Case Report

Successful Surgical and Medical Management of Liver Lobe Torsion and Severe Multiple Renal Cysts Concurrently in a Rabbit: A Case Report

Chakchalat Yoopatthanawong* Kriangkrai Pansomboon
Chaowaphan Yinharnmingmongkol

Animal Space Exotic Pet Hospital, 99/30 Phutthamonthon Sai 2, Sala Thammasop, Thawi Watthana, Bangkok 10170, Thailand

*Corresponding author, E-mail address: chakchalat.y@anshospital.com

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Abstract

Liver lobe torsion is a potentially fatal condition in rabbits, often necessitating diagnostic imaging such as ultrasonography or a computerized tomography scan for confirmation. Surgical intervention is frequently required for optimal outcomes. Renal cysts are uncommon in rabbits, making this case particularly unique. This case study describes the successful management of concurrent liver lobe torsion and multiple severe renal cysts in a single rabbit. A 2-year-old spayed female Mini Rex rabbit, weighing 1.33 kg with a body condition score of 2/5, presented with acute anorexia, depression, and reduced fecal output. Ultrasound imaging revealed a dilated left ureter and renal pelvis with multiple cysts, along with heterogeneous parenchymal echogenicity of the caudate liver lobe with no Doppler signal detected. Emergency surgery, including hepatic lobectomy and nephroureterectomy, was performed, and a blood transfusion was administered immediately. Postoperative management included pain control, monitoring of blood chemistry parameters, and clinical presentation, resulting in subsequent normalization. Ongoing follow-up is essential to assess for complications such as renal insufficiency or hepatitis. This case adds to our understanding of managing complex conditions in rabbits and underscores the importance of a comprehensive approach to optimize clinical outcomes.

Keywords: Liver lobe torsion, Renal cyst, Rabbit

รายงานสัตว์ป่วย: การจัดการภาวะตับบิดและโรคถุงน้ำในไต ด้วยการผ่าตัดพร้อมกันในกระต่าย

จักรชลัช อยู่พัฒนะวงศ์* เกรียงไกร ปั้นสมบูรณ์ เชาวพันธ์ ยินหาญมิ่งมงคล

โรงพยาบาลสัตว์แอนิมอลสเปซ, 99/30 ถนนพุทธมณฑลสาย 2 แขวงศาลาธรรมสพน์ เขตทวีวัฒนา กรุงเทพมหานคร 10170 ประเทศไทย

***ผู้รับผิดชอบบทความ E-mail address: chakchalat.y@anshospital.com**

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บทคัดย่อ

ภาวะตับบิดเป็นภาวะที่มีความรุนแรงถึงขั้นเสียชีวิตในกระต่าย โดยส่วนใหญ่ต้องมีการใช้เทคนิคทางรังสีวิทยาในการวินิจฉัยยืนยันโรค เช่น การตรวจอัลตราซาวด์ (Ultrasound) หรือการเอกซเรย์คอมพิวเตอร์ (CT Scan) ทั้งนี้การผ่าตัดเป็นวิธีการรักษาที่ทำให้สัตว์มีโอกาสรอดชีวิตมากที่สุด ส่วนโรคถุงน้ำในไตเป็นโรคที่พบได้ยากในกระต่ายเช่นกันและมีข้อมูลการศึกษาค่อนข้างจำกัด ซึ่งกรณีศึกษานี้เป็นการพบโรคตับบิดร่วมกับโรคถุงน้ำในไตพร้อมกัน กระต่ายอายุ 2 ปี เพศเมียที่ได้รับการทำหมันแล้ว น้ำหนัก 1.33 กิโลกรัมซึ่งมีค่าคะแนนความสมบูรณ์ของร่างกายที่ 2/5 เข้ารับการรักษาด้วยปัญหาไม่กินอาหาร ซึม และขับถ่ายน้อยลง จากผลการวินิจฉัยด้วยการอัลตราซาวด์พบว่ามีการขยายใหญ่ขึ้นของท่อไตและกรวยไตฝั่งซ้าย รวมทั้งมีถุงน้ำจำนวนมากในไต นอกจากนี้ยังพบลักษณะเนื้อเยื่อที่ไม่สม่ำเสมอกันและไม่มีการไหลเวียนของเลือดที่บริเวณพูคอเดตของตับ (caudate lobe) กระต่ายได้รับการผ่าตัดฉุกเฉินซึ่งประกอบไปด้วยการตัดตับส่วนที่มีการบิดและการตัดไตกับท่อไตฝั่งซ้ายออก จากนั้นจึงได้รับการถ่ายเลือดโดยทันทีหลังผ่าตัดและได้รับการรักษาทางยาเพื่อระงับความเจ็บปวดต่อเนื่องจนกระทั่งกลับมามีความอยากอาหารปกติ ร่าเริง ขับถ่ายปกติและสามารถจำหน่ายสัตว์ป่วยกลับบ้านภายหลังรักษาตัวในโรงพยาบาล อย่างไรก็ตาม การติดตามอาการต่อเนื่องในระยะยาวเป็นสิ่งที่สำคัญเพื่อประเมินภาวะแทรกซ้อนที่อาจเกิดขึ้นได้ต่อไป เช่น ภาวะไตวาย (renal insufficiency) หรือภาวะตับอักเสบ (hepatitis) กรณีศึกษานี้จึงเน้นย้ำความสำคัญและเพิ่มความเข้าใจในการจัดการภาวะที่มีความซับซ้อนในกระต่ายเพื่อผลการรักษาทางคลินิกที่มีประสิทธิภาพยิ่งขึ้นในอนาคต

คำสำคัญ : ภาวะตับบิด โรคถุงน้ำในไต กระต่าย

Introduction

Liver lobe torsion, a rare and potentially fatal condition in rabbits, necessitates diagnostic imaging for confirmation, typically through ultrasound and computerized tomography (CT) scans (Sheen et al., 2022). While the exact cause of liver lobe torsions remains uncertain (Graham et al., 2014), studies in dogs and cats have proposed that congenital absence of supporting ligaments or their laxity, possibly trauma or dilation of other abdominal organs could play a role (Swann and Brown 2001). In rabbits, it is speculated that the caudate lobes have a predisposition to torsion may be due to its narrow attachment at the hilus, serving as a pivot point for rotation (Quesenberry et al., 2021). The Ultrasonographic diagnosis of liver lobe torsion typically reveals heterogeneous liver parenchyma, and the presence of free abdominal fluid. Additionally, characteristic features may include hypoechoic lesions with rounded margins, surrounded by hyperechoic fat. Contrast-enhanced ultrasonography often demonstrates a complete lack of perfusion in the affected liver lobe (Wenger et al., 2009; Stock et al., 2019). CT scans commonly depict liver lobe torsion as enlarged, rounded lesions with hypoattenuating and heterogeneous characteristics, often lacking contrast enhancement. Scant regional peritoneal effusion may accompany these findings. Moreover, contrast enhancement of the affected liver lobe typically registers approximately 50% lower compared to healthy liver tissue (Daggett et al., 2020). Although medical management may suffice in some cases, it had a low survival rate. Surgical intervention is often imperative for optimal outcomes, with liver lobectomy associated with higher survival rates (Ozawa et al., 2022). While the presence of renal cysts in rabbits suggests potential shared molecular pathways with human cystic disorders like Autosomal Dominant Polycystic Kidney Disease (ADPKD) and Autosomal recessive polycystic kidney disease (ARPKD), yet precise mechanisms remain elusive (Maurer et al., 2004), warranting further investigation. This case study documents the unique occurrence of both conditions in a single rabbit, emphasizing the need to devise effective case management strategies for survival. This study aims to contribute valuable insights into the management of these rare concurrent conditions in rabbits, thereby enhancing our understanding and improving clinical outcomes for affected animals.

Patient and methods

On January 27, 2024, A 2-year-old spayed female mini rex rabbit weighted 1.33 kg with body condition score of 2/5 presented at the Animal Space Exotic Pet Hospital with anorexia, depression, and reduced fecal output over the past 24 hours. The rabbit was the sole indoor pet of the owner and had been maintained on a consistent diet without any recent changes in its environment. Physical examination revealed pale mucous membranes, poor perfusion, delayed capillary refill time (>2 seconds), cranial abdominal discomfort, a Rabbit Grimace Scale (RbtGS) score of 2/2, 7% dehydration and normal rectal temperature (38.3 ^{o}C). Subsequently, abdominal radiography, abdominal ultrasonography, and hematological and biochemical tests were conducted.

Results and discussion

The radiographic examination revealed mild gas accumulation in the small intestine and cecum, indicative of ileus grade 1/4 (Weerakhun 2024), with no evidence of other lesions. Ultrasonography demonstrated dilation of the left ureter and left renal pelvis, accompanied by multiple cysts (Figure 2). Additionally, the caudate liver lobe exhibited heterogeneous parenchymal echogenicity, with no

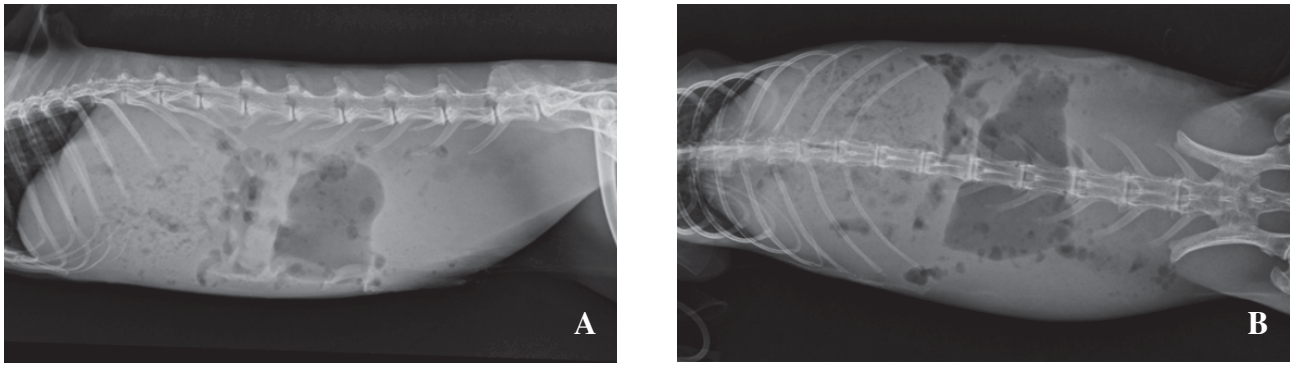


Figure 1. Illustrates mild localized gas accumulation in the small intestine and cecum, with no evidence of other lesions (A; Lateral, B; Ventrodorsal).

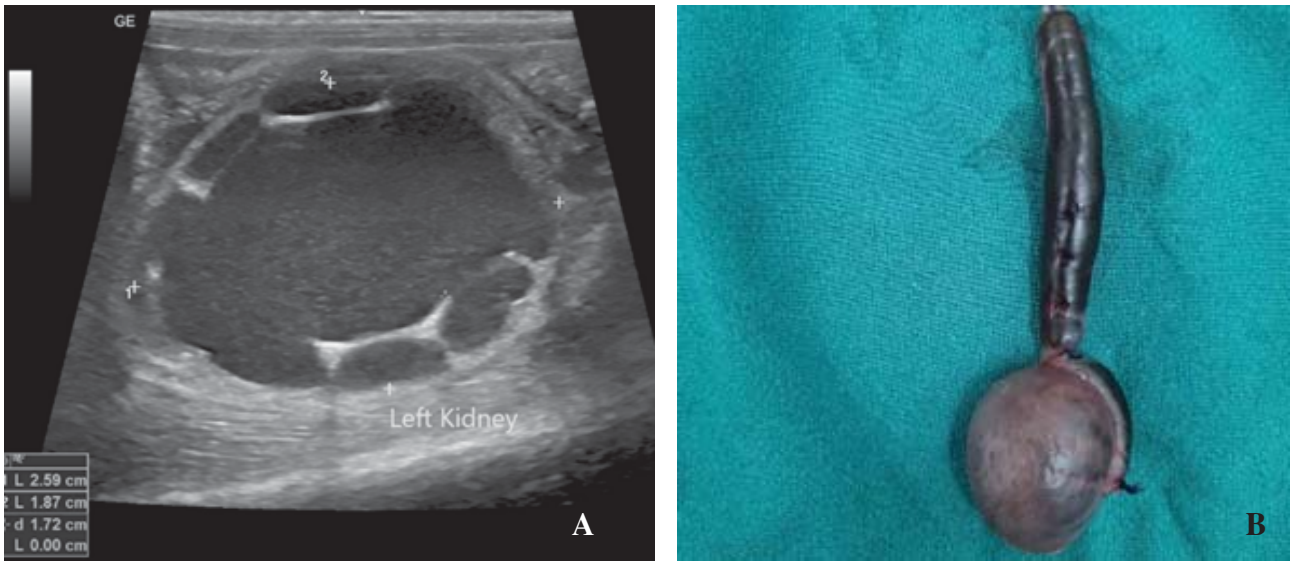


Figure 2. Illustrates Ultrasonography showing dilation of the left renal pelvis, accompanied by multiple cysts (A), along with macroscopic findings of dilation of the left ureter and severe multiple renal cysts (B).

Doppler signal detected within the affected lobe's ultrasound window. Surrounding the affected lobe, free anechoic abdominal fluid was observed (Figure 3). Although creatinine and blood urea nitrogen levels remained within normal ranges (creatinine: 1.6 mg/dL, blood urea nitrogen: 26 mg/dL), there was a marked increase in Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST) (ALT: 483 U/L, AST: 798 U/L). Furthermore, severe anemia was evident, with a hematocrit level of 10.7% as depicted in Table 1 and 2.

Intramuscular morphine (0.5 mg/kg) was administered for premedication, followed by intravenous etomidate (1 mg/kg) for induction, with maintenance using 3 - 5% sevoflurane. Emergency surgery was then performed, commencing with a hepatic lobectomy of the caudate lobe, followed by a left nephroureterectomy. A ventral midline approach was utilized, extending from the xiphoid cartilage to the caudal pair of nipples. Hepatic lobectomy was performed as follows: A ventral midline laparotomy was made from the xiphoid process to the umbilicus. The

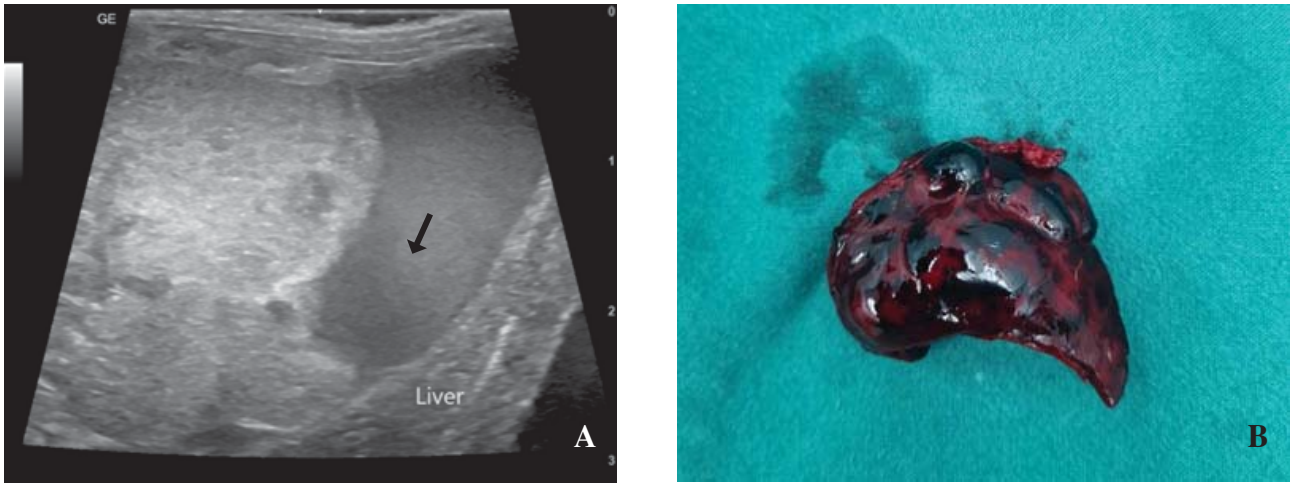


Figure 3. Illustrates Ultrasonography showing heterogeneous parenchymal echogenicity at the caudate liver lobe (A), accompanied by abdominal effusion (arrow), along with macroscopic findings of caudate liver lobe torsion (B).

stomach was mobilized and retracted caudally. The caudate lobe of the liver was palpated using the index finger, followed by dissection and mobilization of the lobe. The caudate lobe vessels were ligated with 3-0 polyglycolic acid sutures, and the caudate lobe was then resected. Nephroureterectomy was carried out with the following steps: The laparotomy incision was extended from the umbilicus to the pelvis. The left renal artery and vein were ligated with 3-0 polyglycolic acid sutures, and the distal left ureter was ligated near the trigone of the urinary bladder. An abdominal swab was obtained for bacterial culture. For closure: The laparotomy was closed using 3-0 polydioxanone sutures in a double suture simple continuous and simple interrupted pattern. Musculofascial closure was achieved with a simple continuous suture. The subcutaneous tissue was closed with a simple continuous suture, followed by subcuticular closure with absorbable subcuticular sutures. Finally, the skin was closed with interrupted 3-0 nylon sutures. The abdominal bleeding of approximately 20 ml was encountered during the procedure, and no abnormalities were noted in other organs. During the procedure, the rabbit received a blood transfusion immediately, as it is generally indicated in rabbits when the PCV decreases below 20% (Nugent-Deal and Palmer 2016). Prior to the blood transfusion, the donor PCV was determined at 40% and the recipient PCV was determined to at 10%. Crossmatching revealed compatibility for both major and minor reactions. Given the acute blood loss in this case, a target PCV of 35% was set. Consequently, 40 ml of blood was collected from the donor and transfused to the recipient. Additionally, no transfusion reactions were observed. No bacterial growth was observed in the abdominal effusion culture 7 days after surgery, while biopsy results confirmed severe necrotic hemorrhagic hepatitis, hepatic lobe torsion syndrome, and severe multiple renal cysts with renal atrophy. Postoperative pain management included Fentanyl-Lidocaine-Ketamine (FLK) constant rate infusion (CRI) initially (Fentanyl: 1 μg/kg/h, Lidocaine: 1 mg/kg/h, Ketamine: 0.5 mg/kg/h), transitioning to Lidocaine CRI alone after 48 hours (dose = 3 mg/kg/h). The Lidocaine CRI was discontinued on January 31, 2024. The rabbit received treatment upon admission to the hospital, including acetate Ringer's solution administered intravenously at a rate of 100 - 150 mL/kg/day for 3 days, Marbofloxacin given

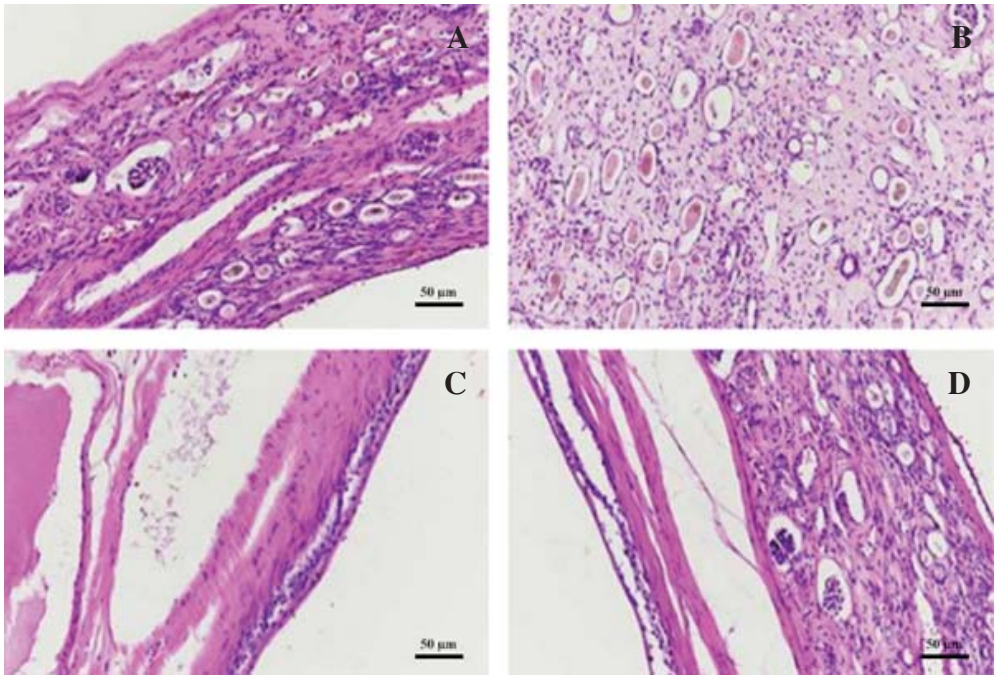


Figure 4. The section of the left kidney with a hydronephrotic and ureter dilatation revealed a multifocal large renal cyst in the cortex, lined by flatted renal tubular epithelial cells and contained clear intraluminal fluid (A, C, D). Renal tissue revealed severe diffuse atrophy of renal parenchyma in both the cortex and medullar layers (A, B, D). Tubular cells showed severe tubular-nephrosis and partial tubular necrosis (B).

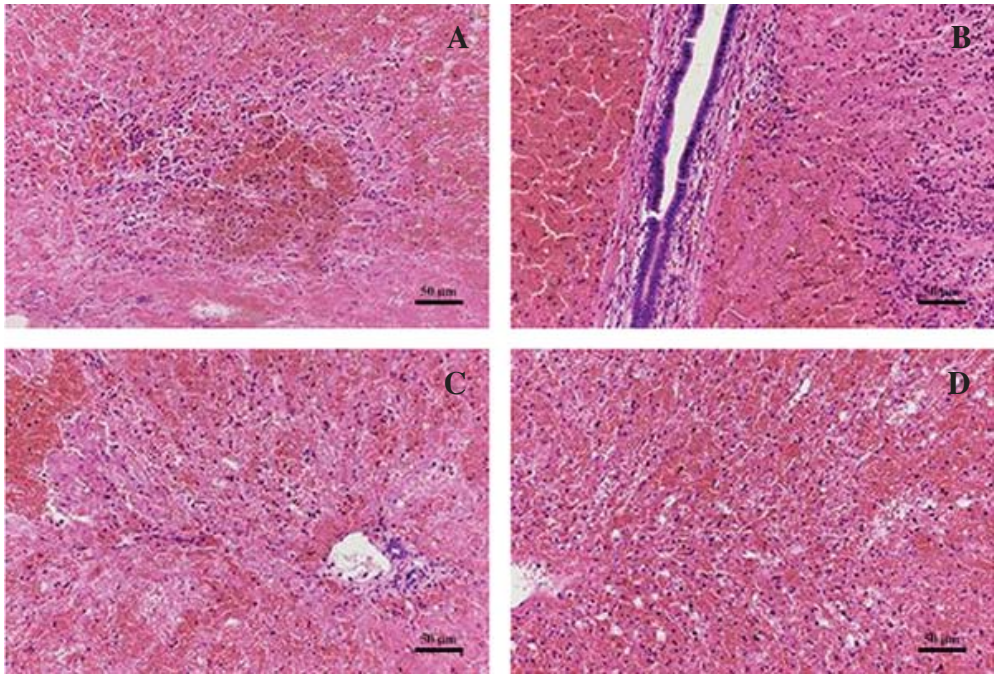


Figure 5. The section of liver revealed dilatation of sinusoids and diffuse irregular arrangement of hepatic cell cords with a severe diffuse accumulation of erythrocytes in sinusoids (A, B, D). Multifocal to coalescing coagulative necrosis was observed (C). Mainly some hepatocytes were necrosis, large round hyperchromatic nuclear walls and contained karyorrhexis and karyolitic nuclei. The remaining hepatocytes showed moderate diffuse hydropic degeneration. The hepatocytes contained cloudy swelling of cytoplasm with round dense nuclei.

Table 1. The complete blood count results from the initial visit on January 27, 2024, and subsequently reassessed postoperatively on January 30, 2024.

Parameter	Value (27/01/2024)	Value (30/01/2024)	Unit	Reference[1]
WBC	2.53	4.59	10^3/μL	3.0-11.5
Monocyte	0.22 (8.86%)	0.04 (0.8%)	10^3/μL	0.0-0.5
Neutrophil	1.75 (69.13%)	3.68 (80.1%)	10^3/μL	0.0-2.8
Lymphocyte	0.55 (21.79%)	0.87 (19.1%)	10^3/μL	2.0-9.1
Eosinophil	0 (0%)	0 (0%)	10^3/μL	0.0-0.5
Basophil	0 (0%)	0 (0%)	10^3/μL	0.0-0.9
RBC	1.77	5.33	10^6/μL	5.0-9.0
Hct	10.7	37.48	%	36.0-50.0
Hb	3.9	8.9	g/dL	12.7-16.3
MCV	60.8	70.0	fL	57.0-70.0
MCH	21.9	16.7	pg	17.5-23.5
MCHC	36.2	23.8	g/dL	30.0-38.0
Platelet	23	411	10^3/μL	218-641

Hct: Hematocrit, Hb: Hemoglobin, MCV: Mean Corpuscular Volume, MCH: Mean cell hemoglobin, MCHC: Mean corpuscular hemoglobin concentration. [1]VETSCAN® HM5 Operator Manual, LBL-03063, Zoetis, Inc.

Table 2. The blood chemistry results from the initial visit on January 27, 2024, and subsequently reassessed postoperatively on February 5, 2024.

Parameter	Value (27/01/2024)	Value (5/02/2024)	Unit	Reference[2]
ALP	43	58	U/L	18-128
ALT	483	85	U/L	20-109
AST	798	52	U/L	10-98
BUN	26.0	28.0	mg/dL	10.0-32.0
Creatinine	1.6	0.9	mg/dL	0.5-1.6

ALP: Alkaline phosphatase, ALT: Alanine transaminase, AST: Aspartate transaminase, BUN: Blood urea nitrogen. [2]VETSCAN® VS2 Operator's Manual, LBL-03064, Zoetis Inc.

orally at a dose of 5 mg/kg every 24 hours for 7 days, Metoclopramide administered orally at a dose of 0.5 mg/kg every 12 hours for 7 days, Cisapride administered orally at a dose of 0.5 mg/kg every 12 hours for 7 days, and Gabapentin administered orally at a dose of 5 mg/kg every 12 hours for 7 days. Additionally, the rabbit was primarily syringe fed Critical Care® Herbivore via forced feeding (10 g/kg, orally, every 6 hours), along with ad libitum access to Timothy hay and drinking water. We monitored feed intake (force-fed), water intake, fecal score, fecal quantity, fecal quality, and pain score at least twice daily. The rabbit was housed in a stainless-steel cage with dimensions of 60 x 60 x 60 cm. Sutures were removed 8 days post-surgery, and subsequent blood chemistry evaluations indicated normalization of all parameters as depicted in Table 2, along with an increase in hematocrit to 37.48% as indicated in Table 2, obtained three days post-surgery on January 30, 2024. With restored appetite, alertness, normal fecal output, and urination, the rabbit was discharged from the hospital on February 5, 2024.

The consequences of liver lobe torsion in rabbits encompass hemorrhage, the release of bacterial toxins, and ischemic by-products, leading to shock, disseminated intravascular coagulopathy, and potentially death. Unfortunately, due to the typically nonspecific signs observed during initial evaluation, there may be a delay in identifying and treating liver lobe torsion in rabbits (Stanke et al., 2011). This study indicates that secondary gastrointestinal problems, manifested by abdominal cramping during physical examination, may warrant consideration of liver lobe torsion as a differential diagnosis. Diagnostic imaging, particularly abdominal ultrasound, revealing markedly elevated serum ALT, AST, or ALP activity, can further support or rule out the diagnosis, as X-rays may not provide conclusive evidence of liver lobe torsion. Early diagnosis and treatment are crucial, as they typically yield better outcomes.

Pignon et al. (2013) emphasize the criticality of prompt surgical intervention within 24 hours of liver lobe torsion in rabbits to prevent acute mortality. Interestingly, Ozawa et al. (2022) found no significant difference in survival rates between medical treatment alone and surgical treatment for liver lobe torsion in rabbits. However, rabbits undergoing liver lobectomy demonstrated a prolonged median survival time compared to those receiving only medical treatment, highlighting the potential benefits of surgical intervention. In this case, the rabbit received both medical and surgical treatment, aligning with the approach advocated by current literatures.

Nephroureterectomy was indicated in this case due to severe hydronephrosis that could not improve with medical management. The affected kidney was non-functional and posed a risk to the overall health of the rabbit, including potential complications such as secondary urinary tract infection, azotemia, and kidney stones (Rhody 2006). Nephroureterectomy was chosen after evaluating the potential benefits of surgery in improving the rabbit's quality of life and overall health outcomes.

While there is limited research on nephrectomy in rabbits, study by Hassan et al. (2012) demonstrated that even in severe cases of polycythemia resulting from nephroblastoma, nephrectomy can be a viable treatment option. Additionally, insights from similar procedures in dogs provide valuable considerations. Duarte et al. (2022) demonstrate that unilateral nephrectomy in dogs with renal disease can lead to long-term survival, with some cases surviving up to 11 years post-surgery. Although complications such as oliguria and organ laceration may arise (Gookin 1996), overall, nephrectomy is well-tolerated and not detrimental to the remaining kidney. However,

long-term renal function post-nephrectomy may vary, warranting monitoring of creatinine and blood urea nitrogen levels as prognostic markers to predict outcomes in similar cases, as well as performing Doppler ultrasound.

Conclusion

This comprehensive approach to diagnosis and surgical intervention successfully managed concurrent liver lobe torsion and severe multiple renal cysts in the rabbit. This underscores the significance of early diagnosis and appropriate therapeutic measures in optimizing clinical outcomes for affected animals. However, long-term management and follow-up are necessary to monitor for complications such as renal insufficiency or hepatitis, especially considering the rabbit's remaining single kidney and five liver lobes.

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