

Case report

Demographic Distribution and Etiological Bacterial Spectrum of Patients with Non-Odontogenic Abscesses and Phlegmons of the Head and Neck

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Abstract

The aims of the present study are to prove that in non-odontogenic abscesses and phlegmons in the head and neck region, the main microbiological agents are representatives of the oral resident microflora, as in odontogenic purulent inflammatory diseases in the same area, and to determine and compare the demographic distribution between the two analyzed etiological groups. It includes and studies 57 patients with non-odontogenic abscesses and phlegmons of the head and neck. In all of them, as a routine procedure, material was taken from the surgical wound for microbiological examination and the identification of the isolated bacteria was confirmed by a microbiological analyzer "VITEK" ("BioMérieux", France). After analyzing the obtained results, the goal was confirmed - the largest part is of the resident microflora (59.5%, n=34) of which 50.75% (n=29) mixed resident microflora and 8.75% (n=5) mono infections, followed by representatives of Gram-positive bacteria (15.75%, n=9), Gram-negative ones (5.25%, n=3) and obligate anaerobes (1.75%, n=1). In the studied group of patients with non-odontogenic abscesses, Gram-positive bacteria are 3 times more than Gram-negative. The causative agents of phlegmons of non-odontogenic origin in the maxillofacial region are Gram-negative bacteria and obligate anaerobes in a 1:1 ratio. Unlike patients with odontogenic purulent diseases, in which the young population under the age of 44 is most affected, non-odontogenic abscesses and phlegmons most often affect mature individuals between the ages of 45 and 59.

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

Резюме

Целите на настоящото проучване е да се докаже, че при неодонтогенните абсцеси и флегмони в областта на главата и шията основните microbiологични причинители са представители на оралната резидентна микрофлора, както това е доказано за одонтогенните гнойни възпалителни заболявания в същата зона, и да определи и сравни демографското разпределение между двете анализирани етиологични групи. В него са включени и проучени 57 болни с неодонтогенни абсцеси и флегмони на главата и шията. Всички те са хоспитализирани и оперирани в условията на спешност. При всички като рутинна процедура от оперативната рана бе взет материал за microbiологично изследване и идентификацията на изолираните бактерии бе потвърдена чрез microbiологичен анализатор "VITEK" („BioMérieux“, Франция). След анализ на получените резултати целта беше потвърдена – най-голям е дялът на резидентната микрофлора (59.5%, n=34), от които 50.75% (n=29) смесена резидентна микрофлора и 8.75% (n=5) моноинфекции, следван от представителите на Грам-положителните бактерии (15.75%, n=9), Грам-отрицателните такива (5.25%, n=3) и облигатните анаероби (1.75%, n=1). В изучаваната група от пациенти с неодонтогенни абсцеси Грам-положителните бактерии са 3 пъти повече от Грам-отрицателните. Причинителите на флегмоните от неодонтогенен произход в лицево-челюстната област са Грам-отрицателни бактерии и облигатни

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анаероби в съотношение 1:1. За разлика от болните с одонтогенни гнојни заболявания, при които най-засегнато е младото население на възраст до 44 години, то най-често неодонтогенните абсцеси и флегмони засягат зрелите индивиди на възраст между 45 и 59 години.

Introduction

In contrast to the odontogenic inflammation disease, in which the entrance door of the infection is a hospital tooth, through which the pathogenic agent enters the jaw bone and from there into the adjacent soft tissues, the most common causes of abscesses and phlegmons in the head and neck area from the non-odontogenic origin are inflammatory skin cysts (epidermal, dermoid), acutely non-specifically registered on the lymph nodes in their stage of lymphadenophlegmon, cheilitis, head and neck injuries (domestic, professional, traffic accidents), skin and mucosal inflammatory diseases, representing an entrance door for an infectious agent in depth (Dahlén, 2009; Faergemann and Dahlén, 2009). This explains why in odontogenic exudative inflammatory diseases the most common causative agents are representatives of the resident microflora of the oral cavity (Bottger *et al.*, 2021; Yankov, 2023). Logically, it would follow that the main causes of neodontogenic abscesses and phlegmons of the head and neck are caused by the microbiological representatives normally inhabiting the surface of the skin in those parts of the human body (resident microflora), the proof and analysis of which is the main aim of this article. The most common bacterial species in non-odontogenic abscesses in the head and neck area are staphylococci, streptococci, and *Hemophilus influenza type B* (Unkelet *et al.*, 1997; Dahlén, 2009; Katarzyna *et al.*, 2018; Kabanova *et al.*, 2020). A study by the Vitebsk Medical University in Belarus, published in 2020, shows that of 494 examined patients with non-odontogenic abscesses in the maxillofacial region, 46% of the isolated causative agents are streptococci and 33% are staphylococci (Kabanova *et al.*, 2020). According to a 2018 article describing and analyzing five cases of severe and long-term neck abscesses and phlegmons of non-odontogenic origin in Poznan, Poland, the main causative agents are *Streptococcus anginosus* and *Escherichia coli* (Katarzyna *et al.*, 2018). Fungal infections occur mostly in immunocompromised

patients and those undergoing long-term antibiotic therapy, and in these cases, *Candida albicans* is the most common agent (Samaranayake *et al.*, 2009).

Materials and Methods

This retrospective study consists of 58 patients (36 men and 22 women) with purulent infections of maxillofacial area – all of them surgically treated in the Clinic of Maxillofacial Surgery (UM-HAT „Sveta Marina“ in Varna, Bulgaria) in the period from the beginning of July 2021 to the end of June 2022. In all of them, the diagnosis has been confirmed during the surgical intervention by the evacuation of the purulent exudate. One patient has been excluded from the study due to the detection of an oncohematological disease, and only individuals over 18 years of age and not suffering from serious chronic diseases are included. In all patients, a sample was taken for microbiological examination to differentiate the pathogenic agent and the development of an antibiogram by medical specialists in microbiology. After screening on an HM&L (Alifax, Italy) instrument, direct Gram microscopy of Uro-Quick screening broth was performed on all positive samples. Identification of the isolated bacteria was performed by routine biochemical identification and the results were confirmed by a VITEK instrument (bioMérieux, France). Figure 1 shows the distribution of patients in the study group by number and gender.

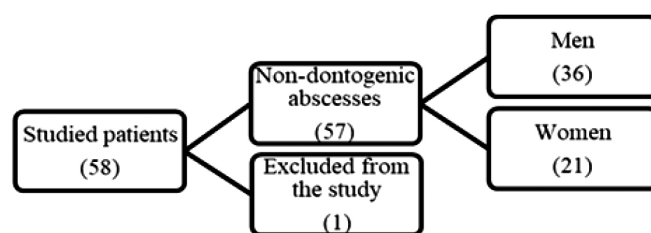


Fig. 1. Distribution of patients in the studied group by number and gender

Results and Discussion

The final group of patients with non-odontogenic abscesses have a total number of 57 patients

Table 1. Age of the studied patients with non-odontogenic abscesses

	Number	Arithmetic mean	Median	Standard deviation	Minimum age	Maximum age
Men	36	46	48	17.15	18	84
Women	21	46	42	16.61	18	84
Total	57	46	48	16.96	18	84

- 36 (63.16%) men and 21 (36.84%) women. The median age of the group is 46 (18-84) years – 46 (18-84) years for men and 46 (18-84) years for women.

Table 1 and Fig. 2 show the distribution of the studied patients from the study group with non-odontogenic abscesses by gender and age groups.

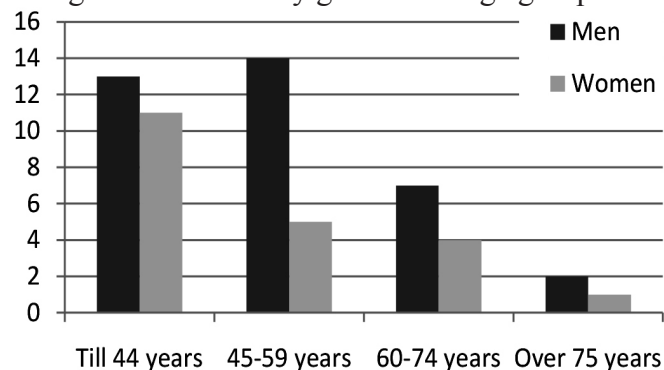


Fig. 2. Distribution of patients with non-odontogenic abscesses by age

In patients with odontogenic abscesses and phlegmons in the maxillofacial area, the most affected is the young age group (up to 44 years of age) with an average age between 35 and 43 years (Cachovan *et al.*, 2013; Yankov, 2023). The most logical reason for this is tooth loss with age. In the population studied in this study, the incidence is highest in the 45-59 age range, i.e. in patients of mature age, with the mean age of the studied population of 46 (18-84) years. Worldwide, there is no literature data and no logical explanation of this phenomenon. Most likely, the reason for this is the preponderance of the population in these age groups as a whole. The share of patients with non-odontogenic infections is the smallest among the elderly (60-74 years) and old (over 75 years)

individuals, whose numbers on Earth as a whole are the smallest.

Table 2 shows the number and percentage distribution of microbial agents in the studied 57 patients with non-odontogenic abscesses and phlegmons of the head and neck.

Mixed resident microflora which is represented by more than one bacterial microorganism species is established in the largest proportion of the bacterial cultures - 29, which represents 50.75%. These bacteria are not primarily pathogenic, but in high concentrations or the wrong place, they give rise to and maintain an infectious inflammatory process, such as abscesses and their diffuse forms, called phlegmons.

Of all 57 patients examined, the total number of cultures with isolated Gram-positive bacteria is 9 i.e. 15.75%. They are coagulase-negative staphylococci (*Staphylococcus coagulase-negative*, CNS) and *S. aureus*. Coagulase-negative staphylococci have been found in 5 of the taken wound secretions, which makes 8.75% of all samples – of these, *S. epidermidis* is present in 4 of the samples, i.e. 7% and *S. haemolyticus* in 1 of them (1.75%). In the head and neck region, they most often cause infections of the oral mucosa (Dahlén, 2009), skin infections (Faergemann and Dahlén, 2009), and abscesses of non-odontogenic origin (Brook, 2008). The latter is also confirmed by the present study, in which coagulase-negative staphylococci are the specific pathogens found in the largest percentage of isolates. *S. aureus* is isolated in 4 of all 57 samples, which is 7%. In the maxillofacial region, it is considered the most common cause of angular cheilitis (Dahlén, 2009). It is found in high concentration both on the

Table 2. Etiological causes of abscesses in patients from the studied subgroup with non-odontogenic abscesses

Pathogens	Number	(%)
Mixed resident microflora (more than one bacterial species)	29	50.75
<i>Staphylococcus coagulase negative</i> :	5	8.75
<i>S. epidermidis</i>	(4)	(7)
<i>S. haemolyticus</i>	(1)	(1.75)
<i>S. aureus</i>	4	7
<i>E. coli</i>	1	1.75
<i>Enterobacter cloacae</i>	1	1.75
<i>Pseudomonas aeruginosa</i>	1	1.75
Obligate anaerobes	1	1.75
Wound discharge (pus) without microbial growth	15	26.25
Total	57	100

skin and in the nasal cavity of a large part of the population, who, without being sick, act as healthy carriers, which explains its involvement as an etiological factor in non-odontogenic abscesses in the maxillofacial region.

Gram-negative bacteria were isolated in only 3 of all studied cultures, which constitutes 5.25% - 1.75% for each of *E. coli*, *E. cloacae*, and *P. aeruginosa*. These microorganisms in the head and neck region most commonly cause respiratory infections of the upper respiratory tract (McChlery *et al.*, 2009) and infections of the oral mucosa (Dahlén, 2009). They occur more often in individuals with suppressed immune forces. The proximity of these areas and the weakened immunity in patients with exudative diseases, especially in their highly prevalent forms called phlegmons, explains their role as causes of skin abscesses of the head and neck.

Obligate anaerobes are found in only 1 of the isolates (1.75%). In the maxillofacial area, these bacteria most often cause sinusitis (Battisti *et al.*, 2023) and abscesses (Brook, 2009; Dahlén, 2009), from where the contamination of the skin of the head and neck is possible. They occur in a large percentage of odontogenic abscesses and phlegmons.

Wound secretions in which no microorganisms have been detected are 15 (26.25%). Most often this is due to mistakes in taking the material for research, its transportation, or storage – factors, which lead to the death of the microorganisms in the biological samples taken.

Both diffuse inflammations (facial soft tissue phlegmons) of non-odontogenic origin in men in the maxillofacial region were caused by Gram-negative bacteria – in one patient the causative agent was *E. coli* and in the other, it was *E. cloacae*. Both are highly virulent in head and neck diseases.

Conclusions

The present study confirms the aim of the study that in non-odontogenic purulent diseases of the head and neck, as in odontogenic ones in the same anatomical area, the part of the resident microflora as the cause of the infection is the largest – 59.5% (50.75% of mixed microbes and 8.75% of monoinfection). Gram-positive bacteria are 3 times more than Gram-negative. Obligate anaerobes were found in less than 2% of the crops. The causative agents of non-odontogenic diffuse purulent inflammatory diseases (phlegmons) in the maxillofacial

region are Gram-negative and obligate anaerobes. Unlike patients with odontogenic purulent infections of the head and neck, which mainly affect the young population (up to 44 years of age), non-odontogenic ones occur mainly in mature individuals (between 45 and 59 years).

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