Summary: Urethral sphincter mechanism incompetence (USMI) is an uncommon urological disorder in male dogs. Affected animals maintain voluntary control of urination but leakage occurs at times when there is raised intra-abdominal pressure. USMI pathophysiology in male dogs is poorly understood. A diagnosis of USMI is made on the basis of the history and the elimination of other possible diagnoses. Phenylpropanolamine is the most effective medical treatment for USMI in male dogs. However androgens, estrogens and surgery may be required if the animal does not respond to standard medical treatment or if side effects develop.

Keywords: urethral sphincter mechanism incompetence; male dog; veterinary urology

Introduction

Urethral sphincter mechanism incompetence (USMI) is an urological disorder that affects particularly female dogs. In male dogs it represents less than 4% of all incontinent patients (Holt, 1999).

It can be caused by a congenital condition that is most commonly recognized in juvenile dogs; or by an acquired condition, seen principally in adult dogs. The congenital condition is often associated with urethral dilations and prostatic urethral diverticula (Holt, 1990; Holt, 2008).

USMI is more common in older dogs and in larger breeds such as Doberman, Irish Setter and Rottweiler. Affected animals maintain voluntary control of urination but leakage occurs at times when there is raised intra-abdominal pressure. This disorder is observed when the animal is recumbent, excited or when the abdominal pressure suddenly rise such as occurs in cough (Aaron et al., 1996).

In these cases urethral closure pressure is insufficient to prevent urinary loss during the storage phase of the bladder. Moderate increases in intra-abdominal pressure are sufficient to reverse the pressure gradient, resulting in incontinence. When severe, even the slightest increase in pressure, from minor movement, may cause leakage of urine (Patel et Chapple, 2008).

Pathophysiology

There is much controversy about the exact pathogenesis of USMI in male dogs. Bladder neck position, prostate size and castration are some known factors that may contribute to the clinical manifestation of this type of urinary incontinence (Holt, 1999).

The caudal bladder position, called pelvic bladder, may encourage the emergence of USMI. When there is a rise in abdominal pressure, the additional pressure is transmitted more efficiently to the bladder wall than to the urethra and the bladder neck. This results in increased intravesical pressure with no or less concomitant rise in opposing urethral pressure, creating a pressure gradient. If urethral resistance is poor, leakage of urine occurs (Power et al., 1998).

Bladder neck position is related to prostate size. Dogs with smaller prostates may be more likely to have intrapelvic bladder necks and those with larger prostates to have intra-abdominal bladder necks. In addition, a large prostate tends to pull, and possibly stretch, the urethra cranially over the pubic brim, especially when the dog is standing, increasing urethral
resistance to outflow (Aaron et al., 1996; Power et al., 1998).

Another evidence of a relationship between the size of the prostate and USMI is verified in some juvenile dogs that improve spontaneously with time as the prostate gland develops and the smooth muscle provides peri-urethral support and tone (Aaron et al., 1996).

A correlation also exists between castration and USMI (Aaron et al., 1996). The median time from castration to incontinence is 5 years, with a range from 2 to 9 years (DeBleser et al., 2011). However, in contrast to bitches about half of the male dogs affected by USMI are intact (Arnold et al., 2006).

While not a cause of USMI, obesity may worsen the degree of incontinence (Holt, 1999). One explanation is that the retroperitoneal fat can displace the caudal peritoneum cranially so that the bladder neck is displaced in an extra-peritoneal position (Noël et al., 2010a).

Diagnosis

A diagnosis of USMI is made on the basis of the history and the elimination of other possible diagnoses, including pelvic, neurological and lower urogenital tract abnormalities, leading to urinary incontinence (Holt, 1990; Power et al., 1998; Holt, 2008).

Serum biochemistry, blood haematology and urinalysis are important to eliminate causes of polydipsia and polyuria. Urine bacteriology and imaging of the bladder may eliminate detrusor instability associated with urinary tract infection. Intravenous urography, retrograde urethrocystography and ultrasonography allow a complete anatomical evaluation of the urinary tract required to eliminate physical abnormalities associated with other causes of incontinence such as bladder neoplasia and ureteral ectopia (Holt, 1999).

Urodynamic procedures, such as urethral pressure profilometry and cystometry, can also aid in the differential of the causes of incontinence, such as those caused by detrusor instability and hyperreflexia (Byron et al., 2007).

In humans, urethral pressure profile is the confirmatory test for USMI because it measures the urethral pressure from the bladder neck to the external urethral orifice (Goldstein and Westropp, 2005). However, in dogs, this technique is not available in most veterinary practices and there is a risk of injuring the urethra and damaging the catheter during the manipulation (Salomon et al., 2002).

Differential diagnosis

USMI must be differentiated from other causes of urinary incontinence. In juvenile dogs, ureteral ectopia, bladder hypoplasia, pervious urachus and congenital neurological problems are the main causes of urinary incontinence. In adult dogs the main differential diagnoses are prostatic disease, bladder neoplasia, urinary tract infection, urolithiasis, acquired neurological conditions, detrusor instability and overflow incontinence associated with chronic retention (Holt, 1990).

Treatment

Conservative management is frequently disappointing. In comparison with the bitch, the condition is less likely to respond to medical therapy (Holt, 2008).

The medical therapy with phenylpropanolamine gives poor results, since only 43.75% of male dogs treated with this medication have a satisfactory response (Aaron et al., 1996).

The administration of phenylpropanolamine stimulates l-adrenergic receptors, which increases the tone of the smooth muscle of the bladder neck and uretha, promoting a significant increase in urethral closure pressure (Beaufays et al., 2008). However, adverse side effects following phenylpropanolamine administration have been described such as decreased appetite, gastrointestinal disorders, restlessness (Scott et al., 2002), convulsions, cardiac complications (Noël et al., 2010b), as well as excitability and aggressiveness, especially in male dogs (Salomon, 2009). In Brazil, its marketing has been prohibited since 2000.

Other drugs used to treat USMI in male dogs include androgens and oestrogens. The effect of testosterone on the lower urinary tract is poorly understood, besides having been considered ineffective in a study by Aaron et al. (1996) on which only one of five animals responded to methyltestosterone.

Testosterone is contraindicated when there has been prostatic disease (Aaron et al., 1996) and exogenous administration may cause aggressivity, hepatotoxicity, prostatic hyperplasia, alteration of blood lipid levels and coagulation factors (Shahidi, 2001).

Male dogs have poor response to oestrogen therapy (Aaron et al., 1996). Affected dogs sometimes respond to the therapy, but in many animals the response ceases eventually, despite increasing the dosage of oestrogens, possibly due to desensitization of oestrogen receptors (Noël et al., 2010a).

Oestrogen receptors are found in the male dog urethra, especially in the medial segment of the prostatic
urethra. Oestrogens are known to increase the number and the responsiveness of 1-adrenergic receptors to sympathetic stimulation, increasing urethral smooth muscle tone and the urethral closure pressure (Noël et al. 2010a). A combination of oestrogen and an 1-adrenergic agent such as phenylpropanolamine may be useful and reduce the dose of each individual drug needed, lessening the chances of side effects (Holt, 1999).

However, prolonged administration of oestrogen may cause thrombocytopenia; aplastic bone marrow; obstructive prostatic hypertrophy; testis atrophy; ginecomastia; thyroid and prostatic squamous metaplasia; and renal interstitial fibroplasia (Zayde et al., 1999).

Surgical treatment of USMI should always be a considerable option, once medical treatment has been ineffective or side effects have been developed (Salomon, 2009).

Some surgical techniques have been described such as prostatopexy (Salomon, 2009) and deferentopexy (Salomon et al., 2002).

Prostatopexy is the cranial traction of the bladder, so that the prostate is moved to an intra-abdominal position and anchored to the prepubic tendon on either side of the midline (Holt et al., 2005), taking care not to enter the prostatic urethra and not cause an excessive pressure of the urethra against the pubic (Salomon, 2009).

Reported results reveal improvement in clinical signs in many cases (Salomon, 2009). However, the results of prostatopexy appear less satisfactory than other techniques, such as deferentopexy (Holt et al., 2005).

Deferentopexy is the preferred technique for male dogs affected with USMI and it is the incision of the deferent ducts at the inguinal canal, cranial traction of the urinary bladder and fixation of the free end of the deferent ducts in the ipsilateral abdominal wall, creating a slight tension on the bladder neck and proximal urethra (Salomon et al., 2002).

A negative point of this technique is that it requires the dog to be castrated. Some authors avoid castration of the entire male dogs with USMI since castration is a predisposing factor and might be expected to worsen the clinical signs (Power et al., 1998).

Although surgery often improves the clinical signs, urinary incontinence may persist, requiring concomitant medical treatment (Salomon et al., 2002).

Urethral sub mucosal injections of bulking agents are an alternative for refractory cases to medical treatment (Claeys et al., 2010).

Currently, collagen is the most used bulking agent for USMI in male dogs, being injected at the middle of the prostatic urethra. For this a midline incision and a cystotomy are necessary as the endoscope is not flexible and cannot be introduced via the penis. The results are often transient. The initial result of the application may reduce 12 months after the procedure (Arnold et al., 2006), since the collagen spreads within the sub mucosa layer leading to flattening and subsequent loss of effect of the deposits, thus requiring the reapplication of the substance (Claeys et al., 2010).

To prevent the risk of an iatrogenically caused prostatitis, intact male dogs with USMI have to be castrated 3 weeks before the procedure. The success rate of the collagen injection is similar to the more invasive surgical techniques, but with a much lower rate of complications (Arnold et al., 2006).

**Prognosis**

The request for euthanasia (Holt et al., 2005) is often due to failure in the USMI treatment of male dogs (Aaron et al., 1996), a situation which is rarely tolerated by owners, particularly those with indoor pets (Salomon et al., 2002).

**Conclusion**

The small number of USMI cases in male dogs makes it poorly reported in the literature. However, the exposure of this theme is important to make the clinicians aware of this disorder of micturition and to stimulate the development and the description of new surgical and alternative procedures able to achieve better results in USMI treatment.

**Bibliography**


