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Objective—To characterize and evaluate risk factors for suture-associated cystoliths in dogs and cats.

Design—Retrospective case-control study.

Animals—163 dogs and 13 cats with suture-associated cystoliths and 326 control dogs and 26 control cats with non–suture-associated cystoliths.

Procedures—Submissions to the Canadian Veterinary Urolith Centre received from 1999 to 2006 were reviewed. Case dogs and cats had cystoliths associated with visible suture or with hollow, cylindrical channels or suture knot impressions consistent with dissolved suture. Control dogs and cats had at least a single recurrent non–suture-associated cystolith submitted closest in time to the sample case. Associations among cystolith composition, recurrence times, sex, age, and breed were evaluated.

Results—Cases consisted of 92 dogs and 7 cats with visible suture and 71 dogs and 6 cats with dissolved suture. Suture-associated cystoliths represented 0.6% of canine cystoliths, 9.4% of recurrent canine cystoliths, 0.17% of feline cystoliths, and 4% of recurrent feline cystoliths. Sexually intact and neutered males were at increased odds of suture-associated cystoliths, relative to spayed female dogs. Shih Tzus, Lhasa Apsos, and Pomeranians were significantly predisposed to form suture-associated cystoliths. In dogs, compound suture-associated cystoliths were significantly more likely than other cystolith types (OR, 8.6). Dogs with suture-associated cystoliths had significantly shorter recurrence times than did control dogs.

Conclusions and Clinical Relevance—Suture remnants in the bladder have an important role in recurrent cystolithiasis in dogs. Identification of risk factors is important for avoiding recurrence of iatrogenic cystoliths. (J Am Vet Med Assoc 2008;233:1889–1895)

Cystotomies are commonly performed in small animal practice, most often to remove cystic calculi. Although typically considered a routine surgical procedure, complications can occur, including cystolith recurrence. Predisposing factors for urolith development in cats and dogs include supersaturation of urine with calculogenic substances, urinary tract infections, urine pH, diet, vascular anomalies, metabolic derangements, endocrinopathies (especially hyperadrenocorticism), hypercalcemia, medications, and genetics. Foreign bodies, such as suture material, may contribute to urolith recurrence.

In human renal transplant patients, the strongest reported risk factors for stone formation are nonabsorbable sutures and hyperparathyroidism. Of human suture-associated calculi, with and without infection, have been reported. In 1 report, the authors noted that “because foreign body stone generation is related directly to the duration of urine contact, nonabsorbable suture is more prone to induce calculus formation.”

In veterinary medicine, absorbable monofila-ment suture material is generally recommended for urinary tract surgery because nonabsorbable suture may promote calculogenesis and multifilla-ment suture may harbor nidus-forming bacteria and debris. However, there has been little objective evaluation of suture-associated recurrent urolithiasis in companion animals to determine its clinical relevance or associated risk factors. The objectives of the present study were to characterize and evaluate risk factors for suture-associated cystoliths in dogs and cats.
Materials and Methods

Case and control selection—Records of all canine and feline cystolith submissions received at the CVUC from November 12, 1999, to October 5, 2006, were evaluated for inclusion. Cystoliths that were formed around an apparent suture nidus (SVNG) or that contained a hollow tract consistent with absorbable suture (SDNG) were classified as suture-associated, and their donor animals were designated as cases. Cystoliths were included in the SDNG if they contained a smooth cylindrical hollow shape consistent with suture, had an overall cylindrical or knot shape, or had the impression of a knot in the nidus. Although non–suture-associated cystoliths with a hollow nidus are rare, cystoliths with an irregular hollow nidus or atypical shape were excluded from the SDNG. A prior cystotomy was confirmed after cystolith analysis and prior to inclusion of a cystolith in the SDNG. Those lacking an identifiable apparent or potential suture nidus were classified as non–suture-associated, and a subset of their donor animals (2 animals of the same species, from which recurrent cystoliths had been submitted closest in time to the case animal) was used as controls.

Urolith analysis—The CVUC receives uroliths from veterinary practitioners for quantitative evaluation of urolith composition. To determine the mineral composition of the cystoliths included in the study, each layer of each specimen was analyzed via optical crystallography by use of polarized light microscopy. If additional clarification was needed, another quantitative technique was used (X-ray microanalysis, Fourier transform infrared spectroscopy, or scanning electron microscopy).

Medical records review—Each cystolith submission was accompanied by a completed questionnaire regarding the animal’s age, sex, breed, environment, diet, medical history, and current medications. Signalment, cystolith type, and prior cystolith history were recorded. Each case was matched to 2 controls of the same species.

The composition of each cystolith was determined from the records. Components of a urolith may include a nidus, a surrounding mineral forming the main body of the urolith, a shell, and surface crystals. A cystolith without a nidus or shell of different composition containing ≥ 70% of 1 mineral type was identified by that mineral; a cystolith composed of < 70% of 1 mineral type was classified as a mixed cystolith. A compound cystolith was defined as one with a nidus or main central mineral layer with 1 or more surrounding layers of different mineral composition. Calcium oxalate monohydrate and dihydrate cystoliths were classified as calcium oxalate cystoliths. All suture-associated cystoliths in which the suture remained visible were allocated to the SVNG, and cystoliths with hollow, cylindrical channels or impressions of suture knots consistent with dissolved suture were allocated to the SDNG.

In calculating recurrence times, if the specific day of the month of prior cystolith removal was not indicated, that day was deemed the 15th. If only the year was provided, the day and month were deemed July 1. If day and year were specified without month, the month was deemed July. Records with further incomplete or inconsistent information were excluded from the analysis. The CVUC does not perform urinalysis or bacteriologic cultures of urine, nor does it have access to such laboratory results corresponding to each urolith submission. Accordingly, any association between infection and suture-associated cystoliths was not assessed.

Statistical analysis—Descriptive statistics were calculated to summarize the data. Associations between putative risk factors for different categories of cystoliths were also evaluated. In the first set of analyses, the outcome was defined as suture-associated cystoliths (vs non–suture-associated cystoliths), without distinguishing between the SVNG and the SDNG. Univariate logistic regression was used to examine unconditional associations between the outcome and the categorical variables for which data had been collected (sex, breed, and cystolith composition). For this univariate analysis, the data from the 2 dogs that formed a calcium carbonate cystolith and the 1 dog each that formed a sodium urate (Dalmatian), calcium phosphate apatite (Bichon Frise), ammonium urate (Miniature Schnauzer), and xanthine (Shih Tzu) cystolith were combined into an “other” cystolith type category. The association between the continuous variable body weight and the likelihood of developing a suture-associated cystolith was not linear. When body weight was converted into a hierarchical, categoric variable, results suggested that the relation between weight and the outcome changed from an increased risk < 10 kg (< 22 lb) to a decreased risk ≥ 10 kg. Consequently, the variable weight was dichotomized into 2 categories on the basis of a 10-kg cutoff value.

Univariate logistic regression was used to analyze unconditional associations between the outcome and age, weight, sex, breed, cystolith type, and time to cystolith recurrence. A P value of ≤ 0.05 was considered significant. Continuous variables were tested for a linear association with the outcome. Variables with a significance level of P ≤ 0.20 in the univariate analyses were subsequently adjusted for the influence of each other on the outcome by manually building a multivariate logistic model. A Hosmer-Lemeshow χ² test was used to assess the fit of the final multivariate model.

In a second set of analyses, multinomial logistic regression was performed to evaluate unconditional associations between all variables and 3 categories of the outcome: non–suture-associated cystoliths, SVNG, and SDNG. A multivariate model was subsequently developed as described. All regression analyses were performed by use of a software program.

Results

During the study period, 34,464 submissions were made to the CVUC, including 29% from western Canada (British Columbia, Alberta, Saskatchewan, and Manitoba), 48% from Ontario, 18% from Quebec, 7% from eastern Canada (Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland), and 0.2% from the United States, Yukon Territory, Nunavut, and overseas. Records from 27,022 canine and 7,442 feline cystolith
submissions were searched. At least 1 episode of recurrent cystoliths was reported in 1,733 dogs and 303 cats. One hundred seventy-six suture-associated cases were identified. Of those, 99 (56%) were formed around visible suture material (SVNG), of which 92 were in dogs (56% of canine cases) and 7 occurred in cats (7/13 feline cases). Seventy-seven cases met the inclusion criteria for the SDNG, of which 71 were dogs (44% of canine cases) and 6 were cats (6/13 feline cases). One hundred sixty-three (93%) suture-associated cystoliths were from dogs, representing 0.60% of canine cystoliths that were submitted and 9.4% of recurrent cystoliths. The remaining 13 (7%) were from cats, representing 0.17% of feline cystolith submissions and 4% of recurrent cystoliths. There were 326 canine controls and 26 feline controls.

Cystolith compositions for the canine SVNG and SDNG were determined (Table 1). Of the 163 canine suture-associated cystoliths, 66 (40%) were calcium oxalate, 60 (37%) were compound cystoliths, 15 (9%) were mixed cystoliths, and 14 (8.5%) were struvite. Of the 60 compound suture-associated cystoliths, 52 (87%) had a separate cystolith nidus type, of which 36 (69%) had a calcium phosphate nidus, 9 (17%) had a calcium oxalate nidus, and 4 (8%) had a silica nidus. Two cystoliths had a struvite nidus, and 1 had a urate nidus. Of the 23 SVNG compound cystoliths, 19 (83%) had a separate cystolith nidus type. Of those, 9 had a calcium phosphate nidus, and of those 9, 7 had a main central mineral layer of calcium oxalate (n = 6) or a main central mineral layer with < 50% calcium oxalate and shell of 100% calcium oxalate (1). Six compound cystoliths had a calcium oxalate nidus (32%), and 3 had a silica nidus (16%). Of the 37 SDNG compound cystoliths, 33 (89%) had a separate cystolith nidus type. Of those, 27 (82%) had a calcium phosphate nidus, and of those 27, 24 (88%) had a more superficial layer of calcium oxalate. Of the 101 dogs for which the composition of the previous cystolith was known, 59 (58%) had a history of calcium oxalate cystoliths, of which 30 (51%) formed a calcium oxalate suture-associated cystolith and 22 (37%) formed compound suture-associated cystoliths (Table 2).

Data for feline cases were summarized (Tables 3 and 4); 70% of all cystolith submissions during the study period were from domestic shorthair cats. Univariate analyses revealed no significant difference between the control group and the study cats, whether or not the type of suture-associated nidus was specified as an outcome, for any factor. In the SVNG, the 3 cats with calcium oxalate cystoliths had a prior history of calcium oxalate cystoliths, as did 4 of the 5 cats with calcium oxalate cystoliths in the SDNG.

Results of univariate analyses of categorical risk factors (Tables 5 and 6) and continuous risk factors (Tables 7 and 8) for canine suture-associated cystoliths were determined. Breeds identified as being at increased odds for suture-associated cystoliths, whether or not the type of nidus was visible, included Shih Tzu, Lhasa Apso, and Pomeranian. Sexually intact and neutered males were at increased odds of suture-associated cystoliths, relative to spayed female dogs. Calcium oxalate, compound, and mixed cystoliths were overrepresented among the suture-associated cystolith group, relative to controls.

In the final multivariate models (Table 9), to achieve stable estimates during the model building pro-

<table>
<thead>
<tr>
<th>Variable</th>
<th>SVNG</th>
<th>SDNG</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y [range])</td>
<td>7.7 (3–14)</td>
<td>9.67 (5–14)</td>
<td>7.7 (0.9–16)</td>
</tr>
<tr>
<td>Time to recurrence (y)</td>
<td>1.30</td>
<td>1.79</td>
<td>2.56</td>
</tr>
<tr>
<td>Male neutered (No.)</td>
<td>4</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Male sexually intact (No.)</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Female spayed (No.)</td>
<td>3</td>
<td>2</td>
<td>8</td>
</tr>
</tbody>
</table>

Table 3—Descriptive statistics for cats in SVNG (n = 7), SDNG (6), and control (26) groups.
cess, 2 categoric variables, sex and cystolith type, were converted into dichotomous form because of the small numbers of dogs at certain levels. In the multivariate model, the univariate associations between the probability of a suture-associated cystolith occurring and age or weight < 10 kg were not significant. However, age was retained in the final model because it was identified as a confounder (ie, removing it from the model changed the ORs achieved by some of the other variables by > 50%).

Table 5—Results of univariate analyses of risk factors for association with dogs developing suture-associated cystoliths (SCs) versus other cystoliths.

<table>
<thead>
<tr>
<th>Variable</th>
<th>SC No.</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>180</td>
<td>7.59</td>
<td>3.10</td>
<td>2.0–16.0</td>
<td>1.00</td>
<td>1.00–1.99</td>
<td>0.003</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>304</td>
<td>8.46</td>
<td>2.79</td>
<td>0.7–15.0</td>
<td>1.00</td>
<td>1.00–1.59</td>
<td>0.007</td>
</tr>
<tr>
<td>Time to recurrence (y)</td>
<td>326</td>
<td>2.76</td>
<td>0.20</td>
<td>0.1–11.7</td>
<td>1.00</td>
<td>1.00–1.98</td>
<td>0.004</td>
</tr>
</tbody>
</table>

To convert kilograms to pounds, multiply value by 2.2. See Table 5 for remainder of key.

Table 6—Results of univariate analyses of stone composition risk factors for dogs that developed SCs versus other cystoliths.

Table 7—Results of unconditional analyses of continuous variables associated with formation of SCs, versus other cystoliths, in dogs.
Table 8—Results of unconditional analyses of continuous variables for association with SCs in SDNG and SVNG dogs, relative to other cystoliths.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group</th>
<th>No.</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
<th>OR</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)</td>
<td>Control</td>
<td>325</td>
<td>7.59</td>
<td>3.10</td>
<td>2.0–16.0</td>
<td>1.00</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SDNG</td>
<td>70</td>
<td>8.52</td>
<td>2.38</td>
<td>4.0–13.0</td>
<td>1.11</td>
<td>1.02–1.21</td>
<td>0.021</td>
</tr>
<tr>
<td></td>
<td>SVNG</td>
<td>90</td>
<td>8.42</td>
<td>3.08</td>
<td>0.7–15.0</td>
<td>1.10</td>
<td>1.01–1.19</td>
<td>0.022</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>Control</td>
<td>304</td>
<td>9.41</td>
<td>5.78</td>
<td>1.0–36.0</td>
<td>1.00</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SDNG</td>
<td>65</td>
<td>9.18</td>
<td>6.17</td>
<td>2.0–45.0</td>
<td>0.99</td>
<td>0.95–1.04</td>
<td>0.773</td>
</tr>
<tr>
<td></td>
<td>SVNG</td>
<td>79</td>
<td>8.17</td>
<td>3.41</td>
<td>2.6–25.0</td>
<td>0.95</td>
<td>0.89–1.01</td>
<td>0.078</td>
</tr>
<tr>
<td>Time to recurrence (y)</td>
<td>Control</td>
<td>326</td>
<td>2.76</td>
<td>2.03</td>
<td>0.10–11.73</td>
<td>1.00</td>
<td>Ref</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SDNG</td>
<td>39</td>
<td>2.36</td>
<td>1.36</td>
<td>0.47–5.52</td>
<td>0.89</td>
<td>0.74–1.07</td>
<td>0.234</td>
</tr>
<tr>
<td></td>
<td>SVNG</td>
<td>41</td>
<td>2.03</td>
<td>1.79</td>
<td>0.02–7.38</td>
<td>0.79</td>
<td>0.64–0.99</td>
<td>0.032</td>
</tr>
</tbody>
</table>

See Table 5 for key.

Table 9—Results of multivariate analysis of putative risk factors for dogs that developed SCs versus other cystoliths.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>SC Adjusted OR</th>
<th>95% CI</th>
<th>SDNG Adjusted OR</th>
<th>95% CI</th>
<th>SVNG Adjusted OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time to recurrence</td>
<td>NA</td>
<td>0.78</td>
<td>0.65–0.95</td>
<td>0.75</td>
<td>0.58–0.96</td>
<td>0.79</td>
<td>0.61–1.03</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>1.00</td>
<td>Ref</td>
<td>1.00</td>
<td>Ref</td>
<td>1.00</td>
<td>Ref</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>3.12†</td>
<td>1.64–5.94</td>
<td>2.67</td>
<td>1.20–5.93</td>
<td>4.00</td>
<td>1.64–9.74</td>
</tr>
<tr>
<td>Cystolith type</td>
<td>All others</td>
<td>1.00</td>
<td>Ref</td>
<td>1.00</td>
<td>Ref</td>
<td>1.00</td>
<td>Ref</td>
</tr>
<tr>
<td></td>
<td>Compound</td>
<td>8.59*</td>
<td>4.4–16.60</td>
<td>5.24*</td>
<td>2.2–12.00</td>
<td>15.02*</td>
<td>6.2–36.06</td>
</tr>
<tr>
<td></td>
<td>Mixed</td>
<td>1.00</td>
<td>Ref</td>
<td>1.00</td>
<td>Ref</td>
<td>1.00</td>
<td>Ref</td>
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<tr>
<td></td>
<td>Lhasa Apso</td>
<td>4.07</td>
<td>0.97–16.98</td>
<td>1.95</td>
<td>0.31–12.16</td>
<td>10.68</td>
<td>1.75–66.03</td>
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<td></td>
<td>Pomeranian</td>
<td>2.57</td>
<td>0.44–12.76</td>
<td>1.40</td>
<td>0.43–4.53</td>
<td>9.11</td>
<td>1.19–68.54</td>
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<tr>
<td></td>
<td>Shih Tzu</td>
<td>3.24</td>
<td>1.20–8.81</td>
<td>2.16</td>
<td>0.70–6.65</td>
<td>7.26</td>
<td>1.56–33.71</td>
</tr>
<tr>
<td></td>
<td>Other purebred</td>
<td>3.18†</td>
<td>1.08–9.27</td>
<td>1.97</td>
<td>0.55–7.04</td>
<td>6.51</td>
<td>1.42–29.93</td>
</tr>
<tr>
<td>Age</td>
<td>Years</td>
<td>1.08</td>
<td>0.96–1.20</td>
<td>1.04</td>
<td>0.91–1.18</td>
<td>1.14</td>
<td>0.96–1.35</td>
</tr>
</tbody>
</table>

NA = Not applicable.  
†Results only for breeds that have significant associations with the outcomes.  
See Table 5 for remainder of key.

Discussion

Although the pathophysiologic features of suture-associated cystoliths require further elucidation, the presence of a visible suture nidus or evidence of a dissolved suture nidus strongly suggested that suture exposed to urine contributes to cystolith recurrence. Although dogs predominated in this study, it is unclear whether recurrent cystolithiasis is more common in dogs versus cats because population-based denominator data were not available. The larger sample size in dogs permitted a more detailed analysis.

The number of compound suture-associated cystoliths reported in this study was disproportionately high, compared with the number in prior reports. It was surprising that suture or a suture nidus was detected in 9.4% of recurrent canine cystoliths and 4% of feline recurrent cystoliths. This indicated that suture-associated cystolith formation is an important issue.

After adjustment for other factors, the only breed to retain a significant association with suture-associated cystoliths (without distinguishing between SVNG or SDNG) was Shih Tzu. However, separating the SVNG from the SDNG in the analysis revealed that Lhasa Apsos and Pomeranians were also at increased risk for cystoliths in which the suture material was visible. A larger sample may have discerned additional predisposed breeds. Overall, the breeds that formed suture-associated cystoliths were generally the same breeds noted in other studies as predisposed to forming uroliths. The presence of suture-associated cystoliths may have reflected not a particular reaction to suture but rather an increased tendency to form cystoliths that was accentuated if a nidus such as suture was present.

It has been theorized that when suture enters the bladder lumen, it is rapidly covered with epithelium, thereby decreasing the risk of suture-related calculus formation. In 2 studies, urethrostomy generally covered exposed suture by day 3 after surgery in guinea pigs and by day 5 in dogs. However, in a study of the calcuogenic potential of 3 suture types in rabbit cystotomies, there was no evidence of epithelialization at 15, 30, 60, and 90 days after surgery. Stone formation in that study was detected with all 3 suture types. Inflamed, infected, or irritated urothelium may not re-epithelialize as quickly or in the same manner as healthy bladder tissue, and the surgical technique of submitting veterinarians likely had greater variability in terms of tissue handling and intraluminal placement of sutures than more uniform techniques that may be used in an experimental setting. Bladder epithelialization after cystotomy in dogs predisposed to development of suture-associated cystoliths may be less robust, suture selection may inhibit epithelialization, or both, resulting in prolonged urine and suture contact.

In Canada, oxalate and struvite uroliths comprise approximately 85% of all urolith submissions in both dogs and cats. Although struvite uroliths predominated in North America in the 1980s, there has been a progressive increase in the number of oxalate urolith submissions in dogs and, since approximately 2002, oxalate submissions have outnumbered struvite submissions. In cats,
a similar pattern was initially detected. Equal numbers of oxalate and struvite uroliths were submitted in 2005.31 In the United States, struvite uroliths predominated until approximately 1993, with an increase in calcium oxalate uroliths over the ensuing years.32,33 Presently, calcium oxalate uroliths predominate, however, with only a 14% difference in submissions over the years 2002 to 2004 between calcium oxalate and struvite.34 The numbers of calcium oxalate and struvite suture-associated cystoliths in dogs reported in the present study may reflect the trend over the past 20 years for increasing numbers of submissions of calcium oxalate cystoliths and decreasing numbers of struvite uroliths.3,7,9,10,24,53-34 This was not significantly different from the control population.

Dogs with suture-associated cystoliths were at significantly greater odds of forming compound cystoliths than non–suture-associated cystoliths. This may indicate that suture attracts specific crystal types that form a characteristic urolith nidus, especially given the frequency of finding a calcium phosphate nidus.

The time for cystolith recurrence in dogs with suture-associated cystoliths was significantly shorter, compared with controls. This was perhaps not surprising because the presence of a suture provides a preformed nidus for mineral aggregation. However, the time for recurrence was still rather long in the suture-associated cystolith group, with means of 1.3 and 1.7 years for the SVNG and SDNG, respectively. In humans, suture-associated uroliths are often not detected for years or even decades after suture placement.3,10 In a study35 in cats, the second episode of ureterolithiasis occurred a median of 12.5 months (range, 2 to 88 months) after initial diagnosis.

Results of the present study suggested either that it generally takes an extended period to form a clinically apparent cystolith around suture exposed to urine or that long-lasting sutures erode through to the bladder lumen with time and subsequently act as a nidus. Several of the SVNG cystoliths contained visible knots, and several of the SDNG cystoliths contained knot impressions. It is possible that knots placed within the lumen provided a larger nidus and took longer to dissolve, especially given that not all of the suture would have been exposed to the same concentration or volume of urine, and thus served as a longer-acting nidus. Consequently, it may be prudent to avoid full-thickness bites, long-lasting absorbable sutures, and nonabsorbable sutures in urinary tract surgery.

Limitations of the present study included its retrospective nature and use of a database for data acquisition. Not all veterinarians submit cystoliths for analysis to the CVUC, and submitting veterinarians may not have fully completed the accompanying submission questionnaire. Of the 163 dogs with suture-associated cystoliths, the submission form only indicated a history of cystolithiasis for 101 (62%) cases. However, the presence of suture in the bladder indicates a prior cystotomy, which is most commonly performed to remove cystoliths.1 Accordingly, these cystoliths were classified as recurrent and suture-associated. It is unlikely that other reasons for suture in the bladder were present. It is more likely that the submitting veterinarian chose not to complete portions of the submission form or may not have been aware of a previous cystotomy if it was performed by another veterinarian. Many records for repeat submissions were excluded because they contained incomplete or inconsistent information, and the reported percentage of all repeat submissions that were suture-associated may have been erroneously low. Relative risk of suture types and different surgical procedures could not be evaluated by this study but require further investigation to determine whether there are modifiable events (ie, suture selection or surgical technique) that can be addressed to reduce the prevalence of this problem. There were insufficient feline suture-associated submissions in the present study to draw meaningful conclusions regarding associations with breed or sex.

Results of this study indicated that suture-associated cystolithiasis is an important issue in dogs and cats and suture remnants in the bladder play an important role in recurrence. Because of the potentially substantial impact of recurrent disease, identification of factors associated with this phenomenon is important. Investigation of the role of different suture types and surgical techniques is needed to determine whether modifications can be made to reduce recurrence.

References


Selected abstract for JAVMA readers from the American Journal of Veterinary Research

Anti-inflammatory and analgesic effects of intra-articular injection of triamcinolone acetonide, mepivacaine hydrochloride, or both on lipopolysaccharide-induced lameness in horses
Alastair T. Kay et al

Objective—To assess analgesia, inflammation, potency, and duration of action associated with intra-articular injection of triamcinolone acetonide (TA), mepivacaine hydrochloride, or both in metacarpophalangeal (MCP) joints of horses with experimentally induced acute synovitis.

Animals—18 horses.

 Procedures—Both forelimbs of each horse were injected with lipopolysaccharide (LPS) 3 times. After the first LPS injection, 1 forelimb of each horse was treated with intra-articular injection of mepivacaine (80 mg; n = 6), TA (9 mg; 6), or mepivacaine with TA (same doses of each; 6) 12 hours after the initial LPS injection. Contralateral limbs served as control limbs. Joint pain was assessed via lameness score and measurements of vertical force peak and pain-free range of motion of the MCP joint. Periarticular edema was evaluated. Degree of synovial inflammation was determined via synovial fluid analysis for WBC count and total protein concentration. Samples of plasma and synovial fluid were analyzed for TA and mepivacaine concentrations.

 Results—Each injection of LPS induced lameness and joint inflammation. Mepivacaine effectively eliminated lameness within 45 minutes after injection, regardless of whether TA was also administered, whereas TA reduced lameness, edema, and concentration of synovial fluid protein after the second LPS injection, regardless of whether mepivacaine was also injected. Treatment with TA also produced higher WBC counts and mepivacaine concentrations in synovial fluid, compared with results for mepivacaine alone.

 Conclusions and Clinical Relevance—Results suggested TA is a potent analgesic and anti-inflammatory medication for acute synovitis in horses and that simultaneous administration of mepivacaine does not alter the potency or duration of action of TA. (Am J Vet Res 2008;69:1646–1654)