Current concepts of odontogenic tumours

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Abstract

Odontogenic tumours can pose significant diagnostic challenges for the pathologist because of their relatively low incidence, somewhat overlapping histology and subtle differentiating features. Despite similar histologies, the biological behaviour and appropriate therapy differ significantly between entities and accurate diagnosis is therefore essential. This article reviews the most common and important odontogenic tumours and highlights key features that will assist the pathologist to identify and appropriately classify these lesions. In addition, several new concepts of classification are discussed and important new developments in our understanding of the biology of these lesions are highlighted.

Keywords jaws; odontogenic tumours

Introduction and classification

Odontogenic tumours are a group of lesions that arise from the tissues derived from the tooth-forming apparatus. They are thus exclusive to the jaws and represent the only situation in pathology where a primary epithelial tumour may be found within bone. Odontogenic tumours are rare and lack of familiarity with these lesions and their variable appearance may lead to difficulties in diagnosis with occasional serious confusion with more sinister lesions.

The histological classification of odontogenic tumours[1] includes more than 30 named entities, but may be somewhat overly complex due to the inclusion of variants, some of which are vanishingly rare and may not be encountered in a lifetime of work. The classification is based first on behaviour, benign or malignant, and then on the histomorphogenesis of the lesions. As a group they are derived from the epithelial, ectomesenchymal and mesenchymal tissues that are part of the tooth-forming apparatus. Thus odontogenic tumours are divided into lesions derived from odontogenic epithelium only, tumours derived from odontogenic mesenchyme only and those composed of both odontogenic epithelium and mesenchyme. The appearance of the lesions and thus their classification also depends on the degree of interaction between the epithelial and mesenchymal components; this interaction, often referred to as inductive change, may result in cytodifferentiation that recapitulates the structures of the normal tooth-forming apparatus or enamel organ. In some lesions, especially those composed of both odontogenic epithelium and mesenchyme, formation of the dental hard tissues, enamel and dentine, is commonly seen. From the diagnostic point of view, the presence of ameloblast-like cells and the formation of dental hard tissues, especially dentine, are useful indicators of the odontogenic origin of epithelial lesions encountered within the jaws.

For a detailed classification of these lesions readers are referred to the latest World Health Organization (WHO) classification[1] and to specialist textbooks that discuss this group of lesions in detail.[2] A simplified classification is given in Table 1. In this review we will give a brief overview of the most common and important odontogenic tumours, drawing attention to key areas of diagnostic difficulty and to important differences in clinical behaviour. We have not attempted to discuss odontogenic cysts, except where they are relevant to the differential diagnosis, and have not included the entire group of fibro-osseous lesions, which have been reviewed elsewhere.[3]

Epidemiology

Odontogenic tumours are relatively rare. In an analysis of cases received in the Oral & Maxillofacial Pathology Department of the University of Sheffield, odontogenic tumours comprised only 1% of all specimens and 5% of jaw lesions.[4] This gives an estimated

Classification of the most common and important odontogenic tumours. (Based on the WHO classification 2005,[1] where readers can find a full and detailed classification of these lesions.)

Benign tumours

Odontogenic epithelium only:
- Ameloblastoma
- Squamous odontogenic tumour
- Calcifying epithelial odontogenic tumour
- Adenomatoid odontogenic tumour
- Odontogenic keratocyst (keratocystic odontogenic tumour)

Odontogenic epithelium and odontogenic mesenchyme:
- Ameloblastic fibroma
- Odontomas - complex and compound
- Calcifying odontogenic cyst (and variants)

Odontogenic mesenchyme:
- Odontogenic fibroma
- Odontogenic myxoma
- Cementoblastoma

Malignant tumours

Odontogenic carcinomas:
- Malignant ameloblastoma
- Primary intra-osseous squamous cell carcinoma
- Clear-cell odontogenic carcinoma
- Ghost cell odontogenic carcinoma

Odontogenic sarcomas:
- Ameloblastic fibrosarcoma

Table 1

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incidence of less than 0.5 cases per 100,000 per year. The most frequently encountered intra-osseous lesions of the jaw (80%) were the odontogenic cysts. The relative frequency of the different odontogenic tumours varies from country to country, but in the West, the odontomas are by far the most common at about 70% of the total (Table 2).[5–7] The most common true neoplasm is the ameloblastoma, comprising less than 20% of all odontogenic tumours. The next most common, at about 3–4% each, are myxomas, adenomatoid odontogenic tumours (AOTs) and ameloblastic fibromas. Other tumours, such as calcifying epithelial odontogenic tumour (Pindborg tumour) and ghost cell lesions, may comprise only about 1% of the total and are therefore very rarely seen. From this it is evident that most pathologists will rarely encounter an odontogenic tumour.

Ameloblastoma

The ameloblastoma is a benign, locally infiltrative tumour that very rarely may undergo malignant transformation. It is the second most common odontogenic tumour after the odontoma and, because of its relative frequency, characteristic histological features and clinical behaviour, the ameloblastoma is the most well recognized and easily diagnosed odontogenic tumour.[6] It most frequently arises in young to middle aged adults, with a peak age of about 35 years, but rare cases have been reported in children.[8] Ameloblastomas are more common in the mandible than the maxilla and over half of all cases are encountered at the angle of the mandible. They appear most frequently as a symptomless radiolucency that is often multilocular and may extend into the ramus of the mandible. Although relatively slow growing, the ameloblastoma may reach large sizes, making management difficult. This is particularly the case for lesions arising in the maxilla that may involve the complex anatomical structures of the paranasal sinuses.

There are several histological subtypes including plexiform, follicular, acanthomatous, basaloid, granular cell, cystic and desmoplastic forms, but generally none has clinical significance. Common to all is the recognition of the neoplastic ameloblast, a basaloid columnar cell that shows nuclear polarization away from the basement membrane (reverse palisading). The characteristic histological appearance of the ameloblastoma is of islands or follicles of epithelial cells composed centrally of loosely arranged stellate cells with columnar ameloblast-like cells at the periphery (Figure 1). These islands resemble the enamel organ seen during normal tooth development but hard tissue formation in ameloblastomas is extremely rare. The follicular pattern is the more common, formed by discrete islands arranged in a collagenous fibrous stroma. Branching strands of ameloblastomatous epithelium forming a plexiform arrangement may also be seen. Cystic change, either within the epithelial follicles or in the stroma, is common, leading to the use of the term solid/multicystic for the conventional form of this lesion.[2]

Ameloblastomas showing extensive stromal desmoplasia are termed *desmoplastic ameloblastoma* and more often occur in the anterior portions of the jaws. In contrast to other subtypes of ameloblastoma that are radiolographically lucent, desmosplastic ameloblastoma is often radiographically opaque and may resemble a benign fibro-osseous lesion.[9,10] Critical to differentiating a desmoplastic ameloblastoma from a squamous odontogenic tumour is the identification of characteristic ameloblasts at the periphery of tumour islands, a feature seen in ameloblastoma but not in the squamous odontogenic tumour.

A biological subtype of ameloblastoma that is predominantly cystic has been referred to as the *unicystic or cystic ameloblastoma*. Some clinical features may separate this form from other subtypes, including the frequent association with impacted teeth, occurrence at a younger age and purported lower recurrence rate. By contrast, other phenotypic features such as integrin expression and proliferation rate suggest that they are similar.[11,12] Cystic ameloblastomas have been classified into three histological growth patterns (Figure 2).[1] The first two describe lesions that are predominantly simple cysts with or without proliferation of tumour into the cyst lumen. When this occurs, the luminal nodules are often composed of ameloblastoma showing a plexiform pattern and this variant is often referred to as the *plexiform unicystic ameloblastoma*. The third variant shows islands of ameloblastoma within the fibrous wall of the cyst, the so-called *mural variant*. Although some authors have suggested that the unicystic ameloblastoma requires less aggressive surgery, others have reported local destruction and recurrence rates similar to other

Relative frequency (%) of various odontogenic tumours by geographical location

Type	USA[6]	China[7]	Nigeria[5]
Odontoma	68[a]	7	4
Ameloblastoma	19	59	59
Odontogenic myxoma	4	8	12
Adenomatoid odontogenic tumour	3	4	6
Ameloblastic fibroma	3	2	5
Pindborg tumour	1	1	1

[a] % of total odontogenic tumours.

Table 2

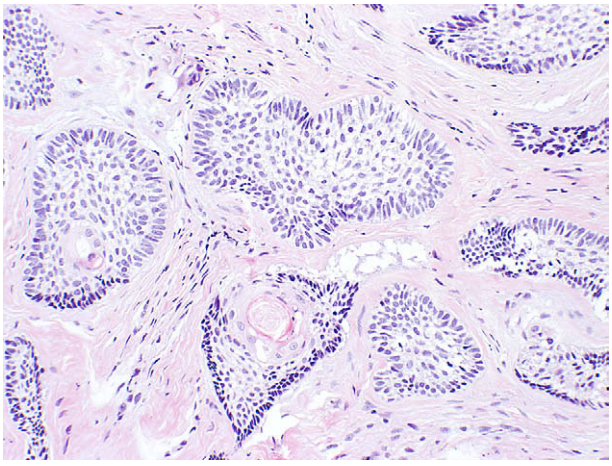

Figure 1 Ameloblastoma is formed of islands and follicles of epithelial cells with columnar ameloblast-like cells at the periphery enclosing loosely arranged stellate cells.