Case Report Medical Imaging

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First case report of urothelial cyst in a dog: diagnostic approach

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ABSTRACT

Importance: Cystic masses in the abdominal cavity near the vaginal area can have a range of origins, including urothelial cysts, which have never been reported in dogs. This paper reports the first known occurrence of a urothelial cyst in a dog.

Case presentation: An 18-year-old, 2.05 kg intact female Maltese dog presented with a mammary nodule with no systemic clinical signs. The radiographs and ultrasound revealed a large cystic mass in the abdominal cavity. Computed tomography imaging showed that the mass was in contact with the bladder, urethra, and vagina but had no direct connections to these organs. Surgical removal was performed. Histopathology analysis confirmed a urothelial cyst lined with transitional and stratified squamous epithelium. **Conclusions and Relevance:** This case highlights the need to include urothelial cysts in a differential diagnosis of cystic masses near the vaginal region in dogs. Early imaging-based detection is crucial to preventing misdiagnoses and ensuring appropriate surgical intervention. Veterinarians must carefully differentiate this condition from other

Keywords: Urothelial cyst; canine cystic mass; transitional epithelium; vaginal region mass; pelvic mass

reproductive disorders, including pyometra and uterine tumors, to avoid complications and

INTRODUCTION

ensure appropriate management.

A cystic mass observed in the abdominal cavity near the vaginal region can have various origins, including epithelial inclusion cysts, Gartner duct cysts, Müllerian cysts, urothelial cysts, mammary-like gland cysts, and cysts of the canal of Nuck [1]. Although Gartner duct cysts have been documented in dogs, the occurrence of other cyst types has gone unreported [2,3]. One such cyst, a urothelial cyst, originates from the periurethral glands and has been studied widely in human medicine, where it provides valuable insights into diagnosis and management [4-6]. Many cases are asymptomatic, but some may present with pain, dyspareunia, dysuria, a distorted voiding stream, or vaginal discharge. The treatment options include aspiration, marsupialization, or excision [7-9]. Despite this, research on this condition in dogs is limited, highlighting the need for further study to understand its clinical

First urothelial cyst in a dog



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Conflict of Interest

The authors declare no conflicts of interest.

presentation and optimal management in veterinary medicine. Nevertheless, early detection is vital to reducing misdiagnoses and improving patient outcomes.

CASE PRESENTATION

An 18-year-old, 2.05 kg intact female Maltese dog presented with a mammary nodule found by the owner. No systemic clinical signs were noted. A physical examination revealed a nodule in the right fifth mammary gland, with no other significant findings. A complete blood count and serum biochemistry tests showed no abnormalities.

Radiographs (HF-525Plus VET, 55 kVp, 100 mA, 3.2 mAs; Eco-ray, Korea) were obtained for screening. Abdominal radiographs revealed an oval-shaped mass measuring $10.0 \times 4.7 \times 4.4$ cm (L × W × H) with homogeneous soft tissue density, occupying a significant portion of the central and caudal abdomen (**Fig. 1A**). The mass caused cranial displacement of the intestines.

An ultrasound examination (Aplio α ; Cannon, Japan) revealed a large cystic mass filled with echogenic fluid (**Fig. 1B**). The cyst was well-defined with a thin, smooth wall, showing no irregularities or thickening. The mass was located near the urinary bladder and vagina, with no clear indication of a direct connection to the surrounding abdominal structures. The



Fig. 1. Radiographic and ultrasonographic imaging features of a urothelial cyst. Right lateral view of a radiograph (A) and ultrasonography image (B). A soft tissue mass (yellow asterisk) occupies the entire abdominal cavity. The mass exerts a mass effect, causing cranial displacement of the intestines (green arrow) and dorsal displacement of the bladder (red asterisk). An ultrasound examination confirmed that the mass is a cyst filled with echogenic fluid (yellow asterisk).



mass showed no internal septations or solid components. A Doppler evaluation showed no significant blood flow within the lesion. The uterus and bladder appeared normal, but the origin of the mass remained undetermined.

A computed tomography (CT) scan (Aquillion; Toshiba, Japan) was conducted under general anesthesia with the patient in sternal recumbency. The scan parameters were 120 kVp, 180 mAs, 512 × 512 matrix, 1 mm slice thickness, 0.75 sec rotation time, and 0.9 collimation beam pitch. Precontrast and postcontrast images were acquired. Postcontrast images were acquired 70 sec after administering iohexol (Omnipaque, 900 mg/kg; GE Healthcare, USA) at a rate of 2 mL/s via a cephalic vein using a power injector (Smart Shot; Nemoto, Japan). The images were reconstructed using a soft tissue algorithm in the transverse, dorsal, and sagittal planes and reviewed in a soft tissue window setting (window width 450, window length 45).

CT imaging revealed a cystic mass with a contrast-enhanced wall, filled with homogeneous, hypoattenuating fluid (30 HU pre- and post-contrast), occupying a large portion of the abdominal cavity and extending from the pelvic region (**Fig. 2A and B**). The cyst wall was smooth and uniform, without irregularities or thickening, and clear contrast enhancement was noted.



Fig. 2. Computed tomographic and intraoperative imaging features of a urothelial cyst. Postcontrast computed tomography images in the sagittal plane (A), dorsal plane (B) using a soft tissue window, and intraoperative image (C). A cystic mass (yellow asterisk) occupied the abdominal and pelvic cavities. The mass was in contact with the urethra (yellow arrow), vagina (red arrow), and bladder (red asterisk), but no direct connection to these structures was identified. Displacement of the adjacent organs caused by the mass was observed. The cystic mass (yellow asterisk) adhered to the bladder (red asterisk). A blunt dissection was successfully performed, revealing no connections between the mass and other structures, including the vagina, urethra, or bladder.



The mass was in contact with the vagina, urethra, bladder, and rectum but with no direct connections to these organs. The uterus, vagina, bladder, ureters, and urethra appeared normal, with displacement caused by the cystic mass. Pyometra and neoplasia were considered less likely because of the diagnostic imaging findings, including the cystic nature, lack of contrast enhancement, and absence of direct invasion into surrounding organs. The tentative diagnosis was a Gartner's cyst, a rare lesion arising from remnants of the Wolffian duct, typically found in the vaginal or pelvic region. Further investigation was conducted to confirm its origin and nature.

Surgery was performed. The intra-abdominal cystic mass was in contact with the bladder, urethra, and vagina (**Fig. 2C**). The cyst was separated carefully from these adjacent structures during a blunt dissection. No direct connections to other organs were identified. Consequently, no ligation was necessary. After removing the cystic mass, the neutering procedure and mammary tumor surgery were completed. Postoperative antibiotics were administered. The patient recovered well, with only a temporary increase in the inflammatory marker C-reactive protein, which rose from 5.1 mg/L to 128.9 mg/L before returning to the baseline within one wk. The complete blood count and serum biochemistry tests showed no abnormalities.

Fluid was aspirated from the cystic mass, revealing a clear, yellow, odourless fluid. Analysis revealed BUN and creatinine concentrations of 27.5 mg/dL and 0.4 mg/dL, respectively, which were similar to blood levels, excluding urine as the source. A cytological examination revealed exfoliated epithelial cells without inflammatory or tumor cells.

A histopathology examination revealed an expanded cystic structure surrounded by connective tissue and smooth muscle (**Fig. 3A**). The cyst was lined with transitional epithelium or stratified squamous epithelium, confirming the diagnosis of a urothelial cyst (**Fig. 3B**).

DISCUSSION

The development of urothelial cysts is not entirely understood in human medicine, but the known causes include congenital factors, ductal obstruction, inflammation, and hormonal imbalances, particularly estrogen [9-11]. Congenital urothelial cysts arise from various embryological elements and vestigial remnants associated with the vagina and female urethra [12]. In this case, a detailed assessment of the estrogen (estradiol) and progesterone levels was not conducted, leaving the precise cause of the urothelial cyst unclear, representing a limitation of this study.

This case is the first report of a urothelial cyst in dogs. Although hormonal factors are one of the causes of cysts, the incidence of such diseases is lower in domestic dogs because they are typically spayed. In addition, although humans tend to seek medical attention because of discomfort, dogs often do not show obvious symptoms, making it difficult for their owners to notice the issue unless the cyst grows beyond a certain size. Consequently, this problem may be underestimated.

The present cyst was initially suspected to be a Gartner's duct cyst because of its anatomical location and lack of connection to other organs. A histological examination of Gartner's duct cysts typically reveals a lining of columnar epithelial cells [13]. In the present case, however, the cyst was lined with transitional or stratified squamous epithelium, leading to the diagnosis of a urothelial cyst [1].





Fig. 3. Histopathologic features of a urothelial cyst. Histopathology examination of the abdominal cyst tissue revealed an enlarged cystic structure surrounded by connective tissue and smooth muscle (A) (H&E, bar = 1,984 μ m). The cystic structure was lined with transitional epithelium or stratified squamous epithelium (B) (H&E, bar = 100 μ m), leading to the diagnosis of a markedly expanded urothelial cyst. H&E, hematoxylin and eosin.

Gartner's duct and urothelial cysts can be distinguished based on their anatomical location, histological differences, and certain ultrasound characteristics. Gartner's duct cysts typically form along the lateral walls of the vagina, arising from remnants of the Wolffian duct, while urothelial cysts develop near the urethra, originating from paraurethral glands. Ultrasound often reveals Gartner's duct cysts as thin-walled, anechoic fluid-filled structures, reflecting their simple, serous content [2]. In contrast, urothelial cysts may present with echogenic fluid because of debris or epithelial shedding [14].

As the cyst size increases, distinguishing between them becomes more challenging because both may be located near the vagina and urethra. Thus, although imaging offers valuable preliminary insights, a histological examination remains essential for a definitive diagnosis.

An enlarged urothelial cyst could cause symptoms, such as dysuria and dyschezia, similar to those caused by a Gartner's duct cyst, owing to its similar anatomical location to a Gartner's duct cyst [2]. In such cases, surgical removal is necessary to alleviate symptoms and prevent complications such as urinary obstruction or constipation.



In human medicine, periurethral cysts are managed through aspiration, marsupialization, or excision, with complete excision considered the gold standard for preventing recurrence [7,8]. Similarly, despite the limited research in dogs, complete excision is likely the most effective approach to prevent recurrence.

A urothelial cyst can be misdiagnosed as pyometra, a uterine tumor, or even a double bladder because of its proximity to the uterus and bladder. Serious rupture can occur if a distended cyst is mistaken for an enlarged bladder and manual expression is attempted. A differential diagnosis using ultrasound or CT imaging is necessary to differentiate between these conditions. In particular, CT imaging can provide detailed anatomical relationships, making it essential for accurate diagnoses. Misdiagnoses can lead to inappropriate treatment and potential complications.

In conclusion, a urothelial cyst should be included in the differential diagnosis when a large cyst is detected in the abdominal cavity near the vaginal region. An accurate diagnosis requires CT imaging combined with a histopathology examination to confirm the nature of the cyst.

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