

# The influence of microvascular complications caused by diabetes mellitus on the inflammatory pathology of periodontal tissues

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## SUMMARY

The aim of our study was to analyze inflammatory pathology of periodontal tissues in patients with diabetes mellitus, and the relationship of this pathology with other complications caused by diabetes mellitus. In our study, we evaluated 126 people aged 16-53 years (42 males and 84 females) with diabetes mellitus admitted to the Clinic of Endocrinology of the Hospital of Kaunas University of Medicine (HKUM). The condition of periodontal tissues was evaluated according to the World Health organization (WHO) CPITN index. Oral hygiene was evaluated using a simplified oral hygiene index (OHI-S) according to Green-Vermillion. Out of 126 subjects with diabetes mellitus, periodontitis was detected in 96 patients (36 males and 60 females) (CPITN index 2-5). Gingivitis was found in 27 subjects (CPITN index 1). Only 2.4% of the studied patients had healthy periodontal tissues. The study analyzed complications of other organs (neuropathy, and nephropathy and retinopathy) caused by diabetes mellitus. The obtained findings showed that microvascular complications were diagnosed more frequently in the presence of more severe inflammatory pathology of periodontal tissues. Retinopathy was diagnosed in patients with CPITN index  $2.8 \pm 0.1$ , while patients with CPITN index  $1.8 \pm 0.3$  had no retinopathy. Neuropathy was more common among patients whose CPITN index was  $2.9 \pm 0.1$ , while the condition was absent in cases where the CPITN index was  $1.8 \pm 0.2$ . Comparable results were yielded by the studies of nephropathies in relation with changes in periodontium. Nephropathy was diagnosed in patients whose CPITN index was  $3.0 \pm 0.1$ , and was not found in patients with CPITN index  $2.1 \pm 0.2$ . The generalization of the obtained study data allows for stating that a more detailed analysis of factors causing complications of diabetes mellitus will also allow for a more profound understanding of the etiopathogenetic mechanisms that cause inflammatory pathology of periodontal tissues.

**Key words:** periodontitis, diabetes mellitus, microvascular complications.

## INTRODUCTION

Diabetes mellitus develops in case of a disturbance of glucose homeostasis in the organism, in the presence of insulin deficiency resulting in the metabolism of carbohydrates, proteins, and fats (20,22).

This is a severe endocrine pathology attributed to the group of chronic non-infectious metabolic diseases (22); this issue has not been solved by medicine yet, and thus is relevant for the society. Ca. 170 millions of people worldwide have diabetes mellitus. It is interesting that morbidity with this diseases is not evenly distributed in Earth hemispheres - less people living on the southern hemisphere have this disease, compared to those living

on the northern one. The lowest percentage of people with diabetes mellitus is in Asia, and the highest - in Europe. Morbidity in Europe ranges between 35.3 per 100,000 population in Finland to 4.6 per 100,000 population in Greece (5). The prevalence of diabetes mellitus increases by 6% per year; this is conditioned by increasing life expectancy, increasing population, sedentary way of life, unhealthy nutrition, and expansion of cities (22).

The first epidemiological data on the disturbances in carbohydrate metabolism in Lithuania were published in 1972-1974, during the Kaunas-Rotterdam intervention study. The data showed that as much as 19.5% of Kaunas citizen aged 45-60 years ran a risk of diabetes mellitus. Randomized epidemiological studies of Lithuanian population are also performed at present. Preliminary data show that more than 3% of Lithuanian adults have a risk for diabetes mellitus. By the mortality structure, diabetes mellitus stands third after cardiovascular diseases and cancer (22).

In addition to that, this disease causes severe complications: microangiopathy, neuropathy, nephropathy, microvascular diseases, and more difficult healing of

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wounds (20). A number of scientific studies were performed, proving a higher prevalence of inflammatory diseases of periodontal tissues among people with diabetes mellitus (6,7,8,9). Inflammatory diseases of periodontium may be attributed as the sixth complication of diabetes mellitus (16). The degree of the severity of periodontitis is directly associated with the control of diabetes mellitus, i.e. the maintenance of normal blood glucose levels (10). On the other hand, effective treatment of periodontitis positively influences the control of diabetes mellitus (11). For this reason, an approach forms in the scientific society that diabetologists and odontologists should closely cooperate for better results of the treatment of such patients.

The aim of the study was to analyze the inflammatory pathology of periodontal tissues in patients with diabetes mellitus, and to study the relationship of this pathology with other complications of diabetes mellitus.

**Material and methods:** in our study, we evaluated 126 people (42 males and 84 females) aged 16-53 years; the subjects had diabetes and were admitted to HKUM Clinic of Endocrinology. The condition of periodontal tissues was evaluated according to the World Health organization (WHO) CPITN index (12). Oral hygiene was evaluated using a simplified oral hygiene index (OHI-S) according to Green-Vermillion (12). The findings of the study were registered in special questionnaires. Statistical analysis of the data was performed using the SPSS (Statistical Package For Social Science) software package. Mean and percentage values were calculated. Statistical hypotheses on two means or percentage values were verified using Student's t criterion. Relationship between qualitative values was evaluated using Pearson's criterion.

## RESULTS

Out of 126 subjects with diabetes mellitus, periodontitis was detected in 96 patients (36 males and 60 females). Of these, 27 subjects were diagnosed with severe periodontitis (CPITN index 4-5), 38 - with medium (CPITN index 3), and 31 - slight periodontitis (CPITN index 2). Gingivitis was found in 27 subjects (CPITN index 1). Only 2.4% of the studied patients had healthy periodontal tissues. A relationship was found between the severity of periodontitis and the duration of diabetes mellitus. The longer the duration of diabetes, the more severe the stage of periodontitis was diagnosed. Mean CPITN value in those who had diabetes for up to 8 years was 2.3, in those who had the disease for 9 to 15 years - 2.5, and in subjects who had the disease for over 16 years - 3.0 (Fig. 1). In addition to that, the hygiene index of the subjects was evaluated. 57.9% of the studied patients did not have any plaque, or the plaque was located around the dental neck; in 30.2% of cases plaque covered 1/3 of the dental crown, and in 11.9% of patients oral hygiene was very poor - plaque covered 2/3 and more of the dental neck (Fig. 2). Hygiene in females was much better - oral hygiene was poor in only 8.3% of them, compared to 19.0% of males in whom plaque covered 2/3 and more of the dental neck (Fig. 3). The study

also evaluated the association between the hygiene index and the degree of the damage to periodontal tissues. The obtained findings showed that poorer hygiene was associated with a higher degree of periodontal damage (Fig. 4).

The study analyzed complications in other organs (neuropathy, and nephropathy and retinopathy) caused by diabetes mellitus. The obtained findings showed that the incidence and intensity of these complications correlated with the pathology of periodontal tissues, and its severity. Microvascular complications were diagnosed more frequently in the presence of a more severe inflammatory pathology of periodontal tissues. Retinopathy was diagnosed in patients with CPITN index  $2.8 \pm 0.1$ , while patients with CPITN index  $1.8 \pm 0.3$  had no retinopathy. Neuropathy was more common among patients whose CPITN index was  $2.9 \pm 0.1$ , while the condition was absent in cases where the CPITN index was  $1.8 \pm 0.2$ . Comparable results were yielded by the studies of nephropathies in relation with changes in periodontium. Nephropathy was diagnosed in patients whose CPITN index was  $3.0 \pm 0.1$ , and was not found in patients with CPITN index  $2.1 \pm 0.2$  (Fig.5).

## DISCUSSION

During the last decades, odontology saw a number of important achievements; still, etiopathogenetic mechanisms of the inflammatory diseases of periodontal tissues remain unknown (1). Only some factors that influence the occurrence and development of the aforementioned pathology have been identified (2). Summing up the results of scientific studies in the field of periodontology for the last decades, R.C. Williams (1998) (3) presented a modern model of the development of inflamma-

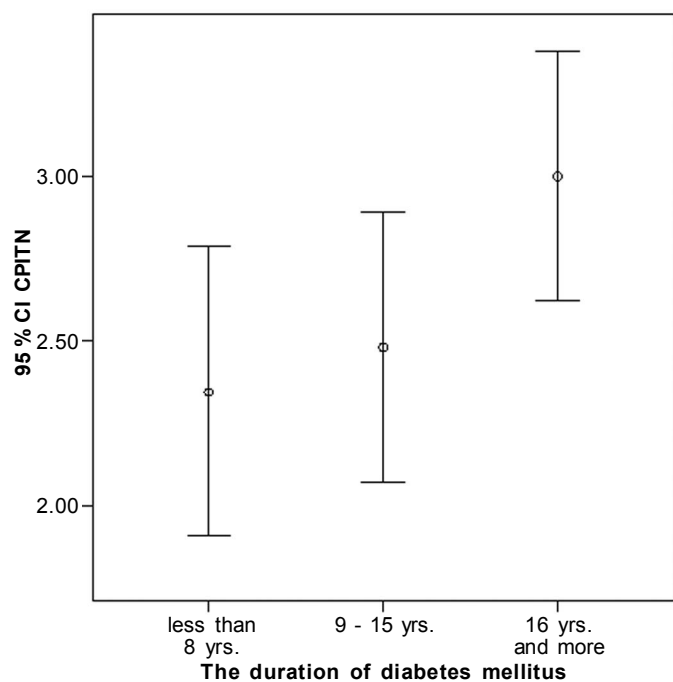
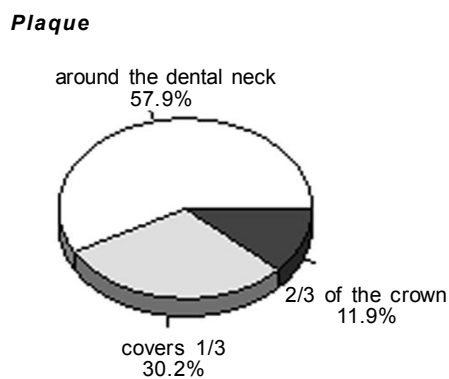


Fig. 1. The association of the severity of the pathology of periodontal tissues with the duration of diabetes mellitus

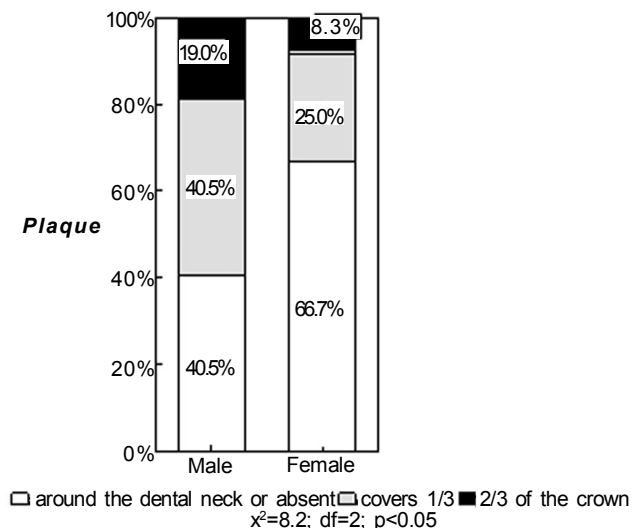


**Fig. 2.** Oral hygiene in the studied subjects

tory diseases of periodontal tissues. According to this model, the main role is attributed to the immune inflammatory response of the macro-organism to the dental plaque organisms and the products of their activity.

Most cases of the inflammatory pathology of periodontal tissues are associated with systemic diseases that change the response of the macro-organism to dental plaque and increase the predisposition to this pathology (4). One of such diseases is diabetes mellitus (20,21).

When searching for etiopathogenetic mechanisms of the inflammatory pathology of periodontal tissues, patients with diabetes were chosen because they are

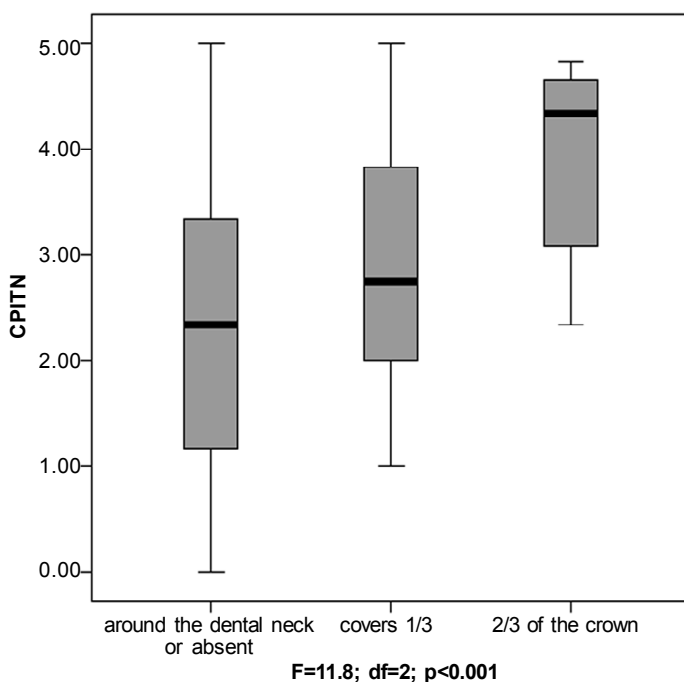


**Fig. 3.** Distribution of the oral hygiene according to sex

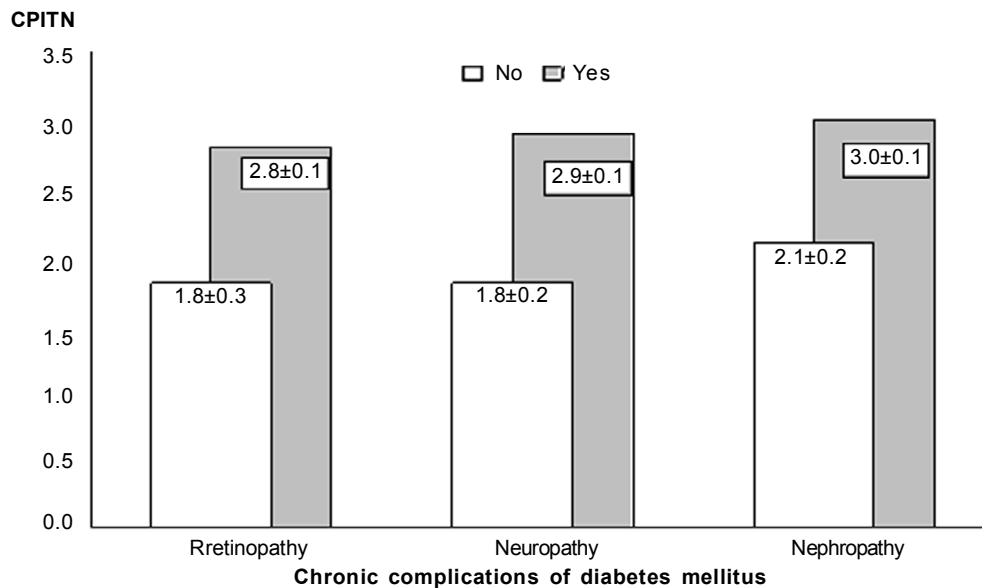
more frequently diagnosed with the aforementioned pathology (6,7,8,9,13). The findings of our study showed that only 2.4% of patients with diabetes had healthy periodontal tissues, which confirmed the data presented by other authors. The results of the performed study allow for stating that more severe pathology of periodontal tissues is found in people in whom the duration of diabetes mellitus is longer. There is no single opinion in literature in this respect. D.E. Pommerau et al. (1992), on the basis of the performed studies, stated that there was no relationship between the duration of diabetes mellitus and the severity of the inflammatory pathology of periodontal tissues. Other scientists (14,15), on the basis of their studies, stated that there existed a clear association between the duration of diabetes mellitus and the severity of the inflammatory pathology of periodontal tissues. We also analyzed the association between the severity of the inflammatory pathology of periodontal tissues and the oral hygiene index. The findings of our study showed (Fig. 4) that poorer oral hygiene is associated with more severe inflammatory damage to periodontal tissues. Similar findings were also presented by other authors (18,19).

The investigation of a possible relationship between the inflammatory pathology of periodontal tissues and microvascular complications of other organs showed (Fig. 5) that microvascular complications were diagnosed more frequently in the presence of a more severe inflammatory pathology of periodontal tissues. These results are also confirmed by other authors. K.M. Karjalainen et al. (1994) studied patients who were ill with diabetes mellitus for more than 10 years, and found that the inflammatory pathology of periodontal tissues is one of the complications of diabetes mellitus.

The generalization of the obtained study data allows for stating that a more detailed analysis of factors causing complications of diabetes mellitus will also allow for a more profound understanding of the etiopathogenetic mechanisms that cause inflammatory pathology of periodontal tissues.



**Fig. 3.** The association of the severity of the pathology of periodontal tissues with oral hygiene status



**Fig. 5.** The association of microvascular complications in patients with diabetes mellitus with the pathology of periodontal tissues  $p < 0.01$  among patients with and without complications of chronic diabetes mellitus.

## CONCLUSIONS

1. The increase in the duration of diabetes mellitus and the presence of complications in other organs caused

by the disease result in a more severe form of periodontal pathology.

2. The oral hygiene status affects the development of the inflammatory pathology of periodontal tissues.

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