

animals. There is a breed predisposition in the UK (Labradors, Golden Retrievers and Skye terriers) whilst in the USA Siberian Huskies, Newfoundlands, Bulldogs, West Highland White terriers, Fox terriers and Miniature and Toy Poodles appear to be at risk.

The cause is unknown but hereditary factors may play a role. Incontinence may be continuous (*Fig. 4*, page 11) or intermittent and even when both **ureters** are ectopic (**bilateral ectopic ureter**), the dog can usually still pass a normal stream of urine, despite the copious leakage at other times. Diagnosis is by **contrast radiography** (special x-ray studies discussed in more detail in the section **How is urinary incontinence investigated?**). Secondary complications are common and usually involve the **kidney** and **ureter** on the affected side. For example, the area of the **kidney** where urine collects before passing down the **ureter** may become **dilated** (distended) with urine (**hydronephrosis**) or infected (**pyelonephritis**) and the **ectopic ureter**, itself is usually **dilated** with urine (**hydro-ureter**).

Congenital Urethral Sphincter Mechanism Incompetence

Congenital urethral sphincter mechanism incompetence means that the dog is born with a weakness of the **urethral sphincter mechanism**. This is the second most common cause of juvenile incontinence (35% of incontinent juvenile dogs) and tends to be a problem of large breeds of dog, predominantly bitches. Leakage of urine is more copious compared to animals with **ectopic ureters**, and occurs predominantly when the dogs are lying down and relaxed or asleep. The **urethra** may be abnormally short (**urethral hypoplasia**) or even absent. Urethral **diverticula**

(cavities outpouching from the **urethra**) and urethral **dilatations** may be present in male animals.

In many bitches, no gross abnormalities are detected on **contrast radiography**, apart from a bladder which is located too far back ('**caudally** positioned bladder') and the diagnosis frequently relies on the history and elimination of other possible causes of incontinence. **Urodynamic investigations** (such as a technique called **urethral pressure profilometry**) can be used to measure the resistance in the **urethra** and are of some value but are not always diagnostic and are rarely available in most veterinary practices.

Bladder Hypoplasia

Bladder **hypoplasia** basically means that the dog has been born with a bladder which is too small for the size of the animal. This is a subjective diagnosis and it is unclear if the problem is true bladder **hypoplasia** or failure of normal bladder growth and development. It is commonly associated with other **congenital** (present from birth) causes of incontinence but may, rarely, occur alone. The diagnosis is confirmed by **contrast radiography** as only a small amount of contrast medium is required to fill the bladder during retrograde techniques (see later). It is important in animals with a presumptive diagnosis of bladder **hypoplasia** to eliminate other causes of incontinence which may also be present. For example, the small bladder may be a reflection of poor bladder development because of lack of stimulation by adequate volumes of urine in the bladder (e.g. the dog with **ectopic ureter**, in which much of the urine bypasses the bladder and so is not stored).

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Fig. 5. In **pervious urachus**, leakage of urine is via the **umbilicus** and may result in local skin **scalding**, as can be seen in this beagle puppy.

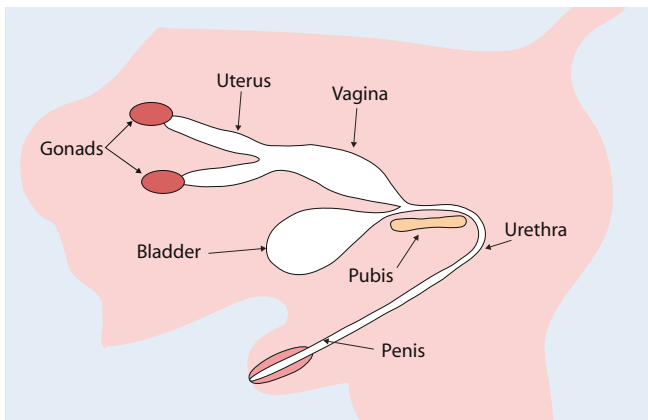


Fig. 6. Diagrammatic representation of the commonest anatomical abnormalities present in intersex dogs which are incontinent. Although these dogs have a male type of **lower urinary tract** anatomy, they also have a **vagina** which opens into the **urethra**. When they urinate, some of the urine passes from the **urethra** into this **vagina**. In between urinations, the urine in the **vagina** may leak out, leading to the sign of incontinence.

Pervious Urachus

Pervious urachus is seen when a communication (the urachus), which is present in the foetus, between the bladder and the **umbilicus** (navel) fails to close before birth. This means that the leakage of urine occurs through the **umbilicus**, leading to **scalding** of the skin on the lower **abdomen** in that region (Fig. 5). It is very rare in puppies compared to horses and farm animals. This condition is easily diagnosed since incontinence occurs through the **umbilicus** which may be **scalded** with urine. **contrast radiography** confirms the diagnosis (see later).

Intersexuality

Intersexuality occurs when animals are born with both male and female **genitalia**. Rarely, intersex animals may be incontinent. During urination, some of the urine passes normally down the **urethra** while some urine accumulates in abnormally-present internal sex organs (for example within a **vagina** inside a dog which externally looks male! – Fig. 6). The urine which accumulates in the **vagina** subsequently leaks out via the **urethra** between urinations, thus leading to the sign of incontinence. Diagnosis relies on **contrast radiography** such as retrograde positive contrast **urethrocytography** (contrast imaging of the **urethra** and bladder).

Congenital Neurological Conditions

Very rarely, puppies are born with abnormalities of the spine. The main sign in these animals is an inability to stand and/or walk normally but incontinence (urinary and faecal) may also be present. Spinal radiography and or **MRI** scanning may confirm the diagnosis.

What are the causes of urinary incontinence in adult animals?

Most causes of **urinary incontinence** in dogs are acquired; that is, they develop in adulthood in a dog which was previously continent. Incontinence in adults is *much* more common in bitches than in male dogs. Although there are many conditions which can lead to **urinary incontinence** in adults, by far the commonest (80% of incontinent adult bitches) is **acquired urethral sphincter mechanism incompetence**. More details will be given about this condition than the other, much rarer, causes of incontinence therefore. The main causes of adult incontinence are:

- **Acquired urethral sphincter mechanism incompetence**
- **Prostatic diseases**
- **Bladder neoplasia (cancer)**
- **Ureterovaginal fistula**
- **Acquired neurological conditions**
- **'Overflow' incontinence**
- **Detrusor overactivity/instability**

Acquired Urethral Sphincter Mechanism Incompetence

In adult dogs referred for the investigation of **urinary incontinence**, **urethral sphincter mechanism incompetence** – failure of the **urethral sphincter mechanism** – is by far the commonest diagnosis made, affecting 80% of incontinent bitches. In these animals, incontinence occurs mainly when the dogs are recumbent and relaxed (*Fig. 7*). Although this is the doggy equivalent of human stress incontinence, few of these animals leak doing aerobics! Thus most owners notice that there



Fig. 7. Urine leakage in an adult Rottweiler bitch with **acquired urethral sphincter mechanism incompetence**. In adult female and male dogs with this problem, urine leakage occurs predominantly when the dogs are lying down and relaxed.

are damp patches or pools of urine on the floor, carpets etc. where the dog has been lying. Although **urethral pressure profilometry** – measurement of the tone of the urethral wall – can be used to demonstrate incompetence of the **urethral sphincter mechanism**, this technique is not readily available in general practice and is predisposed to a number of **artefacts** which can make interpretation difficult. In general practice, therefore, the diagnosis is usually made on the basis of the breed, history and by the elimination of other possible diagnoses using imaging (radiography) and laboratory techniques. **Acquired urethral sphincter mechanism incompetence** usually (but not always) follows neutering in both bitches and male dogs. Before treatment can be contemplated, an understanding of the **pathophysiology** (i.e. the factors which contribute to the condition) of **urethral sphincter mechanism incompetence** is

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required. Our current knowledge is more extensive in the bitch (the commonest sex affected) and so what follows relates to female dogs although mention will be made of males later. Since no true bladder neck sphincter muscle 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 urinary continence control.

The 'urethral sphincter mechanism' is a term used to summarise the forces acting in the urethra to keep the urethra closed and prevent incontinence. A number of factors are believed to contribute towards this sphincter mechanism and these include:

- Urethral tone – the ability of the tissues of the urethral wall to prevent the passage of urine when an animal is not urinating. Measurement of urethral tone (urethral pressure profilometry) has demonstrated that poor urethral tone is implicated in urinary incontinence. Urethral tone is maintained by a complex interaction of neuromuscular, vascular and passive elastic components and it is unclear which of these is deficient in sphincter mechanism incompetence.
- Length of the urethra – there is considerable variation in urethral length between bitches of different sizes. However, taking body size into consideration, bitches with sphincter mechanism incompetence tend to have shorter urethras than continent animals.
- Position of the bladder neck – a number of authors recorded the radiographic finding of a caudally positioned bladder (also referred to as a 'pelvic bladder') during the investigation of incontinent animals (compare Fig. 12c with Fig. 12a on page 22). The significance of this finding was disputed in the past but there is now good evidence that an intrapelvic bladder neck (i.e. a bladder the neck of which is too far back, inside the pelvic cavity – a so-called 'pelvic bladder') contributes 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 backwards 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 continent animals, suggesting a deficiency in supporting mechanisms in the lower urinary tract of affected animals.
- Breed and body size – body size appears to be a factor since large and giant breeds are particularly at risk. Urethral sphincter mechanism incompetence is most common in the UK in Dobermans and Old English Sheepdogs, and there is evidence that these breeds and Rottweilers, Weimaraners, Springer Spaniels and Irish Setters are at increased risk for developing this form of incontinence.
- Obesity – whilst not a cause of the condition, obesity may worsen the degree of incontinence.