1

Disorders of the Salivary Gland

Catriona M. MacPhail

Salivary glands can be affected by inflammation, trauma, calculus formation, and neoplasia, resulting in abscessation, rupture of the duct or gland, and formation of a salivary mucocele, obstruction, or pain on palpation or opening of the mouth. The mode of therapy is generally dictated by the type of lesion present (abscess, mucocele, neoplasia).

Anatomy

There are four paired salivary glands in the dog and cat: parotid, mandibular, sublingual, and zygomatic glands. The cat also has paired molar glands, which lie in the lower lip at the angle of the mouth. In addition, there are numerous buccal glands present in the soft palate, lips, tongue, and cheeks. The salivary glands most commonly injured or involved in pathologic processes (calculi, neoplasia, trauma) are the mandibular and sublingual salivary glands.

The mandibular salivary gland is a mixed gland (serous and mucous secretion) located in the junction of the maxillary (internal maxillary) vein and lingual facial (external maxillary) vein as they form the jugular vein. It is adherent cranially to the darker monostomatic portion of the sublingual gland, and shares a common heavy fibrous capsule with that gland. The mandibular duct leaves the medial portion of the gland near the sublingual gland and runs craniomedially, medial to the caudal sublingual gland, between the masseter muscle and mandible laterally and the digastricus muscle medially, to empty in the sublingual papilla lateral to the cranial frenulum of the tongue.

The sublingual duct originates at the caudal portion of the gland and joins the mandibular duct. The secretions of the separate lobes of the monostomatic portion of the sublingual gland drain through four to six short excretory ducts into the sublingual duct. The polystomatic portion of the sublingual gland lies under the mucosa of the tongue and secretes directly into the oral cavity rather than through the main sublingual duct.

Diseases of the parotid and zygomatic salivary glands occur infrequently in the dog and cat. The parotid gland is triangular in shape and is located at the base of the horizontal ear canal. The parotid duct runs rostrally along the lateral surface of the masseter muscle and opens into the oral cavity at the level of the second to fourth premolars. The zygomatic gland is located deep and medial to the zygomatic arch, dorsolateral to the medial pterygoid muscle. The major zygomatic duct opens into the oral cavity opposite the last upper molar.

Pathophysiology

Disorders of the salivary glands are generally uncommon in the dog and cat. Salivary gland problems most often manifest as submandibular swelling, which can either be painful or nonpainful depending on the underlying cause. Differential diagnoses for submandibular swelling include inflammation, abscess formation, lymphadenopathy, neoplasia, or salivary mucocele. Submandibular abscessation is usually secondary to bite wounds or oropharyngeal foreign body penetration. These abscesses are rarely associated with the salivary glands. Fine-needle aspiration and cytology facilitate definitive diagnosis, although diagnostic imaging may also be indicated. Both the ultrasonographic and computed tomographic appearance of sialoceles have been

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described (Torad & Hassan 2013; Oetelaar *et al.* 2022). Removal of the affected glands is often the treatment of choice.

Specific disorders

Salivary mucocele (sialocele)

Salivary mucocele formation is the most common disease of the salivary gland in the dog and cat. The mucocele is formed from secretion of saliva from a defect in the gland or duct system. The most commonly affected glands are the mandibular and sublingual, with the sublingual gland being the most frequent source of saliva. The lining of the mucocele consists of inflammatory tissue surrounded by granulation tissue. There is no evidence of a secretory lining present in the mucocele and therefore it cannot be considered a true cyst.

There are three major types of salivary mucocele based on the location of the swelling: cervical mucocele, sublingual mucocele (ranula), and pharyngeal mucocele. Zygomatic and parotid mucoceles can also occur but are very uncommon. Nasopharyngeal sialoceles have been reported in brachycephalic breeds, thought to be a rare consequence of nonphysiologic mechanical stress on the minor salivary glands (De Lorenzi *et al.* 2018).

Cervical mucoceles are generally located on the lateral aspect of the head and neck from the level of the mandibular and sublingual salivary glands to the intermandibular space. The majority of patients present with mucoceles in the intermandibular region. Sublingual mucoceles, or ranulas, are formed from an accumulation of saliva along the base of the tongue. A less common location for salivary mucoceles is the pharynx. Pharyngeal mucoceles appear as a fluctuant, smooth, dome-shaped swelling in the lateral pharyngeal wall.

The etiology of salivary mucoceles is generally unknown, but causes such as trauma, inflammation, sialoliths, foreign bodies, and iatrogenic damage during surgery have been implicated (Figure 1.1). It is generally felt that mucoceles result from damage to the duct or gland tissue with leakage of saliva into the tissues. The monostomatic (cervical mucocele) and polystomatic (pharyngeal mucocele and ranula) portions of the sublingual salivary gland are felt to be the most commonly involved. Poodles and German shepherds are thought to be the most common breeds affected, but numerous breeds have been reported to have developed salivary mucoceles.

Cervical mucocele

The diagnosis of a cervical mucocele is based on history, physical examination, palpation, and aspiration of blood-tinged saliva. Differential diagnoses include cervical abscess, neoplasia, enlarged mandibular lymph nodes, and draining tract secondary to foreign body migration. However, the diagnosis of a mucocele is often made based on the gross appearance of the aspirated fluid. Cytology may be helpful if secondary infection is suspected. A mucus-specific stain, such as periodic acid–Schiff, will confirm that aspirated fluid is saliva, although this step is often unnecessary.

Figure 1.1 Intraoral view of an iatrogenic ranula in an 8-year-old Alaskan malamute following partial mandibulectomy.

The treatment of choice for cervical mucocele is removal of the mandibular and sublingual salivary glands and associated ducts on the affected side, followed by ventral drainage of the accumulated saliva. Both the mandibular and sublingual glands are removed due to the close anatomic association between the two glands. Often, patients with cervical mucoceles will present with a midline intermandibular cervical mass, making lateralization difficult. Determination of the glands involved (right vs. left side) can be accomplished by thorough historical evaluation (which may reveal the side initially involved), careful oral examination (presence of ranula or pharyngeal mucocele), palpation of the swelling, placement of the animal in dorsal recumbency, or sialography.

Sialography is only necessary in a small percentage (5%) of cases. The technique involves injecting radiopaque contrast material retrograde into the ductal openings in the frenulum. Reflux of contrast into the swelling

will determine the affected side. This procedure is time-consuming and can be technically difficult to perform.

If the affected side is unable to be determined or if the mucocele appears to be bilateral, bilateral resection of the mandibular and sublingual glands can be performed without any consequences to saliva production.

Removal of the mandibular and sublingual salivary glands is performed by first positioning the dog in lateral recumbency with the affected side facing up. The neck and jaw should be positioned slightly obliquely and towels or sandbags placed under the neck to elevate the surgical site for better visualization of the bifurcation of the jugular vein.

The incision is made from the ramus of the mandible cranially to the bifurcation of the jugular vein caudally; occlusion of the jugular vein prior to incision will facilitate visualization of landmarks. Dissection is carried into the capsule of the mandibular and sublingual salivary glands. An intracapsular dissection of the glands is performed and the ducts of the mandibular and sublingual salivary glands are followed craniomedially to the mandible. The ducts are followed as far cranially as possible and ligated or stripped out to complete the resection. Tunneling under the digastricus muscles may improve the completeness of the salivary duct excision (Marsh & Adin 2013). A small active drain can be placed in the cervical mucocele to allow drainage of the remaining saliva and accumulated fluid (Figure 1.2). The drain is typically removed 3–5 days postoperatively. If the salivary glandular tissue has an unusual appearance at the time of resection, it should be submitted for histopathologic evaluation. Closure of the incision includes apposition of muscle, subcutaneous tissues, and skin with simple interrupted or simple continuous sutures.

Alternatively, a ventral approach can be considered (Ritter *et al.* 2006). An incision is made from the level of the linguofacial vein to the rostral intermandibular space. The mandibular gland is located at the caudal aspect of this incision. An intracapsular dissection is performed as already described with dissection of the salivary chain rostrally to the level of the digastricus muscle. The digastricus muscle is then undermined from a cranial direction in order to follow the ducts as they course rostrally under the mylohyoideus muscle. This muscle is incised to gain access to residual sublingual salivary glandular tissue.

When comparing the lateral to the ventral approach, the ventral paramedian approach was associated with a lower risk of recurrence but higher rate of surgical wound complications (Cinti *et al.* 2021); long-term outcomes appear to be comparable between the two techniques (Swieton *et al.* 2022).

Complications associated with salivary gland resection are few, but may include inadvertent lymph node removal, operation on the incorrect side, incisional infection, submandibular seroma, and recurrence due to incomplete removal. Prognosis following surgery is generally good to excellent, with very low recurrence rates. This is in contrast to a 42% recurrence rate associated with surgical drainage alone (Bellenger & Simpson 1992). Radiation therapy has been shown to be effective in resolving cervical sialoceles refractory to surgical management (Poirier *et al.* 2018).

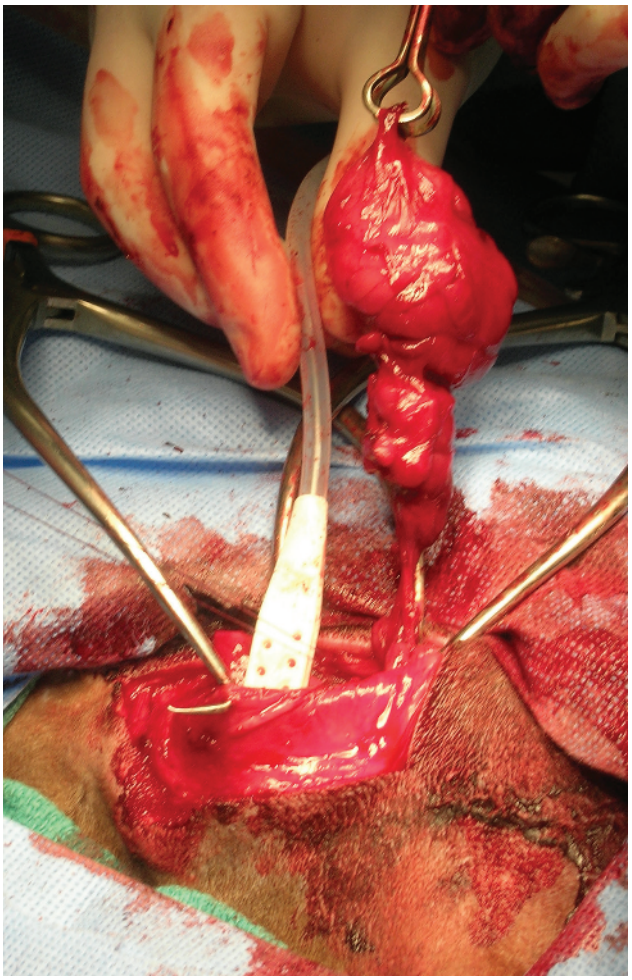

Figure 1.2 Intraoperative view of mandibular and sublingual salivary gland removal with active drain placement into the cervical mucocele.

Ranula

A ranula is a thin-walled linear swelling that results from ruptured sublingual or mandibular salivary ducts below the oral mucosa next to the tongue. It may also occur due to rupture of the polystomatic portion of the sublingual gland. Diagnosis is based on history, oral examination, palpation, and aspiration of the mass. Blood-tinged saliva on aspiration is diagnostic.

The treatment of choice is marsupialization of the ranula. Marsupialization is performed by incising into

the swelling and resecting an elliptical segment of the overlying sublingual mucosa. The cut edges of the remaining mucosa are sutured to adjacent tissues in a simple continuous pattern with rapidly absorbable suture, thereby creating a pouch that allows saliva to drain into the oral cavity.

If there is recurrence or the ranula is associated with a cervical mucocele, the mandibular and sublingual salivary glands on the affected side should be removed.

Pharyngeal mucocele

Patients with pharyngeal mucocele may present with signs related to upper airway obstruction, since the swelling eventually becomes large enough to occlude the laryngeal orifice (Figure 1.3). Affected patients may have a history of noisy respiration progressing to intermittent dyspnea, cyanosis, and syncope in severe cases.

A presumptive diagnosis can be made by careful oral examination. The pharyngeal mucocele appears as a fluctuant, smooth, dome-shaped swelling in the lateral pharyngeal wall. Aspiration of blood-tinged saliva is diagnostic, and is generally performed when the patient is under anesthesia to avoid unnecessary stress.

Pharyngeal mucoceles are treated by marsupialization. The swelling is incised and drained by partially excising the overlying pharyngeal mucosa and suturing the cut edges of the mucosa to the adjacent pharyngeal wall. An alternative technique is to dissect the mucocele free from the surrounding tissue and remove it en bloc. The pharyngeal wall is allowed to heal by granulation. Either procedure generally gives rewarding results. Recurrence is rare, but unilateral mandibular and sublingual salivary gland resection should be done if recurrence does occur or to avoid the potential for recurrence, due to the life-threatening clinical signs associated with this condition.

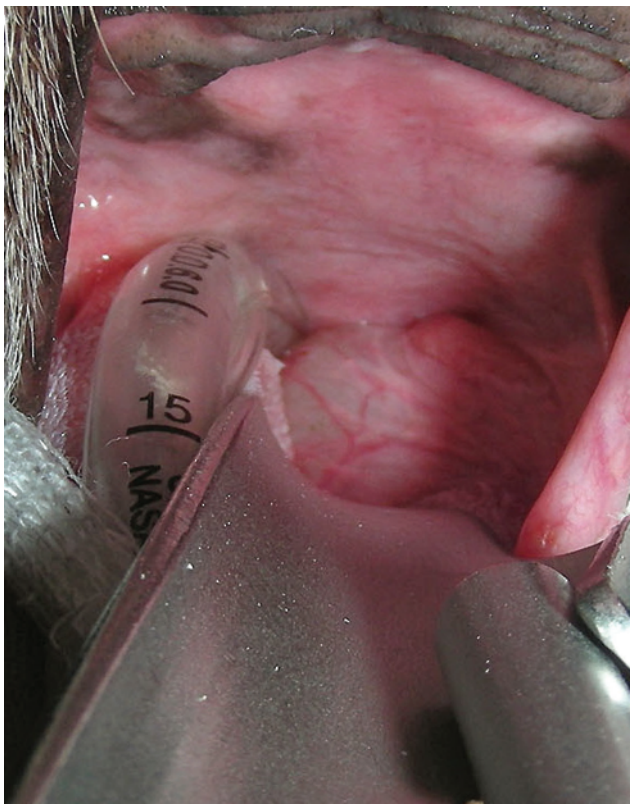

Figure 1.3 Intraoral view of a pharyngeal mucocele.

Zygomatic mucocele

Sialoceles associated with the zygomatic glands are rare. Dogs may present with a variety of clinical signs, the most common being ventral periorbital swelling. Other signs included exophthalmos, periocular pain, chemosis, and nictitating membrane protrusion. The typical location of the swelling is similar to that seen with maxillary carnassial tooth root abscesses. These conditions are differentiated by fine-needle aspiration. Advanced imaging (computed tomography [CT] or magnetic resonance imaging [MRI]) may also be beneficial in diagnosis, particularly in investigating other causes of exophthalmos. Treatment of choice is excision of the zygomatic gland, most often requiring resection of the zygomatic arch for best exposure and access. However, a ventral nonostectomy approach has been described in cadavers, allowing for complete zygomatic gland excision (Dörner *et al*. 2021). Intracanalicular injection of 10% N-acetylcysteine has also been reported with good success for resolution (Ortillés *et al*. 2020).

Parotid mucocele

Sialoceles associated with the parotid glands are also very uncommon. Dogs present with a fluctuant nonpainful swelling over the area of the parotid gland on the lateral side of the face. Advanced imaging (e.g., sialography, CT, MRI) is often required for diagnosis. Treatment is complete parotidectomy, which can be a difficult procedure due to the regional anatomy (e.g., facial nerve) and as the capsule is tightly adhered to the gland. Alternatively, the parotid duct can be ligated as close as possible to the gland to cause atrophy.

Neoplasia

Salivary gland neoplasia is a rare condition, but when it does occur it is usually adenocarcinoma of the mandibular or parotid salivary gland. Salivary gland adenocarcinoma is locally invasive and is typically associated with concurrent lymph node metastasis. Other reported salivary gland neoplasms include squamous cell carcinoma, basal cell adenocarcinoma, and mast cell tumor. Siamese cats appear to be overrepresented, although there is no

breed association in dogs. Recommended treatment is aggressive surgical resection, with or without adjunctive radiation therapy. The most recent reported median survival times for dogs and cats with salivary gland neoplasia are 550 and 516 days, respectively (Hammer *et al.* 2001).

Sialolithiasis

Salivary calculus formation is very uncommon in the dog and cat. When it does occur, salivary stones can obstruct salivary ducts, causing an acute painful swelling or rupture of the affected gland. Most stones are composed of calcium phosphate or calcium carbonate and have been reported to occur mostly in the parotid gland, although sialolithiasis associated with cervical and pharyngeal sialoceles has been reported (Han *et al.* 2016). Diagnosis is made using skull radiographs with or without sialography, although advanced imaging may also be beneficial. Surgical removal of the calculus is the treatment of choice. This is followed by cannulation and lavage of the affected salivary duct. If this is not possible due to fibrosis, inflammation, or a concurrent sialocele, surgical excision of the affected gland and duct will also be curative.

Sialoadenitis

Salivary gland inflammation (sialoadenitis) is uncommon, but has been reported in the zygomatic, mandibular, and parotid salivary glands of dogs. Causes are numerous, including blunt trauma, iatrogenic trauma, penetrating bite wounds, foreign body migration, tumor infiltration, and systemic viral infection. Severe inflammation can progress to abscess formation and require surgical intervention. Otherwise, treatment of the underlying cause may help resolve this condition.

Necrotizing Sialometaplasia

Necrotizing sialometaplasia is a benign, ischemic, and inflammatory disease of the mandibular glands, although a case involving the parotid gland has been reported (*Kim et al.* 2010). This condition is manifested by severe retropharyngeal pain, gagging, nausea, ptyalism, and dysphagia. Surgical excision of the mandibular glands tends not to resolve clinical signs, although transient administration of anticonvulsants has resulted in marked improvement (Brooks *et al.* 1995).

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