УДК 616.31-002.3-071
МРНТИ 76.29.55, 76.29.50

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THE FEATURES OF PYOSEPTIC INFECTION CLINICAL COURSE OF MAXILLO-FACIAL AREA IN EXPERIMENT

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Abstract. Inflammation and hypersensitivity are associated processes, and in the field of human pathology are causally dependent. Their link is immunity. The work is devoted to studying the effect of the degree of bacterial sensitization of inflammatory process in the maxillofacial area in the experiment. The state of the organism's immunological reactivity is the most important factor in the pathomorphosis of inflammatory diseases in the maxillofacial area (MFA). Since the discussion of general conceptual issues of inflammation is still ongoing. The study of some fundamental aspects of bacterial sensitization of the body in the clinical course of infectious inflammatory process in MFA to analyze existing biomedical theories, as well as the development of new scientific approaches and concepts, is relevant.

The purpose is to study the clinical course of purulent-septic infection in the MFA in the experiment.

Research methods. Experimental purulent-destructive inflammation of the lower jaw and perimaxillary soft tissues reproduced according to the original method developed by us, on 100 guinea pigs. The weight of laboratory animals was 475.0 ± 25.0 g. Reproduction of the infectious-inflammatory model in the MFA based on the immunological laboratory of WKSMU. The material for infection was microbial suspension of culture St. aureus, containing 1 billion microbial cells in 1.0 ml. The animals were sensitized by a single, double, three-fold, and four-fold injection of 0.5 ml of microbial suspension of a daily culture of St. Aureus to the periosteum of the vestibular surface of the mandible of the guinea pig. The interval between the 1st and 2nd, between the 2nd and 3rd, between the 3rd and 4th injection of the bacterial infection was 7 days. The injection of the resolving dose of the staphylococcal antigen into the primary infectious focus was carried out on the 7th , 14th , 21st and 28th days in a volume of 0.5 ml and concentration of 0.5 billion microbial cells (mt/ml).

Results. The study found that all the animals of I, II, III, IV groups on the introduction of the microbial culture resolving dose the infectious-inflammatory process was developed. Moreover, the response of the body in all animals reached a maximum on the 2nd day after injection.

The clinical picture of the disease, manifested in increased body temperature, drowsiness and lethargy, lack of appetite, hypodynamia, the development of infectious-inflammatory process are indicated in the MFA in infected animals. Prior to the experiments, the basal body temperature in Guinea pigs was 37.8 C, by the end of the first day after the introduction of microbial culture it increased to 39.8 C.

External symptoms of acute suppurative inflammation in the MFA were observed in some guinea pigs of the I and II groups already on the 2nd day after injection, and later, with great consistency in all animals, almost until the end of the observation. In this case, the animals became unpleasant in appearance, "exhausted," the wool became disheveled and dull. These phenomena were most pronounced from 3 to 9 days after infection, and especially in animals with four or three-fould injection of a bacterial agent. At the same time the death of animals was recorded (in 1.5% of cases) due to the developed bacterial shock.

Objectively, this manifested by acute phase shortening of the purulent-inflammatory process and its rapid chronization. Moreover, the dynamics assessment of the local signs of inflammation of the MFA in the experiment showed a wide variation in different groups of animals.

Conclusion. Thus, as a result of the conducted research, it was established that with an increase terms of contact with bacterial LPS, the level and degree of sensitivity to it increases. Moreover, the level of bacterial sensitization of the organism, in turn, causes the shortening of the acute phase of the purulent-inflammatory process and its chronization..

Keywords: *pyoseptic infection, maxillofacial region, experiment, bacterial sensitization, inflammatory system, allergotest, injection, immunity*

Introduction. The state of organism immunological reactivity is the most important factor in the pathomorphosis of inflammatory diseases in the maxillofacial region. Despite numerous studies in experimental and clinical medicine, up to the present time it has not been possible to form a single concept of the pathogenesis of severe odontogenic infection. Data from the literature indicate that the state of immunological reactivity of the organism is the most important factor in the pathomorphosis of the inflammatory diseases of the maxillofacial region [1]. The role of sensitization to antigens of local microflora is unquestionable and makes possible to consider that the acute odontogenic inflammation is a result of the immediate or delayed types of hypersensitivity reaction [2]. Since the discussion of general conceptual issues of inflammation is still ongoing, the study of some fundamental aspects of bacterial sensi-

tization during infectious and inflammatory processes in maxillofacial region is relevant. Experimental purulent-destructive inflammation of the lower jaw and perimaxillary soft tissues reproduced according to the original method developed by us, on 100 guinea pigs. Microbial suspension of the daily culture of St. aureus containing 1 billion microbial cells in 1.0 ml. The animals sensitized by a single, double, three-fold, and four-fold introduction of 0.5 ml microbial suspension and effects on the site of infection with a constant electric current of positive polarity, with a force of 5-10 μA for 3-5 minutes, under general ether anesthesia [3]. The interval between the 1st and 2nd, between the 2nd and 3rd, between the 3rd and 4th injection of the bacterial infection was 7 days.

The purpose of the research is to study bacterial sensitization degree effect of the inflammatory process in the maxillofacial area.

Material and methods: The experimental purulent inflammation of the mandible and perimandibular connective tissue was reproduced according to the original technique developed by us (prepatent No. 19378, application No. 2006≈1256, dated by November 14, 2006 by Taganiyazova A.A.), on 100 guinea pigs. The mass of laboratory animals was 475.0 ± 25.0 g. Reproduction of the model of infectious-inflammatory process in the maxilla-facial area was carried out on the base of the immunological laboratory of the West Kazakhstan Marat Ospanov Medical University.

The animals kept under standard conditions in the vivarium of West Kazakhstan Marat Ospanov Medical University. The material for infection was a suspension of Staphylococcus aureus, containing 109 colony-forming units (CFU) in 1.0 ml of saline. The animals were sensitized by single, double, triple and quadruple syringe injections of 0.5 ml of the suspension under the periosteum of the vestibular surface of the mandible. The infected site was exposed by a constant electric current of positive polarity of 5-10 μA strength for 5-7 minutes under general ether anesthesia. There were 4 groups of experimental animals, 25 in each group: 1st group were animals with fourfold injection of the injectious agent, 2nd group- triple injection, 3rd group - double injection and 4th group - a single injection.

The development of infectious-inflammatory process in mandible and perimandibular connective tissue was evaluated on the following criteria:

1. Clinical manifestations. Local signs of infectious-inflammatory response: the size and square of connective tissue inflammation, area of necrosis, the period of external fistula formation and the nature of discharge [4]. Prior to the beginning of the experiments, the basal body temperature of all guinea pigs was 37.8ºC, by the end of the first day after the inoculation it increased to 39.8ºC. The animals became uncomfortable in appearance, “exhausted”, the hair became disheveled and dull. They were obviously drowsy, sluggish, had lack of appetite and hypodynamic.

These phenomena were most marked from 3 to 9 days after infection, especially in animals of four- and three-fold injection of bacterial agent. At the same time, the death of animals (in 1.5% of cases) recorded because of bacterial shock. We observed a shortening of the acute phase of the purulent-inflammatory process and its rapid chronization [5].

2. Immunological research. During the study the level of sensitization by allergotests in vitro were evaluated: RSLL (reaction of specific leukocytes lysis), RSAL (reaction of specific agglomeration of leukocytes), RDMC (reaction of degranulation of mast cell), RSBTL (reaction of specific blast transformation of lymphocytes) [6,7]. As the antigen *St.aureus* killed by heating in a concentration of 5,5 x 10 ml of microbial bodies was used.

Statistical analysis

Data were performed in the program ‘Statistica’ 6.0 (Stat soft, Inc, 2001) [8]. Quantitative results were calculated using ANOVA test.

Results. It is established that at the site of inoculation of the shocking dose of bacteria an inflammatory process of various severities had developed [9]. The response of the organisms reached the maximum on the 2nd day after the infection.

Prior to the beginning of the experiments, the basal body temperature of all guinea pigs was 37.8ºC, by the end of the first day after the inoculation it increased to 39.8ºC. The animals became uncomfortable in appearance, “exhausted”, the hair became disheveled and dull. They were obviously drowsy, sluggish, lack of appetite and hypodynamic.

These phenomena were most marked from 3 to 9 days after infection, especially in animals of four- and three-fold injection of a bacterial agent. At the same time, the death of animals (in 1.5% of cases) recorded because of bacterial shock. We observed a shortening of the acute phase of the purulent-inflammatory process and its rapid chronization [10].

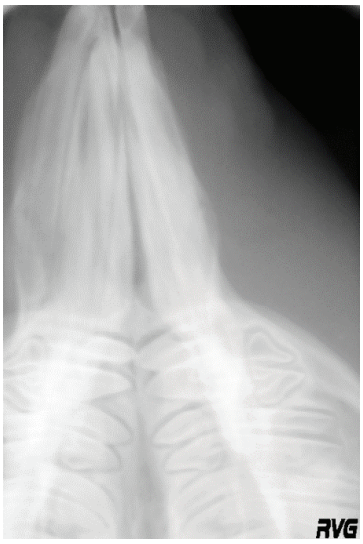
I group of animals. On the 2nd day after inoculation in infectious-inflammatory process manifested with diffuse edema and infiltration of soft tissues in the submandibular region measuring 2.2x3.1 cm, spreading to the neck region [11]. The presence of a formed defect of connective tissues in the focus of inflammation and fistula with abundant purulent discharge was detected [12]. (Picture 1)

II group of animals. On the 2nd day after sensitization infectious-inflammatory reaction was accompanied by edema and infiltration of connective tissues in the submandibular region measuring 1.5x2.5 cm. On the 4th -5th days of the disease the skin became thinner, fistula with copious purulent discharge formed [13]. (Picture 2)

III group. On the 2nd day after the injection a moderate inflammatory reaction was observed: limited edema and infiltration of connective tissues in the submandibular region measuring 1.1x1.5 cm. (Picture 3)

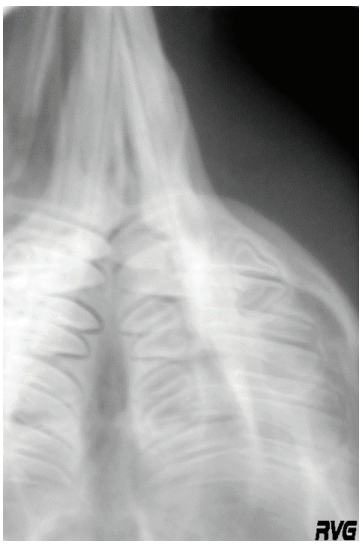
IV group. The local signs of the clinical course of infectious-inflammatory process in the maxillofacial region in the on the 2nd day after infection were not expressed and showed insignificant infiltration of the connective tissues [14]. (Picture 4)

(Table 1). Level of bacterial sensitization in the experimental animals.



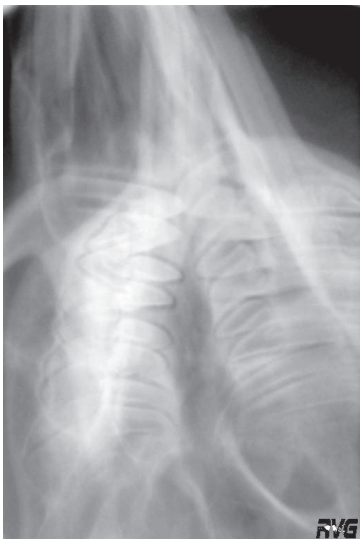
Picture 1.

Assessment of dynamics of local signs of inflammation showed a wide variation in different groups of animals. Thus, infectious-inflammatory process in animals of the 1st group is characterized by vivid expression is manifested by diffuse edema and infiltration of soft tissues in the submandibular area in size 2.2 x 3.1 cm, with the irradiation to the neck, presence of formed defect of soft tissues in the focus of inflammation and fistula with profuse pus discharge. On the computer radiovisiography there was revealed extensive destruction of bone tissue with sequestration and loss of teeth rudiments in these animals.



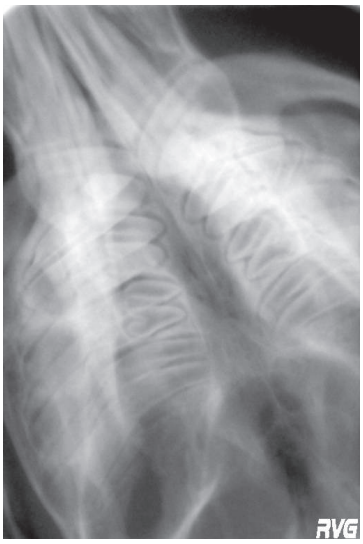
Picture 2.

In the 2nd group of animals on the 2nd day after infection the process is accompanied by swelling and soft tissue infiltration in the submandibular area of size 1.1 x 1.5 cm. On the 4- 5th day the skin becomes thinner, a fistula is formed with profuse purulent discharge. On a computer radiovisiography extensive zone of purulent inflammation of soft tissues with symptoms of osteolysis of the jaw bone tissue is noted.



Picture 3.

In experimental animals of 3rd group on the 2nd day after infection there was a fair response: limited swelling and soft tissue infiltration in the submandibular area of 1,1 × 1.5 cm. By computer radiovisiography a focus of purulent cavity in soft tissue without signs of bone disease is revealed, on the 5-7th day the process is accomplished.



Picture 4.

The local signs of the clinical course of the infectious-inflammatory process in the maxillofacial region after infection were not expressed and showed insignificant infiltration of the connective tissues.

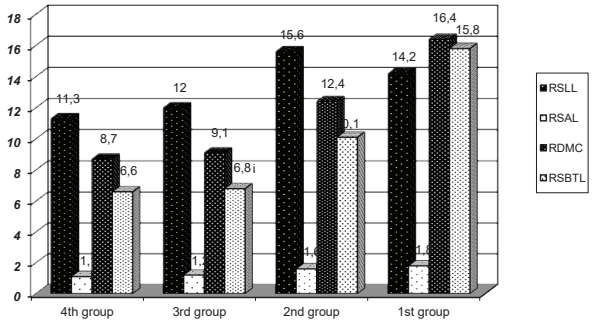


Table 1. Level of bacterial sensitization in experimental animals.

As shown in table 1, diagnostic showed that bacterial sensitization developed in all groups of experimental animals. We found that increasing duration of contact with bacterial lipopolysaccharides (LPS) lead to a quantitative raise of RSLL (from 11.3±2.4 Si to 14.2±2.0 Si). The number of animals with positive values of RSLL also increased from 30% to 80% .

A similar process was observed in the analysis of the results of RSLA. A single exposure of antigen showed 1.1 Si±0.19 Si (IV group), a fourfold infection was 1.8 Si±0.17 Si (I group). The percentage of animals with positive samples increased in accordance with the increase in exposure time (from 10% to 70%).

The results of RDMC tests showing the level of antibodies of the reactive type, a twofold increase in the reaction rates established from 8.7 Si± 0.7 Si to 16.4 Si ±0.8 Si. The percentage of positive samples detected increased from 10% to 40%.

Analysis of RSBTL revealed a 2.5-fold increase in quantitative values (6.6 Si±0.9 Si and 15.8 Si±0.9 Si, $p<0.05$). The percentage of positive samples increased from 0% (IV-group) to 20% (I-group), which indicates the formation of delayed type of hypersensitivity.

A comprehensive analysis of the data obtained showed that sensitization to LPS in animals of the first group is revealed in 100% of cases. In 20% of cases, all 4 tests used allergotests were positive, 40% of cases - 3 tests, and in the remaining animals - 2 tests.

Analysis of data obtained in the II group animals also showed the presence of sensitization to LPS in 100% of cases. In this case, 10% of the animals had a positive 4 tests, in 30% -3 tests, in the remaining 2 tests. In animals of the III - group, development of sensitization to LPS in 60% of cases noted. However, 4 positive reactions were detected only in 10% of them, 3 reactions - 20%, 2 reactions - 30%. In 40% of cases, only one of the used allergotests was positive [15].

Among the animals of the IV group, only 30% were sensitized, in whom no more than 2 used allergotests were positive.

Discussion. Assessment of dynamics of local signs of inflammation showed a wide variation in different groups of animals. Thus, infectious-inflammatory process in animals of the 1st group on the 2nd day of infection is characterized by vivid expression is manifested by diffuse edema and infiltration of soft tissues in the submandibular area in size 2.2 x 3.1 cm, with the irradiation to the neck, presence of formed defect of soft tissues in the focus of inflammation and fistula with profuse pus discharge [16]. On the computer radiovisiography there was revealed extensive destruction of bone tissue with sequestration and loss of teeth rudiments in these animals.

The material for infection was a microbial suspension of the daily culture of *St.aureus*, containing 1 billion microbial bodies in 1.0 ml. The animals were sensitized by single, double, triple and quadruple administration of periosteum of the vestibular surface of the low jaw [17]. Affected the source of infection by constant electric current of positive polarity, for 3-5 minutes, under general ether anesthesia. The interval between the 1st and 2nd, between the 2nd and 3rd, between the 3rd and 4th injection of the bacterial infection was 7 days . In the 2nd group of animals on the 2nd day after infection the process is accompanied by swelling and soft tissue infiltration in the submandibular area of size 1.1 x 1.5 cm. On the 4- 5th day the skin becomes thinner, a fistula is formed with profuse purulent discharge. On computer radiovisiography extensive zone of purulent inflammation of soft tissues with symptoms of osteolysis of the jaw bone tissue is noted.

Clinical picture of infected animals showed the increase of the body temperature, drowsiness and lethargy, lack of appetite, hypodynamia. The basal body temperature in guinea pigs was 37.8 C , and by the end of the first day after the introduction of the microbial culture is increased to 39.8. In experimental animals of 3rd group on the 2nd day after infection there was a fair response: limited swelling and soft tissue infiltration in the submandibular area of 1,1 × 1.5 cm. By computer radiovisiography a focus of purulent cavity in soft tissue without signs of the bone disease is revealed, on the 5th day the process is accomplished.

External symptoms of acute purulent inflammation in the maxillo-facial area were observed in some guinea pigs already on the 2nd day after infection, and later, with great persistence in all animals, almost to the end of the observation. In this case, the animals became uncomfortable in appearance, “exhausted”, the hair became disheveled, dull. These phenomena were most marked from 3 to 9 days after infection, and especially in animals with a four- and threefold injection of a bacterial agent. At the same time, the death of animals (in 1.5% of cases) recorded as the result of bacterial shock. Local bacterial level of sensitization of inflammation in the 4th of animals is absent. Thus, as the result of the conducted studies, it established that the increase in the duration of contact with bacterial LPS increases the level and severity of sensitization to it. Moreover, the level of bacterial sensitization of the organism, in turn, causes a shortening of the acute phase of the purulent-inflammatory process and its chronization. It should be noted that an increase in the number of positive allergotests in the same animal has unfavorable prognostic value in the development and course of the purulent-inflammatory process.

This circumstance is caused both by the immunotoxic effect of the products of bacterial decay (increase of the RSLL) and by the violation of the cellular immunity (positive RSAL, RSBTL) [18]. In addition, the increase in the level of antibodies of the reactive type indicates that in a number of cases, the formation of immediate-type hypersensitivity occurs.

Inflammation and hypersensitivity are conjugate processes, and in the sphere of human pathology are in a cause-and-effect relationship. Their link is immunity. The relationship between inflammation and hypersensitivity, and the accompanying autoimmunization, predetermines the undulating course of the chronic inflammatory process.

Conclusion.

Summarizing the above, it should be noted that:

1. The method of modeling the infectious-inflammatory process in the maxillofacial region ensures high reproducibility of the purulent-inflammatory process of the mandible and perimandible in the experimental animals. According to the nature of the inflammation, this model corresponds more to odontogenic inflammatory diseases, the pathogenesis of which based on the mechanisms of specific sensitization of the body [19].

2. Repeated multiple inoculations of S. aureus to experimental animal induce a state of increased sensitiveness of different levels. In this case, the nature of infectious-inflammatory reaction in guinea pigs depends on the timing of the body's contact with bacterial agent. More severe and prolonged course of inflammation observed with long periods of contact of the organism with bacterial agent in comparison with those of animals with a short contact time and in non-sensitized animals.

3. The shortening of the acute phase of the purulent-inflammatory process and its chronization are due to the level of bacterial sensitization of the animal organism.

Authorship: A.A. Taganiyazova made a significant contribution to the concept and design of the study, collection, analysis and interpretation of data; A.M. Alzhanova prepared the first version of the article and substantially revised it for important intellectual content; A.A. Taganiyazova and A.M. Alzhanova are finally approved the manuscript sent to the editor. There is no conflict of interest.

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ТҮЙІН

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ЖАҚ-БЕТ АЙМАҚТАРЫНЫҢ ІРІНДІ-СЕПТИКАЛЫҚ ИНФЕКЦИЯСЫНЫҢ ЭКСПЕРИМЕНТТІК АҒЫМЫНЫҢ ЕРЕКШЕЛІКТЕРІ

Марат Оспанов атындағы Батыс Қазақстан медицина университеті, Ақтөбе, Қазақстан

Кіріспе. Асқыну мен жоғары сезімталдық – түйіндес процестер, және адам патологиясы кеңістігінде себеп-салдарлық тәуелділікте болады. Оларды байланыстырушы бөлігі болып иммунитет табылады. Жұмыс тәжірибеде жақ-бет бөлігінің асқыну процесінің ағымына бактериалды сенсибилизациясының дережесіне әсерін зерттеуге арналды. Ағзаның иммунологиялық реактивтілік жағдайы асқынған аурулар мен жақ-бет аймағы (ЖБА) патоморфозының маңызды факторы болып табылады. Асқынудың жалпы концептуалды мәселелерін талқылау әлі күнге дейін жалғасып келе жатқандықтан, қолда бар медико-биологиялық теорияларды, сондай-ақ жаңа ғылыми тәсілдерді талдау үшін ЖБА-да инфекциялық-асқынған процестің клиникалық ағзаның бактериалды сенсибилизациясының кейбір іргелі аспектілерін зерттеу маңызды болып табылады.

Мақсаты. Тәжірибеде ЖБА іріңді-септикалық инфекциясының клиникалық ағымын зерттеу.

Зерттеу әдістері. Авторлардың дайындаған түпнұсқа әдістемесі бойынша 100 теңіз шошқасына төменгі жақ және жақ маңы жұмсақ тіндерінің эксперименттік іріңді-деструктивтік асқынуының ағымы зерттелді. Зертханалық жануарлар массасы 475,0±25,0г. М.Оспанов атындағы БҚМУ иммунологиялық зертханасы базасында ЖБА-да инфекциялық-асқыну процесін моделдеу жүзеге асырылды. Жұқтыру материалы болып 1,0 мл-да 1 миллиард микробты денелерді құрайтын St.aureus FDA 209-P тәуліктік дақылының микробты жүзгіні алынды. Жануарлар 1,0 мл-де 1 миллиард микробты дене құрайтын St.aureus FDA 209-P тәуліктік дақылының 0,5 мл микробты жүзгінінің төменгі жақтың вестибулярлық бетінің сүйек тысы астына бір, екі, үш және төрт реттік енгізу және жалпы эфирлі наркозда 3-5 минут ішінде 5-10 мкА күшімен оң кереғарлық тұрақты электр тогымен жұқтыру ошағына әсер ету жолымен сенсибилизденді. Бактериалды инфектіні енгізудің 1 мен 2, 2 мен 3, 3 пен 4 арасының интервалы 7 күнді құрады. Біріншілік инфекция ошағына стафилококкты антигеннің рұқсат етілген дозалы екпесін 7, 14, 21 және 28 тәулікте 0,5 миллиард микробты дене (м.т/мл) концентрациясында 0,5 мл көлемінде жүзеге асырды.

Зерттеу барысында әрқайсысында 20 шошқадан: I – төрт қайтара жұқпамен, II – үш қайтара жұқпамен, III – екі реттік жұқпамен, IV – бір реттік жұқпамен 4 зертханалық жануарлар тобы құрылды.

Бұл тәжірибе сериясын бақылау ретінде

РЕЗЮМЕ

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ОСОБЕННОСТИ КЛИНИЧЕСКОГО ТЕЧЕНИЯ ГНОЙНО-СЕПТИЧЕСКОЙ ИНФЕКЦИИ В ЧЕЛЮСТНО-ЛИЦЕВОЙ ОБЛАСТИ В ЭКСПЕРИМЕНТЕ

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Введение. Воспаление и гиперчувствительность – процессы сопряженные и в сфере патологии человека находятся в причинно-следственной зависимости. Их связующим звеном является иммунитет. Работа посвящена изучению влияния степени бактериальной сенсибилизации на течение воспалительного процесса в челюстно-лицевой области в эксперименте. Состояние иммунологической реактивности организма является важнейшим фактором патоморфоза воспалительных заболеваний и челюстно-лицевой области (ЧЛО). Поскольку до сих пор продолжается обсуждение общих концептуальных вопросов воспаления, изучение некоторых фундаментальных аспектов бактериальной сенсибилизации организма в клиническом течении инфекционно-воспалительного процесса в ЧЛО для анализа имеющихся медико-биологических теорий, а также разработки новых научных подходов и концепций является актуальным.

Цель. Изучение клинического течения гнойно-септической инфекции в ЧЛО в эксперименте.

Методы исследования. Экспериментальное гнойно-деструктивное воспаление нижней челюсти и околочелюстных мягких тканей воспроизведено на 100 морских свинках по разработанной нами оригинальной методике. Масса лабораторных животных составляла 475,0±25,0 г. Воспроизведение модели инфекционно-воспалительного процесса в ЧЛО осуществляли на базе иммунологической лаборатории ЗКМУ имени М. Оспанова. Материалом для заражения служила микробная взвесь суточной культуры St.aureus FDA 209-P, содержащий 1 миллиард микробных тел в 1,0 мл. Животные были сенсибилизированы путем однократного, двукратного, трехкратного и четырехкратного введения под надкостницу вестибулярной поверхности нижней челюсти 0,5 мл микробной взвеси суточной культуры St.aureus FDA 209-P, содержащий 1 миллиард микробных тел в 1,0 мл, и воздействия на очаг инфицирования постоянным электрическим током положительной полярности силой 5-10 мкА в течение 3-5 минут под общим эфирным наркозом. Интервал между 1 и 2, между 2 и 3, между 3 и 4 введением бактериального инфекта составлял 7 дней. Инъекцию разрешающей дозы стафилококкового антигена в первичный инфекционный очаг осуществляли на 7, 14, 21 и 28 сутки в объеме 0,5 мл и концентрации 0,5 миллиарда микробных тел (м.т/мл).

В ходе исследования были сформированы 4 группы