Influence Of Different Concentrations Of Dimethylsulfoxide Solution On Antibiotic Sensitivity Of Pathogenic Microorganisms In Experiment (In Vitro)

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ABSTRACT

The fight against surgical infections remains an urgent problem in surgery. The problem of microflora resistance makes it difficult to obtain positive results of purulent-surgical diseases of soft tissues. In the literature, there are few studies devoted to the suppression of the existing microflora resistance to antibiotics.

The aim of the study: There was a laboratory study of the microbiological activity of dimethylsulfoxide, the identification of the optimal concentration of the solution with the maximum bactericidal and suppressive properties of the resistance of pathogenic microflora in vitro.

The results of the experimental in vitro studies have shown that 25% dimethylsulfoxide is the optimal concentration in terms of suppressing microflora resistance.

Key word: purulent wound, microorganism, resistance, dimethylsulfoxide,

1. RELEVANCE.

Given the progressive development of modern technologies and new methods of treating purulent wounds, the problem of resistance of pathogenic micro flora remains relevant. The number of patients with acute purulent diseases of soft tissues is up to 35-40% of all surgical patients and tends to increase. Despite the significant advances in modern surgery, the problem of diagnosis and treatment of surgical infection remains relevant [1, 2Purulent complications account for 30–35% of all surgical diseases, and in the structure of hospital infections in a surgical clinic, wound suppuration ranges from 2–3% to 11–62.2% [3]. More than 1/3 of patients with a surgical profile have various degrees of surgical infection [4]. Over time, there is a change in the etiological structure of surgical infection, its pathomorphosis as a result of the wide, uncontrolled and unreasonable use of antibacterial drugs, the expansion of indications for invasive methods of diagnosis and treatment [5, 6, 7]. The increase in the frequency and severity of surgical infection, insufficient effectiveness of traditional methods of treatment determine the importance of this problem, which is currently considered one of the main in surgery.[8, 2, 9, 10]. According to some studies, the number of deaths due to infectious complications is 42-60% [11, 5]. The effectiveness of the fight against pathogens of surgical infection directly depends on their resistance to antibacterial drugs.

Difficulties in the treatment of purulent wounds with the use of antibiotics due to the high resistance of micro flora prompted the search for an additional and more effective, generally available method of local treatment. One of these methods is research aimed at the use of chemical methods of influencing the micro flora of purulent wounds, with the aim of studying the bactericidal effect and simultaneous suppression of micro flora resistance to antibiotics. Based on this, we decided to study the effect of dimethyl sulfoxide solution on resistant microflora. To solve this problem, laboratory and experimental studies were carried out, allowing their further introduction into clinical practice.

The aim of the study is: laboratory study of the microbiological activity of dimethyl sulfoxide, identification of the optimal concentration of the solution with the maximum bactericidal and resistant - suppressive properties for pathogenic microflora in vitro.

2. MATERIALANDMETHODS

Considering that in our practice, in most cases (up to 60-70%) with purulent-surgical diseases, S. aureus was sown as the dominant pathogenic flora, the experiment was carried out on the bacterium S. aureus. The method of obtaining clinical material was intra operative biopsy material, as well as an imprint (smear, scraping, and aspirate) of wounds. Sowing of pathogenic microorganisms on nutrient agar that is on Petri dishes, was performed at a dilution of 1010 mt / ml. To determine the maximum effective concentration of dimethyl sulfoxide solution, exposure was carried out with a solution of dimethyl sulfoxide on the surface of agar in the following variants of various concentrations in series VI: I - control without exposure to dimethyl sulfoxide solution, with exposure to 5% - II, 10% - III, 15% - IV , 20% - V, 25% - VI, dimethyl sulfoxide solution.The exposure time was 24 hours. Each series was carried out in 10 Petri dishes, seeded micro flora. After 24 hours, the micro flora was sub cultured into pure agar, and then the sensitivity to 15 types of antibiotics, which we had chosen in advance, was determined.

After the end of the incubation, the Petri dishes were placed upside down on a dark matte surface so that the light fell on them at an angle of 45 ° (taking into account the light reflections). The diameter of the growth inhibition zones was measured with an accuracy of 1 mm, using a caliper.

Table №1

The sizes of growth inhibition zones in the agar Giventhal-Vedmina environment of the pathogen S. aureus after exposure to various concentrations of dimethyl sulfoxide solution.

Antimicrobialdrug	**Dimexidesolutionconcentration**					
	0	5%	10%	15%	20%	25%
Oxacillin	-	-	-	-	24,6+1,6	26,6+1,6
Cefazolin	17,4+1,6	22,6+1,6	25.7+1.2	27.1+1.1	29.4+1.4	28.1+0.8
Cefuroxime	-	-	18,7+0,84	22,2+0,84	24,7+0,78	27,4+0,83
Cefotaxime	21,2+0,84	25,5+1.2	27.3+0.81	28.2+0.7	28.6+0.9	2.4+1.3

Gentamicin	-	-	-	-	-	17.8+0.7
Levomycetin	-	-	-		-	17,7+1,8
Rifampicin	12,7+1,8	18.9+1,4	22,5+1,3	27,5+1,21	28,9+,3	28,5+1,3
Erythromycin	-	13,5+1,1	16,2+0,9	18,4+1.2	21,2+0.87	24,4+0,85
Tetracycline	-	-	-	-	-	
Ciprofloxacin	-	-				
Amikacin	-	-	-	22,5+0,75	24,5+0,6	27,5+1.2
Cefoperazone	21,5+0,6	22,5+0.86	24,4+1,1	26,3+0.9	28,1+1,1	28,4+1,7
Moxifloxacin	18,3+1,7	22,4+0.89	24.5+1.31	26.8+0.85	27.8+0.7	29.2+1.2
Benzylpenicillin	-	-	-	-	-	-
Ampicillin	-	-	-	-	-	-
Sensitivityin%	5 (33,3%)	6 (40%)	7 (46,7%)	8 (53.3)	9 (60%)	11 (73.3%)

Note: * - resistanttoantibacterialpreparation; ** - anintermediatetypeofresistancetoanantibacterialdrug.

Our study of the sensitivity of micro flora in various series allowed us to reveal a number of features, namely: when pathogenic microorganisms were exposed to a solution of dimethyl sulfoxide, an increase in the sensitivity to antibiotics of bacteria was noted with an increase in each 5% concentration: 5%, 10%, 15%, 20% and 25 %, the number of antibiotics to which the micro flora was more sensitive increases accordingly.With an increase in the dose of exposure to a solution of dimethyl sulfoxide, sensitivity of micro flora to new antibiotics appears, to which there was no sensitivity without exposure to a solution of dimethyl sulfoxide or at low doses. The maximum peak of the expected results was achieved when exposed to a 25% solution of dimethyl sulfoxide.

When exposed to a 25% solution of dimethyl sulfoxide for 24 hours, we observed the maximum increase in the sensitivity of pathogenic microbes. As can be seen from Table№1 of the micro flora used in vitro in the experiment, which was not influenced with a solution of dimethyl sulfoxide, the sensitivity was noted only in 33.3% of the 15 antibiotics we selectedWhen exposed to a 5% solution of dimethyl sulfoxide, the sensitivity to antibiotics increased to 40%, when exposed to a 10% solution of dimethyl sulfoxide, 46.7% was noted, with a 15% solution of 53.3%, under the influence of a 20% concentration, sensitivity to antibiotics increased up to 60%. Whene xposedtoa 25% concentration of dimethylsul foxide solution, thes ensitivity to anti biotics wasatits maximum, reaching 73.3%.

Thus, experimental studies in a series of experiments made it possible to reveal that when exposed to a solution of dimethyl sulfoxide of nutrient agar, inoculated with pathogenic microorganisms in a dilution of 1010 mt / ml, with various concentrations of a solution of dimethyl sulfoxide with the above exposure time, it has a heterogeneous effect on micro flora resistance. These studies have revealed that the expected bactericidal concentration of 25% dimethyl sulfoxide exhibits the inhibitoriest properties of micro flora resistance, which made it possible to take this concentration as a working standard.

The results of the experimental studies showed that when exposed to a solution of dimethyl sulfoxide nutrient agar with colonies of pathogenic microorganisms at a dilution of 10^{10}mt / ml, starting with a 25% concentration, there is a maximum zone of inhibition of micro flora growth for most antibiotics.This degree of concentration of the chemical dimethyl sulfoxide makes it possible to achieve the maximum effect from the position of suppressing the resistance of microflora.

These data allow us to apply in clinical practice the optimal concentration of the chemical preparation dimethyl sulfoxide for maximum effect, from the standpoint of suppressing microflora resistance.

3. CONCLUSIONS:

1. A solution of dimethyl sulfoxide at 25% concentration exhibits the maximum resistance-suppressing properties to petogen S. aureus.
2. In the treatment of purulent-surgical diseases using a 25% dimethyl sulfoxide solution, it is necessary to re-determine the sensitivity of microflora to antibiotics during treatment, which makes it possible to expand the choice of antibiotics during treatment.
3. Thus, the features of the dimethyl sulfoxide solution revealed by us in 25% concentration indicate the effectiveness in suppressing the resistance of pathogen S. Aureus,

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