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ANTIBIOTIC PREVENTION DURING DENTAL INTERVENTIONS AND THE RISK OF INFECTIOUS ENDOCARDITIS IN HIGH-RISK GROUPS ANALYSIS OF THE NATIONAL REGISTRY

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ABSTRACT
The aim of the study was to evaluate the relationship between the appointment of antibiotic prophylaxis for invasive dental procedures and the risk of developing infectious endocarditis in patients at high cardiac risk based on a model analysis of data from the national registry and clinical material from the Novosibirsk dental clinic.
The model national registry included data from patients with confirmed infectious endocarditis over the age of eighteen who were hospitalized in cardiological hospitals in the country over a five-year period. The cases in which invasive dental intervention was performed within four weeks before the manifestation of the disease were analyzed. Patients with serious structural heart damage and other high-risk conditions were allocated to a separate group.
Additionally, a study was conducted at the Novosibirsk dental clinic, which consistently included fifty high-risk patients who needed invasive dental interventions. The incidence of infectious endocarditis during a twelve-month follow-up period was assessed, depending on the fact of antibiotic prophylaxis according to current recommendations.
According to the model registry, approximately one sixth of patients with infectious endocarditis had a temporary association with previous dental procedures, while the majority had serious cardiac diseases and only a minority received preventive antibiotics. In the clinical group of Novosibirsk, the development of infectious endocarditis was registered in three patients during the year, and the frequency of the event was lower among those who received antibiotic prophylaxis.
Based on the combined data, a systematic prevention scheme is proposed that combines risk stratification, an assessment of the nature of dental intervention, the choice of an antibacterial drug, and organizational measures aimed at increasing the adherence of both cardiologists and dentists to current recommendations.
The results emphasize the need for an integrated approach in which antibacterial prophylaxis is strictly addressed to patients at the highest risk, and the leading role in preventing infectious endocarditis is given to maintaining dental health, early rehabilitation of infection foci and interdisciplinary interaction.
KEYWORDS: infectious endocarditis, antibiotic prophylaxis, dental interventions, high-risk groups, amoxicillin, national registry.

INTRODUCTION

Infectious endocarditis is a severe, potentially life-threatening disease associated with a high mortality rate and frequency of disabling complications, despite the development of antibacterial therapy and surgical approaches. According to modern international registry studies and clinical observations, the proportion of infectious endocarditis in the structure of cardiac morbidity remains relatively low, however, the severity of the course and the cost of treatment make the problem of its prevention extremely relevant for cardiologists, internists and dentists [8].
The development of infectious endocarditis is traditionally associated with transient bacteremia, which occurs against the background of bacterial infections of the oral cavity, invasive medical and dental interventions, injuries to the mucous membranes and daily activity. For many decades, there has been a concept according to which dental procedures involving manipulation of the gum or periapical tissues were one of the key sources of

bacteremia, primarily associated with viridian streptococci. This served as the basis for the widespread introduction of antibiotic prophylaxis before invasive dental interventions in patients with various forms of structural heart pathology [7].

The publication of updated recommendations from the American Heart Association, the European Society of Cardiology, and national professional communities has led to a fundamental revision of prevention tactics [13]. Indications for prescribing antibiotics were significantly limited to patients with the highest risk of an adverse outcome of infectious endocarditis, which include people with prosthetic heart valves, valve reconstruction using prosthetic materials, previous infectious endocarditis, some complex congenital heart defects and a number of other conditions.

At the same time, the guidelines emphasized the role of everyday bacteremia that occurs when brushing teeth, chewing, and in the presence of chronic inflammatory periodontal diseases. Maintaining a good level of oral hygiene and timely sanitation of foci of odontogenic infection are considered as a more significant factor in reducing the risk of infectious endocarditis than single antibiotic prophylaxis before individual interventions [9].

Despite this, the question of the effectiveness of antibiotic prophylaxis in real clinical practice remains controversial. A number of studies based on large national registries and insurance databases do not demonstrate a clear reduction in the incidence of infectious endocarditis at the population level after the recommendations were changed, although retrospective meta-analyses indicate a possible benefit of prevention in carefully selected high-risk groups [12].

In the Russian Federation, the problem of registration of infectious endocarditis and assessment of the role of dental interventions in its development remains insufficiently developed. In clinical practice, there is still variability in prescribing antibiotic prophylaxis, due to both the heterogeneous awareness of specialists about international recommendations and the lack of adapted local algorithms for specific regions and institutions [4].

Taking into account these circumstances, it seems relevant to conduct an analysis combining data from the model national registry of infectious endocarditis and the results of local clinical monitoring of high-risk patients undergoing invasive dental procedures. Such work allows not only to assess the possible relationship between antibiotic prophylaxis and the frequency of infectious endocarditis, but also to form a practice-oriented prevention system adapted to the conditions of the dental service of a large city.

MATERIALS AND METHODS OF RESEARCH

The study included two complementary blocks: an analysis of the model national registry of infectious endocarditis and a prospective single-center observational study conducted at a dental clinic in Novosibirsk. The overall approach was based on the principles of evidence-based medicine and modern guidelines for the management and prevention of patients with infectious endocarditis.

The model registry included data from adult patients with confirmed infectious endocarditis who were hospitalized in federal and regional cardiology centers over a five-year period. The diagnosis was based on the revised Duke criteria using clinical, laboratory, microbiological, and instrumental data. For each patient, the presence or absence of invasive dental surgery was noted for four weeks before the first symptoms of the disease appeared. Such interventions included complex tooth extractions, root tip resection, surgical treatment of periodontitis, implantation, and other procedures involving manipulation of the gum or periapical tissues.

A subgroup of patients with high cardiac risk was identified from the total number of cases of infectious endocarditis. It included people with prosthetic heart valves or reconstruction of the valvular apparatus using prosthetic materials, patients with previous infectious endocarditis, owners of certain forms of complex congenital heart defects, as well as people with severe valvular pathology of natural valves, for which surgical treatment was planned. The presence or absence of antibiotic prophylaxis before dental procedures was recorded according to medical statements, outpatient documentation, and dental records.

In parallel, a study was organized at the Novosibirsk city dental clinic. It consistently included patients over the age of eighteen who had cardiologist-confirmed conditions of high risk of developing infectious endocarditis and aimed at invasive dental interventions. The selection was carried out jointly with the cardiology service of the city on the basis of current international recommendations.

A total of 50 patients were included in the clinical observation. At the time of treatment, a standard dental examination was performed to assess the degree of activity of inflammatory processes, the hygienic condition of the oral cavity and the need for invasive intervention. The decision to prescribe antibiotic prophylaxis was made by a cardiologist and dentist together, taking into account the risk category, the nature of the upcoming procedure and concomitant pathology. The choice of the regimen was based on current international and national recommendations, including the use of amoxicillin or alternative drugs in patients with allergy to beta-lactam antibiotics.

The patients were divided into two groups. The first group included people who received antibiotic prophylaxis thirty to sixty minutes before the intervention. The second group includes patients who did not receive prophylaxis due to lack of indications, individual contraindications, or refusal. All patients signed an informed consent to participate in the follow-up, and the study protocol was approved by the local ethics committee.

The clinical group was monitored for twelve months after the intervention with a frequency of visits at least once every three months, as well as when symptoms appeared that could indicate the development of infectious endocarditis. If the disease was suspected, laboratory and instrumental studies were carried out in accordance with current recommendations.

The main outcomes analyzed were the incidence of infectious endocarditis within twelve months after the intervention, the time before the event, and the association of episodes with the presence or absence of antibiotic prophylaxis. Additionally, the demographic and clinical anamnestic characteristics of patients, the type of dental intervention, the frequency of complications, and the tolerability of antibacterial therapy were evaluated.
Descriptive statistics with the calculation of fractions, averages, and standard deviations were used to present the results. The comparison of the frequency of events between the groups was carried out using appropriate nonparametric methods, however, given the small sample size, the emphasis was on clinically significant differences and their interpretation, rather than on formal p-values.

RESULTS AND DISCUSSIONS

Fifty patients with high cardiological risk who were referred for invasive dental interventions were included in the clinical observation in Novosibirsk. The average age was sixty-one years, while men predominated, whose proportion slightly exceeded half of the sample. Most of the patients had a history of valvular pathology, and about half had undergone prosthetic heart valves or reconstructive interventions using prosthetic materials. Some of the patients had a history of infectious endocarditis, which further increased the risk of disease recurrence. The main clinical and demographic characteristics of the examined individuals are presented in Table 1.

Table 1. Clinical and demographic characteristics of Novosibirsk clinic patients (n = 50)

Indicator	Meaning
Average age, years	61,2 ± 10,4
Men, percentage of patients	56 %
The presence of prosthetic heart valves	48 %
Previous infectious endocarditis	18 %
Complex congenital heart defects	14 %
Severe valvular pathology without a prosthesis	32 %
Type 2 diabetes mellitus	30 %
Chronic kidney disease stage 3-4	20 %
Active periodontitis or periodontitis	62 %

The types of dental interventions performed included complex tooth extractions, surgical rehabilitation of foci of chronic periodontitis, resection of root tips, and the installation of dental implants with varying degrees of injury. A significant part of the procedures were accompanied by manipulations on the gingival margin and periapical tissues, which is traditionally considered as a factor contributing to transient bacteremia [2].
Antibiotic prophylaxis in accordance with the agreed decision of the cardiologist and dentist was performed in thirty-two patients, which accounted for almost two thirds of the clinical sample. The overwhelming majority used amoxicillin in a single dose of two grams per os thirty to sixty minutes before the intervention as the main drug. In patients with an allergy to beta-lactam antibiotics, alternative regimens were used, including clindamycin or azithromycin, with dosage adjustments taking into account body weight and concomitant pathology.
Within 20 months, the development of infectious endocarditis was observed in three patients, which accounted for six percent of the clinical sample. In the group that received antibiotic prophylaxis, the disease occurred in one patient, while in the second group, where prevention was not carried out, two cases were registered. Thus, the relative frequency of the event was approximately three percent in the prevention group and eleven percent in the non-prevention group.
Taking into account the small numerical composition of the sample, formal statistical conclusions are limited, but already at the descriptive data level there is a tendency to decrease the incidence of infectious endocarditis when prescribing antibiotic prophylaxis in carefully selected high-risk patients. It is important to emphasize that in all three cases, the disease developed in people with severe structural pathology of the heart, and one patient had a history of previous infectious endocarditis.
A graphical representation of the cumulative incidence of infectious endocarditis in a clinical group, depending on the fact of antibiotic prophylaxis, is shown in Figure 1.

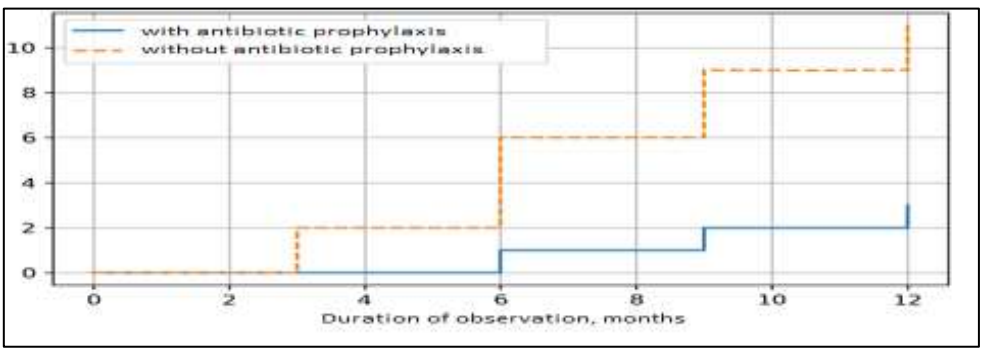

Figure 1. Cumulative incidence of infectious endocarditis within twelve months in patients with and without antibiotic prophylaxis

It can be seen that the cumulative frequency curves diverge already in the first months of observation, although the absolute number of events remains small. This trend is in good agreement with the data of meta-analyses, which note the advantage of antibiotic prophylaxis in a limited number of patients with severe structural heart damage, whereas the effect is hardly noticeable or absent in the general population of dental patients.

The model national registry included data from one and a half thousand adult patients with confirmed infectious endocarditis who were hospitalized in cardiac hospitals over a five-year period. Among them, eighty-five patients had a temporary association with invasive dental surgery within four weeks before the onset of symptoms, which corresponded to about six percent of the total number of cases.

In this subgroup, more than two thirds of the patients had serious structural heart diseases, including prosthetic valves, complex congenital malformations, and previous infectious endocarditis. When analyzing the documentation, it turned out that only about a fifth of patients with established indications for prevention actually received antibiotics before dental surgery. In some cases, there were references to the recommendation to consult a cardiologist to clarify the need for prevention, but there was no documentary evidence of its implementation.

A comparison of the frequency of dentally associated infectious endocarditis in patients with indications for prevention and the fact of its implementation is conventionally presented in Table 2.

Table 2. Incidence of dental-associated infectious endocarditis in the model national registry among high-risk patients

Parameter	Meaning
Number of IE patients in the registry	1500
Dental procedure 4 weeks before IE	85 (5,7 %)
Patients with high cardiac risk are among these 85	60 (70,6 %)
Those who received antibiotic prophylaxis	12 из 60 (20,0 %)
Did not receive antibiotic prophylaxis	48 из 60 (80,0 %)

The data in table 2 indicate that there is a gap between formal recommendations and the practice of their implementation. Despite the presence of frequent and clear indications, the actual proportion of patients receiving antibiotics before dental procedures remains low. Similar problems are described in foreign works, which emphasize the lack of awareness of both dentists and cardiologists about the current recommendations and the need for interdisciplinary educational programs.

The comparison of the data from the Novosibirsk clinic and the model registry allows us to make several important observations.

Firstly, the absolute contribution of dental interventions to the overall structure of infectious endocarditis is relatively small, which confirms the position of the leading role of everyday bacteremia and chronic inflammatory processes in the oral cavity.

Secondly, it is among high-risk patients that non-compliance with antibiotic prevention recommendations may contribute to the development of some cases of the disease, as demonstrated by both local clinical observations and model registry data.

Based on the analysis of recommendations from international professional communities, a model registry, and the results of clinical observation, a practice-oriented system for the prevention of infectious endocarditis in high-risk cardiological patients undergoing invasive dental interventions was formed [11].

The key element of the system is the stratification of patients according to the risk of an unfavorable outcome of infectious endocarditis. For people with prosthetic valves, previous infectious endocarditis, complex congenital heart defects, and a number of other serious conditions, antibiotic prophylaxis is considered an essential component of preparation for surgery if it involves manipulation of the gingival margin or periapical tissues [6]. Patients at intermediate risk require an individualized approach that takes into account the scope and injury of the intervention, the condition of the oral cavity, concomitant diseases, and the expected benefits of prevention [2].

An equally important component of the system is strict consideration of the nature of dental intervention. Procedures limited to surface treatment, as a rule, do not require antibiotic prophylaxis even in high-risk patients, whereas surgical interventions with severe tissue injury are almost always accompanied by the appointment of antibacterial drugs if indicated [7].

A schematic representation of the proposed system, including the level of risk, the nature of the intervention, and the recommended preventive regimen, is shown in table 3.

Table 3. Proposed system of prevention of infectious endocarditis during dental interventions

Patient category and intervention	Recommended prevention tactics
High cardiological risk, invasive intervention with gum injury	Mandatory antibiotic prophylaxis
High risk, minimally traumatic intervention	Consideration of prevention on an individual basis
Intermediate risk, invasive intervention	Personalized solution after consultation with a cardiologist and dentist
Low risk regardless of the type of intervention	Antibiotic prophylaxis is not indicated

Any risk category for poor oral hygiene and active periodontitis	Priority of sanitation and hygiene improvement; prevention is discussed only at high risk

The choice of a specific antibiotic prophylaxis regimen is based on recommendations according to which the first-line drug in patients without allergy to beta–lactam antibiotics remains amoxicillin in a single dose thirty to sixty minutes before the procedure, and alternative drugs are used in people with allergies. Special attention is paid to dose adjustment in the presence of chronic kidney disease and other conditions affecting the pharmacokinetics of drugs [10].

The prevention system also implies organizational measures, including standardized routing of patients between cardiologists and dentists, the use of unified memos and checklists, as well as regular training events for specialists. An important element is to inform the patients themselves about the importance of oral hygiene, the need for regular preventive examinations and timely sanitation of infection foci [5].

Thus, the proposed scheme makes it possible to integrate international recommendations into the daily practice of a dental clinic, taking into account the real limitations and peculiarities of the organization of medical care in the region.

CONCLUSION

The analysis of the model national registry of infectious endocarditis and the clinical material of the Novosibirsk dental clinic demonstrated that the contribution of invasive dental interventions to the overall structure of infectious endocarditis is relatively small, however, in patients with severe structural heart pathology they can act as a significant trigger of the disease.

In the clinical group of high-risk patients who underwent invasive dental interventions, there was a tendency to decrease the incidence of infectious endocarditis when prescribed antibiotic prophylaxis compared with patients who did not receive prophylaxis. Despite the limited sample size, the data obtained are consistent with the results of international studies indicating the potential benefits of targeted antibiotic prophylaxis in carefully selected high-risk groups.

The analysis of the model national registry revealed a significant gap between the formal indications for antibiotic prophylaxis and the actual frequency of its use, reflecting the need to improve interdisciplinary interaction between cardiologists and dentists, as well as to raise awareness of modern recommendations among specialists.

The proposed prevention system, based on risk stratification, assessment of the nature of dental intervention and a standardized choice of antibiotic prophylaxis regimen, makes it possible to adapt international recommendations to the practical conditions of a dental clinic in a large city.

The key element of effective prevention of infectious endocarditis remains the maintenance of good dental health, regular sanitation of foci of odontogenic infection and the formation of stable motivation in patients to maintain oral hygiene. At the same time, antibiotic prophylaxis should be considered as an important but additional tool strictly aimed at patients with the highest risk of an adverse outcome of the disease.

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