MICROMORPHOMETRIC CHANGES IN RATS SPLEEN IN THE FIRST 7 DAYS AFTER SKIN BURNS AND UNDER APPLICATION OF INFUSION SOLUTIONS

Summary. In the experiment, during 7 days, were studied changes in the relative volume of white and red spleen pulp of rats without burn and after burning of the skin with 0.9% solution of NaCl, lactoprotein with sorbitol or HAES-LX-5%. When introducing infusion solutions for animals without burning of skin set only 10-13% higher relative volume of white pulp and 7-11% lower values of the relative volume of red pulp when injected lactoprotein with sorbitol than with the introduction of 0.9% NaCl solution or HAES-LX-5%. On the background of skin burns set: reduction when administrating lactoprotein with sorbitol by 4.1%, and when HAES-LX-5% applied by 7.8% of the relative volume of white pulp from 1 to 7 days of the experiment; higher (14.4 and 18.0% respectively) values of the relative volume of white pulp and smaller (7.1 and 9.1% respectively) of the relative volume of red pulp in rats after 3 days after burning of the skin at the administration of HAES-LX-5% or lactoprotein with sorbitol than in animals at a given time when administering 0.9% NaCl solution; larger by 19.4% values of relative volume of white pulp and 5.8% smaller by the value of the relative volume of red pulp in rats 7 days after skin burns when HAES-LX-5% solution is injected than in animals of present the term with administration of 0.9% NaCl solution; less by 7.9% values of the relative amount of red pulp in rats 7 days after skin burns when administrating lactoprotein solution with sorbitol than in animals at this time administering with 0.9% NaCl solution.

Key words: micromorphometry, spleen, rats, 0.9% NaCl solution, lactoprotein with sorbitol, HAES-LX-5%.

Introduction

At present time, the spectrum of damage and compensatory changes in the immunocompetent organs (including the spleen) following a burn injury of the skin, along with macroscopic rearrangements has expanded to histological, cytological and ultrastructural changes [4-6, 17]. All this leads to the treatment and prevention of complications of burn disease, guided by a preliminary assessment of the morpho-functional state of immune competent organs with subsequent adequate infusion therapy.

A promising direction of treatment of the consequences of burn intoxication is the use of domestic combined organoprotective colloidal-crystalloid drug solutions, which have several advantages over mono-preparations. In this plan, our attention was attracted by lactoprotein with sorbitol [10, 14] and HAES-LX-5% - a new blood substitute developed by the Institute of Blood Pathology and Transfusion Medicine of the Academy of Medical Sciences of Ukraine [11]. Their use requires prior careful study of morphological and morphometric changes at different levels of structural organization of the spleen, features of the cell cycle and DNA fragmentation in the correction of the effects of thermal trauma of the skin.

The purpose of the study was to determine, at the optical-optical level, stereological changes in the parenchyma of the spleen of rats in 1-7 days after skin burn and application of 0.9% NaCl solution, lactoprotein with sorbitol and HAES-LX-5%.

Materials and methods

Within the framework of scientific cooperation between National Pirogov Memorial Medical University, Vinnytsya and SI "Institute of blood pathology and transfusion medicine of NAMS of Ukraine" (Lviv) and National Pirogov Memorial Medical University, Vinnytsya and the National Medical University named after O.O. Bogomolets an experimental study of the effect of the control infusion drug - 0.9% solution of NaCl, reference product - solution of lactoprotein with sorbitol (serially issued by Kyiv "Biopharm" Company - certificate of state registration of the Ministry of Health of Ukraine № 464/09-300200000 dated 12.03.2009 - is a protein-saline solution that contains 5% of colloidal base and 5% sodium bicarbonate sorbitol, 6% sodium citrate, 2.1% lactate, sodium chloride 0.8%, calcium chloride 0.01%, potassium chloride - 0.0075%, sodium bicarbonate - 0.01%;
іонів рідкого розчину містить: Na\(^+\) - 343.5 mmol/L; K\(^+\) - 1.0 mmol/L; Ca\(^{++}\) - 0.9 mmol/L; Cl\(^-\) - 139.7 mmol/L; HCO\(_3\)\(^-\) - 1.2 mmol/L; CH\(_2\)CH(CH\(_3\))(OH)COO\(^-\) - 187.4 mmol/L. Осмолярність розчину становила 1020 mosmol/L.) Основою розчину HAES-LX-5% були коллоїдні розчини, які включають: підготовлений розчин глюкози (0.9% NaCl) і розчин глюкози з розчином води (0.9% NaCl) і розчин глюкози з розчином води (0.9% NaCl).

Результати. Розглянемо специфічність розчину HAES-LX-5% на основі вивчень, проведених в переважно гуманітарних обставинах. Розпилення розчину HAES-LX-5% утворює більш глибоку зону ванілінії за порівнянням з розчином глюкози з розчином води (0.9% NaCl). Розпилення розчину HAES-LX-5% утворює зону ванілінії, що має більш сильний вплив на шкіру тварин.

Результати. Результати проведених вивчень показали, що розчин HAES-LX-5% має більш глибокий вплив на шкіру тварин, ніж розчин глюкози з розчином води (0.9% NaCl). Розпилення розчину HAES-LX-5% утворює зону ванілінії, що має більш сильний вплив на шкіру тварин.

Оригінальні дослідження

ОРИГІНАЛЬНІ ДОСЛІДЖЕННЯ
Relative volume of red pulp in rats without burn injuries of skin, which was injected 0.9% NaCl solution after 1 day 0.600±0.132 cm³/cm³, after 3 days is 0.599±0.128 cm³/cm³, after 7 days - 0.594±0.156 cm³/cm³.

Relative volume of white pulp in rats without burning skin injury, which was injected with lactoprotein with sorbitol solution after 1 day 0.440±0.151 cm³/cm³, after 3 days is 0.448±0.131 cm³/cm³, after 7 days - 0.460±0.165 cm³/cm³. Relative volume of red pulp in rats without burn injuries of skin, which was injected with lactobacillus solution with sorbitol after 1 day is 0.558±0.151 cm³/cm³, after 3 days, is 0.548±0.128 cm³/cm³, after 7 days - 0.534±0.161 cm³/cm³.

Relative volume of white pulp in rats without burn injury caused by HAES-LX-5% solution, after 1 day 0.403±0.124 cm³/cm³, after 3 days is 0.416±0.108 cm³/cm³, after 7 days - 0.413±0.156 cm³/cm³. Relative volume of red pulp in rats without burn injuries of skin, which was injected HAES-LX-5% solution, after 1 day 0.597±0.124 cm³/cm³, after 3 days is 0.584±0.108 cm³/cm³, after 7 days - 0.571±0.148 cm³/cm³.

An analysis of the relative volume of white and red pulp in rats without skin burn, which colloidal hyperosmolar solutions was administered during the first seven days of the experiment, did not reveal any significant changes in the values of these indices after 1, 3 and 7 days from the beginning of the experiment. Attention is drawn only to 10-13% higher relative volumes of white pulp and 7-11% lower volumes of the relative volume of red pulp in animals when administering lactoprotein with sorbitol than when administering 0.9% NaCl solution or HAES-LX-5%, which coincides with the peculiarities of the dynamics of structural changes in the spleen of rats at the light-optical level when infused with lactoprotein with sorbitol [2].

Relative volume of white pulp in rats 1 day after burn skin injury when administered 0.9% NaCl solution is 0.348±0.122 cm³/cm³, which is 12.6% less (p>0.05) than in rats without burn injuries of the skin which were injected with the same solution in a similar period of observation. The relative volume of red pulp is 0.647±0.123 cm³/cm³, which is 7.8% more (p>0.05) than in rats without burning skin injury, which was injected with a 0.9% NaCl solution at the same time of observation.

Relative volume of white pulp in rats 3 days after skin burn injury when administered 0.9% NaCl solution is 0.305±0.169 cm³/cm³, which is 23.9% less (p=0.01) than in rats without burn injuries of the skin which was injected 0.9% NaCl solution at the same time of observation. The relative volume of red pulp is 0.693±0.167 cm³/cm³, which is 15.7% more (p<0.05) than in non-burning skin injuries of rats, which injected a 0.9% NaCl solution at the same time of observation.

Relative volume of white pulp in rats 7 days after skin burn injury when administered 0.9% NaCl solution is 0.278±0.127 cm³/cm³, which is 31.6% less (p<0.01) than in rats without burn injuries of the skin which was injected 0.9% NaCl solution at the same time of observation. Relative volume of red pulp is 0.699±0.133 cm³/cm³, which is 17.7% more (p<0.05) than in rats without burning skin injury, which was injected with a 0.9% NaCl solution at the same time of observation.

Relative volume of white pulp in rats administered lactoprotein with sorbitol after 1 day after burn skin injury is 0.370±0.140 cm³/cm³, which is 15.9% less (p>0.05) than in non-burning skin rats injected a similar solution at the same time of observation. Relative volume of red pulp in rats administered lactoprotein with sorbitol 1 day after the burn skin injury is 0.630±0.140 cm³/cm³, which is 12.9% more (p=0.068) than in non-burning skin rats, which were given similar solution at the same time of observation.

The relative volume of white pulp in rats by which the lactoprotein with sorbitol was injected 3 days after the skin burn injury is 0.360±0.143 cm³/cm³, which is 19.6% less (p<0.01) than that of non-burning skin rats injected a similar solution at the same time of observation. Relative volume of red pulp in rats by which the solution of lactoprotein with sorbitol was injected 3 days after the burn injury of the skin is 0.637±0.142 cm³/cm³, which is 16.2% more (p<0.01) than in non-burning skin rats injected a similar solution at the same time of observation.

Relative volume of white pulp in rats by which the lactoprotein with sorbitol was injected 7 days after the skin burn injury is 0.355±0.148 cm³/cm³, which is 22.8% less (p<0.05) than in non-burning skin rats injected a similar solution at the same time of observation. Relative volume of red pulp in rats, which was injected with a solution of lactoprotein with sorbitol 7 days after the burn injury of the skin, is 0.644±0.148 cm³/cm³, which is 20.6% more (p<0.01) than in non-burning skin rats injected a similar solution at the same time of observation.

Comparing the stereometric changes in the relative volume of the white and red pulp of the spleen in the first seven days after the burn injury of the skin and the use of a solution of lactoprotein with sorbitol, with results after burning of the skin and the use of 0.9% NaCl solution attracted the following differences: larger by 18.0% (p>0.05) value of the relative volume of white pulp and lower by 9.1% (p>0.05) the value of the relative volume of red pulp in rats 3 days after burning of the skin with the introduction of lactoprotein with sorbitol, than in animals at a given time when the 0.9% solution of NaCl was introduced; 7.9% (p>0.05) values of the relative amount of red pulp in rats were lower in 7 days after burning of the skin with administration of lactoprotein with sorbitol than in animals at the given time when 0.9% solution of NaCl was administered.

Relative volume of white pulp in rats by which HAES-LX-5% solution was injected 1 day after the skin burn injury is 0.360±0.171 cm³/cm³, which is 10.7% less (p>0.05) than in rats without skin burn which was administered a similar solution at the same time of observation. Relative volume of red pulp in rats by which the HAES-LX-5% solution was injected 1 day after the skin burn injury is 0.640±0.171 cm³/
cm³, which is only 7.2% higher (p>0.05) than in rats without burning the skin, which was injected with a similar solution at the same time of observation. This is due to the stenosis of the sinusoid, as well as the decrease of the marginal zone in the lymphoid follicles and periarterial region [7].

Relative volume of white pulp in rats by which the HAES-LX-5% solution was injected 3 days after the skin burn injury is 0.349±0.151 cm³/cm³, which is 16.1% less (p<0.05) than in rats without skin burn which was administered a similar solution at the same time of observation. The relative volume of red pulp in rats, which was injected HAES-LX-5% solution, after 3 days after the skin burn injury was 0.644±0.144 cm³/cm³, which is 10.3% more (p = 0.060) than in non-burning skin rats which was administered a similar solution at the same time of observation.

Relative volume of white pulp in rats by which the HAES-LX-5% solution was injected 7 days after the skin burn injury is 0.332±0.108 cm³/cm³, which is 19.6% less (p = 0.067) than in non-burning skin rats which was administered a similar solution at the same time of observation. Relative volume of red pulp in rats by which the HAES-LX-5% solution was injected 7 days after the skin burn injury is 0.659±0.139 cm³/cm³, which is 15.4% more (p<0.05) than in rats without skin burn which was administered a similar solution at the same time of observation.

Comparing the stereometric changes in the relative volume of the white and red spleen of the spleen in the first seven days after skin burn injury and the use of the HAES-LX-5% solution, with results after burning the skin and applying 0.9% NaCl solution, draw attention to the following differences: larger on 14.4% (p>0.05) value of the relative volume of white pulp and lower by 7.1% (p>0.05) the value of the relative volume of red pulp in rats 3 days after skin burn in the introduction of HAES-LX-5%, than in animals at the given time when the 0.9% solution of NaCl was introduced; the values of relative volume of white pulp and the smaller by 5.8% (p>0.05) than in rats without skin burn which was administered a similar solution at the same time of observation.

Relative volume of white pulp in rats by which the HAES-LX-5% solution was injected 7 days after the skin burn injury is 0,332±0,108 сm³, which is 15.4% more (p<0.05) than in rats without skin burn which was administered a similar solution at the same time of observation.

Comparing the stereometric changes in the relative volume of the white and red spleen on the spleen in the first seven days after skin burn injury and the use of the HAES-LX-5% solution, with results after burning the skin and applying 0.9% NaCl solution, draw attention to the following differences: larger on 14.4% (p>0.05) value of the relative volume of white pulp and lower by 7.1% (p>0.05) the value of the relative volume of red pulp in rats 3 days after skin burn in the introduction of HAES-LX-5%, than in animals at the given time when the 0.9% solution of NaCl was introduced; the values of relative volume of white pulp and the smaller by 5.8% (p>0.05) were higher by 19.4% (p>0.05), the value of the relative volume of red pulp in rats 7 days after burning of the skin at administration of a solution of HAES-LX-5%, than in animals at a given time, with administration of 0.9% solution of NaCl.

The changes in the relative volume of the white and red spleen in the first seven days after the burn injury of the skin and the use of infusion solutions coincide with the features of the dynamics of structural changes in the spleen of the rats at the light-optical level [2, 7].

Conclusions and perspectives of further development

1. The relative volume of white and red pulp in rats without skin burn, which during the first seven days of the experiment were administered infusion solutions practically did not change after 1, 3 and 7 days from the beginning of the experiment. Only 10-13% higher values of the relative volume of white pulp and only 7-11% lower values of the relative volume of red pulp in animals when administered with lactoprotein with sorbitol were established only when compared with administration of 0.9% NaCl solution or HAES-LX-5%.

2. The following dynamics of changes in the relative volume of white and red pulp in animals after the skin burn following the introduction of infusion solutions was established: reduction when administrating of solution lactoprotein with sorbitol by 4.1%, and when administered HAES-LX-5% by 7.8% relative volume of white pulp from 1 to 7 days of the experiment; higher (14.4 and 18.0% respectively) values of the relative volume of white pulp and smaller (7.1 and 9.1% respectively) of the relative volume of red pulp in rats 7 days after skin burns when HAES-LX-5% solution is injected than in animals of present the term with administration of 0.9% NaCl solution; less by 7.9% values of the relative amount of red pulp in rats 7 days after skin burns when administering lactoprotein solution with sorbitol than in animals at this time administering with 0.9% NaCl solution.

Prospects for further development: the established stereometric changes in the red and white pulp of the spleen of rats in the experimental burn disease indicate the expediency of the use of infusion solutions of lactoprotein with sorbitol and HAES-LX-5% in order to prevent the negative changes in the spleen under conditions of burn shock.

List of references
Гумінський Ю.Ю., Гунас І.В., Очеретна Н.П., Башинська О.І.
МІКРОМОРФОМЕТРИЧНІ ЗМІНИ В СЕЛЕЗІНЦІ ЩУРІВ У ПЕРШІ 7 ДІБ ПІСЛЯ ОПІКУ ШКІРИ ТА ПРИ ВВЕДЕННІ ІНФУЗІЙНИХ РОЗЧИНІВ

Резюме. У експерименті на протягі розчина мікрофільма судин в відношенні об’єму білкої та червоної пульпи в селезінці щурів при введенні розчину NaCl та HAES-LX-5%. На фоні опіку шкіри установлено: зменшення при введенні розчину NaCl або HAES-LX-5%. На фоні опіку шкіри, значення відносного об’єму білкої пульпи у селезінці щурів, відповідно на 14,4 і 18,0% менші, ніж при введенні розчину NaCl чи HAES-LX-5%. На фоні опіку шкіри, значення відносного об’єму червоної пульпи у селезінці щурів, відповідно на 19,4 і 5,8% менші, ніж при введенні розчину NaCl.

Ключові слова: мікрофільм, селезінка, щури, 0,9% розчин NaCl, лактопротеїн з сорбітолом, НАES-LX-5%.

Гумінський Ю.Ю., Гунас І.В., Очеретна Н.П., Башинська О.І.
МИКРОМОРФОМЕТРИЧЕСКИЕ ИЗМЕНЕНИЯ В СЕЛЕЗИНЕ ЩУРЫ В ПЕРВЫЕ 7 ДНЕЙ ПОСЛЕ ОЖОГА КОЖИ И ПРИ ВВЕДЕНИИ ИНФУЗИОННЫХ РАСТВОРОВ

Резюме. В эксперименте в течение 7 дней изучены изменения относительного объема белой и красной пульпы селезенки щуря после ожога кожи и при введении инфузионных растворов. При введении инфузионных растворов животным без ожога кожи установлено лишь на 10-13% больше значений относительного объема белой и красной пульпы, чем при введении 0,9% раствора NaCl или HAES-LX-5%. На фоне ожога кожи установлено: уменьшение при введении лактотрепина с сорбиона на 4,1%, а при введении HAES-LX-5% на 7,8% значения в сравнении с контролем, меньше на 7,9% значения относительного объема красной пульпы у щуря через 7 дней после ожога кожи при введении раствора NaCl; меньше на 19,4% значения относительного объема белой пульпы у щуря через 7 дней после ожога кожи при введении раствора HAES-LX-5%, нежели у животных в данной термин при введении 0,9% раствора NaCl.

Ключевые слова: микроморфометрия, селезенка, щуры, 0,9% раствор NaCl, лактопротеин с сорбитолом, HAES-LX-5%.