

Diagnosis and management of canine urethral sphincter mechanism incompetence

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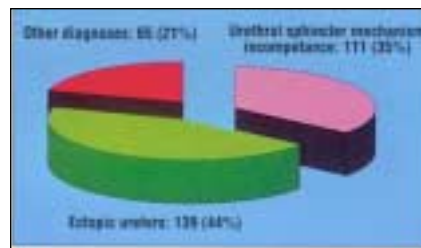
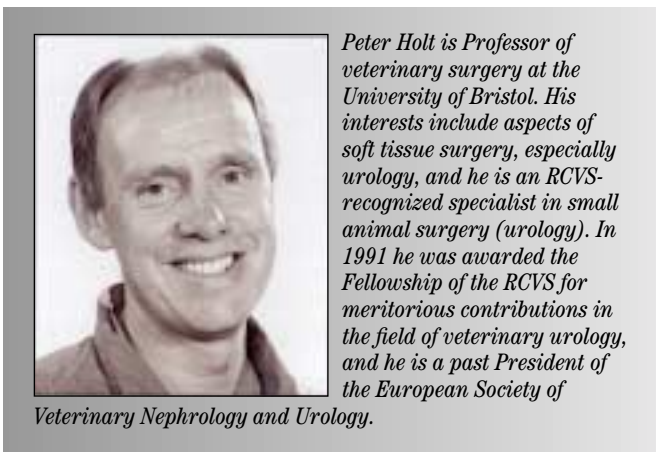


Figure 1
Diagnoses made in 315 incontinent juvenile dogs.

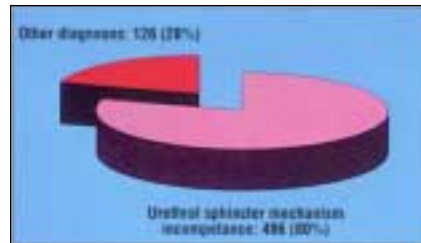


Figure 2
Diagnoses made in 622 incontinent adult dogs.

KEY POINTS

- Urethral sphincter mechanism incompetence is the most common cause of urinary incontinence in adult dogs, particularly bitches.
- Intravenous urography and retrograde positive contrast urethrography/vagino-urethrography are the most useful radiographic investigations.
- In the order of 50% of cases in bitches will exhibit a good response to surgery.
- Relocation of the bladder neck to an intraabdominal position by means of colposuspension is the preferred surgical technique.
- Medical management with phenylpropanolamine is also effective in many cases.
- Management of sphincter mechanism incompetence in male dogs is frustrating, with most demonstrating a poor response to both medical and surgical treatment.

INTRODUCTION

In dogs referred for the investigation of urinary incontinence, urethral sphincter mechanism incompetence is the most common diagnosis made in adults and is second only to ureteral ectopia in juveniles (Figures 1 and 2), particularly in females (Table 1).

Table 1
Diagnoses made in 937 dogs referred for investigation of urinary incontinence

	Number of affected animals				Total
	Juveniles		Adults		
	Females	Males	Females	Males	
Sphincter mechanism incompetence	96	15	467	29	607
Ureteral ectopia	124	15	19	6	164
Undiagnosed	6	5	14	11	36
Ureteral ectopia plus sphincter mechanism incompetence	30	0	4	0	34
Sphincter mechanism incompetence and detrusor instability	8	1	6	2	17
Detrusor instability	2	1	6	5	14
Neurogenic incompetence	0	0	5	8	13
Prostatic disorders	0	0	0	12	12
Intersexuality	9	1	1	0	11
Bladder neoplasia	0	0	5	5	10
Cystitis	2	0	5	1	8
Uretero-vaginal fistula	0	0	4	0	4
Vaginal tumors/cysts	0	0	3	0	3
Vesiculo-vaginal fistula	0	0	2	0	2
Pelvic abscess	0	0	1	0	1
Perineal rupture	0	0	0	1	1
Total	277	38	542	80	937

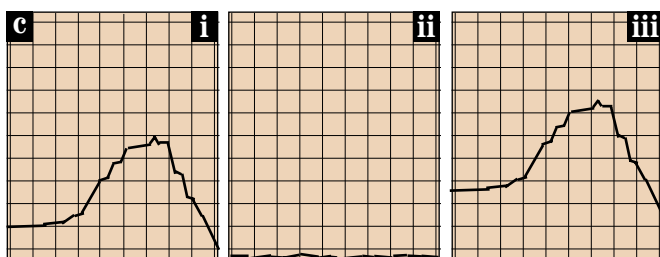


Figure 3 Urethral pressure profilometry.

(a) Double sensor microtip pressure transducer catheters (Gaeltec, Isle of Skye) used to perform urethral pressure profilometry. The tip sensor is used to measure intravesical pressure at the same time as the other sensor is recording urethral resistance, so that a continuous comparison between these can be made.

(b) The catheter is inserted via the urethra into the bladder. It is clamped to a withdrawing device which pulls the catheter out along the urethra. The resulting pressure changes are recorded. Thus the pressure within the urethra along its length (the 'urethral pressure profile') is recorded as a measure of urethral resistance and can be compared with intravesical pressure.

(c) Simultaneous urethral pressure profilometry in a one-year-old entire female continent German Shepherd. From left to right the traces are: (i) the urethral pressure profile; (ii) the intravesical pressure; (iii) the subtracted urethral pressure profile (i.e., i - ii).

It can present as a congenital or acquired condition. Although urethral pressure profilometry can be used to demonstrate incompetence of the urethral sphincter mechanism (**Figure 3**), this technique is not readily available in general practice and is predisposed to a number of artefacts that can make interpretation difficult. In general practice, therefore, the diagnosis is usually made on the basis of breed and history, and by elimination of other possible diagnoses using imaging and laboratory techniques. The most useful of these are intravenous urography and retrograde positive contrast urethrography or vagina-urethrography, along with appropriate laboratory tests. These investigations are summarized in **Tables 2-4**.

Table 2

Intravenous urography (IVU)

Indications	Hematuria, incontinence, abdominal mass
Preparation	Empty gastrointestinal tract by adequate starvation and enemas General anesthesia is required
Dosage and administration	Take plain right lateral and VD films, centered on the umbilicus. Rapid IV injection of 1 ml/kg of Conray '420' (May & Baker); Conray '280' at 2 ml/kg may be used in small dogs and cats. Alternatives are Urografin '370' and Urografin '150' (Schering), given in correspondingly larger volumes VD film immediately after injection (nephrogram) VD and right lateral films at 5 and 15 minutes post-injection, although further exposures may be required in individual animals

Note: It may prove helpful to inject a small amount of air into the bladder (1 ml/kg) before the IVU is performed in incontinent animals to improve contrast between ureters and bladder.

CONGENITAL URETHRAL SPHINCTER MECHANISM INCOMPETENCE

This tends to be a problem in large breeds of dog, and predominantly in bitches. Leakage of urine is more copious than in animals with ureteral ectopia and occurs predominantly when the dogs are recumbent. The urethra may be abnormally short or even absent (this occurs also in cats), or urethral diverticula and dilations may be present in male animals (**Figures 4 and 5**). In many bitches, no gross abnormalities are detected on contrast radiographic investigations, apart from a caudally positioned bladder, and the diagnosis frequently relies on the history and elimination of other possible causes of incontinence. Approximately half of affected bitches become continent following their first estrus. Those that do not may be candidates for medical or surgical management (see Acquired urethral sphincter mechanism incompetence, below). Estrogens are contraindicated in juvenile bitches with this condition because of possible adverse feedback effects on the pituitary gland, but α -adrenergics such as phenylpropanolamine could be used, pending estrus.

ACQUIRED URETHRAL SPHINCTER MECHANISM INCOMPETENCE IN BITCHES

This usually (but not always) follows spaying in the bitch and, occasionally, castration in male dogs.

Before treatment can be contemplated, an understanding of the pathophysiology of urethral sphincter mechanism incompetence is required. Since no true bladder neck sphincter exists in the bitch, and continence is maintained by a complex mechanism of interacting factors, the term 'urethral sphincter mechanism incompetence' has been used to describe a weakness of the urinary sphincter. The best known example is what used to be called 'estrogen-responsive' incontinence.

Causative factors

The exact abnormality leading to urethral sphincter mechanism incompetence and the region of the urethra in which it occurs are unknown. It is a multifactorial problem, and a variety of factors are

Table 3
Urethrography and vagino-urethrography

Indications	Lower urogenital tract disease, incontinence, hematuria, dysuria, intrapelvic masses
Preparation	As for IVU
Dosages and administration	In males: Urografin '150' (Schering) introduced via paediatric Foley catheter inserted into distal urethra. In cats use 3–4FG catheter and occlude preputial opening with tissue forceps. Doses from 5 ml (cat/small dog) to 20 ml (large dog). Lateral (\pm VD) radiograph taken during injection when $\frac{3}{4}$ of dose injected In females: similar, but it is preferable to perform vagino-urethrography. Inject Urografin '150' (dose 1.5 ml/kg approximately) through a Foley catheter placed in vestibule (close vulva with tissue forceps)

- The clinician must take care during these techniques, particularly if ureteral ectopia is suspected, to avoid the risk of introducing excessive contrast medium into ureter/renal pelvis. Use lower initial doses and serial radiographs to check

- Most of the positive contrast medium introduced into the bladder during the above techniques can be removed and, subsequently, air may be introduced via a catheter to obtain a double contrast cystogram—useful for showing urethral abnormalities and intraluminal masses

- Simple negative contrast (air) cystography is only adequate for demonstrating bladder position and gross lesions. The dose of air/positive contrast medium is arbitrary. Fill the bladder until distended, but avoid overdistension to prevent vesico-ureteral reflux or bladder rupture

Table 4
Other diagnostic aids

- Serum biochemistry and blood hematology to eliminate causes of polydipsia/polyuria
- Urine bacteriology to eliminate detrusor instability associated with urinary tract infection
- Ultrasonography of the kidneys and bladder to eliminate physical abnormalities associated with other causes of incontinence (e.g., bladder neoplasia causing detrusor instability, hydronephrosis or pyelonephritis secondary to ureteral ectopia)
- Urodynamics includes urethral pressure profilometry and cystometry. Neither of these is readily available in general practice. Even if they were available there may be inadequate data on normal values in continent animals with which to make comparisons

known or suspected to contribute to its clinical manifestation of urinary incontinence. These factors include urethral tone, urethral length, bladder neck position, body size and breed, ovariectomy, hormones and obesity.

The introduction of urethral pressure profilometry as an investigative aid in the bitch (Figure 3) has allowed confirmation of the belief that poor urethral tone is implicated in urinary incontinence due to urethral sphincter mechanism incompetence. Urethral tone is maintained by a complex interaction of neuromuscular, vascular, and passive elastic components, and it is



Figure 4 An incontinent juvenile Golden retriever with urethral sphincter mechanism incompetence. The signs of urinary incontinence (scalding of the preputial opening and soiling of the coat with urine) are just that—they are not pathognomonic for any particular cause of urinary incontinence.



Figure 5 Ventrodorsal positive contrast urethrocystogram. (a) Bilateral prostatic urethral diverticula and abnormal dilation of the pelvic urethra in the animal illustrated in Figure 4. (b) The post-mortem appearance.

unclear which of these is deficient in urethral sphincter mechanism incompetence.

There is considerable variation in urethral length between bitches of different sizes. However, taking body size into consideration, bitches with urethral sphincter mechanism incompetence tend to have shorter urethras than continent animals.

A number of authors have recorded the radiographic finding of a 'pelvic bladder' during the investigation of incontinent animals. The significance of this finding was disputed in the past, but there is now good evidence that an intrapelvic bladder neck contributes

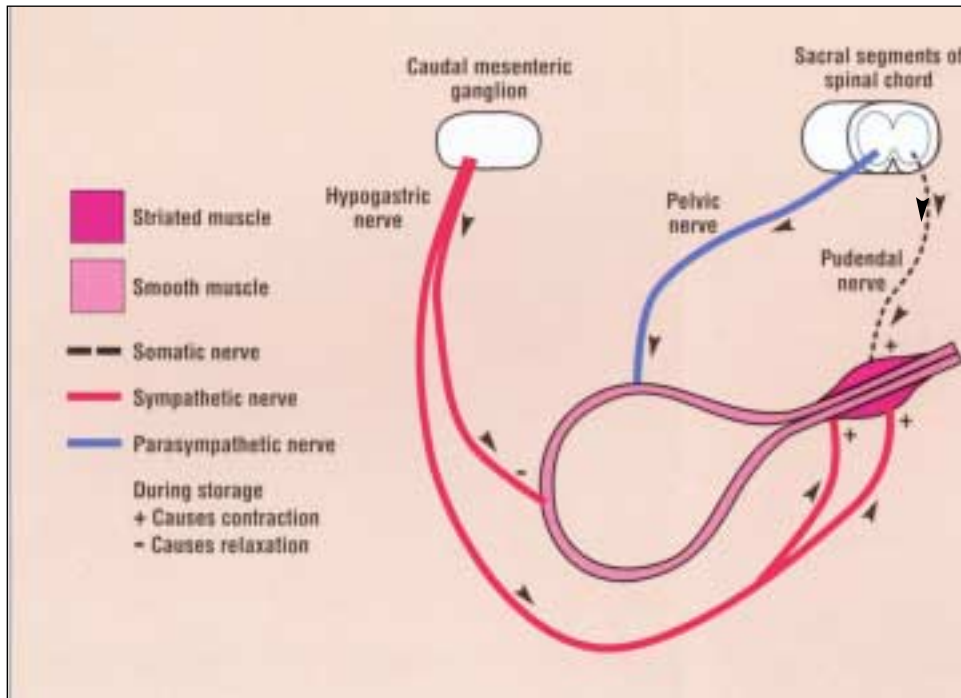


Figure 6
Diagrammatic summary of continence control. This is a gross oversimplification of what is actually thought to occur. For example, there is dual autonomic (sympathetic and parasympathetic) innervation of both the bladder and urethra, and the nerves from both meet and interact at the same ganglia on the bladder and urethral walls. In addition, in some species (e.g., cat and human), there is sympathetic innervation of the urethral striated muscle (as illustrated) although this has yet to be proven in the dog.

significantly to urinary incontinence due to urethral sphincter mechanism incompetence. The caudal bladder position in affected dogs is associated with the shorter urethral length and also the fact that the bladder moves caudally when a bitch moves from a standing to a relaxed recumbent position. This movement is more pronounced in bitches with urethral sphincter mechanism incompetence than in normal animals, suggesting a deficiency in supporting mechanisms in the lower urinary tract of affected animals.

Body size is a factor, and large and giant breeds are particularly at risk. Urethral sphincter mechanism incompetence is most common in the UK in Doberman pinschers and Old English sheepdogs. Recent work has shown that these breeds and Rottweilers, Weimaraners, Springer spaniels, and Irish setters are particularly at risk.

There is an association between spaying and urinary incontinence, which is probably due to a lack of circulating estrogens. In general terms, spayed animals are nearly eight times more likely to develop this form of urinary incontinence than are entire bitches. Spaying before the first season may increase the risk, although this could not be proved conclusively in a recent study, probably because of the low number of animals examined.

Hormones, particularly sex hormones, can influence vesico-urethral function and so may be implicated in sphincter mechanism incompetence.

While not a cause of the condition, obesity may worsen the degree of incontinence, and weight loss may improve the situation.

Treatment options

The treatment of cases of sphincter mechanism incompetence may be difficult, and most therapies correct only one of the above factors. It is unlikely, therefore, that any one form of treatment alone will cure 100% of cases in the long term.

In theory, sympathomimetic or parasympatholytic agents should improve continence control (Figure 6), but the results of clinical trials are variable and possible long-term adverse systemic effects have not been evaluated. Currently, the most popular medical treatment is the α -adrenergic agent phenylpropanolamine. Affected spayed bitches sometimes respond to estrogen therapy, but in many animals the response ceases eventually, despite increasing the dosage of estrogens, possibly due to desensitization of estrogen

receptors. Estrogens sensitize the urethral smooth muscle to α -adrenergic stimulation, so a combination of estrogen and an α -adrenergic agent such as phenylpropanolamine may be useful and reduce the dose of each individual drug needed, lessening the chances of side effects. Androgens have been employed in castrated male dogs but, in the author's experience, the results are disappointing.

The main options for surgical treatment are to attempt to:

- Increase urethral resistance (e.g., peri-urethral surgical slings, artificial sphincters or intra-urethral injection of bulking agents such as collagen).
- Increase urethral length, using bladder neck reconstruction techniques.
- Relocate the bladder neck to an intraabdominal position by means of colposuspension.

The problem with techniques intended to increase urethral resistance is that they may increase the morbidity by making an incontinent animal dysuric. Similarly, increasing urethral length carries potentially serious surgical risks and should be reserved for animals with severe congenital urethral hypoplasia.

The technique least likely to lead to serious complications is to relocate the bladder neck to an intraabdominal position by means of colposuspension. The greater experiences of medical urologists treating incontinent women suggest that colposuspension provides firmer anchorage of the lower urogenital tract than urethropexy does and avoids urethral trauma. The author believes that cystopexy is contraindicated in these cases, since it may result in detrusor instability, a further cause of urinary incontinence!

Colposuspension

Colposuspension is intended to move the intrapelvic bladder neck of bitches with urethral sphincter mechanism incompetence to an intraabdominal position so that increases in intraabdominal pressure can act simultaneously on the bladder and urethra. Thus, any increase in intravesical pressure is counteracted by an increase in urethral resistance. During the procedure, the vagina is stretched cranially and anchored on either side of the urethra to the prepubic tendon. This cranial movement of the vagina results in similar

displacement of the urethra and bladder. Care is taken to avoid compression of the urethra during the technique.

A long-term evaluation of cases treated by the author indicates that a cure rate of approximately 50% can be expected, with most of the remaining bitches improved. Ten percent of bitches fail to respond at all to colposuspension, and the complication rate is low.

URETHRAL SPHINCTER MECHANISM INCOMPETENCE IN MALE DOGS

Urethral sphincter mechanism incompetence is uncommon in male dogs. As in the bitch, the condition can occur as either a congenital or an acquired condition.

The congenital condition is often associated with gross prostatic/pelvic urethral deformity (**Figures 4 and 5**) and is unlikely to be successfully treated, although, like bitches, less severely affected male animals may improve after puberty.

As in the bitch, the acquired form often follows neutering and larger breeds appear to be at risk. Incontinence is likely to occur when intraabdominal pressure increases (e.g., during recumbency), and affected animals tend to have intrapelvic bladder necks, although a short urethra does not appear to be a factor in males.

Conservative management is frequently disappointing and, in

comparison with the bitch, the condition is less likely to respond to medical therapy. The pathophysiology of male urethral sphincter mechanism incompetence is poorly understood, making rational treatment difficult. Drugs used in the management of male urethral sphincter mechanism incompetence include androgens, estrogens, and α -adrenergics. Of these, α -adrenergics give the best results but, even then, more than half of dogs fail to respond to therapy.

Attempts have been made to relocate the intrapelvic bladder neck to an intraabdominal position. These have mainly involved pexy of the deferent ducts to the abdominal wall, although the author has used prostatopexy (in castrated males) to the prepubic tendon. As with medical treatment, the impression in a limited number of cases is that surgical treatment alone of urethral sphincter mechanism incompetence is less successful in males than in bitches.

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