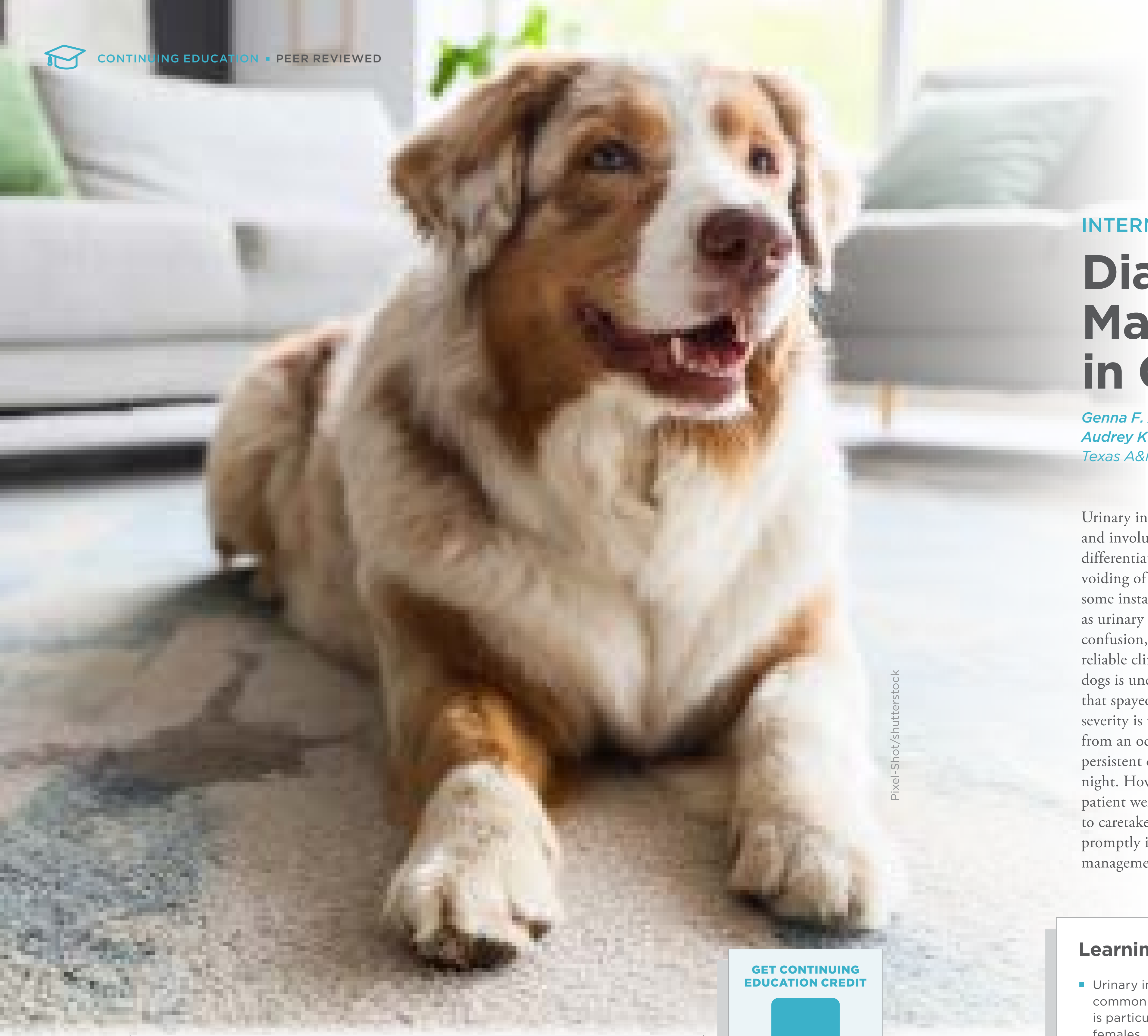

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INTERNAL MEDICINE

Diagnosing and Managing Incontinence in Canine Patients

Genna F. Atiee, DVM, DACVIM (SAIM)
Audrey K. Cook, BVM&S, FRCVS, MSc Vet Ed, DACVIM (SAIM), DECVIM (CA), DABVP (Feline Practice)
Texas A&M University College of Veterinary Medicine and Biomedical Sciences, College Station, Texas

Urinary incontinence (UI), defined as the passive and involuntary leakage of urine, must be differentiated from periuria (the conscious voiding of urine in inappropriate locations).[1] In some instances, complications related to UI such as urinary tract infection (UTI) can cause confusion, and care must be taken to establish a reliable clinical picture. The prevalence of UI in dogs is unclear, although it is well established that spayed female dogs are predisposed.[2-6] The severity is variable, with clinical signs ranging from an occasional damp spot on bedding to persistent dripping throughout the day and night. However, even low-grade UI can impact patient wellbeing and cause substantial distress to caretakers[2,3,7]; it is therefore important to promptly identify the cause and offer appropriate management options.

NORMAL VOIDING

Control of urination is complex and includes a storage phase during which the bladder relaxes as it slowly fills, and a voiding phase in which urine is deliberately released.[1] Considered simplistically, the bladder acts as a reservoir for urine and the urethra functions as a sphincter; normal voiding requires coordinated contraction of the former and relaxation of the latter, and is controlled by both local reflexes and inputs from higher centers. In dogs with UI, these normal processes are disrupted by mechanical or functional disorders.

Differentiating storage disorders from voiding disorders relies on determination of the postvoid residual volume (PVRV; i.e., the amount of urine remaining in the bladder after voluntary

Topic Overview

Urinary incontinence can profoundly impact quality of life for dogs and their caretakers. This article provides an overview of the common causes of urinary incontinence and outlines a logical approach for evaluation and management of dogs with this condition.

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Learning Objectives

- Urinary incontinence (UI) is a common condition in dogs and is particularly prevalent in older females.
- Most dogs with UI have a storage disorder, meaning that urine is not retained appropriately within the urinary bladder.
- Congenital defects such as ectopic ureter are the most common cause of UI in juveniles.
- Selection of an appropriate medical therapy requires differentiation of UI due to a storage disorder from UI due to a voiding disorder.
- Interventions—cystoscopic or surgical—may be necessary for the effective amelioration of some causes of UI.
- Prompt referral for specialized diagnostics or treatments, when indicated, is expected to improve long-term outcomes for affected patients.

urination). This is routinely calculated using 2D ultrasonographic measurements of bladder size (**BOX 1**). A normal PVRV is defined < 1 mL/kg, while a PVRV > 3 mL/kg indicates urine retention; intermediate values are regarded as inconclusive.[1] It can be helpful to determine PVRV immediately after a routine walk with the owner, as (in the authors' experience) the stress of being in the clinic and observed by strangers may inhibit normal voiding behaviors.

STORAGE DISORDERS

Dogs with storage disorders have a PVRV < 1 mL/kg but are unable to retain urine reliably within the urinary bladder. Causes may be divided into non-neurogenic and neurogenic, with the former being most likely (**FIGURE 1**).[1,2,5]

Common non-neurogenic conditions include urethral sphincter mechanism incompetence (USMI) and congenital issues such as ectopic ureter. UTI also falls in this category, although affected dogs often have a concurrent contributory disorder. Less common considerations include pelvic bladder/short urethra, idiopathic detrusor instability, bladder fibrosis, and fistulae (ureterovaginal, urethrovaginal, urethrorectal). Depending on the underlying cause, dogs with non-neurogenic storage disorders may also consciously urinate normal volumes in appropriate locations.

Neurogenic conditions include problems affecting the sacrocaudal spinal cord or cauda equina, such as intervertebral disk herniation, trauma, and neoplasia.[8]

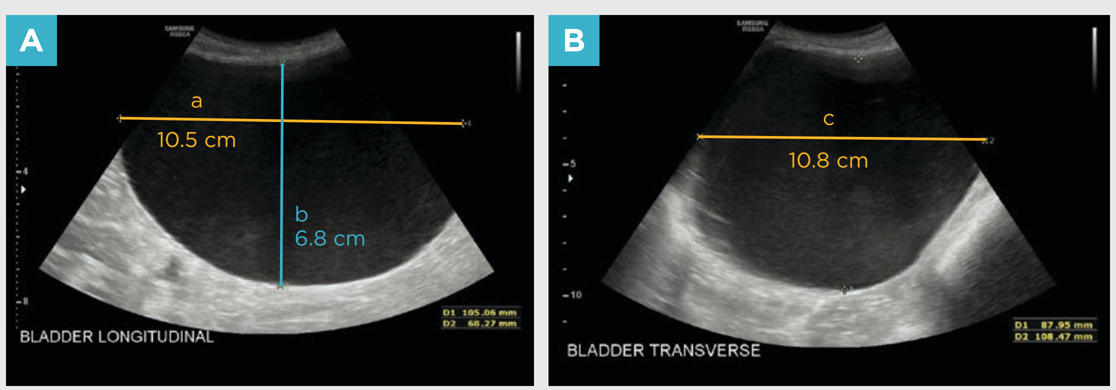
Urethral Sphincter Mechanism Incompetence

Dogs with USMI usually void small urine puddles while resting but are continent when active and engaged. Establishing a diagnosis of USMI requires exclusion of other likely possibilities. However, as this condition is the most common cause of UI in ovariectomized middle-aged female dogs, it is reasonable to make a presumptive diagnosis in these patients and assess the response to therapy (**TABLE 1**) before considering more advanced diagnostics (**CASE EXAMPLE**).

The authors routinely prescribe estriol initially as this is usually well tolerated.[2,9,10] Phenylpropanolamine can be added to the treatment plan if continence is not achieved within 3 to 4 weeks.[11-13] Refractory cases may benefit from cystoscopic urethral bulking; this procedure requires general anesthesia but routinely

BOX 1 **Calculation of Postvoid Residual Volume (PVRV) Using 2D Ultrasonography**

- Postvoid residual volume (PVRV) = Length (a) × height (b) × width (c) × 0.52
- Maximal dimensions (in cm) should be used for each measurement (**FIGURES A AND B**).
- If the bladder is too large to be effectively captured in the image, dimensions can be approximated.
- For the patient shown in **FIGURES A AND B**, the estimated PVRV is 10.5 × 6.8 × 10.8 × 0.52 = 401 mL.
- This patient weighs 26.5 kg (58.4 lb); therefore, PVRV is 15.1 mL/kg.



provides > 9 months of improved continence.[1,14,15] USMI in male dogs should be initially treated with phenylpropanolamine; androgens may be considered if this drug is not adequately effective.[16] A permanent artificial urethral sphincter is an option for both male and female dogs that fail standard therapies. These devices substantially improve continence in most dogs; however, significant complications such as urethral stricture have been reported in up to 30% of patients.[17-19]

Ectopic Ureter

This condition can be unilateral or bilateral and is the primary cause of incontinence in juvenile dogs.[1] Affected animals usually drip urine continuously and often get severe urine scald. The abnormal ureteral opening(s) can be repositioned within the bladder through cystoscopic laser ablation or surgical reimplantation.[20-22] The latter option should be reserved for dogs with extramural ectopia; cystoscopic laser ablation is the superior option for dogs with intramural (tunnelling) ectopic ureters as complications are rare and the recovery time is brief. Unfortunately, some dogs with ectopic ureter remain incontinent after correction; this is often due to a concurrent short urethra and may improve with phenylpropanolamine.[21,22]

Idiopathic Detrusor Instability

This condition—also known as hyperactive bladder—is

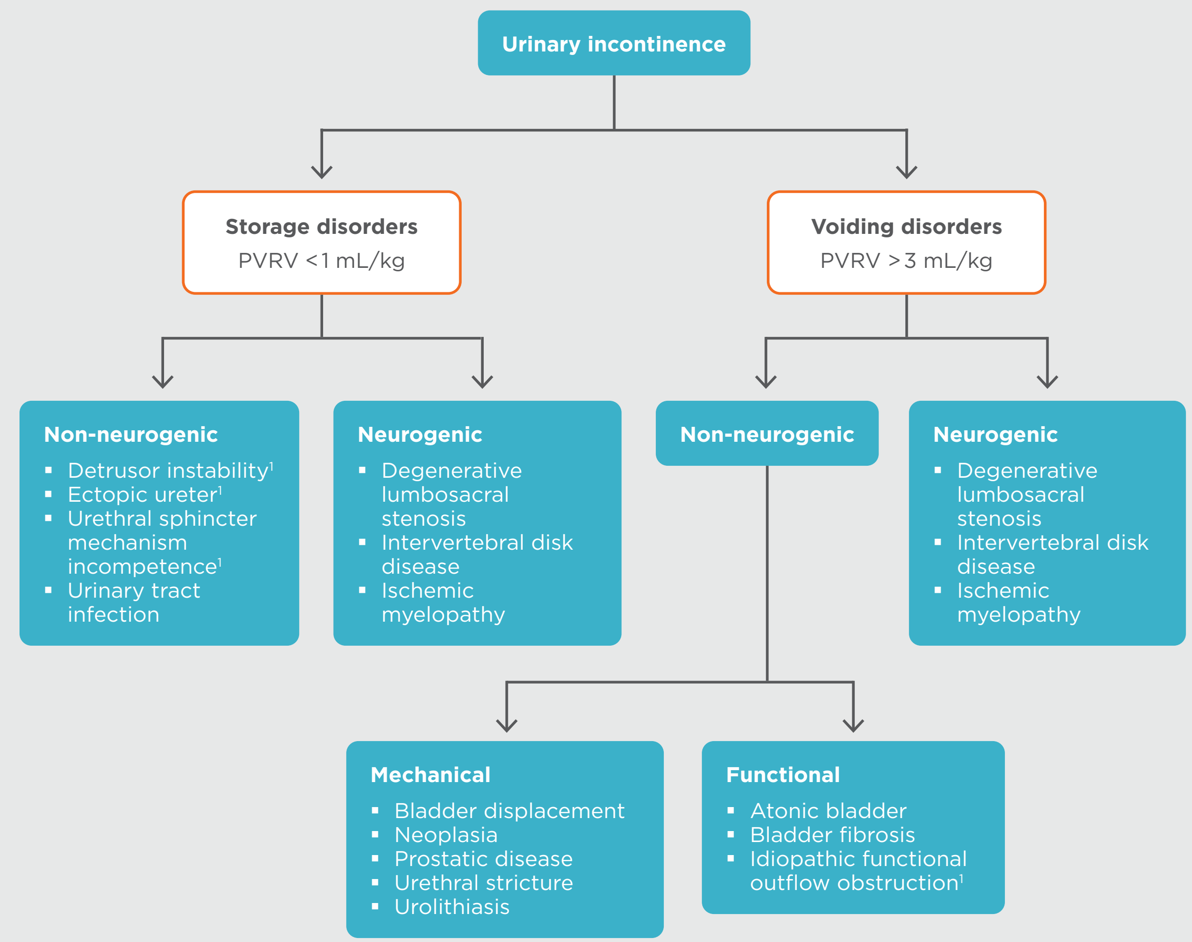


FIGURE 1. Classification model for urinary incontinence, including primary considerations for each category.[1]
PVRV = postvoid residual volume.

TABLE 1 Drugs Routinely Used in the Management of Canine Urinary Incontinence

NAME	DOSE	DRUG CLASS AND MECHANISM OF ACTION	INDICATION	COMMENTS
Acepromazine	0.5–2.2 mg/kg PO q6–8h	Phenothiazine derivative; skeletal muscle relaxant	Functional outflow obstruction	Side effects include sedation and hypotension.
Alprazolam	0.02–0.1 mg/kg PO q12h	Benzodiazepine; skeletal muscle relaxant	Functional outflow obstruction	Schedule IV controlled substance. Side effects include sedation and polyphagia.
Bethanechol	2.5–25 mg/dog PO q8–24h	Muscarinic cholinergic agonist; stimulates detrusor contraction	Detrusor atony	Side effects include salivation and diarrhea.
Dantrolene sodium	0.3–0.9 mg/kg PO q8h	Postsynaptic muscle relaxant; skeletal muscle relaxant	Functional outflow obstruction	Side effects include sedation, weakness, and hepatotoxicity.
Diazepam	0.02–0.25 mg/kg PO q8h	Benzodiazepine; skeletal muscle relaxant	Functional outflow obstruction	Schedule IV controlled substance. Side effects include sedation. Give 30 minutes before walking.
Diethylstilbestrol	0.1–1.0 mg PO q24h × 5 days, then weekly or as needed	Estrogen; increased sphincter responsiveness to norepinephrine, also inhibits gonadotropin-releasing hormone production	USMI (females)	Only (unapproved) compounded products available in the United States. Side effects include mammary and vulval swelling; myelosuppression may occur with incautious dosing.
Estriol	2 mg PO q24h × 14 days, then reduce to 1 mg PO q24	Estrogen; increased sphincter responsiveness to norepinephrine, also inhibits gonadotropin-releasing hormone production	USMI (females)	Some dogs can be maintained on every-other-day dosing. Side effects include mammary and vulval enlargement.
Lorazepam	0.02–0.2 mg/kg PO q8–12h	Benzodiazepine; skeletal muscle relaxant	Functional outflow obstruction	Schedule IV controlled substance. Side effects include sedation and behavioral changes.
Methyltestosterone	0.5 mg/kg PO q24h	Androgen; actual mechanism unclear	USMI (males)	Only (unapproved) compounded products available. Prolonged use is not advisable; patient with a positive response should be transitioned to testosterone cypionate.
Oxybutynin	0.2–0.3 mg/kg PO q8–12h	Antimuscarinic and antispasmodic; reduces frequency of bladder contractions through parasympathetic blockade	Detrusor instability	Side effects include urine retention and hypersalivation.
Phenylpropanolamine	2 mg/kg PO q8–12h or 2-4 mg/kg PO q24h extended-release formulation	α-Adrenergic antagonist; smooth muscle stimulant	USMI	Side effects include hypertension and restlessness.
Phenoxybenzamine	0.5 mg/kg PO q24h or 0.25 mg/kg PO q12h	α-Adrenergic antagonist; smooth muscle stimulant	Functional outflow obstruction	Side effects include hypotension and weakness.
Prazosin	0.5–3 mg PO q8–12h	α-Adrenergic antagonist; smooth muscle stimulant	Functional outflow obstruction	Side effects include hypotension and weakness.
Tamsulosin hydrochloride	0.4–0.8 mg/dog PO q24h	α-Adrenergic antagonist; smooth muscle stimulant	Functional outflow obstruction	Side effects include hypotension and weakness. Dose may be cautiously increased to 3 times a day if necessary.
Testosterone cypionate	2.2 mg/kg IM q4–8 weeks	Androgen; actual mechanism unclear	USMI (males)	Only (unapproved) compounded products available in the United States. Side effects include aggression and prostatic hyperplasia.

USMI = urethral sphincter mechanism incompetence.

characterized by involuntary bladder contractions despite minimal filling; affected dogs exhibit urinary urgency or dribble urine after voiding.[1,3] Definitive diagnosis requires cystometry (see under **IMAGING** below), but it is reasonable to assess the response to drugs (**TABLE 1**) such as oxybutynin, an anticholinergic antispasmodic, if the clinical picture is consistent with this diagnosis and conditions such as UTI or urinary tract neoplasia have been reliably excluded.

VOIDING DISORDERS

Dogs with UI due to a voiding disorder are unable to effectively empty the bladder, and PVRV is > 3 mL/kg.[1] This condition is sometimes referred to as overflow incontinence, as urine leaks out when the storage capacity of the bladder is exceeded; this is routinely noted when the dog is resting. These dogs may attempt to urinate but only pass dribbles or short spurts of urine.[23] In some cases, a small amount of urine may be forcibly ejected from the bladder when deliberate efforts to void are abandoned.

Patients with voiding disorders may again be broadly categorized as having non-neurogenic or neurogenic disorders (**FIGURE 1**).[1] Non-neurogenic issues are subcategorized as mechanical or functional; mechanical causes include urolithiasis, urinary tract neoplasia, urethral stricture, prostatic disease, bladder displacement, and extramural compression. Functional disorders include bladder atony or fibrosis and idiopathic functional outflow obstruction. Common neurogenic causes of voiding disorders include those affecting the T3 to L3 and S1 to S3 spinal regions, such as intravertebral disk herniation, ischemic myelopathy, and degenerative lumbosacral stenosis.[24,25] Prognosis and treatment will depend on the underlying cause.

Bladder Displacement

Conditions such as perineal hernia can compromise urine voiding.[26,27] Affected dogs are usually intact middle-aged males, and concurrent prostatomegaly may play a role. On digital rectal examination, there is often an obvious weakness within the pelvic canal; in severe cases, a bulge may be visible on either side of the anus. Urethral kinking with caudal displacement of the urinary bladder may occur in dogs of any sexual status and can cause severe compromise to micturition.[28] As the affected dog postures to urinate, the bladder moves caudally, and the urethra becomes compressed and occluded. Signs can be intermittent but tend to be more pronounced when the bladder is fully distended. This condition may be diagnosed using contrast cystourethrography and is addressed by surgically securing the cranial aspect of the bladder to the ventrolateral abdominal wall.

Idiopathic Functional Outflow Obstruction

This condition was traditionally referred to as detrusor–urethral dyssynergia or reflex dyssynergia and is due to failure of the bladder to contract and/or failure of the urethra to relax.[1] Affected patients are usually large-breed, middle-aged males, and clinical signs range from a narrowed and erratic urine stream to complete inability to void.[29-31] Signs can wax and wane, and treatment may be delayed if owners fail to grasp the significance of changing urinary patterns. These dogs are particularly prone to secondary bladder atony, as long periods of incomplete emptying slowly stretch the wall and damage the connections between the detrusor fibers.

Treatments focus initially on urethral relaxation (**TABLE 1**), with α-adrenergic blockers such as prazosin, tamsulosin, or phenoxybenzamine. Skeletal muscle relaxants such as dantrolene sodium, acepromazine, or a benzodiazepine may also be useful, particularly in

Case Example: Urinary Incontinence in a 5-Year-Old Dog

History
A 5-year-old female spayed Doberman pinscher presented for additional management of urinary incontinence (UI). The owners reported that they first noticed small (hand-sized) wet spots on the dog's bedding about 4 months earlier. These were initially uncommon, but became an every-other-day or daily occurrence. Leakage only seemed to occur when the dog was resting. There were no other changes in urinary habits, and the dog continued to void appropriately outside 4 to 5 times a day. This dog was spayed at 6 months of age, prior to her first heat, and was otherwise well.

On initial evaluation by her primary care veterinarian approximately 3 months after UI was first noted, the dog's physical examination was unremarkable. A urine sample collected via cystocentesis had a specific gravity of 1.038 and pH of 6.5, with an unremarkable sediment examination. Based on these findings, the dog was presumptively diagnosed with urethral sphincter mechanism incompetence (USMI) and started on extended-release phenylpropanolamine at 2.1 mg/kg PO q24h. The owners noted some improvement in continence after 2 weeks, but still routinely found wet spots on the bedding. Estriol was subsequently started at 2 mg PO q24h for 14 days, then 1 mg PO q24h, but appeared to provide minimal benefit and was subsequently discontinued. The dog was referred to an internist for further evaluation.

Diagnostic Findings
The dog's physical examination was unremarkable. There was no evidence of urine scald or perivulvular dermatitis. Results of a CBC and serum biochemical profile were unremarkable. Transabdominal ultrasonography showed normal kidneys and a midsized urinary bladder. No masses or stones were noted, and both ureteral openings appeared to be within the trigone. The dog was observed to urinate normally when outside and had a postvoid residual volume of 0.4 mL/kg. Findings on routine urinalysis were similar to those reported before, and a quantified urine culture was negative.

The dog was anesthetized a few days later for cystourethroscopy performed with a 2.7-mm 30° rigid pediatric cystoscope with the patient in dorsal recumbency. The vestibule was unremarkable, but a vestibulovaginal septal remnant was noted spanning the vaginal opening and was ablated with a diode laser (**FIGURE A**). The urethral walls were smooth and pink; urethral length was somewhat shorter than expected at 7 cm. The trigone was clearly defined and was easily traversed with the cystoscope. The urinary bladder wall was unremarkable, with no stones or masses. Both ureteral openings were identified and appeared normal.

A urethral bulking agent containing cross-linked porcine gelatin (VetFoam; BioChange, **biochange.life**) was injected at 3 sites within the proximal urethra, approximately 1 cm caudal to the trigone. About 1.3 mL of bulking agent was injected at each site, with the 3 blebs positioned at regular intervals around the circumference of the urethra (**FIGURE B**). The dog was discharged with a 3-day course of carprofen (2 mg/kg PO q12h), and the owner was instructed to discontinue phenylpropanolamine. Four weeks postprocedure, the dog was fully continent and able to void comfortably.

Discussion
This dog's history is very consistent with USMI. This case is likely due to a combination of diminished urethral tone secondary to ovariohysterectomy and a somewhat short urethra. Although many dogs respond well to medical management, some experience side effects or have limited improvement. Urethral bulking agents are excellent options for female dogs with refractory USMI, with response rates greater than 90% reported.[1] Patients should be screened for UTI prior to administration of a bulking agent. As urethral bulking agents are delivered through a rigid scope, this treatment option is not routinely performed in males. However, bulking agents can be injected into the distal urethra with a rigid scope in large males or via a perineal approach in smaller individuals.

Vestibulovaginal septal remnants may be incidental and unrelated to lower urinary tract disease, but they sometimes distort the urethral papilla and have been associated with recurrent urinary tract infection.[2] The authors routinely ablate these during cystoscopic examinations in case they are contributing to clinical problems.

The urethral bulking agent used in this case is expected to slowly dissipate within a year, at which time the incontinence may recur. In some patients, restarting phenylpropanolamine may be sufficient to achieve continence for a few more months. However, owners should be counseled that the procedure will likely need to be repeated for long-term maintenance of continence.

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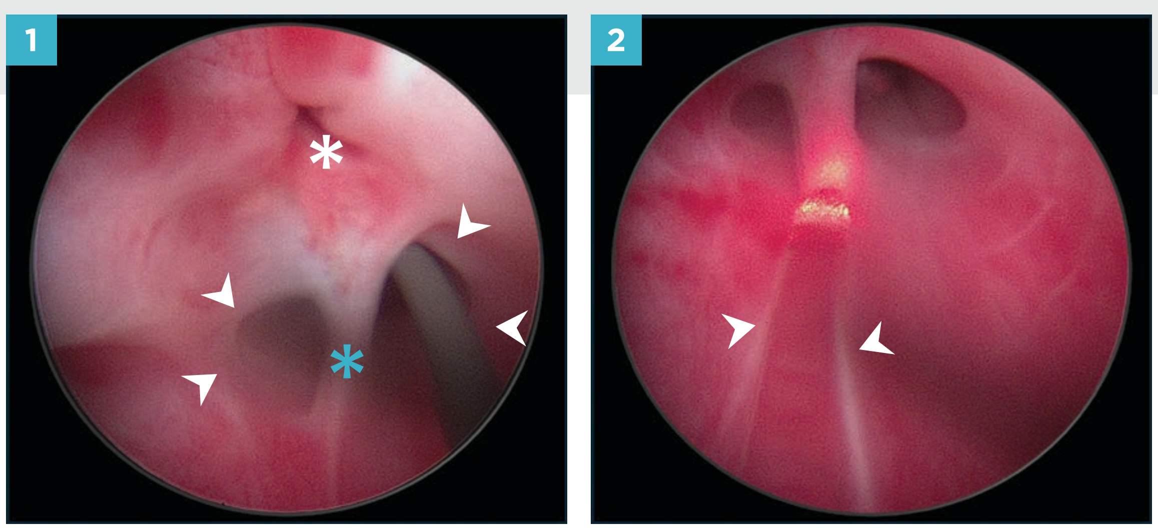

FIGURE A. Cystoscopic images of a 5-year-old spayed female Doberman pinscher with a 4-month history of intermittent urinary incontinence. The dog is in dorsal recumbency for the procedure. **(1)** A vestibulovaginal septal remnant **(blue asterisk)** spans the vaginal opening **(arrowheads)**. A hydrophilic guidewire has been placed through the left side of the vaginal opening to enable the endoscopist to reliably differentiate a septal remnant from a bifid vagina. The urethral papilla is visible near the top of the image **(white asterisk)**. **(2)** A diode laser **(arrowheads)** is used to bisect the vestibulovaginal septal remnant.

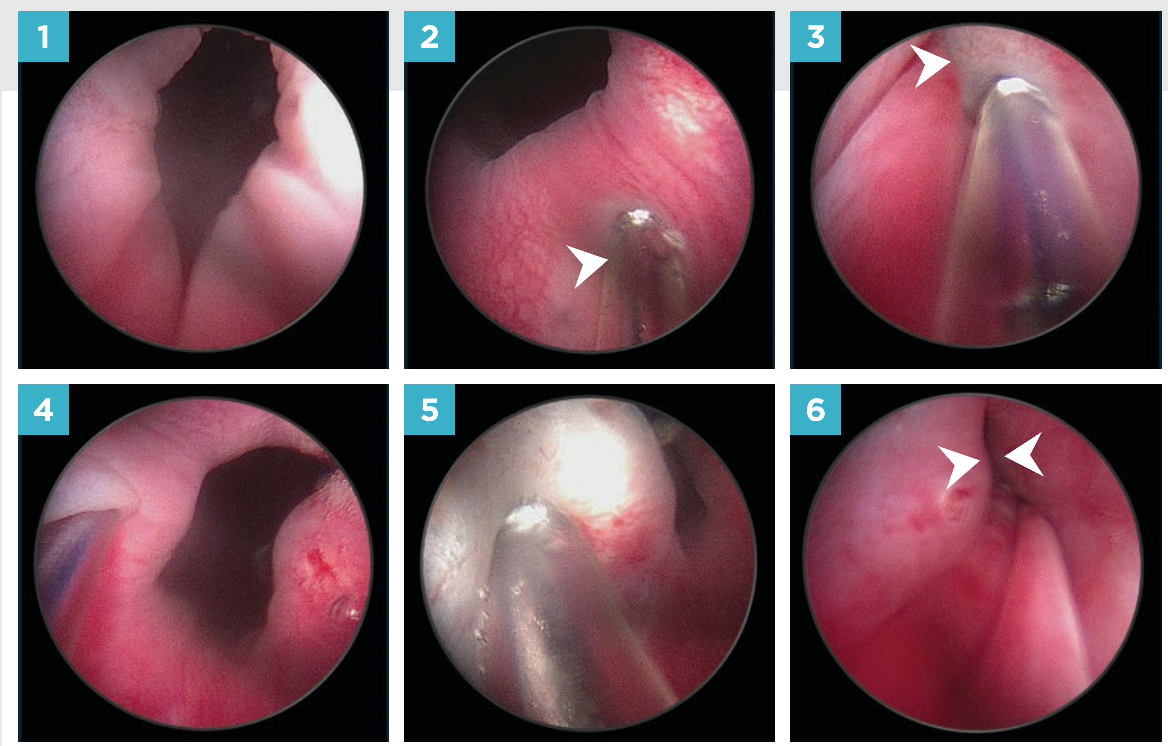

FIGURE B. Cystoscopic images of the same dog as in **FIGURE A. (1)** The transition from proximal urethra to urinary bladder on initial examination. **(2)** A 22-gauge flexible endoscopic needle **(arrowhead)** is positioned against the urethral mucosa approximately 1 cm caudal to the trigone. **(3)** Injection of cross-linked gelatin into the mucosa. A small white bleb **(arrowhead)** is evident. **(4)** The second bleb is injected on the other side of the urethra; a small amount of hemorrhage is noted from the first bleb. **(5)** Large white bleb is evident at the end of the second injection. **(6)** The appearance of the trigone at the end of the procedure; note that the urethral lumen **(arrowheads)** is now essentially occluded by expanded mucosa.

males, as these agents reduce tone in the extensive urethralis muscle.[1] Concurrent detrusor atony may be subsequently addressed with bethanechol; if indicated, the authors introduce this drug 2 to 3 days after starting urethral relaxants.

PATIENT EVALUATION

The first step in the evaluation of a patient with UI is to collect a detailed history, including duration of clinical signs, pattern(s) of incontinence, voiding behaviors, and response(s) to previous therapy. Patient signalment should be considered; UI in puppies is usually due to anatomic defects such as ectopic ureter, whereas UI in older dogs is more likely to be USMI or related to mechanical or functional obstruction.

On physical examination, careful attention should be paid to the appearance of the external genitalia and surrounding skin. Are the tissues inflamed or urine scalded? A digital rectal examination should be performed in all dogs, as abnormalities of the urethra or prostate may be noted. In older intact males, the structural integrity of the pelvic diaphragm should be carefully assessed. Urinary bladder size and tone should be noted, along with any signs of discomfort. A full neurologic examination should also be performed, including assessment of anal tone.

It is also very helpful to observe the dog's behavior during micturition, including ability to effectively posture, and the strength of the urine stream. If necessary, the dog may need to be placed off-leash in a secured area to facilitate voiding. The PVRV should then be established to narrow the list of possible causes of UI.

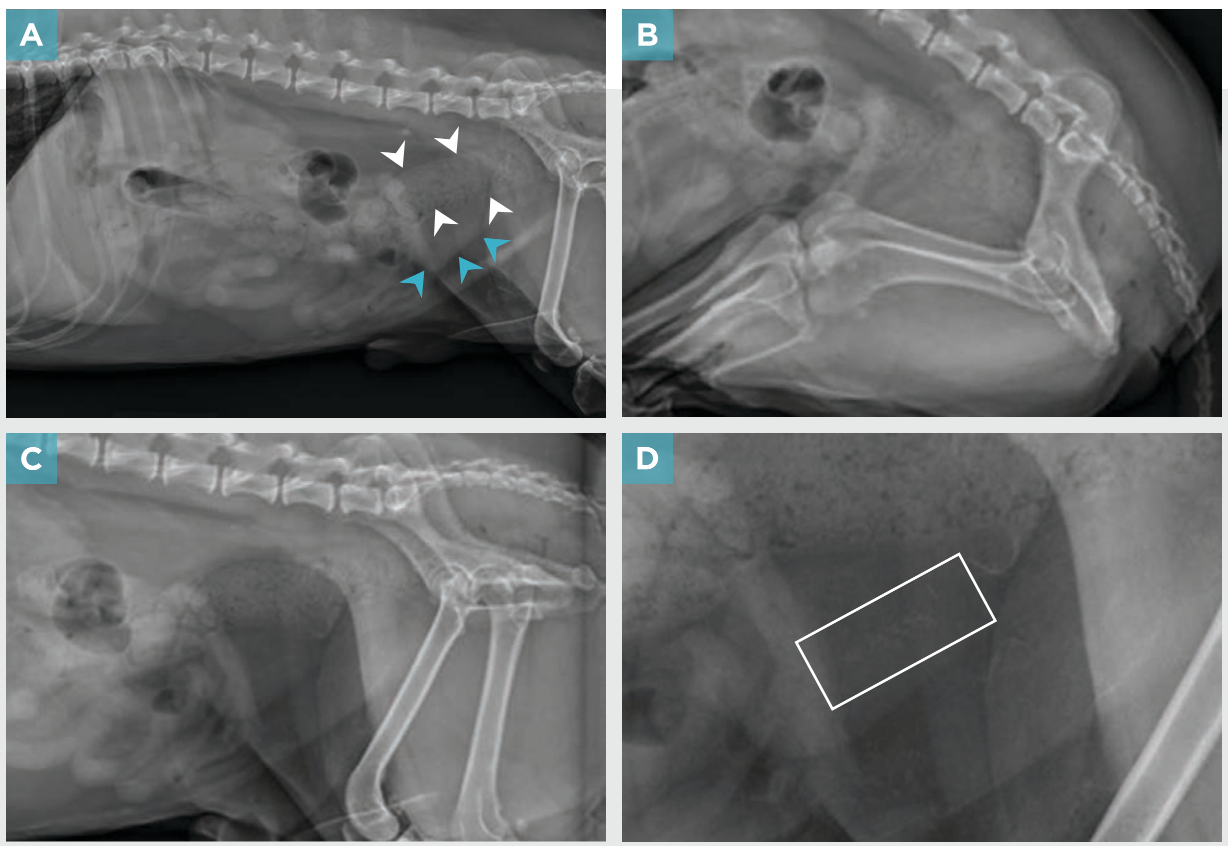

FIGURE 2. Right lateral abdominal radiographs of a 5-year-old bichon frise with a history of intermittent urinary incontinence (UI) attributable to a storage issue and characterized by small puddles voided while at rest. **(A)** Standard lateral abdominal image; the bladder **(blue arrowheads)** is small and is overlain by the colon **(white arrows)**. **(B)** The patient's hind legs have been pulled forward to allow for effective imaging of the prostatic, pelvic, and penile urethra. **(C)** A large plastic spoon is used to compress the urinary bladder and displace the overlying colon dorsally. **(D)** Magnified view of the same image as **C**; more than a dozen tiny cystoliths are now visible **(box)**. These stones were successfully removed with voiding urohydropropulsion and were found to be calcium oxalate. The dog's diet was adjusted to reduce the risk of stone recurrence, and UI was successfully managed with phenylpropanolamine.

Diagnostic Testing

Findings on routine urinalysis should be carefully evaluated. Pyuria and bacteriuria indicate UTI; this is most likely to be secondary to UI rather than the cause, although cystitis can exacerbate leakage or trigger urge incontinence in dogs with mild USMI. A quantified urine culture should be performed if UTI is suspected and results used to guide therapy. Abnormal transitional epithelial cells or evidence of squamous metaplasia suggest obstructive conditions and indicate the need for imaging to evaluate urinary tract and prostatic anatomy. Poorly concentrated urine is not a reason for UI per se, but will certainly affect the magnitude and frequency of leakage.

Results of a CBC and serum biochemical profile should be evaluated. Although these tests are unlikely to provide direct insight into the cause of UI, concurrent issues such chronic kidney disease or endocrinopathy may exacerbate UI by driving polyuria and should be addressed as appropriate.

UI in puppies is usually due to anatomic defects such as ectopic ureter, whereas UI in older dogs is more likely to be USMI or related to mechanical or functional obstruction.

Imaging

Plain abdominal radiographs can provide insight into the size and position of the kidneys, urinary bladder, and prostate (**FIGURE 2A**) and can reliably identify radiopaque uroliths. Readily apparent stones are usually calcium oxalate or magnesium ammonium phosphate (struvite); urate stones may sometimes be noted with high-quality imaging.[32,33] In males, the perineal and penile urethra are best evaluated with the back legs pulled cranially (**FIGURE 2B**). Compressing the bladder with a paddle may facilitate the detection of small cystoliths (**FIGURES 2C AND 2D**).

Transabdominal ultrasonography allows for detailed evaluation of the kidneys, ureters, urinary bladder, proximal urethra, and prostate, as well as routine identification of masses, cysts, stones, and extraluminal compressive lesions. Although ureteral jets may be visualized using color Doppler ultrasonography, this imaging modality may not reliably identify an ectopic ureter and most experts prefer to rely on cystoscopy to establish or refute this diagnosis.[1,34]

Contrast radiographic studies can be performed using standard radiography, fluoroscopy, or computed tomography. As a general rule, patients should be deeply sedated or fully anesthetized for these studies to

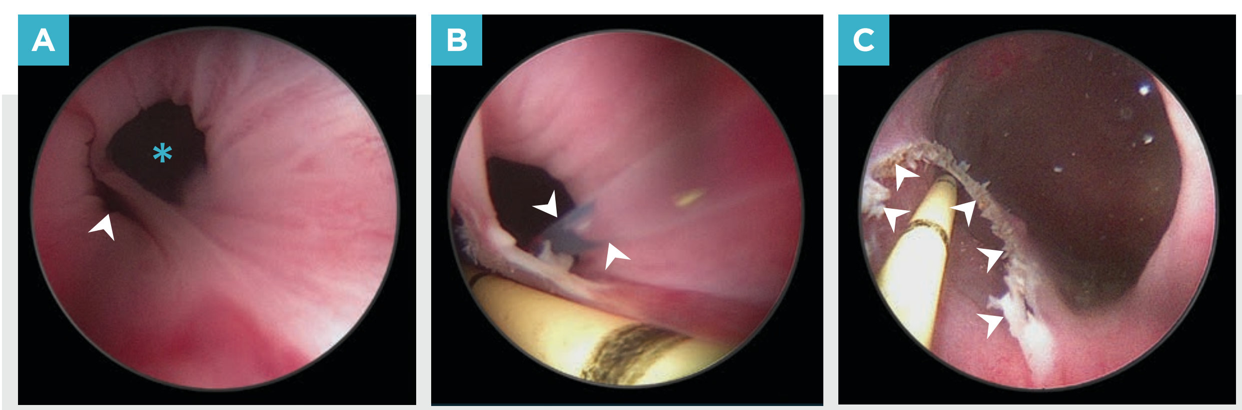

FIGURE 3. Cystoscopic images of a 6-month-old female intact goldendoodle with severe urinary incontinence, characterized by persistent dripping. The dog is in dorsal recumbency for the procedure. **(A)** The opening to an ectopic right ureter **(arrowhead)** is visible within the urethral lumen **(asterisk)**. **(B)** A 5-Fr, yellow, open-ended ureteral catheter has been placed over a hydrophilic guidewire into the ectopic ureter. A diode laser fiber **(arrowheads)** is being used to cut the tissue between the ectopic ureter and the urethral lumen. **(C)** The opening to the right ureter is now within the urinary bladder. The cut edges of the ureter are visible **(arrowheads)**. Urine from the right kidney will now enter the urinary bladder. This dog was completely continent following this procedure.

In males, it is prudent to pass an appropriately sized red-rubber catheter before scheduling cystourethroscopy to be sure that the scope will be able to traverse the distal urethra.

ensure adequate image collection and minimize risk to personnel. The most appropriate modality will depend on the likely causes of UI in a particular patient. Retrograde positive-contrast cystourethrography is often the best choice for patients with signs suggestive of mechanical urethral obstruction; fluoroscopic contrast studies are particularly useful in dogs with fistulae or those with dynamic mechanical obstructions due to caudal displacement of the bladder.[1,28] Computed tomography with intravenous contrast administration allows more detailed evaluation of the anatomy without the hindrance of anatomic superimposition. This modality has superior diagnostic reliability for dogs with ectopic ureter than ultrasonography or traditional retrograde contrast studies but is still less sensitive than cystoscopy.[35]

Cystourethroscopy, direct endoscopic visualization of the urethra and bladder, is highly informative in many instances and is the most reliable way to identify or exclude urolithiasis, stricture, neoplasia, and ureteral ectopia (**FIGURE 3**). General anesthesia is required for cystourethroscopy, and practitioners must be adequately trained. Rigid cystoscopy is routinely performed in females, whereas a flexible scope is required for males. Patient size must be considered, as the urethra must comfortably accommodate the scope. In males, it is prudent to pass an appropriately sized red-rubber catheter before scheduling cystourethroscopy to be sure that the scope will be able to traverse the distal urethra. If necessary, a minimally invasive perineal approach may be used in males to allow access to the pelvic and prostatic urethra with a rigid scope.[36]

Urodynamic studies such as cystometry and urethral pressure profiling are available at some referral centers and can provide specific information regarding lower urinary tract function.[1,37] However, specialized equipment and standardized sedation/anesthesia protocols are necessary, and most clinicians feel that the benefits of performing these studies are limited. Cystometry determines the amount of fluid required to trigger involuntary detrusor contraction and is needed to confirm a diagnosis of detrusor instability or bladder fibrosis.[1] Urethral pressure profiling assesses the tone of the urethra and can confirm USMI.[1]

SUMMARY

It is essential to establish a diagnosis in a dog with UI so that appropriate tests and treatments are provided in a timely manner. Initial differentials are influenced by signalment, history, and urine characteristics and should be combined with determination of PVRV. Referral should be recommended for challenging or refractory cases. TVP

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Genna F. Atiee

Dr. Atiee is a graduate of Texas A&M University and completed an internship and residency in small animal internal medicine at North Carolina State University's College of Veterinary Medicine. She is a diplomate of the American College of Veterinary Internal Medicine and is fellowship-trained in interventional radiology. Dr. Atiee is currently a clinical assistant professor at Texas A&M, with assignments to both the internal medicine and interventional radiology and endoscopy services. Her professional interests include vascular and urinary interventions and the management of chronic kidney disease and urinary tract infections.

Audrey K. Cook

Dr. Cook is a graduate of the University of Edinburgh and completed an internship at North Carolina State University and a residency in small animal internal medicine at the University of California, Davis. She is a diplomate of both the American and European Colleges of Veterinary Internal Medicine and is additionally recognized as a specialist in feline practice by the American Board of Veterinary Practitioners. Dr. Cook is a professor at Texas A&M and is chief of the interventional radiology and endoscopy service. Her professional interests include urolithiasis and chronic kidney disease.

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CE QUIZ QUESTIONS

1. **α-Adrenergic blockers are used to decrease urethral tone and improve emptying in dogs with certain voiding disorders. Which of the following drugs is an α-adrenergic blocker?**
   a. Prazosin
   b. Finasteride
   c. Phenylpropanolamine
   d. Bethanechol

2. **Side effects associated with estrogen administration include:**
   a. Truncal alopecia and pigmentation
   b. Tachycardia and syncope
   c. Hypertension and proteinuria
   d. Vulval swelling and mammary hyperplasia

3. **Side effects associated with administration of phenylpropanolamine include:**
   a. Hypertension
   b. Vulval swelling
   c. Mammary hyperplasia
   d. Somnolence

4. **Urethral bulking agents may be an effective option for dogs with incontinence due to:**
   a. Urethral carcinoma
   b. Unilateral ureteral ectopia
   c. Urethral sphincter mechanism incompetence
   d. Functional urethral obstruction

5. **Dogs with functional urethral obstruction routinely present with which of the following clinical signs?**
   a. A narrowed and erratic urine stream
   b. Frequent attempts to urinate despite an essentially empty bladder
   c. Constant dribbling of urine
   d. Persistent dribbling of urine and involuntary voiding of fecal material