Workup of the Urinary Incontinent Dog

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ABSTRACT

Workup of the incontinent dog should include tests and procedures to identify the type of incontinence present and its exact cause(s). Some causes are more likely to occur in certain groups of dogs (e.g., ectopic ureter in purebred female puppies, urethral sphincter mechanism incompetence in medium to large purebred females of any age, prostate disease in older, intact, larger breed males). A complete history can help differentiate true incontinence from abnormal urinary patterns. Physical examination findings are likely to be normal in dogs with functional or congenital disorders and abnormal in dogs with incontinence due to acquired disorders. Laboratory evaluation should include measurement of serum urea nitrogen and creatinine concentrations, urine specific gravity, and urinalysis and bacterial culture on cystocentesis-collected urine. Diagnostic imaging (i.e., survey abdominal radiographs, contrast radiographic studies, ultrasonography) is vital in the workup of incontinent dogs. Urodynamic studies and endoscopy can be useful, although the latter must be performed with care to prevent trauma to the urethra and bladder. Patient management of dogs with urethral sphincter mechanism incompetence and ectopic ureters, the two most common causes of urinary incontinence in dogs, is discussed.

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Urinary incontinence is defined as the loss of voluntary control of micturition. The causes can be divided into functional and anatomical disorders[1] (Table 1), but for diagnostic purposes it is often easier to divide them into congenital and acquired disorders[2] (Table 2). Workup of the incontinent dog should include tests and procedures that will help to define the type of incontinence that is present and its exact cause. It is important to remember that, in any given dog, more than one cause may be present. For example, about 50% of dogs with ectopic ureters have urethral sphincter mechanism incompetence (USMI) contributing to their incontinence problem.

PATIENT WORKUP[1,2]

Signalment

It is important to know the age, breed, and sex of the dog as these will help to determine whether the incontinence is more likely to be due to a congenital or an acquired disorder. It is also important to know which of the causes of incontinence are more likely to occur in which groups of dogs, for example:

- purebred female puppies—ectopic ureter
- medium to large purebred females, any age—USMI
- older, intact, larger breed males—prostate disease.

TABLE 1
Functional versus anatomical causes of urinary incontinence

Cause	*Disorder*
Functional	*Neurogenic* Lower motor neuron disorders Upper motor neuron disorders Detrusor urethral dyssynergia *Non-neurogenic* Urethral sphincter mechanism incompetence Urge incontinence Detrusor atony from overdistension Paradoxical incontinence
Anatomical	Ectopic ureter Patent urachus Bladder hypoplasia Intersexuality Uretero- or vesicovaginal fistula Bladder/urethral neoplasia Prostatic disease

TABLE 2
Congenital versus acquired causes of urinary incontinence

Cause	*Disorder*
Congenital	Ectopic ureter Urethral sphincter mechanism incompetence Patent urachus Bladder hypoplasia Intersexuality Congenital neurological abnormalities
Acquired	Urethral sphincter mechanism incompetence Prostatic disease Bladder/urethral neoplasia Uretero- or vesicovaginal fistula Detrusor dysfunction Urge incontinence Paradoxical incontinence Acquired neurological abnormalities

TABLE 3
Clinical features of common causes of urinary incontinence in the dog [1]

Disorder	*Historical findings*	*Physical findings*
Lower motor neuron disorders—lesions involving sacral spinal cord segments or pelvic nerves	Continuous dribbling of urine	Distended, easily expressed bladder Loss of perineal and bulbospongiosus reflexes
Upper motor neuron disorders—lesions involving spinal cord above sacral segments	Inability to urinate Loss of voluntary control	Distended, turgid bladder that is difficult to express Paresis/paralysis
Detrusor-urethral dyssynergia: ■ lesions of reticulospinal tract ■ lesions cranial to or involving caudal mesenteric ganglion	Initiation of urination with abrupt cessation Strangury	Distended, non-expressible bladder No obstruction to catheterization
Urethral sphincter mechanism incompetence (cause?)	Normal voiding Incontinence when resting or stressed	No physical abnormalities
Urge incontinence: ■ cystitis/urethritis ■ bladder/urethral neoplasia	Pollakiuria, strangury Inappropriate urination habits	Small bladder
Detrusor atony from overdistension: ■ due to outflow obstruction (prostatic disease, neoplasia, urolithiasis, stricture) Functional compromise of detrusor muscle (may be permanent change)	Strangury, dysuria Constant urine dribbling	Distended, flaccid bladder Large residual volume Intact perineal and bulbospongiosus reflexes No detrusor reflex
Paradoxical incontinence ■ partial urethral obstruction (urolithiasis, prostatic disease, neoplasia) ■ resolves when obstruction relieved	Strangury Constant urine dribbling	Distended, turgid bladder that is difficult to express
Ectopic ureters	Constant incontinence Normal voiding	Urine-soaked fur (perineum and hindlimbs)

History

In many incontinent dogs there may be no detectable abnormalities on physical examination. A complete history of the dog's problem is essential to help rule out the possible causes of incontinence.

Questions to ask include:

- neutered or intact and, if appropriate, age when neutered?
- age at onset of the problem?
- previous medical problems with urinary system and treatment administered?
- urinary incontinence
  - continuous or intermittent?
  - amount of urine leaking?
  - dog aware that urine is leaking?
  - does the dog void normally in addition to the incontinence?
- pattern of urination, including frequency, inappropriate, nocturia, dysuria, hematuria, and strangury?

It is important to determine whether the dog is truly incontinent or just has abnormal urination patterns. Pollakiuria may appear as an incontinence problem to an owner.

Physical examination

Few abnormalities are found in most of the dogs presented for urinary incontinence caused by functional or congenital disorders. The following, however, should be performed and/or noted:

- degree of wetness/urine scalding
- obvious gross abnormalities in the anatomy of the urogenital system
- observe the dog urinating—dysuria, strangury, pollakiuria
- the bladder palpated before and immediately after urination to check distension, tone, ease of expression, and residual volume
- rectal examination including prostate, pelvic diaphragm, and anal tone
- neurological examination to rule out neurological problems as the underlying cause
- residual urine volume measured after voiding (catheterize bladder and collect the urine); normal residual volume <0.4 ml/kg.

Acquired disorders that result in urinary incontinence, such as prostatic disease, bladder/urethral neoplasia, and neurological disorders, are more likely to be associated with abnormal physical findings.

The clinical (historical and physical findings) features of common causes of urinary incontinence are summarized in Table 3.

Laboratory evaluation

Significant abnormalities on blood and urine analysis are not commonly found when working up incontinent dogs. However, associated congenital renal anomalies, impaired renal function, and urinary tract infection (UTI) may be present, and it is important that a minimum database for these patients includes:

- measurement of serum urea nitrogen and creatinine concentrations and urine specific gravity
- urinalysis and bacterial culture and sensitivity performed on urine obtained by cystocentesis.

Additional diagnostic procedures may be indicated, particularly in patients with acquired diseases such as prostatic disease and bladder/urethral neoplasia. Such procedures include fine-needle aspiration cytology and biopsy (preferably performed with ultrasound guidance) and cytological examination of samples obtained by techniques such as urethral brushing, prostatic wash, ejaculation, and endoscopy.

TABLE 4
Potential findings on survey abdominal radiographs

Image area	*Potential findings*
Kidneys	Number, size, shape Presence of calculi and/or mineralization
Bladder	Position—abdominal versus intrapelvic Shape—rough assessment of bladder tone, masses Presence of calculi Degree of emptying following urination
Prostate (male)	Size, position, shape Masses—cyst, abscess, paraprostatic cyst
Urethra (male)	Presence of calculi Lesions of os penis, masses
Spine and pelvis	Bony lesions—periosteal reaction, lysis—possible metastatic disease Intervertebral disc disease, lumbosacral disease

Diagnostic imaging

Diagnostic imaging techniques are vital in the workup of the incontinent dog.[2] Specialized studies (contrast radiography) will be required to make a definitive diagnosis, but survey radiographs and ultrasound examinations can yield useful information, particularly in patients with acquired causes of incontinence. Survey thoracic radiographs should be taken in any patient with suspected malignancy to evaluate for possible metastatic disease.

Survey abdominal radiographs

Survey abdominal radiographs can be evaluated for gross abnormalities in the abdominal viscera and surrounding structures but are unlikely to demonstrate the exact cause of the incontinence. Potential findings are summarized in Table 4.

Contrast radiographic studies

Intravenous urography, retrograde urethrocystography and vagino-urethrography are the contrast radiographic techniques that allow complete evaluation of the urinary system. More than one of these procedures may have to be performed to evaluate thoroughly the cause of incontinence in any given patient.

Before performing contrast radiographic studies, it is important to have the gastrointestinal tract as empty as possible

because the presence of ingesta can make radiographic interpretation difficult, especially when trying to evaluate intravenous urograms in dogs with suspected ectopic ureter. The dog should be fasted and enemas given as necessary, with survey radiographs taken to ensure that the rectum and colon are empty.

General anesthesia is not necessary for intravenous urography, but sedation can help to achieve optimum positioning of the patient. Emptying the bladder and introducing a small volume of air (1 ml/kg) will allow better visualization of the ureters as they enter the bladder.

Approximately 1 ml/kg of an iodine-based, water-soluble contrast medium is given by rapid intravenous injection. Radiographs are taken immediately and then every 5 minutes, with the dog in different positions, so that both kidneys and ureters can be clearly visualized. After about 15 minutes, a cystogram will be obtained that will allow for evaluation of the bladder. Although intravenous urography is an anatomical study of the urinary tract, some relative assessment of renal function is possible.

With retrograde urethrocystography, an anatomical evaluation of the lower urinary tract and adjacent organs can be made. It is important that the urethra is evaluated as part of the study and, in male dogs, additional radiographs must be taken so that the whole penile and perineal portions of the urethra can be visualized.

General anesthesia is necessary when performing vaginourethrography, otherwise contractions of the vagina may result in an incorrect diagnosis of a vaginal stricture. A water-soluble iodine-based contrast agent is used, and up to 2 ml/kg in volume may be required to obtain an adequate study. A Foley catheter suitable for the size of the patient is inserted into the vestibule, and the balloon is inflated sufficiently to prevent contrast material from leaking around the catheter. Allis tissue forceps are used to close the vulva, and the catheter is pulled caudally so that the balloon is sealed tight against it. Once the vulva is closed, the contrast material is infused into the vagina.

A radiograph is taken after 1 ml/kg has been injected. If urethral filling has not occurred, more contrast material is injected in incremental amounts and additional radiographs taken until the vagina, urethra, and associated structures are clearly outlined. This procedure does not cause ascending UTIs.[2,3]

Fluoroscopy, if available, allows the studies described above to be viewed dynamically. This is particularly important in evaluating the ureters because fluoroscopy provides some assessment of function. It can also be more accurate than a static radiograph in determining if a ureter is ectopic because the contrast-containing urine can been seen flowing from the ureteral opening. Altering the position of the patient during the study allows each ureter to be individually evaluated, again increasing the likelihood of correctly diagnosing an ectopic ureter.

TABLE 5
Potential findings on contrast radiographic studies

Study	*Potential findings*
Intravenous urography	*Kidneys* Anatomy Relative assessment of function *Ureters* Function Ectopic position *Bladder* Shape, position Trigone lesions
Retrograde urethrocystography	*Bladder* Position, shape, tone Thickening, masses, diverticuli Calculi *Urethra* Stricture, dilation, obstruction *Prostate* Size, position, shape Masses—cyst, abscess, paraprostatic cyst
Vagino-urethrography (female)	*Ureters* Ectopic position *Bladder* Position of neck *Urethra* Length, width Lesions—neoplasia *Vagina* Strictures, masses

Potential findings from these contrast radiographic studies are summarized in Table 5.

Ultrasonography

Ultrasonography is a very useful imaging technique for detecting abnormalities in the structure of the kidneys, bladder, prostate, and urethra but should be considered as complementary to the radiographic evaluations already described. This is because the technique is not able to evaluate the function of the components of the urinary system and may not be able to

determine the exact cause of incontinence—for example, USMI or ectopic ureter. However, dogs with congenital causes of incontinence may well have other abnormalities of the urinary system, such as abnormal renal morphology, that can be detected by this technique.

Ultrasonography should be used to help increase the diagnostic accuracy of fine-needle aspiration and biopsy by aiding in the localization of specific lesions. It is particularly helpful in the differential diagnosis of prostatic diseases.

Urodynamic studies

The urodynamic studies that have been investigated in the dog include urethral pressure profilometry (resting and stressed), cystometry, and electromyography.[2,4] These can be used to demonstrate the site of abnormal function of the lower urinary tract and therefore to diagnose more accurately the cause of incontinence—for example, to distinguish among USMI, detrusor functional abnormalities, and neurogenic problems. However, urodynamic studies are often only of academic interest as the results can usually be predicted accurately by the methods of patient evaluation described above and by the response of the patient to therapeutic intervention. Furthermore, the tests are subject to a wide variety of artifacts and variations in the results and have proved to be of less diagnostic value than was originally thought. Factors that result in variability of results include the position of the dog, method of chemical restraint, size and orientation of the catheter in the urethra, catheter withdrawal rate, and degree of bladder filling.

Table 6 lists the various urodynamic procedures and their potential findings, but, because of their limited use, the procedures will not be described in this article. Selected references are provided on this subject.[4–6]

Endoscopy

Urethrocystoscopy can be used to visualize, and to biopsy, lesions of the urethra and bladder, to identify ectopic ureters, and to catheterize the ureters for individual collection of urine samples.[2] The usefulness of this procedure, however, is somewhat limited because specialized equipment is necessary. It must also be performed with great care to prevent traumatizing the urethra and bladder.

PATIENT MANAGEMENT

Two of the most commonly seen causes of urinary incontinence in the dog are USMI and ectopic ureters.

Urethral sphincter mechanism incompetence

USMI is usually seen in medium and large purebred female dogs of any age and may become more obvious following ovariohysterectomy. It has also been reported in males. Dogs with USMI have a history of continuous or intermittent incontinence that occurs most commonly when the animal is resting and relaxed or when it is stressed. The animal is able to urinate normally. Dogs with USMI frequently have an associated UTI, and some present only with clinical signs of recurrent UTI. The majority of dogs with USMI are found to have a "pelvic bladder" on radiographic evaluation.

TABLE 6
Urodynamic procedures used to investigate urinary incontinence in the dog

Procedure	*Potential findings*
Urethral pressure profilometry	Maximum urethral pressure Maximum urethral closure pressure Functional profile length Bladder pressure
Cystometry	Bladder tone and volume Threshold volume and pressure Maximum contraction pressure Detrusor reflex
Electromyography	Evaluate coordination of muscular activity between the detrusor muscle and urethral sphincter

Diagnosis is made by excluding other causes of incontinence, such as ectopic ureters. In the female, vagino-urethrography is the diagnostic procedure of choice and frequently demonstrates a short dilated urethra and a "pelvic bladder." In the male, retrograde urethrocystography may demonstrate dilation of the pelvic urethra and a "pelvic bladder." Given the high incidence of UTI, urine should be obtained by cystocentesis for analysis and culture and sensitivity testing. Urodynamic studies demonstrate that the incontinence is due to a low urethral closure pressure and a reduced effective urethral length, although these studies are not necessary to make the diagnosis.[5,6]

Treatment

In the female, medical treatment is attempted first as up to 90% of dogs will respond favorably. UTI will make the incontinence worse and therefore needs to be aggressively treated with appropriate antibiotic therapy along with specific therapy for the USMI. Sympathomimetic α-adrenergic agonists, which directly increase urethral smooth muscle tone, are the drug of choice—phenylpropanolamine (1–2 mg/kg PO every 8–12 hours) or ephedrine (5–25 mg PO every 8 hours). Dogs need

to be on steady-dose therapy for 1 to 2 months before medical therapy is considered unsuccessful. Similarly, the dose can be adjusted to see if a more favorable response can be obtained. For those dogs that do not respond to appropriate medical management, colposuspension can help. This procedure repositions the bladder neck into the abdomen, thereby increasing urethral resistance and improving pressure transmission to the urethra (see "Surgery of the urinary tract," pages 78–89). Following colposuspension, about 50% of the females will be continent, 40% will be improved but will require medical therapy, and 10% will remain incontinent.[5]

In the male, variable success has been reported with medical therapy as described for the female.[7] Because of this, a procedure similar to colposuspension, namely fixation of the deferent ducts, which repositions the bladder neck into the abdomen, has been described for male dogs with USMI. A success rate of about 50% is reported for this procedure, similar to that for colposuspension in the female. Dogs that do not respond completely to this procedure will also improve with the addition of medical therapy.[8]

Ectopic ureters

Ectopic ureters are usually diagnosed in young, female, purebred dogs, although the problem is occasionally reported in males. Historically, these dogs are noticed to be incontinent at a young age and have continuous incontinence but are able to urinate voluntarily. Urine-soaked fur is found around the perineum and rear legs. The bladder is small on palpation, and there is often an associated UTI present. The diagnosis is confirmed by contrast radiography. Intravenous urography will delineate the kidneys and ureters and will usually identify where the ureters are entering the lower urinary tract. The ectopic ureter is frequently dilated. Vagino-urethrography is very useful in identifying ectopic ureters and where they connect to the urethra or vagina, often resulting in a better study than intravenous urography. Endoscopy can also be used to help identify the site of the ectopic ureteral opening.

Previous reports on the success of surgical correction of ectopic ureters have shown that about 50% of dogs will still be incontinent to some extent after surgery. Recently it has been recognized that a significant number of dogs that have ectopic ureters also have USMI (retrospective and prospective patient evaluation, Michigan State University, unpublished data), which would account for the low success rate. Therefore the radiographic studies that are performed as part of the workup for the diagnosis of ectopic ureter should also be carefully evaluated for evidence of USMI.

Treatment

Treatment for ectopic ureter is surgical repositioning of the ureteral opening into the trigone of the bladder. The entire ectopic portion of the ureter should be dissected out of the urethra as this contributes to the poor functioning of the urethra (McLoughlin MA, The Ohio State University, unpublished data). This results in a urethroplasty being performed, which also helps in resolving the problem of poor urethral tone. In dogs in which USMI has been identified, a colposuspension can be performed at the time of ectopic ureter correction. If incontinence persists, additional medical therapy with a sympathomimetic agent as described above will be necessary.

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