Rheology and physical-chemical characteristics of the solutions of the medicines

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Abstract. In the laboratory studied the dynamics of rheology of water solutions with plasma-inflammatory and antiseptic funds when mixing them with blood, plasma and pus under the influence of the following physical and chemical factors of local interaction: gravity, specific gravity, temperature, relative viscosity, internal pressure, sparkling water, total concentration of the ingredients, surface activity, volume of acid and osmotic activity of medicines. Found that the rheology of biological liquids improve hyperthermic, highly alkaline and highly carbonated solution medicines. For the dilution of pus, dense festering mass of sulfur plugs and tear stones invited to apply heated to +39 - +42°C with aqueous solution of 0.5 - 3% hydrogen peroxide and 0.5 - 10% sodium bicarbonate saturated with carbon dioxide to excess pressure 0.2 ATM.

1. Introduction
Currently in medicine and veterinary medicine are very widely used antiseptic and substitutes plasma, which shall be entered accordingly in the festering wounds (cavity) and in the blood [1]. Traditionally, nobody examines the processes of diffusion of solutions in these biological fluids, believing that these funds are equally bred blood and pus. The medicines of these groups are used in the form of water solutions entered in very large quantities (amounts), calculated in hundreds of milliliters. And still the essence of conventional technologies the use of these drugs, namely the essence of intravenous and intracavitary injections, is to introduce into the blood and pus cold substitutes plasma, antiseptic and even disinfectants solutions [2-6]. Such technology application drugs is so routine that its efficiency is not in doubt, processes of diffusion of drug in the blood and pus not investigated and no new technologies radically increase the efficiency of cultivation of blood (plasma) and dense festering mass [5,7,8]. At the same time, us has received a large amount of scientific evidence proving the existence of significant shortcomings of traditional technologies of drug cultivation of blood and pus, explaining the nature of the deficiencies identified and showing the way of effective modernization of conventional breeding techniques of blood and pus using famous plasma-inflammatory and antiseptic funds [9-15]. Our results show that to achieve a powerful clinical success (for the rapid and radical dissolution of blood clots, remove blood clots, dense purulent masses, ear wax and others) it is enough only to optimize processes rheology of drugs and dense and viscous colloidal fluids [16-21].
Initially, we examined the dynamics of infiltrations postinjection of medicines in the subcutaneous fat. It turned out that long-term local action solutions of medicinal products in the large concentration of subcutaneous fat cause devastating erosion, the appearance of which we explained excessive distinction physical and chemical characteristics of medicines and subcutaneous fat of each other [1]. Next, our study showed that the most significant destructive influence of such physical-chemical interaction factors as temperature, acidity (alkalinity) and the saturation gas solution [22].

In this regard, the aim of our study was to investigate the peculiarities of rheology and interstitial diffusion solutions of medicines in the thickness of purulent mass changes of the temperature, pH, internal pressure and oxygen content and/or carbon dioxide.

2. Materials and methods

The study of the state of purulent masses conducted in laboratory conditions. In the experiments used purulent contents of the pleural cavity of patients TB pleural empyema, hospitalized in the surgery Department of TB clinic of the Udmurt Republic in 2007-2012, abdominal cavity patients with suppurative spilled peritonitis, hospitalized in the surgery Department clinics № 9 of the city of Izhevsk in 2010 - 2012, and conjunctival cavity of patients by a purulent conjunctivitis, received by the «Clinic Medlife» the city of Perm in 2010. Changing the state of isolated purulent masses and rheology of water solutions of medicines during pouring them into a festering mass of the volume ratio of 1:1 at +24, +37 +42°C degrees studied with the eye on the previously published method [22]. Temperature of purulent masses in their interaction with solutions of drugs in vitro is in the infrared range of a spectrum of radiation with the help of thermal imager NEC TH91XX (USA), with the subsequent processing of information by means of programmes Thermography Explorer and Image Processor. Microstructure of pus up and 15 minutes after the start of interaction with the solutions studied by his strokes, preparing and similarly stained smear of blood on standard laboratory methods of dyeing 0,5% paint Main-Grjunval cooked 96° ethyl alcohol, and paint Romanovsky-Giems. Osmotic activity of aqueous solutions defined cryoscopy using vapor-pressure osmometer OSMOMAT-030 RS production company ANSELMA Industries (Austria). The value of acidity (alkalinity) solutions and purulent masses identified with strips of the universal indicator paper company Lachema. Visualization of gas bubbles in carbonated solutions carried out using an ultrasound device «ALOKA SSD - ALPHA 10» with the use of sensor convex type with a frequency of 3 to 7 MHz.

3. Results and Discussion

Laboratory studies conducted on isolated fragments of thick purulent masses, who in the initial state at a temperature of +24, +37 +42°C with looked in the visible range of the spectrum of radiation is not transparent, have a consistence of the formless, thick, viscous and sticky mass of yellow-grey. While in the infrared range of the spectrum of radiation on thermovisor purulent masses looked solid colour to match the colour of inanimate objects when their temperature is +24, +37 +42°C (respectively). The microstructure of the pus was a relatively homogeneous and moderately transparent intercellular environment with rarely placed in it opaque cells, half of which was located in isolation from each other, and the other half are closely adjoined to each other, forming groups, including 2 - 9 cells.

15 minutes after the start infiltration festering mass at a temperature of +24 or +37°C water for injection, or solutions of 0,9% and 10% sodium chloride, 10% and 20% sodium sulfatsil, 0,02% furatsilin, 0,4% «Ekor-Forte», 3% «Alaminol», 0,25% «Lizophormine - 3000», «Ahdez 3000» (solution, ready to use), 4% double-main salt hypochlorite calcium, as well as a solution prepared by dissolving 1 effervescent tablet «Pjurgjavel» in 1 liter of water, rheology, appearance and microstructure of pus has not undergone significant changes.

Slight decrease in the viscosity of dense purulent mass were observed at infiltration it these same solutions, but heated to a temperature of +42°C. In this case, 15 minutes after the start of interaction with drugs purulent masses looked swollen and their viscosity decreased (increased turnover). In the infrared spectrum thermovisor purulent masses looked solid colour to match the colour of inanimate
objects at a temperature of +42°C. Microstructure of pus after its interaction with water, solutions of 0.9% sodium chloride, furatsilin (at a dilution of 1:5000) or 1.5% hydrogen peroxide testified about the division of a homogeneous mass of pus translucent turbid liquid multiple «islands». In pockets of pus in the most part kept the microstructure in the form of a relatively homogeneous moderately transparent intercellular environment in which rarely were spread non-differential cellular elements. Islets of unchanged pus had a variety of irregular shape, irregular partially blurred edges and look isolated from each other due to the fact that around them unevenly and irregularly and were placed layers of translucent liquid. Layers of the liquid looked as many splitting and merging streams surrounding all sides of the fragments of thick pus from the original microstructure.

At the same time, in 15 minutes after the interaction with pus solutions «Ahdez 3000», 4% «Alaminol», 1.5% «Lizophormine 3000», 2% «Tephlex», 2% «Pjurgjavel», 0.4% «Ekor-Forte», or 4% double-main salt hypochlorite calcium in addition to the above changes in pus appear destroyed cellular elements and areas of the destroyed structure of the extracellular environment. The sites are identified uneven infiltration thick, purulent substrate influencing solutions in the form of clusters. We conducted identification of indicators of the acidity of the water and the solutions showed that all of them except solutions 10% and 20% sodium sulfatsil have a pH lower than 7.0. In particular, water and ready-to-use solution «Ahdez 3000» has a pH about 5.0, solutions 4% «Alaminol» and 1.5% «Lizophormine 3000» have a pH of 6.5, solution 2% «Pjurgjavel» has a pH of about 6.8, and the solution of 0.4% «Ekor-Forte» has a pH of approximately 7.0.

In the next series of experiments in vitro we studied viscosity and microstructure of thick pus after 15 minutes of his infiltration water and water solutions of medicines at room temperature (+24°C) in the artificial lowering of the pH to 2.0 by introducing hydrochloric acid or when raising the pH to 12.0 through the introduction of sodium hydroxide. It is established that acidification not allows, and alkalization allows to decrease the viscosity of dense purulent masses. So, after 15 minutes of interaction thick festering mass of water or solution containing one of the following medicines: solution 0.9% and 10% sodium chloride, 10% and 20% sulfatsil-the sodium, 0.02% furatulin, 0.4% «Ekor-Forte», 3% «Alaminol», 0.25% «Lizophormine - 3000», «Ahdez 3000» (solution, ready to use) or a solution «Pjurgjavel» (solution prepared by dissolving 1 "sparkling" tablets «Pjurgjavel» in 1 liter of water) at pH 2.0 purulent masses remain thick, viscous, sticky and viscous, while after the interaction with these same solutions, but at pH 12.0 viscosity festering mass decreases several times, and viscous thick pus becomes liquid and gain good fluidity.

In parallel, we have studied the ability of water and solutions of medicines thin thick pus and delete it out in the conditions of mechanical mixing of environments through standardized shaking model cavity filled with commensurate amounts of pus and investigated solutions. It is shown that alkalization to pH 12.0 water for injection, solutions 0.9% and 10% sodium chloride, 10% and 20% sodium sulfatsil, 0.02% furatsilin, «Ahdez 3000», 0.4% «Ekor-Forte», 3% «Alaminol», 0.25% «Lizophormine» and 2% «Pjurgjavel» at a temperature of +24°C and +42°C with speeds up the process of thinning and removal of thick pus in 4 and 5 times, respectively, compared with their original wash activity. However, active shake for 30 minutes model cavities containing comparable amounts of thick pus and the above solutions do not lead to absolutely complete dissolution of all pus clots.

Then, we have examined the state of dense pus through 15 minutes of its location at a temperature of +24°C in solutions of 2.4% and 24% of aminophylline (issued in the dosage form «solutions for injections» with a pH about 9.0 and 12.0 respectively in accordance with the requirement of the Pharmacopoeia article) solutions 4% and 10% sodium bicarbonate (have a value of pH 8.0), or in solutions 5% and 20% glucose (issued in the dosage form «solution for injections» with a pH of about 3.5 in accordance with the requirement of the Pharmacopoeia article). It is established, that after 15 minutes of interaction thick, purulent mass with acidic solutions 5% and 20% glucose rheology, appearance and microstructure of purulent masses remains almost unchanged, and in 15 minutes of interaction purulent masses with alkaline solutions 2.4% and 24% aminofillina or 4% and 10% sodium
bicarbonate thick pus almost fully loses its viscosity, becomes liquid and is very fluid. The biggest intensity of the dilution of the pus was observed when placed in a solution of 10% sodium bicarbonate. Following this, we have conducted research in the state of dense pus when mixing it with a solution of 4% sodium bicarbonate through standardized shaking model cavity filled with equal volumes of interacting environments. It is shown that when +24°C solution 4% sodium bicarbonate leads to complete the liquefaction of pus from the formation of a homogeneous fluid liquid after 15 minutes, at +37°C - through of 12.5 minutes, and at +42°C - through of 12 minutes of interaction. The study of the microstructure of pus showed that after thinning he is a homogenous transparent intercellular environment in which very rarely are «scattered» non-differential cellular elements that have preserved their structures and their congestions appear «loose» (non-dense).

Then we studied the dynamics of the movement purulent masses after infusion of water in them and different solutions. The results obtained showed that pus sinks in water and solutions of traditional antiseptic and disinfectant means, but it floats on the surface of a saturated solution of sodium bicarbonate. Exploring the quality of thick pus obtained from the pleural cavity of patients pleural empyema and abdominal patients with peritonitis, we have determined that it represents a heavy, viscous and acidic isotonic biomass. The acidity of pus is within pH 6.0, osmotic activity of pus within 300 мОсмоль/l of water, and the share of pus is within 1,035 ± 0.005 g/cm³. In turn, solutions of sodium bicarbonate in concentrations above 5% a value pH of 8.0, osmotic activity is above 500 мОсмоль/l of water, and the density is higher 1,050 g/cm³. These data allowed to explain that it is due to the gravitational force and the difference between the weights of purulent masses emerge in solutions of 5 - 10% sodium bicarbonate up, situated in the upper layer of the solution, and sink in water, as well as in all the «easy» solutions of medicines.

After that we decided to increase the concentration of gases in a solution of 4% sodium bicarbonate, turning it into carbonated mineral water, hoping thus to strengthen its aggressive action up to the ability to form foam and geyser. To do this, we added a soda solution in the first case, hydrogen peroxide, and in the second case - carbonic gas under high pressure of 0.2 ATM like sparkling drinking water.

It is shown that injections of warm solution of 3% hydrogen peroxide and 4% sodium bicarbonate in isolated fragments thick pus in 5 minutes transformation of two interacting environments in one turbid liquid with a fluid properties, microstructure which is a divorced translucent colloidal intercellular environment with «scoured out» cellular elements united in groups of up to 20 cells.

In a laboratory model of the purulent fistula filled with serous tissue, taken from the pleural cavity of the patient destructive pneumonia, it is shown that a single injection of the bottom part of the channel solution of 4% sodium bicarbonate carbonated carbon dioxide for to excess pressure of 0.2 ATM and heated up to +42°C provides instant rapid expulsion from fistula of almost all purulent contents foaming like a geyser [18]. Found that warm solution of sodium bicarbonate and hydrogen peroxide has the ability to dissolve pus by alkaline burn intercellular colloid environment catalyzed by its heating and interstitial application only boiling (blasting). Alkaline burn intercellular colloid environment softens clot for by hydrolysis of proteins and saponification of fats, accelerated by heat and massive «explosions» of the surface layer of pus on the boundary separating the media bubbles of oxygen released from hydrogen peroxide under the action of the enzyme catalase.

In experiments with ultrasound carbonated solutions in plastic and rubber packages it is shown that the appearance of bubbles gas in solution of 3% hydrogen peroxide and 4% sodium bicarbonate, and the water from the tap, or in solution of 0.9% sodium chloride or 4% sodium bicarbonate when their carbonated carbon dioxide under excessive pressure of 0.2 ATM, «makes» the movement of solution more visible. It is established that the presence of gas bubbles in solutions provides visualization not only of the solutions of a modified their ultrasonic density, but almost every bubble in them, as well as the direction of its movement in the solution. In addition it is shown that visualised using ultrasound direction of movement of gas bubbles in the solution allows you to monitor, and change the location of the cavity in space allows you to change the direction of movement of gas bubbles, as well as the solution and liquid colloidal environment inside the cavity [10,11].
4. Conclusion
It is shown that the rheology of solutions studied plasma substitutes drugs and antiseptic before and after mixing with purulent masses mostly depends on the volume of drug solution, the temperature, alkalinity, osmotic activity, total concentration of the ingredients, the specific weight and carbonation. It was found that the rheology of liquid and viscous and dense biological tissues improve drug having the following physicochemical characteristics: hypertermia, hyperalkalization and hypergazation. Found that the leader rheology improving drugs and biological tissues is sodium bicarbonate, hydrogen peroxide and carbon dioxide introduced into the pressurized drug (similar food carbonated beverages). The data allowed to develop a new hygienic medicine designed to liquefy thick purulent masses with pleural empyema, peritonitis, rhinitis, sinusitis, conjunctivitis, osteomyelitis, and thinning of cerumen and dissolution of the lacrimal stones. New hygiene medicament comprises an aqueous solution of 0.5 - 3% hydrogen peroxide and 0.5 - 10% sodium bicarbonate, carbonated with carbon dioxide to a pressure of 0.2 ATM and heated up to +39 - +42°C [3,8,12,18,20,21,22].

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