Bilobed gallbladder in a cat

I. ERGIN\textsuperscript{1*}, O.O. SENEL\textsuperscript{1}, Y. SEN\textsuperscript{1} and A. BUMIN\textsuperscript{1}

\textsuperscript{1}Department of Surgery, Faculty of Veterinary Medicine, Ankara University, 06110 Ankara, TURKEY.
\textsuperscript{*}Corresponding author: iremerg@gmail.com

\textbf{SUMMARY}

Gallbladder abnormalities, especially bilobed gallbladder, have been rarely reported in cats because they are not associated with evident clinical symptoms, and they are usually determined at necropsy, incidentally. In this case report, a 5 year old, male, tabby cat with complaints of loss of appetite, fatigue, weight loss, vomiting and icterus for 2 days was clinically examined and ultrasound-guided indirect cholecystography revealed a bilobed gallbladder coupled to extrahaepatic biliary obstruction. Choledochoduodenostomy was performed and antibiotherapy was instituted in the post-operative period because of the associated cholangiohepatitis evidenced by laparotomy and microbiological examinations of the biopsied liver samples and of the free peritoneal fluid. The general condition of the cat was improving and icterus disappeared during the first week; however, dehydration occurred soon after and the diagnosis of acute nephritis was established based on dramatically elevated uraemia and creatininemia and ultrasonographical examination. Cat died on day 16. In the present case, it was considered that the bilobed gallbladder has promoted cholangiohepatitis that in turn leaded to extrahaepatic biliary obstruction but possible complications to other organ systems such as kidneys may also be investigated.

Keywords: Cat, bilobed gallbladder, cholecystography, cholangiohepatitis, choledochoduodenostomy, acute interstitial nephritis

\textbf{Introduction}

The liver and biliary tracts develop from a bud-like outpouching of the ventral wall of the primitive foregut just cranial to the yolk sac; this area is termed the anterior intestinal portal. This small diverticulum is the primary structure for the development of the liver, extrahepatic biliary ducts, gallbladder, and ventral pancreas. Two solid buds of cells form the right and left lobes of liver while the original elongated diverticulum forms the hepatic and common bile duct. The gallbladder arises as a smaller bud of cells from the same diverticulum. Eventually, re-vacuolisation takes place, starting simultaneously in different parts of the solid gallbladder bud and spreading until the whole system is re-canalized [1, 12, 17]. The majority of the congenital abnormalities can be related to alterations in the original budding from the foregut or to failure of vacuolisation of the solid gallbladder and bile duct diverticulum [12].

Abnormalities about the number of lumens have three types. Septated gallbladder has a very large lumen and one or more spaces are formed by septa inside the lumen. Bilobed gallbladder in which fundus or corpus of gallbladder is split lumens are totally or partly separated by a longitudinal septum. The lobes are opened to a common bile duct by a single cystic duct. In duplex gallbladder, corpus, fundus and the cystic duct are formed as couple and they join together at the common bile duct [10, 16].

Congenital abnormalities, especially bilobed gallbladder, have been rarely reported in cats. They cannot be easily diagnosed by clinical examination and are usually determined incidentally in necropsy [10, 18]. The aim of this study is to share detailed diagnosis and surgical outcomes of congenital bilobed gallbladder in a cat.

\textbf{Case Report}

A 5 year old, male, tabby cat was brought with complaints of loss of appetite, fatigue, weight loss and vomiting for 2 days. It was taken to another veterinary clinic with fever, weakness and vomiting 1 month ago and treated by antibiotics (combination of amoxicillin [20 mg/kg, bid, \textit{per os}] and metronidazole [10 mg/kg, bid, IV]) for 1 week.

\textbf{RESUME}

Vésicule biliaire bilobée chez un chat

Les malformations de la vésicule biliaire, en particulier l'existence d'une vésicule bilobée, sont très rarement décrites chez le chat, puisqu'elles ne s'accompagnent pas de symptômes cliniques évidents et sont donc accidentellement observées lors d'une autopsie. Dans ce rapport, un chat mâle tigré de 5 ans présentait une baisse de l'état général, une perte d'appétit, un amaigrissement important, des vomissements et une icérè après 2 jours. Une cholécystographie indirecte assistée par ultrasons a révélé l'existence d'une vésicule biliaire bilobée associée à une obstruction extra-hépatique. Une chéledochoduodenostomie a été effectuée et une antibiothérapie a été mise en place en période postopératoire en raison de l'existence d'une cholangiohépatite détectée lors de la laparotomie et de la réalisation d'une analyse bactériologique des biopsies de foie et du liquide péritonéal. L'état général du chat s'est amélioré et l'ictère a disparu durant la première semaine ; cependant une déshydratation est apparue peu après et l'augmentation considérable de l'urémie et de la créatininémie conduite à l'examen échographique des reins a conduit à un diagnostic de néphrite aigüe. Le chat est mort le 16ème jour. Il est possible que, dans le cas présent, la bilobation de la vésicule biliaire ait favorisé le développement d'une cholangiohépatite conduisant à une obstruction des canaux biliaires mais, de possibles complications intéressant aussi d'autres organes tels que les reins doivent également être recherchées.

Mots-clés : Chat, vésicule biliaire bilobée, cholécystographie, cholangiohépatite, cholédocoduodenostomie, néphrite interstitielle aigüe.
In clinical examination, the body temperature was 38.1°C, and oral mucosa and conjunctivas were icteric. The altered haematological and blood biochemical results were reported in Table I. The animal exhibited leukopenia due to lymphocyte depletion, hyperproteinemia, an excessive blood total (free and conjugated) bilirubin concentration and markedly increased ALP and AST activities which evoke liver damage.

Direct abdominal radiograms did not reveal any pathological findings. In ultrasonographical examination, the liver size was within normal limits but its parenchyma was heterogeneous. The gallbladder exhibited an abnormal anatomical shape and it seemed to have two dilated lobes. It could not be diagnosed whether there were two separate lobes or whether one lumen was divided by a septum. Wall thickness of the gallbladder was also increased. The common bile duct was expanded. A small amount of fluid was seen in the abdomen.

Ultrasound-guided indirect cholecystography was performed for detailed examination of the gallbladder. A total of 3 mL of fluid was aspirated from one compartment of the gallbladder using a 22g needle. Then, the same amount of iomeprol contrast agent (Iomeron®, Gurel, Greece) was injected into it. The cat was fed with canned food right after. Abdominal radiograms were taken 0, 15, 30 and 60 minutes after and it was observed that the contrast agent passed into the two compartments of the gallbladder. This observation showed that the abnormality was not duplex, but bilobed gallbladder. The bile did not seem to discharge into duodenum. Radiograms revealed that the contrast agent remained in bilobed gallbladder after 24 hours, and passage through intestine was not observed.

Surgery was decided after clinical, radiographical, and ultrasonographical examinations of the cat. Intravenous fluid therapy was provided with 15 mL/kg/h 0.9% NaCl solution IV (Fizyol, Vilsan, Turkey).

The cat was placed in dorsal recumbency and a ventral midline laparotomy was performed. Light yellow free peritoneal fluid was revealed and 1 mL sample was taken for laboratory analysis. Wide-spread abscesses of each approximately 1 mm in diameter were present on omentum and liver. The gallbladder was still expanded and the septum, which had been observed in cystography, was seen as a midline between two dilated lobes. Cystic duct and common bile duct (ductus choledochus) had become enlarged and the bilobed gallbladder was connected to the common bile duct by only one cystic duct (figure 1). Duodenal papilla was not in the normal anatomical site and it was much thickened having a hard structure about 2 cm in diameter. Biopsy samples were taken from liver and the ductus choledochus for laboratory analysis. Two millimetres long incision was made to intestine about 1 cm cranial to duodenal papilla and a 1.0 mm urinary catheter was placed in it (Buster Cat Catheter, Kruuse, Denmark). Tip of the catheter was advanced to the entrance of the channel to check whether it was open or not. However, the catheter could not be directed into the channel. Common bile duct was ligated with 3/0 polypropylene, 2 mm away from the access site of duodenum. The bilobed bladder was emptied with an 18g needle. The incision was elongated to 1.5 cm and choledochoduodenostomy was done by Lambert and Schmieden sewing techniques, using 4/0 polypropylene.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Cat value</th>
<th>Usual values¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (10⁹/L)</td>
<td>4.5</td>
<td>5.50 – 19.50</td>
</tr>
<tr>
<td>Lymphocytes (10⁹/L)</td>
<td>0.77</td>
<td>1.50 – 7.00</td>
</tr>
<tr>
<td>Total proteins (g/L)</td>
<td>85</td>
<td>54 – 78</td>
</tr>
<tr>
<td>Total bilirubin (mg/L)</td>
<td>89.1</td>
<td>1 – 2</td>
</tr>
<tr>
<td>ALP (U/L)</td>
<td>529.2</td>
<td>25.0 – 93.0</td>
</tr>
<tr>
<td>AST (U/L)</td>
<td>198.2</td>
<td>26.0 – 43.0</td>
</tr>
</tbody>
</table>

WBC: White blood cells; ALP: Alkaline phosphatase; AST: Aspartate aminotransferase; ¹usual values were defined by the laboratory.

Table I: Haematological and biochemical results found in the presented cat.

Figure 1: Bilobed gallbladder (BG) with enlarged cystic duct (CD) and common bile duct (CBD) in the presented cat.
The laboratory analysis and microbiological examination was performed on the fluid and biopsy samples. *Streptococcus* spp, *Staphylococcus* spp, *E. coli* and *Enterococcus* spp were cultured from both biopsy materials and from the abdominal fluid (except for the *Enterococcus* spp).

In the post-operative period, balanced electrolyte solution (Elektrovet, Vilsan, Turkey) was administered at a rate of 10 mL/kg/h (Elektrovet, Vilsan, Turkey) for 5 days. At the end of the 5th day icteric mucous membranes and conjunctivas returned to normal. Fluid therapy continued for 15 days, due to anorexia. Metoclopamide hydrochloride 0.5 mg/kg, bid, IV (Metpamid*, Sifar, Italy) and ranitidine 1 mg/kg, bid, IV (Ulcuran*, Aifar, Turkey) were given for the post-operative 5 days. Post-operative antibiotic therapy was provided with 5 mg/kg enrofloxacin SC (Baytril*, Bayer Animal Health, Germany), and 20 mg/kg ampicillin sodium IV (Ampisina*, Mustafa Nevzat, Turkey) for 10 days. In order to suppress the inflammatory reactions of the gallbladder and biliary tract, 10 mg/kg ursodeoxycholic acid (Ursolfalk*, Aris, Turkey) was given orally for 15 days. At the end of the 1st week the patient's general condition was improving, the cat was drinking water, but did not have appetite yet.

On the post-operative 8th day, dehydration was observed in the patient. Every day, according to the degree of dehydration, IV fluid therapy was continued but the patient's general condition did not improve. On the post-operative 10th day, blood analysis revealed increases in blood urea (18.32 mmol/L), BUN (Blood Urea Nitrogen) (400 mg/L) and creatinine (397.8 μmol/L), while enzyme activities have returned into the range of usual values. Ultrasonographical examination revealed acute nephritis and the cat has died at the 16th day. Cholangiohepatitis was not observed in necropsy. Reduction in the amount of bile in the bladder was observed and the diameter of the dilated duct was seen to be decreased. Presence of fibrous tissue was noted at the duodenal papilla. No free fluid was still observed in the abdomen. Severe renal interstitial nephritis was determined in both kidneys. There were not any pathology in other organs and tissues of abdomen.

**Discussion**

Gallbladder abnormalities are usually of no importance and cannot be related to any symptoms. But if these abnormalities are accompanied by other biliary diseases, from which emerge clinical symptoms, the abnormality is diagnosed incidentally during examination [5, 6]. Symptoms such as vomiting and acute abdomen which are common symptoms of several diseases (pancreatitis, interstitial nephritis, acute hepatitis...) prevent rapid diagnosis of biliary diseases in cats [5, 7]. Because of these reasons, abnormalities of the gallbladder are usually determined at necropsy [10, 16, 18]. Various techniques such as ultrasonography, cholecystography, scintigraphy and tomography can be used for the diagnosis of gallbladder abnormalities. Ultrasonography is the most often used method [11, 14]. Partial or total obstruction of the bile ducts was suspected in the present study, depending on weakness, vomiting and icterus. Ultrasonography revealed an abnormality in the gallbladder but bilobed gallbladder was diagnosed by indirect cholecystography. As in the other studies, ultrasonography was found to be useful to reveal the abnormality, but it was concluded that the exact diagnosis should depend on a combination of different imaging techniques.

Abnormalities of gallbladder and biliary duct are shown to create predisposition for bile stasis, inflammation (cholecystitis, cholangiohepatitis) and cholelithiasis in humans [9, 10]. Similar studies in cats did not exactly define this relationship [13, 15]. In the present study, abnormality was accompanied by cholangiohepatitis and this inflammation was thought to occur because of the predisposition created by the bilobed gallbladder. The relationship between extrahepatic biliary obstruction (EHBO) and cholangiohepatitis is still being researched. Cholangiohepatitis might be the primary cause of EHBO, but it is mostly developed secondarily to obstructions [12]. An experimental study showed that cats whose common bile ducts were ligated had developed cholangiohepatitis [3]. According to the study, histopathology of common bile duct revealed bacterial growth, which is the cause of cholangitis. But it is unknown if cholangiohepatitis has developed because of the obstruction depending on cholangitis, or because EHBO has caused extrahepatic biliary disease after cholangiohepatitis [3, 12]. Another study conducted on 15 cats having EHBO reported cholangiohepatitis in 93% of the animals [12]. In the present study, the patient had received antibiotics in another clinic and had been considered as cured. One month after healing, the cat was brought to the Faculty clinic with icteric mucous membranes and similar symptoms excluding fever. Bilobed gallbladder, cholangiohepatitis and EHBO were diagnosed in the presented cat. Evaluating these data, the patient was thought to have bacterial cholangiohepatitis first one month ago, and because of the insufficient cure of this disease, EHBO has secondary developed.

Cholecystectomy is recommended in cases with cholecystitis or gallbladder ruptures [3, 8]. In cases with bile duct obstructions due to cholelithiasis, parasitic infestations, chronic pancreatitis or gallbladder tumours cholecystenterostomy (cholecystoduodenostomy, cholecystojejunostomy) or choledochoduodenostomy is performed [2, 15]. In the present study cholecystoenterostomy was not retained because the bile content from two separate lobes did not presume to drain sufficiently. Cholecystoenterostomy was performed and bile flow to duodenum was restored.

After surgery of the biliary system in humans and animals, many complications can occur such as hypotension, anaemia, infection, renal failure and coagulopathy [2, 4, 5, 15]. In this study, the patient has survived for two weeks, gradually getting better and icterus has disappeared in the post-operative first week, but uraemia and creatininemia have increased and biochemical analysis, radiographical and
ultrasonographical examinations revealed acute nephritis. After death of the cat on day 16, severe nephritis in both kidneys was observed at necropsy and has certainly led to the cat death because of acute renal failure. In a previous study, the relationship between inflammatory liver disease and pancreatitis, nephritis and enteritis was evaluated in cats and severe pancreatitis, nephritis, and/or enteritis were recorded in 39% of animals with cholangiohepatitis [19]. It was concluded that cats with cholangiohepatitis have to be also examined for nephritis, hepatitis and enteritis [19]. In this study, we did not observe any complications directly related to the biliary system, but the cat has died due to an acute interstitial nephritis 16 days after surgery. As the dehydration could not be associated with sufficient accuracy to renal failure, an exact therapeutic response was not driven and the patient was lost.

As a conclusion, results of the present study suggest that bilobed gallbladder can be diagnosed by combination of different imaging techniques in cats and extrahepatic biliary obstruction, secondary to this abnormality can be treated surgically, with the necessity of focusing on other organ systems such as kidneys for potential complications.

References