OZONETHERAPY INFLUENCE ON MORPHOLOGIC CHANGES OF LIVER IN PURULENT INFLAMMATION OF THE LUNGS IN THE EXPERIMENT

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Relevance. Ozone increases the oxygen transport function of the blood. The use of ozone therapy for pulmonary pathology is promising. The effect of ozone therapy is associated with the ability of ozone to eliminate hypoxemia and tissue hypoxia, which is always present in patients with pathology of the bronchopulmonary apparatus.

Objective: to study morphofunctional changes in liver tissue, in the dynamics of the use of ozonized water in rats in an experimental model of chronic purulent pneumonia.

Materials and methods. Three groups were formed from 30 male white rats (180-200 g). In group 1 (n = 10) healthy rats were injected intraperitoneally with 5 ml of ozonated (0.02 mg / L) 0.9% NaCl once a day for 10 minutes. Course 10 days. Animals of the 2 (n = 10) and 3 (n = 10) groups were first modeled for chronic pneumonia. For this, under local novocaine anesthesia, a 1.5-2.0 cm long incision was made on the animal's neck. A nylon thread with a diameter of 0.4 mm and a length of 10-12 cm was inserted into the lumen of the trachea, between its rings, on a thin piercing needle. The distal end of the thread was located in the lumen of the trachea, and its proximal end was fixed on the skin. The wound was sutured tightly in layers. After 45 days, the thread was removed without opening the trachea. Subsequently, animals of group 2 did not receive treatment. And rats of group 3 were injected once a day with 5 ml of ozonized (0.02 mg / l) 0.9% NaCl for 10 minutes. Course 10 days. The animals were removed from the experiment by instant decapitation. The taken pieces of the liver were fixed in formalin. Histological sections were stained with hematoxylin and eosin. Microscopy was performed using an XS-213 light microscope and a Leica microscope.

Results. With prolonged irritation of the respiratory tract, structural changes in the liver, characteristic of toxic hepatitis, were revealed. After treatment with ozonated saline, the morphological picture of the liver improved. In healthy rats, ozone therapy did not have a negative effect on the general condition and behavior of the animals.

Conclusions. Treatment with ozonated saline improves the morphological picture of the liver of rats with chronic pneumonia.

Keywords: chronic purulent inflammation of the lungs, rats, ozone therapy, morphology, liver.

Relevance. Maintaining immune homeostasis of the lungs depends on a balance of sufficiently effective defense mechanisms that ensure the elimination of inhaled pathogens, and equally effective mechanisms of inhibiting inflammation to limit subsequent damage to lung tissue. Chronic inflammation of the respiratory system occupies a significant proportion among diseases in general [1, 8, 11]. The effect of ozone therapy is determined by the high oxidation-reduction potential of ozone, which provides a dual mechanism of action (in therapeutic doses). The first one is local, with disinfecting activity against bacteria, viruses and fungi. The second is systemic, metabolic in relation to protein-lipid complexes of plasma and cell membranes, leading to an increase in oxygen tension, transformation and synthesis of biologically active substances, increased activity of immunocompetent cells, improved rheology and oxygen transport function of blood [6]. At the same time, unlike many antiseptics, ozone does not have a destructive and irritating effect on tissues [3, 7]. The use of ozone for the treatment of a number of diseases is pathogenetically justified [1, 7, 9]. Ozone acts simultaneously on several links in the pathogenesis of many diseases.

There is a favorable effect of ozonized saline solution on the liver in experimental peritoneal inflammation, which is manifested in the maintenance of plastic and energy homeostasis of hepatocytes. Good clinical results are observed when ozone is used as a treatment for chronic diffuse liver diseases, including viral etiology. The combination of ozone therapy procedures with interferon made it possible to achieve good clinical results: the state of health improved in most patients, weakness, heaviness and pain in the liver area disappeared. Normalization of disturbed biochemical parameters was noted [4].

There is some opinion, that when using high concentrations of ozonized physiological solution, it is necessary to use vitamin E. The most effective is 5 ozone therapy procedures, which is associated with the rapid stabilization of the process of lipid peroxidation (LPO) [6]. It is shown that during artificial circulation ozone increases the oxygen transport function of the blood, improving the state of the microcirculatory bed of organs, enhances the release of oxygen to tissues and thereby prevents the development of hypoxia. In particular, the liver maintains a normal content of glucose, glycogen, glucose-6-phosphate and pyruvate, the degree of severity

of degenerative changes in hepatocytes decreases. Under the influence of ozone, structural and functional mechanisms are stimulated in liver cells that convert fatty energy substrates into carbohydrate ones, which are easier to use in extreme and pathological conditions. This decreases the likelihood of both the development of fatty dystrophy, as well as the formation of toxic ketone products from fatty acids [4].

The use of ozone therapy for pulmonary pathology is promising. The effect of ozone therapy is associated primarily with the ability of ozone to eliminate hypoxemia and tissue hypoxia, which is always present in patients with pathology of the bronchopulmonary apparatus due to the presence of respiratory failure of varying severity. The complex morpho-functional organization of the lungs, as a polyfunctional organ responsible for the regulation of a number of the most important parameters of gas exchange, and the indicators of gas exchange in general, determines the need for further research on a whole complex of interrelated problems of pathogenesis and therapy of respiratory diseases.

Objective: to study morphofunctional changes in liver tissue, in the dynamics of the use of ozonized water in rats in an experimental model of chronic purulent pneumonia.

MATERIALS AND METHODS

Used 30 male outbred white rats weighing 180-200 g. Animals are divided into 3 groups. In the first group (n = 10) healthy rats were injected intraperitoneally with 5 ml of ozonated (0.02 mg / l) 0.9% sodium chloride solution once a day for 10 minutes. The course of treatment is 10 days. Animals of the second (n = 10) and third (n = 10) groups were first modeled with e-CIL. The e-CIL model was reproduced by the method of Z. Batyrova and N. Shamirzaeva [2]. For this, under sterile conditions, under local novocaine anesthesia, a longitudinal incision 1.5-2.0 cm long was made along the midline on the anterior surface of the animal's neck. After exposing the anterior wall of the trachea between its rings, a nylon thread with a diameter of 0.4 mm and a length of 10-12 cm was inserted into its lumen on a thin piercing needle. The distal end of the thread was in the lumen of the trachea, and its proximal end was fixed on the skin. The wound was sutured tightly in layers. After 45 days from the beginning of the experiment, the fixing thread was removed by cutting with forceps without opening the trachea.

Subsequently, the animals of the second group did not receive treatment.

The animals of the third group, 45 days after the reproduction of e-CIL, were injected once a day with ozonized (0.02 mg / l) 0.9% sodium chloride solution for 10 minutes into the peritoneum, 5 ml each. The course of treatment is 10 days.

For ozone therapy we used an ozonator - «Binafsha».

The animals were removed from the experiment by instant decapitation.

The taken pieces of the liver were fixed in formalin. Histological sections were stained with hematoxylin and eosin. Microscopy was performed using an XS-213 light microscope and a Leica microscope.

RESULTS AND DISCUSSION

E-CIL manifested itself in the form of distant wheezing, disturbances in the frequency of breathing rhythm and inactivity of the subjects. Macropicture: lungs without atelectasis, in places of a pale gray-red or dark red color, a doughy consistency, under the pleura and in the parenchyma, small hemorrhages are often found. On the cut, a frothy, turbid liquid, sometimes colored pink, is squeezed out of the lumens of the cut bronchi and flows down. The surface of the lung is smooth, juicy, gray or dark red, against which the expanded gelatinous cords of the infiltrated interstitial connective tissue with serous exudate clearly stand out. The liver is not enlarged, the surface is smooth, dark cherry-colored in section (Fig. 1). Microscopically, 80% of large and 20% of small hepatocytes were found in the liver tissue.

In animals of the second group with e-CIL without treatment, in contrast to healthy animals of the first group, characteristic changes were observed in the liver, resembling a picture of acute toxic liver damage. Many hepatocytes were in a state of pronounced balloon dystrophy, with damage to the nuclei, which was expressed by karyopycnosis, and multiple foci of parenchymal necrosis were identified. Sinusoids were practically not visible due to an increase in the volume of dystrophically swollen hepatocytes. The chaotic arrangement of hepatocytes of the hepatic lobules was also characteristic. In addition, lack of blood circulation of the central veins and vessels of the triads was also determined (Fig. 2).

At the initial stages of treatment, the phenomena of balloon dystrophy of the liver persist (Fig. 3).

After a course of ozone therapy, regular changes are observed in the morphological picture of the liver tissue, expressed in a gradual improvement in the state of the tissue, which correlates with the duration of therapeutic measures. Thus, noticeable improvement in the state of the structure of the liver tissue in the group treated with ozone therapy attracted attention. These changes were characterized by a decrease in the manifestations of hydropic dystrophy and focal necrosis of hepatocytes, restoration of the normal trabecular-beam architectonics of the hepatic lobules (Fig. 4, 5).

By the 30th day after the completion of treatment, the state of the parenchymal elements and blood circulation in the liver significantly improved. Signs of balloon dystrophy decreased, although swelling of hepatocytes was still preserved, granular degeneration of cells appeared. Hepatic lobules acquire a characteristic beam structure. These changes indicate the activation of reparative recovery processes. Impaired blood circulation is also restored (Fig. 6). In places the sinusoids are

Fig.1. Purulent inflammation of the lobe of the lung on the 45th day of calling the E-CIL model.
The liver is not enlarged, smooth.

Fig. 2. Liver of rat with E-CIL before treatment. Balloon dystrophy and focal necrosis of hepatocytes.
Liver tissue anemia. Coloring: hematoxylin-eosin.
Zoom: 10x10.

Fig. 3. Liver of E-CIL rats after treatment, initial terms.
The phenomena of balloon dystrophy persist. Zoom: 10x10, 20x10.

Fig. 4. Liver of rats with E-CIL model. Diffuse hydropic dystrophy and focal necrosis of hepatocytes.
Violation of the beam structure of the lobules. Coloring: hematoxylin-eosin.
Zoom: 10x20, 10x40.

Fig. 5. Rat liver after a course of ozone therapy. Restoring normal cytoarchitectonics of liver tissue. Reduction of dystrophic manifestations. Coloring: hematoxylin-eosin. Zoom: 10x20.

Fig. 6. Liver of E-CIL rats on the 30th day after completion of treatment. A. Swelling and granular dystrophy of hepatocytes, expansion of sinusoids with plethora; B – hyperplasia of the lymph node follicles of the hepatic hilum. Coloring: hematoxylin-eosin. Zoom: 10x20.

Fig.7. The liver of an E-CIL rat on the 30th day after completion of treatment. C, D – beam structure of hepatic lobules, vascular congestion. Zoom: 10x10, 20x10.

sharply expanded with plethora. The central veins are also full-blooded (Fig. 7). Hyperplasia of lymphoid structures is observed in the liver tissue by the 30th day after completion of treatment.

CONCLUSIONS

1. In rats, experimental chronic inflammation of the lungs caused by prolonged mechanical irritation of the respiratory tract causes structural changes in the liver characteristic of toxic hepatitis.
2. A 10-day course of treatment with ozonized saline improves the morphological picture of the rat liver.
3. In healthy rats, a 10-day course of ozone therapy does not adversely affect the general condition and behavior of the animals.

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ОСОБЛИВОСТІ МОРФОЛОГІЧНИХ ПОКАЗНИКІВ ПЕЧІНКИ ПРИ ХРОНІЧНОМУ ГНІЙНОМУ ЗАПАЛЕННЯ ЛЕГЕНІВ У ДИНАМІЦІ ОЗОНОТЕРАПІЇ (ЕКСПЕРИМЕНТАЛЬНЕ ДОСЛІДЖЕННЯ)

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Актуальність. Озон підвищує кисневотранспортну функцію крові. Перспективним є застосування озонотерапії при легеневої патології. Ефект озонотерапії пов'язаний зі здатністю озону до ліквідації гіпоксемії і гіпоксії тканин, яка завжди є у хворих з патологією бронхо-легеневого апарату.

Мета: вивчити морфофункціональні зміни тканини печінки, в динаміці застосування озонованої води у щурів в експериментальній моделі хронічного гнійного запалення легенів.

Матеріали та методи. 30 самців білих щурів (180-200 г) сформували 3 групи. В 1 групі (n=10) здоровим щурам один раз на день внутрішньочеревинно вводили по 5 мл озонованого (0,02 мг/л) 0,9 % NaCl протягом 10 хв. Курс 10 днів. Тваринам 2 (n=10) і 3 (n=10) груп спочатку моделювали хронічне запалення легенів. Для цього під місцевою новокаїновою анестезією на ший тварини робили розріз завдовжки 1,5-2,0 см. У просвіт трахеї, між її кільцями вводили на тонкій колючій голці капронову нитку діаметром 0,4 мм, довжиною 10-12 см. Дистальний кінець нитки знаходився в просвіті трахеї, а проксимальний її кінець закріплювали на шкірі. Рану поширено ушивали наглухо. Через 45 днів нитку витягували без розтину трахеї. Надалі тварини 2 групи лікування не отримували. А щурам 3 групи один раз на добу вводили 5 мл озонованого (0,02 мг/л) 0,9 % NaCl протягом 10 хв. Курс 10 днів. З експерименту тварин виводили шляхом миттєвої декапітації. Взяті шматочки печінки фіксували у формаліні. Гістологічні зрізи фарбували гематоксилін еозин. Мікроскопію проводили в світловому мікроскопі XS-213 і мікроскопі Leica.

Результати. При тривалому подразненні дихальних шляхів виявлено структурні зміни печінки, характерні для токсичного гепатиту. Після лікування озонованим фізіологічним розчином відбувалося поліпшення морфологічної картини печінки. У здорових щурів озонотерапія не чинила негативного впливу на загальний стан і поведінку тварин.

Висновки. Лікування озонованим фізіологічним розчином покращує морфологічну картину печінки щурів з хронічним запаленням легенів.

Ключові слова: хронічне запалення легенів, щури, озонотерапія, морфологія, печінка.

**ОСОБЕННОСТИ МОРФОЛОГИЧЕСКИХ ПОКАЗАТЕЛЕЙ ПЕЧЕНИ
ПРИ ХРОНИЧЕСКОМ ГНОЙНОМ ВОСПАЛЕНИИ ЛЁГКИХ В ДИНАМИКЕ ОЗОНОТЕРАПИИ
(ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ)**

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Актуальность. Озон повышает кислородтранспортную функцию крови. Перспективным является применение озонотерапии при легочной патологии. Эффект озонотерапии связан со способностью озона к ликвидации гипоксемии и гипоксии тканей, которая всегда имеется у больных с патологией бронхолегочного аппарата.

Цель: изучить морфофункциональные изменения ткани печени, в динамике применения озонированной воды у крыс в экспериментальной модели хронического гнойного воспаления лёгких.

Материалы и методы. Из 30 самцов белых крыс (180-200 г.) сформировали 3 группы. В 1 группе (n=10) здоровым крысам один раз в день внутривентриально вводили по 5 мл озонированного (0,02 мг/л) 0,9 % NaCl в течение 10 мин. Курс 10 дней. Животным 2 (n=10) и 3 (n=10) групп сначала моделировали хроническое воспаление лёгких. Для этого под местной новокаиновой анестезией, на шее животного делали разрез длиной 1,5-2,0 см. В просвет трахеи, между её кольцами вводили на тонкой колющей игле капроновую нить диаметром 0,4 мм, длиной 10-12 см. Дистальный конец нити находился в просвете трахеи, а проксимальный её конец закрепляли на коже. Рану послойно ушивали наглухо. Через 45 дней нить извлекали без вскрытия трахеи. В дальнейшем животные 2 группы лечения не получали. А крысам 3 группы один раз в сутки вводили 5 мл озонированного (0,02 мг/л) 0,9 % NaCl в течение 10 мин. Курс 10 дней. Из эксперимента животных выводили путём мгновенной декапитации. Взятые кусочки печени фиксировали в формалине. Гистологические срезы окрашивали гематоксилином эозином. Микроскопию проводили в световом микроскопе XS-213 и микроскопе Leica.

Результаты. При длительном раздражении дыхательных путей выявлены структурные изменения печени, характерные для токсического гепатита. После лечения озонированным физиологическим раствором происходило улучшение морфологической картины печени. У здоровых крыс озонотерапия не оказывала отрицательного воздействия на общее состояние и поведение животных.

Выводы. Лечение озонированным физиологическим раствором улучшает морфологическую картину печени крыс с хроническим воспалением лёгких.

Ключевые слова: хроническое гнойное воспаление лёгких, крысы, озонотерапия, морфология, печень.