Determinants of severe periodontal disease among diabetes mellitus patients, attending Ndola central hospital in Zambia

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Abstract

Aim: To determine the prevalence and factors associated with severe periodontal disease among diabetic patients. **Design:** Cross sectional study. **Study subjects and methods:** Diabetes mellitus patients visiting their regularly scheduled medical review at NCH Diabetic clinic participated in the study. Data collection was done using a pretested structured questionnaire and the oral examination was done according to the WHO 1987 Oral Health Surveys. Levels of fasting blood glucose were recorded. SPSS version 16 was used for data analysis, level of significance was set at $p \leq 0.05$. **Results:** 133 diabetic patients aged 20 to 80 years were enrolled in the study of whom 55.5% were females. A larger proportion of patients with higher education were more affected by bleeding (67.1%) than those with low education (47.9%), ($\chi^2 = 4.47$, p=0.035). Proportionately more patients aged 55 years or older (47.4%) had deep pockets compared to 29.1% of those aged less than 55 years, the difference was statistically significant (p=0.040). More than half of the patients who reported brushing <2 times a day (51.9%) had deep pockets compared to 22.2% of those reporting to brush two or more times per day, ($\chi^2 = 11.78$, p<0.001). **Conclusion:** Older patients and those reporting to brush less than twice per day had deep pockets.

Key words: Severe periodontal disease, diabetes mellitus, brushing, patients, Zambia.

Introduction

International Diabetes Federation (IDF) estimated 366 million people (8.3% of the world population) to have diabetes in 2011. The federation also projected by 2030 about 522 million (9.9% of the world population) people will be affected (1). Clear evidences both in animal and human model prove a two way relationship between diabetes especially Type 2 and periodontal diseases (2-5). Higher glucose levels, increased urea concentration in gingival crevicular fluid as well as thickening of basement membrane and glycosylation of haemoglobin promote a unique environment, resulting in pathogenic shifts of the microbial flora in diabetic patients (6). This environment favours growth of gram negative anaerobes which are responsible for periodontal diseases (7). On the other hand periodontal disease has an influence on the course of diabetes as it complicates glycemic control (2,8,9). Patients with severe forms of periodontitis have poor glycemic control (9, 10) and studies have shown that improvement in periodontal health results in improvement in glycemic control (11,12).

Diabetic patients have been shown to have higher risk of developing periodontal diseases especially severe forms of periodontitis compared to non diabetic patients after controlling for age, sex and other confounders(13,14). Prevalence and severity of periodontal disease increases with age among diabetic and non diabetic patients but oral hygiene has been shown to be an important determinant (15]). Other factors affecting prevalence and severity of periodontal disease among diabetic patients include diabetic age, glycemic control (20), smoking behaviour (16,17), compliance with treatment (17) and dental visits (18).

Prevention of periodontal disease is more important in diabetic than in non-diabetic patients as the disease may result in poor function due to tooth loss or pain therefore leading to improper diet (15). Secondly periodontal disease may complicate glycemic control of the patients (2). The third reason is the fact that mucosa of diabetic patients

cannot tolerate dentures and implants (19) signifying the importance of maintaining healthy natural dentition. Due to dual occurrence and mutual relationship of periodontal disease and diabetes, knowledge of the magnitude and associated factors of periodontal diseases among diabetic patients is important. Furthermore, a dentist and physician should work together as control of one can affect the other.

Little is known on the magnitude of diabetes in Zambia. A study done in Lusaka urban estimated prevalence of diabetes at 4% (27). The magnitude and influence of periodontal disease on diabetes among the patients is also unknown. The current study therefore aimed at assessing prevalence and determinants of severe periodontal diseases among diabetic patients in Ndola, Zambia. The study is important towards understanding the need of mutual management of diabetic patients between physicians and dentist and proper planning for improving oral and general health of diabetic patients in Zambia.

Methodology

A cross-sectional study was conducted among known diabetic patients (both Type 1 and 2) who visited Ndola Central Hospital for their routine appointments from April to May 2015. Completely edentulous patients were excluded from the survey. Approval to conduct the study was obtained from the Copperbelt University School of Medicine and permission to conduct the study was granted by Ndola Central Hospital Management. Verbal consent was obtained from each individual participant.

Data collection was done using a pretested structured questionnaire and oral examination was done according to WHO 1987 Oral Health Surveys (28) using dental mirror and CPITN probe under natural light at the diabetic unit [21]. Contents of questionnaire included demographic information, oral hygiene practices, smoking behaviour, and compliance with diabetic management. Only fasting blood glucose (FBG) values were recorded, due to lack of reagents for glycated haemoglobin and these were recorded as (normal 3.5 to 5.5mmol/l and high > 5.5mmol/l) using the laboratory reference range (2). Periodontal examination findings were recorded per sextants using Index teeth 11, 16, 17, 26, 27, 31, 36, 37, 46, and 47. Coding was done in the following manner, 0 = healthy, 1= bleeding, 2= calculus, 3 = pocket 4 -5 mm, 4 = pocket 6mm or more and 9 = not recorded and these codes represented the periodontal status (as worst findings) for each sextant. Data was thereafter dichotomized into 1=normal and 2 for abnormal findings for bleeding, calculus and pockets in any of the index teeth representing sextants. Pockets of 6mm or more were regarded as severe periodontal diseases in this study. Data was entered using Epi Info version 3.1 and exported to Statistical Package for Social Sciences (SPSS) version 16 for data analysis. Yates corrected test was used to determine correlates for periodontal status. The cut off point for statistical significance was set at 0.05

Results

A total of 133 diabetic patients (both Type 1 and 2) were enrolled in this study. Age and diabetic age were missing in one of the participants (Note the total for age and diabetic age are 132) . More than half (55.5%) of the participants were females. Patients age ranged from 20 to 80 years (mean 54± 1.3). More than half of the participants (68.2%) had diabetic age of below 15 years as shown in table 1. About two thirds (63.2%) of patients had completed tertiary education. 15.0% of the patients reported smoking behaviour. Alcohol drinking behaviour was significantly (p = 0.062) more reported among males (36.7) than females (20.5%) reported by males (36.7%) than females (20.5%). More than half (59.4%) of the patients reported brushing their teeth less than 2 times a day Majority (82.3%) had poor periodontal health and most of the patients (82.7%) had their fasting blood glucose (FBG) levels above5.5 mmol/l (Table 1).

Table 1: Distribution of participants according to demographics, smoking and drinking habits, brushing habits and FBG levels by sex

FACTOR	TOTAL n(%)	Sex		^{2}-test	P. value
		Male n(%)	Female n(%)		
Age					
20 - 54	55(41.4)	27(45)	28(38.4)	0.762	0.383
55+	78(58.6)	33(55)	45(61.6)		
Diabetic age					
<15	90(67.7)	43(70.5)	47(65.3)	0.616	0.433
≥15	43(32.3)	17(29.5)	25(34.7)		
Education					
1-3 secondary	49(36.8)	20(33.3)	29(39.7)	0.578	0.447
4-5 Tertiary	84(63.2)	40(66.7)	44(60.3)		
Occupation					
Employed	75(56.4)	39(65)	36(49.3)	3.295	0.07
Unemployed	58(43.6)	21(35)	37(50.7)		

Smoking					
Yes	20(15.0)	10(16.7)	10(13.7)	0.227	0.634
No	113(85.0)	50(83.3)	63(86.3)		
Drinking Alcohol					
Yes	37(27.8)	22(36.7)	15(20.5)	4.261	0.039
No	96(72.2)	38(63.3)	58(79.5)		
Brushing/day					
<2	79(59.4)	40(66.7)	39(53.4)	2.394	0.122
≥2	54(40.6)	20(33.3)	34(46.6)		
FBG					
Normal	23(17.3)	10(16.7)	13(17.8)	0.03	0.862
High	110(82.7)	50(83.3)	60(82.2)		

Bleeding, shallow pockets, and deep pockets (as worst findings) were found on 60.2%, 77.2% and 39.8% of patients respectively.

Table 2 shows distribution of participants by socio-demographic factors, oral hygiene habits and FBG levels by bleeding upon gentle probing. Our findings revealed no statistically significant differences in bleeding, by age, diabetic age, occupation, smoking and drinking behaviours as well as FBG levels. Bleeding upon gentle probing was significantly associated with education (p=0.035) and frequency of tooth brushing (0.023). Patients with higher education were more affected (67.1%) than those with low education. More than eighty percent (85.2%) of those who reported to brush 2 times or more per day were found with positive bleeding upon gentle probing.

Table 2: Distribution of participants by social demographic factors, oral hygiene habits and FBG levels by bleeding upon gentle probing

Variable	Total	Bleeding upon gentle probing		^{2}-test	P. value
		Bleeding	No bleeding		
Age					
<55	55 (41.4%)	33(60.0%)	22(40.0%)	0.025	0.875
≥55	78(58.6%)	47(60.3%)	31(39.7%)		
Diabetic age					
<15	90(67.7%)	56(62.2%)	34(37.8%)	0.441	0.506
≥15	43(32.3%)	25(58.1%)	18(41.9%)		
Education					
Up to Sec	48(36.1%)	23(47.9%)	25(52.1%)	4.469	0.035
Tertiary	85(63.9%)	57(67.1%)	28(32.9%)		
Occupation					
Employed	75(56.4%)	46(61.3%)	29(38.7%)	0.159	0.690
Unemployed	58(43.6%)	34(58.6.%)	24(41.4%)		
Brushing					
<2	79(59.4%)	67(84.8%)	12(15.2%)	0.004	0.953
≥2	54(40.6%)	46(85.2%)	8(14.8%)		
Smoking					
Yes	20(15%)	13(65.0%)	7(35.0%)	0.260	0.610
No	113(85%)	67(59.3%)	46(40.7%)		
Drinking alcohol					
Yes	37(27.8%)	24(64.9%)	13(35.1%)	0.538	0.463
No	96(72.2%)	56(58.3%)	40(41.7%)		
FBG					
Normal	23(17.3%)	17(73.9%)	6(26.1%)	1.822	0.177
High	110(82.7%)	63(57.3%)	47(42.7%)		

Nearly half of the participants (47.4%) aged 55 years or older had deep pockets unlike those aged less than 55 years (29.1%), the difference was statistically significant (p=0.040). Deep pockets were significantly associated with frequency of tooth brushing whereby more than half of the patients who reported brushing <2 times a day (51.9%) had deep pocket compared to 22.2% of those reporting to brush two or more times per day,($\chi^2 = 11.78$, $p<0.001$).

Discussion

This study sought to determine the factors associated with developing severe periodontal disease in diabetic patients and its social demographic correlates. Periodontal disease was prevalent among patients who participated in the survey (97.7%). Similar to other authors (7, 9, 25,

31) we found high prevalence of severe periodontal diseases. There was no statistical association between severe periodontal disease and increased age in logistic regression model. These findings are contrary to findings from other studies that reported periodontal diseases increases with age among diabetic patients (7, 25, 29, 30). A study done in Pima India reported significant increase in periodontal disease among older patients aged 55 years or older (30). Another study done by Moore et al (24) also reported severe periodontal diseases increasing with age. The difference between our findings and other studies may be due to increase in oral health promotion through media may have contributed to increase in awareness of individuals on prevention of periodontal disease. In this study more than half of the participants reported brushing 2 time or more. This could be an explanation of age not being the main determinant of periodontal disease.

We also found frequency of brushing to be associated with severity of periodontal diseases. In this study patients brushing <2 times a day constituted almost two thirds (64.0%) of those found with shallow pockets and more than three quarters of patients with deep pockets. Also frequency of brushing was statistically associated with bleeding. The observation could be explained by the reason that plaque accumulation is likely to be controlled by brushing two times or more a day than once as this increases possibility of reaching missed areas than only when one brushes once (6). The finding supports other studies which reported frequency of brushing as an important predictor of severe forms of periodontal diseases among diabetic patients (33).

Table 3: Distribution of participants by social demographic factors, oral hygiene habits and FBG levels by pocket depth

Variable	Total	Probing Pocket		^{2}-test	P value
		Deep pocket	No pocket/Shallow pockets		
Age					
<55	55 (41.4%)	16(29.1%)	39(70.9%)	4.21	0.040
≥55	78(58.6%)	37(47.4%)	41(52.6%)		
Sex					
Male	60(45.1%)	21(35.0%)	39(65.0%)	1.07	0.3
Female	73(54.9%)	32(43.8%)	41(56.2%)		
Diabetic age					
<15	90(68.2%)	32(35.6%)	58(64.4%)	2.486	0.115
≥15	42(31.8%)	21(50.0%)	21(50.0%)		
Education					
Sec	49(36.8%)	21(42.9%)	28(57.1%)	0.293	0.588
Tertiary	84(63.2%)	32(38.1%)	52(61.9%)		
Occupation					
Employed	75(56.4%)	30(40.0%)	45(60.0%)	0.002	0.968
Unemployed	58(43.6%)	23(39.7%)	35(60.3%)		
Brushing					
<2	79(59.4%)	41(51.9%)	38(48.1%)	11.785	0.001
≥2	54(40.6%)	12(22.2%)	42(77.8%)		
Smoking					
Yes	20(15%)	11(55.0%)	9(45.0%)	2.254	0.133
No	113(85%)	42(37.2%)	71(62.8%)		
Drinking alcohol					
Yes	37(27.8%)	15(40.5%)	22(59.5%)	0.01	0.920
No	96(72.2%)	38(39.6%)	58(60.4%)		
FBG					
Normal	23(17.3%)	9(39.1%)	14(60.9%)	0.006	0.938
High	110(82.7%)	42(38.2%)	68(61.8%)		

Cigarette smoking is an established risk factor for developing periodontal disease in both healthy and diabetic patients (9, 16, 23, 25), however our findings did not support this finding. The reason may be due the fact most patients reported quitting smoking immediately after being diagnosed as diabetic patients. Patients having known risk factors for periodontal disease, such as smoking, increased age and diabetes may require more frequent visits to the dentists.

In this study, gender, diabetic age, education, occupation, and alcohol consumption were not significantly associated with severe periodontal disease. Contrary to our findings, other authors reported severe periodontal disease being associated with increased age, duration of diabetes and smoking (9, 23, 33).

Establishing the magnitude of periodontal diseases and its determinants among high risk groups such as diabetic patients, smoking habits and increased age is important in properly planning their dental care. These patients may require close care of the dentists than general population (25) due to higher risk of impaired oral health (32, 33). Diabetics have higher rates of tooth loss, periodontal disease and soft tissue diseases than in non diabetic patients (24). Prevention of these oral health sequelae depends on education and health promotion strategies such as proper oral hygiene practice and diet, early diagnosis, rigorous glycemic control and smoking cessation counselling (16, 22). Dental practitioners have a responsibility to educate diabetic mellitus patients about periodontal disease.

Considering that glycated haemoglobin levels were not taken, this gives a limitation for this study on ascertaining proper diabetic control of the patient and its association with severe periodontal disease.

Conclusion

Older patients and those reporting to brush less than twice per day had deep pockets.

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