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Urinary incontinence in the dog: Diagnosis and management

Urinary incontinence is a relatively commonly encountered disorder in dogs. Whilst a favourable response can be seen with medical and surgical management options, or a combination of the two, urinary incontinence can be a challenging condition to treat. The potential for multiple causes of incontinence to co-exist and a limited understanding of some of the more common causes contributes to the challenges encountered. This article will review urinary incontinence in dogs and the management options that are currently available.

Key words: Urinary incontinence, ectopic ureter, USMI, dog, surgery

Introduction

Urinary incontinence is the involuntary passage of urine. Female neutered dogs are over represented but males can also be affected. A thorough diagnostic approach with logical application of the management options available is necessary in order to optimize response to treatment, especially when individuals are refractory to conventional treatment options. This article will firstly discuss the common causes of urinary incontinence in dogs and will then cover the frequently employed diagnostic techniques and management options.

The control of urination

The lower urinary tract consists of the urinary bladder and urethra. An anatomical sphincter does not exist at the bladder neck and consequently urinary continence is largely dependent on muscle tone within the bladder neck and urethra. Smooth muscle fibers that are longitudinally orientated span the entire length of the urethra in the male dog. In addition, striated muscle with circumferentially orientated fibers surrounds the smooth muscle other than along the proximal one third of the urethral length where this muscle type is absent. This muscular composition provides good control over involuntary urination in the male. In comparison, female dogs have a shorter and wider urethra containing less muscle overall with an absence of smooth muscle in the distal urethral wall and a focus of voluntary, striated muscle distally at the external urethral orifice.

The storage and voiding phases of urination are under the control of complex neurological mechanisms. In summary, the storage phase of urination is controlled by the sympathetic nervous system (hypogastric nerve) which results in smooth muscle contraction within the bladder neck and proximal urethra due to stimulation of α–receptors and relaxation of the detrusor muscle within the bladder wall due to stimulation of β–receptors. Continence is further enhanced by voluntary stimulation and contraction of urethral striated muscle via the pudendal nerve. When the bladder fills and voiding of urine is necessary, there is synchronous relaxation of the urethral musculature and contraction of the detrusor muscle within the bladder wall. This is under the control of the parasympathetic nervous system (pelvic nerve) which inhibits sympathetic tone to the urethra and causes detrusor muscle contraction. There is also a voluntary component to urethral relaxation.

Common causes of urinary incontinence

The causes of urinary incontinence can be broadly categorized as congenital or acquired. Congenital causes of urinary incontinence typically present when the affected individual is juvenile (< 6 months old) and include anatomical anomalies (e.g. ectopic ureter, intersexuality, urogenital fistula, urachal anomalies), congenital urethral sphincter mechanism incompetence (USMI) and various

neurogenic causes. Individuals affected by acquired urinary incontinence are likely to present as adults and causes include USMI, prostatic disease, neoplasia, detrusor instability and neurological disorders. The most common cause of congenital urinary incontinence is ureteral ectopia, followed by USMI, and the most common cause of acquired incontinence is USMI therefore this article will focus on these two conditions. The reader is directed to the reading list for more information on other, less common causes of urinary incontinence.

Ectopic Ureter

The ureter functions as a conduit to enable the passage of urine from the kidney to the bladder. The distal ureter normally inserts at the trigone of the bladder. Ureteral entry at this level means that urine enters the bladder proximal to the anatomical restrictions to involuntary passage of urine located within the bladder neck and urethra. In the case of ectopic ureter, one or both ureters open into the urinary tract lumen distal to the normal entry point (typically within the urethra or vagina), meaning that the anatomical restrictions to urine leakage are bypassed resulting in the potential for involuntary voiding of urine. An ectopic ureter can either be described as extramural (bypassing the normal insertion point in the bladder completely and entering the urinary tract more distally) or intramural (apparent normal level of insertion in the bladder with the ureter then tunnelling distally within the submucosa of the urethra before opening into the urinary tract lumen) (Figure 1). The vast majority of ectopic ureters diagnosed in dogs are intramural (>95%). The Golden Retriever and Labrador Retriever are over represented and females are more commonly affected than males. Incontinence associated with ectopic ureter is often described as continuous urine dripping, rather than intermittent urine pooling influenced by posture as is more typical of USMI.

Urethral sphincter mechanism incompetence

Congenital USMI is typically encountered in large breed, female dogs and may be the result of anatomical anomalies such as urethral hypoplasia, urethral diverticulum and a caudally positioned bladder neck. The acquired form of USMI is usually seen in female neutered, large breed dogs with Dobermans, Old English Sheepdogs and

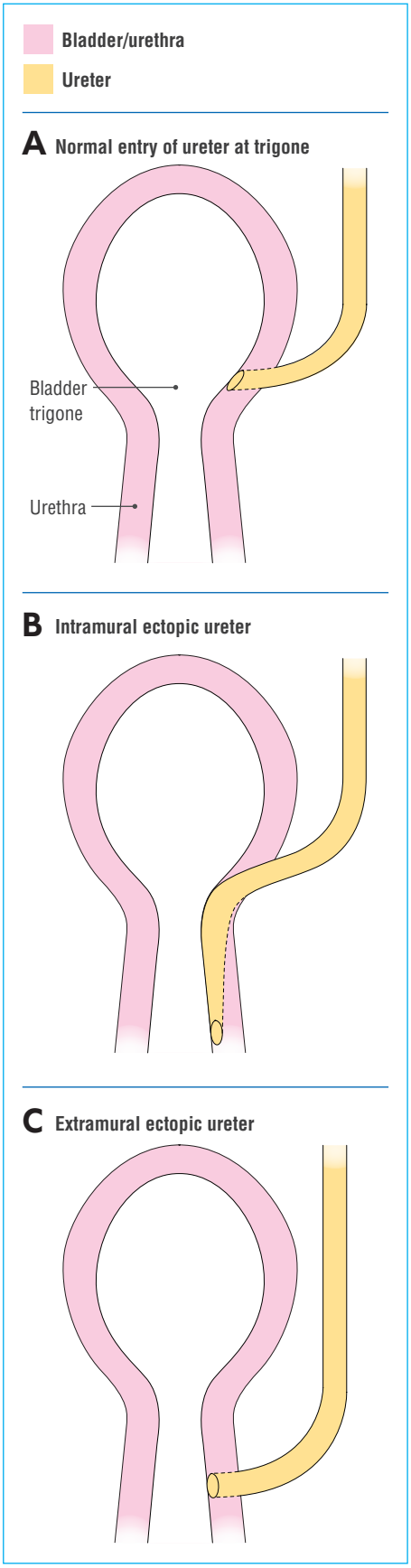

Figure 1: Schematic drawing of ectopic ureter configuration. Normal ureteral opening into the bladder at the level of the trigone (A), intramural ectopic ureter with apparent normal ureteral entry point at the trigone then submucosal tunnelling of the ureter distally before it opens into the urethra (B) and extramural ectopic ureter with the ureter completely bypassing the bladder and entering the urinary tract directly at the level of the urethra (C).

Weimaraners reported as over represented amongst other breeds. The incidence of urinary incontinence in female neutered dogs is in the region of 10-20% (Arnold 1997, Thrusfield *et al.* 1998). Neutering and body weight have been demonstrated to be risk factors for the development of acquired USMI however the causative factors are generally poorly understood. In most individuals, USMI is likely to be the result of various interacting factors including short urethral length, reduced urethral muscle tone, a caudally positioned bladder neck (intrapelvic bladder) and neuter status. A recent study concluded that neutered bitches had three times the odds of developing urinary incontinence compared to entire bitches (Pegram *et al.* 2019). A reduction in sex steroid hormones and resultant increase in gonadotrophins (luteinising hormone (LH) and follicle-stimulating hormone (FSH)) after neutering has been postulated as a contributing factor for incontinence. The composition of the lower urinary tract is also altered after neutering (less smooth muscle fibers and more collagen) which is likely to adversely affect urethral tone. The timing of neutering, particularly in relation to the first oestrus, has been widely debated as a relevant consideration with regard to incontinence risk however recent studies have refuted the timing of neutering as a significant factor (Pegram *et al.* 2019, Reichler and Hubler 2014, Thrusfield *et al.* 1998). Interestingly, resolution of urinary incontinence in juvenile intact bitches has been observed after the first oestrus and delaying neutering to assess the effects of oestrus on incontinence is advised in such individuals (Holt, 1985). Urinary incontinence secondary to USMI typically results in high volume urine leakage during periods of recumbency and is often nocturnal, likely due to recumbent posture and a reduced opportunity to urinate overnight.

Urinary incontinence in the male

Urinary incontinence in male dogs is uncommon and this is likely due to differences in urethral length and tone compared to females. A juvenile male dog presenting with urinary incontinence should be investigated for ureteral ectopia and if this is excluded, other potential anatomical causes of urinary incontinence should be considered (intersex, uterus masculinus and prostatic anomalies). The presence of an ectopic ureter in a male may be masked by urethral length and

tone meaning affected males may present later in life than females.

Rarely male dogs may be affected by USMI. Congenital USMI is likely to be secondary to anatomical anomalies (e.g. urethral and prostatic diverticuli) and the acquired form, as in females, is incompletely understood with urethral length, tone and neuter status likely to be significant. Reduction in prostate gland size post neutering will alter tone within the prostatic urethra and encourages caudal movement of the prostate and bladder to an intrapelvic position with secondary effects on intra-abdominal pressures influencing the urethra and bladder.

Any prostatic disease forming defects or cysts within the prostatic parenchyma will predispose to urine pooling and provide an opportunity for urine to bypass the normal anatomical constraints of the bladder neck and proximal urethra. Examples of conditions that may result in urinary incontinence secondary to prostatic disease include benign prostatic hyperplasia, bacterial prostatitis and paraprostatic cyst (Figure 2).

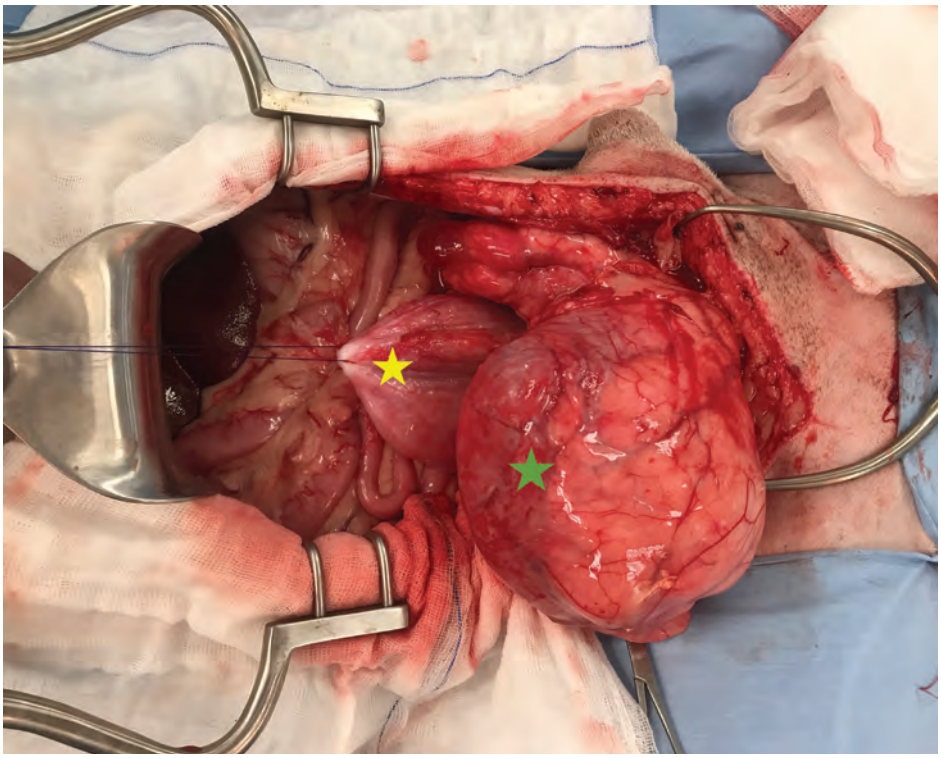

Figure 2: Exploratory laparotomy for surgical management of a paraprostatic cyst in an eight year old, male entire, cross breed dog. The dog presented for investigation of urinary incontinence and the incontinence resolved following partial resection and omentalization of the paraprostatic cyst. The urinary bladder (yellow star) and paraprostatic cyst (green star) before partial resection and omentalization are shown. Cranial is to the left of the image.

Diagnostic approach to urinary incontinence

Obtaining a detailed clinical history is an essential step towards determining the cause of urinary incontinence. Clear and precise questioning of the client will help to rule out the possibility of clinical signs that may be mimicking urinary incontinence such as dysuria or inappropriate urination habits due to behavioural issues. Thorough history taking may also highlight confounding factors, for example polyuria and/ or polydipsia, that may be exacerbating urinary incontinence. In this case, investigation of the polyuria/ polydipsia should be the focus as addressing the underlying cause of this will likely resolve the incontinence.

A complete physical examination of the patient is indicated to identify any signs that may be indicative of concurrent disease (e.g. Cushing's disease). Examination should include rectal examination, neurological assessment and a thorough assessment of the external genitalia for potential anomalies that may be contributing to, or mimicking, incontinence. For example, a juvenile or recessed vulva resulting in lower urinary tract signs could be mistaken for urinary incontinence and it is worth addressing the abnormal vulva conformation surgically before performing extensive investigations for other potential causes of incontinence (Figure 3).

A full serum haematological and biochemical analysis is performed to investigate the potential for underlying diseases that could be contributing to urinary incontinence (e.g. renal disease, endocrinopathy). A complete urinalysis is necessary including urine specific gravity (USG) to assess the concentrating ability of the kidneys. Urine sediment analysis allows for the identification of inflammatory cells, bacteria and crystals. Urine culture is indicated in all instances as the likelihood of a secondary, ascending bacterial infection is increased in an individual that is frequently voiding urine involuntarily and likely has reduced urethral tone. Whilst a bacterial urinary tract infection (UTI) is most likely to be secondary to another primary cause of the incontinence, the presence of infection is likely to exacerbate the degree of incontinence and consequently every effort should be made to identify and treat an infection if present. The urine sample should be obtained by cystocentesis to eliminate the potential for bacterial contamination of the sample from the distal urinary tract.

Figure 3: Perivulval dermatitis secondary to a recessed vulva in a one year old, female neutered, Old English Sheepdog.

Abdominal diagnostic imaging is a useful tool for the investigation of urinary incontinence. Plain abdominal radiographs allow for assessment of bladder position (intra-abdominal vs intrapelvic) and can be used to assess other urinary and reproductive structures, with or without the addition of intravenous contrast agent (excretory urography) or retrograde administration of contrast (urethrocystogram) (Figure 4).