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INFLUENCE OF BIOACTIVATION ON HEMOLYTIC STAPHYLOCOCCUS (INFORMATION 5)

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The article contains the research results of the influence of bioactivation without external sources of power on hemolytic staphylococcus. The use of bioactivation proves to be effective, non- pharmacological and available method of influence on the micro flora of thermal wounds.

Key words: bioactivation, hemolytic staphylococcus, electrode, xenoskin.

У статті викладені результати вивчення впливу біоактивації без зовнішніх джерел струму на культуру гемолітичного стафілокока. Використання біоактивації є ефективним, безмедикаментозним і доступним методом впливу на мікрофлору опікових ран.

Ключові слова: біоактивація, гемолітичний стафілокок, електрод, ксеношкіра.

Изложены результаты влияния биоактивации без внешних источников тока на культуру гемолитического стафилококка. Использование біоактивації является эффективным, без медикаментозным и доступным методом воздействия на микрофлору ожоговых ран.

Ключевые слова: биоактивация, гемолитический стафилококк, электрод, ксенокожа.

Evolution of the issue and analysis of the latest researches and publications

Nosocomial infection of heavily injured patients has been one of the major and unresolved issues of combustiology [1]. Despite the fact that existing antibacterial medications have improved the outcomes of treatment [10], the infection remains the main reason of complications [7] and fatal outcomes of the patients, who experienced the period of thermal shock [8].

The main nidi of infection of heavily injured thermal patients are the necrotized tissues and the injury surface, lungs, intestines, urinary tracts, areas of catheter access to the main blood vessels [2]. Together with the direct thread to a patient's life, durable existence of infection in the thermal injuries leads to the inhibition of epithelization and formation of regular tissues, lysis of newly formed epithelium, deepening of surface burns, sepsis, which does not allow timely performance of autoplasty and trans-plantation of cultivated cells [9].

Today, sepsis related issues have gained an increasing worldwide interest [3]. One may speak about sepsis when there is a nidus of infection in the organism that periodically or continuously supplies bacteria into the blood stream, resulting in subjective and objective symptoms of disease [5]. The main reason of death with sepsis is multiple organ failure and its late diagnostics that make it impossible to prevent serious complications and get positive outcomes in the process of treatment [6]. The search for non-pharmacological, effective and available means and methods of influence on micro flora of wounds is a very important task for contemporary combustiology [4].

Materials and methods. The research covered the influence of minor intensity (bioactivation) on the bacteria of hemolytic staphylococcus, which were previously seeded on agar. Copper plates (ultra clean) were used as electrodes donors (ED) of electrons. For electrodes-acceptors (EA) specific alloys on the basis of aluminum, magnesium and zinc (AMZ) were taken. The electrode pair DE-AE was located on agar and connected with a conductor. The pair initiated transportation of charge carriers (electrons) within interelectrode area.

The strength of the current in the electric circuit, because of the contact difference of the electrode potentials, reached 30 mcA with the voltage 0,03-0,06V. The influence factor on hemolytic staphylococcus was studied under the conditions of connected and disconnected electro conductive circuit. The picture of the experiment was the following. On the agar in the Petri dish, where the bacteria of hemolytic staphylococcus had been previously seeded, we located standard (diameter 5mm) discs connected between each other with the electrode pair DE-AE. Hence, electric current appeared, because of the contact difference of the electrode potentials. The Petri dish was placed into the thermostat with the temperature 36°C for 24 hours. The bactericidal and bacteriostatic influences of bioactivation on hemolytic staphylococcus were assessed according to the diameter of lysis. The bactericidal efficiency of bioactivation in the conditions of connected and disconnected circuits was controlled with the help of the standard disc with ceftriaxonum.

Results of the research and discussion.

Under the conditions of closed (connected) circuit, the bactericidal influence of bioactivation (BA) on the bacteria of hemolytic staphylococcus under the electrode AE was insignificant (fig. 1). The diameter of its lysis did not exceed 8,5 mm. At the same time, the bactericidal efficiency under the electrode DE was strongly apparent and reached in diameter 27,2 mm. The experiment testifies that the bactericidal influence under the electrode DE is stronger in 3,2 in comparison with the electrode AE.

In the conditions of disconnected circuit the polarity of the apparent bactericidal action did not change (fig. 2). Under the electrode DE the bactericidal influence was insignificant (the diameter of lysis was 7,4 mm). At the same time, the diameter of lysis under the electrode AE reached 20,5 mm, which testifies to its stronger bactericidal efficiency. It should be taken into account, that in these conditions specific contour BA was being formed, composed electrode AE and underlying substance.

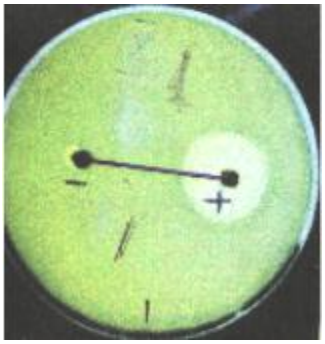


Fig.1 Influence of bioactivation on the bacteria of hemolytic staphylococcus in the conditions of closed circuit.

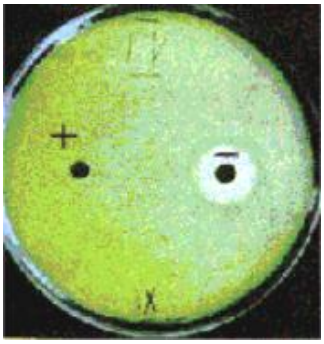


Fig. 2. Influence of bioactivation on the bacteria of hemolytic staphylococcus in the conditions of disconnected contour.

In order to evaluate the validity of the received data (changes in bactericidal influence polarity) we located the electrode pair DE-AE on different Petri dishes (fig. 3) and received analogous results.

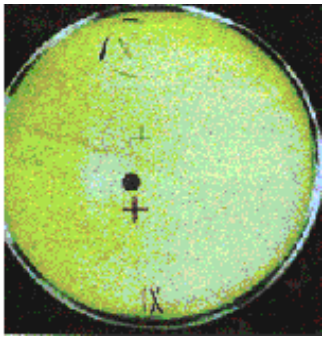
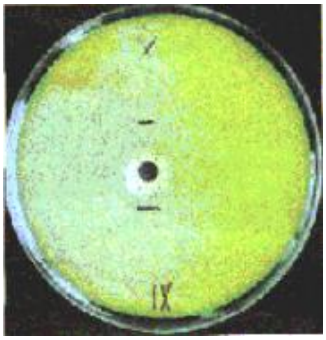


Fig. 3. Influence of the electrodes DE and AE on the bacteria of hemolytic staphylococcus.



The bactericidal action under the electrode DE did not change and was 7,4 mm, while under the electrode AE decreased and reached 12,1 mm. Stronger bactericidal action under the electrode AE testifies to the existence of their common circuit through a single agar.

We also studied the action of the previously activated and non-activated xenoskin on the bacteria of hemolytic staphylococcus. We produced standard discs with the diameter 5 mm of a sterile freeze-dried (lyophilized) xenoskin. One part of the discs undergone bioactivation in saline solution (patent № 50619A, 15.10.2002p. Bul. №10). Another part of the discs, moistened in saline solution, were located on the agar of the Petri dishes with the previously seeded bacteria of hemolytic staphylococcus (non-activated xenoskin discs -1; activated -2; fig. 4). Bactericidal efficiency was observed under both discs. However, under non-activated xenoskin the diameter of lysis was 12,4 mm, while under activated - 21,2 mm, which directly testified to positive effect of the previous bioactivation.

Fig. 4. Influence of non-activated (1) and activated (2) xenoskin on the bacteria of hemolytic staphylococcus.

Fig. 5. Influence of xenoskin on hemolytic staphylococcus in the conditions of disconnected circuit.

We also studied the bactericidal action of xenoskin in the conditions of disconnected circuit. For this purpose we placed two separate standard discs of freeze-dried xenoskin with DE and AE electrodes with the diameter of 5 mm on the areas with hemolytic staphylococcus. Under these conditions bactericidal and bacteriostatic actions was observed under both discs of xeno-skin (fig.5). The diameter of lysis under xenoskin with the electrode DE was 15,8 mm, and under the electrode AE – 16,6 mm.

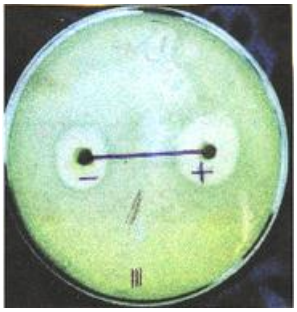


Fig. 6. Influence of xenoskin on hemolytic staphylococcus in the conditions of closed circuit.

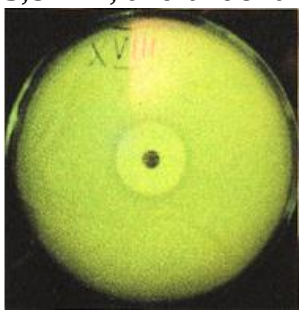


Fig.7. Influence of the standard disc with ceftriaxonum on hemolytic staphylococcus.

At the same time, bactericidal efficiency of the xenoskin usage significantly increased in the conditions of closed (connected) circuit (fig. 6), when the electrode pair DE-AE were placed on its standard discs. Meanwhile, bactericidal action increased under the both electrodes, reaching, under the electrode AE, the lysis diameter of 18,7 mm, and under the electrode DE – 22,5 mm. The received result unambiguously exceeded the bactericidal efficiency of xenoskin in the conditions of disconnected circuit. The bactericidal efficiencyof bioactivated xenoskin in the conditions of connected and disconnected circuits was controlled with the help of the standard disc with ceftriaxonum (fig.7). The diameter of bactericidal influence on hemolytic staphylococcus was 22,1 mm.

After the analysis of the received data we can state that the most efficient bactericidal influence on hemolytic staphylococcus is inherent in the electrodes DE in the conditions of closed circuit, which in 1,2 times exceeded the efficiency of standard discs with ceftriaxonum.

The contact bioactivation of xenoskin in the conditions of disconnected circuit increases its bactericidal influence in1,3 times in comparison with non-activated xenoskin. However, it was 24,9% lower than of the standard disc.

Bioactivation of xenoskin conditions the increase of its bactericidal efficiency in 1,7 times, but in the comparison with the standard disc it was 4,5% lower. Bioactivation of xenoskin in the conditions of closed circuit increases its bactericidal efficiency in 1,8 times in comparison with non-activated xenoskin, which is 1,8% greater of bactericidal action of the standard disc with ceftriaxonum.

Conclusion

1. Bioactivation is a non-pharmacological, effective and available method of influence on the micro flora of thermal wounds.

2. The highest efficiency of bactericidal influence on the bacteria of hemolytic staphylococcus is observed in the conditions of closed (connected) circuit under the electrode DE.

3. Bioactivation of xenoskin with the purpose to increase its bactericidal efficiency should be provided on a patient after the end of surgery, locating electrodes DE on the xenoskin, while AE electrodes – on integral zones (palm, sole).

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