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Original article

# ETIOLOGICAL BACTERIAL SPECTRUM OF PATIENTS WITH ODONTOGENIC AND NON-ODONTOGENIC ABSCESSES AND PHLEGMONS IN THE MAXILLOFACIAL AREA

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## ABSTRACT

**Background:** Clarifying the bacterial causes of inflammatory diseases has a major role in the treatment of this type of pathology.

**Materials and methods:** In a retrospective study of 138 adult patients with abscesses and phlegmons of the head and neck, hospitalized and operated on urgently in the Clinic for Maxillofacial Surgery at University Multispecialty Hospital for Active Treatment "Sveta Marina" EAD – city of Varna, Bulgaria. Depending on their origin, the patients were divided into two groups - with odontogenic and non-odontogenic abscesses.

**Results:** The study group consists of 73 men (52.9%) and 65 women (47.1%) with a mean age of 43 (18-84) years.

The mixed resident microflora, including more than one bacterial species, is isolated in the largest number of cultures – 64.2%.

The total number of cultures with Gram-positive bacteria isolated in the samples of the studied 92 patients with isolates is 20,33%.

Representatives of Gram-negative bacteria are isolated in 7.49% of all.

Obligate anaerobes are found in 2.14% of the isolates.

Microorganism fungi are encountered in 3.21% of the crops.

In patients with phlegmons of odontogenic origin the ratio between Gram-positive and Gram-negative bacteria is 3:1. In phlegmons of non-odontogenic origin, they are entirely of the Gram-negative spectrum.

**Conclusion:** Microorganisms are not isolated in a third of the examined patients, which are most likely long errors in taking material for microbiological examination or in its improper storage and transportation. Of the other crops, the share of resident microorganisms as opportunistic pathogens is the largest. Of the conditionally pathogenic microorganisms, Gram-positive ones predominate.

**Keywords:** bacteria, etiological bacterial spectrum, maxillofacial surgery, non-odontogenic abscess, odontogenic abscess, phlegmon, head and neck surgery,

## INTRODUCTION

Abscesses in the maxillofacial area in relation to the severity of the flow and the area affected by the purulent exudate can vary in very wide limits - from small abscesses with weak symptoms, which can be treated on an outpatient basis, to large-spread purulent foci of the spilled area (phlegmons), which together with their complications can lead to a long stay in intensive care units and end in death [1]. The latter must be treated in specialized surgical clinics and the operation is performed under general anesthesia. Antibacterial treatment for acute inflammatory diseases of the head and neck, such as abscesses and phlegmons, necessarily requires the use of antibacterial therapy [2]. Clarifying the bacterial causes of inflammatory diseases has a major role in the treatment of this type of pathology. It is key in determining the type of antibiotic that is administered to patients with abscesses and phlegmons in the maxillofacial area when it is taken into consideration the resistance of the isolated microbe. In our clinical practice, we appoint and start the application of the appropriate antimicrobial drug empirically - before the isolation of the causative bacterial agent, already at the time of the diagnosis, the culture of which is usually presented a few days after taking the pus for examination [3, 4]. In some cases, no microbial pathogen is isolated (no culture), and some authors even speak of culture-negative abscesses [4, 5]. In these cases, relatively new methods are increasingly applied to determine the type of pathogens by isolating and studying their genome [6, 7]. Such methods are the detection of 16S rRNA and DNA sequences of the pathogens [4, 8,9]. However, they are unable to detect fungal microorganisms [10].

## MATERIALS AND METHODS

In a retrospective study of 138 adult patients with abscesses and phlegmons of the head and neck, hospitalized and operated on urgently in the Clinic for Maxillofacial Surgery at University Multispecialty Hospital for Active Treatment "Sveta Marina" EAD – city of Varna, Bulgaria in the period from 01.07.2021 to 31.06.2022 were

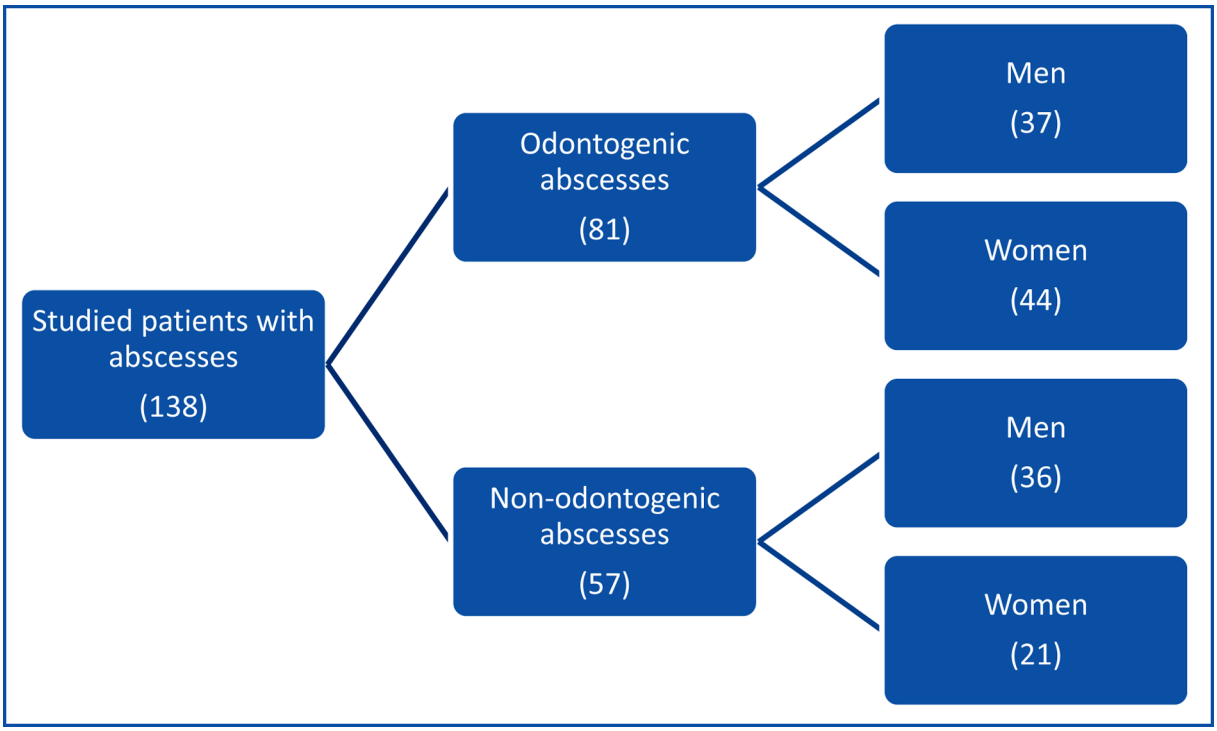
included. In all of them, the diagnosis was confirmed during the operative intervention by the evacuation of the purulent exudate. In all patients, material was taken for microbiological examination and preparation of an antibiogram as a routine examination. Depending on their origin, the patients were divided into two groups - with odontogenic and non-odontogenic abscesses.

## RESULTS AND DISCUSSION

The study group consists of 73 men (52,9%) and 65 women (47,1%) with a mean age of 43 (18-84) years – 42 (18-84) for men and 45 (18-84) for women.

Figure 1 shows the distribution of patients in the study group by number and gender.

**Fig. 1.** Distribution of patients in the studied group by number and gender




Tables 1 and 2 show the distribution of the studied patients from the study group by gender, age groups and mean age.

**Table 1.** Average age of the examined patients in the studied group

| | Number | Arithmetic mean | Median | Standard deviation | Minimum age | Maximum age |
|---|---|---|---|---|---|---|
| Men | 73 | 42 | 39 | 17,09 | 18 | 84 |
| Women | 65 | 45 | 45 | 17,06 | 18 | 84 |
| **Total** | **138** | **43** | **43,5** | **17,18** | **18** | **84** |

**Table 2.** Distribution of the examined patients from the studied group by gender and age groups

| Age (years) | Gender | | Total |
|---|---|---|---|
| | Men | Women | |
| to 44 (young age) | 41 | 30 | 71 |
| 45-59 (middle age) | 19 | 19 | 38 |
| 60-74 (elderly) | 10 | 14 | 24 |
| 75-89 (old people) | 3 | 2 | 5 |
| **Total** | **73** | **65** | **138** |

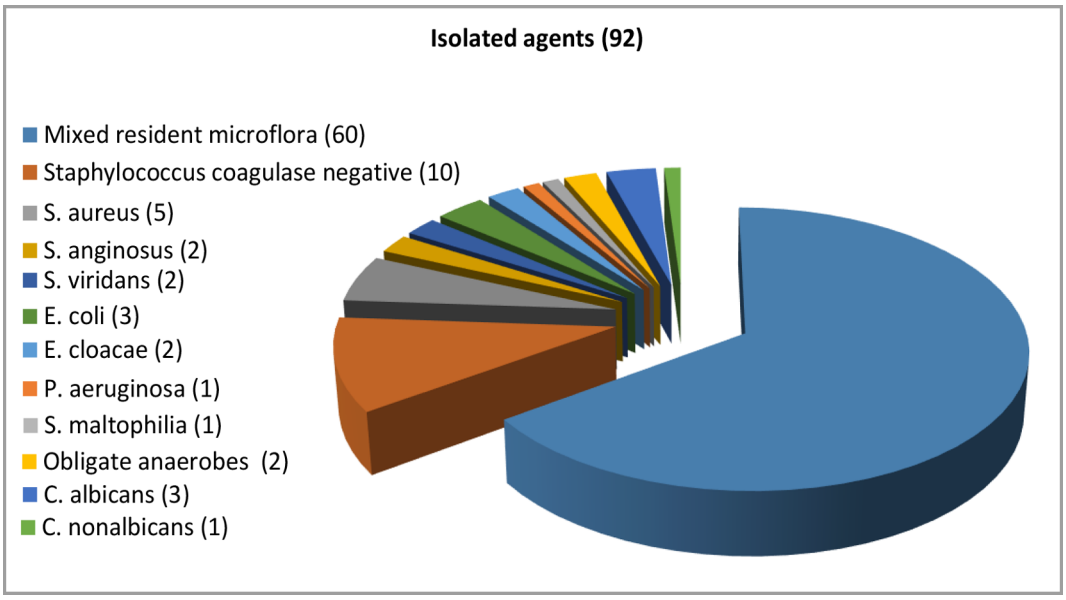
As can be seen from the results presented in Tables 1 and 2, the proportion of patients is younger. With increasing age, the number of patients with abscesses and phlegmons in the maxillofacial area decreases. The largest share of patients is at a young age (up to 44 years), and the smallest is among old people (between the ages of 75 and 89). There is no data in the world literature explaining this phenomenon. The most likely reason for this is the reduction of teeth in the dentition as the human race ages. The gender distribution did not show significant differences, both in the odontogenic and non-odontogenic abscess groups, and requires special comment.

In 46 of all 138 patients (33.33%), no specific pathogen was isolated, these are the so-called culture-negative abscesses. The most likely reason for this is that the anaerobic causative agents of infectious diseases, due to the non-observance of the conditions in the storage and transportation of the samples, die [4]. Separately, they are difficult to cultivate [11]. The remaining 92 patients (50 with odontogenic and 42 with non-odontogenic abscesses and phlegmons) were divided into groups according to the microorganisms isolated and the results obtained are presented in Table 3 and Graphic 1.

**Table 3.** Etiological causes of abscesses in patients from the studied group

| Pathogen | Number | Odontogenic | Non-odontogenic |
|---|---|---|---|
| Mixed resident microflora (more than one bacterial species) | 60 | 31 | 29 |
| Staphylococcus coagulase negative (CNS): | 10 | 5 | 5 |
| • *Staphylococcus epidermidis* | (7) | (3) | (4) |
| • *Staphylococcus haemolyticus* | (2) | (1) | (1) |
| • *Staphylococcus capitis* | (1) | (1) | |
| *Staphylococcus aureus* | 5 | 1 | 4 |
| *Streptococcus anginosus* | 2 | 2 | |
| *Streptococcus viridans* | 2 | 2 | |
| *Escherichia coli* | 3 | 2 | 1 |
| *Enterobacter cloacae* | 2 | 1 | 1 |
| *Pseudomonas aeruginosa* | 1 | | 1 |
| *Stenotrophomonas maltophilia* | 1 | 1 | |
| Obligate anaerobes | 2 | 1 | 1 |
| *Candida albicans* | 3 | 3 | |
| *Candida nonalbicans* | 1 | 1 | |
| **Total** | **92** | **50** | **42** |

**Graphic 1.** Etiological causes of abscesses in the patients of the studied group




The mixed resident microflora, including more than one bacterial species, is isolated in the largest number of cultures - 60, which represents 64,2%.

The total number of cultures with Gram-positive bacteria isolated in the samples of the studied 92 patients with isolate is 19, i.e. 20,33%. They are coagulase-negative staphylococci (Staphylococcus coagulase negative, CNS), *S. aureus*, *S. anginosus* and *S. viridans*.

Coagulase-negative staphylococci are found in 10 of the collected wound secretions, making 10,7% of all samples. When analyzing this group of isolated microorganisms, *S. epidermidis* is found in 7 of the samples, i.e. 7,49%, 2 samples with *S. haemolyticus* (2,14%) and *S. capitis* in 1 of the samples (1,07%).

The classic causative agent of purulent infections, *S. aureus*, is isolated in 5 of all 92 samples, which is 5,35%.

*S. anginosus* is found in 2 of the samples (2,14%).

*S. viridans* is present in 2 of all samples, representing 2,14%.

Representatives of Gram-negative bacteria are isolated in 7 of all 92 cultures of the examined patients, which is 7,49%. These are *E. coli*, *E. cloacae*, *P. aeruginosa* and *S. maltophilia*.

*E. coli* is found in 3 of the samples taken and constituted 3,21% of the total.

*E. cloacae* is isolated in 2 of all wound secretions and represented 2,14%.

*P. aeruginosa* is detected in 1 of the samples performed (1,07%).

*S. maltophilia* is also observed in only 1 of all cultures (1,07).

Obligate anaerobes are found in 2 of the isolates (2,14%).

Microorganism fungi are encountered in 4 of the crops (4,28%). Of these, *C. albicans* in 3 samples (3,21%) and *C. nonalbicans* in 1 (1,07%).

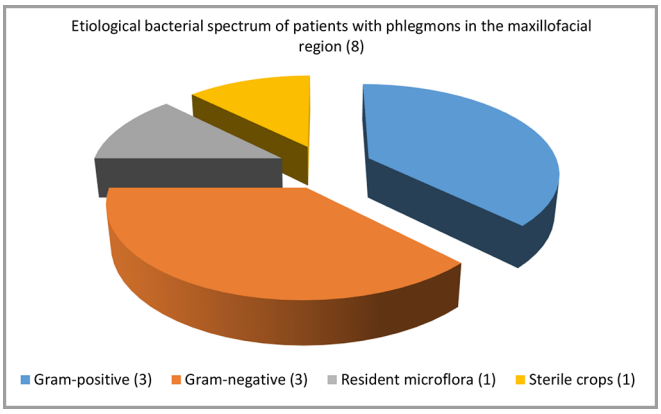
It can be concluded that Gram-positive bacteria are more than 2,7 times more than Gram-negative (19 versus 7), fungi are 4, and obligate anaerobes are only 2.

The largest number is of the resident microflora as the cause of the evacuated exudate - a total of 70 out of 92 (74,9%), of which 60 are mixed microflora that contains more than one type of bacteria, and 10 (Staphylococcus coagulase negative) are only with one isolated bacterial agent each.

Eight of all 138 patients have diffuse purulent inflammation (phlegmon) of the soft tissues in the maxillofacial region – 6 with phlegmon on the floor of the oral cavity of odontogenic origin and 2 with facial phlegmon of non-odontogenic origin. In four of these patients with phlegmon on the floor of the oral cavity of odontogenic origin, a monoinfection with the following causative agents is found – *S. epidermidis*, *S. haemolyticus*, *S. anginosus* and *S. maltophilia*. In one of them, resident microflora is demonstrated, and in one, the cultures remained sterile (wound discharge without microbial growth). The pathogens found in the patients with facial phlegmon of non-odontogenic origin are *E. coli* in one patient and *E. cloacae* in the other. I.e. in patients with phlegmon of odontogenic origin, the ratio of Gram-positive to Gram-negative bacteria is 3:1, and in phlegmonous inflammations of non-odontogenic origin, the causative agents are from the Gram-negative spectrum. Taken together for the entire group of patients with phlegmons in the maxillofacial area, the ratio of Gram-positive to Gram-negative bacteria to resident microflora to sterile cultures is 3:3:1:1.

Graphic 2 presents the distribution of patients with phlegmonous inflammations in the maxillofacial area in relation to their etiological cause.

**Graphic 2.** Etiological spectrum of the studied patients from the studied group with phlegmons




## CONCLUSIONS

Microorganisms are not isolated in a third of the examined patients, which are most likely long errors in taking material for microbiological examination or in its improper storage and transportation. Of the other crops, the share of resident microorganisms as opportunistic pathogens is the largest. Of the conditionally pathogenic microorganisms, Gram-positive ones predominate. Gram-negative bacteria were the only causative agents of phlegmons of non-odontogenic origin.

## REFERENCES:


1. Böttger S, Zechel-Gran S, Schmermund D, Streckbein P, Wilbrand JF, Knitschke M, et al. Clinical Relevance of the Microbiome in Odontogenic Abscesses. *Biology (Basel).* 2021 Sep 15;10(9):916. [PubMed]

2. Palma DM, Giuliano S, Cracchiolo AN, Falcone M, Ceccarelli G, Tetamo R, et al. Clinical features and outcome of patients with descending necrotizing mediastinitis: prospective analysis of 34 cases. *Infection.* 2016 Feb;44(1):77-84. [PubMed]

3. Verma D, Garg PK, Dubey AK. Insights into the human oral microbiome. *Arch Microbiol.* 2018 May;200(4):525-540. [PubMed]

4. Wiese KG, Merten HA, Wiltfang J, Luhr HG. [Clinical studies on the pathophysiology of odontogenic abscesses]. [in German] *Mund Kiefer Gesichtschir.* 1999 Sep;3(5):242-6. [PubMed]

5. Siqueira JF Jr, Rôças IN. Microbiology and treatment of acute apical abscesses. *Clin Microbiol Rev.* 2013 Apr;26(2):255-73. [PubMed]

6. Chen H, Jiang W. Application of high-throughput sequencing in understanding human oral microbiome related with health and disease. *Front Microbiol.* 2014 Oct 13;5:508. [PubMed]

7. Siqueira JF Jr, Rôças IN. As-yet-uncultivated oral bacteria: breadth and association with oral and extra-oral diseases. *J Oral Microbiol.* 2013 May 23;5. [PubMed]

8. Böttger S, Zechel-Gran S, Streckbein P, Knitschke M, Hain T, Weigel M, et al. A New Type of Chronic Wound Infection after Wisdom Tooth Extraction: A Diagnostic Approach with 16S-rRNA Gene Analysis, Next-Generation Sequencing, and Bioinformatics. *Pathogens.* 2020 Sep 28;9(10):798. [PubMed]

9. Voelkerding KV, Dames SA, Durtschi JD. Next-generation sequencing: from basic research to diagnostics. *Clin Chem.* 2009 Apr;55(4): 641-58. [PubMed]

10. Brook I, Wexler HM, Goldstein EJ. Antianaerobic Antimicrobials:

Spectrum and Susceptibility Testing. *Clin Microbiol Rev.* 2013 Jul; 26(3):526-46. [PubMed]

11. Eckert AW, Höhne C, Schubert J. [Pathogen spectrum and resistance status of exclusively anaerobic odontogenic infections]. [in German] *Mund Kiefer Gesichtschir.* 2000 May;4(3): 153-8. [PubMed]

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