General Principles:
Healing of the urethra is dependent on urethral continuity and local urine extravasation. If a strip of urethra remains intact and urine is diverted from the site, the urethral mucosa can seal the wound in one week. If the urethra is completely transected, the mucosal ends will retract and fibrous tissue fills the intervening gap, obstructing the urethra. Primary repair is therefore required with complete urethral transection. Urethral injuries can seal within 3 days but heal best when urine is diverted from tears or surgical sites. Urine diversion can be performed with transurethral catheters or cystostomy tubes; either method will decrease the risk of stricture compared to primary anastomosis alone. Risk of urethral stricture formation is increased with tension on the anastomosis or use of oversized urethral catheters.

Surgical Approach:
The distal urethra can be approached through a perineal or scrotal approach (males) or through an episiotomy (females). Perineal and episiotomy approaches are often performed with the animal in sternal recumbency with its rear legs hanging over the end of a tilted, padded table. If identification or catheterization of the urethra is expected to be difficult, concurrent cystotomy is needed, or a mass is present that extends into the abdominal cavity, surgery is performed with the animal in dorsal recumbency. If necessary, the rear legs of the animal are pulled cranially to provide a perineal view; this is particularly useful in cats during perineal urethrostomy. In female dogs, the perivulvar area is clipped and prepped and included in the draped field to allow retrograde or antegrade catheterization. In male dogs, the prepuce is included in the prep and sterile field.

The proximal urethra can often be reached through a caudal abdominal incision. Approach to the midportion of the urethra may require pelvic osteotomy or ostectomy. Pubic osteotomy alone (a raised flap incorporating the pubic bone) will expose the cranial half of the intrapelvic urethra. Adductor muscular attachments are left in place along one edge of the pubis to improve blood supply and stability. If possible, a portion of the prepubic tendon can also be left attached to the pubic flap. The bone flap is reflected ventrally and caudally during surgery. If a wider exposure is required, a bilateral pubic and ischial osteotomy (sagittal pubic osteotomy) or symphyseal ostectomy can be performed. For sagittal pubic osteotomy, the pubis is divided along its length with an oscillating saw and its edges gently separated with a rib spreader. The edges are wired back together once the intrapelvic procedure is complete. With bilateral pubic and ischial osteotomy, muscular attachments are left in place along one lateral margin of the bone flap, and the flap is reflected laterally along these attachments. To facilitate closure of ostotomies, holes can be drilled in the pubis and ischium before osteotomy. The prepubic tendon can be secured to the bone fragment through additional drill holes or reapposed as needed along its midline and then sutured caudally to the adductors. Pubic osteotomy can be performed with rongeurs or burr. The cranial half of the pubis can be removed to expose the urethra immediately caudal to the prostate and trigone. If more extensive exposure is required, the entire pubic and ischial symphysis can be removed to produce a gap that is 2 to 3 cm wide, depending on the size of the animal; rib retractors can be used to widen the gap even more. A portion of the cranial (acetabular) branch of the pubis medial to the iliopubic eminence should be left intact.
with the attached prepubic tendons. During closure, the prepubic tendon and adductors are apposed along the midline and the tendon is sutured caudally to the cranial edge of the adductors.

Urethral Repair

Urethral tears and lacerations are usually secondary to trauma, urethral catheterization, or calculi but can also occur inadvertently during surgery. If a strip of the urethral wall remains intact, most patients can be treated with urinary diversion. If the urethra cannot be catheterized retrograde, a cystotomy is performed and a catheter passed antegrade through the bladder and out the urethra; a Foley catheter is tied to the catheter and pulled retrograde into the bladder. If the urethra is completely transected, primary repair is required. Urethral resection and anastomosis is occasionally performed to resolve strictures or remove tumors. Urinary diversion is important for healing and should be maintained for a minimum of 3 to 5 days, depending on the health of the urethral tissues and the amount of tension on the anastomosis. Urine should be cultured after catheters are removed. In male dogs undergoing intrapelvic urethral resection and anastomosis, there was no significant difference in urethral healing in those that had an indwelling urethral catheter, cystostomy tube, or a combination of both after surgery.

Prescrotal Urethrotomy

Under general anesthesia, most urethral calculi can be retropulsed into the urinary bladder and removed with cystoscopy, cystoscopically assisted cystotomy, or open cystotomy. Those that cannot be shifted are usually lodged within the urethra at the caudal end of the os penis. Many of these calculi become embedded within the mucosa and are not easily removed, even through a urethrotomy; in these dogs, scrotal urethrostomy is usually performed. In a few dogs, the calculus can be dislodged through a prescrotal urethral incision. Prescrotal urethrotomies are usually closed primarily to reduce postoperative hemorrhage. Urethral incisions that are left open to heal by second intention will bleed for 3 to 14 days, particularly when animals are excited. Rarely, dogs may undergo permanent prescrotal urethromstomies. Owners should be warned of the potential for urine scald along the scrotum and inner thighs.

Scrotal Urethrostomy

Persistent or severe hemorrhage and dehiscence are uncommon after scrotal urethrostomy when the urethrocutaneous apposition is performed with a continuous pattern, suture bites include mucosa, and postoperative self-mutilation is prevented. A rapidly absorbable monofilament synthetic suture can be used for closure; sutures are usually not visible 3 weeks after surgery and therefore do not need removal. Addition of a mattress suture at the cranial and caudal extents of the urethrostomy may prevent hemorrhage from the sites, since the “crotches” of the incisions are often missed during urethrocutaneous apposition.

Perineal Urethrostomy (PU)

For cats with concurrent cystic calculi and urethral obstruction or those with strictured PU sites, surgery is most easily performed with the cat on its back and the rear legs pulled forward so that the bladder and urethra can be approached simultaneously. The veterinarian must take care to incise the correct side of the penile body- the one closest to the anus- when opening the urethra. As with dogs, the PU site can be closed with a simple continuous pattern with rapidly absorbable monofilament. However, preplacement of the first 3 to 5 sutures in an interrupted pattern will help secure the urethral mucosa to the skin appropriately. When
preplacing the top 3 sutures, bites should be taken as close to the top (“crotch”) of the urethrostomy incision as possible. The first 2 sutures pass through this “crotch” area and angle out to grab skin at the 10 and 2 o’clock positions. The top suture also passes through this area and angles out slightly higher (a less acute angle at about the 1 o’clock position) instead of grabbing the skin directly dorsal to the urethrostomy. This will prevent kinking of the skin and shortening of the distance between the urethrostomy and the anus. Perineal urethrostomy is not always required for cats with obstructions; in fact, 73% of cats in one study responded to treatment with sedatives, analgesics, intermittent cystocentesis, subcutaneous administration of fluids, and a stress free environment.

Perineal urethrostomy through an episiotomy can be performed in female dogs that require vaginal and distal urethral resection (e.g. for leiomyomas). Because of the aggressive nature of the tumor, it is not recommended for dogs with distal urethral transitional cell carcinomas; instead, those dogs may benefit from urethral stenting and appropriate chemotherapy (e.g. piroxicam). In female dogs the distal urethra can be resected and the proximal end anastomosed onto the remaining vagina (vaginourethroplasty) or the vestibule.

Subpubic and Antepubic urethrostomies:

When the urethral end is too short to reach the skin without tension, it can be brought cranial to the pubis (antepubic urethrostomy), or a portion of the pubis can be removed with rongeurs (subpubic urethrostomy). Because of the curve produced in the urethra, subpubic urethrostomy does not always reduce the length of urethra needed to reach skin. Antepubic urethrostomy has a high complication rate (incontinence, urine scald) and is considered a salvage procedure.

Urethral Prolapse:

Repair techniques for urethral prolapse include resection and anastomosis or urethropexy. For anastomosis, fine rapidly absorbable suture is recommended. Recurrence (57%) has been reported with both procedures, and postoperative hemorrhage (39%) is also common.

Urinary Incontinence

Hydraulic occluders are becoming more popular for treatment of incontinence caused by urethral sphincter mechanism incompetence. A silicone cuff is placed around the proximal urethra about 2 cm distal to the bladder neck and is attached by tubing to a subcutaneous vascular access port inserted along the caudal abdomen. Many dogs do not need any cuff inflation because of local pressure in the area from the cuff or resultant scar tissue. Those that need extra pressure to maintain continence must be managed cautiously; sometimes addition of as little as 0.1 ml of saline to the cuff can result in obstruction of the dog.