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<table>
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<tr>
<th>Objective</th>
<th>To determine complications associated with anal sacculectomy in dogs with non-neoplastic anal sac disease and compare complication rates for open versus closed techniques.</th>
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<tr>
<td>Design</td>
<td>Retrospective study.</td>
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<td>Animals</td>
<td>95 dogs.</td>
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<tr>
<td>Procedure</td>
<td>Medical records were reviewed for information on signalment, history, physical examination findings, type of anal sac disease, surgical technique (closed, standard open [surgery performed prior to 1980], or modified open [surgery performed after 1980]), and postoperative complications.</td>
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<td>Results</td>
<td>In 57 dogs, a closed technique was used, and in 38, an open technique was used. Only 3 dogs developed short-term complications (excessive drainage, scooting and inflammation, and seroma formation), and 14 developed long-term complications (continued licking of the surgery site, fecal incontinence, fistulation, and stricture formation). Development of postoperative complications was significantly associated with surgical technique. Dogs that underwent standard open sacculectomy prior to 1980 were 13.67 times as likely to have a long-term complication as were dogs that underwent closed sacculectomy. Weight of the dog, type of anal sac disease, age at the time of surgery, and whether the wound was closed surgically were not significantly associated with whether dogs developed postoperative complications.</td>
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<td>Conclusions and Clinical Relevance</td>
<td>Results suggest that anal sacculectomy is a safe and effective treatment for non-neoplastic anal sac disease in dogs and is associated with a low rate of complications. The standard open technique was associated with the greatest number of complications, whereas complication rates for the closed and modified open techniques were similar to each other. (J Am Vet Med Assoc 2002;221:662–665)</td>
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Various methods for removal of the anal sacs in dogs have been described. Although all of these methods differ from each other to some degree, they generally can be classified as open or closed techniques depending on whether the sac itself is or is not intentionally opened to some degree prior to dissection. Open techniques can be further subdivided into standard open and modified open techniques on the basis of the extent of the incision into the anal sac and the method of dissection.

Despite the fact that anal sacculectomy is a common procedure in dogs, to our knowledge, no studies of the overall frequency of complications associated with anal sacculectomy in dogs with non-neoplastic anal sac disease have been published. The purposes of the study reported here, therefore, were to determine complications associated with anal sacculectomy in dogs with non-neoplastic anal sac disease and compare complication rates for open versus closed techniques.

Criteria for Selection of Cases

Medical records of client-owned dogs that underwent bilateral anal sacculectomy because of non-neoplastic anal sac disease at The Ohio State University College of Veterinary Medicine between January 1969 and December 1994 were reviewed. Dogs with preexisting fistulas as a result of a previous surgery, dogs with anal sac neoplasms, dogs that underwent unilateral anal sacculectomy, and dogs with perianal fistulas and concurrent anal sac disease were excluded from the study. Dogs with a history of spontaneous anal sac rupture that had fistulas at the time of surgery, defined as 1 or more draining tracts in the anal sac region contiguous with the anal sac, were included in the study.

Procedures

General information obtained for each dog included in the study consisted of signalment, initial complaint, history (including information provided by the referring veterinarian, when available), and physical examination findings. In addition, information was collected regarding surgical technique for anal sac removal (standard open, modified open, or closed), any intraoperative complications that occurred, whether there was evidence of infection at the time of surgery, postoperative complications, the year surgery was performed, and results of histologic examination of biopsy specimens, when available. Postoperative complications of interest included, but were not limited to, fecal incontinence, tenesmus, dyschezia, and draining tracts.

Dogs were grouped on the basis of body weight as small (< 12 kg [25 lb]), medium (12 to 25 kg [25 to 50 lb]), or large (> 25 kg [50 lb]). Postoperative complications were classified as short-term if they were evident during the postoperative period (up to the time of suture removal 10 to 14 days after surgery) and resolved without incident. Postoperative complications were classified as long-term if they began or persisted after the time of suture removal and required additional medical or surgical treatment.

Anal sac disease was defined as acute or chronic...
anal sacculitis, with or without abscess formation, impaction, or fistulation. Anal sacculitis was defined as enlargement and inflammation of the anal sacs with a characteristic green or yellow secretion with or without flecks of blood. A hemorrhagic or purulent discharge was usually evident in dogs with anal sac abscess and rupture. Anal sac impaction was defined as marked distention of the anal sac by an accumulation of anal sac secretions that were difficult to express. Anal sac fistulation was defined as spontaneous rupture of the anal sac resulting in formation of a fistulous tract between the sac and overlying skin.

Examination of the surgical records indicated that prior to 1980, if an open technique was used, a standard open technique similar to that described by Walshaw, in which the entire anal sac was opened to the base and the sac was excised by dissection deep to the skin, was used. After 1980, if an open technique was used, a modified open technique similar to that described by Marretta was used, with the exception that the incision over the anal sac was made only down to the haired area of the anus. In addition, after the incision was made, hemostats were placed on the incised anal sac orifice, and the anal sac was dissected free from the tissues beginning at the sac orifice and extending into the deeper tissues, staying as close as possible to the anal sac wall without perforating the sac. The anal sac was kept under constant traction during this dissection so as to avoid important deep structures. If a closed technique was used, a technique similar to that described by Johnson was used.

Statistical analyses—The main goal of the statistical analyses was to determine whether there was a difference in the frequency and type of complications that occurred after open versus closed bilateral anal sacculcetomy. Cross-tabulations and corresponding \( \chi^2 \) tests were used to test for associations between surgical technique (open vs closed) and body weight, type of anal sac disease, age of surgery, and type of short- and long-term complications. Nonparametric Wilcoxon rank-sum tests were used to test for differences in age at the time of surgery and time to development of complications between dogs undergoing open anal sacculcetomy and dogs undergoing closed anal sacculcetomy.

To test the hypothesis that there was no significant difference in frequency of complications between the 2 surgical techniques, a \( \chi^2 \) test for independence was used. Multinomial logistic regression was also used to investigate this relationship. Multinomial logistic regression allowed the outcome variable (postoperative complications) to have 3 responses (none, short-term, and long-term) and was used to simultaneously calculate the relative risk ratios of a short-term complication versus no complication and a long-term complication versus no complication while comparing open versus closed surgical techniques. Additional variables were included in these models to assess their impact on the relationship between surgical technique and the risk of postoperative complications.

Nonparametric Kruskal-Wallis tests were used to compare ages at the time of surgery among dogs that developed each type of complication, to compare ages at the time of surgery and times to development of complications among dogs with each type of anal sac disease, and to compare ages at the time of surgery and times to development of complications among dogs grouped on the basis of body weight. A \( \chi^2 \) test was used to test for an association between type of disease and body weight. For all analyses, values of \( P \leq 0.05 \) were considered significant.

Results

Ninety-five dogs fit the criteria for inclusion in the study, including 57 that had undergone bilateral anal sacculcetomy with a closed technique and 38 that had undergone bilateral anal sacculcetomy with an open technique (17 with the standard open technique and 21 with the modified open technique). Follow-up time for dogs that underwent closed anal sacculcetomy ranged from 8 days to 5 years (mean, 917 days), follow-up time for dogs that underwent the standard open anal sacculcetomy ranged from 21 days to 4 years (mean, 740 days), and follow-up time for dogs that underwent the modified open anal sacculcetomy ranged from 13 days to 5 years (mean, 919 days).

Short-term complications were rare, regardless of the surgical technique. Only 3 dogs developed short-term complications, including 2 that underwent open sacculcetomy (1 had excessive drainage and 1 developed a seroma) and 1 that underwent closed sacculcetomy (scooting and inflammation). In all 3 dogs, short-term complications resolved without treatment. Overall, 14 of the 95 (15%) dogs developed long-term complications. Eleven of the 14 dogs with long-term complications had undergone open anal sacculcetomy, and complications in these dogs included continued licking (3 dogs), fecal incontinence (2), fistulation (3), and anal stricture (3). Three of the 14 dogs with long-term complications had undergone closed anal sacculcetomy; all 3 had fistulation. Fistulation was a result of retained anal sac epithelium creating a fistulous tract between the site of the dissected anal sac and the overlying skin.

Weight of the dog, type of anal sac disease, age at the time of surgery, and whether the wound was closed surgically were not significantly associated with whether dogs developed postoperative complications. However, postoperative complications (none vs short-term vs long-term) were significantly (\( P = 0.003 \)) associated with surgical technique (open vs closed; Table 1). When multinomial logistic regression was per-

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<th>Complications</th>
<th>Surgical technique</th>
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<tr>
<td></td>
<td>Open</td>
</tr>
<tr>
<td>None</td>
<td>25</td>
</tr>
<tr>
<td>Short-term</td>
<td>2</td>
</tr>
<tr>
<td>Long-term</td>
<td>11</td>
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Surgical technique was significantly (\( \chi^2 \) test; \( P = 0.003 \)) associated with type of complications.
formed, dogs that underwent open anal sacculectomy were significantly (\( P = 0.003; \) relative risk ratio, 7.77) more likely to have a long-term complication than were dogs that underwent closed anal sacculectomy (Table 2). When only those dogs that underwent surgery prior to 1980 were considered, those dogs that underwent standard open anal sacculectomy prior to 1980 were significantly (\( P < 0.001 \)) more likely (relative risk ratio, 13.67; 95% confidence interval, 2.74 to 58.5) to have a long-term complication than were dogs that underwent closed anal sacculectomy. For dogs that underwent surgery prior to 1980, surgical technique was significantly (\( P = 0.001 \)) associated with postoperative complications (Table 3), whereas for dogs that underwent surgery after 1980, surgical technique was not significantly (\( P = 0.2 \)) associated with postoperative complications.

There was a significant (\( P = 0.004 \)) association between date of surgery (before vs after 1980) and surgical technique. Before 1980, 42 of 59 (71%) dogs underwent closed anal sacculectomy and 17 (29%) underwent open anal sacculectomy, whereas after 1980, only 15 of 36 (42%) dogs underwent closed anal sacculectomy and 21 (58%) underwent open sacculectomy. All dogs with preoperative evidence of fistulation underwent a modified open anal sacculectomy; all of these dogs underwent surgery after 1980.

Ages at the time of surgery and times to development of long-term complications were not significantly different between dogs that underwent open anal sacculectomy and dogs that underwent closed anal sacculectomy. Size of the dog (small vs medium vs large) was not significantly associated with surgical technique (open vs closed), nor was type of anal sac disease, type of short-term complication, or type of long-term complication. Two of the 4 dogs with anal sac impaction underwent closed anal sacculectomy and developed long-term complications; however, the importance of this finding could not be determined because of the low number of cases. No long-term complications developed after sacculectomy in dogs with anal sac fistulation.

No significant differences were found in regards to ages at the time of surgery for each type of complication or for ages at the time of surgery and times to development of complications for each type of anal sac disease. Type of anal sac disease was not significantly associated with size of the dog, and no significant differences were found in regards to ages at the time of surgery or time to development of complications for dogs of the various sizes.

**Discussion**

Results of the present study suggest that anal sacculectomy is a safe and effective treatment for non-neoplastic anal sac disease that is associated with a low rate of complications. Overall, the standard open technique, as opposed to the modified open technique, was associated with the greatest number of short- and long-term complications, whereas the closed technique was associated with the lowest number of complications. The modified open technique, which was used after 1980, also had a low rate of complications and was an acceptable alternative for anal sacculectomy. Short-term complications that were identified include excessive drainage, scooting and inflammation, and seroma formation, whereas long-term complications that were identified included continued licking of the surgery site, fecal incontinence, fistulation, and stricture formation.

Inclusion and exclusion criteria used for this study...
were chosen so that we could identify the type and frequency of complications associated with bilateral anal sacculectomy in dogs with non-neoplastic anal sac disease. Including patients with other diseases, such as perianal fistulas, would have confused the results, since these dogs can develop complications related more to the underlying disease than to the surgical treatment.

A review of the medical records of the dogs included in the study revealed that a wide variety of surgical techniques were used. It is uncertain at this time whether adoption of the modified open technique after 1980 was responsible for the low number of complications reported after 1980 or whether this change was related to changes in the surgeons performing surgery after 1980.

As with any retrospective study, there were certain weaknesses and drawbacks in the present study. Criteria for determining whether dogs developed short- or long-term complications were not standardized, and surgery reports, particularly for dogs that underwent surgery during the early part of the study period, often did not provide full details, such as degree of contamination at the time of surgery and whether the dogs received antimicrobials during the perioperative period. It was also difficult to assess the experience of the surgeon, as many surgeries were presumably performed, at least in part, by residents in training with an experienced surgeon supervising. Therefore, these confounding variables must be taken into consideration when examining the results of this study.

References