1. Insufficient contraction of the sphincter: this is the most common cause of urine leakage in female dogs. If the sphincter is too weak or does not contract enough, then urine will pass through the bladder neck into the urethra before the bladder is full and before the dog consciously decides to urinate. This usually happens when the dog is lying or sleeping. This condition is called urethral sphincter mechanism incompetence or USMI.

2. Irritation of the bladder wall due to inflammation (for example in the case of bacterial infection or bladder stones) can lead to premature contraction of the detrusor. Contraction of the detrusor before complete filling of the bladder will lead to unconscious leakage of urine. This condition is also known as stress incontinence or active incontinence.

3. If as a consequence of a malformation one of the ureters (or both) do not open into the bladder but avoid the sphincter muscle and open into the urethra, then there will be a continuous and unconscious flow of urine from the kidneys directly to the outside. This condition is called ectopic ureter(s).

As mentioned, USMI is the most common cause of urinary incontinence in bitches. However, not all incontinent bitches have USMI and other causes of incontinence should be ruled out.

Pathophysiology of urinary incontinence
There are basically three mechanisms which can lead to leakage of urine:

1. Insufficient contraction of the sphincter: this is the most common cause of urine leakage in female dogs. If the sphincter is too weak or does not contract enough, then urine will pass through the bladder neck into the urethra before the bladder is full and before the dog consciously decides to urinate. This usually happens when the dog is lying or sleeping. This condition is called urethral sphincter mechanism incompetence or USMI.

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As mentioned, USMI is the most common cause of urinary incontinence in bitches. However, not all incontinent bitches have USMI and other causes of incontinence should be ruled out.

Pathophysiology of USMI
As mentioned above, the sphincter muscle is controlled by the sympathetic nervous system. However other factors are known to also have an influence on the capacity of the sphincter to effectively close the bladder. Hormones (estrogens) have been found to have an effect on the strength of the sphincter muscle, which explains why incontinent bitches start having problems within months after ovariectomy.

Another factor of importance is the position of the bladder: if the bladder is entirely in the abdomen, then an increase in pressure in the abdomen (e.g. if the dog is lying or sleeping) will be transmitted to the bladder and to the sphincter. The net effect is 0 and the dog does not leak urine. However if the bladder lies too far back and the bladder neck is in the pelvic cavity, then a pressure increase in the abdomen will only lead to a pressure increase in the bladder without pressure increase on the sphincter. In this case the pressure difference between the inside of the bladder and the outside world will increase and urine will leak out of the bladder.
Other medicines with less well documented results

This is the easiest way to treat USMI and is successful

1. Conservative treatment with medication:
   This is the easiest way to treat USMI and is successful
   in most cases. The main medicines used belong to
   the group of sympaticomimetic drugs, i.e. drugs that
   activate the sympathethic nervous system and there-
   fore activate the sphincter muscle of the bladder.
   The two most often used in the Netherlands are phe-
   nylpropanolamine (Propalin®) and ephedrine (Enu-
   race®). Since one of the possible explanations for the
   weakening of the sphincter muscle is the absence of
   hormones after castration, it has been found that
   the combination if the sympaticomimetis with
   estrogens has a good effect. Many types of estro-
   gens may have side effects that limit their use (they
   inhibit the formation of blood in the bone marrow).
   Estriol (Incurin®) is one which is safe to use over a
   long period of time. If the medication has an effect,
   it should be given for the rest of the life of the dog.
   Other medicines with less well documented results
   include tricyclic antidepressants (Imipramine) and
   GnRH antagonists (e.g. Suprelorin).

2. Endoscopic treatment:
   In cases where medication has an insufficient effect
   or no effect at all, other treatments have to be used.
   With the dog under anesthesia and using a cysto-
   scope it is possible to inspect the urethra and blad-
   der. At the same time a paste made of teflon or col-
   lagen can be injected under the mucosa of the
   urethra close to the bladder neck in order to make
   the bladder neck narrower thereby decreasing the
   leakage of urine. This technique is relatively quick
   and initially gives good results, however inconti-
   nence usually re-appears after 1-2 years. Therefore
   this treatment is usually used in older bitches only.

3. Operations
   A number of operations have been described to try
   and treat the problem of USMI in bitches. One type
   of operation is performed with the objective of cor-
   recting the abnormal position of the bladder if it lies
   to far caudally in the pelvis (so-called "pelvic blad-
   der"). The bladder is pulled forward and the vagina
   or urethra are fixed to the abdominal wall (colposus-
   pension or cystourethropexy).
   In another type of operation a band of suture mate-
   rial is passed through the openings in the pelvis and
   over the urethra and pulled tight enough to increase
   the resistance in the urethra and prevent urine leak-
   age (transpelvic sling). This operation has to be per-
   formed with pressure measurements in the urethra
   to avoid tightening the band to hard and causing
   urinary obstruction.

Ectopic ureter

Ectopic ureter is a congenital condition in which the
ureter opens outside the bladder. The condition can
affect one or both ureters. The ureter opens usually in
the urethra, but a ureteral opening in the vagina or the
uterus is also possible. Ectopic ureters are said to be
extramural if they bypass the bladder completely, or
intramural if they run within the wall of the bladder,
underneath the mucosa.

As an anatomical abnormality, ectopic ureters predis-
pose the urinary tract for infections that can affect only
the lower urinary tract or both the lower and upper uri-
mary tract and cause pyelonephritis. Hydroureter is
often seen on the side of the ectopy. This may be a con-
sequence of infection or of urinary flow obstruction, as
the ureter courses through the sphincter muscle of the
bladder neck. If both ureters are affected, the bladder
may become hypoplastic due to the lack of normal
filling.
Ureteroneocystostomy:
The ectopic ureter is ligated and transacted close to its attachment to the urethra. A stay suture is placed on the end of the ureter to aid with manipulation. The bladder mucosa is incised at the normal location of the ureteral opening and a short tunnel is created under the mucosa. The seromuscular layer of the bladder is then also incised and the ureter is pulled into the bladder using the stay suture. A short longitudinal incision is made into the end of the ureter (this is called “spatulating”) and the wall of the ureter is sutured to the mucosa of the bladder (same suture pattern and material as for neoureterostomy).

Postoperatively, animals should be checked for urinary obstruction as manipulation of the bladder mucosa during surgery can cause swelling in the bladder neck. In case of obstruction a catheter should be placed. When the ureter has been re-implanted, patency should be checked ultrasonographically.

In many dogs, ectopic ureter is combined with functional problems of the bladder and urethra (such as USMI) and 30%-50% of dogs (especially females) remain incontinent after surgery for ectopic ureters. These dogs may respond to α-adrenergic agonists (e.g. phenylpropanolamine).

UROLITHIASIS
Henry F L'Eplattenier
DrMedVet, PhD, DipECVS, MRCVS
VRCC Veterinary Referrals, Laindon, Essex
(www.vrcc.co.uk)
United Kingdom
h.leplattenier@googlemail.com

Stones that are formed in the urinary tract are called uroliths or calculi. Uroliths may form in the upper or lower urinary tract although clinical signs are more often associated with lower urinary tract disease. The clinical management of patients with urolithiasis depends on the type of urolith, the location of the urolith and the clinical signs. The most common uroliths include: struvite (magnesium-ammonium-phosphate), calcium oxalate, urate, calcium phosphate, cystine and silicate.
**Aetiopathogenesis**

Uroliths can only form in the urine under certain conditions:

a) The chemical components have to be present in the urine at concentrations exceeding their solubility. That way crystals form that can aggregate to produce uroliths.

b) Some crystals (such as struvite) are highly sensitive to the acidity of the urine, others (such as calcium oxalate) are not pH sensitive.

c) Crystals will normally be flushed out with the urine. For uroliths to be formed, crystal aggregation must take place rapidly.

For specific causes and predisposing factors for each type of urolith, please refer to Table 1 at the end of this abstract.

**Clinical signs**

The clinical signs associated with urolithiasis can vary depending on the location of the calculi. These symptoms can also vary in intensity from no signs to life-threatening signs. Clinical signs are usually typical for lower urinary tract disease but they are not specific for urolithiasis.

**Stage 1: subclinical disease**

Uroliths can be present without the owner noticing any abnormalities in their pets. Stones with very smooth surfaces may not cause any clinical signs at all and are sometimes discovered as an incidental finding. Nephroliths often do not cause any signs other than haematuria.

**Stage 2: mild signs**

These include slightly increase frequency of urination, mild haematuria, mild straining and discomfort during urination, licking of the genital area.

**Stage 3: severe signs**

Same signs as in stage 2, but with severe intensity, in addition signs of urinary obstruction such as grossly distended bladder and general depression.

**Stage 4: life-threatening signs**

These include anuria (no urine is passed), weakness or collapse, dehydration, absent bladder upon palpation in cases of bladder rupture, vomiting and even seizures.

**Diagnosis**

The clinical signs will usually suggest possible urolithiasis. Detection of the uroliths can be achieved by direct palpation (in the bladder or urethra), visualisation on survey radiographs if the uroliths are radiodense, visualisation using contrast radiography for radiolucent uroliths, visualisation with ultrasound (all uroliths).

An important part of the diagnosis is the determination of the type of urolith. While a definite diagnosis is often only obtained after chemical analysis of the calculi, several elements make it possible to guess the composition of uroliths:

a) Urine pH

Phosphate uroliths (struvite and calcium phosphate) are formed in alkaline urine, whereas urate and cystine are formed in acid urine. Calcium oxalate crystals are not pH sensitive.

b) Urine sediment

Detection of crystals in the sediment can be suggestive of the type of urolith. It is very important to analyse the urine as soon as possible, avoiding changes in temperature as these can induce the formation of other crystals, giving a false positive result.

c) Radiodensity

Calcium-containing uroliths are very radiodense, struvite calculi are usually radiodense, whereas urate and cystine calculi are radiolucent.

d) Presence of another disease

Liver disease or portosystemic shunts can predispose to the formation of urate calculi. Diseases causing hypercalcaemia and hypercalciuria can predispose to calcium oxalate calculi. Urinary tract infections are a common cause of struvite uroliths.

**Treatment**

Treatment can be surgical or medical and depends on the location and type of the calculi:

a) Kidney

Nephroliths are difficult to manage surgically as nephrotomy causes significant damage to the parenchyma and reduction on the glomerular filtration rate. Surgical removal is performed only when
Clinical signs are severe (persistent haematuria or urinary obstruction leading to hydronephrosis) and if the uroliths cannot be dissolved medically. Before nephrometry, the renal artery and vein are temporarily ligated to minimize haemorrhage. The kidney capsule and parenchyma are then incised in the middle plane of the kidney until the renal pelvis is opened. The kidney is closed by placing mattress sutures across the renal parenchyma and by suturing the renal capsule with a simple continuous suture pattern.

b) Renal pelvis
Infrequently, uroliths will cause dilatation of the renal pelvis from where they may be removed by incising only the renal pelvis instead of the renal parenchyma (pyelotomy).

c) Ureter
Uroliths in the ureters are usually passed through into the bladder with time. Forced diuresis can be attempted to accelerate movement of the calculi. Uroliths that are firmly lodged in the ureter and cause obstruction may require to be removed surgically. Options include ureterotomy (with a high risk of complications including strictures and renal failure), removal of part of the ureter and ureter re-implantation (if the urolith is located very distally in the ureter) and nephrectomy (only in unilateral disease, obviously).

d) Bladder
Cystotomy: in males when the composition is not known, in males and females when the calculi cannot be dissolved medically (Ca-oxalate), in females when the calculi are too large to be flushed out and when the composition is not known.

Voiding urohydropropulsion: in females only for small calculi (performed under anaesthesia: the bladder is filled with fluid, the dog is held upright to let the uroliths migrate to the bladder neck, then the bladder is compressed to evacuate the stones through the urethra. Simultaneous cystoscopy is useful to make sure treatment is effective).

Medical dissolution: useful if the composition of the stones is known (see Table 2).

e) Urethra
Urethra obstruction by uroliths is a potentially fatal condition and prompt intervention is indicated. Emergency treatment of urethral obstruction includes:
- IV fluid therapy (NaCl)
- Assess for hyperkalemia (blood sample, ECG)
- Relieve bladder pressure by cystocentesis
- Retain urine sample for routine analysis and bacteriology
- Place a urinary catheter, if possible

Ideally, calculi lodged in the urethra should be flushed back into the bladder and removed by cystotomy, as this technique presents far less complications as surgical removal of uroliths directly from the urethra.

Uroretropropulsion: a catheter is placed as far into the urethra as possible. The urethra is manually occluded distally (at the urethral opening) and proximally to the urolith (by transrectal digital pressure on the urethra). Fluid is injected into the urethra to distend it allowing the calculus to be dislodged. By releasing the proximal urethral occlusion, the urolith can be flushed back into the bladder.

Urethrotomy: in cases where the urolith cannot be dislodged, surgical removal may be required and performed by incising the urethra directly over the urolith.

Permanent urethrostomy: in cases where the urolith cannot be surgically removed (e.g. if it is located in the os penis), a permanent stoma is made in the urethra. The technique of choice in dogs is a scrotal urethrostomy (requiring castration and scrotal ablation). The urethra is opened and the mucosa is sutured directly to the skin creating an opening if about 3-4 cm length.

Prevention of recurrence
Whichever technique is used for the treatment of the uroliths, attention should be given to the factors contributing to the formation of the uroliths, since recurrence will be very likely if nothing is done to modify the circumstances that led to urolith formation. The measures to be taken are different for the different types of uroliths and are listed in Table 2 at the end of this abstract.
Table 1. Aetiology and characteristics of the most common uroliths in cats and dogs.

<table>
<thead>
<tr>
<th>Urolith</th>
<th>Major mineral composition</th>
<th>Urine pH which favours formation</th>
<th>Known predisposing factors</th>
<th>Physical characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Struvite</td>
<td>Mg-ammonium-phosphate</td>
<td>Alkaline</td>
<td>Dog: Urinary tract infection (UTI) by urease-producing bacteria Cat: sterile formation, hyper-saturation</td>
<td>Radiodense (variable)</td>
</tr>
<tr>
<td>Calcium oxalate</td>
<td>Ca-oxalate monohydrate</td>
<td>Not pH sensitive</td>
<td>Hypercalciuria (hypercalcaemia, acidifying diet)</td>
<td>Very radiodense</td>
</tr>
<tr>
<td>Urate</td>
<td>Ammonium urate Sodium acid urate Unic acid</td>
<td>Acid</td>
<td>Defect of enzyme uricase (Dalmatians) Liver disease (e.g. portosystemic shunt)</td>
<td>Radiolucent</td>
</tr>
<tr>
<td>Calcium phosphate</td>
<td>Calcium phosphate or Calcium hydrogen phosphate</td>
<td>Alkaline</td>
<td>Minor component of Struvite or Ca-oxalate uroliths</td>
<td>Very radiodense</td>
</tr>
<tr>
<td>Cystine</td>
<td>Cystine</td>
<td>Acid</td>
<td>Hereditary defect in cystine transport by renal tubular cells Newfoundland Engl. Bulldog Dachshund</td>
<td>Radiolucent</td>
</tr>
<tr>
<td>Silica</td>
<td>Silicone dioxide</td>
<td>Less soluble in acid urine</td>
<td>Diet of corn gluten feed or soyabean hulls</td>
<td>Relatively radiodense</td>
</tr>
</tbody>
</table>

Table 2. Medical management and prevention of recurrence or the most common uroliths in cats and dogs (Hill’s prescription diets are mentioned as examples only, similar diets from other manufacturers are of course equally appropriate).

<table>
<thead>
<tr>
<th>Urolith</th>
<th>Goals for medical management</th>
<th>Medical therapy for dissolution</th>
<th>Prevention of recurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Struvite</td>
<td>Eliminate UTI</td>
<td>Check for cause of UTI Culture and sensitivity Long AB treatment Repeat culture and sensitivity Feed s/d (canine or feline) (low protein, low Mg, acidifying)</td>
<td>Check urine pH after fasting Long term use of canine or feline c/d</td>
</tr>
<tr>
<td></td>
<td>Acidify urine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduce Mg</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reduce nitrogenous waste</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increase urine volume</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium oxalate</td>
<td>Not possible</td>
<td>Not possible</td>
<td></td>
</tr>
<tr>
<td>Urate</td>
<td>Reduce formation of urates</td>
<td>Allopurinol (10 mg/kg BID) Feed canine u/d Urine alkalising agents (NaHCO3, K-citrate)</td>
<td>Long term use of canine u/d Long term use of feline x/d Urethrostomy to prevent recurrent urethral obstruction and/or to allow urolith removal by voiding hydropropulsion (male cats)</td>
</tr>
<tr>
<td></td>
<td>Lower intake of purines</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Alkalinise urine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Treat liver disorder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium Phosphate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cystine</td>
<td>Reduce dietary protein</td>
<td>Feed canine u/d</td>
<td>Combination of diet plus alkalinisation of urine</td>
</tr>
<tr>
<td></td>
<td>Alkalinise urine</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chelate cystine to form a more soluble complex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silica</td>
<td>Not possible</td>
<td>Not possible</td>
<td>Alkalinise urine?</td>
</tr>
</tbody>
</table>

2-MPG = N-2-mecaptopropionylglycine (not available in NL)
UROLOGIC EMERGENCIES

Henry F L’Eplattenier  
DrMedVet, PhD, DipECVS, MRCVS  
VRCC Veterinary Referrals, Laindon, Essex  
(www.vrcc.co.uk)  
United Kingdom  
h.leplattenier@googlemail.com

Urologic emergencies are related either to urine leakage or obstruction of the urinary tract.

Urine leakage  
Pathophysiology and diagnosis: Trauma to the kidney can cause leakage of urine. The urine can leak either into the retroperitoneal space or into the abdomen. Ureteral ruptures may occur with similar consequences. If only one kidney or ureter is involved and leaking into the retroperitoneal space, the other side might be functioning properly, resulting in normal urea and creatinine. If there is a uroabdomen, however, serum urea and creatinine levels will increase.

One study showed that urinary tract injury was diagnosed in 39% of cases of pelvic trauma. In another study, only 40% of bladder ruptures were detected within 12 hours of trauma.

Tears in the distal urethra can cause urine to leak into the perineum and under the skin. If the rupture is not identified rapidly, urine will leak further down the hind limbs and cause large surfaces of skin to necrotise.

Metabolic changes associated with urine leakage include increase serum urea and creatinine, increase serum potassium with reduced sodium and chloride and a gradually increasing PCV and white blood cell count.

When urine leakage is suspected, abdominocentesis should be performed. For definitive diagnosis, urea, creatinine and potassium of the fluid should be measured. If these measures are higher than the values in a concurrently obtained blood sample, that indicates that the fluid is urine.

Diagnostic imaging should be performed in all cases of urinary tract trauma. Survey radiographs can reveal a number of abnormalities: pelvic fractures, loss of detail in the abdomen, uroliths, etc. If a rupture of the lower urinary tract is suspected, a cysto-urethrogram should be performed with iodinated contrast medium. Excretory urography is required to identify injury and obstruction of the kidneys and ureters definitively.

Treatment:  
Patients should be stabilised before any surgical treatment is attempted. In particular serum potassium levels should be corrected before anaesthetising the patients as hyperkalemia can cause severe heart dysrhythmia. When the bladder or the urethra is ruptured, a catheter can be passed into the bladder and connected to a closed urine collection system. If a ureteral tear is present or is uroabdomen persists, urine should be drained from the peritoneal cavity. A catheter (e.g. peritoneal dialysis catheter) can be placed into the abdomen to reduce peritonitis, uraemia and hyperkalemia. Fluid therapy should be initiated as soon as possible with physiological NaCl rather than Ringer’s as it does not contain any potassium.

Renal parenchymal injuries are treated surgically if they are associated with significant haemorrhage or urine leakage. Partial or total nephrectomy may be indicated depending on the severity of the trauma.

Incomplete tears in the ureter can be debrided and sutured. If the ureter is transacted, the ends can be debrided and anastomosed after spatulation to avoid stricture. A stent can be placed in the ureter, then passed into the bladder and out through the urethra to facilitate suture of the ureter. The stent can be removed after 5-7 days. Ureters avulsed close to the bladder can be re-implanted into the bladder. If none of these techniques are an option and if the problem is unilateral, nephrectomy can be performed.

Urinary bladder injuries are debrided and repaired. For small tears in the urinary bladder or urethra, placement of an indwelling catheter can be used to divert urine while the defect heals. Small tears can heal with a catheter in 5-7 days without surgical intervention. Larger tears require surgical repair.

Lower urinary tract obstruction  
History of urinary tract obstruction usually includes stranguria. Systemic signs do not generally occur in the first 24 hours. Postrenal uraemia develops within 48 hours. Abdominal palpation reveals a large tense bladder, except if the obstruction has lead to rupture of the bladder. In cats, urethral obstruction should be differentiated from stranguria with an empty bladder as a result of idiopathic cystitis.
Urethral obstruction is usually caused by uroliths in dogs and urethral plugs in cats. Other causes include transitional cell carcinoma and granulomatous urethritis. Clinical signs vary greatly depending on the duration of the obstruction, from stranguria alone to severe systemic signs like shock and unconsciousness. Rectal or vaginal palpation can reveal uroliths or masses.

The following steps should be followed in an emergency situation:

1. obtain a blood sample to assess the severity of the condition
2. start fluid therapy immediately: use NaCl (hyperkalemia)
3. ECG in case of bradycardia
4. Cystocentesis
5. Correct hyperkalemia: fluid therapy alone is often sufficient
6. Catheterisation: in cats an intravenous catheter is often helpful to relieve the obstruction at first at it has a forward opening, then a urinary catheter can be placed. Water-soluble lubricant can be added to physiological NaCl, if necessary.

In dogs, uroliths can be flushed back into the bladder using hydropulsion: two people are needed, one person occludes the proximal urethra in the pelvic canal via rectal palpation, the other passes the catheter and occludes the urethral opening. Fluid with lubricating gel (50/50) is injected to dilate the urethra, then the proximal occlusion is released.

7. The catheter is passed into the bladder and secured.
8. Attach the catheter to a closed collection system.
9. Cats: in mild cases, there is no need to leave the catheter in place. If the bladder was very distended and detrusor function is likely to be reduced then the catheter should be kept in place until urination is normal.
10. Dogs: the catheter is left in place until the uroliths are removed surgically from the bladder.

Obstruction caused by tumours of the urethra of by urethritis are usually diagnosed by cystoscopy and biopsy.

**URINARY TRACT NEOPLASIA**

Henry F L'Eplattenier
DrMedVet, PhD, DipECVS, MRCVS
VRCC Veterinary Referrals, Laindon, Essex
(www.vrcc.co.uk)
United Kingdom
h.leplattenier@googlemail.com

**Renal tumours**

Metastases of other tumours to the kidney are more frequent than primary tumours in the kidneys in dogs. The majority of primary renal tumour are malignant and include renal tubular cell carcinoma (RCC), transitional cell carcinoma (TCC). Others include haemangiosarcoma, nephroblastoma and fibrosarcoma. Lymphoma is the most common renal tumour in the cat. Most tumours are found in older dogs, but nephroblastoma can occur in young dogs. Clinical signs are often non-specific (weight loss, anorexia, depression). Gross haematuria is not always seen. German shepherds with renal cystadenocarcinoma also have multiple cutaneous nodules.

The primary diagnostic tool is imaging with ultrasound. Advanced imaging such as MRI and CT can also be valuable, particularly to evaluate invasion into the caudal vena cava.

Unilateral tumours are best treated with nephrectomy. Chemotherapy has not been well evaluated except for lymphoma.

Metastatic disease is common, therefore staging is important. Median survival times for operable tumours range in reports from 8 to 16 months.

Nephroblastoma is an embryonal tumour and is also called Wilm's tumour. It is the most common tumour of young dogs, sometimes as young as less than 1 year. Metastasis is frequent and survival less than 12 months.
Companion Animal Programme

Chapter 2

Tumours of the ureter
Primary tumours of the ureters are extremely rare. They are typically leiomyoma/-sarcoma or transitional cell carcinomas (TCC). Obstruction usually leads to hydroureter and hydrenephrosis. The tumour can be imaged with an IVU (intravenous urogram) and/or ultrasound. Treatment of choice is ureteronephrectomy. Prognosis is worst with TCC as they will metastasise and better with leiomyosarcoma as the metastatic potential is lower.

Tumours of the bladder
Most tumours of the urinary tract are found in the bladder. The most common is TCC (about 90% of all bladder tumours). Other tumours include sarcoma, haemangiosarcoma and lymphoma.

TCC is most commonly located in the trigone region of the bladder. About 30% of patients have metastases at the time of diagnosis. Metastases are to the local lymph nodes and lungs. Most common clinical sign is haematuria. In more advanced cases animals present in renal failure due to bilateral obstruction of the ureters at the trigone. It is important to perform a good work-up in older patients with haematuria rather than just administer antibiotics in order to diagnose bladder tumours as early as possible.

Bladder tumours are usually diagnosed on ultrasound. Biopsies can be taken with a urinary catheter (under ultrasound guidance). This technique avoids the risk of tumour seeding to the abdominal wall. Cystoscopy is useful to determine resectability before surgery. Surgery (partial cystectomy) results in a median survival time of 3-6 months. Tumour-free margins are often impossible to achieve and failure of treatment is due to local recurrence.

The current chemotherapy protocol after surgery (or as sole treatment in inoperable cases) is a combination of mitoxantrone and piroxicam (Feldene) or meloxicam.

Tumours of the urethra
Urethral tumours are uncommon in the dog and the cat. Tumours of the proximal portion of the urethra are usually TCC and in the distal portion squamous cell carcinoma (SCC). Urethral tumours are a common cause of stranguria in older bitches. The main differential diagnosis is granulomatous urethritis.

These tumours can be palpable rectally but the final diagnosis is usually obtained with cystoscopy and biopsy. Treatment is usually with chemotherapy as in bladder tumours. In rare cases of limited involvement of the urethra, surgery (partial urethral resection and anastomosis) can be attempted. Urethral stenting may be a useful palliative measure for non-resectable tumours.

Tumours of the prostate
Canine prostate carcinoma (PCA) is uncommon with an estimated prevalence of 0.2 to 0.6% (Bell et al., 1991). True prevalence is unknown as population-based data is not available. Canine PCA has an invasive growth pattern and commonly metastasizes to the sublumbar lymph nodes; occasionally, metastases to the lungs and lumbar vertebrae are observed. Castration has no effect on disease progression, nor does it prevent occurrence of PCA; in fact, it appears that castrated males are at an increased risk of developing PCA compared with intact males (Teske et al., 2002). Clinically, canine PCA therefore resembles late stage, hormone-independent human PCA and the dog is an appropriate model for understanding the pathogenesis of PCA in humans.

Most dogs diagnosed with PCA are not treated, either because of the presence of metastases, or because of the poor prognosis. Treatment is often unrewarding due to advanced stage of the disease and the absence of effective treatments. Treatment is usually palliative. Various surgical treatment have been described. Total prostatectomy: Treatment with curative intent is rendered difficult by the fact that radical prostatectomy in dogs with prostatic disease is associated with a very high incidence of postoperative urinary incontinence. Partial prostatectomy: Because of the complications associated with radical prostatectomy, techniques for partial removal of the prostate have been described. These include partial prostatectomy using a Nd:YAG laser (1,2) and intracapsular subtotal prostatectomy using electrocoagulation (3,4) or an ultrasonic aspirator (5,6). Mean survival times of about 4 months were obtained with these techniques.

Radiotherapy can be used with palliative intent, provided good planning software is used to minimize exposure of the colon and bladder to the radiation.

Medical treatment with a combination of NSAIDs (COX-2 inhibitors) and the chemotherapeutic agent mitoxantrone can alleviate symptoms. There is little data on survival times using this type of management.
Like for urethral tumours, urethral stenting can be a useful palliative measure in dogs with urinary obstruction secondary to prostate carcinoma (7).

References