Dentigerous cyst in a South African fur seal (*Arctocephalus pusillus pusillus*)

José Carlos Almansa Ruiz,[1*] Carol Knox,[2] Sonja Boy,[3,4] Gerhard Steenkamp [1,5]

[1]Companion Animal Clinical Studies, Faculty of Veterinary Sciences, University of Pretoria, Pretoria, South Africa

[2]South African Association for Marine Biological Research, uShaka Marine World, Durban,

South Africa

[3]Pathology Department, Sefako Makgatho Health Sciences University, Pretoria, South Africa

[4]Lancet Laboratories Pretoria Main Office (Pencardia), Arcadia, Pretoria, South Africa

[5]Centre for Wildlife Veterinary Studies, Faculty of Veterinary Science, University of Pretoria, Pretoria, South Africa

*Correspondence to Dr José Carlos Almansa Ruiz; Email: jcalmansa.vet@gmail.com

Abstract

The dental pathology of pinnipeds has been well studied with periodontal disease the most common dental pathology accounting for 19.4–91.8 per cent of all dental pathologies. An eight-month-old stranded South African fur seal (*Arctocephalus pusillus pusillus*) was rescued from the south coast of South Africa; during his rehabilitation process his handlers noticed the absence of his left maxillary canine tooth (204). Eleven years later, during a health examination, the veterinarian upon closed examination could visualise approximately 5 mm of a tooth crown in the area where tooth 204 should have been. A presumed diagnosis of a dentigerous cyst was made based on the radiological findings. Surgery was performed to surgically extract 204 and enucleate the cyst lining. The histological analysis of the enucleated cyst lining confirmed the first reported case of a dentigerous cyst in a marine mammal.

Background

Pinnipeds are aquatic members of the mammalian order Carnivora and comprise three different families: Odobenidae (walruses), Phocidae (true or earless seals) and Otariidae (fur seals and sea lions).[1] They feed generally on fish, squid and crabs. Their dentition is quite simplistic in comparison to other carnivores, due to their lack of refined occlusion, reduced food mastication and processing.[2] Because of this, their maxillary and mandibular premolar and molar teeth are grouped together as postcanine teeth.[2] The dental pathology of pinnipeds has been well studied with periodontal disease the most common dental pathology accounting for 19.4–91.8 per cent of all dental pathologies.[1-7] Congenital and developmental dental pathology is generally infrequent in marine mammals[1-8]; with a reported agenesis incidence of 0.93 per cent, affecting mostly the posterior most maxillary postcanine teeth.[1]

Odontogenic cysts occur in the dentulous areas of the maxilla and mandible, with a lining of odontogenic epithelium, which includes residual dental lamina (rests of Serres), reduced enamel epithelium and remnants of the epithelial root sheath (rests of Malassez).[9]

Dentigerous cysts are odontogenic cysts arising from fluid accumulation between the dental follicle and developing tooth. These cysts are infrequently encountered in veterinary medicine and they have only been reported in dogs, cats and horses.[9] The diagnosis and removal is important to prevent the development of complications; they enlarge slowly, having the tendency to displace but also resorb teeth, and expand/distort rather than destroy cortical bone plates. [9] By definition, a dentigerous cyst is an odontogenic cyst that forms around the crown of an unerupted tooth. [9] The mandibular first premolar of brachycephalic dog breeds is the most common tooth associated with dentigerous cysts.[10] The diagnosis of these lesions is mainly based on the histopathological analysis of the cyst lining, but it is important to notice that the majority of epithelial linings lack dental features. Hence, the importance of an active collaboration between the pathologist and the clinician to integrate the histopathological, radiological and clinical features of the lesion. [9]

Stranded pinnipeds are treated worldwide in wildlife rehabilitation centres for many causes, with a growing incidence of fishing gear-related injuries.[11] Juvenile animals with lower feeding experience and an increased curiosity are at bigger risk.[11] The presence of maxillofacial trauma at a young age can result in abnormal tooth development and/or eruption; as a consequence a dentigerous cyst can form around the impacted tooth. [9] With increasing numbers of stranded pinnipeds in the coasts around the world, awareness for dental disease in pinnipeds is growing in importance.

This is the first case report describing the diagnosis and treatment of a histologically confirmed dentigerous cyst in a pinniped, a South African fur seal (*Arctocephalus pusillus pusillus*).

Case presentation

A South African fur seal bull (*A pusillus pusillus*) arrived at Bayworld (Port Elizabeth, South Africa) in 2001 as a stranded pup; his age was estimated to be around eight months old. He was transferred to uShaka Marine World (Durban, South Africa) in 2005. Since his arrival handlers and veterinarians believed that he had lost his left maxillary canine tooth (204), as it was absent since his arrival. During a health examination in 2013, the veterinarian, on close examination, could visualise approximately 5 mm of a tooth crown in the area where tooth 204 should have been (figure 1). An extraoral oblique skull radiograph confirmed the presence of a well-formed tooth crown with poorly developed root associated with a cystic lesion surrounding the impacted tooth 204 (figure 2) with what seemed like early closure of the apical floor by a dental hard tissue bridge (figure 2). Root formation, seen only as a short dental hard tissue wall, was identifiable apically to the coronal pulp floor. The lamina dura and periodontal ligament space was not identifiable. The clinical diagnosis of a dentigerous cyst was made.

Figure 1. Conscious oral examination performed as part of a health evaluation in 2013. A 5 mm defect was noticed in the area where 204 was presumed absent.

Figure 2. The extraoral oblique radiograph demonstrates the well-formed crown of an impacted 204 but with almost no root development. Although no root formation is present, the coronal apical floor is closed off by a cementum-like bridge (asterisk).

Two years later the seal was anaesthetised for a routine clinical examination. A detailed oral examination and dental charting was performed. Different skull radiographic views were made to evaluate the progression of the previously presumed dentigerous cyst and to evaluate other teeth of concern. Grade 3 calculus was present on the whole dentition; both the left and the right maxillary third incisor teeth (103, 203) were non-vital as determined by the width of the pulp chamber in comparison to the other incisor teeth present in the mouth; the right and left maxillary first incisor teeth (101, 201) and the right maxillary and right mandibular canine teeth (104, 404) were deemed absent. Grade 3 periodontal disease affecting many of the maxillary and mandibular teeth was present. A large, well-defined area of bone loss was identified on the radiographs extending from the partially erupted left maxillary canine tooth (204) to the four postcanine tooth (208) (figure 1). Tooth 204 was partially erupted.

Surgical removal of tooth 204 was performed and the thick connective tissue cyst wall easily enucleated from the bone, associated with purulent material draining due to secondary bacterial infection of the cyst. The infected soft tissue wall of the cyst and abnormal tooth were submitted for histopathological evaluation.

One week later, a conscious oral examination confirmed no infection, but two weeks after surgery wound dehiscence affecting 25 per cent of its length on the distal aspect was discovered during another conscious examination. The decision was made to allow wound healing by second intention and complete healing was recorded two months later. Follow-up radiological examination 24 months after the surgical procedure revealed no further pathology (figure 3).

Figure 3. Two months of follow-up conscious oral examination of the South African fur seal (*Arctocephalus pusillus pusillus*) showing complete healing of the cyst enucleation site.

Microscopic examination confirmed the presence of a connective tissue wall lined by stratified squamous epithelium with subacute inflammation, dilated vascular spaces, neurovascular structures as well as mixed minor salivary gland lobules in the subepithelial connective tissue (figure 4). Some of the fragments were lined by normal respiratory epithelium confirmed to be from the nasal mucosa, which was also opened during surgical exploration and removal of the impacted tooth. The non-specific nature of the epithelium was ascribed to the inflammatory response, known to result in non-specific squamous epithelial changes in odontogenic cysts.

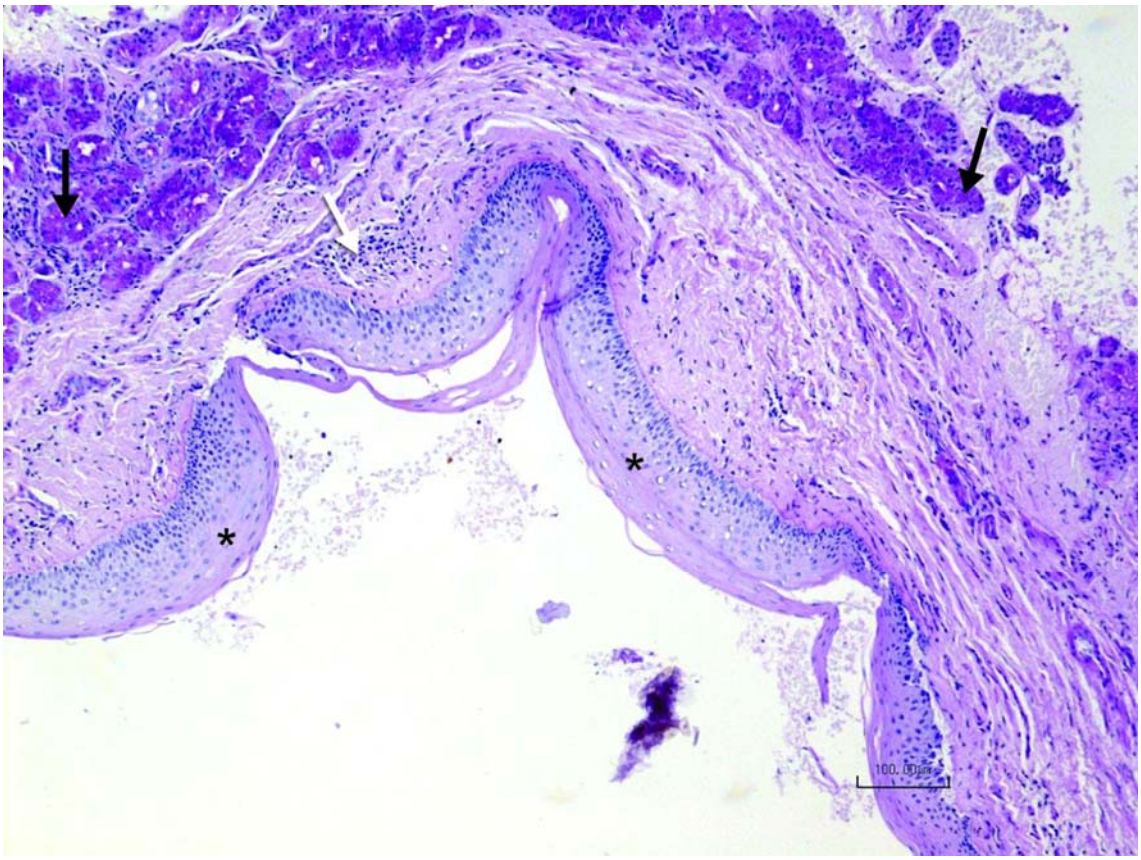

Figure 4. Photomicrograph demonstrating the cyst wall lined by stratified squamous epithelium (*) deep to the seromucinous glands of the respiratory mucosa (black arrows). Focal mild chronic inflammation is visible below the lining epithelium (white arrow). The scale bar represents 100 µm.

Investigations

Skull radiographic views were made to evaluate the progression of the previously presumed dentigerous cyst and to evaluate other teeth of concern. Grade 3 calculus was present over the whole dentition; both the left and right maxillary third incisor teeth (103,203) were non-vital as determined by the width of the pulp chamber in comparison to the other incisor teeth present in the mouth; the right and left maxillary first incisor teeth (101,201), the right maxillary and right mandibular canine teeth (104,404) were deemed absent. Grade 3 periodontal disease affecting many of the maxillary and mandibular postcanine teeth was present. A large, well-defined area of bone loss was identified on the radiographs extending from the partially erupted left maxillary canine tooth (204) to the fourth premolar tooth (208) (figure 2). Tooth 204, was partially erupted.

The soft tissue wall of the cyst was submitted for histopathological evaluation. Microscopic examination confirmed the presence of a connective tissue wall lined by stratified squamous epithelium with subacute inflammation, dilated vascular spaces, neurovascular structures as well as mixed minor salivary gland lobules in the subepithelial connective tissue (figure 4). Some of the fragments were lined by normal respiratory epithelium confirmed to be from the nasal mucosa, which was also opened during surgical exploration and removal of the impacted tooth. The non-specific nature of the epithelium was ascribed to the inflammatory response, known to result in non-specific squamous epithelial changes in odontogenic cysts.

Differential diagnosis

The clinical and radiological signs of the left maxillary canine tooth (204) suggested the diagnosis of a dentigerous cyst. Surgical extraction of the 204 and enucleation of the cyst was planned.

Treatment

Surgical removal of tooth 204 was performed and the thick connective tissue cyst wall easily enucleated from the bone, associated with purulent material draining due to secondary bacterial infection of the cyst.

Outcome and follow-up

One week later, a conscious oral examination confirmed no infection but two weeks post-surgery wound dehiscence affecting 25 per cent of its length on the distal aspect was discovered during another conscious examination. The decision was made to allow wound healing by second intention oppose to another surgical intervention and complete healing was recorded two months later (figure 3). Follow-up radiological examination 24 months after the surgical procedure revealed no further pathology (figure 5).

Figure 5. Follow-up extraoral oblique radiograph taken 24 months after impacted tooth extraction and dentigerous cyst enucleation. Please notice the retained tooth root of the left maxillary first incisor tooth (201).

Discussion

The clinical presentation as a partially erupted tooth associated with a large bone cyst in this case is not typical. Dentigerous cysts are usually associated with a fully impacted tooth in the gnathic bone and eruption cysts are the soft tissue variants which follow when the tooth has erupted through the alveolar bone and into the gingival soft tissue yet still covered by a fluid-filled and epithelial-lined cavity within the soft tissue.[12] We hypothesise that the slow

enlargement of the dentigerous cyst associated with an abnormally developed canine tooth eventually resulted in cortical bone perforation opening the tooth to the gingival soft tissue. It is possible that the roof of the cyst was lost due to trauma with secondary bacterial infection exposing the abnormal tooth to present as partially erupted. This would explain why there was never any part of the crown visible for several years after which the tip of the abnormal tooth became exposed. Radiographically dentigerous cysts typically appear as well-defined radiolucent lesions.[13, 14] When infection is present, like in this case, the peripheral margins of the bone cyst become ill defined and ragged, almost moth eaten as seen in cases of osteomyelitis,[13] this is in contrast with the present case where well-defined margins can be seen radiographically (figure 2). The involved teeth are frequently found to be abnormally positioned and very often malformed.[15] Irrespective of the form or inclination of the tooth involved, dentigerous cysts are usually attached at the cementoenamel junction, although this relationship is not always radiographically visible when they become larger.[13, 14]

Learning points

- There are many important reasons why impacted or retained teeth should be examined. Some of the complications associated with impacted or retained teeth have already been described in the veterinary literature,[10, 16, 17] with several more described in the human literature.[18-22]
- To remove the impacted or retained tooth or the decision to monitor the tooth depends on the clinician. Clinicians who prefer to remove impacted teeth when it is discovered base their decision on the possibility of pathology that may develop in association with the impacted tooth to justify surgical removal of all impacted or embedded teeth. Others prefer only careful radiographic monitoring as an alternative to surgical removal.[10] The conservative option is however difficult in veterinary dentistry because of the lack of compliance from pet owners and the need of general anaesthesia to obtain diagnostic intraoral radiographs.[10]
- The absence of teeth in the oral cavity of wild animals should be confirmed with radiographic studies, and if impacted teeth are present, these should be extracted to prevent the development of a dentigerous cyst and its associated complications.

Contributors
JCAR and GS drafted the manuscript. SB was involved in histopathology. CK did the follow-up radiographs and oral examination of the patient. GS, SB and CK critically reviewed the manuscript.
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