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ORIGINAL ARTICLE

Clinical questionnaire study of oral health care and symptoms in diabetic vs. non-diabetic predialysis chronic kidney disease patients

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Abstract This paper aims to study oral symptoms (burning mouth sensation, xerostomia, dysphagia, and dysgeusia) and background characteristics among chronic kidney disease (CKD) patients. The hypothesis was that patients experience oral discomfort and show interest towards dental care differently depending on the origin of their kidney disease. One hundred thirty-eight CKD patients at predialysis stage (94 men, 44 women, mean age 54 years) at the Helsinki University Central Hospital participated in the study. The patients were divided into a diabetic nephropathy group and a group of patients with other kidney diseases. The patients had a clinical oral examination and filled in a structured questionnaire. The data were analyzed and compared between the groups (SPSS for Windows version 15.0). *T* test was used for parameters normally distributed while binomial data were analyzed with cross-tabulations and chi-square test. Contrary to our study hypothesis, no statistically significant differences were seen in the questionnaire study between the diabetic vs. non-diabetic CKD patients in any other study parameter except in the use of medication (10±2.3 vs. 8±3.1 drugs daily, $p<0.05$), and working status (23.5% vs. 50% working full time, $p<0.01$). No difference was seen in the frequency of oral discomfort among the different groups. Xerostomia, however, was frequently observed among the predialysis patients investigated (41.7% in diabetic, 48.2% in non-diabetic patients). No difference was seen in the frequency of oral discomfort among the different groups of predialysis patients investigated. Clinicians should be aware of nephropathy patients who frequently suffer from oral discomfort, particularly xerostomia.

Keywords Burning mouth sensation · Chronic kidney disease · Diabetes mellitus · Oral symptoms · Predialysis · Xerostomia

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Introduction

This study describes oral symptoms and various background characteristics in severe chronic kidney disease (CKD) patients. CKD is a worldwide public health problem associated with increased risk of cardiovascular disease, morbidity, and mortality. The ageing of populations along with the growing prevalence of diabetes and other chronic diseases is leading to worldwide increase in the prevalence of CKD and finally to kidney failure [1].

Risk factors for CKD include cardiovascular diseases, diabetes mellitus, hypertension, chronic glomerulonephritis, uropathy, systemic autoimmune diseases, and obesity [2–4]. Current evidence suggests that the two major causes of kidney disease worldwide are hypertension and diabetes [5, 6]. The total number of diabetic patients is projected to increase globally from 171 million in 2000 to 366 million in 2030 [7]. When defined by a glomerular filtration rate (GFR) of 60 ml/min/1.73 m^2 or less, the approximate CKD prevalence across Europe, Asia, North America, and Australia is 2–11% of the population [1].

CKD may cause variety oral symptoms which include xerostomia, periodontal disease [8–13], gingival bleeding [14], and stomatitis [15, 16].

However, data are sparse regarding oral symptoms among the patients with kidney disease. Knowing the diabetes-associated oral symptoms [17], we anticipated that differences might be seen in subjective oral discomfort in CKD patients with this background, when compared with patients with other causes of the renal disease. Hence, we set out to study in a cross-sectional convenience sample the frequency of xerostomia and burning mouth syndrome in patients with kidney disease of the predialysis stage. Because low salivary secretion and yeast infection are known risk factors for oral discomfort [18], we also measured the patients salivary flow rates and took samples for yeast cultivation.

Material and methods

The patients

Altogether, 178 patients with CKD at predialysis stage had clinical oral examination. Of these patients, 138 (44 women, 94 men, mean age 54 years, range 23–83) were finally included in our questionnaire study. Of the original patient material, 30 patients were excluded from the analyses due to exclusion criteria: a GFR assessed by 24-h creatinine clearance >30 ml/min/1.73 m^2 and/or a dialysis treatment already started. The inclusion criteria were age greater than 18 years and GFR <30 ml/min/1.73 m^2 (CKD stages 4 and 5) and/or a plasma creatinine level ≥250 μmol/l. Further, 10 patients refused to participate in the questionnaire study giving thus a final response rate of 93%.

The group of subsequent patients consisted of 37% of patients with diabetic nephropathy (29 patients with type 1 diabetes mellitus and 22 patients with type 2 diabetes mellitus), 21% of patients with chronic glomerulonephritis, 20% of patients with polycystic kidney disease, 13% of other specified kidney disease patient; 9% had an unspecified kidney failure. According to our study hypothesis, namely that the patients experience oral discomfort and show different interest towards dental care depending on the origin of their kidney disease, we divided the patients for further analyses into those with or without diabetic nephropathy. The results of the clinical oral examination have been published earlier [19]. The present article gives the results mainly of the questionnaire study of the 138 patients.

Interview

The patients were questioned by the dentist who also had performed the clinical examination. A structured form was used in recording the patients' oral sensations (open questions about "burning mouth" [BMS], "xerostomia", "dysphagia" [difficulty of swallowing], and "dysgeusia" [an alteration in taste]) as well as background characteristics (educational level, working status, and smoking habits). The choice of answers was given in multiple alternatives or by "yes" and "no" when appropriate.

Ethical considerations

The study protocol had been approved by the Ethical Committee of the Helsinki and Uusimaa Hospital District (HUS99/E6/2000). The study is registered in the Helsinki University Central Hospital database for clinical trials (http://www.hus.fi).

Statistical analyses

The patients were grouped into two groups depending on the origin of the kidney disease (diabetic/non-diabetic). The data were analyzed by comparing the groups using SPSS for Windows version 15.0. Patients were also divided into groups of smokers and non-smokers. *T* test was used for parameters normally distributed while binomial data were analyzed with cross-tabulations and chi-square test. The level of significance was set at $p<0.05$.

Results

Table 1 gives the basic characteristics of the patients investigated. No statistically significant differences were seen in the background variables except that half of the CKD patients with non-diabetic disease were still in working life while only 23.5% of the diabetic patients worked fulltime, and the diabetic nephropathy patients used statistically significantly more drugs daily than the non-diabetic patients (10±2.3 vs. 8±3.1, respectively, $p<0.05$).

The subjective oral discomfort among the patients is shown in Fig. 1, which summarizes the prevalence of BMS, xerostomia, dysphagia, and dysgeusia in the groups. In all patients, location of the BMS was mostly in the tongue but the prevalence of this symptom was low and the differences were not statistically significant. BMS was reported by 6.0% and 5.7% of the diabetic nephropathy and of the non-diabetic patients, respectively. Of the diabetic and non-diabetic patients, 41.7% and 48.2% reported xerostomia, respectively. Dry mouth sensation was at its worst in the morning subsiding in the course of the day. Of the patients who reported xerostomia, 9.8% and 17% had low resting salivary flow in the diabetic nephropathy group and in the non-diabetic group, respectively. Correspondingly, 7.8% of the diabetic patients with xerostomia and 12.6% of the non-diabetic patients had low stimulated salivary flow rate. The differences were statistically not significant.

Table 1 Characteristics of the study population

	Diabetic nephropathy *N*=51	Other kidney disease *N*=87
Women/men	14/37	30/57
Glomerular filtration rate (ml/min/1.73 m^2)	≤20	≤20
Creatinine (μmol/l)	457 (±126.4)	530 (±158.9)
Age (years)	52 (±13.5)	54 (±12.6)
Educational level (%)		
University or institute	32.0	39.5
Technical school	20.0	10.5
Other	38	38.4
No education	10.0	11.6
Working status (%)		
Working fulltime	23.5	50.0*
Unemployed	11.8	1.2
Retired (employment or disability pension)	64.7	48.8
Last visit to dental office (%)		
≤12 months ago	54.9	50.6
≥1 year ago	43.1	49.4
Considering own oral health as (%)		
Good	21.6	34.5
Average	25.5	35.6
Poor	53	29.9

*$p \leq 0.01$

Mean stimulated salivary flow rate was significantly lower in the diabetic nephropathy group than in the non-diabetic group: 1.2±0.4 vs. 1.6±0.5 ml/min, respectively ($p < 0.05$). The diabetic patients with xerostomia and low-stimulated salivary flow rate used in the mean 11.3 drugs daily while the corresponding number of drugs in the xerostomic non-diabetic patients was 8.5 ($p < 0.05$). In comparison, the diabetic patients without xerostomia used 9.5 drugs daily while the non-diabetic patients the respective number was 8.4. In the xerostomic diabetic and non-diabetic groups, two and 1.7 concomitant other systemic diseases, respectively, were recorded in addition to the kidney disease. Yeast counts were positive in 35% of the diabetic and 23% of the non-diabetic patients (ns).

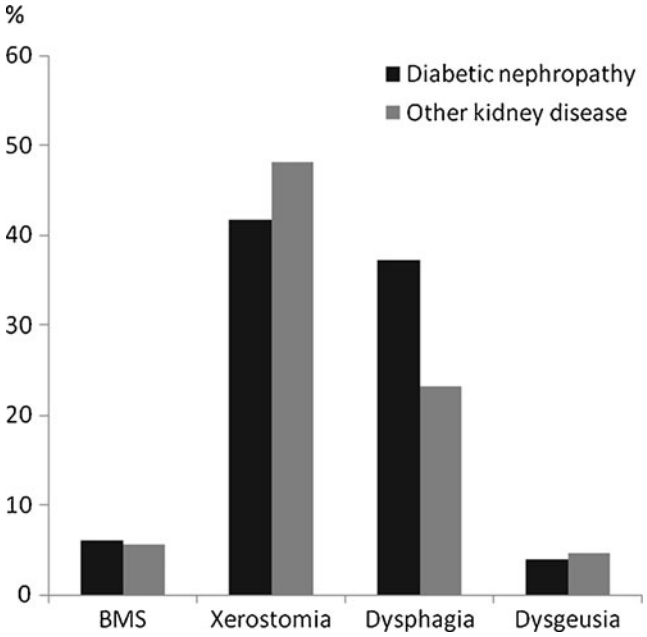

Fig. 1 Prevalence of burning mouth sensation (BMS), xerostomia, dysphagia, and dysgeusia between the groups

Of the diabetic nephropathy and non-diabetic patients, 37.3% and 23.3% reported dysphagia, respectively. Of the diabetic and non-diabetic patients, 3.9% and 4.6%, reported dysgeusia, respectively. The differences were not statistically significant.

Of the diabetic nephropathy and non-diabetic patients, 21.6% and 26.4%, were active smokers, respectively. No differences were observed in the study parameters between the groups regarding the smoking and non-smoking patients, however.

Discussion

This study is the first to investigate oral discomfort among predialysis CKD patients. We anticipated that the kidney disease of the patients would render them liable to oral discomfort mainly through reduced salivary flow rates and subsequently increased oral yeast counts. This appeared not to be the case in this material. A weakness of the study was,

however, the relatively low number of patients (n=138) which was due to practical limitations.

The overall prevalence of xerostomia was 41.7% and 48.2% of the diabetic nephropathy and non-diabetic patients, respectively. The prevalence of xerostomia varies greatly depending on the method of assessment and the population studied, with estimates ranging from 10% to 20% [20, 21]. We used direct interview with the patients. Although increasing age has a minimal impact on salivary flow; as such, the chronic diseases and use of drugs together with aging may decrease salivary flow as much as 40% [22–24]. This may subsequently, but not always, link with xerostomia.

BMS is an unpleasant condition characterized by a bilateral burning sensation of the oral mucosa usually in the absence of clinical and laboratory findings. Prevalence varies from 0.7% to 4.8% in the general adult population [25, 26]. In our study of the diabetic nephropathy and non-diabetic patients, 6.0% and 5.7% reported BMS, respectively. Hence, the present findings do not practically differ from the prevalence values earlier reported from other subjects.

We observed positive yeast counts in 35% vs. 23% of diabetic and non-diabetic patients, respectively, which seems to be in line with other studies of patients with CKD. However, end-stage renal disease patients have been found to have significantly more oral fungal infections than the controls [27–29].

Self-reported oral dryness is three times more likely among patients with oral fungal infection [27]. Reports by several authors have indeed shown that diabetic patients have an increased predisposition to manifestations of oral fungal infection which, in turn, associates with poor glycaemic control and use of dentures [30–32]. In the present study, we did observe higher number of patients with positive yeast counts in the diabetic nephropathy group but the difference was not statistically significant when compared with the non-diabetic patients.

When compared with the non-diabetic patients the values of stimulated salivary flow rates were significantly lower among the diabetic patients thus supporting earlier observations. Namely, diabetes has been shown to cause hyposalivation and xerostomia [33–35]. Our patients with diabetic nephropathy also statistically used significantly more drugs than the other CKD patients. Närhi et al. [36] have shown that the more drugs a patient takes daily, the greater is the effect on salivary secretion irrespective of the nature of the medication. All our patients used cardiovascular drugs which are known to affect saliva secretion [37, 38]. The diabetic patients reported dysphagia slightly more often than the non-diabetic patients. Dysphagia frequently follows many neurological and neuromuscular disorders and it has been also observed in diabetic patients [39]. It remains to be shown if diabetic polyneuropathy plays a role in these symptoms discussed above. However, the frequency of xerostomia was somewhat higher among the non-diabetic patients supporting the concept that measured salivary flow rates do not necessarily reflect in subjective symptoms of the mouth, and vice versa [40, 41]. Although the mean saliva secretion rates were normal, some of the patients in both groups reported dysgeusia, more often among the non-diabetic patients. Saliva is the principal fluid component of the external environment of the taste receptor cells and plays a major role in taste sensitivity [42].

The overall prevalence of smokers in the adult population in Finland is 23%, among US adults is 20.8%, and in the UK is 26% to give a few examples [43, 44]. Hence, the prevalence of smoking habit in our material was in line with that of general populations. However, we found no effect of smoking on the prevalence of the oral symptoms investigated in this material.

Finally, it was of interest to observe that 64.7% of the diabetic nephropathy vs. 48.8% of the non-diabetic patients, respectively, was retired. Subsequently, far less diabetic patients were working full time when compared with the non-diabetic group. These findings further emphasize the impact of diabetes in the overall morbidity and well-being of the patients.

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Conflict of interests The authors declare that they have no conflict of interest.

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