

A 5-Year Survey of Oral Biopsies in an Oral Surgical Unit in Singapore: 1993-1997

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Abstract

A survey of oral biopsies performed in an oral surgical centre in Singapore from 1993 to 1997 was carried out to determine the relative frequency of oral pathologies encountered. A total of 2057 reports were reviewed, of which 1986 separate diagnoses were counted. The great majority of patients were Asian. The 20 most common diagnoses were: fibrous epulis (10.3%), periapical granuloma (8.8%), mucocele (8.6%), radicular cyst (7.6%), lichen planus (5.7%), mucosal inflammation (3.6%), squamous cell carcinoma (3.5%), granulation tissue (3.3%), fibrous hyperplasia (3.1%), keratosis (3.1%), pyogenic granuloma (2.6%), keratocyst (2.4%), osteomyelitis (2.3%), dentigerous cyst (2.3%), dental follicle (1.9%), non-specific ulcer (1.8%), ameloblastoma (1.8%), papilloma (1.5%), odontoma (1.5%) and residual cyst (1.3%). Oral malignancies accounted for 5.2% of all diagnoses, with squamous cell carcinoma (67.0% of malignancies) as the most common malignancy. Odontogenic cysts made up 14.9% of all specimens, with radicular cysts (50.7% of odontogenic cysts) being most common. Non-odontogenic cysts comprised 0.5% of all biopsies. Odontogenic tumours accounted for 5.0% of all diagnoses, with ameloblastoma as the most common tumour (35.0%). Similar surveys in the literature were reviewed. The relative frequency of some conditions appear to be higher than in other studies, including squamous cell carcinoma, odontogenic keratocysts and ameloblastomas.

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Key words: Odontogenic cysts, Odontogenic tumours, Oral malignancies, Oral pathology, Relative frequency

Introduction

There are a variety of pathological conditions that present in the oral cavity. While clinical and radiographic examination will suggest a provisional diagnosis, histological examination is often required to confirm or exclude a suspected diagnosis. Knowledge of the types and frequency of oral lesions in the local population may often be invaluable in managing the patient.

Objective

A survey of histopathological reports was carried out to determine the types and relative frequency of oral pathologies encountered in the Department of Oral and Maxillofacial Surgery (OMS) of the Government Dental Clinic/National Dental Centre in Singapore during the five-year period from 1993 to 1997.

Materials and Methods

The histopathologic reports of oral biopsies performed by staff of the OMS Department in the Government Dental Clinic and the National Dental Centre over five years from January 1993 to December 1997 were retrieved and examined. Data were compiled according to diagnosis. Reports of fine needle aspirate cytology and microscopy of blood or fluid smears were excluded from

this survey. Repeat biopsies were not counted unless they were performed for recurrences after treatment. In cases where the reported histologic diagnosis was unclear, an attempt was made to have the slides reviewed to clarify the diagnosis.

Results

A total of 2057 reports from 1993 to 1997 were reviewed, of which 1986 separate diagnoses were counted from the histopathologic reports. Seventy-one reports were excluded as they were repeat biopsies, fluid smears or needle aspirates. The great majority of specimens were processed, read and reported by the Department of Pathology in the Singapore General Hospital, where all specimens from the Government Dental Clinic and National Dental Centre were sent. A small proportion was reported by the pathology departments of various hospitals where the surgery was done. The specimens were read by general pathologists and/or oral pathologists.

The great majority of patients in this survey were Asian. While most patients were Singaporeans, a small number were from Malaysia, Indonesia, the Philippines and India. The 20 most common oral lesions reported are presented in order of descending frequency in Table I. They comprised three-quarters (76.7%) of the

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1986 reports included in the survey. Fibroepithelial polyps or fibrous epulis were the most common lesion (10.3%), followed by periapical granulomas (8.8%), mucocoeles (8.6%) and radicular cysts (7.6%). However, if periapical granulomas and radicular cysts are considered together as manifestations of the same inflammatory process, they comprise 16.3% of oral diagnoses. Lichen planus (5.7%) was the fifth most common pathological entity diagnosed. Squamous cell carcinoma (3.5%) ranked seventh but all oral malignancies together made up to 5.2% of oral diagnoses (Table II).

Anatomical sites of oral malignancies included the intraoral lips, tongue, gingiva, floor of mouth, buccal mucosa, palate, retromolar area or any other unspecified part of the mouth or jaws. Of the 103 oral malignancies reported, squamous cell carcinoma was the most common entity, including 3 cases of carcinoma-in-situ, and accounted for 67.0% of oral malignancies. Salivary gland cancers made up 0.9% of all biopsies. Of the 29 salivary gland tumours reported, 18 (60%) were malignant and 12 (40%) were benign (all pleomorphic adenomas). Other rarer malignancies are listed in Table II. An average of about 20 cases of new or recurrent oral malignancies were diagnosed annually in the last five years at our centre. An average of about 14 cases of new or recurrent squamous cell carcinoma were diagnosed annually in the last five years, with a low of 9 cases in 1996 and a high of 23 cases in 1994. Of the 103 cases of oral malignancy seen, 4 were diagnosed in non-

Singaporeans.

Odontogenic tumours and cysts were classified according to WHO classification. Odontogenic cysts (296 cases) comprised 14.9% of biopsies performed and are listed in Table III. Radicular cysts were most common, followed by keratocysts, dentigerous cysts and residual cysts. The number of paradental cysts reported each year has progressively increased from 1 in 1993 to 10 in 1997. This increase may be a reflection of the growing awareness of this pathological entity that was described relatively recently, rather than an actual increase in the incidence of this condition. Non-odontogenic cysts (10 cases) were relatively uncommon (0.5% of all biopsies). Six other cysts were reported in a way that could not be categorised (e.g. "benign epithelial cyst") while 1 other specimen was reported as a globulo-maxillary cyst, a controversial diagnosis.^{2,3}

Odontogenic tumours (100 cases) made up 5.0% of biopsies done and are listed in Table IV. Ameloblastomas were the most common tumour, accounting for one third

TABLE I: TOP 20 MOST COMMON ORAL LESIONS

Diagnosis	No.	% of all biopsies
Fibroepithelial polyp/fibrous epulis	205	10.3
Periapical granuloma	174	8.8
Mucocoele / mucus extravasation cyst	171	8.6
Radicular cyst / apical periodontal cyst	150	7.6
Lichen planus	113	5.7
Mucosal inflammation	71	3.6
Squamous cell carcinoma	69	3.5
Granulation tissue	65	3.3
Fibrous hyperplasia (denture induced hyperplasia)	62	3.1
Keratosis/leukoplakia/epidermal hyperplasia	61	3.1
Pyogenic granuloma	52	2.6
Odontogenic keratocyst	48	2.4
Osteomyelitis/sequestrum/osteoradionecrosis	4	2.3
Dentigerous cyst	45	2.3
Dental follicle	37	1.9
Non-specific ulcer	35	1.8
Ameloblastoma	35	1.8
Squamous papilloma / viral wart	30	1.5
Odontoma	30	1.5
Residual cyst	26	1.3
Total	1524	76.7

TABLE II: ORAL MALIGNANCIES

Diagnosis	No.	% of malignancies
Mucosal		
Squamous cell carcinoma*	69# (1)	67.0
Melanoma	2	1.9
Malignant spindle cell tumour	1	1.0
Verrucous carcinoma	1	1.0
Undifferentiated carcinoma	1 (1)	1.0
Salivary gland		
Mucoepidermoid carcinoma	7 (1)	6.8
Adenoid cystic carcinoma	7@ (1)	6.8
Acinic cell carcinoma	2@	1.9
Adenocarcinoma	1	1.0
Clear cell carcinoma	1†	1.0
Mesenchymal		
Sarcoma	2	1.9
Bone		
Osteogenic sarcoma	1	1.0
Lymphoid/Haematologic		
Lymphoma	3	2.9
Leukaemia	1	1.0
Metastatic		
Nasopharyngeal carcinoma	1	3.9
Hepatocellular carcinoma	1	
Clear cell carcinoma	1	
Small cell carcinoma	1	
Total	103	100
% of all biopsies		5.2

* includes 3 cases of carcinoma-in-situ

3 cases of recurrence included

@ 1 case with possible diagnosis included

† 1 case of recurrence included

() number of non-Singaporeans

TABLE III: ODONTOGENIC AND NON-ODONTOGENIC CYSTS

Diagnosis	No.	% of cysts
Odontogenic		
Radicular cyst	150 [@]	50.7
Odontogenic keratocyst	48*	16.2
Dentigerous cyst	45 [@]	15.2
Residual cyst	26	8.8
Paradental cyst	24	8.1
Lateral periodontal cyst	3	1.0
Total	296	100
% of all biopsies		14.9
Non-odontogenic		
Nasopalatine cyst	9	90.0
Nasolabial cyst	1	10.0
Total	10	100
% of all biopsies		0.5
Unclassifiable epithelial cyst	7	
Total	313	
% of all biopsies		15.8

[@] 1 case with possible diagnosis included

* 2 cases with possible diagnosis and 1 case of recurrence included

of odontogenic tumours. Odontomas were the second most common, with compound odontomas being reported twice as often compared to complex odontomas. Cementomas were third most likely to be encountered, followed by odontogenic myxomas and calcifying odontogenic cysts tied for fourth place. Ameloblastomas and myxomas are treated at our centre by resection and may often require reconstruction. An average of 7 new cases of ameloblastoma and 1 new case of myxoma were diagnosed annually over the last five years at our centre. Of the 35 cases of ameloblastoma diagnosed, 9 were non-Singaporeans by nationality; all 5 cases of myxoma were Singaporeans.

There was difficulty in categorising some biopsy reports because the histologic diagnoses as reported by the pathologist were morphologic or descriptive rather than definitive, e.g. some periapical granulomas were reported as "chronic inflammation", and a clinically evident papilloma was reported as "squamous hyperplasia and submucous fibrosis". This difficulty was encountered in reports of specimens that were not read by an oral pathologist.

Discussion

The Government Dental Clinic (GDC) in Singapore was both a general and specialist dental centre for many years, until it was restructured to become the National Dental Centre (NDC) in March 1997, becoming more of a specialist referral centre. The Department of Oral and

TABLE IV: ODONTOGENIC TUMOURS

Diagnosis	No.	% of odontogenic tumours
Ameloblastoma	35* [@]	35.0
Odontoma	30	30.0
. Compound	19	
. Complex	8	
. Unclassified		
Cementoma	18	18.0
Odontogenic myxoma	5	5.0
Calcifying odontogenic cyst	5	5.0
Cementoblastoma	3	3.0
Ameloblastic fibroma	2	2.0
Peripheral odontogenic fibroma	1	1.0
Odontoameloblastoma	1	1.0
Total	100	100
% of all biopsies		5.0

* 1 previously biopsied, untreated case excluded

[@] 2 cases with possible diagnosis included

Maxillofacial Surgery (OMS) in the Government Dental Clinic has continued in the National Dental Centre. Staff of this unit also operate in all government-linked hospitals, except the National University Hospital which has its own OMS unit and Oral Pathology service. The government and university OMS units were together in the same facility until the university dental faculty was relocated to the National University Hospital in 1986. The OMS unit in the Government Dental Clinic and the succeeding National Dental Centre acts as a referral centre for the government dental service and a proportion of private dental clinics. A significant proportion, if not the majority, of all oral biopsies in Singapore would have been carried out in this OMS unit.

The work profile of a dental clinic will affect the relative frequencies of oral lesions seen; a clinic with more endodontists may have more apical lesions biopsied, while an oral surgical centre may encounter relatively more tumours and cysts. Our centre serves as a specialist referral centre and has all dental specialties in the same building. It may be assumed that the profile of cases seen and biopsied at our centre should be fairly representative of oral pathology patterns in Singapore. However, certain pathological conditions may be expected to 'concentrate', i.e. appear at higher frequency, at a tertiary healthcare centre offering specialist care that is subsidised by the government for citizens. Unfortunately, it would not be reasonable to derive the incidence of any particular lesion in Singaporeans from data in this study as an unknown number of patients also seek treatment at the National University Hospital and at private clinics.

Several similar retrospective surveys on histopathological records were reported in the literature. Bhaskar⁴

reported in 1968 on 20,575 biopsy specimens, including oral cytological smears, seen in dental offices by 527 civilian and military dentists in the United States. Thompson⁵ reported on 8018 head and neck biopsies seen over 6 years from 1972 to 1978 in a dental school biopsy service in Oregon, USA. Weir et al⁶ reported on 15,783 oral biopsies seen over 17 years from January 1969 to June 1986 at the state dental school oral biopsy service in Louisiana, USA. These studies were done on largely Caucasian populations in the United States. Nakade et al⁷ reported on 503 oral biopsy specimens collected over 10 years from 1979 to 1989 at a university oral pathology department in Japan. Chidzonga et al⁸ reported on 1732 oral biopsies seen over 10 years from 1982 to 1991 in a central hospital in Harare, Zimbabwe. However, the data were presented in a different manner from Western literature, making comparison of the relative frequencies of lesions difficult. Zhao and Yeo⁹ reported on 11,347 oral biopsy records of Oriental patients accumulated over 40 years from 1954 to 1993 at a university oral histopathology laboratory in Singapore. This report was an abstract and unfortunately does not give detailed data of individual pathologies.

Factors that make for difficult comparison of data between various studies include different methods of data collection and presentation, the description of new pathological entities and changes in the definition of other entities over time. However, some comparisons may still be made within reasonable limits.

General

Fibroepithelial polyps/fibrous epulis or irritation fibromas (irritation hyperplasia) was the most common diagnosis in the studies by Thompson⁵ and Weir et al,⁶ as well as the present series, but ranked third in the reports by Bhaskar⁴ and Nakade et al.⁷ While dental or periapical granulomas and radicular cysts ranked in various positions within the top five most common lesions, when combined as inflammatory apical lesions, they formed the most common category in all series except for Weir et al.⁶ Full data from the three American studies

were available and are selectively tabulated for comparison (Table V). Chidzonga et al⁸ reported no periapical granulomas in his series; the reason for this variance may be due to differences in data collection or clinical practice. The abstract report by Zhao and Yeo⁹ carried relative proportions of only neoplasms, odontogenic tumours, odontogenic cysts and benign salivary gland tumours.

Mucocele was the most common salivary gland pathology and was relatively common, as were denture-induced epulis fissuratum or fibrous hyperplasia. A recent survey showed that nearly 30% of adults in Singapore wore dentures.¹⁰ Another study on Chinese denture users seen at a government dental centre in Singapore showed that around 12% had denture-induced tissue hyperplasia.¹¹ Pyogenic granulomas were ranked comparatively closely in all series (9th to 11th place). Dentigerous cysts were relatively common in the three previous studies (5th to 6th) but was ranked 14th in the present study. Papillomas were relatively less common in this series, ranking 18th in contrast to the other three studies where it was within the 10 most common diagnoses. Other oral lesions were less distinct and difficult to compare due to differences in nomenclature and definition. In a study of 204 cases of gingival fibrous lesions in Asian patients, Zain and Yeo¹² noted the use of varied nomenclature in the literature and suggested a simpler set of terminology that reflected the view that such lesions represented a spectrum of a single disease process. White mucosal lesions were relatively common in all series, ranking within the 10 most common oral conditions, but cannot be compared for the reasons mentioned.

The most common diagnosis in the Japanese series by Nakade et al⁷ was radicular cysts, followed by dental granulomas and thirdly, fibromas or fibrous polyps. In the African study by Chidzonga et al,⁸ the most common diagnoses in descending order of frequency were epidermoid (squamous cell) carcinoma, pyogenic granuloma and pleomorphic adenoma. The difference in the overall profile of lesions in this study raises

TABLE V: SELECTIVE COMPARISON WITH OTHER STUDIES

	Bhaskar 1968	Thompson 1981	Weir et al 1987	Present series
	% in series/ Rank in series			
Irritation fibroma/ fibrous epulis/ fibroepithelial polyp	7.6%/ 3rd	9.2%/ 1st	15.0%/ 1st	10.3%/ 1st
Dental/periapical granuloma	12.2%/ 1st	7.2%/ 3rd	8.0%/ 2nd	8.8%/ 2nd
Mucocele/ mucous extravasation cyst	2.9%/ 7th	3.9%/ 8th	6.0%/ 3rd	8.6%/ 3rd
Radicular cyst	11.2%/ 2nd	7.2%/ 4th	5.8%/ 5th	7.5%/ 4th
Epulis fissuratum/ fibrous hyperplasia (denture induced)	2.8%/ 9th	2.8%/ 10th	1.5%/ 16th	3.1%/ 9th
Pyogenic granuloma	1.8%/ 11th	2.7%/ 11th	2.3%/ 9th	2.6%/ 11th
Dentigerous cyst	6.6%/ 5th	5.6%/ 5th	4.2%/ 6th	2.3%/ 14th
Papillomas/ viral warts	1.9%/ 10th	3.3%/ 9th	4.0%/ 7th	1.5%/ 18th
Squamous cell carcinoma	0.7%/ 15th	1.0%/ 18th	1.7%/ 15th	3.5%/ 7th

questions as to whether there was a bias in performing biopsies or in the type of cases referred to this centre. In any case, any comparison of data from this paper would have to be made with caution.

Oral Malignancy

Oral malignancy formed 1.6% to 2.6% of oral biopsies in the American surveys^{4,6,13} and about 5%⁷ in the Japanese study. Chidzonga et al⁸ reported an unusually high proportion of malignancies (29.5%) in their series, which also included facial basal cell carcinomas. Zhao and Yeo⁹ reported that malignant neoplasms formed 6.1% of all oral biopsy specimens. Our result (5.2%) in this present series is in closer agreement with the Japanese and previous local data. Oral cancer accounts for 2% to 4% of all malignant tumours in the United States;¹³ in comparison, data from the Singapore Cancer Registry (previously unpublished) indicate that oral malignancy forms about 1% of all malignancies in Singapore.

Squamous cell carcinoma was the most common oral malignancy in all surveys. It formed around 65% of all oral malignancies and was ranked as the 15th to 18th most common oral lesion in the three American surveys.^{4,6} Twenty cases of squamous cell carcinoma made up 87% of oral malignancies in the Japanese study.⁷ In the present series, squamous cell carcinoma accounted for 67.0% of oral malignancies, closely approximating the American results, but was ranked as the 7th most common diagnosis. There may be mitigating factors to explain this comparatively high ranking, including differences in the definition of other conditions, differences in referral and treatment practices, demographic differences and the relatively smaller sample size of this series.

Nonetheless, cancer is the most common cause of death in Singapore (27.0%), followed by cardiac disease (25.1%).¹⁴ Data from the Singapore Cancer Registry showed that over the same period from 1993 to 1997, 274 cases of oral malignancies (sites included tongue, vestibule, gingiva, floor of mouth, buccal mucosa, palate, retromolar area, other unspecified sites) were diagnosed in Singapore citizens and residents, with squamous cell carcinoma being most common (87.2%) followed by salivary gland cancers (7.3%). There were no lymphoid or haematologic malignancies included in these data. As reporting of all malignancies is mandatory in Singapore, it may be assumed that almost a third (31.8%) of all new cases of oral malignancies (excluding recurrences, metastatic tumours and lymphoid/haematologic malignancies diagnosed in the mouth) reported in Singaporean citizens were diagnosed at our dental centre in the period 1993 to 1997.

Weir et al⁶ and Krutchkoff et al¹³ both reported that after squamous cell carcinoma, the next most common oral malignancies were verrucous carcinoma and

mucoepidermoid carcinoma at equal frequencies (4.6%¹³ to 6.6%⁶ of all oral malignancies). Both mucoepidermoid carcinoma and adenoid cystic carcinoma occurred with equal frequency (6.8%) as the second most common oral malignancy in this present series.

Malignant salivary gland tumours formed 11.0%¹³ to 15.5%⁶ in American studies; they formed a comparable 17.5% of oral malignancies in this present series. The most common salivary gland malignancy in both American studies as well as in our Singaporean series was mucoepidermoid carcinoma.

Odontogenic Cysts

Daley et al¹⁵ and Bhaskar⁴ reported that odontogenic and non-odontogenic cysts formed 18.1% to 20.9% of all biopsies, while Chidzonga et al⁸ reported that cysts accounted for 10.9% of oral biopsies in their African series. Nakade et al⁷ reported their proportion of all cysts to be 35.7% of all biopsies. The percentage of cysts in this present series at 15.4% is closer to the American result. Odontogenic cysts accounted for 14.9% of all biopsies, comparable to American reports (17.1%¹⁵ to 19.4%⁴) but rather higher than the African series (9.8%).⁸ The relative proportion of odontogenic cysts were lower in the previous local series by Zhao and Yeo⁹ (5.3% of all specimens).

Radicular cysts were the most common odontogenic cyst in most studies^{4,7,15,16} including the present series: 50.7% of odontogenic cysts, which is somewhat lower than in other Western studies (59%¹⁶ to 65%¹⁵). Dentigerous cysts have been reported in various Western series to account for 10%¹⁶ to 34%⁴ of odontogenic cysts; the proportion reported by Daley et al (24.1%¹⁵) is probably the most accurate. Dentigerous cysts accounted for only 15.2% of odontogenic cysts in this survey. Odontogenic keratocysts are known to recur even after years after enucleation and therefore require complete surgical removal and long-term follow-up. The incidence of keratocysts in Western literature has been reported to vary from 3% to 12%¹⁵⁻¹⁷ of odontogenic cysts. In comparison, the present series shows odontogenic keratocysts to be relatively more common (16.2% of odontogenic cysts). Of the 48 cases of odontogenic keratocysts in our series, 4 patients were non-Singaporeans. Sampling bias or ethno-geographic differences may be contributory reasons for the apparently higher relative frequency of keratocysts in our Asian population compared to Western countries. Comparison with some older studies of odontogenic cysts^{18,19} is difficult because of differences in nomenclature and definition. Clinico-pathologic studies of radicular cysts,²⁰ dentigerous cysts²¹ and odontogenic keratocysts²² in Asian patients were previously published, and provide greater details of the individual pathologies.

Non-odontogenic cysts formed 1.0%¹⁵ to 1.5%⁴ in North American studies. The number of non-odontogenic cysts

(10 confirmed cases, 0.5% of all biopsies) in this present series is too small for reasonable comparison. Nasopalatine cysts were the most common non-odontogenic cyst in other studies^{4,15} including this series.

Odontogenic Tumours

Odontogenic tumours formed 1.0% to 2.4% of biopsies in studies done in Canada,¹⁵ Mexico²³ and America,^{4,24} Nakade et al⁷ reported the proportion of odontogenic tumours to be slightly higher at about 3% in the Japanese study. In the previous local study by Zhao and Yeo,⁹ odontogenic tumours accounted for a somewhat higher 4.8% of all specimens, similar to the result in this present series (5.0% of all oral biopsies). The incidence of odontogenic tumours in Africa has been reported to be unusually high.²⁵⁻²⁷ However, Anand et al²⁸ and Mosadomi²⁹ suggested that a reason for an apparently high relative frequency of jaw tumours in Africans was the "harvesting phenomenon", the impression resulting from Africans with slow-growing benign jaw tumours seeking treatment in large numbers at newly established hospitals and treatment centres. More recently, Chidzonga et al⁸ reported that odontogenic tumours made up 8.6% of biopsies done in Zimbabwe.

Odontomas were the most common odontogenic tumour (22.4% to 67.0%) followed by ameloblastomas (11.0% to 23.8%) in most studies reported from the North American continent.^{4,5,15,23,24} Bhaskar's⁴ study reported odontogenic fibromas to be the most common odontogenic tumour, followed by odontomas and ameloblastomas, probably reflecting the older and wider definition of odontogenic fibromas. Sato et al³⁰ in their series of oral and maxillofacial tumours in Japanese children below the age of 15 years, also reported odontomas to be the most common odontogenic tumour followed by ameloblastomas.

In other studies from Turkey, Africa and Asia, ameloblastomas were the most common odontogenic tumour. Gunhan et al³¹ reported that ameloblastomas formed 36.5% of 409 odontogenic tumours seen in Turkey. The frequency of ameloblastomas in Africa has been reported to be higher: approximately 59% in Nigeria^{32,33} and 79% in Zimbabwe.⁸ Wu and Chan³⁴ also reported a relatively high frequency of ameloblastoma (62.2%) followed by odontomas (6.1%) in their series of 82 odontogenic tumours in Hong Kong Chinese. Chung et al³⁵ reported on 20 cases of ameloblastoma out of 157 jaw tumours seen in Korea, but data cannot be compared as their series included non-odontogenic malignancies. Yeo and Zhao³⁶ reported on 205 ameloblastomas collected over 40 years in Singapore, which accounted for 24.4% of odontogenic tumours. In this present series, the ameloblastoma also appears to be the most common

odontogenic tumour (35.0%), comparable to Turkish results but higher than in the previous local study by Yeo and Zhao.³⁶ Ameloblastoma was the 17th most common pathologic diagnosis in this series accounting for 1.8% of all biopsies, similar to the previous local series by Yeo and Zhao (1.9% of oral lesions).³⁶ In contrast, neither of the two similar histopathologic surveys done in the United States listed odontogenic tumours in their 20 most common diagnoses;^{5,6} Bhaskar⁴ listed only the 15 most common pathologic diagnoses found in his study. It appears that the incidence of ameloblastomas is relatively higher outside North America, but it is unclear if a racial or geographical reason is responsible for this variation. It is tempting to speculate that the incidence of ameloblastoma is increasing from the apparent increase in proportion of ameloblastomas amongst odontogenic tumours, but there is no corresponding increase when the relative frequency is taken in relation to all oral pathologies.

In this present study, the second most common odontogenic tumour was the odontoma (30.0% of odontogenic tumours, 18th to 19th most common diagnosis at 1.5% of oral biopsies). There is, however, a clinical impression that odontomas are more commonly encountered in practice. Odontomas are easily diagnosed radiographically and do not exhibit the invasive behaviour associated with ameloblastomas, and may often be removed without being sent for histological examination. Differences in sample size and definition of sample parameters are further confounding factors to fair comparison of relative frequencies. In most studies, it was not stated if the samples included foreigners seeking treatment in a country with better developed medical services, which would give an apparently higher incidence of disease. Of all the large series of odontogenic tumours reviewed, only Daley et al¹⁵ corrected their data to include local cases only.

Conclusion

The relative frequencies of most oral pathological conditions seen at the Department of Oral and Maxillofacial Surgery of the National Dental Centre are comparable with similar studies in the literature. The relative frequency of some conditions appears to be higher than in other studies, including oral malignancies, especially squamous cell carcinoma, and odontogenic keratocysts. The relative frequency of ameloblastomas in our centre is higher than that reported in North America but is less or comparable to other studies done elsewhere. The importance of careful examination as well as timely and appropriate investigation for accurate diagnosis of invasive or malignant oral lesions cannot be overemphasised. Where the histological diagnosis of an oral lesion is in doubt, it would be best to consult an oral pathologist.

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