

Evaluation of the prevalence of periodontal disease as a non-classical risk factor in the group of patients undergoing hip and/or knee arthroplasty

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Abstract

Background: Periodontal disease is a chronic disease causing an inflammatory process that affects various organs and is associated with an increased risk of many diseases, including bone and cardiovascular disease.

Aim: The aim of this study was to establish the prevalence of periodontal disease in continuous patients scheduled for hip or knee replacement surgery.

Methods: The study was a prospective, epidemiological analysis performed in consecutive patients scheduled for total joint (hip or knee) replacement surgery. Patients enrolled into the study were screened for classical risk factors and had a dental evaluation performed for the diagnosis of periodontal disease.

Results: The study population consisted of 228 patients. A total of 137 (60.1%) patients were scheduled for a hip replacement surgery, while 91 (39.9%) had a knee replacement. The mean age of the study population was 66.8 ± 12.2 years, and 83 (36.4%) patients were male. A clinically significant disease was present in 65 (28.5%) cases, while all (100%) of the patients had at least minimal signs of periodontal disease. In patients with periodontal disease the percentage of tartar involvement of the teeth was $33.1 \pm 26.8\%$, mean dental plaque coverage was $48.1 \pm 29.8\%$, and bleeding occurred at a rate of $35.4 \pm 29\%$. As for the hygiene level, it was generally poor in the majority of patients with periodontal disease. No differences in terms of baseline risk factors were present between patients with and without periodontal disease.

Conclusions: In conclusion, periodontal diseases are highly prevalent in patients undergoing hip and/or knee replacement surgery. The presence of the periodontal disease is possibly associated with a worse prognosis and should be treated.

Key words: periodontal disease, hip replacement, knee replacement

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INTRODUCTION

Periodontal disease is a chronic infectious disease of the tissues surrounding the tooth and holding it in the dental alveolus [1]. The fact that it is chronic is important because the inflammatory process may not only affect the local tissues, but also the general health of the patient [2]. Bacteria in the periodontal pocket have the ability to enter the bloodstream and activate various undesirable biological mechanisms. Pa-

tients most often assume that untreated periodontal disease results in local complications, in the form of abscesses, tooth mobility, and finally its loss. Patients perceive it as tooth pain and worsening in aesthetics, but they do not realise that the consequences are much more serious.

Therefore, prophylaxis and treatment of periodontal diseases play an important role in patient management. Unfortunately, preventive strategies to date do not fulfil their

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task. Perhaps it is because patients do not know the effects of periodontal disease. To this day patients and physicians are unaware that it may be a risk factor for a heart attack, stroke, premature labour, low birth weight of new-borns, or affect the course of diabetes [3]. The increased risk of cardiovascular disease may be especially important in high-risk groups such as patients undergoing joint replacement surgery. The aim of the study was to establish the prevalence of periodontal diseases in patients undergoing hip and/or knee arthroplasty.

METHODS

This was a prospective, single-centre epidemiological study performed in consecutive patients scheduled for elective hip and/or knee replacement surgery. All patients were recruited in a tertiary University Hospital. The study was performed with respect to the Declaration of Helsinki, and approval from the Ethics Committee by the Medical University of Warsaw was obtained before the beginning of the study.

The study enrolled continuous, unselected patients who were electively hospitalised for a total hip or knee replacement. All patients included into the study were previously qualified for the hip replacement procedure according to the current indications and physician's decision. Patients were also screened for cardiovascular and general risk factors that might have increased the perioperative risk. Exclusion criteria were: age < 18 or ≥ 75 years, ineligibility for surgery, the absence of written, informed consent, or contraindications to any of the study protocol examinations.

Apart from the standard pre-operative workup, all patients were interviewed, screened, and had their medical records checked for prior diagnosis of perioperative risk factors and periodontal disease. Diagnosis of the mentioned conditions was made according to the current guidelines. Diagnosis of the periodontal disease was made by a qualified dentist, a specialist in periodontal disease. Dental assessment was made during hospitalisation and prior to the surgery. It included assessment of teeth, tartar, and bacterial plaque and assessment of the periodontal tissue. In the case of any diagnosed abnormalities that required intervention, all patients were scheduled a free ambulatory visit in a dental clinic.

Statistical analysis

Statistical analysis was performed using SPSS v 21.0 (SPSS Inc., Chicago, IL, USA). Continuous data are presented as mean ± standard deviation and were compared using the Mann-Whitney test or Student's t-test. Categorical variables were compared using either the χ^2 or Fisher's exact tests. A p value of less than 0.05 was considered statistically significant, whereas the confidence intervals (CI) were 95%.

RESULTS

The study population consisted of 228 patients. 137 (60.1%) patients were scheduled a hip replacement surgery, while 91 (39.9%) had a knee replacement. The mean age of the

Table 1. General characteristics of the study population

Parameter	Value
Age [years]	66.8 ± 12.2
Male sex	83 (36.4%)
Diabetes mellitus	31 (13.6%)
Hip replacement	137 (60.1%)
Knee replacement	91 (39.9%)
Prothrombin time [s]	11.7 ± 1.6
APTT [s]	28.9 ± 3.7
White blood cells [$10^3/\mu\text{L}$]	7.2 ± 2.2
Neutrophils [$10^3/\mu\text{L}$]	4.2 ± 1.9
Lymphocytes [$10^3/\mu\text{L}$]	2.1 ± 0.8
Monocytes [$10^3/\mu\text{L}$]	0.6 ± 0.2
Eosinophils [$10^3/\mu\text{L}$]	0.2 ± 0.2
Basophils [$10^3/\mu\text{L}$]	0.1 ± 0.2
Red blood cells [$10^6/\mu\text{L}$]	4.8 ± 3.3
Haemoglobin [g/dL]	136 ± 15.6
Haematocrit [%]	0.5 ± 0.5
Mean cell volume [fL]	92.1 ± 4.6
Mean cell haemoglobin [pg]	29.9 ± 1.7
Mean cell haemoglobin concentration [g/dL]	324.2 ± 9.8
Red blood cell distribution width [%]	13.5 ± 1.1
Platelets [$10^3/\mu\text{L}$]	252.7 ± 71.5
Mean platelet volume [fL]	11.3 ± 6.2
C-reactive protein [mg/L]	4.4 ± 8.2

Data are shown as mean ± standard deviation or number (percentage). APTT — activated partial thromboplastin time

study population was 66.8 ± 12.2 years and 83 (36.4%) patients were male. In the whole population 31 (13.6%) patients were diagnosed with diabetes mellitus. Detailed characteristics of the study population are shown in Table 1.

When we divided patients according to the presence of periodontal disease, it showed that a clinically significant disease was present in 65 (28.5%) cases, and all (100%) of the patients had at least minimal signs of periodontal disease. In patients with periodontal disease the percentage of tartar involvement of the teeth was 33.1 ± 26.8%, mean dental plaque coverage was 48.1 ± 29.8%, and bleeding occurred in a mean of 35.4 ± 29%. As for the hygiene level, it was generally poor in the majority of patients with periodontal disease. Detailed results are presented in Figure 1.

A comparison of patients with and without significant periodontal disease showed no differences in the baseline characteristics. Detailed characteristics are presented in Table 2. There were also no differences in the on-admission blood parameters, with a higher C-reactive protein concentration in patients with significant periodontal disease than in those without (4.8 ± 11.5 vs. 4.1 ± 6.2 mg/L, respectively), but it did not reach statistical significance.

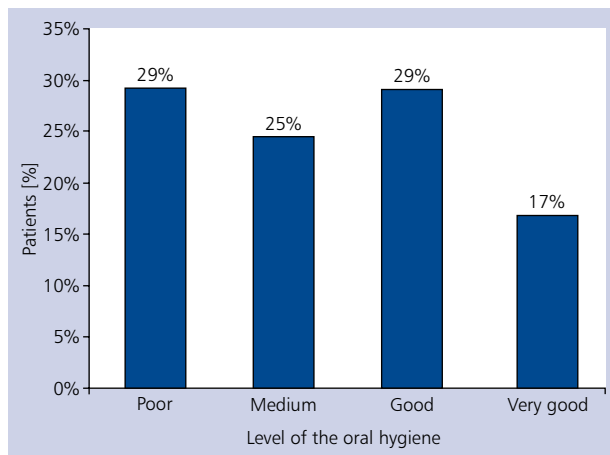


Figure 1. Level of the oral hygiene in patients with periodontal disease

DISCUSSION

The influence of inflammation associated with periodontal disease on the whole body is a complex and not fully understood process. It can be direct, with bacteria from the periodontal pocket entering the bloodstream (direct influence of bacteria on the vascular endothelium), and from it to individual organs. Another theory says that it has an indirect action resulting from infiltration of inflammatory mediators formed in the gingivae, which causes an interaction between inflammatory mediators and endothelium [4, 5]. Damaged endothelium is a starting point in the development of various cardiovascular diseases, including hypertension and atherosclerotic disease [6]. They can also affect the atherosclerotic plaque, causing its destabilisation and leading to myocardial infarction [3, 7, 8].

The prevalence of periodontal disease is very high, as was shown in a study conducted in Poland in 2011 and between

Table 2. Comparison of patients with and without significant periodontal disease

	Patients with periodontal disease (n = 65)	Patients without significant periodontal disease (n = 163)	p
Age [years]	66.2 ± 14.1	67 ± 11.3	0.05
Male sex	27 (41.5%)	56 (34.3%)	0.31
Diabetes mellitus	11 (16.9%)	20 (12.3%)	0.4
Hip replacement	45 (69.2%)	92 (56.4%)	0.056
Knee replacement	20 (30.8%)	70 (42.9%)	0.056
Tartar [%]	33.1 ± 26.8%	–	–
Dental plaque [%]	48.1 ± 29.8%	–	–
Bleeding [%]	35.4 ± 29%	–	–
Prothrombin time [s]	11.7 ± 1.1	11.7 ± 1.7	0.461
APTT [s]	28.5 ± 3.7	29 ± 3.7	0.542
White blood cells [$10^3/\mu\text{L}$]	7.0 ± 2.0	7.2 ± 2.3	0.718
Neutrophils [$10^3/\mu\text{L}$]	4.1 ± 1.7	4.3 ± 2	0.397
Lymphocytes [$10^3/\mu\text{L}$]	2.1 ± 0.6	2.1 ± 0.8	0.106
Monocytes [$10^3/\mu\text{L}$]	0.6 ± 0.2	0.6 ± 0.2	0.451
Eosinophils [$10^3/\mu\text{L}$]	0.2 ± 0.1	0.2 ± 0.3	0.221
Basophils [$10^3/\mu\text{L}$]	0.1 ± 0.1	0.1 ± 0.2	0.195
Red blood cells [$10^6/\mu\text{L}$]	4.6 ± 0.5	4.9 ± 3.9	0.471
Haemoglobin [g/dL]	137.7 ± 13.8	135.3 ± 16.3	0.800
Haematocrit [%]	0.4 ± 0.1	0.5 ± 0.6	0.370
Mean cell volume [fL]	92.2 ± 5	92.1 ± 4.4	0.759
Mean cell haemoglobin [pg]	30.1 ± 2	29.8 ± 1.6	0.658
Mean cell haemoglobin concentration [g/dL]	326 ± 10.6	323.4 ± 9.4	0.056
Red blood cell distribution width [%]	13.5 ± 1.3	13.4 ± 1.1	0.226
Platelets [$10^3/\mu\text{L}$]	248.5 ± 64	254.5 ± 74.6	0.641
Mean platelet volume [fL]	10.9 ± 1	11.5 ± 7.3	0.429
C-reactive protein [mg/L]	4.8 ± 11.5	4.1 ± 6.2	0.225

Data are shown as mean ± standard deviation or number (percentage). APTT — activated partial thromboplastin time

2013 and 2014 on the order of the Ministry of Health. Participation in the study was proposed to 20 thousand people aged 35–44 and 65–74 years, in four large centres: Białystok, Szczecin, Wrocław, and Warsaw and four smaller ones: Toruń, Olawa, Łobez, and Elk. Unfortunately, fewer than 10% of the invited participants reported for a screening. In total 1750 people were examined. In the group of younger respondents only 1.7% did not require improvement of hygiene and medical intervention. About 15% had gingivitis, and almost 23% had advanced periodontal disease (gingivitis, deep pockets [over 6 mm] and/or pathological mobility of the teeth). Everyone required treatment, at least removal of plaque, and 23% needed specialist treatment. In the group of older people, the results were even worse because healthy periodontium was present only in 0.7% of respondents. Nearly 40% of subjects required specialist treatment, and there was not a single person with a healthy periodontium [9, 10].

The association between periodontal disease and cardiovascular health is well established. Patients with periodontal disease are at higher risk of coronary artery disease, myocardial infarction, and stroke [3]. This elevated risk is especially important in the early perioperative period. Effective strategies for reducing the risk of complications in an early perioperative period in patients undergoing hip or knee replacement should include assessment of cardiac risk, including periodontal disease.

Moreover, patients with venous thromboembolic disease and periodontal disease are at higher risk of a thromboembolism episode and have high D-dimer levels [11]. That is especially important in hip and knee replacement recipients because these procedures are associated with one of the highest levels of thromboembolic complications.

There is also a direct association between periodontal disease and bone disease, which can complicate late follow-up in joint replacement patients. There is an epidemiological association between periodontitis and rheumatoid arthritis, which is hypothesised to lead to bone and connective tissue damage occurring because of the local and generalised immune response [12]. Periodontitis is characterised by inflammation and bone loss. This process is generally local but can become a systemic condition. Tissue destruction is believed to be the consequence of host inflammatory response to the bacterial challenge. In this scenario, periodontitis could also lead to an impaired healing after joint surgery [13, 14].

CONCLUSIONS

In conclusion, periodontal diseases are highly prevalent in patients undergoing hip and/or knee replacement surgery.

The presence of periodontium disease is possibly associated with an incorrect prognosis and should be treated.

Conflict of interest: none declared

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