ORIGINAL ARTICLE

The association between medical diseases and orofacial abscess: A retrospective, hospital-based study

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Abstract *Objective:* This study aimed to identify the most commonly reported medical diseases among dental patients and to assess its association with the development of the orofacial abscess.

Methods: The medical records (n = 3164) of dental patients who visited the dental hospital at Umm-Al-Qura University (Makkah, Saudi Arabia) were reviewed. Demographic characteristics of eligible patients were collected. Medical diseases were collected as reported by the patients in the medical records. The International Classification of Diseases (ICD-10) was used to classify the reported medical diseases. Simple descriptive statistics were used to define the characteristics of the study variables through a form of counts and percentages. Multivariable logistic regression analysis was carried out to find out the significant predictors of orofacial abscess.

Results: Upon reviewing 3164 medical records, almost half of the patients had medical diseases (n = 1543, 49%). The mean age of the cohort was 30.3 (SD = 16.43). Diabetes mellitus (n = 316, 20%) and hypertension (n = 210, 14%) were the most common reported medical diseases. Male patients reported having more medical diseases compared to the female. Hypertension was found to be significantly high among female patients (X^2 = 3.167, P-value < 0.001). Multivariable logistic regression analysis indicated that the female gender is significantly associated with the development

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of orofacial abscess after adjustment for age and vascular risk factors (i.e., hypertension) (B = 1.26, S.E. = 0.57, OR = 3.54, 95%CI = 1.13 to 11.40, P-value = 0.028).

Conclusion: Dentists should be aware that diabetes mellitus and hypertension are prevalent among patients visiting dental services. The female gender has a higher association of developing orofacial abscess than male. Within the limitation of this study in a single study center with few patients having orofacial abscess, this study found no association between medical diseases and the development of orofacial abscess.

1. Introduction

Orofacial abscess is a common sequela of infection among dental patients (Bertossi et al., 2017). It founds in both genders equally (1:1) (Bertossi et al., 2017). Several factors contribute to the development of orofacial abscess. For instance, dental caries, dental trauma and poor oral hygiene are common factors for the development of orofacial abscess (Sanders and Houck, 2019). Basically, after the invasion of the intact pulp chamber by bacteria, a colonization process by invasive bacteria takes place within the root canal space, which affects the periodontal region of the infected tooth. However, orofacial abscess develops when these colonizations invade the adjacent orofacial spaces beyond the periodontal region of the tooth structure (Hupp and Ferneini, 2016). Patients with orofacial abscess have common signs and symptoms such as; fever, intraoral or extraoral swelling with or without pain, trismus and pus discharge (Hupp and Ferneini, 2016). The majority of orofacial abscess responds well to either endodontics treatment or dental extraction of the infected tooth, with/without antimicrobial agent (Hupp and Ferneini, 2016).

In Saudi Arabia, Hamasha et al. (2018) showed that male patients were found to act less than female patients in oral health aspects (i.e., behaviors); hence male patients have poorer oral health. A cross-sectional study in Saudi Arabia reported that the prevalence of medical diseases is higher among male patients due to the high body mass index (Saquib et al., 2017). The orofacial abscess may develop if the patients do not improve their poor oral health. Several studies reported how medical diseases impact negatively on the oral health due to poor access to dental services or negative effects of medical disease and its treatment on oral health (Abed, 2017, Abed and Ainousa, 2017, Abed et al., 2018, Aljabri et al., 2018, Abed et al., 2019a, Abed et al., 2019b). However, the causation between medical diseases and poor oral health is still ambiguous and no study yet explores the impact of medical diseases on the development of the orofacial abscess. Therefore, this study aimed to identify the most commonly reported medical diseases among dental patients and to assess its association with the development of the orofacial abscess.

2. Material and method

2.1. Study type and setting

This was a retrospective analysis of 3164 medical records of dental patients who visited the dental hospital at Umm Al-Qura University, Makkah, Saudi Arabia from 2014 to 2015.

2.2. Study procedures

Demographic characteristics such as age, gender, and past medical history of the patients were collected from the medical records. Medical diseases were collected as reported by the patients during the first dental assessment visit before any dental treatment was received. The International Classification of Diseases (ICD-10) of the World Health Organization (WHO) was used to classify the medical diseases (World Health Organization, 2019). Chief complaints of orofacial abscess (i.e., dental, non-dental and facial swelling) were collected as reported by patients and diagnosed by dentists who performed the dental examination.

2.3. Inclusion and exclusion criteria

Medical records of all patients who visited the dental hospital for a dental assessment visit and aged 16 years old or above were considered in the study. The dental assessment visit should be delivered by staff dentists who are qualified and trained to assess dental patients and have obtained a full medical, dental, social, and family history, as well as performing comprehensive extra-oral and intra-oral examinations. Medical records of patients who had urgent dental care and did not have a dental assessment visit prior to any dental treatment and/or aged < 16 years old were not included in this study.

2.4. Hypothesis

H₀. There is no association between medical diseases and orofacial abscess.

H₁. There is association between medical diseases and orofacial abscess.

2.5. Data analysis

A simple descriptive analysis was performed to define the characteristics of the study sample through a form of counts and percentages. To establish a relationship between categorical and non-categorical variables, chi-square and independent t-tests were used, respectively. A multivariable logistic regression model was constructed to adjust and find out the significant predictors of orofacial abscess. The statistical significance was assumed at a 5% level. Both RStudio (version 1.1.423) and the Statistical Package for Social Science (Released 2015, IBM SPSS Statistical for Windows, Version 23.0,

Armonk, NY: IBM Corp) were used to perform this study analysis.

2.6. Sample size calculation

A minimum of 55 was enough to assess if there is a significant association between medical diseases and orofacial abscess. The sample size was calculated based on regression analysis at the 5% level of significance with 80% power (effect size $f^2 = 0.15$ with 5 variables). The G*power 3.1.9.2 was used to calculate sample size.

2.7. Ethical approval

Ethical approval was obtained from the Institutional Review Board (IRB) at King Abdulaziz University (proposal number: 012–14), Jeddah, Saudi Arabia.

3. Results

3.1. Characteristics of study population

Table 1 presents characteristics of the study population. Upon reviewing 3164 medical records, almost half of the patients had medical diseases (n = 1543, 48.8%). The mean age of the cohort was 30.3 (SD = 16.43). The majority of patients were male (n = 835, 54%). Fig. 1 presents a treemap chart showing the most common reported medical diseases by the dental patients at Umm Al-Qura University Dental Hospital from 2014 to 2015. Diabetes mellitus (n = 316, 20%) and hypertension (n = 210, 14%) were the most common reported medical diseases, followed by allergy (n = 179, 12%), headache (n = 154, 10%), osteoporosis (n = 103, 7%), anemia (n = 103, 7%), visual impairment (n = 101, 6%), hypotension (n = 67, 4%), ischemic heart diseases (n = 53, 3%), skin diseases (n = 45, 3%), and lastly other medical diseases (n = 212, 14%). Few patients (n = 14, 1%) had orofacial abscess.

3.2. Characteristics of male and female patients

Table 2 presents characteristics of the study population according to the gender distribution. The average age of the male patients was 31.2 (SD = 14.57), while the average age of the female patients was 29.3 (SD = 17.73). Age (>30 years old) was found to be significantly high among male patients (t = 11.132, P-value = 0.001). Male patients (n = 835, 54%) reported having more medical diseases compared to females (n = 708, 46%). Hypertension was found to be significantly high among female patients (X^2 = 3.167, P-value = 0.001).

3.3. Factors associated with the development of orofacial abscess

Table 3 presents the outcomes of multivariable logistic regression analysis for factors associated with orofacial abscess. Eight female (1.1%) and 6 male (0.7%) patients had orofacial abscess. Multivariable logistic regression analysis indicated that female gender is significantly associated with the development of orofacial abscess after adjustment for age and vascular risk factors (i.e., hypertension) (B = 1.26, S.E. = 0.57, OR = 3.54, 95% CI = 1.13–11.40, P-value = 0.028). Diabetes was not significantly associated with orofacial abscess (B = 0.67, S.E. = 1.07, OR = 1.96, 95% CI = 0.10–10.9, P-value = 0.530).

Table 1 Characteristics of study population (n = 1543).

Parameter		Total	
		N	%
Age (mean; years)		30.3; SD = 16.43	
Gender	Male	835	54.0
	Female	708	46.0
Types medical diseases (n = 1543)*	Diabetes mellitus	316	20.5
	Hypertension	210	13.6
	Allergy	179	11.6
	Headache	154	9.9
	Osteoporosis	103	6.8
	Anemia (low hemoglobin level)	103	6.8
	Visual impairment	101	6.5
	Hypotension	67	4.3
	Ischemic heart diseases	53	3.4
	Skin diseases	45	2.9
	Others **	212	13.7
Orofacial abscess		14	1.0

* The International Classification of Diseases (ICD-10). For instance, diabetes mellitus (5A10 + 5A11), hypertension (BA00.Z), Allergy (4A8Z), headache (8A8Z), osteoporosis (FB83.1Z), anemia (3A9Z), visual impairment (9D9Z), hypotension (BA2Z), ischemic heart diseases (BA6Z), and skin diseases (EM0Z).

** Other medical diseases such as; cancer, osteoarthritis, respiratory and infectious diseases.
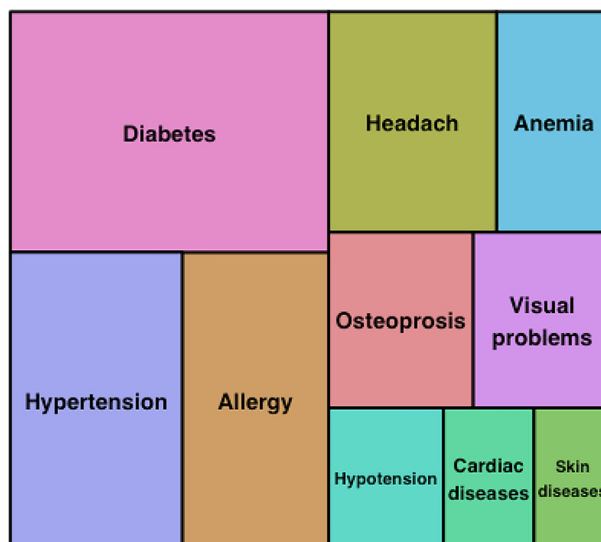

Fig. 1 A treemap chart showing the most common reported medical diseases by dental patients.

4. Discussion

This study aimed to identify the most common reported medical diseases among dental patients and to assess the predictors for the development of orofacial abscess. It found that the prevalence of medical diseases among dental patients was

Table 2 Characteristics of male (n = 835) and female (n = 708) patients.

Parameter		Male		Female		P-value	
		n	%	n	%		
Age	≤30 years	381	46.0	467	66.0		
	> 30–50 years	354	42.0	179	25.0	t = 11.132	0.001*
	> 50 years	100	12.0	62	9.0		
Types of medical diseases	Diabetes mellitus	161	19.3	155	21.9		
	Hypertension	78	9.3	132	18.6		
	Allergy	89	10.6	90	12.7		
	Headache	66	7.9	88	12.4		
	Osteoporosis	55	6.6	48	6.8		
	Anemia (low hemoglobin level)	67	8.0	36	5.2	X^2 = 3.167	0.001*
	Visual impairment	54	6.5	47	6.6		
	Hypotension	29	3.5	38	5.4		
	Ischemic heart diseases	28	3.4	25	3.5		
	Skin diseases	35	4.2	10	1.4		
	Others **	173	20.7	39	5.5		

X^2: Chi-squared test score.
t: Independent t-test score.
  * P-value < 0.01.
 ** Other medical diseases, such as cancer, osteoarthritis, respiratory and infectious diseases.

Table 3 The outcomes of multivariable logistic regression analysis for factors associated orofacial abscess.

	Orofacial abscess*		Multivariable logistic regression analysis				
	No (n = 728) n(%)	Yes (n = 14) n(%)	B	S.E.	OR	95%CI	P-value
Age (mean; years)	28.9; SD = 13.10	28.5; SD = 14.10	−0.02	0.03	0.97	0.92–1.02	0.351
Gender (Female)	203(28.0)	8(57.0)	1.26	0.57	3.54	1.13–11.40	0.028**
Medical diseases							
** Diabetes mellitus**	36(4.9)	2(14.3)	0.67	1.07	1.96	0.10–10.9	0.530
** Hypertension**	18(2.5)	0(0.0)	N/A	N/A	N/A	N/A	1.000

N/A: Multivariable logistic regression analysis was not applicable due to insufficient sample size.
  * The % in this table was calculated for each variable by column.
 ** P-value < 0.05.

higher than other reported studies. For instance, James et al. (2015) found that 16.3% (Total = 566) of dental patients had medical diseases, while Walia et al. (2017) found it to be 26.5% (Total = 5040). These percentages rose in our study to almost 49%. It has been reported that the Saudi Arabian population has a high prevalence of chronic medical diseases associated with risk factors (Saquib et al., 2017). This could be explained by poor lifestyles. For instance, low physical activity level, low consumption of fruits and vegetables and the high proportion of smokers have been reported as leading causes for the majority of medical conditions affecting the Saudi population (Moradi-Lakeh et al., 2015, El Bcheraoui et al., 2016, Alzahrani and Alamri, 2017). Dental care providers can play an important role by educating patients about maintaining a healthy lifestyle including smoking cessation and healthy diet which impacts positively on their oral and dental health, and indeed on their general health. Furthermore, dental care providers should understand how these medical diseases affect patients' oral and dental health, which

sometimes necessitate a modified treatment plan; hence a regular update to medical diseases and its impact on oral and dental health is crucially recommended.

Our study also indicated that males reported having more chronic diseases than females. In Saudi Arabia, a cross-sectional study found that males have more chronic illness than females due to the high prevalence of overweight and obesity among male patients (Saquib et al., 2017). Therefore, male patients are expected to have more oral and dental diseases related to their medical diseases and tobacco use, which required more attention and a strong preventive program dentally and medically.

The most common reported medical diseases by patients in this study were diabetes mellitus followed by hypertension. Several studies reported that diabetes mellitus (Elhadd et al., 2007, AlMazroa, 2018), followed by hypertension (El Bcheraoui et al., 2014, Memish, 2014) are major burdens in Saudi Arabia. As discussed earlier, poor lifestyle including low physical activity level, malnutrition and the high preva-

lence of tobacco use are the main reasons for the high prevalence of the diabetes and hypertension among the Saudi population. Therefore, it's important for dental care providers to understand how both diseases (i.e., diabetes and hypertension) affect oral and dental health. For example, several studies have proven the negative impact of diabetes mellitus on oral and dental health, including gingival and periodontal diseases and a poor healing process (Kudiyirickal and Pappachan, 2015, Alzahrani and Abed, 2016, Preshaw and Bissett, 2019). Other studies showed how maintaining good oral and dental health impacts positively on the oral health-related quality of life in patients living with diabetes (Vergnes et al., 2018). In a similar way for hypertension, anti-hypertension agents develop several side-effects including dry mouth (Scully, 2003). Dry mouth impacts negatively on oral and dental health as it leads to the development of dental caries (Sharma, 2019). Thus, patients need to pay attention to the negative impact of such medications to oral and dental health, but without encouraging them to stop taking their medication.

Allergy and osteoporosis were also reported among the most common medical diseases. It has been reported that anaphylactic shock in dental clinic is to be 0.015 to 0.04 cases/dentist/year (Müller et al., 2008, Arsati et al., 2010) with morbidly of 0.5% to 1.3% of all cases (Helbling et al., 2004, Moneret-Vautrin et al., 2005). Unfortunately, the incidence of anaphylaxis in Saudi Arabia is unknown (Sheikh et al., 2015). Similarly, patients with moderate to severe osteoporosis may take intravenous bisphosphonate to help reduce bone resorption. Patients who are taking the bisphosphonate are at a high risk for the development of the medication-related osteonecrosis of the jaw (MRONJ); which is difficult to manage if it developed; hence the patients require a pre-bisphosphonate dental assessment and regular review (Abed and Al-Sahafi, 2018). In Saudi Arabia, osteoporosis is common among Saudi females due to the dressing customs and avoidance of sun exposure (Al-Saleh et al., 2015). Thus, dental care providers should understand the impact of osteoporosis and its medications on oral and dental health to avoid unexpected complications (i.e., MRONJ or jaws fracture).

Some patients in this study reported having anemia, hypotension and ischemic heart diseases. A cross-section study in the Eastern Province of Saudi Arabia listed orthostatic hypotension among medical emergency encountered by dentists (21.3%) (Alhamad et al., 2015). Care should be taken in patients with hypotension, specifically during adjusting the dental chair to prevent orthostatic hypotension. Similarly, anemia (low hemoglobin level below 10 g/dl) should be managed before any dental treatment that planned under conscious sedation or general anesthesia (Abed et al., 2019c). Furthermore, some patients reported to have cardiac conditions; hence they may require antibiotic cover to prevent the development of the infective endocarditis (Tubiana et al., 2017). Thus, dental care providers should liaise with the patient's cardiologist before any invasive dental procedures that may lead to bacteremia (i.e., dental extraction).

Poor oral health was found to be associated with the development of systemic diseases, such as cardiovascular diseases and diabetes mellitus (Li et al., 2000). On the other hand, within the limitation of our study with few cases of orofacial abscess, medical diseases were found to be not significantly associated with the development of orofacial abscess. A case control study found that patients with myocardial infarction might have poor oral health compared to the healthy population, which indirectly could lead to developing oral abscess if poor oral and dental health is left without improvement and treatment (Willershausen et al., 2009). However, this is an indirect association and the presence of the diseases itself seems to be not significantly related to the development of oral abscess. Similarly, patients with diabetes mellitus are known to have weak immune system; hence, this could lead to accelerating the development of orofacial abscess. Again, this could be an indirect association. Further studies are required to investigate the impact of medical diseases (i.e., diabetes mellitus and hypertension) on the development of orofacial abscess.

4.1. Clinical recommendations

Diabetes and hypertension have an impact on oral and dental care; they necessitate taking a clear medical history prior to oral and dental care. It is important for dental care providers to understand how these diseases impact negatively on oral and dental health and to understand how to manage it dentally. It is the responsibility of the dentist to prevent disability and aggravation of a medical disorder of a patient during the course of treatment. Similarly, dental care providers advise and educate patients about the importance of maintaining good oral and dental health. Lastly, dental care providers are also advised to understand signs and symptoms of common diseases to help refer any suspicious cases to the patient's physician.

4.2. Study limitations

The data was collected from a single center without a control group; hence large sample size is required. Few cases of orofacial abscess were included in this study, which may affect the findings about negative association of medical diseases and orofacial abscess. This study may have limitations on the number of variables included in the logistic regression; other crucial variables may affect current findings if they are included in the data analysis (i.e., oral hygiene level and tobacco use).

5. Conclusions and future research

Among the most common reported medical diseases, the majority of patients had diabetes mellitus and hypertension. Male patients were reported to have more medical diseases compared to the female. However, gender was not significantly associated with medical diseases. Hypertension was found to be significantly high among female patients. Multivariable logistic regression analysis indicated that there was no association between medical diseases and the development of orofacial abscess, but it indicated that female gender is significantly associated with the development of orofacial abscess after adjustment for age and vascular risk factors, including hypercholesterolemia and hypertension.

Further study is required to assess how dental care practitioners are able to manage the most common medical diseases among dental patients. This will help to understand barriers that may counter dental care providers during oral and dental management of dental patients with most common reported medical diseases. This study also recommends a powered study with a large sample size to assess the association between medical diseases and oral abscess, if it exists.

Ethical statement

Ethical approval was obtained from the Institutional Review Board (IRB) at King Abdulaziz University (proposal number: 012–14), Jeddah, Saudi Arabia.

Authors Contribution

All authors contributed equally.

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Declaration of Competing Interest

The authors declared that there is no conflict of interest.

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