

STUDY ON THE SENSITIVITY OF MICROORGANISMS TO ANTIBIOTICS OF VARIOUS CLASSES

W. Hui¹⁾, Q. X. Rui¹⁾, S. Shahab¹⁾

¹⁾ International Sakharov Environmental Institute of Belarusian State University, Dolgobrodskaya str., 23/1, 220070, Minsk, Belarus, wanghui@iseu.by

In this study, four strains of bacteria were successfully isolated from throat swab samples collected from patients with chronic tonsillitis. The Kirby-Bauer disk diffusion method was employed to evaluate the sensitivity and resistance of these strains to four commonly used antibiotics.

Keywords: Chronic tonsillitis; Antibiotic resistance; Sensitivity; Kirby-Bauer method; Throat swab

ИССЛЕДОВАНИЕ ЧУВСТВИТЕЛЬНОСТИ МИКРООРГАНИЗМОВ К АНТИБИОТИКАМ РАЗЛИЧНЫХ КЛАССОВ

В. Хуэй¹⁾, Ц. Х. Руй¹⁾, С. Шахаб¹⁾

¹⁾ Учреждение образования «Международный государственный экологический институт имени А. Д. Сахарова» Белорусского государственного университета, ул. Долгобродская, 23/1

В данном исследовании из образцов мазков из горла, взятых у пациентов с хроническим тонзиллитом, были успешно выделены четыре штамма бактерий. Для оценки чувствительности и устойчивости этих штаммов к четырем commonly используемым антибиотикам был применен метод диффузии в агар с дисками Kirby-Bauer.

Ключевые слова: Хронический тонзиллит; Устойчивость к антибиотикам; Чувствительность; Метод Кирби-Бауэра; Мазок из горла.

<https://doi.org/10.46646/SAKH-2025-1-401-405>

In today's world of widespread antibiotic use, microbial resistance is very common. Therefore, for successful antibiotic therapy, antibiotic resistance of pathogenic microorganisms should be determined before prescribing and attempts should be made to overcome microbial resistance [1]. The aim of this laboratory study was to investigate the resistance and susceptibility to antimicrobial agents in swab isolate cultures from volunteers with chronic tonsillitis.

Materials Microorganisms extracted from the nasopharyngeal mucosa of 7 volunteers diagnosed with chronic tonsillitis with the aim of further studying their resistance to antibiotics - tobramycin, metronidazole, cefoperazone, ampicillin/sulbactam show in Fig. 1.

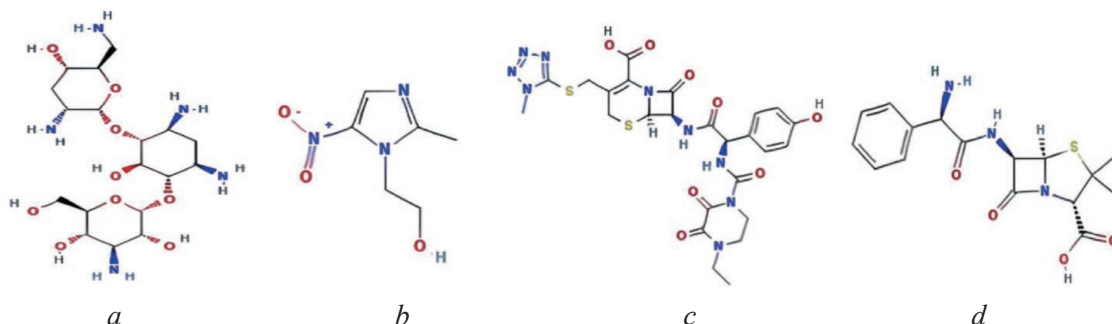


Fig 1. The antibiotics used in the experiment :

a – Tobramycin , b – Metronidazole, c – Cefoperazone, d – Ampicilli

Methods Nasopharyngeal swabs were obtained from the nasopharynx of 7 volunteers diagnosed with chronic tonsillitis. We collected pharyngeal swabs[6]from the pharynx of patients with chronic tonsillitis and placed them on meat pine agar (MPA). We selected one (No. 9) from all the pharyngeal swabs in Fig. 2.



Fig. 2. Petri dish No. 9 with colonies a , b,and c on MPA

Petri dish No. 9 contained 3 different microorganisms, each of which was transplanted into a different petri dish in Fig. 3.



Fig. 3. Petri dish No. 9 with colonies a, b and c on MPA

The microbial species obtained by culturing in Petri dishes were made into smears and subsequently examined under a microscope show in Fig. 4.

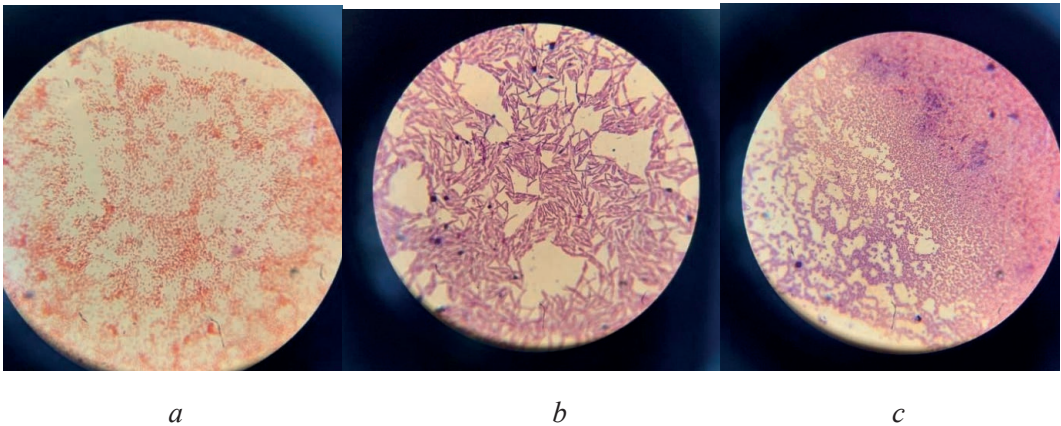


Fig.4.The morphology of microorganisms under a microscope:
a – Gram-negative bacilli, *b* –Gram-positive bacilli , *c* – Gram-positive cocci

The microorganisms were found in Petri dish No. 9:

1. figure 4a contained predominantly single gram-positive bacilli, presumed to be *Corynebacterium* rods.

2. figure 4b contained small gram negative bacilli, presumed to be *Haemophilus influenzae*.

3. figure 4c contained gram-positive cocci - *Staphylococcus aureus* and *Staphylococcus aureus*.

Morphological and vectorial characterization of microorganisms. The morphology and Gram properties of the microorganisms isolated from each colony were studied. As a result, the following microorganisms were detected in 7 patients with chronic tonsillitis show in table 1:

Table 1

Microorganisms Isolated from Petri dish No. 9

Microorganisms	Number
G+ Coccidioides	7
G+ Bacillus	5
G- Bacillus	4
G+ Spore Bacilli	3

Note. G+ – Gram-positive microorganisms, G- – Gram-negative microorganisms.

Results of the paper diffusion method[2] for detecting changes in microbial growth inhibitory diameter (A - ampicillin/sulbactam; T - tobramycin; M - metronidazole; C - cefoperazone). The results of the study are shown in Fig. 6.



Fig. 6. paper diffusion method for detecting changes in microbial growth inhibitory diameter

The results of the Antibacterial preparation (ABP) susceptibility assessment were interpreted by placing the test cultures into one of three categories:

- Sensitive - strains are inhibited at the concentrations and recommended doses of ABP produced in human organs and tissues.
- Moderately susceptible - cultures are considered to be inhibited at concentrations at the maximum administered dose but within the recommended dose range.
- Resistant (drug-resistant) - microorganisms whose growth cannot be inhibited even with the maximum allowable dose of drug[3].

Sensitivity and resistance results were evaluated based on the data presented in table 2.

Table 2

Criteria for interpretation of microbial susceptibility/resistance results for the following antibiotics

Designation	Drug content in round tablets, µg	Diameter of growth inhibition, mm		
		R	R/S	S
Ampicillin/sulbactam (A)	10/10	<14	14 – 15	>16
Metronidazole(M)	5	0	0	>15
Tobramycin (T)	10	<16	16 – 18	>19
Cefoperazone (C)	75	<15	16 – 20	>21

Note. S - Sensitive; R - Resistant, R/S - moderately resistant.

Results and discussion Antibiotic resistance and antibiotic susceptibility results obtained from nasopharyngeal cultures of patients with chronic tonsillitis, depending on the type of infection, are presented in table 3.

Table 3

Antibiotic Resistance Data for Gram-Positive Coccidioides Infections to Selected ABP

Sample	A		T		M		C	
	Diameter, mm	R, S	Diameter, mm	R, S	Diameter, mm	R, S	Diameter, mm	R, S
2	37	S	19	S	0	R	22	S
12	36	S	22	S	0	R	20	R/S
6	30	S	26	S	0	R	15	R
10	31	S	17	R/S	0	R	15	R
11	46	S	31	S	10	R	28	S
14	17	R/S	18	R/S	0	R	16	R/S
17	11	R	16	R/S	0	R	12	R

Cultures isolated from the nasopharyngeal portion of volunteers suffering from chronic tonsillitis were characterized by high resistance and high susceptibility to various antimicrobial drugs (ampicillin/sulbactam, metronidazole, tobramycin, cefoperazone), which acted on different targets of the bacterial cell.

Among the antibiotics studied, ampicillin/sulbactam had the highest bacterial activity against gram positive cocci infections and gram positive and sporulating microorganisms but resistant strains were found in gram negative bacilli infections and the mean diameter of the no growth zone was the largest of all the microorganisms which was 32 mm.

Metronidazole showed high resistance to sporulating microorganisms, Gram-positive bacteria, Gram-negative bacilli and Gram-positive cocci infections. The mean diameter of the no-growth zone was 10 mm.

In most cases, the susceptibility of Gram-positive cocci, Gram-positive and Gram-negative bacilli to tobramycin was 57 %, 85 % and 80 %, respectively. Sporulating microorganisms were sensitive to all samples. The mean diameter of the no-growth zone was 24 mm.

Microorganisms were both sensitive and resistant to cefoperazone. For the most part, Gram-positive cocci were resistant and Gram-positive and Gram-negative bacilli showed sensitivity, resistance and intermediate sensitivity. The sporulating microorganisms were sensitive in all samples. The mean diameter of the no-growth zone was 20 mm.

References

1. Wang Kasa, Shen JH. Identification of bacteria by Gram staining of mixed smears[J]. Science and Technology Innovation Herald, 2018, 15(24): 79+81. DOI: 10.16660/j.cnki.1674-098X.2018.24.079. = 王笠, 沈建华. 混合涂片革兰氏染色法鉴别细菌[J]. 科技创新导报, 2018, 15(24): 79+81. DOI: 10.16660/j.cnki.1674-098X.2018.24.079.
2. Expression profile of Epstein-Barr virus and human adenovirus small RNAs in tonsillar B and T lymphocytes. Assadian F. [et al.] [J]. PLoS one, 2023, 12(5) : e0177275.
3. Cinamon U., Goldfarb A., Marom T. The impact of tobacco smoking upon chronic / recurrent tonsillitis and post tonsillectomy bleeding [J]. Int Arch Otorhinolaryngol, 2025, 21(2) : 165-170.
4. Demonstration of bacterial cells and glycocalyx in biofilms on human tonsils. Kania RE [et al.] [J] Arch Otolaryngol Head Neck Surg, 2007, 133(2) : 115-121.
5. Expression profile of Epstein-Barr virus and human adenovirus small RNAs in tonsillar B and T lymphocytes. Assadian F [et al.] [J]. PLoS one, 2017 12(5) : e0177275.