complications and survival using a large-scale multi-center prospective study.

In conclusion, in this study cats undergoing cholecystectomy for non-neoplastic causes can have a favorable prognosis for recovery and quality of life. Concurrent EHBDO is not a contraindication for cholecystectomy provided that patency of the CBD is restored.

**No grant or financial support.**

**Conflict of Interest:** The authors declare no conflict of interest related to this paper.

**Meeting**: The abstract of this study was presented at the ECVS annual conference 2021.

**Acknowledgements:**

Simpson M, BVMS, FHEA, MRCVS: Data acquisition, manuscript drafting. Neville-Towle J, BVSc (Hons), MPhil, MVS, MANZCVS, Dip. ECVS, MRCVS: Manuscript drafting, study design. Lee K, VetMB, MA, PhD, CertSAS, Dip. ECVS, PGCAP, FHEA, MRCVS: Manuscript drafting, critical revision. Rossanese M, DVM, SPSA, CertAVP, MSc, Dip. ECVS, MRCVS: Study concept, design, data acquisition, manuscript drafting.

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**Figure legends**

**Table 1** – Preoperative and postoperative hematology, serum biochemistry and coagulation parameters.

**Table 1**

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | ***Preoperative*** | ***Postoperative*** |
|  | **Parameter**  | **Value** (median)  | **Range**  | **Number of cats\*** (n)  | **Value** (median)  | **Range**  | **Number of cats\*** (n)   | **Reference range**  |
| *Hematology* |   |   |   |   |   |   |   |   |
|  | WBC  | **14.7**  | 7.7-38  | 20  | **11.25**  | 6.8-13.4  | 6  | 5.5-19.5 10e9/l  |
|  | Neutrophils  | **8**  | 5.3-33  | 20  | **7.6**  | 4.4-11.6  | 5  | 2.5-12.5 10e9/l  |
|  | Lymphocytes  | **1.32**  | 0.3–6.3  | 19  | **2.1**  | 1.3-4.6  | 6  | 1.5-7 10e9/l  |
|  | Monocytes  | **0.61**  | 0–1.93  | 19  | **0.54**  | 0.47-1  | 6  | 0-1.5 10e9/l  |
|  | RBC  | **6.65**  | 4.3-9.8  | 20  | **6.7**  | 5.8-7.8  | 6  | 5-10 10e12/l  |
|  | HGB  | **10.5**  | 7–13  | 20  | **9.6**  | 7.7-10.8  | 6  | 8-15 g/dL  |
|  | PCV  | **32**  | 21–42  | 21  | **30**  | 20-36  | 6  | %  |
| *Biochemistry* |   |   |   |   |   |   |   |   |
|  | Total Protein  | **70**  | 55.7–83  | 21  | **70.1**  | 59.7-79.1  | 8  | 60-80 g/l  |
|  | Albumin  | **30**  | 20.5–35.1  | 19  | **29**  | 22.1-31.1  | 8  | 25-45 g/l  |
|  | Total Bilirubin  | **189.8**  | 1–507  | 22  | **3.9**  | 2.9-7.1  | 9  | 0.1-5.1 umol/l  |
|  | ALT  | **567**  | 34-2015  | 21  | **70.5**  | 45-324  | 8  | 5-60 U/l  |
|  | ALP  | **103**  | 14-708  | 19  | **30.5**  | 24-59  | 8  | 0-60 U/l  |
|  | GGT  | **9**  | 0–36  | 18  | **0**  | 0-4  | 7  | 0-9 U/l  |
|  | Cholesterol  | **4.4**  | 2.5–9.1  | 19  | **3.8**  | 2-6.1  | 8  | 2.2-4 mmol/l  |
|  | Urea  | **6.4**  | 4.4-12.6  | 19  | **8.6**  | 4.5-16.5  | 8  | 2.5-9.9 mmol/l  |
|  | Creatinine  | **108.5**  | 65-185  | 20  | **97**  | 86-119  | 8  | 20-177 mmol/l  |
|  | Creatine Kinase  | **468.5**  | (26-145809)  | 20  | **170**  | 77-178  | 7  | 57-574 U/l  |
| *Coagulation* |   |   |   |   |   |   |   |   |
|  | PT  | **13.5**  | 10.6–18.3  | 9  | -  | -  | -  | 22-34 seconds  |
|  | APTT  | **17**  | 11.3-36.5  | 8  | -  | -  | -  | 48-76 seconds  |
| *ALP Alkaline Phosphatase, APTT Activated Partial Thromboplastin time, ALT Alanine Aminotransferase, GGT Gamma-Glutamyl Transferase, HGB Hemoglobin, PCV Packed Cell Volume, PT Prothrombin Time, RBC Red Blood Cells, WBC White Blood Cell Count, \* Out of a total of 23 cats.* |