Retrospective analysis of biopsied oral and maxillofacial lesions in South-Western Saudi Arabia

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ABSTRACT

الأهداف: الإبلاغ عن مدى انتشار آفات الفم والوجه والفكين وانواعها المأخوذ منها خزعة في جنوب غرب المملكة العربية السعودية.

الطرق: تستند هذه الدراسة المرجعية على استرجاع البيانات الإكلينيكية والمرضية لمدة 6 سنوات في الفترة الممتده من 2009 إلى ديسمبر 2014. والتي قد تم الحصول عليها خلال الفترة من 2014 الى 2015، من سجلّات أمراض الأنسجة في مستشفى الملك فهد المركزي بجازان وهو مركز الإحالة الوحيد لخدمات الخزعة في هذه المنطقة.

النتائج: من بين 32149 خزعة وردت،كانت هناك 714 (2.2%) خزعة مأخوذة من آفات الفم والوجه والفكين وتراوحت أعمارهم من الولادة (حديثي الولادة) إلى 100 سنة، بمتوسط عمر 46.8 ± 23.4 ، ونسبة الذكور إلى الإناث 1: 1.3. كان اللسان هو المكان الأكثر شيوعا لآفات الفم والوجه والفكين وللأورام الخبيثة، على وجه الخصوص. وكانت الفئة الأكثر شيوعا هي الأورام الخبيثة (38.7%) تليها الآفات الالتهابية (16.5%). وشكلت أورام الفم الخبيثة 15.8٪ من جميع الأورام الخبيثة. كما وجِد أن سرطان الخلايا الحرشفية (36.1٪) هو النوع الأكثر شيوعاً، يليه الورم الحبيبي القيحي والقيلة المخاطية (7% لكل منهما). كان شيوع سرطانِ الخلايا الحرشفية والنمو الشاذ الظهارية المصاحبين للشمة مضاعفاً عند الإناث.

الخاتمة: إن عدد افات الفم والوجه والفكين غير الخبيثة أقل بكثير مما كان متوقعاً مقارنة مع الخبيثة. هذا الاختلاف يمكن أن يفسر على الأرجح حقيقة أن الخزعات أخذت فقط من الافات عندما اشتبه أنها خبيثة. ويعزى ارتفاع معدل سرطان الخلايا الحرشفية الذي ذكر أنه ينسب لهذه المنطقة إلى استخدام الشمة. وتؤكد هذه الدراسة على أهمية تقديم خدمات الخزعة لجميع آفات الفم ومنع استخدام الشمة.

Objectives: To report the prevalence and types of biopsied oral and maxillofacial lesions (OMLs) in South-Western (Jazan Province) region, Kingdom of Saudi Arabia (KSA).

Methods: This retrospective study was based on the retrieval of clinicopathological data for a period of 6 years between January 2009 and December 2014. These data were obtained between October 2014 and June 2015 from the histopathology records of King Fahad Central Hospital, Jazan, KSA, which is the only referral center for biopsy services.

Results: Out of the 32149 biopsies received, 714 (2.2%) were OMLs. The age ranged from 0 (neonatal) to 100 years, with a mean age of 46.8±23.4 and a male-to-female ratio of 1:1.3. The tongue was the most common site for OMLs and for malignant neoplasms, in particular. The most common category was malignant neoplasm (38.7%), followed by inflammatory lesions (16.5%). Oral malignancies accounted for 15.8% of all malignancies. Oral squamous cell carcinoma (OSCC) (36.1%) was the most frequent type, followed by pyogenic granuloma and mucocele (7% each). Shammah-associated OSCC and epithelial dysplasia were twice as common in females.

Conclusion: The number of non-malignant OMLs was much lower than expected in comparison to oral malignancies. This difference can likely be explained by the fact that the biopsies were taken only when malignancy was suspected. The higher rate of OSCC reported from this region is attributed to shammah usage. This study emphasizes the importance of biopsy services for all OMLs and the prevention of shammah use.

The oral and maxillofacial region is exposed to a multitude of injurious factors and carcinogenic agents that cause a wide spectrum of lesions. Clinical and radiographic examinations can yield only a tentative diagnosis; however, the appropriate diagnosis and treatment of oral and maxillofacial lesions (OMLs) rely on proper histopathologic reporting and the availability of adequate dental health services. The description of diverse oral and maxillofacial pathologies has led to significant differences in the nomenculature and classification of these lesions. The prevalence of OMLs varies in different populations, and knowledge of their prevalence in a specific geographic region helps in the planning of appropriate treatment and preventive strategies by identifying possible etiologic factors. Most studies have focused on the prevalence of oral cancer in Kingdom of Saudi Arabia (KSA),[1-6] while studies related to the prevalence of biopsied OMLs in general are relatively sparse.[7,8] In view of the lack of documentation of biopsied OMLs in this region, the present study aimed to report on the overall prevalence and pattern of biopsied OMLs in the South–Western province (Jazan Province), KSA over a period of 6 years from 2009 to 2014.

Methods. Prior to the commencement of this retrospective study, the proposal was submitted to the Institutional Review Board of King Fahad Central Hospital, Jazan Province (KFCHJ), and ethical approval was obtained from the concerned authorities. The archived files of all patients with OMLs were retrieved from the surgical biopsy service of KFCHJ during October 2014 to June 2015 for a period of 6 years (2009 to 2014). Improper documentation prior to 2009 restricted the study period. The clinico-pathologic data of the patient, such as age, gender, nationality, shammah usage (chewing tobacco), cigarette smoking, Catha edulis chewing, anatomic location, clinical appearance and histopathological diagnosis, were recorded. Generally, these lesions were reported by general pathologists, and cases with non-specific diagnosis were reviewed by oral pathologists and re-

categorized. These lesions were grouped into 8 main categories based on the histopathological diagnosis: malignant, benign, odontogenic, inflammatory, reactive, cystic, mucosal and miscellaneous pathology. Odontogenic tumors were classified based on the latest World Health Organization classification.[9] Radicular cysts were included in the group of odontogenic inflammatory lesions. The data were entered in Excel and later transferred to the Statistical Package for Social Science (IBM Corp, Armonk, NY, USA) version 20. Descriptive statistical analyses were performed to clean the data and to check for the presence of extreme values. The Chi square test was applied, with a level of significance $p \leq 0.05$.

Results. During the study period, 714 OMLs were reported among 32149 biopsies, with an incidence of 2.2%. The mean age was 46.8±23 years, ranging from near birth (<1) to 100 years. Approximately 84.5% of these lesions were registered in Saudi patients, with 6.1% in non-Saudi patients and a non-recorded nationality in 9.4% of cases. A slight female (56.9%) predominance was present, with a male-to-female ratio of 1:1.3; this difference was statistically significant (p=0.046).

Most of these OMLs presented clinically in the form of swelling (61.1%) followed by ulcer (22.2%), white patches (8%), nodules (1.5%), red patches (0.8%) and mixed (both white and red areas) lesions (0.7%). The clinical presentation was not recorded in 5.7% cases. The tongue (26.5%) was the most frequently involved site, followed by the buccal mucosa (19.6%). The distribution of OMLs categories by age and gender is summarized in **Table 1** and **Table 2**. The site distribution of these lesions is presented in **Table 3**.

There was a wide range of histopathologic types, with approximately 75 different diagnoses. These diagnoses were grouped broadly as neoplastic (49.7%) and non-neoplastic (50.3%) lesions. The most frequent OML category was malignant neoplasm (38.8%), followed by inflammatory lesions (16.5%), reactive lesions (13.7%), non-inflammatory cysts (9.8%), benign tumors (8.7%), and mucosal pathology (8.1%). Benign odontogenic tumors (2.2%) and miscellaneous lesions (2.1%) were the least common. Oral malignancies represented 15.8% of all body malignancies and accounted for only 0.9% of total biopsies. Oral squamous cell carcinoma (OSCC) was the most common malignant lesion, contributing to 36.1% of all OMLs, whereas verrucous carcinoma was only 1.4%. Almost 45.3% of OSCC patients were shammah users. These patients were predominantly female (68.4%) with male to female ratio of 1:2.2. However, only one female patient with

Table 1 - Distribution of oral and maxillofacial neoplastic lesions by age and gender.

Oral neoplastic lesions	n (%)	Males n (%)	Females n (%)	Mean age	Age range
Malignant neoplasms	277 (38.8)	99 (35.7)	178 (64.3)	64.8	3-100
Squamous cell carcinoma	258 (36.1)	90 (34.9)	168 (65.1)	65.1	22-100
Verrucous carcinoma	10 (1.4)	5 (50.0)	5 (50)	76.1	60-90
Salivary gland malignancy	3 (0.4)	2 (66.7)	1 (33.3)	38.7	19-74
Mucoepidermoid carcinoma	1 (0.1)	0	1 (100)	19	19
Adenoid cystic carcinoma	1 (0.1)	1 (100)	0	74	74
Adenocarcinoma	1 (0.1)	1 (100)	0	23	23
Ameloblastic carcinoma	1 (0.1)	0	1 (100)	100	100
Other malignant tumors	5 (0.7)	2 (40)	3 (60)	39	3-75
Small round cell sarcoma	1 (0.1)	1 (100)	0	3	3
Alveolar soft part sarcoma	1 (0.1)	0	1 (100)	65	65
Ewing's sarcoma	1 (0.1)	0	1 (100)	13	13
Undifferentiated tumor	1 (0.1)	0	1 (100)	75	75
Metastatic tumor	1 (0.1)	1 (100)	0	NM	NM
Benign tumors	62 (8.7)	32 (51.6)	30 (48.4)	36.5	6-85
Squamous cell papilloma	16 (2.2)	8 (50.0)	8 (50.0)	44.9	6 67
Verruca vulgaris	3 (0.4)	2 (66.7)	1 (33.3)	50	15 85
Keratoacanthoma	1 (0.1)	0	1 (100)	13	13
ntra-dermal nevus	1 (0.1)	0	1 (100)	20	20
Benign Fibrous tumors	12 (1.7)	4 (33.3)	8 (66.7)	38.8	10-75
Fibroma	8 (1.1)	2 (25.0)	6 (75)	46.3	10 75
Giant cell fibroma	1 (0.1)	0	1 (100)	21	21
Desmoplastic fibroma	1 (0.1)	0	1 (100)	NM	NM
Benign fibrous histiocytoma	1 (0.1)	1 (100)	0	17	17
Solitary sclerotic fibroma	1 (0.1)	1 (100)	0	18	18
Hemangioma	8 (1.1)	4 (50.0)	4 (50)	19.6	10 29
Lipoma	4 (0.6)	4 (100)	0	49.5	25 80
Lymphangioma	3 (0.4)	3 (100)	0	21	18-25
Pleomorphic adenoma	12 (1.7)	6 (50.0)	6 (50)	32.7	19 50
Basal cell adenoma	2 (0.3)	1 (50.0)	1 (50)	49.5	34-65
Benign Odontogenic tumors	16 (2.2)	7 (43.8)	9 (56.2)	27.8	3 60
Keratocystic odontogenic tumor	5 (0.7)	2 (40.0)	3 (60)	32.8	13 60
Ameloblastoma	3 (0.4)	3 (100)	0	38	14 60
Adenomatoid odontogenic tumor	2 (0.3)	1 (50.0)	1 (50)	18	16 20
Compound odontoma	2 (0.3)	0	2 (100)	9.5	8 11
Odontogenic myxoma	2 (0.3)	1 (50.0)	1 (50)	27	3 51
Calcifying epithelial odontogenic tumor	1 (0.1)	0	1 (100)	27	27
Calcifying cystic odontogenic tumor	1 (0.1)	0	1 (50)	31	31

NM - not mentioned

verrucous carcinoma (10%) had the habit of shammah usage despite of its association with smokeless tobacco. The distribution of oral malignant and potentially malignant neoplasm based on shammah habit is presented in **Table** 4. Shammah-associated OSCC and epithelial dysplasia were twice as common in females, suggesting the need for follow up on these lesions. Other malignant neoplasms of salivary gland, odontogenic and mesenchymal origin; undifferentiated and metastatic tumors were also observed.

Analysis of the data showed that the highest number of cases was reported in 2010, followed by a gradual decline in their prevalence and an increase in 2014. The incidence of oral cancer decreased from 2009 to 2011, followed by a sharp increase in 2012, after which there was a decline. This difference in incidence was found to be statistically insignificant.

Discussion. The main tertiary care facility that receives referral patients from the entire region of Jazan Province is KFCHJ. It is the only hospital that provides biopsy service to this region. This is the first and largest hospital-based report of biopsied OMLs from the South-Western region of KSA. A similar study was presented from the Eastern province that analyzed head and neck lesions along with oral lesions,[7] while a study in the Northern Province included both clinical and biopsied oral lesions.[8] Most of the prevalence studies in this geographic region were either limited to oral cancer[1-6] or study of clinical cases.[10] The prevalence of

Table 2 - Distribution of non-neoplastic oral and maxillofacial lesions by age and gender.

Oral Non-neoplastic lesions	n (%)	Males n (%)	Females n (%)	Mean age	Age range
Inflammatory lesions	118 (16.5)	55 (46.6)	63 (53.4)	39.7	1 - 85
Soft tissue inflammatory lesions	86 (12.0)	40 (46.5)	46 (53.5)	44.2	1 - 85
Epithelial hyperplasia	32 (4.5)	16 (50.0)	16 (50.0)	52.5	12 - 85
Chronic non-specific inflammation	31 (4.3)	14 (45.2)	17 (54.8)	37.7	1 - 73
Sialadenitis	12 (1.7)	8 (66.7)	4 (33.3)	44	18 - 80
Traumatic ulcer	7 (1.0)	1 (14.3)	6 (85.7)	45.4	14 - 65
Sialolithiasis	3 (0.4)	1 (33.3)	2 (66.7)	39.72	23 - 62
Cellulitis	1 (0.1)	0	1 (100)	82	28
Odontogenic inflammatory lesions	32 (4.5)	15 (46.9)	17 (53.1)	8.3	6 - 80
Radicular cyst	16 (2.2)	5 (31.3)	11 (68.7)	28.4	12 - 57
Periapical granuloma/abscess	8 (1.1)	5 (62.5)	3 (37.5)	31	10 - 80
Submandibular abscess	5 (0.7)	3 (60.0)	2 (40.0)	33.2	9 - 60
Osteomyelitis	3 (0.4)	2 (66.7)	1 (33.3)	13	6 - 23
Reactive lesions	98 (13.7)	42 (42.9)	56 (57.1)	35.5	6 - 80
Pyogenic granuloma	50 (7.0)	21 (42.0)	29 (58.0)	35.2	6 - 80
Reactive fibrous group	39 (5.5)	15 (38.5)	24 (61.5)	36.7	13 - 64
Focal fibrous hyperplasia	18 (2.5)	7 (38.9)	11 (61.1)	37	13 - 60
Fibro-epithelial polyp	11 (1.5)	4 (36.4)	7 (63.6)	31.1	16 - 53
Peripheral ossifying fibroma	4 (0.6)	2 (50.0)	2 (50.0)	40	25 - 57
Fibrous epulis	3 (0.4)	1 (33.3)	2 (66.7)	42.3	18 - 64
Epulis fissuratum	2 (0.3)	1 (50.0)	1 (50.0)	39.5	39 - 40
Denture-induced fibrous hyperplasia	1 (0.1)	0	1 (100)	50	50
Peripheral giant cell granuloma	9 (1.3)	6 (66.7)	3 (33.3)	32.4	6 - 75
Non inflammatory cysts	70 (9.8)	40 (57.1)	30 (42.9)	22.7	3 - 65
Salivary gland cysts (Mucocele/Ranula)	50 (7.0)	25 (50.0)	25 (50.0)	19.8	3 - 60
Dentigerous cysts	7 (1.0)	6 (85.7)	1 (14.3)	22.3	9 - 51
Epidermoid cysts	7 (0.1)	5 (71.4)	2 (28.6)	42.7	19 - 63
Thyroglossal cysts	4 (0.6)	2 (50.0)	2 (50.0)	22	5 - 65
Traumatic bone cysts	1 (0.1)	1 (100)	0	21	21
Nasopalatine cysts	1 (0.1)	1 (100)	0	24	24
Mucosal pathology	58 (8.1)	26 (44.8)	32 (55.2)	48.6	4 - 92
Muco-cutaneous lesions	32 (4.5)	14 (43.8)	18 (56.3)	37.3	4 - 77
Lichen planus	11 (1.5)	5 (45.5)	6 (54.5)	46.8	16 - 77
Pemphigus	9 (1.3)	2 (22.2)	7 (77.8)	33.1	17 - 70
Erythema multiforme	7 (1.0)	3 (42.9)	4 (57.1)	27.7	4 - 63
Behcet disease	4 (0.6)	4 (100)	0	36.5	20 - 50
Lichenoid reaction	1 (0.1)	0	1 (100)	50	50
Epithelial dysplasia	26 (3.6)	12 (46.2)	14 (53.8)	64.4	39 - 92
Miscellaneous	15 (2.1)	7 (46.7)	8 (53.3)	17.9	0 - 46
Congenital epulis of newborn	1 (0.1)	0	1 (100)	0	0
Langerhans cell histiocytosis	2 (0.3)	1 (50.0)	1 (50.0)	3	1 - 5
Fibrous dysplasia of bone	6 (0.8)	3 (50.0)	3 (50.0)	23.5	19 - 27
Central giant cell lesion	2 (0.3)	0	2 (100)	32.5	19 - 46

biopsied OMLs (2.2%) in this region is relatively low as only suspected malignancies or tumors are referred and submitted for histopathologic examination. Alternatively, the lack of awareness to seek biopsy service for OMLs or the paucity of oral specialties in the required fields may be the rationale for their decreased histopathologic reporting. The aim of this study was to provide baseline data on the prevalence of OMLs in this province, which will be imperative for health planning, the provision of dental services, and the identification of etiologic risk factors, and prevention. This study also emphasizes the need for increased awareness of health authorities regarding the significance of biopsy service for all surgically removed lesions as well as for suspected potentially malignant or benign lesions. The study reported a diverse range of lesions, with almost 75 different diagnoses, a number that is considerably higher than in previous studies.[8,11] However, a larger scale study conducted by Jones and Franklin presented an even wider range of OMLs.[12] Despite the presence of most of lesions in Saudi patients, close to 9.7% of these lesions were found in Non-Saudis, which is similar to the findings of Ali et al.[7] Non-Saudi nationals are a diverse group, exhibiting different social and cultural practices, such as qat and shammah chewing in Yemenis,[13] Toombak dipping among Sudanese,[14] and cigarette and shisha smoking among Egyptians.[15] All of these habits can contribute to the formation of oral lesions. The mean

Table 3 - Distribution of oral and maxillofacial lesions based on anatomic location.

Oral lesions	Buccal mucosa	Floor of the mouth	Lip	Tongue	Alveolar mucosa/ gingiva	Maxilla	Mandible	Salivary gland	Oral mucosa	NM	Total
Malignant Neoplasm	73 (26.4)	7 (2.5)	20 (7.2)	121 (43.7)	48 (17.3)	0	4 (1.4)	3 (1.1)	0	1 (0.4)	277 (38.8)
Benign tumors	15 (24.2)	2 (3.2)	16 (25.8)	8 (12.9)	6 (9.8%)	1 (1.6)	0	11 (17.7)	0	3 (4.8)	62 (8.7)
Benign Odontogenic tumors	0	0	0	0	0	9 (56.2)	7 (43.8)	0	0	0	16 (2.2)
Inflammatory lesions	21 (17.8)	2 (1.7)	11 (9.3)	22 (18.6)	10 (8.5)	15 (12.7)	23 (19.5)	10 (8.5)	1 (0.9)	3 (2.5)	118 (16.5)
Reactive lesions	12 (12.2)	0	18 (18.4)	15 (15.3)	52 (53.1)	0	0	0	0	1 (1.0)	98 (13.7)
Non inflammatory Cysts	4 (5.7)	11 (15.7)	35 (50.0)	6 (8.6)	0	3 (4.3)	7 (10)	0	0	4 (5.7)	70 (9.8)
Mucosal lesions	19 (32.8)	0	8 (13.8)	17 (29.3)	0	0	0	0	14 (24.1)	0	58 (8.1)
Other lesions	0	0	2 (13.3)	0	2 (13.3)	8 (53.4)	3 (20)	0	0	0	15 (2.1)
Total	144 (20.1)	22 (3.1)	110 (15.4)	189 (26.5)	118 (16.5)	36 (5.1)	44 (6.1)	24 (3.4)	15 (2.1)	12 (1.7)	714 (100)

Data are expressed as numbers percentage (%), NM - not mentioned

Table 4 - Distribution of oral malignant and potentially malignant neoplasm based on shammah habit and gender.

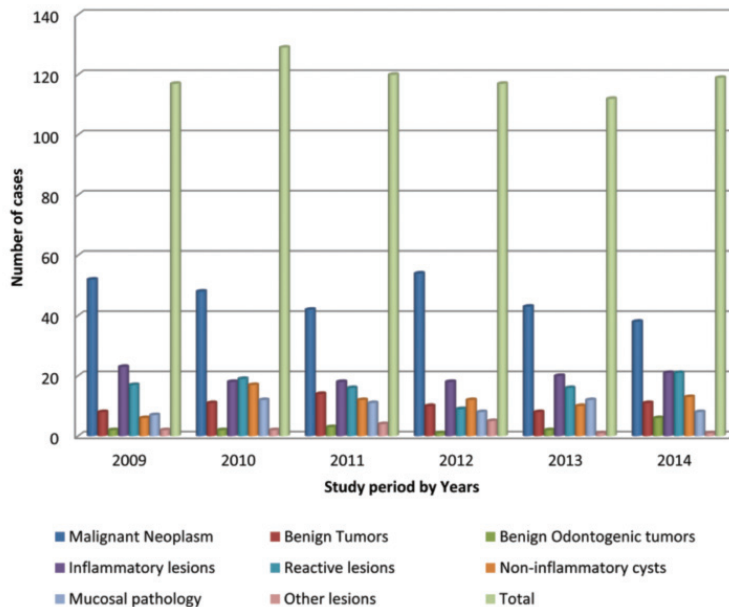| Histological types	Shammah user			Shammah non- user		
	Males	Females	Total	Males	Females	Total
Squamous cell carcinoma (n=258)	37 (31.6)	80 (68.4)	117 (45.3)	53 (37.6)	88 (62.4)	141 (54.7)
Verrucous carcinoma (n=10)	0	1 (100)	1 (10.0)	5 (55.6)	4 (44.4)	9 (90.0)
Epithelial dysplasia (n=26)	3 (33.3)	6 (66.7)	9 (34.6)	9 (52.9)	8 (47.1)	17 (65.4)

Figure 1 - Distribution of oral and maxillofacial lesions, Analysis of the data showed that the highest number of cases was reported in 2010, followed by a gradual decline in their prevalence and an increase in 2014. The incidence of oral cancer decreased from 2009 to 2011, followed by a sharp increase in 2012, after which there was a decline. This difference in incidence was found to be statistically insignificant.

age of OMLs was 46.8±23.4, which is comparatively younger than the figures in other studies;[11] however, a much lower age was reported in previous studies from KSA.[7,8,10,16] The female predominance in this study is in accordance with other studies.[7,12]

Oral malignant neoplasm was the most common category, comprising 38.8% of all OMLs. This value is greater compared with previously reported incidences of 9.9% in Saudi Arabia,[7] 14.9% in UAE,[17] 7.8% in India,[18] and 5.4% in the UK.[12] study from Saudi Arabia[16] reported a very low prevalence of oral malignancies (1.49%), which may be due to the differences in the method of data collection. Hospital statistics from KSA have shown that OSCC constituted 4.3-17.8% of all registered cancers.[1,19] In this study, it accounted for 14.7% of all cancers, in concordance with the previous reports.

The OSCC was common, comprising 93.1% of oral malignant neoplasms, in agreement with a reported incidence of 92.2% in Pakistan.[20] However, other studies have reported incidences from 73-84%, such as 84% in Jordan,[21] 77% in UAE,[17] and 73.6% in Sudan.[14] In our study, the prevalence of OSCC among the oral biopsied lesions was 36.1%. A much lower prevalence was found in Spain (1.4%),[11] Brazil (2.5%),[22] Libya (8%),[23] Nigeria (10.8%)[24] and the (UAE) 14.9%.[17] The higher frequency of OSCC in our series can be correlated to the local habit of shammah usage in the Jazan region. This result is in accordance with previous reports that correlated the association of shammah and oral cancer in the South-Western region of KSA.[1-5,25,26] However, a much higher prevalence of oral malignancy has been reported in Pakistan (55.8%), which may be due to varied levels of health services as well as socioeconomic or geographic differences in risk factors.[20]

Oral squamous cell carcinoma accounted for 15.8% of all malignancies. In 1984, Salem reported a higher prevalence of 33%,[25] but another study from the western region stated a lesser prevalence of 13%.[27] The prevalence of OSCC ranged from 3-4% of all malignancies in most studies conducted in Europe and the USA. The prevalence is reported to be high in Southeast Asia, with figures higher than 30% of all malignancies.[28] The male-to-female ratio of 1:1.9 is in agreement with earlier studies of KSA[3,4] but differs most other reports, where it is predominant in males.[17,29,30]

The high prevalence of OSCC in females in this series, approximately 2-fold that for males, is possibly due to chronic use of shammah for a longer duration and/or longer life expectancy. The bucco-alveolar mucosa was frequently affected, followed by tongue/floor of the mouth, most likely due to dipping of shammah in the buccal vestibule, a practice that is prevalent in this region. This finding is also in consistent with several earlier reports citing buccal mucosa as the frequent site for oral cancer in shammah users.[1] The prevalence of oral cancer remained constant and high over the study period due to the lack of public awareness,[31] relevant health services and preventive actions. The relatively small number of benign neoplastic cases in relation to malignant neoplasms (1:4.5) in our series could be as these cases are not often referred or biopsied. This finding is in contrast to the observation made by Jones et al,[12] who reported an equal number of benign and malignant tumors. The ratio of benign to malignant salivary gland neoplasms (4.7:1) is rather high. Pleomorphic adenoma was the most common benign salivary gland tumor, and malignant salivary gland neoplasms accounted for 0.4% of cases. These findings are quite similar to those reported by Jones et al.[12] In general, elderly females were most commonly affected by malignant neoplasm, while benign tumors showed a slight predilection for males and involved a slightly younger age group.

Odontogenic tumors showed marked geographic variation in prevalence and distribution. Ameloblastomas have been predominant in most studies,[32,33] while odontoma is more common among Caucasians.[34] Similar to previous studies, females were most affected, and the onset was common in the third decade.[35] There has been a dispute regarding the classification of keratocystic odontogenic tumor (KCOT), which has been re-classified as an odontogenic tumor.[9] Therefore, if we exclude keratocystic odontogenic tumors, the prevalence of these tumors is comparable with previous reports.[7,12] The redefinition of odontogenic keratocyst as a tumor produced an increase in the frequency and prevalence of OT.[36] This tumor was most common in our odontogenic series, followed by ameloblastomas, a result that is in agreement with other reports.[8,37] A review of worldwide prevalence of odontogenic tumors showed KCOT to be the third common tumor after ameloblastoma and odontoma.[38] Other odontogenic tumors were rare, including a case of ameloblastic carcinoma. Inflammatory lesions were the second most common category of OMLs in our study. Their female predominance may result from more females than males report to the hospital in general. Inflammatory lesions were primarily of a chronic non-odontogenic type. Radicular cysts were the most common odontogenic inflammatory lesions. The radiographic appearance of this lesion with sclerotic margins necessitates ascertainment by biopsy and hence is frequently biopsied. Periapical granulomas were quite rare in our series, although they are expected to be more

common than cysts.[12,39] Alarmingly, 3 cases (0.4%) of osteomyelitis in children with a mean age of 13 years were described in this report. Though the number is small, osteomyelitis represents a serious complication of spreading oral inflammation, emphasizing the need for good oral health care. Jones et al[12] reported osteomyelitis in an older age group (mean age 50.6+/-14.1 years). Osteomyelitis in children or adolescents often leads to florid proliferative periostitis as a healing response.[40] The frequency of reactive conditions was lower compared with other studies,[12] but a higher rate was reported in the KSA by Nartey et al.[41] Most of these cases were pyogenic granulomas, followed by reactive fibrous lesions in the gingiva/alveolar mucosa. These sites are often exposed to injurious environmental agents. The most common cysts were mucocele (7%), which occur due to frequent trauma to the oral mucosa. However, this figure was higher than other investigations[11,18] and radicular cysts were found to be the most common of all types of cysts.[12,18] Radicular cysts were more common in males, which is consistent with other reports.[12,18] In this study, radicular cysts were the most common odontogenic cyst, with a male-to-female ratio of 1:2. This result is in agreement with Gambhir et al,[18] but differs from Jones et al,[12] who reported an equal gender distribution.

Mucosal pathology, including primarily epithelial dysplasia and mucocutaneous lesions, accounted for 8.1% of all OMLs. The relative frequency of epithelial dysplasia is lower than that reported from India, which is consistent with a high rate of oral cancer in that region.[18] This pathology was predominant in elderly females compared to younger males in India,[18] a difference that can be attributed to the long-term use of shammah in women. The prevalence of mucocutaneous lesions was greater than was reported by Gambhir et al.[18]

The lesions that could not be grouped into any category or that were relatively rare were considered miscellaneous lesions. These lesions were primarily metabolic, infectious or developmental. The mean age of fibrous dysplasia was higher than has been previously reported (23.5 years) most likely due to the insidious, asymptomatic nature, and delay in clinical presentation.[9] Giant cell granulomas were previously diagnosed as giant cell tumors, but this dispute is now resolved.[40]

In conclusion, the number of oral and maxillofacial biopsied lesions documented in this study was much lower than expected, which can be explained by the lack of adequate biopsy services for oral health care in this region. General dental practitioners and other oral health care providers should be aware of the importance of biopsy services in order to reach definitive and early diagnoses of life-threatening lesions. Furthermore, the pattern and type of these lesions and their associated oral habits should be documented for planning appropriate dental health services.

Detailed clinical characteristics, including patient occupation, oral hygiene practices, and social habits (for example, qat use, cigarette smoking, alcohol, and shammah use) that have adverse effects on oral health, should be adequately documented. Special emphasis should be given in providing high quality dental health services, and dental practitioners should be well informed regarding such procedures. Moreover, these professionals should be encouraged to document all OMLs by requesting oral biopsy services for all oral surgical materials as well as for suspected neoplastic conditions.

This study emphasizes the necessity of health authorities in this region to establish oral health promotion programs to improve the quality of health services. An appropriate oral public health program that is specifically designed for the early detection and prevention of oral lesions is recommended.

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