

Contributing Factors for Oral Manifestations in Patients with End-Stage Chronic Kidney Disease

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Abstract: The authors aimed to investigate the contributing factors for certain oral manifestations characteristic of patients with chronic kidney disease (CKD). The study involved 70 CKD patients. The objective findings were gathered using criteria for the extent of tongue coating and by means of FitScan Breath Checker. Patients' oral hygiene was measured using Greene and Vermillion's index. The results indicated statistically significant correlations between the type of dentition and the extent of halitosis and between the patient's age and the degree of tongue coating. The study demonstrated the influence of functional pathology on the incidence of dental rows defects with age and among CKD patients.

Keywords: age factor, CKD, hemodialysis, oral manifestations

1. Introduction

Oral symptoms were observed in 90% of patients suffering from kidney disease and were often associated with the end stage of the disease and its treatment [1]. They are commonly the result of the metabolic and physiological changes characteristic of the disease. Previous studies focus on the relationship between the duration of the dialysis treatment and the development of oral lesions [2]. The oral manifestations in this group of patients frequently include excessive accumulation of plaque, dry mouth, tongue coating, uremic breath, etc. [2, 3,4,5].

As early as 1979 Oshrainet al. reported a strong correlation between the accumulation of plaque and gingival inflammation in patients with chronic renal failure under going hemodialysis[6]. Epstein, Mandel and Scopp explored the same group of patients and found evidence that CKD patients formed heavy calculus [7,8].

2. Objective

To explore the effects of factors such as age, gender, oral hygiene status and the present defects in dental rows on some oral manifestations (halitosis, tongue coating) characteristic of patients with end-stage chronic kidney disease (CKD) on renal replacement therapy (RRT).

3. Material and Methods

The clinical study was approved by the Research Ethics Committee at the Medical University of Varna with Protocol No. 55/ 16 June 2016. The cross sectional study involved 70 patients: 37 women (52.9%) and 33 men (47.1%), aged 58.9 ± 14.5, undergoing chronic dialysis treatment (the youngest participant being 32 years old and the oldest patient being 89 years old), grouped according to age as per WHO classification [9].

All patients underwent extra- and intraoral examinations. A dental diagnostic card reflected the oral hygiene index by Greene and Vermillion for calculus (tartar) and debris (plaque). (Figure 1)

Dental Diagnostic Card									
Patient's name:					Age:				
Telephone:									
Oral hygiene index by Greene and Vermillion (DI): debris (plaque)									
16	14	11	21	24	26	0 - No debris or stain present			
						1 - Soft debris covering not more than 1/3 of the tooth surface			
						2 - Not more than 2/3 of the exposed tooth surface.			
						3 - More than 2/3.			
46	44	41	31	34	36				
Oral hygiene index by Greene and Vermillion (CI): calculus									
16	14	11	21	24	26	0 - No calculus present			
						1 - Supragingival calculus			
						2 - subgingival calculus			
						3 - Supragingival and subgingival calculus			
46	44	41	31	34	36				

Figure 1: A dental diagnostic card for the oral hygiene index by Greene and Vermillion

The objective findings were gathered through visual inspection of the dorsum of the tongue in a protruded position and were recorded using criteria, proposed by the researchers of the present study. The criteria were designed based on statistical analysis and the Index of Kojima et al. (1985) [10]:

- 1) No tongue coating visible;
- 2) Tongue coating on the dorsum of the tongue visible at the tongue root (Radix linguae), extending to 2 mm from the median line (Linea medianalingue);
- 3) Tongue coating visible from the tongue root to the middle of the dorsum and extending to 3 mm from the median line;
- 4) Tongue coating visible over the middle of the dorsum, extending to 4 mm from the median line;
- 5) Tongue coating visible down to the tip of the tongue and extending to 4 mm from the median line.

The degree of halitosis was objectively recorded with FitScan Breath Checker (HC-212SF, Tanita Corporation, USA). The device measured the content of volatile sulfur compounds (VSCs), hydrogen sulphide (H₂S), methyl mercaptan (CH₃SH), dimethyl sulphide (CH₃-S-CH₃) and hydrocarbons in the oral cavity, taking readings in 5 degrees: 0 - no odor, 1 - slight odor, 2 - moderate odor, 3 - heavy odor, 4 - strong odor, 5 - intense odor.

The statistical analysis of data was performed using SPSS Statistics software package for epidemiological and clinical research (V.17.00). The following statistical methods were applied to confirm statistically significant correlations between qualitative variables: Spearman's coefficient, Pearson's correlation coefficient, Kendall's tau-b coefficient of concordance, independentsamplest-test, cross tabulation, calculation of relative frequency distributions, graphic representation of data, etc.

4. Results

Based on the data obtained the patients were divided in the following groups according to the type of defects in the dental rows, i.e. the type of dentition. (Table 1)

Table 1: Distribution of patients according to the type of defect in the dental rows

Type of dentition	Number of patients	Relative percentage
Intact dentition	12	17.14%
Partial edentulism	46	65.71%
Complete edentulism	12	17.14%
Total	70	100.00%

The analysis of the data showed that 83.4% of patients with complete edentulism exhibited halitosis degree 4 or degree 5. On the other hand, 83.3% of patients with intact dentition had halitosis degree 1 or degree 2, while 76.1% of patients with partial edentulism suffered from halitosis degree 3 or degree 4. (Table 2)

Table 2: Cross-tabulation of data on the degree of halitosis and type of dentition

Halitosis Degree	Type of dentition	Count	Type of dentition			Total
			Intact dentition	Partial edentulism	Complete edentulism	
1	Count	1	2	0	3	
	% of row	33.3%	66.7%	.0%	100.0%	
	% of column	8.3%	4.3%	.0%	4.3%	
2	Count	9	7	1	17	
	% of row	52.9%	41.2%	5.9%	100.0%	
	% of column	75.0%	15.2%	8.3%	24.3%	
3	Count	0	16	1	17	
	% of row	.0%	94.1%	5.9%	100.0%	
	% of column	.0%	34.8%	8.3%	24.3%	
4	Count	2	19	8	29	
	% of row	6.9%	65.5%	27.6%	100.0%	
	% of column	16.7%	41.3%	66.7%	41.4%	
5	Count	0	2	2	4	
	% of row	.0%	50.0%	50.0%	100.0%	
	% of column	.0%	4.3%	16.7%	5.7%	
Total	Count	12	46	12	70	
	% of row	17.1%	65.7%	17.1%	100.0%	
	% of column	100.0%	100.0%	100.0%	100.0%	

The significance of the type of dentition and the presence of unpleasant breath in the study group of patients was examined using Kendall's correlation coefficient. A moderately strong, statistically significant correlation was

established between the type of dentition and the degree of halitosis in those patients (Kendall's tau b = 0.442, p < 0.005, N = 70).

The patient's age presupposed the type of dentition in the Study group. Spearman's correlation coefficient revealed a moderately strong, statistically significant correlation between the two parameters (Spearman's rho = 0.489, p > 0.005, N = 70). Then a partial correlation was conducted on the type of dentition and the degree of halitosis, removing the effect of "patient's age" on the correlation. The results revealed that by eliminating the effects of age on the correlation, there was no statistically significant dependence (r = 0.114, p = 0.35, N = 70) between the type of dentition and degree of halitosis.

The data obtained directed the authors' attention to the study of the relationship between patients' age and the degree of halitosis. Pearson's coefficient indicated a strong, direct, statistically significant correlation between the two values (r = 0.821, p < 0.005, N = 70). By removing the effects of "type of dentition" on the correlation, the relationship between age and the degree of halitosis remained strong and statistically significant (r = 0.77, p < 0.005, N = 70).

The study of the relationship between the age of CKD patients and the extent of the tongue coating, with the elimination of the effects of the type of dentition" on the correlation, showed that there was a strong, direct, statistically significant correlation between the two values (r = 0.735, p < 0.005, N = 70). By removing the effects of "the type of dentition", the relationship between age and the extent of tongue coating remained strong and statistically significant (r = 0.68, p < 0.005, N = 70). (Figure 2)

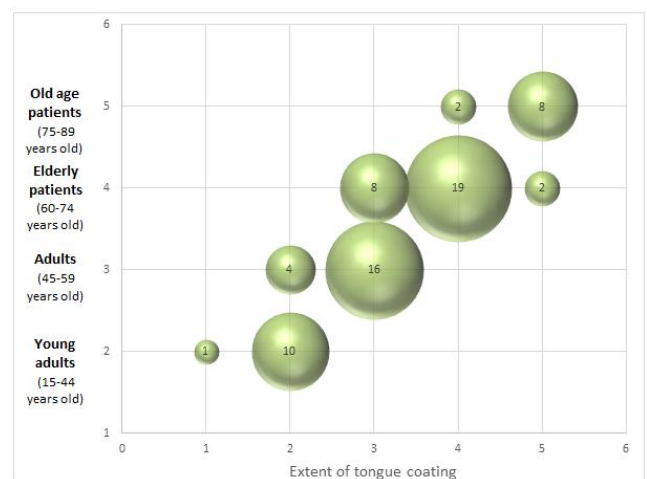


Figure 2: Distribution of patients according to age and the extent of tongue coating

It is reasonable to say that age had less influence on the degree of halitosis (coefficient of determination = 59.3%) rather than on the extent of tongue coating (coefficient of determination = 46.2%).

The study demonstrated that the values of the oral hygiene index were normally distributed (Kolmogorov-Smirnov test Z = 0.077, p = 0.200). However, according to Pearson's correlation coefficient there was no statistically significant

dependence ($r = 0,075$, $p = 0.577$) between patients' age and the oral hygiene index.

For the purpose of comparing the oral hygiene index in both men and women, an independent (unpaired) sample t-test was run, revealing no statistically significant correlation between the oral hygiene index in male patients (Mean = 4.42, Std.Dev = 1.20) and female patients (Mean = 4.13, Std.Dev = 1.20, $t(56) = 0.93$, $p = 0.35$ two-tailed).

The data showed that the oral hygiene index did not affect the degree of halitosis ($p = 0.195$) and the extent of tongue coating ($p = 0.179$).

5. Discussion

This study demonstrated the influence of functional pathology on the incidence of dental rows defects with age and among CKD patients. The data collected from the available dental literature on the relationship between age and halitosis appear controversial. Evirgen et al. failed to prove dependence between halitosis diagnoses and patients' age or gender [11]. In a 2007 research Nadanovsky et al. reported more than three times higher risk of malodour in people over 20 years of age compared to those aged 20 years or under [12]. The authors of the present study also demonstrated statistically significant correlations between the type of dentition and the degree of halitosis and between patients' age and the degree of halitosis. Using Pearson's coefficient, a statistically significant correlation ($r = 0.735$, $p < 0.005$) between patients' age and the extent of tongue coating was found. The data obtained revealed that age and gender were not contributing factors affecting the oral hygiene index of patients undergoing chronic dialysis treatment ($r = 0,075$, $p = 0.577$). Furthermore, the oral hygiene index was not a factor influencing oral manifestations such as halitosis and tongue coating ($p = 0.195$ for the degree of halitosis and $p = 0.179$ for the extent of tongue coating).

6. Conclusion

Patients' age appeared to considerably contribute to the presence of oral manifestations such as halitosis and tongue coating in CKD patients yet had no significant connection with the oral hygiene index. As a result of the changes in the functional and physiological balance of the masticatory apparatus occurring with age in patients undergoing hemodialysis treatment, their dentition gradually becomes partially edentulous and in severe cases completely edentulous.

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