Case Report

Clear Cell Renal Cell Carcinoma in a Dog

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Abstract

A 10-year-old, spayed, female poodle was presented at Prasuarthon Animal Hospital, Faculty of Veterinary Science, Mahidol University for further investigation on abdominal enlargement, anorexia and frequent vomiting for 1 week. Upon an abdominal palpation, a firm abdominal mass was noted in the cranial abdomen. Hematology and blood chemistry values were within normal limits, except elevated symmetric dimethylarginine (SDMA). Ultrasonography reported a large oval shaped mass at the left retroperitoneal area of unknown origin. The computed tomography (CT) result revealed that the left kidney was severely enlarged with an irregular shape. The dog was diagnosed with a renal mass. An exploratory laparotomy and nephrectomy were performed for diagnosis and treatment. The renal mass was submitted for a histopathological examination and was reported to be a clear cell renal cell carcinoma (ccRCC). The patient was clinically healthy and was under follow up for 24 weeks without any sign of metastasis.

Keywords: clear cell renal cell carcinoma, renal carcinoma, dog, histopathology

โรคมะเร็งไตชนิดเคลียร์เซลล์ในสุนัข

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บทคัดย่อ

สุนัขตัวเมีย พันธ์พุดเดิ้ล อายุ 10 ปี ถูกส่งตัวมาที่โรงพยาบาลสัตว์ประศุอาทร มหาวิทยาลัยมหิดลด้วยปัญหาพบช่องท้องขยายใหญ่ อาเจียน และทานอาหารลดลงเป็นระยะเวลา 1 สัปดาห์ การตรวจร่างกายภายนอกบริเวณช่องท้องคลำพบก้อนเนื้อภายในช่องท้องส่วนหน้าขนาดใหญ่ ผลการตรวจเลือดพบค่า symmetric dimethylarginine (SDMA) เพิ่มสูงขึ้น รังสีวินิจฉัยช่องอกไม่พบลักษณะการกระจายตัวของมะเร็งและรังสีวินิจฉัยช่องท้องพบลักษณะก้อนเนื้อขนาดใหญ่ ทำการตรวจช่องท้องด้วยคลื่นเสียงความถี่สูงพบลักษณะก้อนเนื้อบริเวณช่องท้องฝั่งซ้ายใกล้กระเพาะปัสสาวะแต่ไม่สามารถระบุตำแหน่งที่มาได้ จึงได้ทำการใช้เครื่องเอกซเรย์คอมพิวเตอร์พบลักษณะก้อนเนื้อที่ไต ทำการรักษาด้วยวิธีศัลยกรรมและวินิจฉัยทางจุลพยาธิวิทยาพบว่าก้อนเนื้อดังกล่าวเป็นมะเร็งไตชนิดเคลียเซลล์ จากนั้นทำการติดตามอาการเป็นระยะเวลา 24 สัปดาห์พบว่าสุนัขหลังศัลยกรรมแก้ไขสุขภาพดีไม่พบการกระจายตัวของมะเร็งไปสู่อวัยวะอื่นภายในร่างกาย

คำสำคัญ : เนื้องอกที่ไต มะเร็งไตชนิดเคลียร์เซลล์ สุนัข พยาธิวิทยา

Introduction

Renal cell carcinoma (RCC) is the most common canine primary renal tumor, which is accounted for approximately 60% (Meuten and Meuten 2016). Additionally, the incidence of this tumor is 0.5 - 1.5% in dog (Baskin and De Paoli 1977). The tumor typically affects middle aged dogs (mean = 7.1 years, range = 3 - 15 years) (Lucke and Kelly 1976), and it is usually unilateral (Bryan et al., 2006). The gender distribution of RCC has been demonstrated as 1.3-1.8 : 1 in male to female (Bryan et al., 2006). Breed predilection for RCC has been reported in German shepherds, Labrador retrievers, Golden retrievers and Boxers (Edmondson et al., 2015; Meuten and Meuten 2016). Common clinical signs of RCC in dogs are hematuria, palpable abdominal mass and non-specific signs including anorexia, depression and weight loss (Lucke and Kelly 1976; Collicutt et al., 2013).

In dogs with RCC, hematologic abnormalities may be demonstrated including neutrophilic leukocytosis, mild anemia, mild thrombocytopenia and polycythemia associated with an increase of erythropoietin (Meuten and Meuten 2016). Urinalysis may show hematuria, proteinuria, pyuria or inactive sediment in dogs with primary renal tumor (Klausner and Caywood 1995). Urine cytology with Giemsaís staining may demonstrate transitional epithelial cells and large clusters of markedly pleomorphic cells (Birdane et al., 2004). Hepatic enzymes were found to be elevated in 10-25% of dogs due to secondary liver disease (Meuten and Meuten 2016). Only 16% and 19% of the dogs had increased levels of creatinine and urea, respectively, while mild hypoalbuminemia was observed in just 13%; no other specific biochemical abnormalities were identified (Carvalho et al., 2017). Radiography and ultrasonography are effective and accessible for the diagnosis of renal tumors, however, there are limitations for the identification of tumor metastasis by these techniques (Collicutt et al., 2013). To aid in the visualization of renal tumor and tumor metastasis to other structures, computed tomography (CT) is a useful diagnostic tool (Noh et al., 2022). Pulmonary metastasis is reported in dogs with RCC of 16-26.7% (Noh et al., 2022). The common sites of tumor metastasis in dogs are lungs, lymph nodes, bones, skin and liver (Herthel et al., 2011). The histopathological findings of RCC demonstrate a highly cellular nature with numerous cohesive sheets of round to polygonal epithelial cells with ill-defined cytoplasmic borders (Collicutt et al., 2013). The cells are usually closely packed and the cytoplasm is abundant, dense and non-vacuolated (Nielsen et al., 1976). RCC is classified into three types based on histological patterns: solid, papillary, and tubular (Nielsen et al., 1976). Furthermore, this histocytological pattern of RCC can be divided into three subtypes: chromophobic, eosiophillic and clear cell variants (Gil da Costa et al., 2010). Cytologic criteria for clear cell RCC are solid tumors with extensive areas of numerous carcinoma cells, clear, vacuolated cytoplasm and an extensive network of small caliber blood vessels (Edmondson et al., 2015). Canine clear cell RCC is rare in dogs, with only 9% observed compared to 77% in humans (Keegan et al., 2012; Carvalho et al., 2017).

For therapeutic options, nephrectomy may extend survival time in dogs with primary renal tumors (Bryan et al., 2006). Survival time has been reported from 8 to 24 months with a median of 16 months in dogs with RCC after nephrectomy (Meuten and Meuten, 2016). The Fuhrmann grading system, histological subtype and mitotic count (MC) are all prognostic factors for RCC (Avallone et al., 2021). Moreover, the COX-2 immuno-histochemical score (IHS) and the mitotic index (MI) predict individual outcomes (Carvalho et al., 2017).

Adjunctive therapy using tyrosine kinase inhibitors to prolong the survival time of a dog with metastatic RCC after nephrectomy was recently reported (Damian and Di Bella 2022). Only a few case reports on clear cell RCC in dogs have been published in the veterinary medicine literature. The purpose of this case report is to demonstrate the character of the clinical signs, laboratory findings, diagnostic imaging, histopathologic diagnosis and effect of treatment on survival time in a dog with clear cell RCC.

Case description

History

A 10-year-old, spayed, female Poodle dog was presented at Prasuarthon Animal Hospital, Faculty of Veterinary Science, Mahidol University for further investigation on abdominal enlargement. The dog was suspected of having an abdominal mass of unknown origin.

The dog previously had intermittent vomiting and decreased appetite for a week. Antiemetics such as ondansetron and metoclopramide were administered from a private clinic without any improvement. The dog was indoor living and its vaccination status was current.

Physical examination and laboratory findings

For the physical examination, the dog was quiet, alert and responsive. The patient's vital signs were assessed and found to be within normal limits: the heart rate was 108 beats/minute, respiratory rate was 24 breaths/minute, rectal temperature was 101.4 ?F, capillary refill time was normal, cardiothoracic auscultation revealed no abnormal sounds, and the femoral pulse was normal. The mucous membrane was pale-pink. The dog was slightly obese, with a body condition score of 6/9. Upon an abdominal palpation, the dog was uncomfortable and a large abdominal mass was anticipated.

At the first visit to the referral center, laboratory findings including complete blood count (CBC) and biochemistry profile were performed. The CBC showed leukocytosis and mild anemia (Table 1). The biochemical findings revealed elevation of plasma symmetric dimethylarginine (SDMA) concentration with normal blood urea nitrogen (BUN), creatinine (Cr), total protein, albumin, alanine transaminase (ALT) and alkaline phosphatase (ALP) concentrations (Table 1).

Diagnostic imaging

To further assess the abdominal mass and its metastasis, thoracic and abdominal radiography, abdominal ultrasonography and CT scan were performed. Thoracic and abdominal radiographs were taken in 2 views, lateral and ventrodorsal. Thoracic radiographs showed a bronchial lung pattern without evidence of pulmonary metastasis (Figure 1). Abdominal radiographs demonstrated a caudal abdominal mass with ill-defined margins and loss of serosal detail, and loss of peritoneal space (Figure 2). Abdominal ultrasonography revealed a large oval-shaped mass at the left retroperitoneal area with an unknown origin. The mass was approximately 10 x 15 centimeters in dimension and appeared to be the left kidney with heterogeneous parenchyma and irregular contour (Figure 3). No urolith was detected. Other abdominal organs had unremarkable findings. Based on these findings, a presumptive diagnosis of unilateral renal mass was made. Subsequently, thoracic and abdominal CT scans were performed. The thoracic CT scan showed normal lungs and heart. The left kidney was markedly enlarged with irregular shaped and had heterogeneous contrast enhancement. Vessel enhancement was found in the cortico-medullary phase of post contrast. The regional lymph nodes near the left kidney were slightly prominent

Table 1. Hematological report from the first visit.

Parameters	References (Absolute)	D0	Parameters	References	D0
Wbc (/uL)	6000-17,000	25,580	Alb (g/dL)	2.7-3.8	2.9
Monocyte	150-1,530	1,535	Alp (U/L)	23-212	173
Neutrophil	3,000-11,500	19,952	Alt (U/L)	10-100	19
Lymphocyte	1,000-4,800	4,093	Bun (mg/dL)	7-27	23
Eosiophil	100-1,250	0	Crea (mg/dL)	0.5-1.8	1.37
Basiophil	<100	0	Glu (mg/dL)	77-125	84
RBC (10^6/uL)	5-9	5.08	Total prot (g/dL)	5.2-8.2	6.3
HB (g/dL)	10-18	9.6	SDMA (ug/dL)	0-14	19
Hct %	35-55	29.8	Plt (10^3/uL)	200-500	556

Hct: hematocrit, PLT: platelet, RBC: red blood cell, Hb: hemoglobin, BUN: blood urea nitrogen, ALT: alanine aminotransferase, ALP: alkaline phosphatase, SDMA: symmetric dimethylarginine

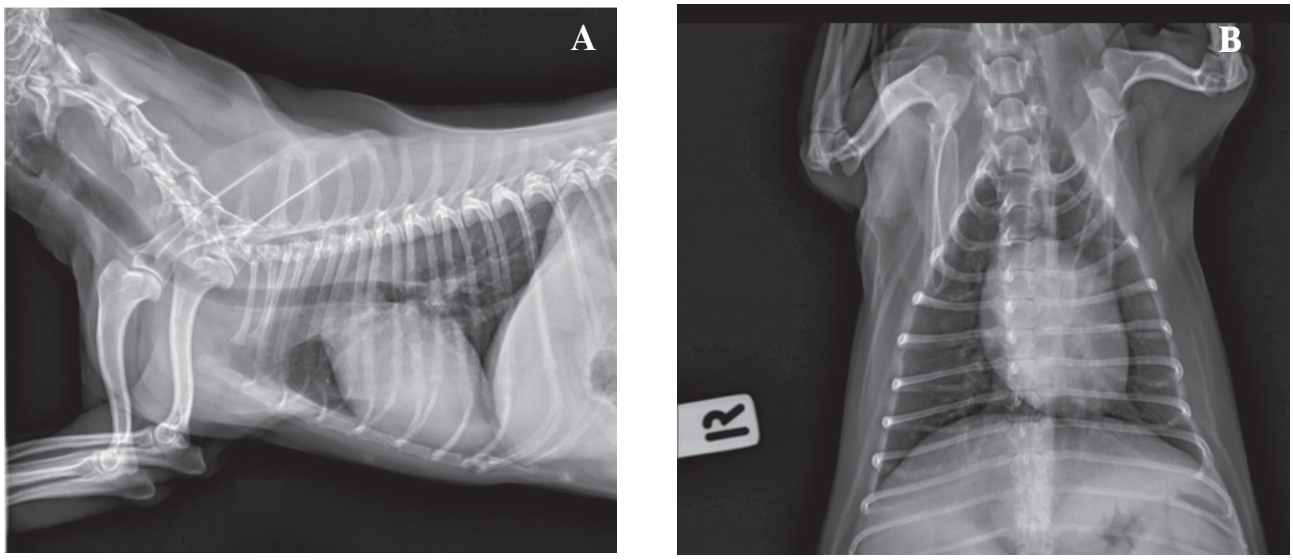

Figure 1. Lateral (A) and ventral-dorsal (B) views of plain thoracic radiographs revealed the absence of pulmonary metastasis at first visit.

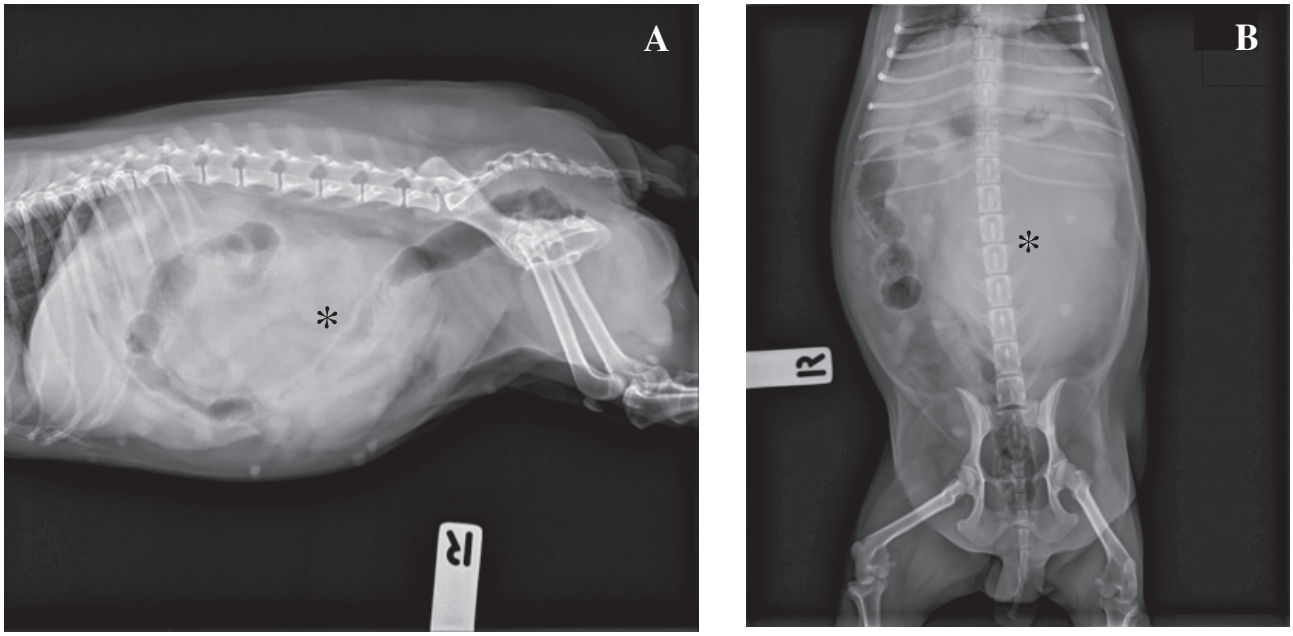

Figure 2. Lateral (A) and ventral-dorsal (B) views of plain abdominal radiographs revealed a soft tissue density mass at the caudal part of the abdomen (asterisk).

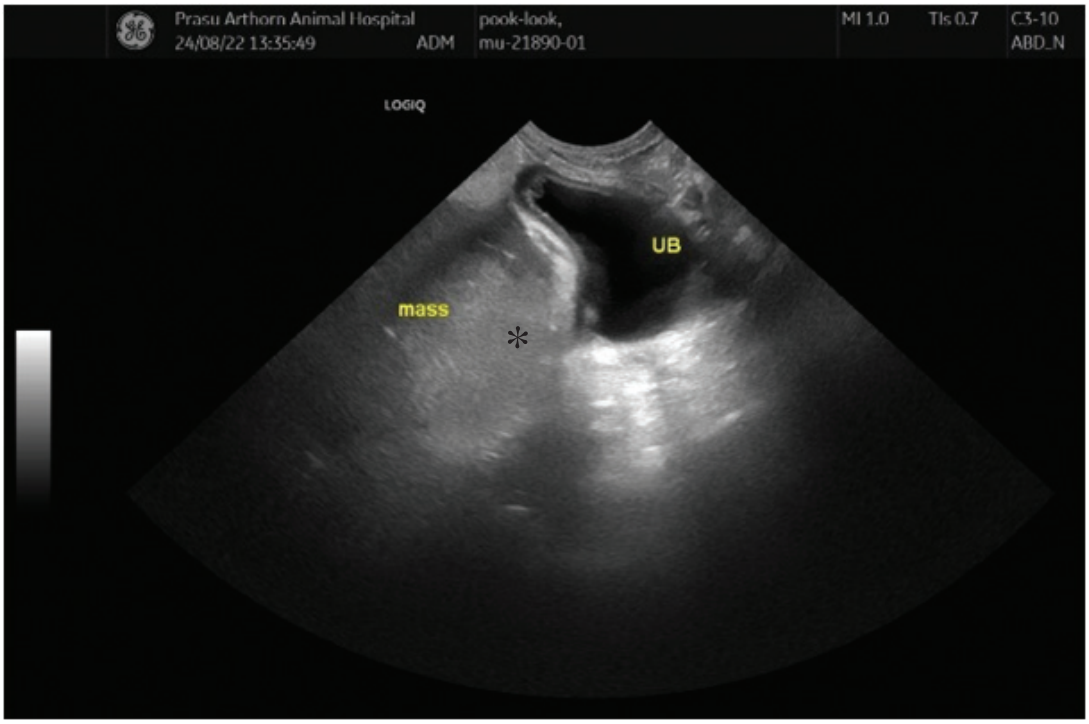

Figure 3. Abdominal ultrasonography showed an unlocated mass (asterisk) which was adjacent to the urinary bladder (UB) (US mode: B-mode, frequency 10 Megahertz, transducer C3 -10).

with inhomogeneous contrast enhancement. Based on these results, the dog was diagnosed as having a left renal mass with regional lymph nodes involvement (Figure 4).

Treatment and monitoring

After the diagnostic imaging, the treatment plan was to implement a surgical removal of renal mass or nephrectomy. Thus, an exploratory laparotomy and unilateral nephrectomy were performed. During the laparotomy, the mass was 15x10 centimeters in dimension, had irregular form with contour, was covered with omentum and was proven to be the left kidney. After the left nephrectomy, the mass was sent for histopathological examination. During visual inspection and palpation, no gross abnormalities were found on the right kidney, liver, gall bladder, intestine and urinary bladder.

After surgery, the dog was hospitalized for 3 days at the intensive care unit for monitoring and post-operative care. During hospitalization, the dog was treated by intravenous fluid, amoxycillin/clavulanic acid (20 mg/kg; Clavamox®, Zoetis Thailand Ltd., Bangkok, Thailand) for 10 days and analgesics. Analgesics included a constant rate infusion (CRI) of fentanyl (4 ug/kg; fentanyl-hameln®, Siam Bioscience Co. Ltd., Nonthaburi, Thailand) for 24 hours, combined with a fentanyl patch (25ug/kg; Sandoz®, Hexal AG, Holzkirchen, Germany) for 48 hours, and robenacoxib (1 mg/kg; Onsior®, Novartis Animal Health US, Inc., Greensboro, NC 27408, USA) for 3 days. A veterinarian monitored the patient's vital signs, including respiratory rate, heart rate, capillary refill time, mucous membrane color and femoral pulse. Blood and urine samples were tested at the first and second days

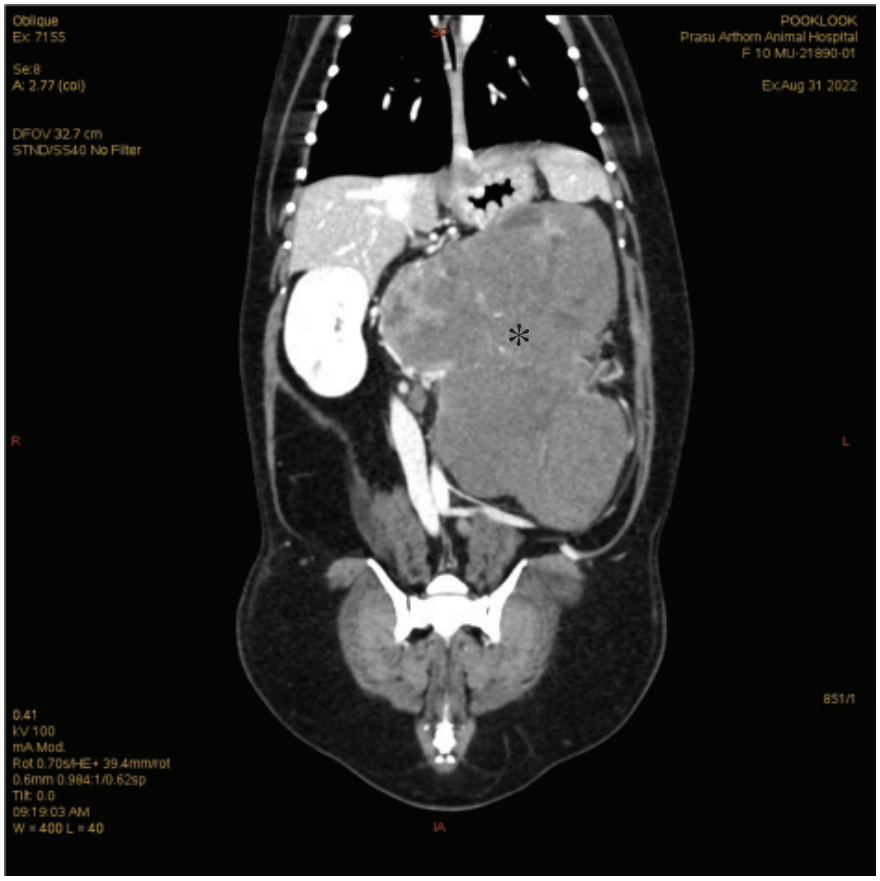

Figure 4. A left renal mass (asterisk) and involved regional lymph node reported from computed tomography.

of hospitalization. The CBC results showed mild anemia and leukocytosis (Table 2). Biochemical profile revealed normal concentrations of plasma creatinine and blood urea nitrogen (BUN) (Table 2). Urinalysis including physical examination, dipstick and sediment analysis were normal (Table 2). Also, the dog had normal urine output (UOP) throughout the hospitalization. After recovering with a normal appetite, the dog was discharged from the hospital and prescribed oral antibiotics and anti-inflammatory medication. Amoxicillin/clavulanic acid (20mg/kg; MOXCLAVET 62.5®, BIC Chemical Co., Ltd. Bangkok, Thailand) for 7 days and robenacoxib (1 mg/kg; Onsior®, Novartis Animal Health US, Inc., Greensboro, NC 27408, USA) for 3 days oral preparation were prescribed for continuation. At the 7-days follow-up after discharge, the dog's vital signs were normal and

Table 2. Hematology and Urinalysis report from post-operative care Days 1, 2, 7 and 120.

Parameters	References (Absolute)	Post-operative Day 1	Post-operative Day 2	Post-operative Day 7	Post-operative Day 120
Wbc (/uL)	6000-7,000	26,340	28,750	17,650	9,070
Monocyte	150-1,530	1,580.4	863.5	529.5	544.2
Neutrophil	3,000-11,500	21,072	23,575	1,3414	6,258.3
Lymphocyte	1,000-4,800	3,688.6	3,450	3,353.5	2,176.8
Eosiophil	100-1,250	0	863.5	353	90.7
Basiophil	<100	0	0	529.5	544.2
RBC (10^6/uL)	5-9	4.64	5.08	5.88	7.14
HB (g/dL)	10-18	8.9	9.6	11.2	14.4
Hct %	35-55	27.4	30.4	35.2	43.1
Plt (10^3/uL)	200-500	532	599	892	396
BUN (mg/dL)	7-27	18	20	26	20
Creatinine (mg/dL)	0.5-1.8	1.24	1.35	1.64	1.83
Glu (mg/dL)	77-125	99	120	122	109
Alb (g/dL)	2.7-3.8	-	-	3.1	3.3
Alp (U/L)	23-212	-	-	745	135
Alt (U/L)	10-100	-	-	144	40
Total protein (g/dL)	5.2-8.2	-	-	7.1	6.9
Urinalysis (Cystocentesis)					
SG	1.015-1.045	1.017	1.015	1015	1030
pH	5.2-6.8	6	6.5	7.5	6.0
Leu	negative	-	-	-	-
NIT	negative	-	-	-	-
PRO	negative	-	1+	1+	-
GLU	normal	-	-	-	-
KET	negative	-	-	-	-
UBG	normal	-	-	-	-
BIL	negative	-	-	-	-
ERY	negative	1+	2+	-	-

Hct: hematocrit, PLT: platelet, RBC: red blood cell, Hb: hemoglobin, BUN: blood urea nitrogen, ALT: alanine aminotransferase, ALP: alkaline phosphatase, SG: specific gravity

there was no evidence of vomiting or hematuria. The blood examination showed thrombocytosis, increased alanine transaminase (ALT), increased alkaline phosphatase (ALP), normal BUN, and normal creatinine concentrations (Table 2). Ultrasonography demonstrated early chronic kidney disease (CKD) from the right kidney, no evidence of peritonitis, and unremarkable other abdominal organs.

At the 120 days of follow-up, the dog was clinically healthy. Blood examination including complete blood count (CBC), blood biochemistry and urinalysis were all within references intervals (Table 2). Thoracic radiographs were performed and showed no pulmonary metastasis (Figure 6). There was no tumor metastasis observed from the ultrasonography.

Histopathological findings

Histopathologic examination confirmed the resected mass as a clear cell renal cell carcinoma. The specimen displayed a cancerous mass with well-demarcated, partially encapsulated, densely cellular appearance. Neoplastic cells were overgrown and compressing the adjacent normal left kidney parenchyma (Figure 5). Those cells were typically arranged in compact nests and sheets with distinct cytoplasmic border. The cells were large, round to polygonal and contained eosinophilic cytoplasm which occasionally displayed multiple small clear vacuoles within the cytoplasm or contained large clear intracytoplasmic vacuoles (Figure 5). The nuclei were irregularly round with finely granular chromatin. There was moderate cellular and nuclear pleomorphism and the rate of mitosis was low. The single cell necrosis and small amounts of multifocally scattered hemorrhages were found throughout the neoplasm. Multifocal aggregates of few lymphocytes, plasma cells and macrophages were observed within the adjacent cortical stroma and mild multifocal interstitial fibrosis was also presented.

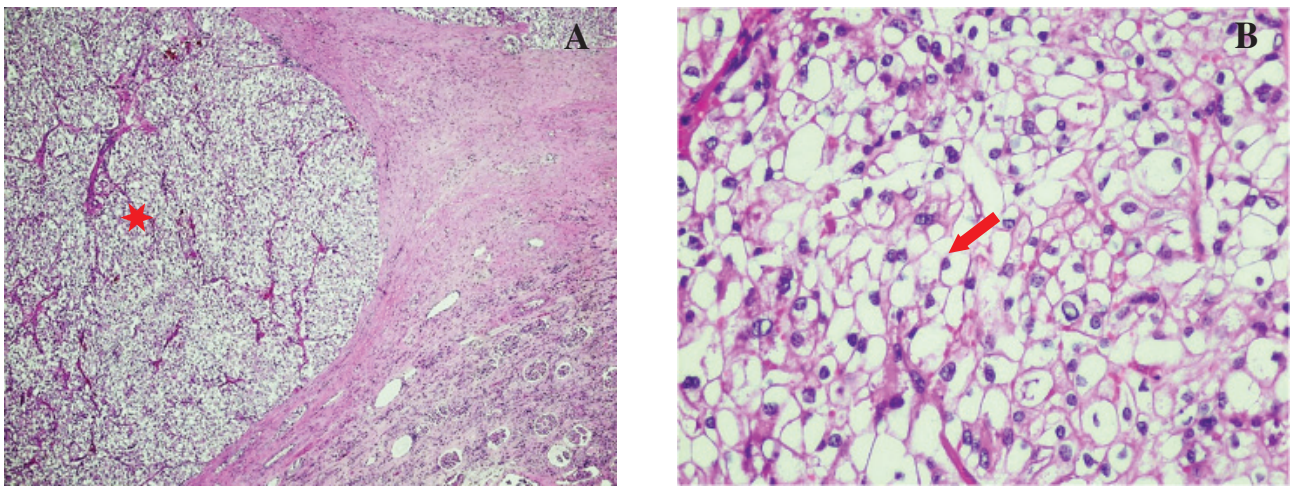

Figure 5. (A) The specimen shows cancer cells with a well-defined, partially encapsulated, tightly cellular appearance (asterisk). Neoplastic cells are hyperproliferative and compress the adjacent normal left renal parenchyma (H&E, 40x). (B) Tumor cells are large, round to polygonal cells with clear intracytoplasmic vacuoles and some neoplastic cells contain small amount of eosinophilic cytoplasm. The nuclei are irregularly round with finely granular chromatin (H&E, 400x) (arrow).

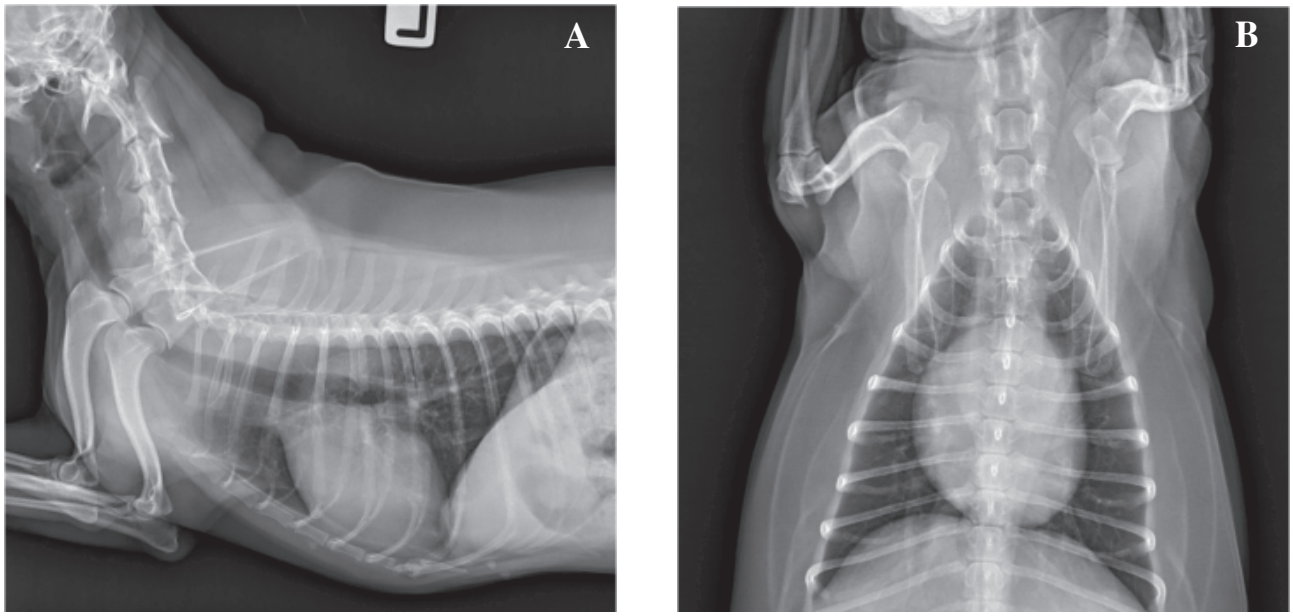

Figure 6. Lateral (A) and ventral-dorsal (B) views of plain thoracic radiograph revealed the absence of pulmonary metastasis at day 120 after nephrectomy.

Discussion

Primary renal tumors including cancers such as RCC, transitional cell carcinoma, sarcoma and nephroblastoma are found in many species such as horses, sheep, dogs and cats (Bryan et al., 2006; Paca and Lazar 2013; Meuten and Meuten 2016). Actually, RCC commonly affects a unilateral kidney. Nevertheless, bilateral involvement is rarely found (Lucke and Kelly 1976). In this case report, unilateral RCC was demonstrated. Breed predilection includes German shepherds and other large sized canine families (Edmondson et al., 2015; Meuten and Meuten 2016). The proportion of male dogs having renal cell carcinoma is higher than females (Gil da Costa et al., 2010), similar to cases reported in humans (Hayes and Fraumeni 1977). Nonetheless, this case report was found in a female Poodle. The age of dogs with RCC in this report was 8 years, in accordance with the age range 3-15 years reported in a previous study (Lucke and Kelly 1976). Dogs with RCC can express clinical signs such as anorexia, weight loss, hematuria and palpable abdominal mass (Birdane et al., 2004) which was also observed in this case report, except without hematuria.

Laboratory findings in RCC hematologic abnormalities include anemia (33%) leukocytosis (20%), lymphopenia (9%), thrombocytopenia (9%), monocytosis (6%) and rarely polycytemia (Bryan et al., 2006). Several paraneoplastic syndromes are found in dogs with primary renal tumor such as mild anemia, mild thrombocytopenia, neutrophilic leukocytosis, and secondary polycythaemia related with increased erythropoietin production by a tumor (Meuten and Meuten 2016). Urinalysis often reveals macroscopic and microscopic hematuria, aiding in the differentiation between urinary inflammation and neoplasia (Wycislo and Piech 2019). Urine sediment cytology often demonstrates large clusters of pleomorphic cells and mitotic figures (Birdane et al., 2004). Nevertheless, urinalysis was unable to be performed in this case during the diagnostic process because the bladder was empty during the examination at the hospital. Several studies have suggested that radiography is imperative for

diagnosis (Meuten and Meuten 2016). Abdominal radiographs often reveal a soft tissue mass with ill-defined margins and a radiopaque silhouette at the caudal part of the abdomen (Lee et al., 2005). Also, ultrasonography helps to verify an abdominal mass; however, it is difficult to differentiate the origin of the mass (Noh et al., 2022). Comparably, the ultrasonography in this case report could not identify the origin of the tumor. Currently, CT scan is very helpful for visualizing RCC and its metastasis (Lee et al., 2011; Tanaka et al., 2019). In this case report, all recommended imaging techniques were performed to precisely locate the location, the origin and the metastasis of the mass.

Renal biopsy in dogs with renal mass is required for a definitive diagnosis and determination of disease severity. The techniques include percutaneous methods with ultrasonographic guidance and biopsy during laparoscopy or surgery (Vaden 2005). Also, fine-needle aspiration from the kidney was suggested as a noninvasive technique to get the samples for cytology (Petterino et al., 2011). Renal cytology is particularly helpful for identifying inflammation, neoplasia, abscesses, infection and metastasis neoplasia (Borjesson 2003). Surgery is the most effective treatment for dogs with unilateral renal neoplasia (Araujo et al., 2021). Thus, unilateral nephrectomy was performed in this case. The renal mass subsequently underwent histopathological examination.

Histopathology for RCC revealed a tubular cell origin containing solid, tubular and papillary patterns (Baskin and De Paoli 1977). One study reported histologic types of RCC which are indicated in dogs as 34 % for solid, papillary 24 % and tubular 4%, but tubular is the most common type in other animals (Meuten and Meuten 2016). Nonetheless, tubular cell type was a result in this study. Clear cell RCC or ccRCC is a type of kidney cancer. In humans, ccRCC is the most common type of kidney cancer, accounting for approximately 80% of all cases of renal cell carcinoma. In contrast, ccRCC in dogs was observed in only 9% of cases (Edmondson et al., 2015). Clear cell RCC arises from the epithelium of the proximal convoluted tubules and exhibits a predominantly expansive growth pattern. Grossly, it is a firm to solid, yellowish lesion with varying degrees of internal necrosis, hemorrhage and cystic degeneration. Such findings are most frequently observed in large, rapidly growing tumors. Histologically, such lesions have clear cells due to their lipid- and glycogen-rich cytoplasmic content. Such tumors often also contain cells with eosinophilic granular cytoplasm (Athanazio et al., 2021).

After nephrectomy, adjunctive therapy such as chemotherapy and anti-inflammatory drugs have been used in dogs with RCC in some case studies, resulting in similar survival time when comparing treatment or no treatment (Watanabe et al., 2008; Carvalho et al., 2017). Cyclooxygenase-2 (COX-2) is an inflammatory enzyme, which plays a role in modulation of neoplastic cell growth (Khan et al., 2001). In addition, the use of target chemotherapy medication of tyrosine kinase inhibitor (Toceranib phosphate) was reported in a dachshund dog to reduce the size of a lung mass from metastasis of RCC and prolong survival time (Damian and Di Bella 2022).

Dogs diagnosed with clear cell RCC had significantly shorter survival times (Edmondson et al., 2015). The survival times for RCC after surgery were reported as 8 ñ 24 months (median 16 months) (Meuten and Meuten 2016). The combination between nephrectomy and chemotherapy with tyrosine kinase inhibitor (Toceranib phosphate) treatment gave a recorded survival time of 36 months (Damian and Di Bella 2022). The survival time of the dog in this case report has already been 6 months thus

far. About 50-70 % of dogs with RCC have tumor metastasis (Meuten and Meuten 2016). Metastatic behavior in RCC is highly spread, and involves a wide range of organs including liver, bone, skin and especially lungs and local lymph nodes (Arai et al., 1991; Herthel et al., 2011). In humans, metastasis of RCC is found in bone as the most common site, which is different from animal species (Padala et al., 2020). Human ccRCCs also have shorter survival times compared to papillary and chromophobe subtypes, and human ccRCC variants more frequently cause metastatic disease (Keegan et al., 2012; Montironi and Cimadamore 2022). No evidence of metastasis has been observed in the dog in this case report after 6 months post operation. During monitoring, RCC dogs that had undergone nephrectomy could develop chronic renal failure, which subsequently led to systemic hypertension and proteinuria (McKiernan et al., 2002). Hence, an angiotensin II receptor blocker such as telmisatan is an additional medication that helps to alleviate systemic hypertension and proteinuria in RCC dogs that had undergone nephrectomy (Kwon et al., 2018). The guideline recommendations for this case are to monitor metastasis, clinical assessment, hematology, blood biochemistry, urinalysis, ultrasonography and chest radiographs at 3 and 6 months (Dobson and Lascelles 2011). After 6 months monitoring, a 6-month to an annual follow up should be continued (Biller et al., 2016). Ideally, CT scan is the most effective tool for close monitoring of metastasis (Noh et al., 2022). In humans, a CT scan every 6 ñ 12 months is very useful for monitoring metastasis and prognosis disease (Kassouf et al., 2009), but its use was limited in this case due to a financial issue.

Conclusion

In this case report, a nephrectomy was effective in treating renal carcinoma, along with supportive treatment to minimize the side effects after the surgery. Monitoring the patient was essential since ccRCC is highly recurrent in nature. Diagnostic imaging such as radiography, ultrasonography and CT scan were used in this patient to monitor for metastasis and blood profile was done regularly for general health condition observation. The limitation of this case was the lack of urinalysis from the first visit, because of having no clinical signs that can lead to urinary tract disorder such as hematuria, pollakiuria and stranguria. However, this might not affect the diagnosis for renal neoplasia. Furthermore, ccRCC in dogs has been reported in only a few publications, making it difficult to compare survival time and laboratory tests. Histopathologic examination of RCC subtypes was limited because of a low number of specialists. Ultimately the dog was given a final diagnosis as ccRCC and nephrectomy was performed. Within 6 months of observation, the dog had recovered well and was clinically improved.

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