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RESEARCH ARTICLE

CLINICAL AND HISTOPATHOLOGICAL ANALYSIS OF BIOPSIED ORAL AND MAXILLOFACIAL LESIONS: A RETROSPECTIVE STUDY IN SANA'A, YEMEN

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Abstract

Background and aims: The term "oral and maxillofacial pathology" describes conditions affecting the mandible, maxillae, salivary glands, temporomandibular joints, facial muscles, and perioral skin. Because there is a dearth of epidemiological data on oral and maxillofacial lesions (OMFLs) in Yemen, the current study aims to determine the relative incidence of these lesions in Sana'a city, as well as their correlation with age and gender.
Methods: A retrospective cross-sectional study was performed on documented records of all patients with OMLs in targeted multi-centers in Sana'a city for 2 years from November 2022 to November 2024. Patient clinical and pathological data, for instance anatomical location, age, gender, and histopathological diagnosis, were recorded and then analyzed.
Results: The sample size was 398 histopathological records of OMFLs, 55.4% of the sample was male and 44.7% were female. The tongue was the site most commonly affected by malignant lesions (49.6%), and the maxilla and mandible were the sites most commonly affected by benign lesions (22.9% and 29.96%). The maxilla and mandible are the most affected sites for cystic lesions (65% and 33.3%). The study found a significant association between male patients and malignant lesions, while female patients were associated with benign and reactive lesions; the odds ratios for these associations were 1.98, 1.7, and 3.8, respectively.
Conclusions: Non-malignant lesions were more prevalent than malignant lesions, and dental and medical care providers should give greater importance to pre-malignant and malignant lesions and chronic traumatic ulcers because these lesions are at risk of developing into malignant lesions, through education and awareness of oral health promotion and early detection and treatment of these lesions. The tongue is the site most affected by malignant lesions and squamous cell carcinoma was the most common malignant lesion.
Keywords: Malignant lesions, Oral and Maxillofacial Lesions (OMFLs), oral and maxillofacial pathology, Sana'a city, Yemen.

INTRODUCTION

The specialty of oral and maxillofacial pathology focuses on diagnosing and researching the origins and effects of illnesses affecting the oral and maxillofacial region. On occasion, it is viewed as a specialty in dentistry and pathology[1]. This could mean that in addition to treating maxillofacial diseases, the pathologist also treats otorhinolaryngologic issues (ear, nose, and throat). The phrase "head and neck pathology" is sometimes used in its place. The fields of expertise of head and neck pathologists and endocrine pathologists in this position partially overlap[2]. The oral and maxillofacial lesions (OMFLs) are diverse types of pathologies affect the oral and maxillofacial region including reactive, inflammatory, cystic, and various types neoplastic lesions with significant pathology include some of benign and malignant tumors. There are also some oral premalignant conditions that start off harmless but can later develop into cancer[3,4]. Premalignant lesions and conditions caused by the use of tobacco in some form. Majority of the lesions usually are silent and asymptomatic, however, overlapping clinical presentations are noted with

various other systemic disorders thereby causing difficulty in clinical diagnosis[5].

In each decade of life, the frequency distribution of these lesions varies between men and women. In the world, oral cancer is the eighth most frequent type of cancer. Additionally, it should be mentioned that the therapy, clinical presentation, and histopathologic characteristics of pediatric and adult oral and maxillofacial malignancies varies greatly[6,7]. According to earlier research, the most prevalent cancers were squamous cell carcinoma (SCC) and mucoepidermoid carcinoma[8-10]. According to Kalantari *et al.*[10], the prevalence of SCC in patients under the age of 20 has increased over time.

Rapid treatment, better health services, and enhanced early prevention and diagnosis are all greatly aided by the identification of oral and maxillofacial disorders. Because there are many different types of oral and maxillofacial lesions, oral healthcare specialists—such as oral and maxillofacial surgeons and general dentists—need to be well-versed in the clinical and demographic features of these lesions. This is because some benign lesions in this region may have similar radiographic or clinical manifestations, or they may even resemble malignant lesions[8]. The clinical and radiological assessments can generate only tentative diagnosis on the other hand the appropriate diagnosis and treatment of OMFL rely on 'gold standard' histopathological diagnosis[9,10].

In Yemen, epidemiological information on tumors are inadequate and several recent studies have been conducted to examine the risk factors and prevalence associated with HBV infection among oncology patients[11], the association of Epstein-Barr virus with breast cancer[12], the prevalence of central nervous system tumors and histological identification in surgical patients[13], the prevalence of HBV and infection-related risk factors among leukemia patients achieving long-term remission after chemotherapy[14], the prevalence of bladder cancer[15], and the prevalence of renal lesions and risk factors[16]. However, data on oral lesions are limited, and the vast majority of these data have been on the association between qat chewing and white lesions; and oral squamous cell carcinoma[17,18]. However, interest in oral lesions has begun, as recently a study was conducted on the prevalence of parotid gland tumors among Yemeni patients in Sana'a city[19], and a study on ameloblastoma in the Yemeni population: analysis of the rate and clinical pathological characters of ameloblastoma in the Yemeni population[20].

The present study thus sheds light on the relative frequency of pre-cancer and cancerous tumors and their association with sex and age in Sana'a city, Yemen. The present study highlights the importance of early detection of pre-cancerous lesions and chronic traumatic inflammatory ulcers that last longer than usual, as these pathological lesions grow silently in most cases and carry the risk of transformation from a benign nature to dangerous malignant lesions.

SUBJECTS AND METHODS

Over the course of two years, from November 2022 to November 2024, the histopathology records of every patient with OMLs were obtained from the surgical biopsy at the National Public Health Laboratories, Al-Mamoon Center, and Al-Awlaqy Lab Centers in Sana'a city. The clinico-pathologic data of the patient, such as age, gender, anatomic location, and histopathological diagnosis, were recorded. The lesions were categorized into two main groups; neoplastic lesions subdivided into; (Malignant, benign lesions) and non-neoplastic lesions further divided into 5 categories; inflammatory, reactive, cystic, premalignant, and miscellaneous pathology. The study inclusion criteria are all biopsy with complete data, including age, gender, anatomical location, and histopathological pattern; all biopsy reports received during the period of the study.

RESULTS

In the study; males were 55.3% compared to the females 44.7%. The study includes 42 histopathological different diagnosis of different categories, most of the lesions were the neoplastic (malignant and benign) lesions were 66.8%, compared to the non- neoplastic (inflammatory, cystic, reactive, premalignant and miscellaneous) lesions were 33.2% of the seven lesions type.

Table 1: Location of oral and maxillofacial lesions among Yemeni patients.

Site	Tongue	Lips	Palate	FOM	Buccal Mucosa	Gingiva	Maxilla	Mandible	Other
n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**	**n (%)**
Malignant 141(35.43)	70 (49.6)	14 (9.9)	7 (5)	18 (12.8)	4 (2.8)	3 (2.1)	10 (7.1)	4 (2.8)	11 (7.8)
Benign 118(29.64)	15 (12.7)	17 (14.4)	4 (3.4)	0 (0.0)	12(10.2)	6 (5.1)	27 (22.9)	33 (29.96)	4 (3.4)
Cystic 60 (15.07)	1 (1.7%)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	39 (65)	20 (33.3)	0 (0.0)
Inflammatory 47 (11.80)	17 (36.2)	3 (6.4)	3 (6.4)	0 (0.0)	3 (6.4)	2 (4.3)	5 (10.6)	14 (29.8)	0 (0.0)
Premalignant 13 (3.26%)	4 (30.8)	2 (15.4)	1 (7)	4 (30.8)	1 (7.7)	1 (7.7)	0 (0.0)	0 (0.0)	0 (0.0)
Reactive 12 (3.01%)	1 (8.3)	1 (8.3)	0 (0.0)	0 (0.0)	1 (8.3)	9 (75)	0 (0.0)	0 (0.0)	0 (0.0)
Miscellaneous 7 (1.75%)	1 (14.3)	1 (14.3)	0 (0.0)	1 (14.3)	4 (57.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Total	109 (27.4)	38 (9.5)	14 (3.5)	23 (5.8)	25 (6.3)	22 (5.5)	81 (20.4)	71 (17.8)	15 (3.8)

Table 2: Association of oral and maxillofacial lesions types with gender.

Lesion types	N (%)	*OR*	*CI 95%*	X^2	*p*
Malignant; n=141 (35.43)					
Males n=220	93 (42.3)	1.98	1.3-3.1	10	0.0015
Females n= 178	48 (26.9)	0.5	0.3-0.7	10	0.0015
Benign; n=118(29.64)					
Males n=220	54 (24.5)	0.57	0.3-0.8	6.1	0.01
Females n= 178	64 (35.9)	1.7	1.1-2.6	6.1	0.01
Cystic; n=60(15.07)					
Males n=220	31(14.1)	0.84	0.48-1.5	0.37	0.54
Females n= 178	29 (16.3)	1.18	0.68-2.0	0.37	0.57
Inflammatory; n=47 (11.80)					
Males n=220	30 (13.6)	1.5	0.8-28	1.5	0.2
Females n= 178	17 (9.6)	0.66	0.3-1.2	1.5	0.2
Premalignant; n=13 (3.26)					
Males n=220	7 (3.2)	0.94	0.31-2.8	0.01	0.9
Females n= 178	6 (3.4)	1.1	0.3-3.2	0.01	0.9
Reactive; n=12 (3.01)					
Males n=220	3 (1.4)	0.25	0.06-0.9	4.6	0.03
Females n= 178	9 (5.1)	3.8	1.02-14.4	4.6	0.03
Miscellaneous; n= 7 (1.75)					
Males n=220	2 (0.9)	0.31	0.06-1.6	2.1	0.15
Females n= 178	5 (2.8)	3.1	0.6-16.4	2.0	0.15

The most common lesions were the malignant lesions 35.43% followed by benign lesions 29.64%, the cystic lesions were 15.07%, while the inflammatory lesions were 11.80%, the premalignant, the reactive and miscellaneous lesion were 3.26%, 3.01% and 1.75% respectively. Considering the location of oral, maxillofacial, and facial lesions among Yemeni patients, the tongue was the most frequently affected site with malignant lesions. Accounting for 49.6% of total tongue lesions, followed by the FOM with 12.8%, and other sites were less frequently affected with malignant lesions (Table 1). When considering the location of oral, maxillofacial, and facial lesions among Yemeni patients with benign lesions, the maxilla and mandible were the most affected sites, with benign lesions accounting for 22.9% and 29.96% of total benign lesions, respectively, followed by the lip site with 14.4%, the oral mucosa with 12.7%, and the tongue with 12.7%, while other sites were less or not affected by benign lesions (Table 1). When considering the location of oral, maxillofacial, and facial lesions among Yemeni patients for cystic lesions, the maxilla and mandible were the most affected sites, with cystic lesions accounting for 65% and 33.3% of total cystic lesions, respectively, while other sites were less or not affected by cystic lesions (Table 1).

Table 3: Prevalence, age and gender characteristics of oral and maxillofacial malignancies among Yemeni patients in Sana'a city.

Malignant lesions	Total N 398	Male N 220	Female N 178	Mean Age years	Age Range years
Squamous cell carcinoma	97 (68.8)	69 (74.2)	28 (70)	56.7	30-77
Verrucous carcinoma	10 (7.1)	7 (7.5)	3 (7.5)	56.6	50-60
Basal cell carcinoma	7(5)	4 (4.3)	3 (7.5)	63.6	61-73
Adenoid cystic carcinoma	4 (2.8)	4 (4.3)	0 (0.0)	47	40-52
Clear cell carcinoma	2 (1.4)	0 (0.0)	2 (5)	58	58
Malignant Undifferentiated tumor	4 (2.8)	4 (4.3)	0 (0.0)	50	30-70
Lymphoma	9 (6.4)	3 (3.2)	6 (15)	48	47-53
Ewing's sarcoma	2 (1.4)	0 (0.0)	2 (5)	11	10-12
Mucoepidermoid carcinoma	1 (0.7)	0 (0.0)	1 (2.5)	34	34
Blue cell tumor	3 (2.1)	2 (2.1)	1 (2.5)	12	11-14
Osteosarcoma	2 (1.4)	0 (0.0)	2 (5)	17	16-18
Total	141 (35.4)	93 (42.3)	40 (22.5)	41.3	11-77

When considering the location of oral, maxillofacial, and facial lesions among Yemeni patients for inflammatory lesions, the tongue and maxilla were the most affected sites, accounting for 36.29% and 29.8% of total inflammatory lesions, respectively, followed by the mandibular site with 10.6%, while other sites were less or not affected by inflammatory lesions (Table 1). When considering the premalignant lesions, the tongue and FOM were the most affected sites, accounting for 30.8% and 30.8% of total premalignant lesions, respectively, followed by the lip site with 15.4%, while other sites were less or not affected by premalignant lesions (Table 1). When considering the reactive lesions, the gingiva was the most affected. sites accounting for 70% of total reactive lesions, while other sites were less or not affected by reactive lesions (Table 1) When considering the association of oral and maxillofacial lesion types with gender, there was a significant association between male patients and malignant lesions in which the associated odds ratio was 1.98 with a 95% CI ranging from 1.3 to 3.1, with X^2 equal to 10 and *p* equal to 0.0015.

Table 4: Age and gender characteristics of oral and maxillofacial benign lesions among Yemeni patients in Sana'a city.

Benign lesions	Total N398	Male N 220 (55.3%)	Female N 178 (44.7%)	Mean Age	Age Range
Verruca vulgaris	2 (1.7)	2	0	42	34-49
Fibroma	34 (28.8)	16 (29.6)	18 (28.1)	38	4-80
Giant cell granuloma	14 (11.9)	2 (3.7)	12 (18.7)	27	30-50
Hemangioma	16 (13.6)	10 (18.5)	6 (9.4)	27.6	7-37
Pleomorphic adenoma	5 (4.2)	3 (5.6)	2 (3.1)	53	44-68
Ameloblastoma*	16 (13.6)	9 (16.7)	7 (10.9)	44	43-78
Odontogenic odontoma*	4 (3.4)	1 (1.8)	3 (4.7)	18	15-29
Odontogenic myxoma*	7 (5.9)	4 (7.4)	3 (4.7)	26	24-30
Odontogenic fibroma*	5 (4.2)	4 (7.4)	1 (1.6)	17	15-20
Calcifying cystic odontogenic tumor*	2 (2.1)	0 (0.0)	2 (3.1)	30	25-32
Osteoma	2 (2.1)	2 (3.7)	0 (0.0)	29	29
Ossifying fibroma	4 (4.2)	0 (0.0)	4 (6.3)	29	28-30
Schwannoma	4 (4.2)	1 (1.9)	3 (4.7)	21	19-22
Fibrous dysplasia	3 (2.5)	0 (0.0)	3 (4.7)	27	26-28
Total	118 (29.6)	54 (24.5)	64 (36)	30.3	4-80

*Odontogenic tumor

Table 5: Age and gender characteristics of oral and maxillofacial Cystic lesions among Yemeni patients in Sana'a city.

Cystic lesions	Total N 398	Male N 220	Female N 178	Mean Age years	Age Range years
Radicular cyst	35 (58.3)	18 (58.1)	17 (58.6)	38	10-62
Dentigerous cysts	15 (25)	9 (29)	6 (20.7)	27	19-43
Odontogenic keratocyst	6 (10)	2 (6.5)	4 (13.8)	22	20-27
Calcifying odontogenic cyst	2 (3.3)	2 (6.5)	0 (0.0)	17	17
Thyroglossal cysts	2 (3.3)	0 (0.0)	2 (6.9)	47	46-48
Total	60 (15.1)	31 (14.1)	29 (16.3)	30.2	10-62

On the other hands, there was significant association between female patients and benign lesions in which the associated odds ratio was 1.7 with CI 95% ranged from 1.1 to 2.6, with X^2 equal to 6.1 and p equal to 0.01. Also, there was a significant association between female patients and reactive lesions in which the associated odds ratio was 3.8 with a CI of 95% ranging from 1.02 to 14.4, with X^2 equal to 4.6 and p equal to 0.03. However, there was no significant association between other types of lesions and gender (Table 2).

The most common malignant lesion in the current study was Squamous cell carcinoma counting 68.8% of total malignant lesions followed by Verrucous carcinoma counting 7.1% of total malignant lesions, while others types of malignancy are less frequent as shown in Table 3. When sex and age characteristics were analyzed, squamous cell carcinoma was roughly equal in males, counting 74.2% vs. 70% in females (Table 3). The mean age for squamous cell carcinoma was 56.7 years and ranged from 30 to 77 years. For verrucous carcinoma, the total prevalence was 7.1% with roughly similar prevalence in both genders (7.5%), with mean age equal to 56.6 years and their ages ranged from 50-60 years. For basal cell carcinoma, the total prevalence was 5%, with higher prevalence in females equal to 7.5% vs. 7.5% in female patients, with a mean age equal to 63.6 years, and their ages ranged from 61 to 73 years. For lymphoma, the total prevalence was 6.4%, with higher prevalence in females equal to 15% vs. 3.2% in male patients, with a mean age equal to 48 years, and their ages ranged from 47 to 53 years. Other types of malignant lesions are presented in Table 3, which showed less frequency for other malignancies. The most common benign lesions in the current study were fibromas, counting for 28.8% of total benign lesions**,** followed by hemangiomas and ameloblastoma, counting for 13.6% each from the total benign lesions, while other types of benign lesions are less frequent, as shown in Table 4. When sex and age characteristics analysis fibroma was roughly equal in males counting 29.6% VS 28.1% in females (Table 3). The mean age for fibroma was 38 years and ranged from 30-50 years. For Hemangioma, the total prevalence was 13.6% with higher prevalence in males (18.5%, vs 9.4% in females), with mean age equal to 27.6 years and their ages ranged from 7-37 years. For ameloblastoma, the total prevalence was 13.6%, with higher prevalence in males equal to 16.7% vs. 10.9% in male patients, with a mean age equal to 44 years, and their ages ranged from 43 to 78 years. For giant cell granuloma, the total prevalence was 11.9%, with higher prevalence in females equal to 18.7% vs. 3.7% in male patients, with a mean age equal to 27 years, and their ages ranged from 30-50 years. Other types of benign lesions presented in Table 4, which showed less frequents for other benign lesions. The most common cystic lesion in the current study was radicular cyst counting 58.3% of total cystic lesions followed by Dentigerous cysts counting 25% from the total cystic lesions, while others types of cystic lesions are less frequent as shown in Table 5. When sex and age characteristics were analyzed, the radicular cyst was roughly equal in both sexes (males counting 58.1% vs. 58.6% in females (Table 5).

Table 6: Age and gender characteristics of oral and maxillofacial inflammatory lesions among Yemeni patients in Sana'a city.

Inflammatory lesions	Total 398	Male 220	Female 178	Mean Age years	Age Range years
Epithelial hyperplasia	10 (21.3)	4 (13.3)	6 (35.3)	65	55-73
Traumatic ulcer	21 (44.7)	15 (50)	6 (35.3)	34.6	23-60
Osteomyelitis	13 (27.7)	9 (30)	4 (23.5)	55.6	32-61
Granulomatous inflammation	3 (6.4)	2 (6.7)	1 (5.9)	41	4-60
Total	47 (11.8)	30 (13.6)	17 (9.6)	49.1	4-73

Table 7: Age and gender characteristics of oral and maxillofacial premalignant lesions among Yemeni patients in Sana'a city.

Premalignant lesions	Total 398	Male 220	Female 178	Mean Age years	Age Range years
Epithelial dysplasia	5 (38.5)	4 (57.1)	1 (16.7)	47	34-55
Leukoplakia	5 (38.5)	2 (28.6)	3 (50)	55	54-60
Papillomatous squamous hyperplasia	3 (23.1)	1 (14.3)	2 (33.3)	34	33-35
Total	13 (3.3)	7 (3.2)	6 (3.4)	45.3	34-60

The mean age for radicular cyst was 38 years and ranged from 10-62 years. For dentigerous cysts, the total prevalence was 25%, with higher prevalence in males (29% vs. 20.7% in females), with a mean age equal to 27 years, and their ages ranged from 19 to 43 years. Other types of cystic lesions are presented in Table 5, which showed less frequency for other cystic lesions. The most common inflammatory lesions in the current study were traumatic ulcers, counting for 44.7% of total inflammatory lesions**,** followed by osteomyelitis, counting for 27.7% of total inflammatory lesions, while other types of inflammatory lesions are less frequent, as shown in Table 6. When sex and age characteristics were analyzed, traumatic ulcer was higher in males, counting 50% vs. 35.3% in females (Table 6). The mean age for traumatic ulcer was 34.6 years and ranged from 32 to 60 years. For osteomyelitis, the total prevalence was 27.7%, with higher prevalence in males (30% vs. 23.5% in females), with a mean age equal to 55.6 years, and their ages ranged from 32 to 61 years. Other types of inflammatory lesions are presented in Table 6, which showed less frequency for other inflammatory lesions.

Table 9: Age and gender characteristics of oral and maxillofacial miscellaneous lesions among Yemeni patients in Sana'a city.

Miscellaneous lesions	Total 398	Male 220	Female 178	Mean Age Years	Age Range Years
Lichen planus	4 (57.1)	1 (50)	3 (60)	44	41-57
Amyloidosis	3 (42.9)	1 (50)	2 (40)	51	35-58
Total	7 (1.8)	2 (0.9)	5 (0.6)	47.5	35-58

The most common premalignant lesions in the current study were epithelial dysplasia and leukoplakia, each counting for 38.5% of the total premalignant lesions**,** followed by papillomatous squamous hyperplasia, counting 23.1% from the total premalignant lesions**,** while other types of premalignant lesions are less frequent, as shown in Table 7. When sex and age characteristics were analyzed, epithelial dysplasia was higher in males, counting 57.1% vs. 16.7% in females (Table 7). The mean age for epithelial dysplasia was 47 years and ranged from 34 to 55 years. For leukoplakia, the total prevalence was 38.5%, with higher prevalence in females (50% vs. 28.6% in females), with a mean age equal to 55 years, and their ages ranged from 54 to 60 years. Other types of premalignant lesions are presented in Table 7, which showed less frequency for other premalignant lesions. The most common reactive lesions in the current study were pyogenic granulomas, counting for 66.7% of total reactive lesions**,** followed by lichenoid-like reactions, counting for 33.3% of total reactive lesions, as shown in Table 8. When sex and age characteristics were analyzed, pyogenic granuloma was higher in females, counting 88.9% vs. 0.0% in males (Table 8). The mean age for pyogenic granuloma was 35 years and ranged from 26 to 44 years. For lichenoid-like reactions, the total prevalence was 33.3%, with a higher prevalence in males (100% vs. 0.0% in females), with a mean age equal to 62 years, and their ages ranged from 60 to 65 years. The most common miscellaneous lesions in the current study were lichen planus**,** counting 4 cases, one male and 3 females total. Miscellaneous lesions followed by amyloidosis count 3 cases, one male and 3 female, as shown in Table 9.

DISCUSSION

The study reported a variety of lesions, with approximately 45 diverse diagnoses, a lower figure than previous studies[21-23]. However, a larger study such as that by Jones and Franklin reported a wider range of oral lesions[24]. The occurrence of these diverse lesions in Yemeni patients reflects different socio-cultural practices, such as qat chewing and snuff[25], which is similar to the dipping of tobacco among Sudanese[26], and cigarette and shisha smoking among Egyptians[27], all of which may be a factor of the development of oral lesions in this region.

The average age of malignant OMLs was 41.3 years, which is younger than the average age in other studies[21,23], but a much lower age was reported in earlier Saudi Arabian studies[22,28-30]. The study's male preponderance contrasts with other studies that indicate a higher prevalence of OMFLs in females[21,24,28]. The most common category was oral malignant lesion, accounting for 35.43% of all OMLs, which is higher than the incidences of 9.9% in Saudi Arabia[28], 14.9% in the United Arab Emirates[31], 7.8% in India[32], and 5.4% in the United Kingdom[24]. The variations in earlier studies may have been caused by different data collection methods.

Squamous cell carcinoma accounted for 68.8% of all malignant lesions in the current investigation, making it the most prevalent kind (Table 3). This leads to agreement with Saudi Arabian research[33,34]. Squamous cell carcinoma was prevalent, accounting for 68.8% of malignant neoplasms of the mouth, which is less than the 92.2% incidence that has been recorded in Pakistan[35]. Incidences ranging from 73 to 84% have also been found in other studies; for example, 84% in Jordan[36], 77% in the United Arab Emirates[31], and 73.6% in Sudan[26]. The study found that 35.4% of the mouth biopsied lesions had oral cancer. Spain (1.4%) [23], Brazil (2.5%)[37], Libya (8%)[38], Nigeria (10.8%)[39], and the United Arab Emirates (14.9%)[31] had significantly lower prevalence. The native practice of using Shammah and qat in Yemen is linked to the greater incidence of oral cancer in our dataset. This finding is consistent with other research that linked Shammah to oral cancer in Saudi Arabia's southwest[33,35,39]. Nonetheless, Pakistan has a significantly higher reported prevalence of oral cancer (55.8%), which could be brought on by regional or socioeconomic variations in risk factors as well as disparities in health care quality[42]. The oral squamous cell carcinoma prevalence extended from 3–4% of all malignancies in most studies conducted in Europe and the United States. The prevalence has been described to be high in Southeast Asia, where the figures exceed 30% of all malignancies[43]. The male-to-female ratio is similar to previous studies in Saudi Arabia, where the ratio was 1:1.9[44,45], but differs from most other reports, where it was predominantly male[31,46,47]. In the current study, squamous cell carcinoma was roughly equal in males, counting 74.2% vs. 70% in females (Table 3). Longer life expectancy and/or continuous usage of Shammah may be the cause of the similar prevalence of OSCC in this series. Considering the location of oral, maxillofacial and facial lesions among Yemeni patients, the tongue was the most commonly affected site by malignant lesions. It accounted for 49.6% of the total tongue lesions. This is likely due to sublingual snuff dipping, a common practice in Yemen. This result is also in line with a number of earlier studies that showed that snuff users frequently develop oral cancer on their tongues[33]. Due to a lack of public awareness of pertinent health services and preventive measures, the prevalence of oral cancer will not change and may possibly rise in the near future.

In the present study, when considering the location of oral, maxillofacial and facial lesions among Yemeni patients with benign lesions, the maxilla and mandible were the most affected sites, with benign lesions accounting for 22.9% and 29.96% of the total benign lesions, respectively, followed by the lip area with 14.4%, oral mucosa with 12.7%, and tongue with 12.7%, while other sites were less or not affected by benign lesions (Table 1). The incidence rate of benign lesions compared to malignant tumors was 1:1.2. This could be due to the fact that cases are not often referred to specialists or biopsied. This conclusion is comparable to the findings observed by Jones *et al.*[24], who reported approximately equal numbers of benign and malignant tumors. However, our result is different from that reported by Saleh *et al.*[21], in Saudi Arabia where the ratio of benign to malignant lesions was 1:4.5. The ratio of benign to malignant lesions in the tongue is 1:4.7. This result differs from the surveillance made by Jones *et al.*[24], who reported an approximately identical number of benign and malignant tumors in the tongue. However, our result is similar to that reported by Saleh *et al.*[21], in Saudi Arabia where the ratio of benign to malignant lesions in the tongue is 1:3.8.

In the present study, when considering the association of oral, maxillofacial and facial lesion types with sex, there was a significant association between male patients and malignant lesions with the associated odds ratio of 1.98 with a 95% confidence interval ranging from 1.3 to 3.1, with X^2=10 and p=0.0015. This finding contrasts with that reported from Saudi Arabia[21] where females were more affected by malignant tumors, while benign tumors showed a slight male predilection and were affected.

In the present study, pleomorphic adenoma was very rare, a finding that differs from that reported by Saleh *et al.*[21], in Saudi Arabia where pleomorphic adenoma is a common tumor. pleomorphic adenoma showed significant geographic variation in prevalence and distribution, being predominant in most studies[47,48] while odontoma was more common among Caucasians[49]. Similar to previous studies, females were more commonly affected, and the onset of the disease was common in the third decade[50].

In the current study, fibromas were the most common benign lesions, accounting for 28.8% of the total benign lesions, followed by hemangiomas and odontogenic adenomas, accounting for 13.6% each of the total benign lesions, while other types of benign lesions were less frequent, as shown in Table 4. This finding is different from that reported in Saudi Arabia where odontogenic lesions were the most common, followed by ameloblastoma, a finding consistent with other reports[22,51]. A review of the prevalence of odontogenic tumors worldwide showed that KCOT was the third most common tumor after ameloblastoma and odontogenic tumors[52]. Other odontogenic tumors were rare, including a case of ameloblastoma.

In contrast to other reports where inflammatory lesions were the second most prevalent group of OMLs, mainly of a chronic non-odontogenic kind, our study found that inflammatory lesions were the fourth most common category of OMLs[21,48].

The cystic lesions in the current study were one of the most common categories of OMLs. The most common

cystic lesions in the current study were radicular cysts, counting 58.3% of total cystic lesions, followed by dentigerous cysts, counting 25% of total cystic lesions, while other types of cystic lesions are less frequent, as shown in Table 5. When sex and age characteristics were analyzed, the radicular cyst was roughly equal in both sexes (males counting 58.1% vs. 58.6% in females) (Table 5). The mean age for radicular cysts was 38 years and ranged from 10 to 62 years. For dentigerous cysts, the total prevalence was 25%, with higher prevalence in males (29% vs. 20.7% in females), with a mean age equal to 27 years, and their ages ranged from 19 to 43 years. Other types of cystic lesions are presented in Table 5, which showed less frequency for other cystic lesions, although inflammatory lesions are expected to be more common than cysts[24,53].

The most common inflammatory lesions in the current study were traumatic ulcers, accounting for 44.7% of all inflammatory lesions, followed by osteomyelitis, accounting for 27.7% of all inflammatory lesions. Although small in number, osteomyelitis is a serious complication of oral inflammatory disease, highlighting the importance of proper oral health care. Of concern, this study reported 13 cases of osteomyelitis in children with a mean age of 13 years. Jones *et al.*[24], reported osteomyelitis in an older age group (mean age 50.6±14.1 years). Vesicular proliferative periostitis is a common healing response to osteomyelitis in children or adolescents[54].

The most common reactive lesions in the current study were pyogenic granulomas, accounting for 66.7% of the total reactive lesions, followed by lichenoid reactions, accounting for 33.3% of the total reactive lesions. The incidence of reactive conditions in our study was go down contrast to other studies[21,24], but a higher rate was described in Saudi Arabia by Nartey *et al.*[41]. Most of these cases were pyogenic granulomas (66.7% of the total reactive lesions), followed by lichenoid reactions, accounting for 33.3%. The cause of such ulcers is that these sites are often exposed to harmful environmental factors[55].

Limitations of the study

Cross-sectional methodology makes it challenging to infer causal linkages because exposure and outcome are measured once. Due to the short time frame for data collection and the fact that the study was restricted to a single Yemeni location, these kinds of studies are also susceptible to certain biases.

CONCLUSIONS

Total 30.5% of benign lesions were odontogenic and 9% of all oral and periodontal tumors in our study. Inflammatory lesions involve a low incidence of cellulitis and abscesses are easily diagnosed and hence; this is attributed to the low demand for histopathological examination. Of interest in the recent study was the high incidence of traumatic ulcers (44.7%) of the inflammatory lesion group, these chronic ulcers were mostly on the tongue and in most cases were caused by a chronic irritant and most of the time developed silently; such as sharp tooth edges, sharp deformed or broken teeth and other social habits such as; qat chewing, these ulcers require public awareness because the risk of these benign chronic inflammatory ulcers turning into malignant lesions, these dangerous lesions should be given importance to medical and dental care providers by educating patients about the importance of early diagnosis and treatment of this type of lesions. Keratinizing squamous cell carcinoma is the most common subtype (59%), followed by non-keratinizing squamous cell carcinoma (27%), and verrucous squamous cell carcinoma (6%).

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AUTHOR'S CONTRIBUTIONS

Al-Sayadi AS: formal analysis, conceptualization, data organization to obtain a board's degree in maxillofacial surgery. **Al-Rahbi LM:** statistical analysis, review. **Al-Shamahy HA:** critical review, supervision. **Al-Ashwal AA:** review and editing. Final article was checked and approved by all authors.

DATA AVAILABILITY

Upon request, the accompanying author can furnish the empirical data used to bolster the findings of the study.

CONFLICT OF INTEREST

There are no conflicts of interest in regard to this project.

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