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ODONTOGENIC TUMORS

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Occurrence

Odontogenic tumors are generally considered to be rare in all species. However, precise epidemiological data are not available for the dog and cat. One of the main reasons for this is the continuing confusion regarding the true nature of some of these lesions. In many surveys the so-called epulides, which are localized swellings on the gingival margin and which constitute a variety of pathological entities, are either grouped together or excluded. Recent findings indicate that many epulides are odontogenic tumors, while focal fibrous hyperplasia is also very common. Another reason is the fact that many clinicians do not routinely submit epulides for histopathological examination, thereby introducing bias in the studies based on archival material. An accurate assessment of the nature of the condition is a prerequisite for therapeutic decision-making. It is therefore important to understand the biology of odontogenic tumors.

Classifications

Odontogenic tumors have traditionally been classified on the basis of the presence or absence of the phenomenon of induction. To understand the classification based on induction, it is important to consider the reciprocal interactions of epithelial and mesenchymal tissues during odontogenesis. The epithelial dental lamina invaginates to form the dental or enamel organ. The inner dental organ epithelium consists of the pre-ameloblasts. The mesenchymal odontoblast precursors migrate to the basement membrane and eventually make contact with the pre-ameloblasts. The pre-ameloblasts then induce the odontoblasts to form the dentin. In turn, the odontoblasts influence the ameloblasts and these cells start secreting the enamel matrix. The mesenchymal stroma enclosed in the developing dental follicle is induced to take on the characteristics of dental pulp. As tooth formation is completed, the odontogenic epithelium disappears leaving behind the epithelial rests of Malassez in the periodontal ligament. These clusters of epithelial cells retain their odontogenic potential, which may subsequently be expressed in neoplasia.
The ameloblastoma is an example of a non-inductive tumor. In this tumor-type the neoplastic cells of ameloblast origin do not induce the surrounding mesenchymal cells. Therefore no dental hard tissues are formed and the tumor remains essentially a soft-tissue tumor. The odontoma is the best example of an inductive tumor. Odontomas are tumors of odontogenic epithelium with induction of odontogenic ectomesenchyme, characterized by the formation of all dental hard and soft tissues, including enamel, dentin, cementum and pulp. Although the classification based on induction has recently been abandoned, there is merit in this classification as understanding the underlying processes helps to understand the clinicopathological correlations.

The World Health Organization has recently adopted a classification based on the epithelial, mesenchymal or mixed epithelial-mesenchymal origin of the neoplastic cells, rather than one based on inductive changes. Table 1 summarizes the currently accepted classification of odontogenic tumors in man, with one example of each type known to occur in animals.

Table 1: Tumors related to the odontogenic apparatus

<table>
<thead>
<tr>
<th>Benign</th>
<th>Malignant</th>
<th>Malignant</th>
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<tbody>
<tr>
<td>Odontogenic epithelium without odontogenic ectomesenchyme</td>
<td>Odontogenic epithelium with odontogenic ectomesenchyme, with or without dental hard tissue formation</td>
<td>Odontogenic ectomesenchyme with or without included odontogenic epithelium</td>
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<tr>
<td>e.g., ameloblastoma</td>
<td>e.g., odontoma</td>
<td>e.g., odontogenic fibroma</td>
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Ameloblastoma

The (central or intra-osseous) ameloblastoma is one of the most common odontogenic tumors, occasionally incorrectly referred to as adamantinoma. This tumor usually presents as a locally invasive neoplasm with osteolysis around the tooth roots and cystic changes. The classic histological appearance of an ameloblastoma is a follicular arrangement of ameloblasts and stellate reticulum cells, resembling the basic structure of the enamel organ. A number of histological variants are known to occur. Ameloblastoma in the dog is often characterized by focal keratinization. Metastasis has not been described.

The canine acanthomatous ameloblastoma is a benign odontogenic tumor with the same histological characteristics as the centrally located ameloblastoma, but appearing in the gingiva and mucosa of the tooth-bearing area of the jaws. In one review of canine epulides, the majority of lesions, which were originally classified as acanthomatous epulis, were found to be peripheral ameloblastoma. These lesions are composed of islands and sheets of mature squamous epithelium within a collagenous fibrous connective tissue stroma of low to moderate cellularity. These islands and sheets are each bounded by a row of palisading cells with nuclear polarization away from the basement membrane. Infiltration in the underlying bone is evident in most cases. The radiological picture of peripheral ameloblastoma is dominated by discrete infiltration, alveolar bone resorption, and tooth displacement. Although histologically very similar, this variant of ameloblastoma differs from the peripheral ameloblastoma in man in that it invades bone. The term canine acanthomatous ameloblastoma was therefore suggested to make this distinction. In the dog, local recurrence is very common following marginal excision and wide or radical excision is therefore recommended.
Peripheral odontogenic fibroma

A large proportion of tumors previously described as fibromatous and ossifying epulides are peripheral odontogenic fibromas. This is a slow-growing, benign neoplasm characterized by the proliferation of fibrous tissue in which isolated islands or strands of odontogenic epithelium are present. A variety of bone, osteoid, dentinoid or even cementum-like material may be found, often in close association with the odontogenic epithelium, suggesting mesenchymal induction. Radiological features vary according to the presence and amount of mineralized products. Peripheral odontogenic fibroma does not recur if adequately excised. In man, the peripheral odontogenic fibroma is a rare condition, whereas it is common in the dog.

Odontoma

An odontoma is a tumor in which both the epithelial and mesenchymal cells are well differentiated resulting in the formation of all dental tissue types. An odontoma may also be considered a hamartoma rather than a neoplasm. The dental tissues may or may not exhibit a normal relation to one another. An odontoma in which tooth-like structures are present indicates advanced cellular differentiation and is referred to as a compound odontoma. On the other hand an odontoma in which the conglomerate of dental tissues bears no resemblance to a tooth, is called a complex odontoma. Odontomas have been diagnosed in young dogs and in the cat. The radiological appearance is typical, and is either a sharply defined mass of calcified material surrounded by a narrow radiolucent band, or a variable number of tooth-like structures. An odontoma may be associated with unerupted teeth, a dentigerous cyst, or may be attached to an otherwise normal tooth. The term ameloblastic odontoma is occasionally encountered in the veterinary literature. An ameloblastic odontoma is an ameloblastoma with focal differentiation into an odontoma.

Feline inductive odontogenic tumor

This tumor type was originally described in young cats as inductive fibro-ameloblastoma. This tumor is characterized by ameloblastic epithelial cells arranged around dental pulp-like stroma. The rostral maxilla is the most common site of occurrence. The tumor may be locally invasive, but metastasis has not been recorded.

Amyloid-producing odontogenic tumor

This tumor type is rare and may also present clinically as an epulis. It has been referred to in the veterinary literature as a calcifying epithelial odontogenic tumor, although it was found that it is not the canine counterpart of the human CEOT. The term, amyloid-producing odontogenic tumor, would therefore seem more appropriate for this lesion. The tumor bears some resemblance to an ameloblastoma: the epithelium in some areas exhibits palisading of the basal cells and stellate reticulum may occur focally. The most prominent feature is the presence of amyloid which tends to calcify. Recurrence after excision has been reported, but metastasis does not take place.

Clinicopathologic correlations

A retrospective study of the most common odontogenic tumors and focal fibrous hyperplasia in dogs was recently performed at the University of California, Davis. Information was collected from records of 152 dogs including breed, age, sex and location of lesion in the oral cavity. Histological slides pertaining to each patient were reviewed. Statistical analyses were applied to the clinicopathological features of the three most common lesions; canine acanthomatous ameloblastoma (CAA), peripheral odontogenic fibroma (POF) and focal fibrous
hyperplasia (FFH). The included cases consisted of 68 (44%) CAA, 47 (31%) POF, 24 (16%) FFH, and 13 (9%) were other odontogenic tumors. The distribution of the three 32 most common lesions within the oral cavity was significant; CAA was most common in the rostral mandible, POF and FFH in the rostral maxilla. The sex predilection was found to be significant. Males and females were equally represented for CAA and FFH. Castrated males were more predisposed to POF. Golden retrievers, Akitas, Cocker spaniels, and Shetland sheep dogs were overrepresented for CAA. No breed predisposition was noted for FFH or POF. Dogs with FFH were presented at a greater mean age than dogs with CAA or POF. It was concluded that CAA, POF and FFH have distinct clinical patterns.

References