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Objective—To evaluate the effectiveness of episioplasty for the treatment of perivulvar dermatitis or chronic or recurrent urinary tract infections (UTI) believed to be secondary to excessive perivulvar skin folds in dogs and to document whether a causal relationship exists between the presence of chronic or recurrent UTI and excessive perivulvar skin folds in female dogs.

Design—Retrospective study.

Animals—31 female dogs.

Procedure—Medical records of dogs with vulvar dermatitis (group 1; n = 15) or UTI (group 2; 16) were reviewed for history, signalment, physical examination findings, hematologic findings, results of urine or vaginal bacteriologic culture, and results of additional diagnostic procedures.

Results—14 of 15 dogs in group 1 had complete resolution of perivulvar dermatitis and associated clinical signs following episioplasty. One dog had a relapse of clinical signs and vulvar dermatitis 2 years after surgery in association with a 9-kg (19.8-lb) weight gain. Sixteen of 16 dogs in group 2 had complete resolution of clinical signs of UTI following episioplasty. Urine samples were obtained via cystocentesis no earlier than 1 month after surgery to confirm resolution of UTI in 13 of 16 of dogs in group 2. Mild-to-moderate incisional swelling was the only surgical complication in 13 of 16 of dogs in group 2. All owners were satisfied with surgical outcomes.

Conclusions and Clinical Relevance—All owners reported complete resolution of clinical signs for both groups of dogs. Episioplasty is an effective low morbidity treatment for perivulvar dermatitis and chronic UTI associated with excessive perivulvar skin folds. (J Am Vet Med Assoc 2001;219:1577–1581)

Skin fold pyoderma, also known as intertriginous dermatitis, develops in the recesses of excessive skin folds.1-4 Heat, moisture, and body excretions accumulate within the folds, creating an environment conducive to skin maceration, bacterial overgrowth, and inflammation. Constant microtrauma to the skin because of friction between the opposing skin sur-

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Criteria for Selection of Cases

Medical records of all female dogs that had an episioplasty performed at The Ohio State University Veterinary Teaching Hospital (OSU-VTH) between 1983 and 2000 were reviewed. Episioplasty was performed on each dog based on a clinical diagnosis of either perivulvar dermatitis or chronic recurring UTI in dogs with excessive perivulvar skin folds. No other conditions that resulted in a dog having an episioplasty during this time were identified. Only dogs with complete medical records in which follow-up information was available for a minimum of 6 months after surgery were included in this study.

Female dogs that had an episioplasty performed were categorized into 2 groups: dogs with perivulvar dermatitis alone that was unresponsive to appropriate medical treatment (group 1) and dogs with documented chronic or recurring UTI with excessive perivulvar skin folds (group 2). Perivulvar dermatitis was defined as superficial moist dermatis of the skin folds around the vulva. All dogs in group 2 had chronic or recurring UTI diagnosed by quantitative aerobic bacterial culture (greater than 1,000 CFU/ml); all samples were obtained via cystocentesis.

Figure 1—Recessed vulva with excessive perivulvar skin folds in a 5-year-old spayed female Bearded Collie with a history of chronic urinary tract infections.

Procedures

The following information was obtained: history, signalment (age, breed, sex), body weight, body condition score (if available), physical examination findings, laboratory results (CBC, serum biochemical analysis, urinalysis, urine or vaginal bacteriologic culture), and results of any additional diagnostic procedures.

The episioplasty procedures were performed at OSU-VTH as previously described. A purse-string suture was placed in the anus. The dogs were positioned in sternal recumbency with the head tilted down 45° (perineal position). Two crescent shaped incisions were made in the perivulvar skin, with the first incision beginning lateral to the ventral commissure of the vulva, continuing dorsal to the vulva, and ending at the contralateral commissure. The second incision was made parallel to the first but in a wider arc around the vulva. The skin and subcutaneous tissue directly associated with the skin was excised. Aggressive excision of local perivulvar subcutaneous fat was not routinely performed. The amount of skin excised eliminated recession of the vulva and redundant skin folds. The subcutaneous tissues and skin were closed in separate layers, using an interrupted suture pattern. Elizabethan collars were placed on all patients after surgery until suture removal. Owners were instructed to restrict the dogs from rubbing or scooting on the incision line. The surgical site was evaluated, and sutures were removed 10 to 14 days after surgery.

Clinical outcomes after surgery for all dogs were based on follow-up information obtained from the medical records at OSU-VTH or telephone interviews with the referring veterinarians and owners. Follow-up information was obtained for a minimum of 6 months after surgery. Information included identification of complications after surgery, determining whether clinical signs associated with perivulvar dermatitis or UTI had resolved, and evaluation of quantitative aerobic urine culture results in group-2 dogs. Owners were also asked to evaluate the results of this surgical procedure as satisfactory or unsatisfactory.

Results

Medical records of 37 female dogs that had an episioplasty performed between 1983 and 2000 were identified. Six dogs were excluded from the study because of incomplete documentation and follow-up. The remaining 31 dogs met the criteria for inclusion into this study. Fifteen dogs with perivulvar dermatitis alone were included in group 1, and 16 dogs with chronic or recurrent UTI were included in group 2.

Mean age (± SEM) was 4.51 ± 1.03 years (range, 0.5 to 11 years) for dogs in group 1. Five were of mixed breeding. The remaining 10 dogs represented 9 breeds including Collie (n = 1), Airedale Terrier (1), English Springer Spaniel (1), Bull Terrier (1), Akita (1), Labrador Retriever (1), Newfoundland (1), Dalmatian (1), and German Shepherd Dog (2). Mean weight (± SEM) for group 1 was 26.7 ± 1.89 kg (58.74 ± 4.16 lb), with a range of 15 to 38.2 kg (33 to 84.04 lb). The duration of vulvar dermatitis prior to episioplasty ranged from 1 to 72 months, with a mean duration (± SEM) of 15.27 ± 4.78 months. Follow-up information for group-1 dogs was available for a period of 6 to 96 months after surgery.

Fourteen of 15 group-1 dogs had recessed vulvas on physical examination. Excessive licking of the vulvar area was recorded for 9 of 15 dogs. Urine staining of the hind limbs, with urine pooling in the vaginal vault, was found in 2 of 15 dogs, whereas 1 of 15 had clinical signs of dysuria, and 1 of 15 exhibited frequent scooting of the perineal area along the floor. Owners complained of severe malodor in 5 of 15 group-1 dogs.

Medical treatment for group-1 dogs prior to surgery included oral administration of antibiotics (9/15), application of topical agents (5/15), vaginal douching (2/15), and hormonal therapy (1/15). Five of the 9 dogs treated orally with antibiotics were given various length trials of different antibiotics. The remaining 4 dogs received only 1 antibiotic. None of
the medical treatments were successful for long-term resolution of clinical signs. If clinical improvement was noticed while on treatment, clinical signs returned when treatment was discontinued.

Presurgical laboratory analysis included CBC in 13 of 15 dogs, serum biochemical analysis in 7 of 15, vaginal culture in 3 of 15, urinalysis 8 of 15, and aerobic urine culture in 5 of 15. Results of CBC and serum biochemical analyses were within reference ranges in all dogs. Results of urinalysis were unremarkable, and aerobic urine culture results were negative for bacterial growth in all group-1 dogs. Vaginal culture results were positive for *Proteus* spp in 3 dogs and *Pseudomonas* spp in 3. In addition, vaginal culture results of 1 of these 3 dogs grew *Escherichia coli*.

No surgical complications were noticed in any group-1 dog other than mild-to-moderate incisional swelling. Fourteen of 15 dogs in group 1 had complete resolution of perivulvar dermatitis and associated clinical signs after surgery. One dog had a relapse of clinical signs and recurrence of perivulvar dermatitis 2 years after the episiotomy associated with a 9-kg (19.8-lb) weight gain. All owners evaluated the surgical outcomes as satisfactory.

Mean age (± SEM) was 3.56 ± 0.67 years (range, 7 months to 10 years) for dogs in group 2. Four dogs were of mixed breeding. The remaining 12 dogs represented 11 breeds including German Shepherd Dog (1), Chow Chow (1), Bearded Collie (1), Cavalier King Charles Spaniel (1), Labrador Retriever (1), Rhodesian Ridgeback (1), Golden Retriever (1), Bichon Frise (1), Bouvier des Flandres (1), Akita (1), and Newfoundland (2). Mean weight (± SEM) for this group was 32.43 ± 4.02 kg (71.35 ± 8.84 lb), with a range of 5.9 to 56.8 kg (12.98 to 124.96 lb). The duration of clinical signs associated with chronic or recurrent UTI prior to episiotomy ranged from 3 to 48 months, with a mean duration (± SEM) of 14.31 ± 3.0 months. Clinical signs of UTI in group-2 dogs included hematuria, pollakiuria, stranguria, and dysuria that occurred alone or in various combinations. Follow-up information for group-2 dogs was available from 6 to 60 months after surgery.

Presurgical evaluation for etiologies of chronic or recurrent UTI varied according to clinician discretion and included abdominal radiography (6/16), abdominal ultrasonography (8/16), contrast urethrocystogram (3/16), vaginoscopy (4/16), and uroendoscopy (8/16). Radiodense cystic calculi were identified on survey abdominal radiographic views in 1 of the 16 dogs. Two dogs had struvite calculi removed via cystotomy prior to evaluation for episiotomy. All abdominal ultrasonograms and contrast urethrocystograms were unremarkable. Vaginoscopy revealed vestibular lymphoid follicular hyperplasia in 3 of 16 dogs and raised vaginal plaques in 1 of 16 dogs. Five of the 8 uroendoscopic examinations were unremarkable. Nodular hyperplasia of the urinary bladder, distal urethritis, and raised plaques in the urethra and vagina were each identified in 1 dog. Serum biochemical analyses and CBC were performed in 12 of 16 group-2 dogs before surgery. Results of this blood work were unremarkable in 10 of 16 dogs. Two dogs had mild increases in serum alkaline phosphatase concentrations, and 1 dog had a mature neutrophilia with a total WBC count of 23,800 cells (reference range, 3 to 11.5 × 10⁹ cells/L).

Positive aerobic bacteriologic culture results of urine (collected via cystocentesis) were obtained in all 16 group-2 dogs prior to referral for surgery. Thirty-five positive bacteriologic urine culture results were obtained from the 16 dogs in group 2. Nine of 16 dogs had a single positive urine culture result. The remaining 7 dogs had multiple positive urine culture results. Single bacterial isolates were cultured in 7 of 9 dogs with only 1 culture. Single bacterial isolates included *E. coli* (n = 3), *Proteus* spp (2), *Enterococcus* spp (1), and *Staphylococcus* spp (1). Dogs with multiple positive urinary culture results had anywhere from 2 to 9 positive results. One dog had 2 positive urine culture results, 5 dogs had 3 positive urine culture results, and 1 dog had 9 positive urine culture results. Single bacterial isolates were most commonly cultured from the urine of group-2 dogs (24 of 26 dogs had multiple positive urine culture results). A total of 7 different bacterial species were isolated. *Escherichia coli* was cultured most commonly (7/26) from the urine samples from group-2 dogs, followed by *Proteus* spp (6/26). The other bacterial isolates in group-2 dogs with multiple positive urinary culture results included *Pseudomonas* spp, *Enterococcus* spp, *Enterobacter* spp, *Staphylococcus* spp, and *Micrococcus* spp.

Abnormal vulvar confirmation was observed during physical examination in all group-2 dogs. Recessed vulva was reported in 16 dogs. One dog had twisted and deformed vulvar lips. The vulva was not reported to be excessively small in any dog. Active perivulvar dermatitis was evident on physical examination in 12 of 16 group-2 dogs. Three of the 16 dogs had a history of cystic calculi removed via cystotomy, and 2 of 16 dogs had urinary incontinence. Urinary incontinence consisted of apparent lack of voluntary control of urination exhibited by frequent dribbling of urine when awake and spotting of carpet or bedding with urine at rest.

No surgical complications developed in 15 of 16 group-2 dogs. Wound dehiscence of the surgical site occurred in 1 dog. Clinical signs of lower urinary tract disease resolved and did not recur after surgery in any group-2 dog. Urine samples were obtained via cystocentesis for aerobic culture no earlier than 1 month after surgery to confirm resolution of the UTI in 13 of 16 dogs. Three dogs were not available for follow-up urine cultures. No bacterial growth from the urine cultures was reported in any of the 13 dogs evaluated. Clinical signs of urinary incontinence also resolved in 1 of the 2 dogs after episiotomy.

Chronic or recurrent UTI was documented without identification of an underlying cause in 15 of 16 dogs in group 2. Radiodense struvite cystic calculi were documented in the remaining dog of this group. Fifteen of the 31 dogs with excessive perivulvar skin folds included in this study also had chronic or recurrent UTI without an identifiable underlying cause. All owners of group-2 dogs rated the surgical outcome of episiotomy as satisfactory.

**Discussion**

Perivulvar dermatitis has been reported in obese female dogs with hypoplastic or atretic vulvas and
excessive perivulvar skin folds.\textsuperscript{1,2,4} Malodor and fetid discharge are common complaints by the owners of dogs with perivulvar dermatitis. Malodor is the result of breakdown products from the bacterial action on skin secretions and urine deposited between the apposing skin surfaces.\textsuperscript{1,2} \textit{Staphylococcus} spp and \textit{Streptococcus} spp are the most common organisms associated with skin fold pyodermas.\textsuperscript{1,4} Licking and scooting of the perineal region along the floor are commonly reported by the owners of dogs with perivulvar dermatitis.\textsuperscript{1} These actions may result in the transfer of fecal contaminates from the anal and perineal region to the perivulvar skin folds, explaining the expanded list of bacterial isolates that we identified in dogs with perivulvar dermatitis.

It is difficult to standardize the body weights for dogs in this study because of the number of breed and conformations represented. Nine of the dogs were noted as obese, and 2 dogs had body condition scores of 4/5 to 5/5 on physical examination. The owner of 1 of the group-1 dogs reported relapse of clinical signs 2 years after episiotomy for perivulvar dermatitis. A weight gain of 9 kg (19.8 lb) was documented during this period. Prior to this dramatic increase in weight, the owner reported that this dog had complete resolution of all signs associated with perivulvar dermatitis. Nutritional counseling and a strict weight loss program were instituted. When weight reduction of approximately 5.9 kg (13 lb) was accomplished, the dermatitis once again resolved. At the time of last follow-up, no clinical signs associated with perivulvar dermatitis had been evident in this dog for 6 years. This finding is not unexpected, as an association between weight reduction and resolution of clinical signs associated with perivulvar dermatitis has been described.\textsuperscript{1,2,5} Strict weight reduction for obese dogs with excessive perivulvar skin folds could be recommended in lieu of surgery. However, lack of pet and owner compliance, length of time required to accomplish substantial weight loss, and recognition that excessive perivulvar skin folds may still be present following weight loss generally makes this treatment option less desirable. It is interesting that the 4 dogs < 1 year of age that underwent episiotomy had a durable response to surgery despite an increase in body mass as they matured. Additionally, the 11 dogs that were clinically overweight had durable responses to episiotomy. These observations suggest that episiotomy is effective in the face of growth and obesity.

The diagnosis of perivulvar dermatitis in intact females is not described in the veterinary literature. Four of 13 dogs in group 1 were intact females at the time of evaluation and had episiotomy and ovariohysterectomy performed concurrently. These dogs were evaluated prior to their first estrous cycle. All 4 dogs were between 6 and 7 months of age. Each dog had a resected vulva on routine physical examination. Three of the 4 dogs had clinical signs of perivulvar dermatitis and vaginitis since being obtained as puppies. The fourth dog had clinical signs for > 1 month. Neither obesity nor vulvar hypoplasia was evident on physical examination in these 4 dogs. Their condition was not attributable to advanced age, early ovariohysterectomy, or obesity but appeared to be the result of congenital abnormal vulvar conformation. Puppy vaginitis or vaginitis in young intact females is recognized as an inflammatory condition of the vestibule and vagina, which may result in chronic or intermittent mucoid vaginal discharge. This condition is generally thought to be self-limiting and often resolves by the time of the first heat cycle.\textsuperscript{10} Puppy vaginitis has not been associated with perivulvar dermatitis.

Many palliative treatments such as oral administration of antibiotics, topical ointments, and drying agents have been recommended to alleviate the clinical signs associated with perivulvar dermatitis.\textsuperscript{1,5} Group-1 dogs had a variety of these treatments instituted during the course of their disease. None of the dogs of this study had long-term resolution of their clinical signs while being medically managed. The chronic nature of the disease, unpleasant odor, and the pet’s discomfort prompted many of the owners to seek surgical intervention. Two of the dogs in this group were forced to live in the garage because of cutaneous discharge and malodor associated with perivulvar dermatitis. Both dogs were returned to the house after the perivulvar dermatitis was resolved surgically.

The most common cause of lower UTI in small animals is ascending colonization of the lower urinary tract from more distal sites such as the distal urethra or epithelial surfaces surrounding the external urethral orifices.\textsuperscript{11,12} \textit{Escherichia coli}, \textit{Staphylococcus} spp, \textit{Streptococcus} spp, \textit{Proteus} spp, \textit{Klebsiella} spp, \textit{Pseudomonas} spp, and \textit{Enterobacter} spp are the cause of most UTI in dogs and cats.\textsuperscript{13-15} Interference with normal micturition, anatomic defects, alteration of the urethrum, altered volume, frequency of urination, composition of urine, and impaired immunocompetence have been implicated in cases of chronic or recurring UTI. Failure to correct these predisposing abnormalities is a common cause of recurrent UTI.\textsuperscript{13,14}

The use of additional imaging procedures such as contrast radiography, ultrasonography, and uroendoscopy provided detailed information regarding the urinary tract, which enabled us to rule out other causes of UTI in group-2 dogs. All abdominal ultrasounds and contrast urethrocystograms were unremarkable. The uroendoscopic findings of nodular hyperplasia, distal urethritis, and urethral/vaginal plaques in 3 dogs are nonspecific signs secondary to inflammation. Vestibular lymphoid hyperplasia can be seen in dogs with chronic inflammation or as an incidental finding without clinical relevance. The vaginoscopy findings in group-2 dogs were most likely attributable to chronic inflammation. There was no evidence of anatomic anomalies of the urinary tract that could cause immunocompromise of normal host defenses identified during the evaluations before surgery. All group-2 dogs received appropriate antibiotic regimens in an effort to treat their UTI, but relapse or reinflection always occurred. Three of the 16 dogs had a history of struvite cystic calculi removed via cystotomy. Two of these 3 dogs had positive bacteriologic urine culture results after cystotomy. Bacteria in the urine may have resulted from inappropriate or insufficient treatment of the initial UTI at the time the cystic calculi were identified.

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tified and surgically removed. Alternatively, it may have been the result of a new infection. One of the 3 dogs had the cystic calculi removed concurrently with episioplasty. Urinary tract infection is recognized as a predisposing factor in the formation of struvite uroliths in dogs.1,11

Bacterial isolates identified were the aforementioned urinary pathogens. Multiple isolates have been reported in 20% of all UTI cases.1,13 Multiple bacterial isolates from the urine were reported in 4 of 16 dogs in group 2. This may be attributable in part to development of drug-resistant bacterial strains secondary to chronic antibiotic administration. Clinical signs of UTI in group-2 dogs were evident from 3 to 48 months prior to episioplasty. Many of the dogs were treated repeatedly with antibiotics.

It has been suggested that ascending bacterial UTI is a common sequela of perivulvar dermatitis.1,2,8 There has been no objective data in the veterinary literature to support this statement. All dogs in group 2 had abnormal vulvar conformation (recessed vulva with excessive perivulvar skin folds). One of the 16 dogs also had a twisted infolded vulvar lip in addition to recession of the vulva. Active perivulvar dermatitis was reported in 12 of 16 dogs in group 2. The remaining 4 dogs had excessive perivulvar skin folds without moist dermatitis. Chronic or recurrent UTI were identified in 48% of the dogs in this study with excessive perivulvar skin folds. In all dogs, owners reported resolution of clinical signs related to recurrent UTI. Resolution of UTI was confirmed by failure to grow urinary pathogens from urine samples obtained via cystoscopy in 13 of 16 dogs. This finding suggests that a relationship may exist between chronic or recurrent UTI in dogs with excessive perivulvar skin folds when no other underlying cause can be identified.

Potential complications of episioplasty are seroma formation, wound dehiscence, and swelling.5,6 There is no statistical information available for surgical complication rates, but it has been stated that complications are rare following episioplasty.6,7 Dehiscence of the suture line can occur if there is excessive suture line tension at closure. Elizabethan collars are recommended until suture removal to avoid self-mutilation. Self-mutilation can lead to the aforementioned complications. Mild-to-moderate swelling is common following this procedure. Wound dehiscence in 1 of the 31 dogs was the only serious complication reported in either group. This complication was associated with the dog repeatedly scooting the perineal region on the ground.

Owner satisfaction with the surgical outcome was extremely high. All owners reported complete resolution of the clinical signs. On the basis of the information obtained in this study, we conclude episioplasty is an effective low-morbidity treatment of perivulvar dermatitis and chronic or recurrent UTI associated with excessive perivulvar skin folds in dogs.

References