European Veterinary Conference
Voorjaarsdagen

Amsterdam, Netherlands
24 - 26 April, 2008

Next meeting:

Apr. 23-25, 2009 - Amsterdam, Netherlands
EUROPEAN VETERINARY CONFERENCE Voorjaarsdagen

www.voorjaarsdagen.org

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Surgery of the urinary tract (basic level)

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The procedures listed below are considered to be basic level, which means that every veterinarian experienced in general soft tissue surgery should be able to perform them.

Nephrectomy

Removal of the kidney is necessary, when severe loss of functional parenchyma has occurred caused by neoplasia, purulent inflammation, obstruction of the ureters a.o. Most cases of nephrectomy are a result of renal tumors or severe hydroureter.

Before nephrectomy is considered renal function should be assessed carefully to guarantee that the remaining kidney will take over the adequate glomerular filtration rate. If creatinine and urea values in the plasma are already increased, the remaining kidney will most likely fail after a short period of time. Early indicators of insufficient renal function in case of normal creatinine and urea values are decreased specific gravity or osmolality of the urine and proteinuria. If available, renal szintigraphy would be the most valuable tool in pre-surgical assessment of the patient, however the total glomerular filtration rate assessment by exogenous creatinine clearance would be quite helpful either.

Approach to the kidney is via a midline coeliotomy or via a flank incision caudal to the last rib. The latter approach is more invasive, but access to kidney is more comfortable.

A wound retractor such as by Balfourt is helpful. During median coeliotomy the left kidney is visualized by gentle retraction of the colon, the right by medial traction to the duodenum. During manipulation the intestines should be covered with moist sponges.

If the kidney is not too large it may be bended in direction of the midline to access the retroperitoneum of the lateral aspect and dissection of the peritoneal cover. Blunt dissection allows further upward traction on the kidney and visualization of the vessels and ureter. The vessels are isolated by careful dissection with long forceps (e.g. baby Mixter) and then the renal artery is ligated or clipped first, followed by the renal vein. 3-0 or 4-0 suture material is used for ligation or titanium ligacliks. Two clips or ligatures are placed close to the large vessels and one close to the renal pelvis. The ovarian or testicular vein, if necessary to preserve, should be avoided since it is entering the left renal vein. The presence of more than one renal artery should also be taken into account on the left side.

After dissection of the vessels the ureter may be freed from the surrounding tissue and grabbed with a forceps. The kidney is then pulled out of the abdomen and remaining capsule is freed from the peritoneal cover. The site of ureter ligation and dissection depends on the pathologic changes in the ureter, either close to the kidney, or, if necessary, close to the bladder trigone.

Illustrations from „Urologic Surgery of the dog and cat“, Eds: E.A. Stone und J.A. Barsanti, Lea&Febiger, 1992
Cystotomy
The most commonly performed procedure to remove uroliths from the urinary tract, excise bladder polyps or just take a biopsy. Calculi, which have been flushed backwards into the bladder or large stones can be removed easily by a simple surgical procedure. The approach is in the caudal midline, except in the male dog, in which a parapreputial skin incision is made and after lateral retraction of the prepuce and penis the midline of the abdominal fascia is incised. The bladder is pulled into the wound of the abdominal wall after dissection of the ventral ligament and held with stay sutures to avoid trauma caused by grasping forceps. The surrounding area is packed with gauze sponges or covered with a water-resistant drape to prevent contamination of the abdominal wound. The incision in the bladder is made in the cranial aspect, the apex or bladder dome, avoiding nutritive vessels. The urine is removed during the procedure by a suction device. In the female dog and cat uroliths can easily be grasped with a forceps or caught with a spoon and removed from the lumen, while in the male dog retrograde flushing of the proximal urethra may be necessary to bring the smaller calculi into the bladder lumen. If this is not done thoroughly, calculi may be left in the prostatic urethra and may cause immediate recurrence of problems.
Closure of the cystotomy wound may be performed in several manners, but the author prefers the following technique because of the excellent results in regard to the healing of the mucosal layer. The mucosa is sutured in a simple continuous pattern using polydiaxanone (3-0 or 4-0 USP). This material is resolved in urine in a few days, while the mucosa heals in between 2-7 days. The remaining layers, the submucosa, muscle and serosa are sutured by slightly inverting simple Lembert style sutures, using polyglaktin 3-0 or 4-0. Even if there is no evidence of a urinary tract infection, antibiotics are given for 4-5 days postoperatively (e.g. amoxicilline). If UTI has been identified before surgery treatment is started immediately to avoid the presence of an infection during cystotomy. Postoperative hematuria should not last longer than 48 hours and only in cases of persistent dysuria or urgency a spasmolytic agent such as oxybutynine (0,5 mg/kg/day TID orally) could be given temporarily.

Urethrotomy
If calculi are trapped in the urethra and can not be flushed or extracted without causing too much damage to the urethra it may be necessary to incise the urethral lumen. This situation is more or less restricted to male dogs with the area caudal to the os penis and the perineum being the favorite locations. In order to prevent stricture formation and stenosis of the urethral lumen after surgery it is usually recommended to let the incision heal by second intention. However, bleeding from the wound for up to 3 weeks, inflammation of the wound and urine scalding have been observed frequently and therefore the author does not favor this procedure. If secondary closure is attempted anyway, there are some rules which may prevent complications. First, the skin incision is made as small as possible, second, a catheter is left for 2 days at least, fixated to the skin and connected to a urine collection bag. Third, the skin should be adapted slightly to improve dermal healing, which otherwise would take weeks, while the mucosa heals in between 2-7 days. The urethral mucosa is not sutured with this technique because any type of closure will cause some degree of urethral stenosis. Problems with urine leakage which causes severe phlegmonous reaction in the surrounding tissues are prevented with catheter management.

Perineal urethrostomy
Perineal urethrostomy may be required in male cats with severe or recurrent obstruction of the urethra due to urethral plugs, calculi or stricture after conservative management. The disadvantage is a slightly decreased local host defense mechanism explaining a higher rate of urinary tract infection. It also should be made clear to the client, that the stoma will not prevent lower urinary tract disease in general, it only prevents obstruction and is helpful in the management of recurring urolithiasis. The recommended technique requires removal of the prepuce, part of the distal penis and urethra and splitting of the urethra up to the bulbourethral glands. In this region the diameter of the urethra will allow passage a catheter of the size 6-8 French (2,3-2,6 mm). The ischiocavernosus muscle has to be completely separated.
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Scrotal Urethrostomy

Although this is an invasive procedure causing deterioration of the local host defense mechanisms it may be the best solution for specific cases. Severe urethral damage by urinary calculi or due to their removal, frequently recurring obstruction because of unsuccessful prevention of uroliths formation, or complications of a urethrostomy are indications for a permanent fistula. In male dogs the most appropriate location for the stoma is in the area of the scrotum, because of the large diameter of the urethra in this area and the fact that more caudally located locations are increasing the risk of ascending infections and prescrotal fistulas cause irritation of the scrotum and are much smaller. The disadvantage is the required castration. However, if castration is a major problem for the client, the scrotum can be removed and the testicles translocated in the inguinal area. The author has not experienced problems on the long term in dogs in which the testicles have been transposed. In general the scrotal urethrostomy is started as an ablation of the scrotum and castration. The subcutaneous fat is then dissected until the penis with its retractor muscle covering the urethra becomes visible. The retractor muscle is elevated and dissected from the urethra. The corpus spongiosum is then incised carefully until the lumen can be recognized. Bleeding may be serious and interfere with visualization of the structures. The urethra is incised from the caudal end of the os penis to the area where the bulbospongious muscle starts. The tunica albuginea is then sutured to the subcutaneous fat with few stitches on each side and then the mucosa is sutured to the skin. Simple interrupted sutures are placed close to each other, using 4-0 USP suture material. The author prefers polyglaktin, a multifilament, resorbable synthetic suture material. After surgery an Elizabethan collar is put on.

Local hemorrhage is the most common complication and may cause desperation in the clients, depending on the suture technique it also causes hematomas in the subcutaneous layers interfering with wound healing. Dogs which are not castrated should therefore be treated with anti-androgens or gestagens for a period of some weeks, and in severe bleeding hypotensive drugs with sedative effect may be used.

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Fig. II ans III Elevation of the retractor penis muscle which is covering the corpus spongiosum of the urethra and suture placement through dermis and urethral mucosa

References
- E.A. Stone und J.A. Barsanti (eds.). Urologic surgery of the dog and cat, Lea&Febiger, 1992