

SALIVARY MUCOCOELE IN DOGS: AETIOLOGY, DIAGNOSIS, AND MANAGEMENT

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Salivary mucocoele, also known as sialocoele, is characterised by the accumulation of saliva in the tissues surrounding the salivary glands or ducts. This results in a swelling filled with saliva that can cause discomfort, pain, and functional impairment. Effective management of salivary mucocoele requires an understanding of its aetiology, clinical presentation, diagnostic approach, and treatment options. This article provides a comprehensive overview of salivary mucocoele in dogs, with an emphasis on surgical management.

Aetiology and pathogenesis

Salivary mucocoele occurs due to the leakage of saliva from a salivary gland or duct into the surrounding tissue, leading to the formation of a saliva-filled cavity (Ritter and Stanley, 2018; Torad and Hassan, 2013). Leaked saliva causes an inflammatory response, leading to the formation of a capsule lined by inflammatory connective tissue. This encapsulated collection of saliva forms the mucocoele. Leakage of saliva can be caused by trauma (e.g., dog fight), foreign bodies, sialoliths, and tumours (Schmidt and Betts, 1978; Ryan *et al*, 2008; Clarke and L'Eplattenier, 2010; Benjamino *et al*, 2012; Philp *et al*, 2012; Guthrie and Hardie, 2014; Ritter and Stanley, 2018). In many cases, the exact cause of the mucocoele remains unknown (idiopathic) (Ritter *et al*, 2006).

Clinical presentation

In one of the largest retrospective studies of dogs with mandibular and sublingual sialocoeles, the mean age was five years. No breed or sex predisposition was determined (Ritter *et al*, 2006). However, in another study consisting of 14 dogs with pharyngeal mucocoeles, small breeds (50 per cent were miniature and toy poodles) and males were over-represented (Benjamino *et al*, 2012). A 2.2:1 ratio of males to females was also reported in another study that included 16 dogs with cervical mucocoeles (Kaiser *et al*, 2016). The clinical signs of salivary mucocoele depend on the location of the affected gland and the size of the mucocoele. The four major salivary glands in dogs include the mandibular, sublingual, parotid, and zygomatic. The most common offender is the sublingual salivary gland or duct but any of the major salivary glands can be involved. The four main presentations of salivary mucocoeles in dogs include cervical, sublingual, pharyngeal, and zygomatic. Clinical signs associated with sialocoeles related to the zygomatic salivary gland or duct usually include exophthalmos due to periorbital salivary accumulation, while sialocoeles related to the mandibular or sublingual glands or ducts usually manifest as cervical, pharyngeal and/or sublingual salivary accumulation (Landy *et al*, 2021). Sublingual sialocoeles, also called ranulas, likely result from leakage of the rostral

sublingual salivary glands or duct (Ritter and Stanley, 2018). Commonly observed signs include:

- **cervical mucocoele:** swelling in the intermandibular or cranioventral neck region, which may be soft, fluctuant, and non-painful (Kaiser *et al*, 2016).
- **sublingual mucocoele (ranula):** swelling under the tongue, which can deviate tongue position and interfere with prehending, chewing and swallowing.
- **pharyngeal mucocoele:** swelling in the pharyngeal region. These mucocoeles occur within the wall of the pharynx and can result in respiratory distress, airway obstruction, inspiratory stridor, coughing, gagging, ptyalism/hypersalivation, and dysphagia (Benjamino *et al*, 2012).
- **zygomatic mucocoele:** swelling around the eye or upper jaw region. These can result in exophthalmos, difficulty closing the eye, protrusion of the nictitating membrane, and periorbital swelling/swelling ventral to the globe (Schmidt and Betts, 1978).

A subset of dogs can have more than one sialocoele. In one study of 14 dogs with pharyngeal sialocoeles, six had a concurrent cervical mucocoele on the same side (Benjamino *et al*, 2012). Dogs with salivary mucocoele may also demonstrate signs of pain, reluctance to eat, drooling, and halitosis. In cases where the mucocoele becomes infected, additional signs such as pyrexia, lethargy, and purulent discharge may be present.

Diagnosis

Diagnosis of salivary mucocoele involves a combination of physical examination, cross-sectional imaging with contrast computed tomography or ultrasonography, and fine-needle aspiration for cytology. Other tests, such as periodic acid-Schiff (PAS) staining for mucin, can also be performed.

Physical examination

A thorough physical examination is essential for identifying the location, extent and nature of the swelling. Palpation of the mass can help differentiate it from other types of swellings, including abscesses, neoplasms, or enlarged lymph nodes. As mentioned above, the presence of a soft, non-painful, fluctuant swelling in the intermandibular or cranial cervical region would be typical of a cervical mucocoele (Figure 1). With chronicity, sialocoeles can become more firm on palpation. It would be important to palpate in this area for the mandibular salivary gland and mandibular lymph node(s) that lie immediately rostral to the salivary gland. The identification of pain on palpation of this swelling could indicate the presence of an abscess possibly secondary to a stick injury but pain could also be associated with an infected sialocoele. Oral examination should be performed in all cases to rule out the presence of a ranula

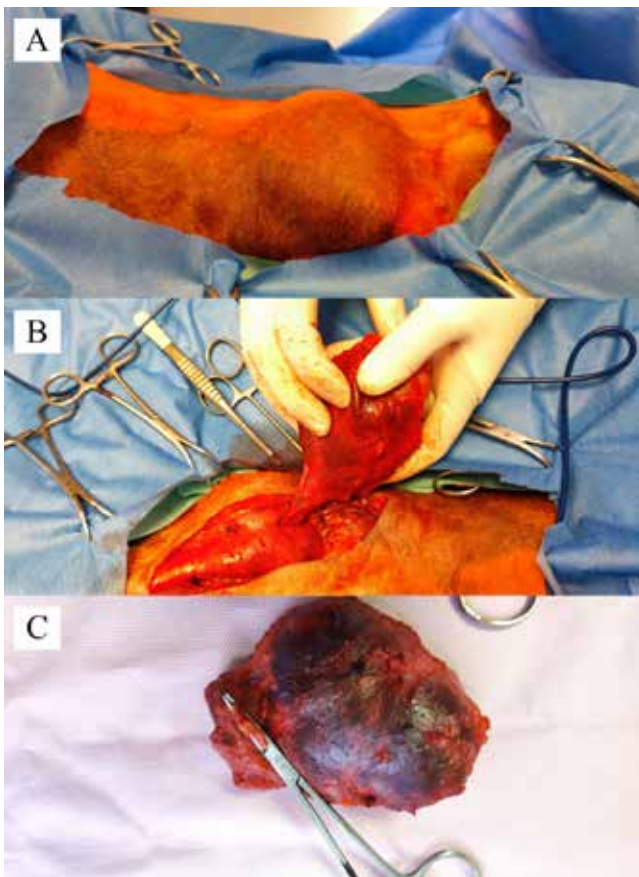


Figure 1: A – Preoperative right-sided cervical sialocele in a two-year-old male neutered mixed breed. The dog is in dorsal recumbency. B – Intraoperative image demonstrating the dissected sialocele along with the mandibular salivary gland and monostomatic part of the sublingual salivary gland. Cranial is to the left of the image. C – *Ex vivo* image of the excised sialocele along with the mandibular and sublingual salivary glands.

(Figure 2). These ranulas are usually soft, painless, and can deviate the tongue to the contralateral side. A swelling in the region of the upper last molar may be associated with the presence of a zygomatic sialocele (Ritter and Stanley, 2018). Upper airway examination would be required for the diagnosis of a pharyngeal sialocele and may reveal a swelling in the region of the pharynx (Figure 3). Physical examination findings in cases with zygomatic sialoceles may include periorbital swelling, exophthalmos, and possibly a swelling in the region of the upper last molar (Clarke and L'Eplattenier, 2010; Ritter and Stanley, 2018). There may also be inability to retropulse the globe during ophthalmologic examination (Bartoe *et al*, 2007)

Imaging studies

Imaging studies such as contrast computed tomography and ultrasonography are useful for diagnosis of salivary mucocoeles in dogs (Figure 4). Ultrasonography is particularly useful for visualising the fluid-filled nature of sialoceles and assessing their relationship with surrounding structures such as local lymph nodes. It may also help identify the affected salivary gland and detect an underlying cause such as foreign bodies or sialoliths. The ultrasound appearance may depend on the chronicity of the sialocele. Acute sialoceles appear as round echogenic structures with central anechoic contents and a hyperechoic wall (Torad and Hasson, 2013). More longstanding sialoceles can appear



Figure 2: Left-sided sublingual sialocele (ranula) in a seven-month-old male entire crossbreed dog. Mandibular and sublingual sialadenectomy combined with drainage of the ranula were performed in this case.

grainy or mottled, with a heterogenous appearance. Contrast computed tomographic features of salivary mucocoeles include fluid attenuating, non-contrast enhancing contents and soft tissue attenuating, contrast-enhancing walls, and possible mineralised foci within consistent with sialoliths (Oetelaar *et al*, 2022). Contrast sialography involves injecting contrast medium into salivary ducts and can provide information regarding the anatomy and integrity of that salivary gland and duct (Benjaminio *et al*, 2012; Guthrie and Hardie, 2014). Sialography can be performed with radiographs or computed tomography, however, the latter is superior because superimposition artifacts with radiography can limit the diagnosis and detection of affected glands (Tan *et al*, 2022). CT sialography may identify intra-sialocele contrast leakage; however, the overall sensitivity of this technique was found to be only moderate (66.7 per cent) in one study (Tan *et al*, 2022).

Fine-needle aspiration and cytology

Fine-needle aspiration (FNA) of the swelling can confirm the diagnosis of salivary mucocoele by revealing the presence of viscous, honey-coloured, clear or blood-tinged mucoid fluid (Ritter and Stanley, 2018) (Figure 5). Cytologic examination of the aspirate may reveal low numbers of lymphocytes, macrophages (containing abundant foamy cytoplasm), neutrophils, plasma cells, variable numbers of red blood cells, and clumps of homogenous pink- to violet-staining mucin (Figure 6) (Ritter and Stanley, 2018). Staining of the fluid with a mucin-specific stain (periodic-acid Schiff) can also confirm the fluid is saliva. FNA can also help rule out other differential diagnoses such as abscesses, aspiration of enlarged lymph nodes or neoplasms. If the diagnosis remains uncertain after imaging and FNA, an incisional biopsy may be obtained but this would be uncommon in the author's experience.

Treatment

Sialadenectomy forms the mainstay of treatment of salivary mucocoele in dogs. Perhaps in rare cases, particularly if the mucocoele is small and asymptomatic, monitoring the swelling and providing supportive care, such as pain relief/anti-inflammatory medication, could be considered.



Figure 3: Images of a six-year-old male neutered mixed breed dog that was presented with inspiratory dyspnoea and stertorous breathing. Upper airway examination identified a right pharyngeal sialocele that was causing partial laryngeal obstruction. Images, courtesy of Dr Ignacio Otero Balda.

This approach does not address the underlying cause of the mucocoele and there is a high risk of persistence or recurrence. Furthermore, incision or drainage of sialoceles alone is not recommended as a definitive treatment because there is a high rate of recurrence (Ritter and Stanley, 2018).

Surgical management

Surgical intervention is the treatment of choice for salivary mucocoele and involves removal of the affected salivary gland and duct. The specific surgical procedure depends on the location of the mucocoele.

Cervical and sublingual sialoceles

1. Mandibular and sublingual sialadenectomy: surgical removal of the mandibular and sublingual salivary glands is the treatment of choice for cervical and sublingual sialoceles. Both lateral and ventral approaches are described, with the author preferring the ventral approach (Cinti *et al*, 2021). In one study, while overall rates of intraoperative and postoperative complications did not differ, the recurrence rate was higher with the lateral approach and wound-related complications were more likely with the ventral approach (Cinti *et al*, 2021). In another study, no difference in the rate of intraoperative complications, recurrence, or postoperative complications



Figure 5: Sialoceles typically contain viscous, honey-coloured, clear or blood-tinged fluid. Note the thick viscous nature of the fluid in image B.



Figure 4: Preoperative transverse plane computed tomographic images of the same dog in Figure 1 demonstrating a large left-sided cranial cervical fluid-filled cavity associated with the rostral extent of the mandibular salivary gland. The asterisk in image A indicates the left mandibular salivary gland. The dagger in image B indicates the fluid-filled sialocele. The right side of the dog is to the left of the images.

was identified among dogs that underwent a lateral or ventral approach (Swieten *et al*, 2022). It is vitally important in cases with intermandibular or cranioventral cervical swelling that the correct sided gland is removed. Affected animals should be placed in dorsal recumbency

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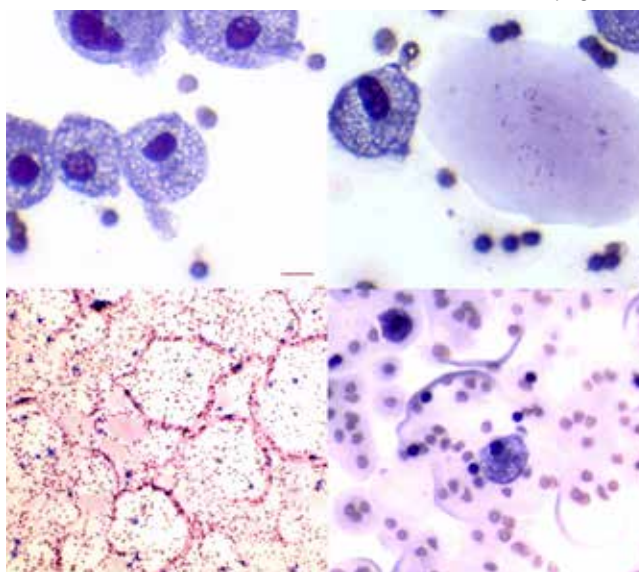


Figure 6: Cytologic analysis of a fine-needle aspirate of a dog with a salivary mucocoele. Cytology identifies moderate cellularity in a background of numerous moderately-to-darkly purple-to-eosinophilic patches of homogeneous material (mucin), numerous red blood cells, large foamy macrophages, and smaller and typically shrunken non-lytic neutrophils and small lymphocytes. Findings consistent with salivary mucocoele with moderate, mixed, mostly-mononuclear/macrophagic, and mild neutrophilic, non-septic inflammation. Images courtesy of Dr Peter J. O'Brien.

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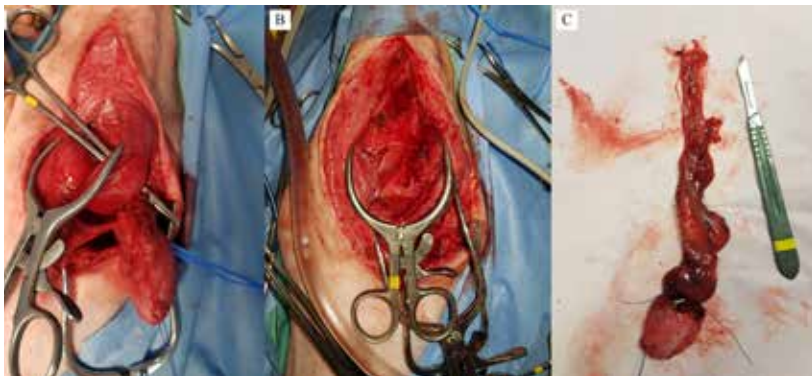


Figure 7: A - Tunnelling of the mandibular and sublingual salivary gland ducts under (deep to) the digastric muscle in order to permit dissection rostral to the lingual nerve and reduce the risk of recurrence. A stay suture for traction has been placed in the mandibular salivary gland. The haemostat is placed under the digastric muscle. B - Image following mandibular and sublingual sialadenectomy. The neural structure running from left to right within the arms of the Gelpi retractor is the lingual nerve. C - Image demonstrating the excised mandibular and sublingual salivary glands and ducts. For images A and B, the dog is in dorsal recumbency with cranial to the top of the image and the dog's left side to the right of the image.

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and the swelling should deviate to the affected side. CT should also identify the affected gland(s). The mandibular salivary gland is located cranial to the bifurcation of the maxillary and linguofacial veins and has a pale greyish appearance. The mandibular and sublingual glands, along with their associated ducts, are carefully dissected and removed (Figure 7). Both glands are removed together because they are intimately associated with one another. The sublingual salivary gland consists of monostomatic and polystomatic components. The most caudal part of the monostomatic component abuts the mandibular salivary gland and shares a capsule with it. The monostomatic component continues rostrally as loose clusters of glandular tissue alongside the mandibular salivary duct (Ritter and Stanley, 2018). Clusters of salivary tissue along this path rostral to the lingual nerve (Figure 7) is considered the polystomatic component of the sublingual salivary gland. Both the mandibular and sublingual salivary ducts exit at the sublingual caruncle. With dissection of these ducts in a rostral dissection, the digastric muscle will be observed along the ventral border of the caudal mandible, crossing and obstructing the path of dissection. The muscle is dissected and elevated and large, curved Kelly or Crile haemostatic forceps passed from medial to lateral, deep to this muscle. The duct is grasped with the forceps and the mandibular and monostomatic part of the sublingual salivary glands excised. The remaining duct is pulled from lateral to medial deep to the digastric muscle and dissection continued rostral to the lingual nerve (Marsh and Adin, 2013) (Figure 7). The actual sialocoele itself can be punctured, its contents suctioned, and its outer connective tissue wall left in place, or it can be removed as part of the sialadenectomy.

- 2. Marsupialisation:** for sublingual mucocoeles (ranulas), marsupialisation involves creating a permanent opening in the floor of the mouth to allow continuous drainage of saliva. This procedure can be performed in conjunction with sialadenectomy or as a standalone treatment for small ranulas. For sublingual sialocoeles, the author typically performs mandibular-sublingual sialadenectomy with dissection as rostral as oral mucosa (rostral to the lingual nerve) combined with either lancing and drainage of the ranula or marsupialisation.

Investigators in a recent study evaluated the response rate and clinical course of 11 dogs with cervical sialocoele treated with radiation therapy (Poirier *et al*, 2018). Six dogs (54 per cent) achieved a complete response, whereas five dogs (45 per cent) achieved a partial response. Three dogs had

progression of their sialocoele two, three, and nine months after radiation therapy.

Pharyngeal mucocoele: pharyngeal mucocoeles require prompt surgical intervention due to the risk of airway obstruction. The surgical approach involves excision of the mandibular and sublingual salivary glands +/- aspiration of drainage of the sialocoele and excision of the mucocoele or marsupialisation of the mucocoele. Marsupialisation of the sialocoele alone without sialadenectomy has also been described (Benjamino *et al*, 2012).

Zygomatic mucocoele: zygomatic mucocoeles are treated by removing the zygomatic salivary gland. This involves a more complex surgical approach due to the gland's deep location near the eye. Sialadenectomy can be performed with or without temporary take down of a portion of the zygomatic arch (modified lateral orbitotomy) or via an intraoral approach (Viitanen *et al*, 2023; Dörner *et al*, 2021). In a recent cadaveric study, an approach ventral to the zygomatic arch allowed complete removal of the zygomatic gland in all dogs, with good surgical overview and reducing tissue trauma (Dörner *et al*, 2021). The intraoral approach involves making an incision in the oral mucosa and muscular tissue caudal to the upper last molar, and was recently shown to be faster than the lateral orbitotomy approach, but technically not any easier (Viitanen *et al*, 2023).

Parotid mucocoele: descriptions of parotid mucocoeles are sparse in the literature (Guthrie and Hardie, 2014). Surgical excision of the parotid salivary gland is technically challenging. One report described a young mixed breed dog that developed right-sided facial swelling after a dog fight (Guthrie and Hardie, 2014). Surgical excision of the right parotid salivary gland and duct was performed along with drainage of the mucocoele.

Prognosis

The prognosis for dogs with salivary mucocoele is generally good with appropriate surgical intervention. Most dogs recover well and the recurrence rate is low when the affected salivary gland and duct are completely removed. However, potential complications such as postoperative infection, seroma, and recurrence or intraoperative damage to surrounding neurovascular structures can occur, emphasising the importance of careful surgical technique and diligent postoperative care.

Conclusion

Salivary mucocoele is a relatively common condition in dogs and can have a number of presentations. Understanding the aetiology, clinical presentation, and diagnostic

approach is crucial for timely and accurate diagnosis. Surgical intervention remains the treatment of choice, with sialadenectomy being the most commonly performed procedure. Proper postoperative care and monitoring are essential for ensuring successful recovery and minimising complications. With appropriate management, the prognosis for dogs with salivary mucocoele is generally good.

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READER QUESTIONS AND ANSWERS

1. WHICH ONE OF THE MAJOR SALIVARY GLANDS AND/OR ITS ASSOCIATED DUCT IS THE MOST COMMON SOURCE OF SALIVA LEAKAGE RESULTING IN FORMATION OF A SIALOCOELE?

- A. Sublingual salivary gland
- B. Zygomatic salivary gland
- C. Parotid salivary gland
- D. Mandibular salivary gland

2. IN GENERAL, WHAT IS THE MAINSTAY OF TREATMENT OF SALIVARY MUCOCOELE IN DOGS?

- A. Drainage via fine-needle aspiration
- B. Marsupialisation
- C. Sialadenectomy
- D. Sclerotherapy

3. TUNNELLING UNDER (DEEP TO) WHICH MUSCLE IS RECOMMENDED TO INCREASE THE LENGTH OF MANDIBULAR AND SUBLINGUAL SALIVARY DUCT EXPOSURE?

- A. Masseter muscle
- B. Temporalis muscle
- C. Lingual muscle
- D. Digastric muscle

4. SUBLINGUAL SIALOCOELES OR RANULAS MOST LIKELY RESULT FROM LEAKAGE OF WHICH SALIVARY GLAND-DUCT COMPLEX?

- A. Caudal sublingual salivary gland-duct complex
- B. Rostral sublingual salivary gland-duct complex
- C. Caudal mandibular salivary gland-duct complex
- D. Rostral parotid salivary gland-duct complex

5. A SIALOCOELE RELATED WITH WHICH ONE OF THE MAJOR SALIVARY GLANDS CAN BE ASSOCIATED WITH A SWELLING IN THE REGION OF THE UPPER LAST MOLAR?

- A. Zygomatic salivary gland
- B. Sublingual salivary gland
- C. Parotid salivary gland
- D. Mandibular salivary gland

ANSWERS: 1A; 2C; 3D; 4B; 5A.