

## Surgical Correction of a Vesicourachal Diverticulum in a Cat

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**Abstract :** A 4-year-old female Korean short hair cat weighing 6.5 kg presented for evaluation of urinary incontinence and stranguria. On physical examination, stranguria was observed concurrently with urinary bladder distention. Abdominal radiographs revealed two small uroliths in the urinary bladder. Urinary bladder sludge was detected on abdominal ultrasound. Urine analysis indicated hematuria and bacteriuria. The cat was treated with a 4-week course of a combination of antibiotics and urinary bladder irrigation using normal saline; however, response to treatment was minimal. Excretory urography was performed to identify a congenital disorder. A small diverticulum, located to the urinary bladder apex, was identified. A tentative diagnosis of a vesicourachal diverticulum was made. Surgical exploration of the abdomen was performed and a triangular-shaped diverticulum was apparent at the urinary bladder apex. Cystotomy was performed to remove two small uroliths. Partial cystectomy was then performed for diverticulectomy. Approximately 2 cm diameter of a part of the apex was removed. Normal urination was regained 5 days postoperatively. The follow-up was completed by physical examination 2 years after surgery. There was no evidence of stranguria and urinary incontinence.

**Key words :** urinary incontinence, excretory urography, vesicourachal diverticulum, diverticulectomy, cat.

### Introduction

Congenital or acquired diverticulum of the urinary bladder is uncommon abnormality in dogs and cats (1,2). A vesicourachal diverticulum is described as a triangular, circular, or rectangular appendix to the apex of the urinary bladder (4). A vesicourachal diverticulum can attribute to formation of uroliths, urinary incontinence, and chronic or recurrent bacterial cystitis, suggesting that there may be an association between vesicourachal diverticula and urinary track disease (3,6). Diagnosis can be made by positive contrast cystogram (3,5). Treatments include partial cystectomy, removal of uroliths, and medical treatment of urinary track infection (8,9). Although a few case reports of vesicourachal diverticula have been reported in dogs and cats, to the authors' knowledge, there is a lack of information on clinical presentation and treatment (6,7). The purpose of this case report is to describe the clinical presentation and successful surgical management of vesicourachal diverticula in a cat.

### Case

A 4-year-old female Korean short hair cat weighing 6.5 kg presented to the Duckso Animal Hospital for evaluation of

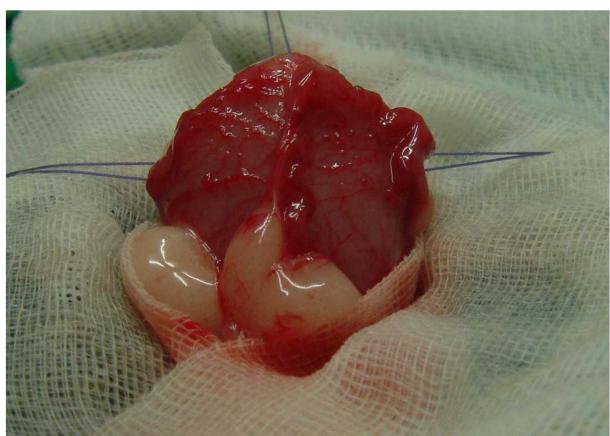
urinary incontinence and stranguria. The owner reported that the cat showed moderate to severe recurrent urinary incontinence for two years. On physical examination, stranguria was observed concurrently with urinary bladder distention. Routine blood examination consisting of hemogram and serum biochemistry was unremarkable. Abdominal radiographs revealed two small uroliths in the urinary bladder. Urinary bladder sludge was detected on abdominal ultrasound. Ultrasound-guided cystocentesis was performed to obtain a urine sample. Urine analysis indicated hematuria and bacteriuria. There was no resistance on urinary catheterization. The cat was treated with a 4-week course of a combination of antibiotics and urinary bladder irrigation using normal saline; however, response to treatment was minimal. Excretory urography was performed using iohexol (iodine 900 mg/kg intravenously; Iobrix® inj, Accuzen, Korea) to identify a congenital disorder. A small diverticulum, located to the urinary bladder apex, was identified (Fig 1). A tentative diagnosis of a vesicourachal diverticulum was made.

The cat was premedicated for surgery with atropine sulfate (0.02 mg/kg subcutaneously; Atropine sulfate inj®, Je Il Pharm. Co., Ltd, Korea), followed by anesthetic induction with propofol (6 mg/kg intravenously; Provive 1%, Myungmoon Pharm. Co., Ltd, Korea). The cat was intubated and anesthesia was maintained with isoflurane (Isoflurane®; Choongwae. Co., Ltd, Korea) and oxygen. Lactated Ringer's solution was administered intravenously at a rate of 10 mL/kg/h until completion

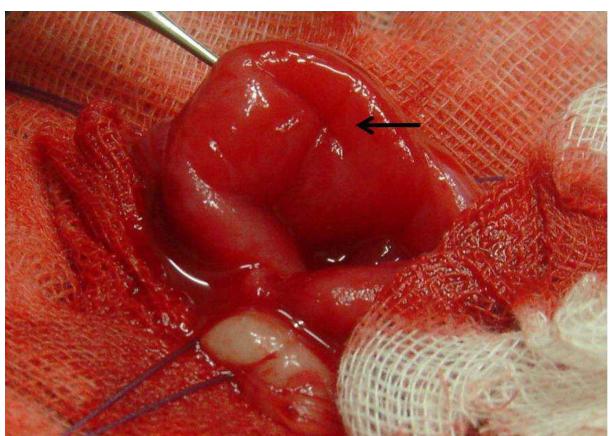
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**Fig 1.** Excretory urography. A small diverticulum, located to the urinary bladder apex, is identified.



**Fig 2.** Intraoperative photograph of diverticulum. A triangular-shaped diverticulum is apparent at the urinary bladder apex.



**Fig 3.** Intraoperative photograph of diverticulectomy. A cross-shaped mucosa fold and a small diverticulum are identified (arrow).

of the surgical procedure. The cat received cefazolin (20 mg/kg intravenously; Safdin®, Daehan Newpharm. Co., Ltd, Korea)

at the time of anesthetic induction. Surgical exploration of the abdomen was performed with the cat in dorsal recumbency. A triangular-shaped diverticulum was apparent at the urinary bladder apex (Fig 2). Cystotomy was performed to remove two small uroliths. The uroliths were submitted for quantitative mineral analysis. The urinary bladder inside was examined and a cross-shaped mucosa fold and a small diverticulum were identified (Fig 3). There was no evidence of a congenital disorder including ectopic ureter and pelvic bladder on urinary system. Partial cystectomy (removal of the urinary bladder apex) was then performed for diverticulectomy. Approximately 2 cm diameter of a part of the apex was removed. The urinary bladder was irrigated with normal saline and closed using a simple continuous pattern and 3-0 polyglyconate (Maxon, Covidien, Mansfield, USA). Abdominal wall, subcutaneous tissue, and skin closure were routine. Chemical analysis revealed the uroliths composed of magnesium ammonium phosphate.

The cat was discharged 3 days after surgery. Owner was instructed to administer cefalexin (20 mg/kg orally twice daily; Cefacin®, Kyongbo. Co., Ltd, Korea) for 14 days and tramadol (3 mg/kg orally twice daily; Tridol®; Yuhan. Co., Ltd, Korea) for 7 days postoperatively. Normal urination was regained 5 days postoperatively. The follow-up was completed by physical examination 2 years after surgery. There was no evidence of stranguria and urinary incontinence.

## Discussion

The urachus is the fetal canal connecting the urinary bladder and the allantois and allows urine to pass from the urinary bladder into the allantoic sac of the placenta (3,4). At birth, the urachus normally becomes obliterated; however, the urachal lumen remains patent occasionally, leaving persistent urachus, urachal cyst, urachal sinus, and vesicourachal diverticulum (2). Cause of congenital condition of incomplete urachal atrophy is unknown (1). Additionally, vesicourachal diverticula are hypothesized to develop secondarily to an increase in intravesicular pressure as a result of inflammation associated with feline lower urinary tract disease (6,8). In human, congenital diverticula of the bladder result from abnormal development of muscular layers and subsequent mucosal herniation (10). Two types including large and solitary diverticula that occur lateral to the ureteral orifice where the bladder mucosa is covered by thin overlying muscle and small multiple diverticula that result from increased intravesicular pressure (10). Acquired diverticula are associated with secondary obstruction to urinary bladder outflow and trauma causing seromuscular tears with herniation of the bladder mucosa (10). In this cat, lack of history of trauma might suggest that the diverticulum was congenital in origin. However, it might be plausible explanation that the diverticulum result from increased intravesicular pressure though the urinary bladder apex covered by thin overlying muscle since the cat has shown stranguria, uroliths, and cystitis for a long time.

Hematuria, stranguria, and cystitis are the characteristic clinical signs of feline lower urinary tract disease (3). Definitive diagnosis of vesicourachal diverticula can be difficult in cats only with clinical signs of feline lower urinary track disease. Additionally, vesicourachal diverticula do not often cause clinical signs in cats younger than one year of age. In this cat, feline lower urinary track disease was diagnosed and treated with a 4-week course of a combination of antibiotics and urinary bladder irrigation using normal saline, followed by minimal response to treatment. Contrast urography was then used for definitive diagnosis of a vesicourachal diverticulum. Diagnosis of vesicourachal diverticula should be based on overall diagnostic tools such as clinical findings, symptomatic therapy, contrast radiography (especially for macroscopic type), and histologic findings (especially for microscopic type).

By appearance, vesicourachal diverticula can be classified as microscopic and macroscopic (1,4). Microscopic type is defined as islands of transitional epithelium of various sizes with a microscopic lumen and macroscopic type are grossly visible on contrast radiographs (4). Macroscopic and microscopic types are most common forms in dogs and cats respectively (1). Macroscopic type is associated with clinical sings but microscopic type is not (1). Therefore, urinary bladder diverticula are clinically significant in dogs since they predispose to chronic or recurrent urinary track infection and urolithiasis by promoting urine stasis and harboring pathogenic bacteria. Although proper treatment with antibiotics and bladder irrigation is provided, urinary track infection and urolithiasis may recur after the treatment is discontinued and until the diverticulum is removed. In cats, however, vesicourachal diverticula may resolve if the underlying cause can be corrected since microscopic vesicourachal diverticula are not usually related with clinical signs. The cat reported here might have microscopic vesicourachal diverticula since no clinical signs were identified under two years of age. However, clinical signs such as stranuria, urinary incontinence, cystitis, and urolithiasis, that might be associated with a macroscopic divercicum, were observed in recent two years. In addition, a diverticulum was grossly identified on contrast radiographs and during surgery. A microscopic diverticulum could develop to a macroscopic type without correction of underlying causes. Cystotomy, antibiotics, and vesiculectomy were performed for removal of uroliths, treatment of cystitis, and correction of underlying disease respectively.

## Conclusion

This case report described the clinical presentation and successful surgical management of a vesicourachal diverticulum in a cat. Based on human cases and findings in this case report, combination of cystotomy, antibiotics, and vesiculectomy is effective treatment for the cat with a macroscopic vesicourachal

diverticulum. A study of large case series with long-term follow-up is warranted to better determine the overall success, appropriate treatment, and complication rate in cats with vesicourachal diverticula.

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## 고양이에서 방광요막관 계실의 외과적 치료 증례

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**요 약 :** 암컷, 4년령, 6.5 kg의 단모종 고양이가 배뇨실금 및 배뇨곤란 증상을 주증으로 내원하였다. 신체 검사에서 방광 팽창을 동반한 배뇨곤란 증상을 확인하였고, 방사선 검사와 초음파 검사에서 2개의 작은 방광 결석과 방광내 슬러지를 각각 확인하였다. 소변 검사에서 혈뇨와 세균뇨를 확인하였다. 식염수를 이용한 방광 세척과 항생제 치료를 4주간 실시하였으나 치료 효과가 미미하였다. 선천적 이상을 확인하기 위해 배설성 요로조영술을 실시하였고, 작은 계실이 방광 앞쪽 끝에서 관찰되었다. 방광요막관 계실이 의심 되어 탐색적 개복술을 실시하였고 삼각형 모양의 계실이 방광 앞쪽 끝에서 확인되었다. 방광 결석 제거를 위해 방광 절개술이 실시되었고 계실 절제를 위해 방광 부분 절제술이 실시되었다. 방광 앞쪽 끝 부분을 지름 약 2 cm 정도 절제하였다. 수술 후 5일 째 정상 배뇨가 가능하였다. 수술 후 정기 검진은 신체 검사를 통해 2년 동안 실시되었으며 배뇨 곤란과 배뇨 실금 증상이 관찰되지 않았다.

**주요어 :** 배뇨 실금, 배설성 요로조영술, 방광요막관 계실, 계실 절제술, 고양이