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CASE REPORTS

ETIOLOGICAL SPECTRUM OF ODONTOGENIC AND NON-ODONTOGENIC ABSCESSES IN ORAL AND MAXILLOFACIAL SURGERY

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ABSTRACT

INTRODUCTION: For their easier study, abscesses in the maxillofacial area are divided according to their clinical picture into acute and chronic, and according to their origin—into odontogenic and non-odontogenic.

MATERIALS AND METHODS: In this article, an analysis of 167 patients with odontogenic and non-odontogenic limited exudative diseases in the maxillofacial area, hospitalized in the Clinic of Maxillofacial Surgery at the St. Marina University Hospital, Varna, Bulgaria, for a period of one year—from 01.07.2022 until 30.06.2023, was conducted.

RESULTS AND DISCUSSION: In 56 of all 167 patients (23 with odontogenic and 33 with non-odontogenic abscesses), no microorganisms were isolated as the causative agents of the infection. Out of all 167 patients examined, in 81 (45 with odontogenic and 36 with non-odontogenic abscesses), representatives of the resident microflora were isolated—a polyinfection caused by normal inhabitants of the oral cavity in humans. After the exclusion from the analysis of these 56 patients with sterile cultures, it was found that in 81 of the total of 111 patients with isolated pathogens, which is 73% of all examined individuals, the inflammation was caused by resident microflora containing more than one bacterial species.

CONCLUSION: The resident microflora predominated, represented by more than one bacterial species (81 out of 111), followed by the classic cause of purulent infections: S. aureus (8 out of 11), C. freundii (4 out of 111), E. coli (3 out of 111), S. pyogenes and K. oxytoca represented by 3 each of all isolates. P. aeruginosa, S. pneumoniae, E. faecalis, P. oris, and C. diversus were found in only one of all prepared antibiograms, and representatives of the Candida species were found in a total of 4 materials—3 with C. albicans and 1 with C. tropicalis.

Keywords: *abscess, bacteria, head and neck, maxillofacial, non-odontogenic, odontogenic*

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INTRODUCTION

Inflammation is a basic defense mechanism characteristic of living organisms. It is a reaction against non-specific stimuli, exogenous or endogenous factors, with the aim of prevention or warning against further deepening of a possible process of damage to cells and tissues, leading to disruption of their function. The inflammation can be acute or chronic and is characterized by the following local

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signs: swelling, redness, increased local temperature, pain, and impaired function (1).

Abscess as an inflammatory disease is a limited collection of pus, which in the maxillofacial region is most often the result of an infectious process caused by complications from dental caries, failed endodontic treatment, trauma, secondary infection from a damaged skin or mucosal surface, etc. (2,3). For their easier study, abscesses in the maxillofacial area are divided according to their clinical picture into acute and chronic, and according to their origin—into odontogenic and non-odontogenic.

Abscesses of non-odontogenic origin are most often related to an infectious agent that has entered the soft tissues through various traumas to the mucous membrane of the oral cavity or the skin in the head and neck area (4).

In order to characterize an abscess as odontogenic, a prerequisite is the presence of a causative tooth from which the inflammatory process begins, referred to as the gateway to infection. In the presence of an open dental pulp chamber or after the opening of an intact one, a process of colonization of the dental root canals with different strains of aerobic or anaerobic microorganisms begins. The latter factors favor their development together with the endo- and exotoxins released from them and with the participation of cells from the body's immune system, especially macrophages, after their penetration into the periapical tissues through the apical foramen lead to the formation of purulent exudate. Although asymptomatic tissue necrosis is observed in practice, the main signs and symptoms accompanying acute odontogenic abscess are pain, swelling, erythema, and presence of purulent infiltrate. With preserved immune properties of the affected individual and/or with weak virulence of the infectious microorganism, these signs and symptoms are localized only in the area of the affected tooth—a limited inflammatory reaction of the organism. With weakened immunity of the patient and/or high virulence properties of the pathogen, the infection can spread and, by affecting large areas of the patient's body, end in severe complications and even sepsis and death (5). Widespread exudative diseases covering several adjacent anatomical areas (lodges) are referred to as phlegmons (6).

In a significant proportion of patients with odontogenic abscesses, after the administration of antibiotic treatment, their condition improves and ends with complete recovery. However, in the majority of patients with abscesses of dental origin and in those with phlegmons, surgical treatment in the form of incision, lavage, and drainage, accompanied by an antibacterial conservative one, is mandatory for the good outcome of the disease (1,3,4).

MATERIALS AND METHODS

In this article, an analysis of the patients with odontogenic and non-odontogenic limited exudative diseases in the maxillofacial area, hospitalized in the Clinic of Maxillofacial Surgery at St. Marina University Hospital, Varna, Bulgaria, for a period of one year—from 01.07.2022 until 30.06.2023. The patient group consisted of a total of 167 individuals at an average age of 39.2 (18–87) years, admitted to the Clinic of Maxillofacial Surgery as an emergency through the Multifunctional Emergency Department with Activities for Adults at the same hospital. The gender distribution was 84 men and 83 women. All patients were 18 years of age or older, with a mean age of 37.7 (18–87) years for men and 40.6 (18–86) years for women. In 82 of them, there was anamnestic data of a toothache that appeared a few days before they sought medical help, and during the incision, different amounts of purulent exudate was evacuated—circumstances confirming the diagnosis of odontogenic abscess. In the remaining 85, the anamnestic data indicated trauma to the soft tissues in the maxillofacial area or skin cysts (epidermal and dermoid) complicated by inflammation. In them, after the evacuation of the pus during the surgical treatment, the diagnosis of non-odontogenic abscess was made. During the surgical treatment, material was taken from all of them for microbiological examination and preparation of an antibiogram. The study

Table 1. Demographic distribution of the examined patients.

Gender	Number of Patients	Mean Age (Years)	Minimum Age (Years)	Maximum Age (Years)
Men	84	37.7	18	87
Women	83	40.6	18	86

did not include patients with diffuse distribution of the exudate, i.e., those with phlegmon.

Table 1 shows the demographic distribution of the studied patients with odontogenic and non-odontogenic abscesses in the maxillofacial region.

RESULTS AND DISCUSSION

In 56 of all 167 patients (23 with odontogenic and 33 with non-odontogenic abscesses), no microorganisms were isolated as the causative agents of the infection. The reasons for this can be various—incorrect collection of the sample for research, which should contain not only pus poor in microorganisms, but also material from the tissues adjacent to it, which are rich in bacterial content; incorrect storage of the sample in an inappropriate environment, temperature, moisture, sunlight; very long time between sampling and testing.

Tables 2 and 3 show the distribution by number and type of the isolated pathogens in the studied patients with odontogenic and non-odontogenic abscesses.

Out of all 167 patients examined, in 81 (45 with odontogenic and 36 with non-odontogenic abscesses), representatives of the resident microflora were isolated—a polyinfection caused by normal inhabitants of the oral cavity in humans. After the exclusion from the analysis of these 56 patients with sterile cultures, it was found that in 81 of the total of 111 patients with isolated pathogens, which is 73% of all examined individuals, the inflammation was caused by a resident microflora containing more than one bac-

Table 2. Examined patients with odontogenic abscesses.

Gender	Number of Patients	Mean Age (Years)	Number of Cultures with Isolated Resident Microflora	Number of Cultures without an Isolate (Sterile Cultures)	Isolated Specific Microorganisms (Type and Number)	Number of Affected Patients by Dental Quadrants
Men	38	42.7	20	10	- *Escherichia coli* (2) - *Staphylococcus aureus* (1) - *Pseudomonas aeruginosa* (1) - *Streptococcus pneumoniae* (1) - *Citrobacter freundii* (1) - *Enterococcus faecalis* (1) - *Candida tropicalis* (1)	- I quadrant (7) - II quadrant (5) - III quadrant (13) - IV quadrant (13)
Women	44	38.6	25	13	- *Candida albicans* (3) - *Prevotella oris* (1) - *Citrobacter freundii* (1) - *Citrobacter diversus* (1)	- I quadrant (6) - II quadrant (2) - III quadrant (24) - IV quadrant (12)

Table 3. Examined patients with non-odontogenic abscesses.

Gender	Number of Patients	Mean Age (Years)	Number of Cultures with Isolated Resident Microflora	Number of Cultures Without an Isolate (Sterile Cultures)	Isolated Specific Microorganisms (Type and Number)
Men	46	44.3	21	16	- *Staphylococcus aureus* (3) - *Klebsiella oxytoca* (3) - *Streptococcus pyogenes* (3)
Women	39	35.4	15	17	- *Staphylococcus aureus* (4) - *Citrobacter freundii* (2) - *Escherichia coli* (1)

terial species. We reached a similar conclusion in another study conducted for an earlier period of time, according to which the resident microflora was established at 64.2% (3).

S. aureus are Gram-positive spherical microorganisms, saprophytes on human skin and respiratory tract mucosa. They are clinically important pathogens causing a wide range of human infections, from mild skin infections to severe tissue infections and sepsis. *S. aureus* has a high level of antibiotic resistance and is a frequent cause of nosocomial infections in the community. It is resistant to antibiotic treatment and with increasing levels of resistance. This is the main and leading incentive for the development of new therapeutic strategies regarding their elimination in affected patients. They are common in the oral cavity and perioral region in humans. A number of authors accept that the oral cavity of the macroindividual is the source of *S. aureus* infection and consider that it is from it that the spread of various *S. aureus* infections in other parts of the body begins. Its role in the pathogenesis of some oral diseases should also be considered as part of the differential diagnosis (7,8). It was isolated in 8 of the patients we studied—one man with odontogenic abscess, three men and four women with non-odontogenic abscesses.

E. coli are Gram-negative microorganisms, normal inhabitants of the lower intestinal tract of warm-blooded organisms, including humans. They have capsules but do not form spores. Most representatives of this genus are mobile because they have cilia. Resistance to antibiotic treatment is rarely observed (9). In our study group, *E. coli* was isolated in two men with odontogenic and in one woman with non-odontogenic abscess.

P. aeruginosa is a Gram-negative microorganism commonly found in the environment. It can cause severe infections in humans, most often in those with cystic fibrosis. It has a natural resistance to antibiotics and the ability to form biofilms. Thus infection with this pathogen causes serious therapeutic problems in patients with urethral catheters and after heart valve replacement (10). It is found in saliva, sputum, and subgingival plaque, so the oral cavity is a possible reservoir for *P. aeruginosa* pulmonary infection (11). It was isolated only in one of the men with odontogenic abscesses.

S. pneumoniae are Gram-positive, facultative anaerobic microorganisms. They are a major infectious pathogen in humans and cause widespread inflammatory diseases, such as pneumonia, meningitis, etc., but can affect all organs and structures of the respiratory system (12). Due to their high resistance to antimicrobial preparations, it is proper to do an antibiogram before starting antibiotic treatment against them. They were isolated only in one of the men with odontogenic abscess.

C. freundii was isolated in 4 of the patients—3 women (one with odontogenic and two with non-odontogenic abscess) and one of the men with odontogenic abscess. They are anaerobic Gram-negative microorganisms of the *Enterobacteriaceae* family. They have a rod-like shape and several flagella that they use for locomotion. They are part of the facultative anaerobic flora of the gastrointestinal tract of humans and animals. They also inhabit soil, but can also be found in water, sewage, and food (13).

E. faecalis was proven to be the bacterial causative agent in one of the men with an odontogenic abscess. This is a Gram-positive microorganism, saprophyte of the human gastrointestinal tract. Under certain conditions, it can manifest as opportunistic infection. The most extensive literature data is on it causing infections in patients hospitalized for a longer period of time, in those who are immunosuppressed, and in those who have received repeated antibiotic therapy. Such infections are often nosocomial. Bacteria can enter the blood, urine, or intraoperatively, spreading to various systems and organs, thereby leading to more serious infections, including sepsis, endocarditis, and meningitis. *E. faecalis* are usually not the cause of infectious diseases in healthy macroorganisms (14).

P. oris are anaerobic Gram-negative microorganisms and are a predominant part of the facultative oral and vaginal flora. They are isolated from respiratory infections and their complications consist of aspiration pneumonia, lung abscess, chronic sinusitis, chronic otitis media, abscesses in and around the oral cavity, post-bite infections, paronychia, brain abscesses and osteomyelitis (15). In the patients stud-

ied by us, only one of the women had an odontogenic abscess.

C. diversus and *C. koseri* are synonyms of the same non-spore-forming Gram-negative microorganisms of the *Enterobacteriaceae* family. They are facultative anaerobes and move by peritrichous flagella. They are part of the normal flora of the digestive tract in humans and some animals, but may manifest as opportunistic pathogens in immunocompromised individuals. Their specific ability is to cause neonatal meningitis. All strains are resistant to ampicillin. There are also those that are resistant to neomycin, kanamycin, and cephaloridine (16). Out of all the examined patients, they were observed in only one female patient with an odontogenic abscess.

K. oxytoca are Gram-negative microorganisms closely related to *K. pneumoniae*. These bacteria are found naturally in the gastrointestinal tract, mouth, and nose of human individuals. Beyond its anatomical limits, however, colitis, urinary tract infections, wound infections, and sepsis can result. Outbreaks of antibiotic-resistant *K. oxytoca* have been observed in hospitals worldwide (17). In the present study, it occurred in 3 of the men with non-odontogenic exudative inflammatory process.

S. pyogenes are Gram-positive, aerotolerant microorganisms. They are extracellular and consist of motile and nonspore cocci that tend to form chains. They belong to the so-called group A streptococci. Pyogenic streptococci cause various diseases—scarlet fever, erysipelas, pyoderma, pharyngitis, pneumonia, puerperal fever. They can affect the valves of the heart, lead to glomerulonephritis, polyarthritis, and others. All group A streptococci are sensitive to penicillin antibiotic drugs. Treatment with similar preparations is used for long-term prevention of attacks of rheumatism and prevents damage to the heart valves. In cases of allergy to penicillins, erythromycin, macrolides, and cephalosporins can be taken (18). Out of the 167 patients, non-odontogenic abscesses were isolated in 3 of the men.

C. albicans was found in three of the women with odontogenic abscesses. It is a type of yeast and is the most common type of *Candida* in the oral cavity. Their presence is considered part of the normal human oral flora, as well as a harmless representative of the human oral microbiome. Their most common localization is on the back of the tongue. With excessive development of this type of yeast in the oral cavity, various forms of oral candidiasis are observed. Oral candidiasis is usually due to systemic disease (most commonly immunodeficiency and diabetes mellitus) or excessive local or systemic antibiotic use (19). The following groups of drugs are effective in *C. albicans* infection: azoles, allylamines, polyene antibiotics, flucytosine, and caspofungin. Other drugs are often used to treat candidiasis, mainly for symptomatic relief.

C. tropicalis is also a type of yeast in the genus *Candida*. It is a common pathogen in neutropenic hosts, where it can spread via the bloodstream to peripheral organs. Amphotericin B, echinocandins, or broad-spectrum triazole antifungal drugs can be used to treat them. *C. tropicalis* enters the human body through the consumption of foods contaminated with it. It has not been proven whether it is also found in the intestines of healthy people (20). It was isolated in one of the men with odontogenic abscesses.

In general, the causative agents of abscesses in the maxillofacial region from the genus *Candida* were found in only 4 of the patients—3 women and 1 man with odontogenic abscesses, and were not found in the patients with non-odontogenic abscesses.

Fig. 1 schematically presents the distribution of the studied 111 patients with odontogenic and non-odontogenic abscesses, in which pathogens were isolated from the antibiograms performed. The resident microflora was predominant, represented by more than one bacterial species (81 out of 111), followed by the classic cause of purulent infections *S. aureus* (8

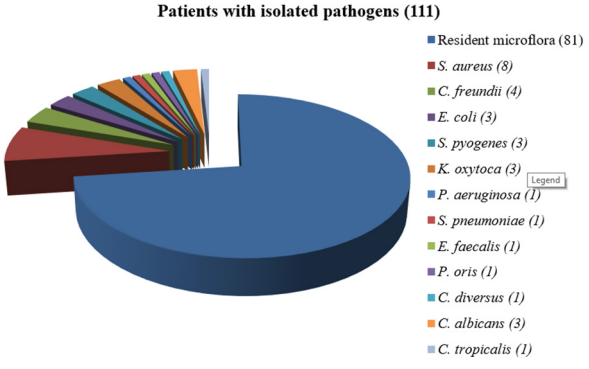


Fig. 1. Graphical distribution of the isolated bacterial pathogens.

out of 11), *C. freundii* (4 out of 111), *E. coli* (3 out of 111), *S. pyogenes*, and *K. oxytoca* represented by 3 each of all isolates. *P. aeruginosa*, *S. pneumoniae*, *E. faecalis*, *P. oris*, and *C. diversus* were found in only one of all prepared antibiograms, and representatives of the *Candida* species were found in a total of 4 materials—3 with *C. albikans* and 1 with *C. tropicalis*.

CONCLUSION

The study found that the largest share of the resident microflora, represented by more than one bacterial species is the causative agent of odontogenic and non-odontogenic abscesses in the maxillofacial area. It is followed by *S. aureus*, *C. freundii*, *E. coli*, *S. pyogenes* and *K. oxytoca*—each represented in several of the samples. The proportion of *P. aeruginosa*, *S. pneumoniae*, *E. faecalis*, *P. oris,* and *C. diversus*, which occurred in only one of the isolates, is the smallest. And fungi of the genus *Candida* were found in a total of 4 of the samples.

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