Vaginal resection and anastomosis for treatment of vestibulovaginal stenosis in 4 dogs with recurrent urinary tract infections

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Case Description—Four dogs were evaluated because of recurrent urinary tract infections.
Clinical Findings—All dogs had recurrent urinary tract infections and similar clinical signs; 3 dogs had urinary incontinence. Digital vaginal examination revealed vestibulovaginal stenosis in all dogs, which was confirmed by results of contrast vaginourethrography. From image measurements, the vestibulovaginal ratio (ratio of the height of the vestibulovaginal junction to the maximum height of the vagina on a lateral vaginourethrogram) was calculated for each dog. Three dogs had severe stenosis (vestibulovaginal ratio, <0.20; severe stenosis is defined as a vestibulovaginal ratio <0.20), whereas the fourth dog had moderate stenosis (vestibulovaginal ratio, 0.24; ratio range for moderate stenosis is 0.20 to 0.25).

Treatment and Outcome—All dogs were anesthetized for surgical correction of the vestibulovaginal stenosis. Vaginal resection and anastomosis of the stenosis was performed in all 4 dogs, with 1 dog also undergoing episiotomy. Complete resolution of clinical signs was apparent in 3 dogs; 1 dog had postoperative complications including pollakiuria and stranguria, which resulted in rectal and vaginal prolapse. This dog underwent ovariohysterectomy, after which clinical signs resolved. All dogs had resolution of urinary tract infections at the time of follow-up (6 to 8 months after surgery).

Clinical Relevance—Resection and anastomosis may resolve recurrent urinary tract infections in dogs with severe or moderate vestibulovaginal stenosis. Episiotomy was not necessary for success of surgical treatment, and overall, that procedure increased morbidity, the severity of intraoperative hemorrhage, and duration of surgery. (J Am Vet Med Assoc 2011;239:972-980)

A 1.5-year-old spayed female Golden Retriever (dog 1) was evaluated at the University of Minnesota Veterinary Medical Center because of intermittent urinary incontinence that began at 2 months of age. The dog was reported to visibly leak urine while sleeping. Prior to evaluation, the dog received several treatments with antimicrobials for a series of urinary tract infections. Diagnosis and treatment were based on results of urinalysis and microbial cultures of urine samples with antimicrobial susceptibility testing of the identified microorganisms. Organisms cultured included Proteus spp, Enterococcus spp, and Escherichia coli. The urinary incontinence was reported by the referring veterinarian to be partially responsive to administrations of antimicrobials. Physical examination revealed that dog 1 weighed 38.9 kg (85.8 lb) and had a body condition score of 7/9. A recessed vulva was noted, but all other findings were considered normal. A CBC and serum biochemical analyses revealed no notable abnormalities. Intravenous urography was performed by use of 86 mL (882 mg/kg [401 mg/lb]) of iodinated contrast agent.

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no notable abnormalities. Retrograde positive-contrast vaginourethrography was performed. Fluoroscopic images revealed a moderate to severe vestibulovaginal stenosis just cranial to the urethral papilla. From image measurements (in millimeters) made on a lateral vaginourethrogram, the vestibulovaginal ratio (ratio of the height of the vestibulovaginal junction to the maximum height of the vagina) was calculated. The vestibulovaginal ratio was indicative of severe stenosis (0.11 [severe stenosis is defined as a vestibulovaginal ratio < 0.20]). The owners consented to surgical resection and anastomosis of the vagina for correction of the stenosis and episioplasty to correct the vaginal invagination.

For surgery (day 0), dog 1 received acepromazine maleate (0.02 mg/kg [0.009 mg/lb]), buprenorphine hydrochloride (0.01 mg/kg [0.005 mg/lb]), atropine sulfate (0.04 mg/kg [0.018 mg/lb]), and medetomidine (0.005 mg/kg [0.002 mg/lb]) IM as premedication; 30 minutes later, medetomidine hydrochloride (0.005 mg/kg), acepromazine (0.125 mg/kg [0.057 mg/lb]), and ketamine hydrochloride (1 mg/kg [0.45 mg/lb]) IM were also administered. Thiopental sodium (2 mg/kg [0.91 mg/lb]) was administered IV for induction of anesthesia. Isoflurane in oxygen was administered for maintenance of anesthesia throughout the procedure. An epidural injection of lidocaine (0.75 mg/kg [0.34 mg/lb]), preservative-free bupivacaine hydrochloride (0.375 mg/kg [0.17 mg/lb]), and preservative-free morphine sulfate (0.1 mg/kg [0.045 mg/lb]) was administered at the L7-S1 intervertebral space. Cefazolin sodium (22 mg/kg [10 mg/lb]) was injected IV immediately before and during surgery (at 90-minute intervals). Carprofen (2 mg/kg) was administered once SC after surgery.

Hair was clipped from the perineal region, and dog 1 was placed in sternal recumbency on a tilted operating table (ie, in a head-down position). Four 4 × 4-inch cotton gauze squares were placed in the anus, and a purse-string suture was applied to close the anal opening. The surgical site was aseptically prepared. A midline skin incision along the median raphe was made through the dorsal commissure of the dorsal labia to a level just distal of the external anal sphincter. The incision was continued through the fascia and the constrictor vestibularis and constrictor vulvaris muscles. The vagina was inspected, and stenosis was evident just cranial to the urethral papilla. Sharp dissection was continued as a dorsal episiotomy to the level of the vaginal stenosis. The urethra papilla was identified, and a 10F red rubber catheter was placed in the urethra. Hemorrhage was controlled with electrocautery. Two full-thickness horizontal mattress stay sutures were placed on each side of the episiotomy incision to facilitate retraction. A ring retractor was placed to improve exposure. The stenotic area was removed via full-thickness resection with a No. 15 blade and Metzenbaum scissors. The vagina was Anastomosed with 2-0 polydioxanone suture applied in a simple interrupted pattern through the tunica mucosa and tunica muscularis, with all knots placed outside the vaginal lumen. The dorsal episiotomy incision was closed with 2-0 polydioxanone suture applied in a simple continuous pattern, through both the tunica mucosa and tunica muscularis. Digital palpation of the inside of the vaginal vault confirmed a wide, patent vault. The urinary catheter was removed prior to closure.

The redundant perivulvar tissue was inspected, and an incision was made near the dorsal commissure of the vulvar mucocutaneous junction. The redundant fat and muscle tissues were removed in an elliptical pattern. The remainder of the episiotomy and episioplasty sites was closed as follows: vestibule (tunica mucosa and muscularis), closed with 3-0 poliglecaprone 25 suture in a simple continuous pattern; perivulvar muscles (constrictor vestibularis and constrictor vulvaris muscles), closed with 3-0 poliglecaprone 25 suture in a simple continuous pattern; and subcutaneous tissues, closed with 3-0 poliglecaprone 25 suture in a simple continuous pattern. The skin was closed with 3-0 nylon suture applied in a cruciate pattern. The purse-string suture and cotton gauze squares were removed from the anal region. Duration of surgery was 120 minutes.

Dog 1 recovered without complications from anesthesia. Initially, the dog was unable to urinate. The effect of the epidural injection was reversed, and the dog was hospitalized for an additional day. The dog was able to urinate on day 2. Dog 1 was discharged to the owners' care on day 3; they were instructed to administer carprofen (2.5 mg/kg [1.14 mg/lb], PO, q 12 h) for 14 days, enrofloxacin (5.1 mg/kg [2.3 mg/lb], PO, q 24 h) for 10 days (to continue treatment of the previously diagnosed urinary tract infection), and tramadol (1.25 mg/kg [0.57 mg/lb], PO, q 8 to 12 h) as needed for pain relief. The owners reported that the dog appeared uncomfortable 2 days after being discharged from the hospital (day 5 after surgery) and required additional pain medication (tramadol, 1.25 mg/kg, PO, q 8 to 12 h) as prescribed by the referring veterinarian. No additional pain management was required after this time.

Six weeks after surgery, a survey was sent to the owners to obtain information regarding the dog's condition. Clinical signs of urinary tract infections were not reported, indicating that one of the initial clinical problems had resolved. The owners also reported no episodes of incontinence since surgery. Subsequently, dog 1 underwent follow-up positive-contrast vaginography 7 months after surgery. The results confirmed marked reduction in the severity of stenosis, compared with findings of preoperative vaginography. The dog had a vestibulovaginal ratio of 0.61, which was considered normal. Only minimal variation in diameter of the vagina was evident. There was some irregularity of the mucosal edges of the vagina, which was most likely a result of scar tissue formation associated with the surgical procedure; however, the mucosal irregularity did not compromise the diameter of the vagina. Digital vaginal palpation at the time revealed an open vaginal vault with no stricture formation. Results of microbial culture of a urine sample collected from the dog were negative.

A 5-year-old spayed female Standard Poodle (dog 2) was referred to the veterinary medical center for evaluation of a possible vestibulovaginal stenosis. The referring veterinarian reported that the dog had recurrent urinary tract infections for several years. Initial clinical signs of pollakiuria, which were nonresponsive to antimicrobial treatments, were noticed at 7 months of age. The dog had recurrent vaginitis since it was 1 year old. The dog was reported to intermittently dribble urine around the house. At times, the dog would ap-
pear to be normal and have no incontinence for several months. The owners noted no urination during sleep and that the urine dribbling was partially responsive to antimicrobial treatments.

A physical examination revealed that the dog weighed 20 kg (44 lb) and had a body condition score of 5/9. Via digital examination, vaginal stenosis was palpable approximately 3 inches proximal to the vulva just cranial to the urethral papilla. No recessed vulva was evident, and all other findings were considered normal. Positive-contrast vaginourethrography revealed a severe stenosis (vestibulovaginal ratio, 0.14; Figure 1). The owners consented to surgical resection and anastomosis of the vagina for correction of the stenosis. Results of a preoperative CBC and serum biochemical analyses were within reference limits.

For surgery (day 0), dog 2 was premedicated with medetomidine (0.005 mg/kg) and morphine (0.5 mg/kg [0.23 mg/lb]) IM; induction of anesthesia was achieved via IV administration of ketamine (2.6 mg/kg [1.18 mg/lb]) and propofol (1 mg/kg). Anesthesia was maintained via inhalation of isoflurane in oxygen for the duration of surgery. Cefazolin (20.8 mg/kg [9.5 mg/lb]) was administered IV before and during surgery (ie, 90 minutes later). An epidural injection of bupivacaine (0.5 mg/kg) was administered at the L7-S1 intervertebral space.

Hair was clipped from the perineal region, and dog 2 was placed in sternal recumbency on a tilted operating table (ie, in a head-down position). Presurgical preparation proceeded as for dog 1. A skin incision was made along the median raphe just distal to the anus to the dorsal commissure of the labia at the level of the myocutaneous junction. Sharp dissection through the subcutaneous tissue exposed the constrictor vestibularis and constrictor vulvae muscles distally. Continued sharp dissection through these muscles allowed observation of the dorsal aspect to the vestibulovaginal vault; a ring retractor was placed to improve exposure. Minimal use of electrocautery provided adequate hemostasis. A 10F red rubber catheter was placed retrograde

Figure 1—Preoperative (A and B) and postoperative (C and D) positive-contrast vaginourethrographic views of a 5-year-old spayed female Standard Poodle (ie, dog 2) with vestibulovaginal stenosis. A—Lateral vaginourethrographic view obtained before surgery. The height of the vestibulovaginal junction (a) and the maximum height of the vagina (b) are measured on lateral vaginourethrographic views to calculate the vestibulovaginal ratio (a divided by b); preoperatively, the ratio was 0.14 (ie, 4.09 mm divided by 29.36 mm). A ratio of < 0.20 is considered indicative of severe stenosis, 0.20 to 0.25 is considered indicative of moderate stenosis, 0.26 to 0.35 is considered indicative of mild stenosis, and > 0.35 is considered anatomically normal. The site of stenosis (white arrow) is evident. The urethra is filled with contrast agent (black arrow). B—Ventrodorsal vaginourethrographic view obtained before surgery. The site of stenosis (white arrow) is indicated. C—Lateral vaginourethrographic obtained 7 months after surgery. The vestibulovaginal ratio was 0.59 (ie, 27.54 mm divided by 46.57 mm) and considered normal. The surgical procedure resolved the stenosis (arrow). D—Ventrodorsal vaginourethrographic view obtained after surgery illustrating the effective treatment of the previously stenotic site (arrow). In all images, the dog’s head is to the left.
into the urethra via palpation (Figure 2). This was done to aid in identification and isolation of the urethra ventrally. The urethra was easily palpated once the red rubber catheter was in place. Blunt dissection of the dorsal and lateral aspects of the vagina exposed the region of vestibulovaginal stenosis. Careful blunt dissection was performed along the ventral aspect of the vaginal stenosis cranial to the urethra papilla, allowing passage of a quarter-inch Penrose drain to be placed between the urethra and vagina (Figure 3). Blunt dissection was continued cranially to expose 1.5 to 2 cm of normal vagina cranial to the stenosis. A single stay suture was placed both cranial and caudal to the stenotic region. By use of a No. 15 blade and Metzenbaum scissors, the region of stenosis was removed. Again, hemorrhage was controlled with minimal electrocautery. The ventral aspect of the anastomosis was closed by placing 3 simple interrupted 3-0 polydioxanone sutures at the 3, 6, and 9 o’clock positions (Figure 4). The areas between the 3 and 6 o’clock and between the 6 and 9 o’clock positions were closed by use of 3-0 polydioxanone suture applied in a simple interrupted pattern. Next, a simple interrupted 3-0 polydioxanone suture was placed at the 12 o’clock position, and the areas between the 9 and 12 o’clock and between the 12 and 3 o’clock positions were closed with 3-0 polydioxanone suture applied in a simple interrupted pattern. All knots were placed outside the vaginal lumen. Digital palpation within the vaginal vault was performed to ensure a wide and patent vestibulovaginal vault. The urethral catheter was removed prior to closure. Closure included reapposition of the constrictor vulvae muscle and subcutaneous and skin layers. The purse-string suture and cotton gauze squares were removed. Duration of surgery was 125 minutes. Dog 2 regurgitated yellow fluid prior to extubation, and the mouth and esophagus were flushed and suctioned. No other complications were observed.

The dog was discharged to the owners’ care on day 1 after surgery; they were instructed to administer carprofen (2.5 mg/kg, PO, q 12 h) and amoxicillin-clavulanate potassium (12.8 mg/kg [5.8 mg/lb], PO, q 12 h) for 10 days and tramadol (2.6 mg/kg, PO, q 8 h) as needed for pain relief. The dog recovered well at home.

Three weeks after surgery, digital vaginal examination revealed that the surgical site had healed. Six weeks after surgery, a survey was sent to the owners to obtain information regarding the dog’s condition. The owners reported that the dog had not had recurrence of clinical signs since the time of surgery. Evaluation of the vaginal vault via digital palpation 3 months after surgery revealed a wide opening of the vaginal vault with no evidence of stricture formation. Results of positive-contrast vaginourethrography performed at 5.5 months after surgery indicated that there was adequate dilation of the vaginal vault with no scarring or stricture at the surgery site; the vestibulovaginal ratio was 0.59, which was considered normal (Figure 1). At that time, no abnormalities were detected via digital vaginal palpation.

A 3-year-old spayed female Labrador Retriever (dog 3) was referred to the veterinary medical center...
Surgery was performed without an episiotomy in a manner similar to that used for dog 2. Carprofen (2 mg/kg) was administered once SC after surgery. Duration of surgery was 75 minutes. The dog recovered from anesthesia without complications.

Dog 3 was discharged to the owners’ care on day 1 after surgery; they were instructed to administer carprofen (2.3 mg/kg [1.05 mg/lb], PO, q 12 h) and amoxicillin-clavulanate potassium (11.6 mg/kg [5.3 mg/lb], PO, q 12 h) for 14 days and tramadol (1.6 mg/kg [0.7 mg/lb], PO, q 8 h) as needed for pain relief. The dog recovered well at home. Six weeks after surgery, a survey was sent to the owners to obtain information regarding the dog’s condition. The owners reported that the dog had not had recurrence of clinical signs since the time of surgery. Seven months after surgery, the referring veterinarian performed follow-up positive-contrast vaginourethrography. At that time, there were no signs of vaginal stricture; the vestibulovaginal ratio was 0.51, which was considered normal. No information regarding results of digital vaginal palpation by the referring veterinarian was provided.

A 6-month-old sexually intact female Labrador Retriever (dog 4) was evaluated at the veterinary medical center because of a traumatic left stifle joint injury. At the time of examination, the owners reported that the dog had a history of urinary tract signs including straining to urinate, leaking urine pools, and having blood in its urine, all of which had been evident since the owners got the dog 3 months earlier. The referring veterinarian records indicated that treatments for several urinary tract infections had been given on the basis of findings of urinalyses (ie, bacteria detected microscopically in urine samples) in the absence of microbial culture results.

Physical examination revealed that dog 4 weighed 19.1 kg (42.0 lb) and had a body condition score of 5/9. During the examination, dog 4 was leaking urine pools. Vaginal stenosis was detected during digital vaginal palpation. Additionally, the dog had excessive skin folds around the vulva. A concurrent finding was left stifle joint abnormalities including effusion, cranial drawer movement, and positive tibial thrust, which were interpreted to be consistent with a cranial cruciate ligament injury.

Positive-contrast vaginourethrography confirmed the presence of severe vaginal stenosis cranial to the urethral papilla; the vestibulovaginal ratio was 0.19. The dog had a history of urinary tract infections including pollakiuria were noted. According to the referring veterinarian’s records, the dog always responded to empirical treatment with antimicrobials.

Results of a CBC and serum biochemical analyses performed prior to surgery were unremarkable. For surgery (day 0), dog 4 was premedicated with morphine (0.9 mg/kg [0.41 mg/lb]) and dexmedetomidine hydrochloride (0.003 mg/kg [0.001 mg/lb]) IM; induction of anesthesia was achieved via IV administration of thiopental (4.7 mg/kg [2.14 mg/lb]) and propofol (0.9 mg/kg). Cefazolin (22 mg/kg) was administered IV before and during surgery (at 90-minute intervals). Anesthesia was maintained via inhalation of isoflurane in oxygen throughout the procedure. An epidural injection of preservative-free morphine (0.09 mg/kg [0.04 mg/lb]) and bupivacaine (0.47 mg/kg) was administered at the L7-S1 intervertebral space.

Results of a presurgical CBC and serum biochemical analyses were unremarkable.

For surgery (day 0), dog 4 was premedicated with IM injections of morphine (1 mg/kg), dexmedetomidine (0.005 mg/kg), and glycopyrrolate (0.01 mg/kg); a mixture of tiletamine hydrochloride and zolazepam hydrochloride (concentration ratio, 50:50; 1 mg/kg) administered IV was used to achieve induction of anesthesia. Anesthesia was maintained via inhalation of isoflurane in oxygen throughout the procedure. Cefazolin (22 mg/kg) was administered IV before and during surgery (at 90-minute intervals). Dog 4 also received an intraoperative dose of fentanyl citrate IV (45.5 mg/kg [22 mg/lb]) once and an intraoperative dose of hydrocortisone (1 mg [0.05 mg/kg [0.024 mg/lb]]) IV once.
An epidural injection of preservative-free morphine (0.1 mg/kg) and bupivacaine (0.5 mg/kg) was administered at the L7-S1 intervertebral space prior to surgery. Surgery was performed in a manner similar to that used for dogs 2 and 3. During the same anesthetic episode, the dog also underwent left stifle joint arthroscopy and left proximal tibial epiphysiodesis to treat a partially ruptured cranial cruciate ligament. Carprofen (2 mg/kg) was administered once SC after surgery. Duration of the vaginal resection and anastomosis was 105 minutes. The dog recovered from anesthesia without complications.

Dog 4 was discharged to the owners' care on day 1 after surgery; the owners were instructed to administer deracoxib (3.9 mg/kg [1.8 mg/lb], PO, q 24 h) for 14 days, cephalaxin (26 mg/kg [12 mg/lb], PO, q 14 h) for 10 days, and tramadol (1.3 mg/kg [0.6 mg/lb], PO, q 8 h). Cephalexin was prescribed prophylactically because the orthopedic procedure that was performed during the same anesthetic episode included placement of metal implants.

Dog 4 was reevaluated on day 2 because of polypnea and an episode of vomiting. At that time, inflammation related to surgery was considered to be the cause of the polypnea. The dog continued to receive oral treatment with deracoxib, cephalaxin, and tramadol because of the short interval since surgery.

Although dog 4 was reported to do well after this visit, clinical signs of polypnea again became apparent approximately 1 month after surgery. The owners reported that the dog was urinating while walking or lying in bed and was straining to urinate. The dog was reevaluated, but no abnormalities were detected via physical examination. Microbial culture of a urine sample revealed evidence of a urinary tract infection with *E. coli*. Treatment with amoxicillin-clavulanate potassium (13.1 mg/kg [5.9 mg/lb], PO, q 12 h, for 14 days) was initiated. After 1 week, no improvement was evident; positive-contrast vaginourethrography was performed, which revealed an obstruction just cranial to the anastomosis site, with dorsal compression of the vaginal lumen, possibly a stricture secondary to surgery. (Figure 5). The site of the stenosis appeared markedly extended, compared with preoperative findings; however, due to the filling defect within the vestibule, which was presumably either an intraluminal or extraluminal mass, the vestibulovaginal ratio could not be determined. Further evaluation (digital vaginal examination, vaginoscopy, or vaginal ultrasonography) was declined by the owners. The relationship between the suspected mass and the dog's clinical signs was unknown. After this visit, the owners declined to complete a survey regarding the dog's condition after surgery and declined further care at the veterinary medical center.

After this visit, the dog's clinical signs resolved for a period of 6.5 months. Thereafter, dog 4 was returned to the referring veterinarian because it was unable to urinate. The dog's vagina and rectum had also prolapsed and were reduced by the referring veterinarian. The referring veterinarian indicated that both digital vaginal examination and vaginoscopy revealed an obstruction, presumably at the site of surgery. The obstruction was palpably soft, and urinary catheterization was possible. The dog had just recently been in estrus, and there was some concern that vaginal hyperplasia had caused the clinical signs; thus, ovariohysterectomy was recommended. During surgery, the uterus was determined to be enlarged, but it was not fluid filled (consistent with a postestrous state); however, there was a fluid-filled dilation just distal to and extending caudally from the cervix. A routine ovariohysterectomy was performed, including removal of the cervix and as much of the dilated section of vaginal tissue as could be approached via a midline laparotomy. The dilated vagina distal to the cervix was filled with fluid. The remaining vaginal tissue was oversewn. Recovery from surgery was uneventful, and the clinical signs resolved. In an update from the referring veterinarian obtained a couple of months after the ovariohysterectomy, no further abnormalities had been detected.

Discussion

Several congenital abnormalities of the vagina in dogs have been reported, including vestibulovaginal stenosis. Vestibulovaginal stenosis is defined as an annular constriction at the vestibulovaginal junction just cranial to the urethral papilla. Vestibulovaginal stenosis is a developmental defect that forms during embryological development. Vestibulovaginal stenosis occurs when there is an incomplete perforation of the hymen or occurs in association with hypoplasia of the genital canal that results in the formation of a vertical septum or an annular fibrotic stenosis at the vestibulovaginal junction. In normally developing dogs, the hymen disappears prior to birth. Prevalence of vestibulovaginal stenosis in dogs has been reported to be approximately 23%.

It has been previously reported that the vestibulovaginal junction should be larger than one-third of the diameter of the vagina. This size difference was determined on the basis of findings in sexually intact female dogs with no known urogenital tract problems. A study involving spayed dogs with and without lower urinary tract signs revealed no significant cutoff point in the vestibulovaginal ratio with which to differentiate clinically affected dogs from unaffected dogs. The vestibular...
Vestibulovaginal ratio is calculated by dividing the height of the vestibulovaginal junction by the maximum height of the vagina (measurements made on a lateral vaginourethrogram). A ratio of < 0.20 is considered indicative of severe stenosis, 0.20 to 0.25 is considered indicative of moderate stenosis, 0.26 to 0.33 is considered indicative of mild stenosis, and > 0.33 is considered anatomically normal. To our knowledge, no filling pressure for performing vaginourethrography for any mammalian species has been described in the veterinary medical literature. Future studies could include assessment of the influence of filling pressure on the calculation of the vestibulovaginal ratio.

In 1 study, measurements of lower urogenital tracts on positive-contrast vaginourethrams, computed tomography vaginourethrams, and uroendoscopy obtained from sexually intact and spayed dogs with no urogenital abnormalities has been reported previously. Vestibulovaginal stenosis has been speculated to result in recurrent urinary tract infections, chronic vaginitis, urinary incontinence and pooling, vulvar dermatitis, nocturia, inappropriate urination, and failure to mate. Dogs with vestibulovaginal stenosis can remain without clinical signs, but when they develop chronic urinary tract infections, surgical correction of the congenital defect is recommended.

In 1 study, surgical correction of severe vestibulovaginal stenosis in 4 dogs resulted in resolution of all clinical signs of recurrent urinary tract infections. However, in other studies, the relationship between clinical signs and vestibulovaginal stenosis has been questioned. In all 4 dogs of this report, recurrence of urinary tract infections was eliminated, supporting surgical correction of moderate and severe vestibulovaginal stenosis.

Vestibulovaginal stenosis can often be diagnosed during digital vaginal palpation, as illustrated by findings in the 4 dogs of this report. As part of the physical examination of female dogs with recurrent urinary tract infections, digital vaginal palpation should be considered to assess for the presence of vestibulovaginal stenosis. The vestibulovaginal junction must be palpated cranial to the urethral papilla to rule out the presence of stenosis. Use of positive-contrast vaginourethrography as a diagnostic aid in cases of urinary incontinence, vaginal discharge, and dysuria or for physical vaginal abnormalities has been reported previously. The vestibulovaginal ratio can then be calculated to determine the severity of the stenosis. In each of the dogs of this report, vestibulovaginal stenosis was detected easily by use of positive-contrast vaginourethrography.

It is interesting to note that in dog 2 of the present report, the vaginal vault appeared more distended in the postoperative vaginourethrogram than it was in the preoperative vaginourethrogram (46.57 vs 29.36 mm). This was most likely due to impaired movement of the contrast agent through the stenotic region because retrograde filling of the urethra and urinary bladder with contrast agent was visible. After the stenosis was resected, no problems with movement of contrast agent were apparent, and the urethra was not filled with contrast agent. This disparity in contrast agent filling further adds to the variables that potentially affect evaluation of vestibulovaginal ratios via vaginourethrography.

Several techniques have been previously described for the treatment of vestibulovaginal stenosis, including manual dilation of the stenosis, T-shaped vaginoplasty, vaginectomy, and vaginal resection and anastomosis. It has been reported that manual dilation generally produces disappointing results, with stricture formation occurring in most dogs. In a report of T-shaped vaginoplasty performed in 4 dogs, the outcome was poor, with success of the procedure reported for only 1 of the 4 dogs. The severity of vestibulovaginal stenosis was not reported for any of those dogs. Furthermore, T-shaped vaginoplasty was described by those authors as a technically difficult procedure. Based on the difficulty of the procedure and poor outcome, the authors did not recommend the procedure. Vaginectomy has been performed to decrease urine pooling. However, vaginectomy can be difficult to perform and is not a viable option if the bitch is to be used for breeding.

In a previous study, vulvoplasty alone did not resolve the problem of urinary incontinence in dogs with severe or moderate vestibulovaginal stenosis. The vestibulovaginal stenosis was not treated surgically with resection and anastomosis or any other surgical treatment; only vulvoplasty was performed. Vulvoplasty alone resolved incontinence in 3 of 11 dogs. In cases of vestibulovaginal stenosis, vulvoplasty may decrease back pressure caused by excess skin folds that overlie the vulvar opening, thereby decreasing urine flow in a cranial direction. However, vulvoplasty does not address urine retention or poor drainage in the vaginal vault cranial to the urethral orifice, which is thought to contribute to urinary tract infections in dogs with vestibulovaginal stenosis.

Severity of the vestibulovaginal stenosis was not reported for the dogs in the vulvoplasty study; however, the authors of that report recommended additional surgical correction of severe and moderate stenosis because resolution of clinical signs was not achieved in all of the study dogs. To the authors’ knowledge, there has been no recent report in the veterinary medical literature regarding the technique of vaginal resection and anastomosis for treatment of vestibulovaginal stenosis in dogs. However, the procedure of vaginal resection and anastomosis in conjunction with an episiotomy has been described. In our experiences with the 4 dogs of this report, we found that increased exposure provided by an episiotomy was unnecessary. In fact, the episiotomy made observations more difficult because of the hemorrhage from the episiotomy incision. We could easily dissect all around the vaginal vault without use of an episiotomy. Catheterization of the urethral papilla can be performed without the need for the episiotomy; it can be achieved either with digital palpation of the urethral papilla or via direct observation after insertion of a vaginal speculum. The urethra could be protected with a Penrose drain placed between the vagina and urethra, as in dog 2 of the present report. The episiotomy worsened the severity of intraoperative hemorrhage significantly, increased morbidity, prolonged the duration of surgery, and likely caused more postoperative discomfort. Therefore, the authors believe that episiotomy is not necessary for success of this surgical procedure.
The use of prophylactic antimicrobial treatment after surgery, without evidence of infection, is generally not recommended. All of the dogs of this report received postoperative antimicrobial treatment. The decision to administer antimicrobials to each of these patients was made on the basis of the history of recurrent urinary tract infections, the location of the surgical incision (ventral to the anus), and the diagnostic vaginographic procedure. Vaginal surgery is considered a clean-contaminated surgery, which often does not necessitate postoperative antimicrobial treatment; however, if a urinary tract infection is present, the procedure would be considered a contaminated surgery and antimicrobials should be prescribed.15

Dog 1 was being treated orally with enrofloxacin prior to surgery, and treatment was continued after surgery to complete the treatment regimen. In addition to vaginal surgery, dog 4 underwent an orthopedic procedure, which included placement of a metal implant, during the same anesthetic episode. The orthopedic procedure prolonged the duration of anesthesia. Furthermore, there was concern that the placement of a surgical implant in combination with a clean-contaminated procedure (or possibly contaminated procedure if a urinary tract infection was present) may have increased the chance of an implant infection. Dogs 2 and 3 each received antimicrobials because of their history of recurrent urinary tract infections. Care must be taken when performing procedures such as urinary catheter placement and vaginography because such procedures have the potential to introduce bacteria to the vagina, vestibule, and urethra or bladder if care is not taken to maintain sterility. The authors acknowledge that the use of postoperative antimicrobial treatment in these patients (except dog 1 that was receiving ongoing treatment) may not have been necessary, especially because all dogs received perioperative and intraoperative IV administrations of cefazolin. More appropriately, these dogs should have had a preoperative urinalysis and microbial culture of a urine sample performed to confirm presence of an ongoing infection prior to administration of antimicrobials after surgery.

It is important to remember that placing these patients in sternal recumbency and tilted with the head down during surgery will increase the possibility of regurgitation and aspiration, as illustrated by dog 2 of this report. Therefore, it is imperative that the endotracheal tube used has an intact cuff that creates a good endotracheal seal. After completion of the surgical procedure, dogs should be evaluated for any signs of regurgitation and treated appropriately if this has occurred, prior to extubation.

The other postoperative complication that developed in 1 of the 4 dogs of this report was an inability to urinate. This may have been due to inflammation at the surgical site, which resulted in temporary constriction of the urethra and prohibited urination, or may have been secondary to the epidural injection that the dog received prior to surgery. Inflammation of the urethra typically resolves within 7 to 10 days after surgery. By day 2 after surgery, the affected dog was able to urinate and was discharged from the hospital.

A survey was sent to the owners of the dogs of this report to determine the success of the surgical procedure. The owners of dogs 1, 2, and 3 responded to the survey, but the owners of dog 4 declined to participate. The dogs all had a primary clinical problem of recurrent urinary tract infections; for dogs 1, 2, and 3, the urinary tract infections were confirmed on the basis of results of microbial culture of urine samples. Owners who completed the survey reported resolution of urinary tract infections in their dog following surgery. In addition, microbial cultures of urine samples from 2 of the dogs yielded negative results and microscopic examination of a urine sample from 1 dog revealed no bacteria following surgery. The owners who completed the survey reported that they were pleased with the outcome of the surgery.

The most striking complaint was from the owners of dog 1 who perceived that their dog was in pain after surgery and that it required more pain relief medication than initially prescribed. Notably, dog 1 underwent episiotomy, unlike dogs 2 and 3. The owners of dogs 2 and 3 did not perceive their dog's condition as overtly painful in the 2-week period after surgery. Unfortunately, dog 4 developed what was presumed to be a vaginal stricture at the site of the surgical resection and anastomosis. Because of our inability to perform follow-up, some of the questions regarding what occurred remained unanswered; however, this complication was likely directly linked to the surgical procedure. This complication may have contributed to the recurrence of clinical signs, as reported by the owner, including polakuria and ultimately stranguria. The stricture certainly could have been exacerbated by the recent occurrence of estrus, especially if any fluid discharge from the uterus was unable to drain. Digital vaginal palpation by the referring veterinarian at the time of vaginal and rectal prolapse did reveal an apparent stricture at the surgery site; however, results of positive-contrast vaginourethrography 5 weeks after surgery revealed that the obstruction was cranial to the surgery site, with no obvious stricture at the surgical site. Other possible causes of the obstruction included vaginal hyperplasia related to estrus, the presence of a perivaginal abscess or granuloma, or the development of a stricture associated with dissection around the vaginal vestibule cranial to the anastomosis site. Ovariohysterectomy performed by the referring veterinarian confirmed the presence of a fluid-filled structure caudal to the cervix. The ovariohysterectomy and abscess drainage were reported to have resolved the dog's clinical signs of stranguria and polakuria. Because the remaining vaginal tissue cranial to the presumed stricture was not resected at the time of ovariohysterectomy because of a more extensive approach than the ventral midline approach performed for the ovariohysterectomy, the owners were warned that similar clinical signs could recur if the remaining tissue filled with fluid again. If this were to occur, vaginal ablation as far as the stricture would be indicated, requiring an extensive surgical approach. Resolution of clinical signs in dog 4, despite the development of a major complication, supports the fact that vaginal stenosis can be a cause of recurrent urinary tract infections and urinary incontinence in dogs. In essence, this dog had a functional vaginal ablation, blocking any urine pooling cranial to the stenosis and preventing reinfection. Vaginal ablation or vaginectomy, with removal of all vaginal tissue cranial to the urethral papilla, is another recommended surgical procedure for vestibulovaginal stenosis.1
Given the good clinical outcome associated with vaginal resection and anastomosis in the dogs of this report, we propose that this procedure can be an effective treatment option for management of chronic urinary tract infections in dogs with moderate or severe vestibulovaginal stenosis. Furthermore, we believe that episiotomy is not necessary for successful performance of the surgical procedure and, in fact, worsens the severity of intraoperative hemorrhage, prolongs the duration of surgery, and increases postsurgical morbidity. Therefore, our recommendation is to perform vaginal resection and anastomosis without episiotomy for the treatment of moderate and severe vestibulovaginal stenosis in dogs that have clinical signs such as recurrent urinary tract infections and urinary incontinence. Digital vaginal palpation in dogs with recurrent urinary tract infections can easily be done during a physical examination. Results of follow-up positive-contrast vaginourethrography can confirm the presence of vestibulovaginal stenosis and allow measurements to be made for calculation of the vestibulovaginal ratio. If the vestibulovaginal ratio is indicative of moderate to severe stenosis, surgical correction via resection and anastomosis of the stenosis may resolve clinical signs of recurrent urinary tract infections in affected dogs. Vaginal stricture can develop as a postoperative complication; further treatment may be required to resolve stricture-associated clinical signs.

References