

Computed tomographic imaging and surgical treatment of an acquired dentigerous cyst in a Slovakian Chuvach – a case report

Jana Václavíková¹, Cedric Tutt², Tomáš Fichtel¹, Petr Raušer¹, Ladislav Stehlík¹,
Barbora Putnová³, Marilena Szazeidou Georgiou¹

¹University of Veterinary and Pharmaceutical Sciences Brno, Faculty of Veterinary Medicine,
Small Animal Clinic, Brno, Czech Republic

²Cape Animal Dentistry Service, Cape Town, South African Republic

³University of Veterinary and Pharmaceutical Sciences Brno, Faculty of Veterinary Medicine,
Department of Pathological Morphology and Parasitology, Brno, Czech Republic

Received June 8, 2020

Accepted September 14, 2020

Abstract

Dentigerous cysts occur infrequently in dogs and they should be a primary consideration in young dogs presented with oral swelling in the edentulous area. They are even less common in cats compared to dogs. Classification of lesions in animals is not very different from those described in humans. Dentigerous cysts are most frequently seen affecting the mandibular first premolar area with unerupted mandibular first premolar teeth. This report describes the clinical case of a four-year-old female Slovakian Chuvach that suffered from long-term difficulties associated with epistaxis and swelling of the facial area. Computed tomography revealed a cyst-like structure associated with an intra-nasal canine, prompting the suspected diagnosis of an odontogenic cyst. Histopathological examination of tissues obtained during the subsequent surgical procedure confirmed the diagnosis of a dentigerous cyst.

Odontogenic cyst, teeth intrusion, missing canine

In small animal clinical practice, it is very important to thoroughly examine the oral cavity since incomplete dentition (hypodontia) is a common finding. Teeth may be missing as a result of congenitally missing teeth, impaction, being unerupted or lost as a result of trauma (including intrusion) or extraction (Thatcher 2017). After the clinical oral cavity examination, an intraoral radiographic examination should be performed to confirm that teeth are missing (Babbitt et al. 2016). Unerupted teeth can be impacted (by a physical obstruction or tooth malformation) or retained (failure of eruption) (Domnick 2014).

Dentigerous cysts are the most common odontogenic cysts in small animal practice (Verstraete et al. 2011). These cysts are usually associated with crowns of permanent unerupted teeth (Menditti et al. 2018) and develop from the epithelial remains of the “Malassez” (Menditti et al. 2018), remnants of odontogenesis that become stimulated by retained teeth (D’Astous 2011). When cysts form, the crown of the unerupted tooth is enclosed in a follicular structure (Sapp et al. 2004). Dentigerous cysts are usually locally expansive, destroying a part of the alveolar jaw bone which results in bone loss around the roots of the adjacent teeth (Baxter 2004). This report describes the clinical case of a dog with intruded maxillary canine teeth where one of the intruded canines was associated with a dentigerous cyst.

Case presentation

Case history

A four-year-old intact female Slovakian Chuvach weighing 30 kg, was referred to the Small Animal Clinic of the University of Veterinary and Pharmaceutical Sciences Brno

Address for correspondence:

Jana Václavíková
University of Veterinary and Pharmaceutical Sciences Brno
Palackého tř. 1946/1, 612 42 Brno, Czech Republic

E-mail: mvdbr.burova@gmail.com
<http://actavet.vfu.cz/>

from a private practice because of a history of chronic nasal discharge and epistaxis of a two year's duration. The patient had responded to periodic antibiotics and non-steroidal anti-inflammatory drug therapy evidenced by a reduction of the nasal discharge and swelling which recurred after medication was terminated. The dog's appetite and eating habits were normal during the past two years and she had maintained her body weight. Clinical examination showed a bilateral nasal swelling about halfway between the medial canthus of the eyes and nostrils. The left nasal swelling was associated with a sinus tract that erupted through the skin and was painful on palpation. There was a serous nasal discharge from both nostrils.

The clinical status was otherwise without pathological findings. Airflow was detectable through both nostrils, but weaker on the right side. Complete blood count and biochemistry profile results were within the reference range. The patient was reluctant to be clinically examined, and it was decided to continue the examination under general anaesthesia.

Diagnosis

A 20G intravenous catheter was placed into the right cephalic vein and secured. The patient was administered $0.01 \text{ mg} \cdot \text{kg}^{-1}$ medetomidine (Domitor 1 mg/ml, Orion Pharma, Espoo, Finland) and $0.02 \text{ mg} \cdot \text{kg}^{-1}$ butorphanol (Butomidor 10 mg/ml, Richter Pharma, Wels, Newry, Austria) via an intravenous catheter as premedication; general anaesthesia was induced using $2 \text{ mg} \cdot \text{kg}^{-1}$ propofol (Norfol, Nordbrook Lab., Monaghan, Ireland). For the radiographic and computed tomography (CT) examinations, anaesthesia was maintained using incremental intravenous doses of propofol (Norfol, Nordbrook Lab., Monaghan, Ireland).

Clinical examination of the oral cavity was performed. Enamel hypoplasia of 201, 202, 203, 109, 309 was found; 104 and 204 were missing and there was a fluctuant soft tissue swelling extending dorsally from the mucogingival junction of 203 to 207 (Plate II, Fig. 1).

Ventrodorsal (Plate II, Fig. 2) and laterolateral (Plate III, Fig. 3) radiographs of the maxilla revealed that both canines were in the nasal passages. The right canine was more rostral and had displaced the rostral part of the nasal bone dorsally. The left canine was situated between premolars 205 and 208 and connected to a cyst-like structure. In the ventrodorsal view, the canine was situated between the premolars and the nasal vomer and the crown was associated with a round structure of soft-tissue opacity with an incomplete sclerotic margin. A CT examination was indicated based on the radiographic findings.

Survey CT examination of the head was performed on a 16 -multislice CT unit (LightSpeed, GE Healthcare, Milwaukee, WI, USA). Images were obtained in the helical mode with a slice thickness of 1.25 mm, 100 kV, automatic mA, rotation time of 1 s, pitch of 1.375, display field of view of 194 mm and a high-frequency reconstruction algorithm. Both maxillary canine teeth were dislocated from their normal position. The right maxillary canine (104) was intruded caudally into the right nasal cavity. A nodular lesion of water density (3 to 20 HU) was found in the rostral left maxilla extended from 203 to 208. The rostral left maxilla was malformed by the nodular lesion and the left canine tooth was intruded caudally into the left nasal cavity. No other remarkable findings were present (Plate III, Fig 4, Plate IV, Fig 5).

Surgical procedure

Based on the CT images, it was evident that the right canine was unattached within the nasal passage, and it was easily retrieved using a pair of curved Kocher forceps. The left canine was situated within a cyst and could not be retrieved via the nostril using forceps. Following the CT examination, the patient was taken to the dental operatory room and connected to the inhalation anaesthesia equipment and maintained on 1.5% isoflurane (Isofluran, Baxter SA, Lessines, Belgium) and air + oxygen at 1.5 l/min. The oral cavity was prepared for surgery and local anaesthesia using a left maxillary block, achieved by

administering 1 ml of lidocaine (Lidocaine Egis 20 mg/ml, Egis Pharmaceuticals PLC, Budapest, Hungary). The patient was given 2 ml of carprofen (Rimadyl 50 mg/ml, Pfizer, Louvain-la-Neuve, Belgium) $2 \text{ mg} \cdot \text{kg}^{-1}$ subcutaneously and 1.5 ml amoxicillin-clavulanate (Synulox, 17.5 mg/ml, Haupt Pharma Latina s.r.l., Borgo San Michele, Italy) intramuscularly.

The following surgical approaches were used to access the tooth and cystic structure via the palate and maxillary bone: A parallel incision was made about 5 mm from the premolar teeth. The palatal mucosa and periosteum were reflected from the hard palate. The major palatine artery was isolated and ligated rostrally. Nonabsorbable monofilament nylon (Ethilon 3–0, Ethicon, New Jersey, USA) stay sutures were placed in the margin of the flap to retract it and keep it away from the surgical site. A high-speed bur was used to create a window through the palatine process into the nasal passage. The cyst was visible through this window. A second window was made through the fluctuant structure which had perforated the maxilla dorsal to the premolars to visualise the tooth. The tooth was dislodged via the palatal window and delivered using curved Kocher forceps via the lateral window. The cyst structure was removed using the high-speed bur and Volkmann curette. Haemorrhage was controlled using direct pressure and topical application (syringe dripping) of 1 ml adrenaline (Adrenalin léčiva 1 mg/ml, Zentiva k.s., Prague, Czech Republic). The surgical site was flushed using sterile Ringer's solution (Baxter, Melsungen, Germany). The palatal mucosa was returned to its original site and sutured using absorbable monofilament material poliglecaprone-25 (Monocryl 5–0, Ethicon, New Jersey, USA) using the simple interrupted pattern. The lateral access was closed by suturing the alveolar mucosa and periosteum back to the normal position using the same suture material and pattern (Plate IV, Fig. 6). An Elizabethan collar was given to the patient after surgery and she was recovering at the ICU for post-operative monitoring and therapy. Post-operative medication included infusion therapy of 80 ml/h Plasmalyte (Baxter, Lessimes, Belgium) and 7.5 ml famotidin (Quamatel, 1 mg/kg, Geden Richter PLC, Budapest, Hungary) intravenously. Post-operative analgesia was performed with fentanyl (Fentanyl Torrex 50 cmg/ml, Chiesi CZ s.r.o., Prague, Czech Republic) $0.003 \text{ mg} \cdot \text{kg}^{-1} \cdot \text{h}^{-1}$ intravenously.

The dog was discharged from the hospital the following day. The patient's medication consisted of 3 mg/kg carprofen (Canidryl, Chanelle Pharmaceuticals, Loughrea, Ireland) *per os* (PO) once a day for 3 days, 16.7 mg/kg amoxicillin-clavulanate (Synulox, Zoetis UK Limited, London, UK) PO twice a day for 7 days, and 1 mg/kg famotidine (Famosan, Pro. Med. Cs, Prague, Czech Republic) PO once a day for 3 days. The dog owner was instructed to administer a soft feed for one week and to return after 1 week for a follow-up. The client was also given instructions on how to maintain the collar clean and postoperative instructions.

Part of the cyst wall was sent for histopathological evaluation (Plate IV, Fig. 7). The histopathological examination together with the radiological findings confirmed the diagnosis of a dentigerous cyst. The patient's owner was requested to return for treatment of the teeth affected by enamel defects but unfortunately failed to show up for follow-up.

Discussion

Odontogenic cysts are pathological structures with epithelium-lined cavities. These structures are derived from the epithelium related to tooth development (Sapp et al. 2004). The preferred method of distinguishing between different odontogenic cysts is histopathology. In human medicine, the histological classification divides odontogenic cysts into two major groups (Soluk-Tekkeşin and Wright 2017): developmental origin and inflammatory origin, according to the World Health Organization (WHO). The WHO details the categorization of the developmental origin group which includes a dentigerous

cyst, odontogenic keratocyst, gingival cyst, lateral periodontal and botryoid odontogenic cyst, glandular odontogenic cyst, calcifying odontogenic cyst and orthokeratinized odontogenic cyst. The inflammatory origin group includes a radicular cyst, residual cyst, and collateral inflammatory cyst (Soluk-Tekkeşin and Wright 2017). Histological classification of cysts of the jaws is not yet fully established in veterinary medicine and the WHO recognises only two types in small animals: dentigerous cysts and radicular cysts (Head 2003). In small animal veterinary medicine, the most common odontogenic cysts are dentigerous cysts which are of similar characterization to humans (Beckman 2003, D'Astous 2011). A dentigerous cyst (DC) surrounds the crown of the un-erupted tooth (Menditti et al. 2018) and is associated with the tooth at the cemento-enamel junction. Problems with teeth eruption can be due to physical inhibition, for example impacted teeth, or due to weak eruptive power, for example embedded teeth (Hoffman 2008). Pathological processes include accumulation of fluid, air or semi-solid material in the layer of the reduced enamel epithelium (Menditti et al. 2018).

In our clinical experience, odontogenic cysts are seen more frequently than has been reported in the literature. A higher prevalence rate has been observed in brachycephalic breeds (D'Astous 2011), and the patients' age ranges from 2 to 10 years (Verstraete and Lomner 2012). Patients with odontogenic cysts are usually asymptomatic until the cyst becomes infected or leads to the presentation of a pathological jaw fracture due to the cyst's tendency to expand and initiate an osteolytic process in the jaw (Thatcher 2017) which is why the diagnosis is often made in older animals. Unilateral presence is more commonly described, however, bilateral cysts have also been reported (D'Astous 2011). In this case, the patient had long term problems with facial swelling and upon the initial clinical examination, a fluctuant swelling in the premolar area was palpated. An important indicator and a common sign is a missing tooth or teeth (hypodontia), as seen also in this case. According to the published studies, the most common site for a dentigerous cyst formation is the first mandibular premolar tooth (Verstraete et al. 2011).

Radiography was used as the primary diagnostic imaging modality. Computed tomography was performed not only to confirm the diagnosis but to clearly define the margins and provide a better, more detailed view of the lesions' extent so that the best treatment option could be chosen. It is recommended to continue using this diagnostic modality in clinical cases in veterinary medicine to gain a better understanding of this condition. Computed tomography served an important role in the decision making regarding the planning of the surgical procedure. In human medicine, CT is the preferred diagnostic method, providing more information than standard radiography. Computed tomography images provide the possibility to evaluate the position of tooth roots in relation to the intruded tooth, cortical bone or maxillary recess and to delineate the cyst margins (Okita et al. 1991; Soukup et al. 2009).

The first step in the treatment process is the creation of the mucoperiosteal flap which will cover the bony defect created as part of the surgical access. The next step is the removal of the intruded tooth and extirpation of the cystic structure including curettage (Sapp et al. 2004; Doran et al. 2008). Curettage of alveolar bone is recommended for facilitating the healing process and preventing a relapse of the cystic lesion (Thatcher 2017). In most cases, curettage is a sufficient method for debridement of the cyst lining but sometimes total extirpation of the cyst wall is extremely difficult. In such case, the cyst cells can be damaged by high-speed bur (Watanabe et al. 2004). If a dentigerous cyst is expansive, enucleation of the pathological structure can cause neurovascular damaging of surrounding tissues or jaw fracture, especially in cysts affecting mandibular teeth (Soukup et al. 2009). In the case of gigantic cysts where the risk of a pathological jaw fracture is high, marsupialization of the odontogenic cyst using the decompression method is performed before surgery (Soukup et al. 2009; D'Astous 2011). This case

report describes the treatment process using a high-speed bur as the method of choice for complete enucleation of the cyst wall. The prognosis after a well performed surgery is very good. It is recommended to obtain radiographs approximately three months after the surgery to assess the bone healing.

Conclusion

Dentigerous cysts are associated with tooth retention and diagnostic method of remains acquisition of an intraoral radiograph. The CT imaging provides additional information to aid with a more accurate diagnosis of associated pathology and treatment planning. Detection of the cyst in a young patient or soon after the odontogenic cyst formation requires a less invasive surgical procedure than when the diagnosis is made later. The patient reported in this case study was successfully treated without a relapse of the symptoms of facial swelling and nasal discharge.

Acknowledgements

This study was supported by institutional research funding (TA 29) by the University of Veterinary and Pharmaceutical Sciences Brno.

References

- Babbit SG, Volker MK, Luskin IR 2016: Incidence of radiographic cystic lesions associated with unerupted teeth in dogs. *J Vet Dent* **33**: 226-233
- Baxter CJK 2004: Bilateral mandibular dentigerous cysts in a dog. *J Small Anim Pract* **45**: 210-212
- Beckman BW 2003: Radicular cyst of the premaxilla in a dog. *J Vet Dent* **20**: 213-217
- D'Astous J 2011: An overview of dentigerous cysts in dogs and cats. *Can Vet J* **52**: 905-907
- Domnick E 2014: Diagnostic Imaging in Veterinary Dental Practice, *JAVMA* **245**: 281-283
- Doran I, Pearson G, Barr F, Hotson-Moore A 2008: Extensive bilateral odontogenic cysts in the mandible of a dog. *Vet Pathol* **45**: 58-60
- Head KW 2003: Histological classification of tumors of the alimentary system of domestic animals. Armed Forces Institute of Pathology in cooperation with the American Registry of Pathology and the World Health Organization Collaborating Center for Worldwide Reference on Comparative Oncology. Vol 10
- Hoffman S 2008: Abnormal tooth eruption in a cat. *J Vet Dent* **25**: 118-122
- Menditti D, Laino L, Di Domenico M, Troiano G, Guglielmotti M, Sava S, Mezzogiorno A, Baldi A 2018: Cysts and pseudocysts of the oral cavity: revision of the literature and a new proposed classification. *In Vivo* **32**: 999-1007
- Okita W, Ichimura K, Iinuma T 1991: Dentigerous cyst of the maxilla and its image diagnosis. *Rhinology* **29**: 307-314
- Sapp J, Eversole LR, Wysocki GP 2004: Cysts of the oral region. In: Sapp J, Eversole LR, Wysocki GP (Eds): *Contemporary Oral and Maxillofacial Pathology*. 2nd edn. Mosby, St. Louis, Missouri, USA, 464 p.
- Suluk-Tekkeşin M, Wright JM 2017: The World Health Organization classification of odontogenic lesions: a summary of the changes of the 2017 (4th) edition. *Türk Patoloji Derg* **34**: 1-18
- Soukup JW, Lawrence JA, Pinkerton ME, Schwartz T 2009: Computed tomography-assisted management of a mandibular dentigerous cyst in a dog with a nasal carcinoma. *JAVMA* **235**: 710-714
- Thatcher G 2017: Oral surgery: Treatment of a dentigerous cyst in a dog. *Can Vet J* **58**: 195-199
- Verstraete FJM, Lommer MJ 2012: Clinical behavior and management of odontogenic cysts. In: Verstraete FJM, Lommer MJ (Eds): *Oral and Maxillofacial Surgery in Dogs and Cats*. 1st edn. Saunders, Elsevier, Philadelphia, USA, 608 p.
- Verstraete FJM, Zin BP, Kass PH, Cox DP, Jordan RC 2011: Clinical sign and histological findings in dogs with odontogenic cysts: 41 cases (1995-2010). *J Am Vet Med Assoc* **239**: 1470-1476
- Watanabe K, Kadosawa T, Ishiguro T, Takagi S, Ochiai K, Kimura T, Okumura M, Fujinaga T 2004: Odontogenic cysts in three dogs: one odontogenic keratocyst and two dentigerous cysts. *J Vet Med Sci* **66**: 1167-1170



Fig. 1. Oral photograph showing the fluctuant soft tissue swelling, mucongingival junction of the third left maxillary incisor (203) to the third left maxillary premolar (207); left maxillary canine (204) is missing



Fig. 2. The ventrodorsal radiograph shows the right maxillary canine (104) was displaced into the rostral part of the nasal cavity. The left maxillary canine (204) was situated between the first maxillary premolar (205) and the fourth maxillary (208) in the left nasal passage and associated with a cyst-like structure (arrows)

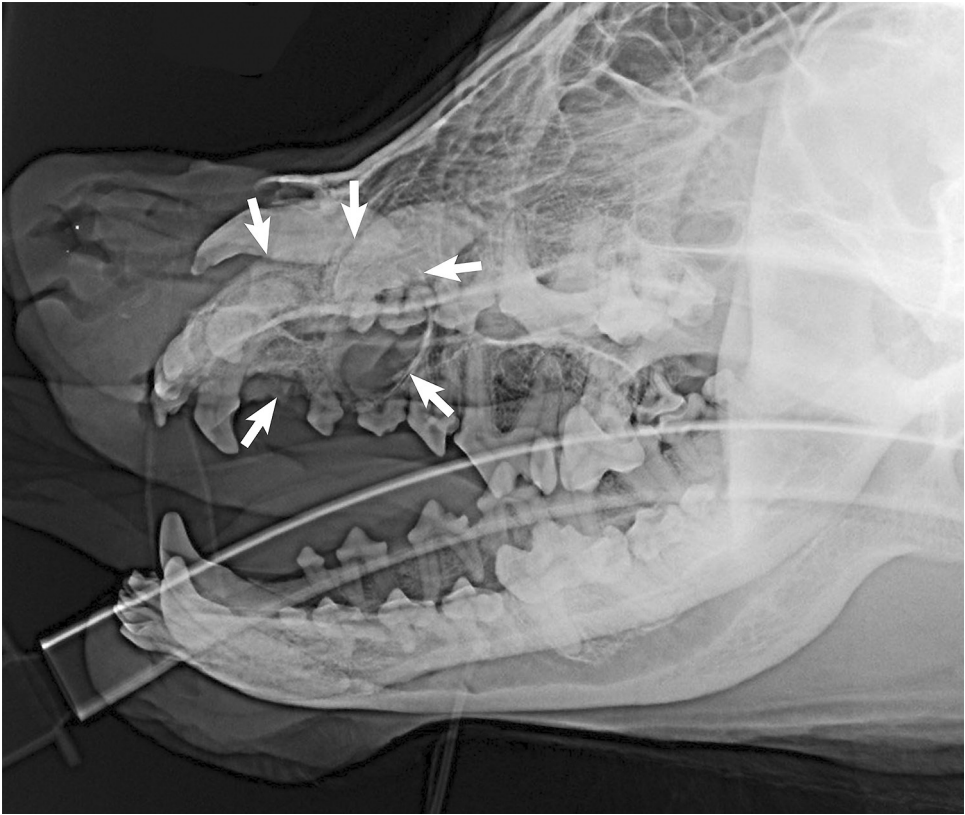


Fig. 3. The laterolateral radiograph shows a radiolucent lesion, a cyst-like structure (arrows), associated with the crown of the left canine (204)

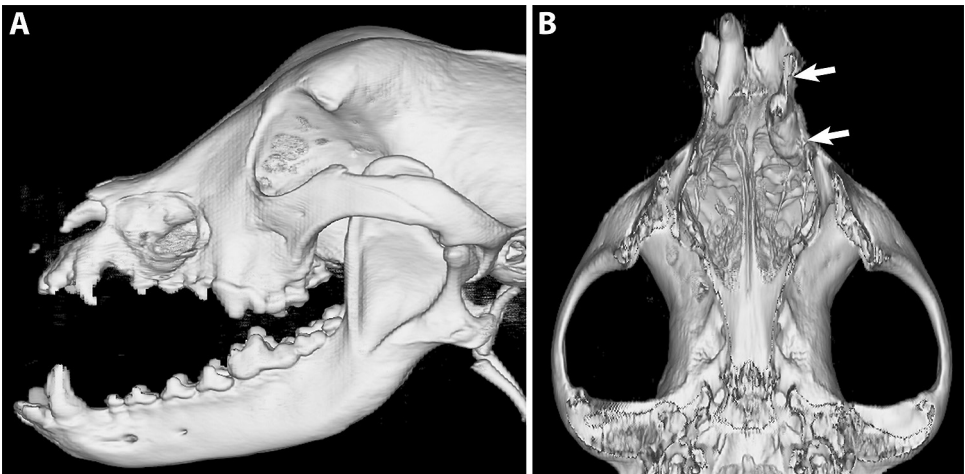


Fig. 4. Volume-rendered CT images demonstrating the osteolytic lesion (arrows) on the left maxilla seen from a lateral (A) and a ventral (B) view. Dislocation of the canine teeth into the nasal cavity and a mild dislocation of the nasal septum towards the right are best visible from the ventral view (B).

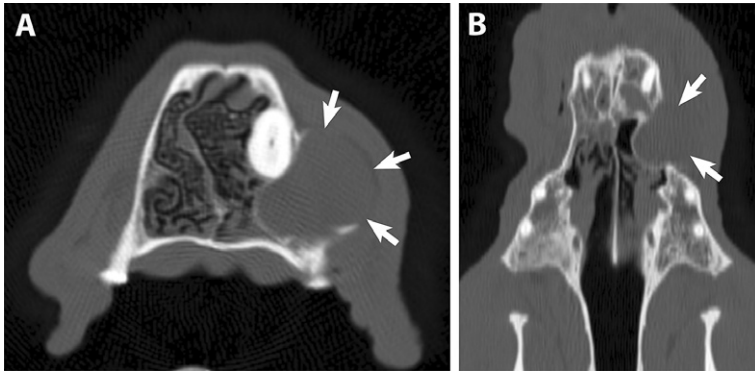


Fig. 5. Transversal (A) and dorsal (B) plane CT images of the maxilla in a bone window (WW 3000, WL 500). The cystic lesion (arrows) is not well visualized due to the scanner setting and reconstruction algorithm used. The deformity and osteolysis of the left maxilla can be seen from both planes. Intrusion of the canine tooth into the left nasal cavity and the deformity of the nasal septum are visible on the transversal plane image.



Fig. 6. Intraoperative photograph showing sutures closing the palatal access and lateral access sites using simple interrupted sutures by using absorbable monofilament suture material

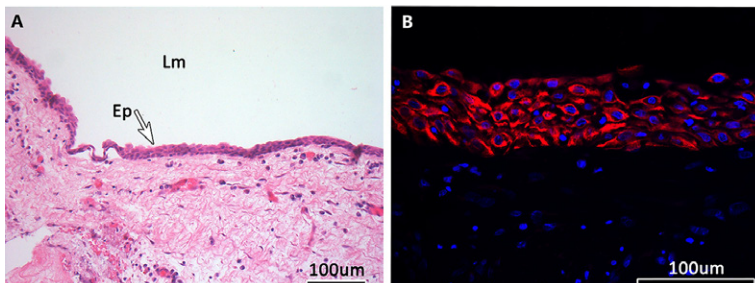


Fig. 7. A) The lumen (Lm) of the cyst is filled with non-cellular fluid. The epithelium (Ep) is usually stratified, but can consist of a single layer of cuboidal to columnar epithelium. The surrounding connective tissue is often mildly infiltrated with lymphoplasmatic infiltrate. B) The inner epithelial layer is positive for most keratin markers (Anti-pan Cytokeratin Antibody [AE1/AE3] (ab27988), counterstained with DAPI Fluoroshield Mounting Medium With DAPI (ab104139))