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Review Article

THE INCIDENCE OF ORAL CANDIDIASIS IN PATIENTS WITH DIABETES MELLITUS: A CROSS-SECTIONAL STUDY IN SOUTHERN VIETNAM

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Abstract

Background: Different studies conducted nationally and internationally to find out the different factors for oral fungal infection in the diabetic patients. The connection between hyperglycemia and Candida' infection has been studied extensively. However, this issue is underexplored in Vietnamese context. This study aimed to investigate the incidence of oral candidiasis among patients with type-II diabetes admitted to hospitals in southern Vietnam.

Methods: A cross-sectional study was conducted in five healthcare centers in southern Vietnam from July 2019 to December 2019. Total sampling method was applied. Patients who previously diagnosed with diabetes, hospitalized due to all-cause, and volunteer to participated was included

Microsoft Excel for Window version 2010 was used for data management. Descriptive statistics and logistics regression were performed by SPSS version 20.0.

Results: There were significant associated of age and duration of diabetes on the risk of candida infection. The older the patient is and the longer they suffered from diabetes, the higher probability they get candidiasis ($p<0.05$).

Conclusion: The incidence of oral fungal infection especially candidiasis increased with the duration of diabetes along with poor glycemic control and with the higher age group of the patients.

Keywords: Candidiasis, diabetes mellitus, oral hypoglycemic, insulin.

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INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder marked by elevated levels of blood sugar. There are currently 2 main etiologies of diabetes i.e. the hypo-secretion of insulin from pancreas and the reduced sensitivity of body cell toward insulin [1]. Diabetes has three main subtypes. Type 1 DM (juvenile diabetes) mostly occurred in young people below the age of 30 years. This is due to hypo secretion of insulin from the beta cell of pancreas. Type 2 DM (adult onset diabetes) often occurred in obese patient above the age of 30 years. This is due to the decrease sensitivity of body cells toward the insulin. Gestational diabetes occurred in the pregnant women without the prior history of diabetes. In 2017, the prevalence of adult-onset diabetes globally (20–79 years) was equal to 425 million, and by 2045 the World Health Organization and the International Diabetes Federation predicted that the percentage of adults with diabetes worldwide will rise by approximately 629 million [2, 3].

Studies carried out in 2015 have shown that 415 million people worldwide had diabetes with type 2 diabetes affecting 90 percent of people [4]. Comparison of recent research reveals that diabetes prevalence continues to rise quickly. Diabetes raises death risk by 2-fold. Between 2012 to 2015, there were about 1.5 to 5.0 million mortality due to diabetes each year [5]. Diabetes increased the risk of complication including both micro and marco vascular complications. Marco vascular complications involve diabetic neuropathy, diabetic nephropathy, heart diseases, stroke and peripheral arterial disease. In micro vascular complications patient cutaneous manifestation are much important and in above group infection especially fungal infection are more frequent. Oral candidiasis is the most severe fungal infection of diabetic patients, found in the oral cavity with the wipeable white plaques, i.e. tongue buccal mucosa, palate, gingivae and mouth surface [6].

Different studies conducted nationally and internationally to find out the different factors for oral fungal infection in the diabetic patients. The major predisposing factors are oral hygiene, glycemic control, smoking, duration of diabetes, type of therapy and xerostomia [7, 8]. The higher *Candida sp.* is due to several pathways. Predisposition among patients with DM according to localized or structural infection. Identified host variables for candida colonization and subsequent infection include adhesion of leaves to epithelial cell membranes, increased levels of salivary glucose [9, 10], and decreased salivary flow [11]. Such factors have a major impact on the host-yeast balance, which promotes *Candida sp.* transition from commensal to pathogenic, inducing infection. The connection between diabetes and candidiasis has been studied extensively [9, 12-16], however, underexplored in Vietnamese context. This study aimed to investigate the incidence of oral candidiasis among patients with type-II diabetes admitted to healthcare centers in southern Vietnam.

PATIENTS AND METHODS:

Study design

A cross-sectional study was conducted in five healthcare centers, including primary medical centers, clinics and hospital, which were located in Long An province in southern Vietnam.

Study subjects

Patients with diabetes mellitus, including all types, were enrolled for the data collection. From July 2019 to December 2019, total sampling method was applied. Patients who previously diagnosed with diabetes, hospitalized due to all-cause, and volunteer to participated was included. Exclusion criteria was infection with other fungi not *Candida sp.*. Interviewers invited the patients join the study when they are waiting for their prescription or for their pharmaceuticals. The questionnaire was self-design, including characteristics of patients with discrete choice. Clinical information was extracted from their medical records.

Data analysis

Microsoft Excel for Window version 2010 was used for data management. Descriptive statistics and logistics regression was performed by SPSS version 20.0. The independent variables were patients demographical and clinical characteristics. The dependent variable was the probability of candidiasis (with or without *Candida sp.* infection).

RESULTS

Total 305 patients were recruited in the study, out of which 190 were male and 115 were female. Mean age of the patients was 56.82±5.64 (**Table 1**).

Table 1. Characteristics of diabetes patients (N=305)

Characteristic	**N(%)**
Age (years old)	
Mean (standard deviation)	56.8±5.6
Median (interquartile range)	55 (50-66)
Min-Max	39-80
<45	89 (29.2)
45-60	135 (44.3)
≥60	81 (26.6)
Gender	
Male	190 (62.3)
Female	115 (37.7)
Residence	
Rural	136 (44.6)
Urban	169 (55.4)
Type of diabetes	
Type 1	67 (22.0)
Type 2	238 (78.0)
Therapies	
Lifestyle change only	7 (2.3)
Oral hypoglycemia agents	145 (47.5)
Insulin	111 (36.4)
OHAs + insulin	42 (13.8)
History of diabetes (year(s))	
<5	69 (22.6)
5 -10	67 (22)
10-15	117 (38.4)
≥15	52 (17.0)
Comorbidity	
None	4 (1.3)
Respiratory diseases	15 (4.9)
Cardiovascular diseases	124 (40.7)
Psychology diseases	7 (2.3)
Gastrointestinal diseases	59 (19.3)
Kidney diseases	98 (32.1)
Other discomforts	9 (3.0)
Note: Data presented as n (%) unless state otherwise	

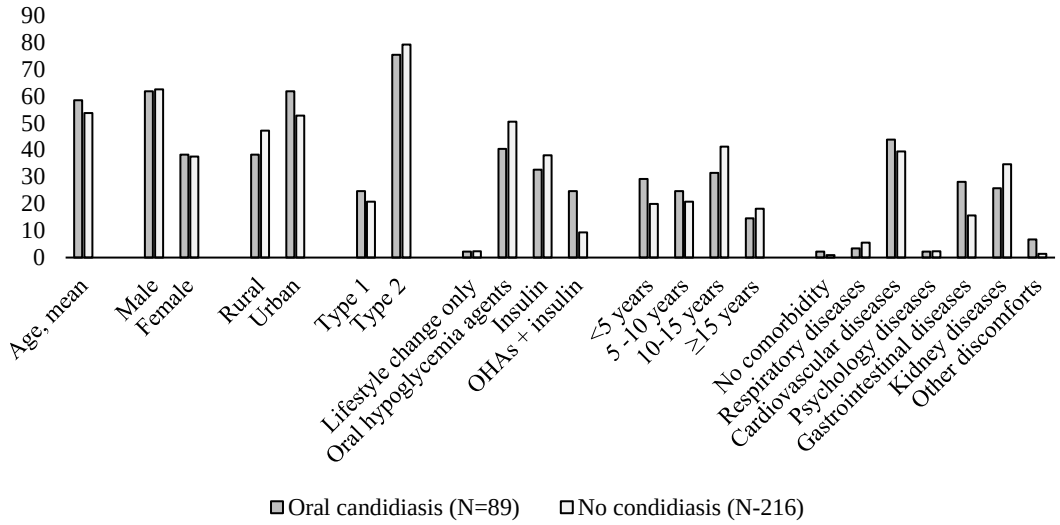

Figure 1. Difference in characteristics of patients with and without candidiasis

Figure 1 shows the difference in demographical and clinical characteristics of patients between two groups. The contribution of these factors on the probability to be candidiasis is tabulated in **Table 2**. There were significant associated of age and duration of diabetes on the risk of candida infection. The older the patient is and the longer they suffered from diabetes, the higher probability they get candidiasis (P<0.05).

Table 2. Logistic regression

	OR (95% CI)	P-value
Age (years old)		
<45	1	
45-60	1.56 (1.23 – 1.89)	0.002
≥60	1.73 (1.58 – 2.45)	0.014
Gender		
Male	1	
Female	1.56 (0.97 – 2.09)	0.073
Residence		
Rural	1	
Urban	0.89 (0.54 – 2.32)	0.127
Type of diabetes		
Type 1	1	
Type 2	0.23 (0.02 – 1.03)	0.089
Therapies		
Lifestyle change only	1	
Oral hypoglycemia agents	1.23 (1.04 – 2.45)	0.065
Insulin	1.45 (0.98 – 1.98)	0.102
OHAs + insulin	1.23 (0.73 – 1.49)	0.003
History of diabetes (year(s))		
<5	1	
5 -10	1.12 (1.02 – 1.98)	0.045
10-15	1.45 (1.34 – 1.65)	0.001
≥15	1.78 (1.39 – 2.03)	0.007
Comorbidity		
None	1	
Respiratory diseases	2.45 (2.03 – 3.09)	0.003
Cardiovascular diseases	0.99 (0.56 – 1.43)	0.236
Psychology diseases	1.01 (0.65 – 3.04)	0.346
Gastrointestinal diseases	0.56 (0.23 – 0.97)	0.098
Kidney diseases	4.01 (3.04 – 5.60)	0.005
Other discomforts	0.12 (0.01 – 1.34)	0.128
Note: Data presented as n (%) unless state otherwise		

DISCUSSION

Oral candidiasis is growing in prevalence, being one of the most serious fungal infections [17]. Differential forms of mucosal alterations such as erythematous, pseudomembranous, and curd-like plaques (biofilms) can be treated with oral candidiasis [18, 19]. In patients with type 1 DM, higher *Candida sp.* colonization levels were registered relative to patients with type 2 DM (84% vs. 68% respectively), while in nondiabetic patients the figure was about 27% [16]. *Candida sp.* has particular characteristics. Several studies have identified a correlation between development of hydrolytic enzymes and an increase of Candida's pathogenic capacity [20, 21]. Biofilms are microorganism populations that are found in extracellular matrix [22, 23], That confer significant antifungal resistance and improved immune responses of the host [24, 25][26, 27]. Because hydrophobic interactions seem crucial for the promotion of tissue invasion by Candida's mycelial process.

Benefit factors for the disease are nuanced, but it is known that tongue lesions, tobacco using, denture wearing (e.g. diabetes) directly influence oral *Candida sp.* delivery and the development of oral candida infection [28-34]. The above results show that the increasing age is the important risk factor of developing oral fungal infection in diabetic patients. However, there are various studies in which this trend is not well appreciated. Relationship among the duration of diabetes and oral infection in not well established [4]. In the study done by Lamey et al. [35] no association was found between the duration of illness and oral fungal infection. However, in the study mentioned above there is significant relation is showed between the duration and frequency of illness. The frequency goes on increasing with the increase in the duration of diabetes.

In this study the type of treatment plans whether the patient is on oral hypoglycemic or using insulin is not well noted. Similarly gender based difference have not been noted in this study. The incidence of oral candidiasis in various studies is noted more in the diabetes type 1 as compared to diabetes type 2. Other contributory factors include the poor glycemic control of patient and poor oral hygiene. The greater HbA1c, the greater will be the frequency of oral candidiasis. Among the fungal infections, oral candidiasis is more common in the humans. Oral candidiasis would result in the pain and discomfort or oral cavity, which would be responsible for malnutrition in the diabetes patients. Therefore, this should be managed properly with tight glycemic control along with good oral hygiene and community awareness.

CONCLUSION

The frequency of oral candidiasis was well associated with the duration of diabetes mellitus and age of the patient. Gender and type of treatment i.e. oral hypoglycemic or insulin, related association was not found is this study.

CONFLICTS OF INTERESTS

The authors have no conflicts of interests to declare.

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