

Microbial Landscape in Patients with Complicated Forms of Chronic Suppurative Mediastinal Otitis Media

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Abstract: Despite significant progress in prevention, diagnosis, and treatment, chronic otitis media remains one of the most common and dangerous diseases among the population of the planet. In otology practice, the problem of early diagnosis and effective treatment of patients with chronic otitis media with complications remains key. The study aims to analyze the microbial flora of different parts of the middle ear in chronic purulent otitis media with complications, assess the sensitivity of these microorganisms to various antibiotics, and comparatively analyze the microflora of pathologically altered areas of the middle ear detected during surgery. A total of 114 patients with chronic purulent otitis media with various complications who were hospitalized over the past 10 years and underwent surgery were examined. Microbiological methods included studying the species composition of microflora from the middle ear. After the identification of the isolated microflora species, its sensitivity to antibiotics of various groups was studied. As a result of bacteriological examination, it was established that in the etiological structure of chronic purulent otitis media complications the predominant microorganisms are gram-positive pyogenic cocci (golden and epidermal staphylococci), as well as non-fermenting rods (*Pseudomonas aeruginosa*). In microbial associations yeast and mold fungi of the genus *Aspergillus* spp., *Candida* spp. and *Mucor* spp. were found. Obligate anaerobic microorganisms were less common, while peptostreptococci dominated among them. During the study, the greatest sensitivity of microbes was established to cephalosporins (cefuroxime, ceftriaxone, cefotaxime) and fluoroquinolones (ciprofloxacin). Based on this, the treatment of patients was carried out using 2nd and 3rd-generation cephalosporins in combination with fluoroquinolones locally, as well as antifungal drugs.

Keywords: chronic purulent otitis media, mastoiditis, labyrinthitis, meningitis, abscess.

Relevance of the problem. Despite significant progress in prevention, diagnosis, and treatment, chronic inflammation of the middle ear remains one of the most common and dangerous diseases among the inhabitants of the globe. Research conducted by scientists shows that chronic suppurative otitis media (CSOM) occurs in 1, 5-4% of the world's population. [1, 7, 8,10, 14].

In otology practice, the problem of early diagnosis and effective treatment of patients with chronic inflammation of the middle ear remains key. This is due to various medical and social factors, as well as negative consequences, including hearing loss and the risk of local and intracranial complications resulting from exacerbations of the chronic process in the middle ear.[3,4,5,6,11].

There are several forms of chronic purulent otitis media, which are distinguished by a peculiar manifestation of clinical courses and outcome of the disease. The tubotympanic form of chronic purulent otitis media proceeds with a more pronounced clinical picture, certain patient complaints of pain in the ears, suppuration, and hearing loss. Epitympanic-antral form of chronic purulent otitis media due to low symptoms may not bother the patient for a long time, and accordingly, remains undetected and causes various complications. In the pathogenesis of the disease, destruction of the bone structure of the middle ear is observed, osteomyelitis of the bones develops and cholesteatoma is formed. As a consequence of osteomyelitis of the bones, the purulent process from the middle ear spreads to neighboring structures and causes various local (mastoiditis, labyrinthitis, facial nerve paresis) and intracranial (meningitis, abscesses of the brain and cerebellum, sinus thrombosis, sepsis) complications. [1,2,13].

Serious sequelae often arise from intracranial complications caused by chronic otitis media, with mortality rates ranging from 10 to 30%. [3,9,14]

The occurrence of various complications associated with diseases of the middle ear depends on the degree of prevalence of the infection. The general reaction of the body also plays an important role in this process. The state of local and general immunity of the whole organism. In this case, it is necessary to take into account the background diseases that are detected in patients.

Microorganisms such as streptococci, staphylococci, pneumococci, anaerobes, fungi, and other opportunistic bacteria play a significant role in the development of chronic purulent otitis media with complications. Often, when examining the contents of the middle ear, cerebrospinal fluid, and purulent focus in the cranial cavity, the presence of mixed microflora is indicated. [1,4, 6,11].

Before the use of antibiotics, purulent inflammatory diseases of the middle ear often had various complications. After the advent of antibiotics, the frequency of complications in purulent otitis media decreased significantly. This allowed doctors to use antibiotics without the need to determine the microbial flora. However, the widely used antibiotic therapy in otolaryngological practice often does not meet modern standards of clinical pharmacology and microbiology. [9,10, 13].

The use of antibacterial drugs without taking into account the biological characteristics of microorganisms has led to the emergence of bacterial strains that are resistant to many drugs and have a clear advantage over other types of bacteria. [14, 15, 19, 20].

The current approach to the use of antimicrobial agents in the treatment of middle ear diseases needs to be seriously reconsidered. Decisions on the selection of antibiotics for the treatment of ear infections should be based on local data on antibiotic resistance and the results of clinical bacteriological studies. Over the past decade, various researchers have confirmed and described changes in the microflora of chronic suppurative otitis media [5,7,16,17].

According to the conducted studies, it was revealed that the true pathogen capable of causing and maintaining inflammation in the middle ear is a microorganism located in the tympanic cavity, antrum, mastoid process, surgical cavity or in the abscess cavity. [8, 12, 18,19].

Changes in the etiological structure and sensitivity of pathogens of chronic otitis media with complications over the past decade have influenced the nature of inflammation in the middle ear, its severity and the duration of the disease [9, 10, 13, 14, 17].

Antimicrobial susceptibility testing provides an important source of information for assessing the level of resistance to bacteria most prevalent in a given area. This helps to optimize the choice of empirical antimicrobial therapy before bacteriological data are available [1, 2, 13, 16, 20].

In recent years, the change in the types of pathogens of chronic otitis media with complications and their sensitivity has affected the level of inflammation, its severity, and duration in diseases of the middle ear.

Objective of the study. The objective of the study is to analyze the microbial flora of different areas of the middle ear in chronic purulent otitis media with complications, to assess the sensitivity of these microorganisms to various antibiotics, and to perform a comparative analysis of the microflora of pathologically altered areas of the middle ear detected during surgery.

Materials and methods: We examined 114 patients with chronic purulent otitis media with various complications who had been treated in the hospital over the past 10 years and who had received surgical treatment in the ENT departments of the clinic of the Samara State Medical University and the Samarkand Regional Multidisciplinary Medical Center.

Among the examined men 65 (57%), women 49 (43.0%), according to the classification of the inflammatory process, 11 (9.7%) patients had chronic purulent otitis media, mesotympanitis, 84 (73.7%) had chronic purulent otitis media, epitympanitis, 19 (16.6%) had chronic purulent otitis media, epimesotympanitis.

Figure 1 shows the frequency of occurrence of chronic otitis media with complications among patients by age.

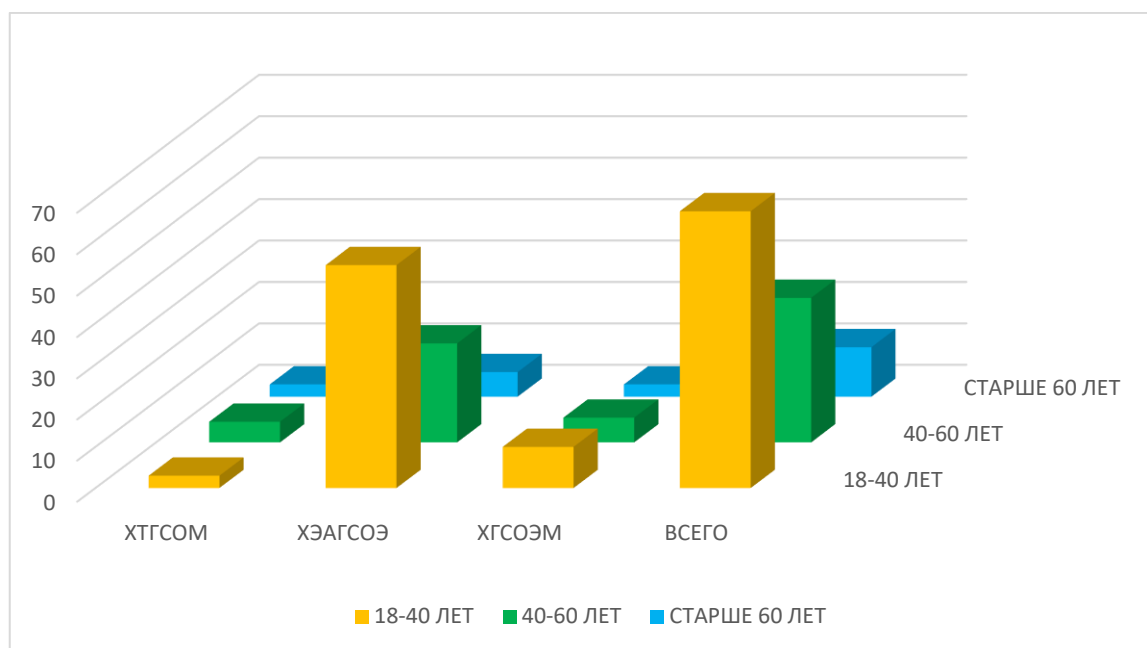


Fig. 1 Age characteristics of chronic gastroesophageal reflux with complications (N = 114)

According to the anamnesis, the duration of the disease ranged from 3 to 18 years. The complications identified among those examined were local in 85 patients and intracranial in 29 patients.

Among otogenic local complications, 47 patients were under 40 years of age, 26 were under 60 years of age, and 12 patients were 60 and older. Among local complications, mastoiditis was detected in 46 patients, atypical forms of mastoiditis in 12, facial nerve paresis in 14, and labyrinthitis in 13 patients.

Among otogenic intracranial complications, there were 20 patients under the age of 40 and 9 patients under the age of 60. Among them, otogenic purulent meningitis was detected in 8, extradural abscess in 7, brain abscess in 5, otogenic cerebellar abscess in 3, sinus thrombosis, and perisinus abscess in 6 patients.

Patients were admitted to the hospital in serious and extremely serious condition, with a high body temperature of 39-40 0 C, complaints of severe pain in the affected ear, headache, dizziness, nausea, vomiting, hearing loss, and tinnitus. All patients had clearly expressed general and meningeal symptoms, as well as clouded consciousness.

Table No. 2

Types of complications	Age of patients						Total number of patients 114 (100%)
	18 – 40 years old (N= 67)		40-60 years (N= 35)		Over 60 years old (N= 12)		
	Husband	Women	Husband	Women	Husband	Women	
	Local complications (n=85)						
Mastoiditis	17	12	8	6	2	1	46
Atypical mastoiditis	4	3	2	1	1	1	12
Facial nerve paresis	4	3	2	2	1	2	14
Labyrinthitis	2	2	3	2	2	2	13
	Intracranial complications (n=29)						
Extradural abscess	3	2	1	1	-	-	7
perisinus abscess, sinus thrombosis	3	2	1	-	-	-	6
Meningitis	3	2	2	1	-	-	8

Brain abscess	2	1	1	1	-	-	5
Cerebellar abscess	1	1	-	1	-	-	3
Total	39	28	20	15	6	6	114

Character complications (N = 114)

All patients underwent general clinical examination, X-ray of the mastoid process using the Schuller and Mayer method, computed tomography of the mastoid process, magnetic resonance imaging of the brain, consultation with a neurosurgeon, neurologist, ophthalmologist, and other specialists. To clarify the diagnosis and differential diagnosis, all patients with purulent meningitis underwent lumbar puncture. The pressure of the spinal cord fluid in patients with otogenic meningitis ranged from 200 to 240 mm H₂O, and the total amount of protein varied from 0.66 to 6 g/L with an obvious Pandy and Nonne-Apelt reaction. Pleocytosis in the spinal cord fluid reached 3 thousand cells in 1 cubic millimeter.

When early signs of local and intracranial complications appear, emergency surgical intervention is necessary to eliminate the purulent focus from the middle ear and cranial cavity.

Bacteriological analysis was conducted to study the species composition of the ear microflora. After determining the type of isolated microflora, its sensitivity to various types of antibiotics was studied.

For microbiological examination, the contents of the external auditory canal, tympanic cavity, antrum and surgical cavity were taken with sterile cotton swabs in standard culture tubes. The obtained material was sent to the bacteriological laboratory, where aerobic and anaerobic microorganisms were isolated. Identification of the isolated cultures was carried out using a bacteriological analyzer. Antibiotic sensitivity was studied using the disk diffusion method.

Research results.

When conducting bacteriological studies of material from the external auditory canal and tympanic cavity in patients with perforation of the tympanic membrane, it was found that the microbial landscape of chronic otitis media with complications includes a wide range of microorganisms, more than 10 species, mainly opportunistic. It was also found that in 9.7% of cases, microflora was absent.

During microbiological examination, microbial associations of two or three microorganisms were cultured with varying frequency in the external auditory canal, including gram-positive cocci (*Staphylococcus aureus*, *Staphylococcus epidermidis*), gram-negative non-fermenting rods (*Pseudomonas aeruginosa*), obligate anaerobic bacteria (*Peptostreptococcus* spp ., *Fusobacterium* spp .), as well as yeast-like (*Candida* spp .) and molds (*Aspergillus* spp .) mushrooms.

Microorganisms were often cultured in associations. Staphylococci were found in 64.3% of patients. Among them, 30.1% had *Staphylococcus aureus*, 32.0% had *Staphylococcus epidermidis*, and 2.2% had *Staphylococcus saprophyticus*. *Staphylococcus epidermidis* in samples from the external auditory canal was not considered the main pathogen in CSOM but was a representative of the normal biocenosis of the skin of this area.

The largest number of isolated bacteria was *S. epidermidis* (32.0 %). Most likely, epidermal staphylococcus entered the tympanic cavity from the ear canal through the perforation of the eardrum. Gram-negative flora from the external auditory canal was isolated only in associations of microorganisms (25.8%). *Pseudomonas aeruginosa* was detected in 16.2% of patients, and *Klebsiella oxytoca* - in 9.6%.

Only one species, monoculture of *Staphylococcus aureus*, was found in cultures from the tympanic cavity in 37.2% of cases and from the antrum in 32.4% of cases, respectively. Mixed flora obtained from the external auditory canal is most often represented by associations of *Staphylococcus aureus* with gram-negative flora (32.3%). In 9.3% of cases, yeast and mold fungi of the genus *Aspergillus* were detected in microbial associations. spp ., *Candida* spp . and *Mucor* spp . In bacterial -fungal associations, *Candida* were most frequently encountered . spp . (6.9%). These microorganisms

complemented the associations of *Staphylococcus aureus* and gram-negative flora or were observed in combination with each of these pathogens.

Obligate anaerobic microorganisms, including *Fusobacterium*, were isolated from 9.9% of patients. spp.), *Bacteroides* (*Bacteroides* spp.) and peptostreptococci.

After the identification of the isolated microflora species, its sensitivity to antibiotics of various groups was studied. As a result of bacteriological research, it was established that in the etiological structure of chronic gastroesophageal reflux disease with complications the predominant microorganisms are gram-positive pyogenic cocci (golden and epidermal staphylococci), as well as non-fermenting rods (*Pseudomonas aeruginosa*). Yeast and mold fungi of the genus *Aspergillus* were found in microbial associations spp., *Candida* spp. and *Mucor* spp. Obligate anaerobic microorganisms were less common, with peptostreptococci dominating among them.

When studying the antibiotic resistance of the main microorganisms isolated from the tympanic cavity, it was found that *Staphylococcus epidermidis* has a high level of resistance to benzylpenicillin, roxithromycin, and azithromycin. In *Pseudomonas aeruginosa* showed resistance to carbenicillin and amoxicillin. *Staphylococcus aureus* had low sensitivity to fusidin and resistance to benzylpenicillin and ampicillin. The highest sensitivity of microbes was found to cephalosporins (cefuroxime, ceftriaxone, cefotaxime) and fluoroquinolones (ciprofloxacin).

During surgery, all patients were found to have significant aditus blockages. Ad antrum, due to filling with cholesteatoma, polyps and granulations, and extensive destructive changes in the temporal bone were also noted.

Conclusion. As a result of bacteriological examination, it was established that in the etiological structure of chronic septic ulcer with complications the predominant microorganisms are gram-positive pyogenic cocci (golden and epidermal staphylococci), as well as non-fermenting rods (*Pseudomonas aeruginosa*). Obligate anaerobic microorganisms were less common, while peptostreptococci dominated among them.

When analyzing the qualitative composition of the microflora colonizing the tympanic cavity in patients with complicated chronic suppurative otitis media, both monocultures and associations consisting of 2–3 types of microorganisms were identified. The most common pathogens in exacerbations of complicated chronic purulent otitis media remain *S. epidermidis* (32.0%), *S. aureus* (30.1%) and *P. aeruginosa* (16.2%). Obligate anaerobic microorganisms (9.9%) were detected less frequently, among which peptostreptococci predominated. Pathogenic fungi were not found in pure form, and *Candida* dominates in bacterial-fungal associations. spp. (6.7%).

The study data showed that in all patients with pronounced destructive changes in the middle ear, the pathogens showed high resistance to antibacterial drugs. *S. epidermidis* was resistant to benzylpenicillin, roxithromycin and azithromycin, while *P. aeruginosa* was resistant to carbenicillin and amoxicillin. *S. aureus* showed the greatest resistance to benzylpenicillin and ampicillin.

The highest sensitivity of microbes is established to cephalosporins (cefuroxime, ceftriaxone, cefotaxime) and fluoroquinolones (ciprofloxacin). Currently, the group of fluoroquinolones is a serious alternative to highly active antibiotics. In terms of effectiveness, fluoroquinolones are not inferior to cephalosporins of the 3rd and 4th generations. Based on this, treatment of patients should be carried out using cephalosporins of the 3rd and 4th generations in combination with local fluoroquinolones and antifungal drugs. Systemic antibiotic therapy is indicated for severe exacerbations and severe, destructive forms of chronic purulent otitis media with complications.

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