

## Successful management of a solitary simple renal cyst in a dog

### *Succesvolle behandeling van een solitaire simpele renale cyste bij een hond*

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## ABSTRACT

**In this report, a dog is described that was referred to the Small Animal Department, Faculty of Veterinary Medicine (Ghent University) for further work-up and treatment of a solitary renal cyst. The cyst was treated successfully with ultrasound-guided drainage and percutaneous sclerotherapy. The dog was followed-up during twenty-four months post procedure with renal sonography. The complaints of intermittent lethargy disappeared after the first treatment. The ultrasonographic appearance of the cyst evolved from a round, anechoic, sharply demarcated lesion to an ill-defined, hyperechoic lesion.**

## SAMENVATTING

In deze casuïstiek wordt een hond beschreven die doorgestuurd werd naar de vakgroep Kleine Huisdieren van de Faculteit Diergeneeskunde (UGent) voor de behandeling en opvolging van een solitaire renale cyste. De cyste werd succesvol behandeld met echografisch begeleide drainage en percutane sclerotherapie. De initiële klachten van intermitterende lethargie verdwenen na de eerste behandeling. De hond werd gedurende vierentwintig maanden verder opgevolgd met renale echografie. Het uitzicht op echografie evolueerde van een ronde, anechogene, goed afgeijnde laesie tot een slecht afgeijnde, hyperechogene laesie.

## INTRODUCTION

Renal cysts are epithelium-lined cavities filled with liquid of various composition (Akinci et al., 2005). Renal cysts can be classified as solitary or multiple, inherited or acquired and simple or complicated. The simple cysts do not contain cells, bacteria or fungi (Zatelli et al., 2007; Nyland et al., 2015). Agut et al. (2008) define simple cysts as cysts not associated with decreased renal function.

In human medicine, simple renal cysts are solitary, unilateral and cortical in 75% of the cases (Waterman, 2014). Pathophysiology is not well-described (Hanna and Dahniya, 1996; Zatelli et al., 2007) and the pathological significance is unclear (Zatelli et al., 2005). Simple renal cysts are mostly clinically silent in humans (Akinci et al., 2005), but they can also be associated with abdominal pain, urinary tract obstruc-

tion and systemic hypertension (Akinci et al., 2005; Zatelli et al., 2005). In human medicine, progression to neoplasia has been described (Naoky et al., 2000).

In veterinary medicine, complaints are abdominal pain, reduced physical activity, anorexia and systemic hypertension, the last being more commonly seen in cats (Zatelli et al., 2007; Agut et al., 2008). Simple renal cysts are typically incidentally detected during an abdominal ultrasonographic examination (Zatelli et al., 2005; Nyland et al., 2015).

In veterinary medicine, ultrasonography is the technique of choice for the diagnosis of cystic lesions (Paskalev, 2012). Simple renal cysts have specific ultrasonographic features of a benign lesion consisting of a well-defined cavity with anechoic content, strong distal acoustic enhancement and sharp demarcation (Nyland et al., 2015). Other differentials for a well-defined cavity with anechoic content, strong distal

acoustic enhancement and sharp demarcation should be considered. Polycystic kidney disease (PKD), seen in Persian cats and Cairn and Bull terriers, cysts seen in familial nephropathy of Shih tzus and Lhasa apsos, hereditary multifocal renal cystadenoma or cystadenocarcinoma, usually seen in German Shepherd dogs, hematoma and abscesses should be on the differential list. The last two usually contain sedimentation and can thus be differentiated from a true cyst by the presence of an echoic content (d'Anjou, 2008; Dennis et al., 2008).

In humans, treatment is necessary when clinical symptoms or urinary tract obstruction are associated with the cyst (Chung et al., 2000; Akinci et al., 2005). Different treatment options have been described but the most frequently and efficiently used method is ultrasound-guided percutaneous sclerotherapy both in human and veterinary medicine (Akinci et al., 2005; Zatelli et al., 2005; Agut et al., 2008). Sclerotherapy is a therapy where a sclerosing solution is injected in a vessel or tissue.

The complication rate of percutaneous sclerotherapy in human medicine is 1.7% (Gelczer et al., 1998), and the most common complication is abdominal bleeding (Lang et al., 1977). Other potential complications both in human and veterinary medicine include rupture or bleeding of the cyst during placement of the needle or leakage of the sclerosing solution, often alcohol, outside of the cyst (Gelczer et al., 1998; Zatelli et al., 2005; Agut et al., 2008).

## CASE DESCRIPTION

### History and physical examination

A ten-year-old, female spayed American Staffordshire terrier was referred to the Small Animal Department of the Faculty of Veterinary Medicine (Ghent University, Belgium) for intermittent lethargy and abdominal discomfort and further evaluation of a

progressively growing renal cyst located at the caudal pole of the left kidney detected by the referring veterinarian during an abdominal ultrasonographic examination. Three months prior to referral, complete blood- and urine analysis were performed (Table 1). Repeated ultrasonographic examinations performed by the referring veterinarian showed gradual enlargement of the cyst (Table 2). Renal diet was initiated. At the time of referral, the patient was asymptomatic and no abnormalities were noted on physical examination.

### Further work-up

Complete blood count and serum biochemistry profile including electrolytes did not reveal significant abnormalities. Measurement of serum symmetric dimethylarginine (SDMA), a new renal biomarker, showed a mildly increased value (Table 1). Complete urinalysis, urinary protein: creatinine ratio (UPC) and bacterial urine culture were performed on urine collected by cystocentesis and revealed no abnormalities (Table 1). Systolic blood pressure, measured with a Doppler technique, according to the American College of Veterinary Internal medicine (ACVIM) consensus statement (Brown et al., 2007) was 140 mmHg. Ultrasonographic examination of the abdomen confirmed the presence of a large, ovoid, well-delineated, thin-walled, anechoic lesion within the caudal pole of the cortex of the left kidney (3.5 cm x 2.7 cm) (Figure 1A). There was a thin hyperechoic line (septum) extending from one side to the other in this cystic structure. The right kidney did not show abnormalities. On the basis of these findings, the diagnosis of a solitary renal cyst was suspected.

### Treatment and follow-up

Percutaneous drainage and alcoholization of the cyst were performed under ultrasound guidance. Before the procedure, coagulation profile (prothrombin time and activated partial thromboplastin time) was

**Table 1. Blood and urine parameters initially and during follow-up. Evolution of serum creatinine, serum symmetric dimethylarginine (SDMA), urine specific gravity (USG) and urinary protein:creatinine ratio (UPC) during several months. T0 being the day of referral to the Faculty, T-3 months the first consultation at the referring veterinarian and T 24 months the last available follow-up at the referring veterinarian.**

	T -3m	T -2m	T 0m	T 1m	T 2m	T 5m	T 8m	T 24m
SDMA-value (0-14 µg/dL)	/	/	17	11	/	/	/	12
Creatinine (Reference: 44-159 µmol/L)	133.5	/	149	144	/	/	/	137
USG (Reference: 1.015-1.045)	1.031	1.012	1.024	1.023	/	/	1.008	/
UPC (Reference: <0.50)	0.06	/	0.05	0.10	/	/	/	/

**Table 2. Ultrasonographic follow-up of the cyst. For legend see Table 1.**

	T -3m	T -2m	T 0d	T 1m	T 2m	T 5m	T 8m	T 24m
<b>Size cyst in cm</b>	3 cm	3.2 cm	3.5 cm x 2.7 cm	2.41 cm x 2.31 cm	1.8 cm	0.99 cm x 0.62 cm	No cyst detectable: ill-defined hyperechoic lesion	No cyst detectable: ill-defined hyperechoic lesion
<b>Size after alcoholization (A) /drainage (D)</b>	/	/	1.1 cm x 0.8 cm (D+A)	No cyst detectable (D)	/	/	/	/

checked and was within normal limits. The dog was premedicated with dexmedetomidine (3 µg/kg, Dexdomitor®) and butorphanol (0.2 mg/kg, Dolorex®). Induction and maintenance of anesthesia were obtained with alfaxalone (2 mg/kg, Alfaxan®). Aseptic preparation of the skin was performed before drainage. The cyst was drained under ultrasound-guided percutaneous approach using a spinal needle (22 gauge) attached to a three-way stopcock with extension set and a syringe. Thirteen milliliters of transparent fluid were successfully aspirated from the renal cyst cavity without complications. Six milliliters of sterile ethanol 95% were then injected into the cyst and re-aspirated after three minutes according to the protocol described by Zatelli et al. (2005). The quantity of ethanol injected, equivalent to one half of the drained liquid, reduces the risk of rupture or bleeding and permits good distension of the cystic wall (Zatelli et al., 2005). After aspiration, a small cavity remained at the level of the cystic area (1.1 cm x 8 mm) (Figure 1B). The aspirated fluid was clear, acellular and low in protein and bacterial culture was negative; hence, the cyst was classified as a simple renal cyst.

At one month follow-up, the dog was asymptomatic and serum creatinine, SDMA, urinalysis and systolic blood pressure (135 mmHg) were re-evaluated (Table 1). Control abdominal ultrasonography revealed a rounded fluid-filled cavity of 2.4 cm x 2.3 cm at the caudal pole of the left kidney. The cavity fluid was slightly more echoic than the initial echogenicity of the cyst and contained a few echoic speckles.

Under general anesthesia with the same protocol as with the first drainage and alcoholization, the left renal fluid-filled cavity was drained a second time as described above and three milliliters of hemorrhagic fluid were aspirated. Alcoholization was not repeated. Cytological examination revealed the presence of a large amount of red blood cells and activated macrophages with phagocytized red blood cells. No bacteria or inflammatory cells were seen at cytological examination and bacterial culture was negative. These findings were consistent with hemorrhage into the cystic cavity. After aspiration, no fluid filled cavity was detectable. At two months post alcoholization, the cyst

showed a diameter of 1.8 cm (Table 2). No medical treatment was instated. Monthly check-ups including abdominal ultrasonography and urinalysis were advised (Table 2). Follow-up renal ultrasonography by the referring veterinarian at eight and twenty-four months after alcoholization did only reveal an ill-defined, hyperechoic lesion and the absence of cystic lesion.

## DISCUSSION

Simple renal cysts are rare in veterinary medicine and pathophysiology has not yet been described. No data exist on the prevalence of renal cysts in veterinary medicine (Zatelli et al., 2002). The overall prevalence in humans is 10.7% of which 17.4% is in the fifth or later decades of life (Chang et al., 2007). In another prevalence survey, 1,700 individuals (11.9% of the total) had at least one renal cyst on sonography. The incidence increases with age and the ratio men:women is 2:1 (Terada et al., 2002; Chang et al., 2007).

Similarly to the majority of human renal cysts (Waterman, 2014), the case reported here consisted of a solitary, unilateral and cortical renal cyst. Simple renal cysts have specific ultrasonographic features. Round or oval lesions, sharply demarcated with an anechoic content, a thin hyperechoic wall and strong distal acoustic enhancement are observed (Nyland et al., 2015). Ultrasonographic appearance of the renal cyst in the patient presented in this report was compatible with all these features.

In the case described here, the content of the cyst was acellular, and bacterial culture was negative; hence, the diagnosis of simple cyst was made, according to the definition proposed by Zatelli et al (2007). On the other hand, according to Agut et al. (2008), simple cysts are not associated with decreased renal function. Despite a creatinine value within reference interval, the renal marker SDMA was increased at initial presentation suggesting a decreased renal function. The glomerular filtration rate (GFR) was not evaluated to assess the renal function more closely.

Direct measurement of GFR is the gold standard for quantitative assessment of kidney function. Due to the need of multiple urine- or blood samples, it is not routinely performed in dogs and cats (Paepe and Daminet, 2013; Pressler, 2013; Relford et al., 2016).

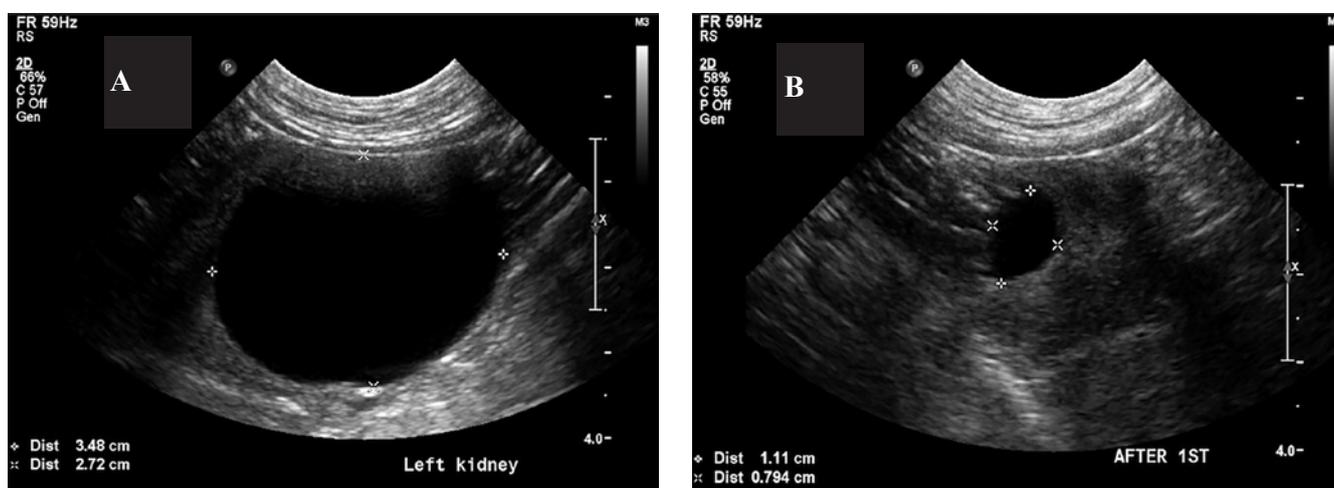
SDMA is a new sensitive and specific renal biomarker. It is a byproduct of protein degradation created by methylation of arginine. This substance is primarily eliminated by renal excretion (>90%) and therefore is a promising renal endogenous marker (Hall et al., 2016). SDMA strongly correlates with GFR, increases before serum creatinine in progressive kidney disease in dogs and is not influenced by muscle mass (Nabity et al., 2015; Hall et al., 2016). SDMA has been shown to increase above reference interval when about 30% of renal function is lost. SDMA has been added preliminary to the International Renal Interest Society guidelines in addition to serum creatinine in staging of early and advanced chronic kidney disease (IRIS guidelines; Relford et al., 2016). Treatment with alcoholization of the renal cyst has led to a decrease of SDMA to a value within reference interval, which shows that sclerotherapy of the cyst improves kidney function. This has not been detected by serum creatinine measurement.

In a retrospective study of Zatelli et al. (2007), ten animals were diagnosed with a renal cyst, and impairment of kidney function was not identified based on normal serum creatinine. Creatinine is the most widely used endogenous biochemical marker of GFR but has many limitations, e.g. it increases only when approximately 75% of nephron mass is lost and is influenced by muscle mass (Nabity et al., 2015; Hokamp and Nabity, 2016; Relford et al., 2016). In a study of Zatelli et al. (2007), SDMA assay was not available in dogs at that time and GFR was not performed. Therefore, a subtle decrease of renal function undetectable by serum creatinine, could have been missed.

Different therapeutic methods of a simple renal

cyst have been described, drainage and sclerotherapy being the mostly used safe and effective procedure in human medicine (Akinci et al., 2004). Before performing sclerotherapy, the clinician must be sure of the diagnosis of a simple renal cyst. Performing sclerotherapy on a cystic structure with a different nature and origin may have serious consequences. Several studies have been performed to evaluate the effectiveness of single versus multiple sclerotherapy sessions for the treatment of simple renal cysts in humans (Hanna and Dahniya, 1996; Chung et al., 2000; Akinci et al., 2004). Single drainage recurrence rate has been reported between 33 and 80% (Hanna and Dahniya, 1996) and thought to be due to continuing fluid production by the epithelial cells lining the cyst (Hanna and Dahniya, 1996; Waterman, 2014). Many authors promote multiple sessions compared to single sessions to decrease recurrence rates (Hanna and Dahniya, 1996; Chung et al., 2000). In a study by Hanna and Dahniya (1996), a success rate of 68% and 100% was obtained with single sclerotherapy session and multiple sessions, respectively. Chung et al. (2000) reported similar success rates, 57% and 95%, respectively for single versus multiple sclerotherapy sessions. Akinci et al. (2004) reported an average cyst volume reduction of 93% at the end of the first year and a complete resolution of the cyst in 17.5% of the cases in patients with one single session of sclerotherapy. The authors of the present case performed only one alcoholization in the patient. As reported in the literature, the authors anticipated to perform two alcoholizations of the cyst. However, the second drainage of the cyst revealed hemorrhagic fluid and a septic lesion could not be excluded. Therefore, a second alcoholization was not performed. Since the nature of the liquid was unknown, it was opted not to perform a second alcoholization but only an aspiration to further investigate the fluid.

However, based on the size reduction of the cyst



**Figure 1A.** Transverse ultrasonographic images of the left kidney. A large ovoid, well-delineated, thin-walled, anechoic lesion is visible within its caudal pole (3.5 cm x 2.7 cm) the day of referral to the Faculty. **B.** Post procedure image. Remaining of a 1.1 cm x 8 mm cystic structure at the caudal pole of the left kidney.

and decrease in serum SDMA measurement, cyst drainage and alcoholization were considered successful. Also twenty-four months post alcoholization, during ultrasonographic examination at the referring veterinarian, only an ill-defined, hyperechoic lesion was detected. The hyperechoic lesion is most likely compatible with scar tissue.

In conclusion, further studies are needed to evaluate the success and recurrence rate of single versus multiple sclerotherapy of renal cysts in veterinary medicine. In this patient, a single sclerotherapy provided complete resolution of the renal cyst and improvement of the renal function. Increased SDMA at initial presentation was compatible with mild decreased renal function that was not detected by serum creatinine.

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