





Outcomes of surgically treated sialoceles in 21 cats: A multi-institutional retrospective study (2010–2021)

Laura G. Marti DVM, MA¹  | Brigitte A. Brisson DVM, DVSc, DACVS¹ |
 Laura-Isabela Del Carpio DVM, MSc¹ |
 Stephanie Goldschmidt BVM&S, DACVD^{2,3}  | Nicole Buote DVM, DACVS⁴  |
 Dominique Gagnon DVM, DVSc, DACVS (Small Animal)⁵ |
 Cindy Shmon DVM, DVSc, DACVS, CCRP⁶ |
 Allyson A. Sterman DVM, DACVS (Small Animal)⁷ |
 Valery F. Scharf DVM, MS, DACVS (Small Animal)⁸  |
 Catriona M. MacPhail DVM, PhD, DACVS⁹ |
 Lynn Maki DVM, DACVS (Small Animal)¹⁰ |
 Boaz Arzi DVM, DAVDC, DEVDC, FF-AVDC-OMFS¹¹

¹Ontario Veterinary College, University of Guelph, Guelph, Ontario, Canada

²Department of Veterinary Clinic Sciences, University of Minnesota, College of Veterinary Medicine, St Paul, Minnesota, USA

³Department of Veterinary Surgery and Radiologic Sciences, University of California-Davis, School of Veterinary Medicine, Davis, California, USA

⁴College of Veterinary Medicine, Cornell University, Ithaca, New York, USA

⁵Faculté de Médecine Vétérinaire, University of Montreal, St-Hyacinthe, Quebec, Canada

⁶Western College of Veterinary Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, Canada

⁷College of Veterinary Medicine, Purdue University, West Lafayette, Indiana, USA

⁸College of Veterinary Medicine, North Carolina State University, Raleigh, North Carolina, USA

⁹College of Veterinary Medicine and Biomedical Sciences, Colorado State University, Fort Collins, Colorado, USA

¹⁰Companion Animal Clinic, Midwestern University, Glendale, Arizona, USA

¹¹School of Veterinary Medicine, University of California – Davis, Davis, California, USA

Correspondence

Brigitte A. Brisson, Ontario Veterinary College, University of Guelph, 28 College Avenue West, Guelph, Ontario N1G 2W1, Canada.

Email: bbrisson@uoguelph.ca

Abstract

Objective: To report the outcomes of cats that underwent surgical correction for sialoceles.

Study design: Multi-institutional retrospective cohort study.

Animals: Twenty-one client-owned cats.

Methods: Medical records were examined of cats diagnosed with sialocele, which underwent surgical intervention over an 11-year period at one of 10 referral hospitals. The data collected included signalment, clinical signs, diagnostic imaging, histopathology, surgical procedures performed, and post-operative complications.

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial](https://creativecommons.org/licenses/by-nc/4.0/) License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes.

© 2024 The Author(s). *Veterinary Surgery* published by Wiley Periodicals LLC on behalf of American College of Veterinary Surgeons.

Results: The most common presenting complaints for cats with sialoceles included dysphagia and ptyalism. Only two cats had a recent history of trauma, and one was diagnosed with a concurrent sialolith. Most displayed visible tissue swelling, with ranulae being most common. Surgical treatment consisted of sialoadenectomy and/or marsupialization. Intraoperative complications occurred in three cats, and postoperative complications in five cats. No recurrence or development of contralateral sialoceles were reported during the follow-up period (30–968 days).

Conclusion: The majority of cats did not have a clear underlying cause for developing a sialocele. The sublingual and mandibular salivary glands were presumed to be the most commonly affected. Mandibular and sublingual sialoadenectomy and/or marsupialization provided resolution of clinical signs to the 21 cats that underwent these procedures.

Clinical significance: Sialocele, although rare, should remain a differential diagnosis when managing cats with relevant clinical signs. Surgical intervention appears to offer resolution of signs with apparently low overall risk of complication or short-term recurrence. In cats it is necessary to evaluate whether sialoadenectomy is necessary, or whether marsupialization alone should be attempted as a less invasive first-line surgical intervention.

1 | INTRODUCTION

Diseases affecting the salivary glands of companion animals are quite rare, making up 0.3% of complaints in surveys of medical records.^{1,2} Of these, the second most commonly reported is sialocele.³ Sialoceles result from abnormal accumulation of saliva outside of the salivary gland or ducts. Most commonly this occurs subcutaneously in the cervical region in dogs.³ A ranula is a specific subtype of sialocele manifesting with sublingual swelling due to leakage from the sublingual salivary gland.³ Dogs historically develop sialoceles more commonly, although cats have also recently been shown to develop this condition.^{2–7} No formal investigation into the relative frequency of salivary gland disease between dogs and cats has been performed but it was previously reported that salivary gland tissue is submitted for analysis twice as frequently in dogs as in cats.¹

Until recently, reports on feline sialoceles were limited to single case studies or small case series. Nineteen cats with sialocele were reported in a European population recently by Bobis-Villagr a et al.⁸ However, this population included cats that did not ultimately undergo surgical treatment. Surgery is considered the recommended treatment for dogs with sialoceles, and the current study was undertaken to examine the clinical presentation and outcomes of

surgically managed sialoceles in cats in a North American population.^{3–5,10}

2 | MATERIALS AND METHODS

2.1 | Case selection criteria

Medical records from 10 veterinary hospitals were searched for cases of cats presenting with sialoceles between January 1, 2010 and July 31, 2021. These records were evaluated retrospectively. Cats that had concurrent salivary gland neoplasia, which did not undergo some form of surgical intervention and that did not have at least one follow-up visit, were excluded.

2.2 | Medical records review

Information retrieved from patient records included signalment (breed, age, sex), date of surgery, body weight at the time of surgery, access to the outdoors, diet consumed, history of trauma, clinical signs at the time of presentation, duration of clinical signs prior to presentation, description of any gross lesions, previous treatment of the sialocele (both surgical and medical), diagnostics performed (cytology, bloodwork, imaging, histopathology,

bacterial culture), surgical approach (lateral or ventral cervical for sialoadenectomy, or intraoral for marsupialization or molar sialoadenectomy), procedure performed, and complications. Complications were divided, as described by Follette et al.,¹¹ into intraoperative (those that occurred between surgical incision and last suture) and postoperative complications. Postoperative complications were further divided into in-hospital complications, short-term postoperative complications (those that developed within the first 30 days following surgery), and long-term complications (those occurring 31 days or more following the surgical procedure).¹¹ When appropriate, means, medians, and ranges were reported.

3 | RESULTS

3.1 | Signalment and clinical data

Twenty-one records were found to satisfy the inclusion criteria. Cat breeds represented in this population included domestic shorthair (11/21, 52.3%), domestic medium hair (1/21, 4.7%), domestic long hair (4/21, 19.0%), Siamese (2/21, 9.5%), Himalayan (1/21, 4.7%), Maine coon (1/21, 4.7%) and British shorthair (1/21, 4.7%) (Table 1). Male cats (12/21, 57.1%) outnumbered females (9/21, 42.8%). One male cat was intact, one female cat had unknown reproductive status and all others were sterilized. The mean and median body weights on presentation were 4.9 and 4.1 kg (range 3.0–10.1). The mean and median ages at the time of surgery were 6.2 and 5 years (range 1–20) across all cats with males averaging 7.9 years old and females averaging 4.4 years. Multiple lifestyle factors were considered. No cats were explicitly reported to live only outdoors, although seven had unreported lifestyle data (7/21, 33.3%). Seven cats were indoor only (7/21, 33.3%) and seven had access to both indoor and outdoor environments (7/21, 33.3%). The type of diet fed included dry kibble (4/21, 19.0%), wet food (2/21, 9.5%) and a combination of the two (8/21, 38.0%). Seven records did not include information about diet (7/21, 33.3%). Of the reported diets, no brand or formulation was found to be reported more than twice. Two cats (2/12, 9.5%) had a potential history of trauma: one may have sustained an unclear injury to the head or neck region while playing with the owner, and the other was a recently adopted stray cat with wounds and scarring around the head and neck that were suspected to be evidence of fighting. One cat had recently undergone dental extractions (1/21, 4.7%). No cats had a history of chewing on toys but one (1/21, 4.7%) was noted to occasionally chew sticks.

3.2 | Clinical presentation

The most common presenting complaints in this population were cervical swelling (11/21 52.3%) and dysphagia (9/21, 42.8%). Ptyalism was also reported in seven cats (7/21, 33.3%). One cat was brought in for evaluation of a swelling on the lower lip (1/21, 4.7%). Three cats had clinical signs involving the respiratory tract, including audible stertor (3/21, 14.2%), and two cats presented in respiratory distress (2/21, 9.5%) (Table 1). One of the cats in respiratory distress was noted to have a large ranula extending to the pharynx. One cat displayed exophthalmos (1/21, 4.7%). Other signs reported included lethargy (2/21, 9.5%) and abnormal behavior of the tongue (2/21, 9.5%). On physical examination, 12 cats had visibly appreciable ranula (12/21, 57.1%). The median (range) duration of clinical signs was 90 days (5 days to 3 years).

3.3 | Diagnostics

Prior to referral, drainage had been attempted by the referring veterinarian in 12 cats (12/21, 57.1%). Eight cats had been treated with antibiotics (8/21, 38.0%), one with steroids (1/21, 4.7%), and two received both steroids and antibiotics (2/21, 9.5%). Antibiotics used in these cats included potentiated penicillin, enrofloxacin, and clindamycin. No prior medical treatment had been attempted in nine cases (9/21, 42.8%). Diagnosis of sialocele was obtained postoperatively through cytology of aspirated fluid (14/21, 66.7%), diagnostic imaging (14/21, 71.4%), and/or histopathology (15/21, 71.4%). Diagnostic imaging modalities utilized included radiographs (3/21, 14.2%), computed tomography (CT) (10/21, 47.6%), and focused ultrasound assessment (1/21, 4.7%). One cat was noted to have a sialolith on CT (1/21, 4.7%). Intraoperative cultures were obtained in four cases (4/21, 19.0%), and a single sample reportedly grew *Actinomyces* spp. (1/21, 4.7%).

3.4 | Distribution of lesions and treatment

Lesion distribution was left sided in 15 cats (15/21, 71.4%) and right sided in six cats (6/21, 28.5%). Seventeen cats received intraoperative antibiotics (17/21, 80.9%). All cats in this study underwent surgical intervention, including sialoadenectomy and/or marsupialization of a ranula. Sialoadenectomy alone was performed in 11 (52.3%) cats. The glands removed were: sublingual gland (1/21, 4.7%), mandibular gland (4/21, 19.0%), molar salivary gland (1/21, 4.7%) or both the mandibular and sublingual glands (2/21, 9.5%). Four cats underwent only

TABLE 1 Summary of patient characteristics, clinical data, procedures and follow-up time for 21 cats undergoing surgical treatment for sialoceles.

Case number	Signalment	Indoor or outdoor lifestyle	Diet type (kibble or hard food)	Other relevant history	Presenting complaint(s)	Duration of clinical signs (days)	Lesion location	Diagnostics performed	Surgical procedure performed (surgical approach)	Follow up beyond one month if available (days)
1	5-year-old MC domestic shorthair	Both	Unknown	Known to chew sticks	Dysphagia, salivation, lethargy, ranula	8	Left	Cytology	Left sublingual sialoadenectomy (lateral)	
2	7-year-old MC Himalayan	Unknown	Both		Swelling of the neck	120	Left	Cytology, CT	Left mandibular sialoadenectomy (ventral)	968
3	12-year-old FS domestic longhair	Unknown	Both		Swelling of the neck	365	Right	Cytology	Right mandibular sialoadenectomy (lateral)	
4	8-year-old FS domestic longhair	Unknown	Both		Mild exophthalmos OS, swelling of the neck	30	Left	Cytology, CT	Left mandibular sialoadenectomy (lateral)	186
5	5-year-old MC Siamese	Indoor only	Kibble only		Dysphagia, salivation, swelling of the neck	365	Left	CT	Left mandibular sialoadenectomy (ventral)	
6	1.1-year-old MC domestic shorthair	Unknown	Unknown	Potential trauma when playing	Salvation, ranula	16	Right	Cytology, radiographs	Right sublingual marsupialization (oral only)	1205
7	3.1-year-old FS domestic shorthair	Unknown	Both		Dysphagia, swelling of the neck, ranula, rolling tongue, weight loss	60	Right	Cytology, radiographs	Right sublingual marsupialization (oral only)	1201
8	19-year-old domestic shorthair	Indoor with restricted outdoor access	Both	Multiple dental extractions 5 months before surgery	Dysphagia, salivation, swelling of the neck, ranula	120	Left	CT	Left mandibular and sublingual sialoadenectomy (left lateral)	879
9	3-year-old F ^u domestic shorthair	Outdoor	Unknown		Salvation, ranula	1095	Right	Cytology	Right mandibular sialoadenectomy (not specified), ranula marsupialization (oral)	

TABLE 1 (Continued)

Case number	Signalment	Indoor or outdoor lifestyle	Diet type (kibble or hard food)	Other relevant history	Presenting complaint(s)	Duration of clinical signs (days)	Lesion location	Diagnostics performed	Surgical procedure performed (surgical approach)	Follow up beyond one month if available (days)
10	10-year-old MC domestic shorthair	Both	Kibble only		Dysphagia, salivation, ranula, tongue hanging out of mouth	150	Right		Right sublingual marsupialization (oral only)	
11	20-year-old MC domestic shorthair	Both	Both		Swelling of the neck	60	Right	Cytology, radiographs	Right molar marsupialization (not specified)	365
12	11-year-old MC domestic shorthair	Unknown	Both		Respiratory distress, ranula, 1.5 month history of gurgling noise	60	Left	CT	Left mandibular sialoadenectomy (not specified)	964
13	1.5-year-old FS domestic shorthair	Unknown	Unknown		Swelling of the neck, ranula	90	Left	Cytology	Left mandibular sialoadenectomy and marsupialization ^b (ventral)	
14	10-year-old MC domestic mediumhair	Indoor only	Unknown		Approximately 3-month history of mass on lower left lip that grew in size	90	Left	CT	Left molar sialoadenectomy (oral)	287
15	1-year-old FS domestic shorthair	Indoor only	Kibble only		Discrete, soft approximately 4 cm mass under the left mandible	210	Left	Cytology, CT	Left mandibular and sublingual sialoadenectomy (lateral)	
16	2.5-year-old MC domestic longhair	Both	Soft food only		Dysphagia, ranula	270	Left	Cytology, CT	Left mandibular and sublingual sialoadenectomy (lateral), ranula marsupialization (oral)	90
17	4-year-old MC domestic shorthair	Both	Soft food only		Dysphagia, ranula	365	Left	CT	Left mandibular and sublingual sialoadenectomy (lateral), ranula marsupialization (oral)	

(Continues)

TABLE 1 (Continued)

Case number	Signalment	Indoor or outdoor lifestyle	Diet type (kibble or hard food)	Other relevant history	Presenting complaint(s)	Duration of clinical signs (days)	Lesion location	Diagnostics performed	Surgical procedure performed (surgical approach)	Follow up beyond one month if available (days)
18	1-year-old M Maine Coon	Indoor only	Kibble only		Dysphagia, respiratory distress, swelling of neck	30	Left	Ultrasound	Left mandibular and sublingual sialoadenectomy (left lateral), ranula marsupialization (oral)	
19	7-year-old FS British Shorthair	Indoor only	Both		Ranula	30	Right	Cytology, CT	Bilateral mandibular and sublingual sialoadenectomy (ventral), ranula marsupialization (oral)	90
20	2-year-old FS Siamese	Both	Unknown	Suspect history of trauma due to wound and scar on left side of neck	Saliva leaking from draining tract, swelling of the neck	30	Left		Left mandibular and sublingual sialoadenectomy (not specified)	
21	2.25-year-old FS domestic longhair	Indoor only	Unknown		Swelling of the neck, ranula	5	Left		Left mandibular and sublingual sialoadenectomy (lateral), ranula marsupialization (oral)	822

Abbreviations: F, female; FS, female spayed; M, male; MC, male castrated.

^aReproductive status unknown at the time of surgery; owners declined further investigation.

^bHistopathology of the tissue removed during sialoadenectomy revealed inadvertent mandibular lymph node removal.

a marsupialization procedure (4/21, 19.0%). Both marsupialization and sialoadenectomy of the lingual and submandibular salivary glands were carried out in six cats (6/21, 28.5%). Surgical approaches used included lateral (7/21, 33.3%), ventral (4/21, 19.0%), intraoral (4/21, 19.0%), combination lateral and intraoral (1/21, 4.7%), and combination ventral and intraoral (1/21, 4.7%). The surgical approach was not specified in the surgery report and could not be confirmed in four cases (4/21, 19.0%). Twelve cats were prescribed postoperative antibiotics (12/21, 57.1%).

3.5 | Complications and postoperative outcomes

Intraoperative complications were noted in 3 of 21 cats (14.2%). The linguofacial vein was inadvertently transected during a ventral approach for left mandibular and sublingual sialoadenectomy in one cat. In another cat undergoing left mandibular sialoadenectomy (surgical approach not specified in the record) and marsupialization of a ranula, histopathology revealed that the mandibular lymph node was removed instead of the mandibular salivary gland. As the clinical signs resolved following the initial surgery, mandibular sialoadenectomy was not pursued for this cat. One cat was suspected of having transient iatrogenic damage to the sublingual nerve following marsupialization of a ranula. Five of 21 cats (23.8%) were reported to have postoperative complications. In-hospital complications were reported in three cats (3/21, 14.2%). Two cats displayed swelling at the surgical site (2/21, 9.5%), one of which was unwilling to eat upon recovery (1/21, 4.7%). The nature of the swelling was not reported, nor was sampling performed; however, the swelling resolved without intervention in both cats. The third cat reportedly pawed at its face in the 48 hours immediately postoperatively (1/21, 4.7%).

Short-term complications were reported in three cats. One produced hemorrhagic purulent material from the site of the ranula marsupialization site. Another, which developed incisional swelling shortly after undergoing a lateral approach for left mandibular and sublingual sialoadenectomy, reportedly had a swelling for several weeks. This swelling was self-limiting and did not require further intervention. At a recheck appointment, one cat, which had undergone bilateral mandibular and sublingual sialoadenectomy through a ventral approach as well as marsupialization of its ranula through an intraoral approach, had evidence of trauma on the lateral aspect of the tongue that did not recur following resolution.

The single cat with a documented long-term complication, occurring over 1 month following surgery was the

cat that pawed at its face in the immediate postoperative period. This cat had undergone a lateral approach for left mandibular and sublingual sialoadenectomy. The owners described the cat as “attacking [its] face” 2 months after surgery. The cat was tentatively diagnosed with feline oral pain syndrome and treated with corticosteroid, analgesic, and anticonvulsant therapy. One year following surgery, no further pain episodes were reported for this cat.

3.6 | Follow up

Follow up was available for a minimum of 30 days for all cats. Follow up beyond the 30-day period was sought by telephone contact with owners and referring DVMs on record but was only available for 11 (52.3%) of 21 cats. The median follow-up time beyond 30 days (11 cats), was 822 days (90–1205) with all cats having a minimum of 90 days' follow up. No episodes of long-term complications, recurrence, or contralateral lesion were reported within this period for these 11 cats. Minimum and median follow-up time for the four cats (4/21, 19.0%) that underwent only marsupialization were 30 and 615.5 days, respectively.

4 | DISCUSSION

As far as the authors are aware, the current study represents the largest investigation into the surgical management of feline sialoceles. Given that feline sialocele occurs rarely, cats were recruited from multiple institutions and over an 11-year period, which led to difficulty in obtaining long-term follow up beyond 30 days for approximately half the cats in this study. Within the study population, a clear cause for sialocele formation was not identified in most cats. The most commonly affected glands were the mandibular and sublingual salivary glands, which is consistent with the reported findings in dogs. Surgical management, either through sialoadenectomy, marsupialization, or a combination thereof, had a relatively low rate of complication. No recurrence was reported in this study.

With the increasing frequency of cases recorded, the focus is now shifting to management of the disease and identifying potential trends. This population was small but it does show interesting patterns that reflect those seen in dogs. More than 70% of cats in this study had a left-sided lesion, in contrast to previous reports in dogs.^{12,17} All but two cats had presumed involvement of the mandibular and/or sublingual salivary glands, based on histopathologic findings, lesion location and response

to treatment. This is consistent with previous reports of sialoceles in canines despite the differences in anatomy between the two species.^{2,12} These differences include the cat having an additional molar salivary gland that sits on the lingual side of the first mandibular molar.¹⁰ The mandibular and sublingual salivary glands are more closely associated in the dog than in the cat, which perhaps underlies the frequency with which these glands are affected.⁸ Dogs also commonly have more anatomic variation within their salivary glands than cats; however, the significance of these variations is unknown.¹³

A slight predisposition in males has been reported in dogs with sialoceles.¹³ The current study did have more male cats than females included in the population; however, it is unclear if this is reflective of a true predisposition or simply a product of sampling. Breed predispositions have been suggested to exist in dogs, with greyhounds, poodles and dachshunds seeming to have an increased incidence.^{12,15,16} The majority of cats in the current study fell into the domestic shorthaired or domestic longhaired breed. This, however, may simply reflect the frequency with which these breeds are kept as pets rather than a meaningful breed predisposition.

In dogs, the most common salivary glands associated with sialocele formation are the sublingual and mandibular salivary glands.^{14,17} Nineteen of the sialoceles in the current study were thought to involve one or both of these glands, showing a similar trend in cats. The sialocele in the remaining two cats was suspected to involve the molar salivary gland. As is also the case for dogs, response to treatment is often used as a confirmation that the affected gland was removed and this cannot always be confirmed with preoperative imaging or postoperative histopathology.

Notably, over half of the cats presented with an appreciable ranula. This underscores the importance of the oral examination as an integral part of the feline physical examination. Previously, it had been reported that the molar salivary gland, found only in cats, was not capable of forming a sialocele.⁸ However, a recently reported sialocele in a British shorthair was believed to have originated from the molar salivary gland.⁶ In the current study, two of the cats were suspected to have sialoceles originating from the molar salivary gland based on lesion location and characterization on histopathology. One of these cats presented for a growing mass on the lip just caudal to the left labial frenulum. Histopathology confirmed complete excision of a salivary-filled structure, leading to suspicion of the molar gland's involvement. While these are rare instances, they demonstrate the potential for sialoceles to arise from any of the salivary glands. Completely disregarding the molar salivary gland as a site of sialocele formation may result in failure to definitively treat a cat.

This study does not offer new insight into the underlying etiology of feline sialoceles; however, it does suggest similarities between canine and feline cases. In the current study, two cats had a known or suspected history of trauma and one cat had an obstructive sialolith. The remaining eighteen cats did not have a known cause for developing a sialocele. The underlying etiology of sialoceles in companion animals remains unclear. Previous research has implicated trauma, sialoliths, neoplasia, and dirofilariosis as conditions resulting in the formation of sialoceles in dogs.^{3,17} However, the majority of cats do not present with a clear underlying etiology.^{3,15,18} Experimental attempts to replicate sialocele formation through damage or ligation to the salivary glands and associated ducts has been met with mixed results. In dogs, attempts to provoke sialocele formation through ligation of salivary ducts have not been successful, leading to thought that trauma may be a contributing factor.^{14,19} Conversely, ligation of the sublingual salivary duct in cats produced subcutaneous extravasation of mucous in the majority of cats in one study, where sialoceles formed up to 1 year following ligation.¹⁴ As pointed out by Bellinger and Simpson, this delay may result in failure to associate a traumatic event with sialocele formation.¹⁵ With cats that had both indoor and outdoor access, the traumatic event may not have been witnessed by the owners. Likely, sialocele formation is a multifactorial process that does not solely result from a singular insult. Harrison and Garret suggested that sialocele formation in the cat is dependent on the macrophagic and fibroblastic reactions following insult to the salivary gland and extravasation of mucus.²⁰ A substantially robust response may cause the secretory acini to atrophy and prevent sialocele formation, while sialoceles may form when the extravasated saliva overwhelms the host inflammatory response.

Surgery remains the treatment of choice for managing sialoceles.^{3–5,10} Over half of the cats in the current study had undergone previous drainage of the sialocele, which recurred and prompted the need for surgery. Marsupialization has previously been shown to be a less effective treatment than sialoadenectomy in dogs, likely due to the propensity for the mucosa to heal and obstruct the site of marsupialization.⁵ We did not identify a recurrence in the four cats that were treated with marsupialization alone in this study but the follow-up time for some of these cats was short. Nevertheless, as 12 cats showed recurrence of ranula soon after aspiration alone and were subsequently referred for surgery, it may be that marsupialization could represent a viable, less invasive first step in cats if owners are reluctant to proceed with sialoadenectomy. Of course, we cannot rule out potential recurrences for which pet owners did not seek a recheck appointment and without standardizing long-term follow up, no definitive

conclusions can be drawn. However, these data are supported by another study reporting on feline sialoceles, which may indicate that marsupialization of sialoceles in cats could be met with less postoperative complications than when performed in dogs.⁹

The overall, occurrence of postoperative complications in the current study (5/21, 23.8%) was slightly higher than those reported in canine retrospective studies (~15%).¹⁷ Side effects of sialoadenectomy reported in dogs included hemorrhage, seroma formation, infection, sublingual swelling, and recurrence.^{5,18} Two cats in the current study developed postoperative incisional swelling that was not conclusively characterized as a seroma or recurrence but resolved without treatment. Bleeding occurred in one patient when the linguofacial vein was inadvertently transected intraoperatively. In one patient the mandibular lymph node was inadvertently removed instead of the mandibular salivary gland and was confirmed by histopathology. The reason for the higher rate of complication in this study is unknown but could reflect species differences between dogs and cats or result from surgeons being less familiar with the anatomy and procedure in smaller feline patients. Additional care in surgical planning and technique should be employed when treating feline sialoceles. No conclusions could be made with regard to the effect of surgical approach on complications based on our small number of cases. With the digastricus muscle limiting access through a lateral approach, it is believed that the ventral approach may yield better success at removing the sublingual salivary gland tissue in dogs.^{3,17,18} The ventral approach has been associated with a lower risk of recurrence but it has also been associated with a higher risk of wound-related complications in dogs.²¹ The relevance of this is unknown but the sublingual gland is reportedly second most commonly affected, at least in dogs.^{2,12}

Recurrence of sialocele following sialoadenectomy has been reported in 5% to 15% of dogs and is presumably caused by incomplete removal of the affected salivary tissue.^{15,22,23} Cervical swelling secondary to recurrent sialocele has been reported within 7–30 days following surgery and as late as 3 years postoperatively in dogs.^{16,17,22} In the current study, the minimum follow-up time was 30 days (range 30–968). Without a standard window within which recurrence is expected, comparison between canine and feline cases is difficult. However, with recurrence being reported to be within 30 days postoperatively by at least one study, the lack of reported recurrence is promising.²² However, this must be interpreted with caution given the wide timeframe in which recurrence has been reported in dogs and the small number of cases included in the current study. An important limitation to this study is its multi-institutional retrospective nature, which limits

standardization across diagnostic and surgical procedures and most importantly limited patient follow up. Despite our best efforts, follow up of 3 months or more was only available for half of the cases in this study. It is the single most important limitation of this study and may have caused late complications to be missed. The relatively small sample size, related to the rarity of the condition and the fact that only cats that underwent surgery were included also limits the ability to extrapolate data regarding correlation that accurately reflects the overall population.

Feline sialoceles, although infrequently reported, represent an important differential diagnosis for swelling of the head and neck. Surgical intervention appears to offer resolution of associated clinical signs and complication rates comparable to similar procedures in dogs. Whether sialoadenectomy is necessary in cats, or whether marsupialization alone could be attempted as a less invasive first-line surgical intervention should be evaluated.

ACKNOWLEDGMENTS

Author Contributions: Marti LG, DVM, MA: Data interpretation, manuscript drafting, and review. Brisson BA, DVM, DVSc, DACVS: Study design, data collection, manuscript drafting, review and approval. Del Carpio L, DVM, MSc: Data acquisition (four cases), organization of preliminary overall data, manuscript review and approval. Goldschmidt S, BVMS&S, DACVD: Data acquisition (five cases), manuscript review and approval. Buote N, DVM, DACVS: Data acquisition (three cases), manuscript review and approval. Gagnon D, DVM, DVSc, DACVS (Small Animal): Data acquisition (three cases), manuscript review and approval. Shmon C, DVM, DVSc, DACVS, CCRP: Data acquisition (one case), manuscript review and approval. Sterman AA, DVM, DACVS (Small Animal): Data acquisition (one case), manuscript review and approval. Scharf VF, DVM, MS, DACVS (Small Animal): Data acquisition (one case), manuscript review and approval. MacPhail CM, DVM, PhD, DACVS: Data acquisition (one case), manuscript review and approval. Maki L, DVM, DACVS (Small Animal): Data acquisition (one case), manuscript review and approval. Arzi B, DVM, DAVDC, DEVDC, FF-AVDC-OMFS: Data acquisition (one case), manuscript review and approval.

CONFLICT OF INTEREST

The authors declare no conflict of interest in this study.

ORCID

Laura G. Marti  <https://orcid.org/0009-0004-6964-2092>

Stephanie Goldschmidt  <https://orcid.org/0000-0001-5944-4202>

Nicole Buote  <https://orcid.org/0000-0003-4623-3582>

Valery F. Scharf  <https://orcid.org/0000-0002-5011-9005>

REFERENCES

- Spangler WL, Culbertson MR. Salivary gland disease in dogs and cats: 245 cases (1985-1988). *J Am Vet Med Assoc.* 1991; 198(3):465-469.
- Lieske DE, Rissi DR. A retrospective study of salivary gland diseases in 179 dogs (2010-2018). *J Vet Diagn Invest.* 2020;32(4): 604-610. doi:10.1177/1040638720932169
- Lane JG. Surgical treatment of Sialoceles. *Oral and Maxillofacial Surgery in Dogs and Cats.* Elsevier; 2020:554-564.
- Fossum TW, ed. Surgery of the digestive system. *Small Animal Surgery.* Elsevier; 2019:358-363.
- Ritter MJ, Stanley BJ. Salivary glands. *Veterinary Surgery: Small Animal.* Elsevier Saunders; 2012.
- Kilduff-Taylor A, Gombert A, Hahn H, Dempsey LM. Sialocele associated with the molar salivary gland in a British shorthair cat. *JFMS Open Rep.* 2021;7(1) 2055116921990307. doi:10.1177/2055116921990307. Published 2021 Feb 23
- Bassanino J, Palierno S, Blondel M, Reynolds BS. Sublingual sialocele in a cat. *JFMS Open Rep.* 2019;5(1) 2055116919833249. doi:10.1177/2055116919833249. Published 2019 Feb 26
- Keifer KM, Davis GJ. Salivary mucoceles in cats: a retrospective study of seven cases. *Vet Med.* 2007;102(9):582-585.
- Bobis-Villagr a D, Rossanese M, Murgia D, et al. Feline sialocele: clinical presentation, treatment and outcome in 19 cases. *J Feline Med Surg.* 2022;24(8):754-758. doi:10.1177/1098612X211046197
- Reiter AM, Soltero-Rivera MM. Oral and salivary gland disorders. In: Ettinger SJ, Feldman EC, C ot e E, eds. *Textbook of Veterinary Internal Medicine.* Elsevier; 2017:3537-3551.
- Follette CM, Giuffrida MA, Balsa IM, et al. A systematic review of criteria used to report complications in soft tissue and oncologic surgical clinical research studies in dogs and cats. *Vet Surg.* 2020;49(1):61-69. doi:10.1111/vsu.13279
- Glen JB. Canine salivary mucoceles. Results of sialographic examination and surgical treatment of fifty cases. *J Small Anim Pract.* 1972;13(9):515-526. doi:10.1111/j.1748-5827.1972.tb06880.x
- Durand A, Finck M, Sullivan M, Hammond G. Computed tomography and magnetic resonance diagnosis of variations in the anatomical location of the major salivary glands in 1680 dogs and 187 cats. *Vet J.* 2016;209:156-162. doi:10.1016/j.tvjl.2015.07.017
- Harrison JD, Garrett JR. Mucocele formation in cats by glandular duct ligation. *Arch Oral Biol.* 1972;17(10):1403-1414. doi:10.1016/0003-9969(72)90099-4
- Bellenger CR, Simpson DJ. Canine sialoceles - 60 clinical cases. *J Small Anim Pract.* 1992;33(8):376-380. doi:10.1111/j.1748-5827.1992.tb01177.x
- Benjamino KP, Birchard SJ, Niles JD, Penrod KD. Pharyngeal mucoceles in dogs: 14 cases. *J Am Anim Hosp Assoc.* 2012; 48(1):31-35. doi:10.5326/JAAHA-MS-5670
- Swieton N, Oblak ML, Brisson BA, Singh A, Ringwood PB. Multi-institutional study of long-term outcomes of a ventral versus lateral approach for mandibular and sublingual sialoadenectomy in dogs with a unilateral sialocele: 46 cases (1999-2019). *J Am Vet Med Assoc.* 2022;260(6):634-642. Published 2022 Jan 28. doi:10.2460/javma.20.12.0692
- Ritter M, von Pfeil D, Stanley B, Hauptman J, Walshaw R. Mandibular and sublingual sialoceles in the dog: a retrospective evaluation of 41 cases, using the ventral approach for treatment. *N Z Vet J.* 2006;54(6):333-337. doi:10.1080/00480169.2006.36720
- DeYoung DW, Kealy JK, Kluge JP. Attempts to produce salivary cysts in the dog. *Am J Vet Res.* 1978;39(1):185-186.
- Harrison JD, Garrett JR. Experimental salivary mucoceles in cat. A histochemical study. *J Oral Pathol.* 1975;4(6):297-306. doi:10.1111/j.1600-0714.1975.tb01747.x
- Cinti F, Rossanese M, Buracco P, et al. Complications between ventral and lateral approach for mandibular and sublingual sialoadenectomy in dogs with sialocele. *Vet Surg.* 2021;50(3):579-587. doi:10.1111/vsu.13601
- Tsioli V, Papazoglou LG, Basdani E, et al. Surgical management of recurrent cervical sialoceles in four dogs. *J Small Anim Pract.* 2013;54(6):331-333. doi:10.1111/jsap.12044
- Poirier VJ, Mayer-Stankeova S, Buchholz J, Vail DM, Kaser HB. Efficacy of radiation therapy for the treatment of Sialocele in dogs. *J Vet Intern Med.* 2018;32(1):107-110. doi:10.1111/jvim.14868

How to cite this article: Marti LG, Brisson BA, Del Carpio L-I, et al. Outcomes of surgically treated sialoceles in 21 cats: A multi-institutional retrospective study (2010–2021). *Veterinary Surgery.* 2024;1-10. doi:10.1111/vsu.14138