

CRYSTALLIZATION CHARACTERISTICS OF BIOLOGICAL FLUIDS OF PATIENTS WITH POSTOPERATIVE ALVEOCOCCOSIS

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The aim of the investigation was to analyze the changes of crystallogenic and initiating activity of biofluids of patients with alveococcosis to estimate the metabolism normalization level intraoperatively and in a long-term postoperative period.

Materials and Methods. Saliva and urinary samples of 42 patients treated for alveococcosis were studied. The diagnosis was verified by instrumental (ultrasound, computed and/or magnetic resonance tomography) and laboratory (latex particle agglutination, ELISA) tests. All the patients were operated: 30 of them underwent radical surgeries, the rest — palliative operations. Biofluid sampling was performed on admission and before discharge from hospital. The patients were followed up for a year and more, saliva and urinary sampling was repeated 2 weeks after the operation, as well as 1 and 3 months after the surgery. All substrate samples were studied according to teziocrystalloscopy technique.

Results. The analysis of the parameters of crystallogenic and initiating properties of saliva and urine showed the patients after radical surgery to have eventual metabolism normalization in a long-term postoperative period, while palliative operations were found to provide its temporal partial optimization, metabolic effect being neutralized 3 months after the operation.

Key words: alveococcosis; crystallization of biological fluids; crystallogenic properties of saliva and urine.

Helminthiasis is a group of diseases caused by parasite worms — helminths. A human body has been recorded to have over 250 helminth species, which are primarily referred to two worm types: nematodes — *Nemathelminthes* (class *Nematoda*) and flat worms — *Plathelminthes* (class of tapeworms — *Cestoidea* and flukes — *Trematoda*) [1]. Three groups of helminths are distinguished depending on biological characteristics and routes of invasion: geohelminths, biohelminths and contact helminths. The most common diseases are nematodoses — geohelminthoses. According to WHO official data, ascariasis annually affects about 1.2 billion

people worldwide, ancylostomiasis — over 900 million people, trichocephaliosis — up to 700 million [2]. In the estimation of the authors [3], currently, helminthiasis prevalence among the population of different continents of Earth is little different from Leriche's data, who described the situation in the 60-s of XX c.: over 2 helminth types account for each African on average, in Asia and Latin America — over 1 type, and one in three European is affected.

Larval cestodiasis: echinococcosis, alveococcosis, cysticercosis — have special place among helminthiasis [4, 5]. They can proceed asymptotically even if there

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are rather large cysts. At the same time rupture or empyema of a small echinococcus cyst result in severe complications: anaphylactic shock, pyoperitonitis, pleural empyema, etc. [6]. The compression of the portal or inferior vena cava by growing cyst or alveococcus results in portal hypertension.

Currently, primary diagnosis of the mentioned pathological conditions common both to animals and human beings, alveococcosis, in particular, is predominantly made immunologically [7, 8] and based on ultrasound and imaging examination [9, 10]. Unfortunately, the observed tendency in current medical investigations for the expansion of applied biocrystallome techniques to study composition and properties of biofluids has not been extensively used in helminthology [11].

Long work experience of Kirov Regional Center of Liver and Bile Duct Surgery, Ministry of Health of the Russian Federation, shows that there is a large group of patients with focal hepatic diseases. Surgeons based on the findings of explorative laparotomy or salvage procedures considered such patients to be radically inoperable [12–14]. It refers to both malignant and benign tumors and parasitic diseases. In particular, this fact can be due to the localization of alveococcal node and tumor cavitation, extremely high risk of radical surgery and other causes.

Quite recently, hepatic reoperations have been limited to syringectomy or fistula curettage, opening of purulent cavities, and administration of parasitotropic agents [2, 13]. Currently, there emerged a real opportunity to reoperate radically on those patients who were considered to be radically inoperable during explorative laparotomy or palliative operations [12–14].

On the other hand, complete diagnostic support of alveococcosis surgery is very important [10, 11, 15]. The application of current instrumental techniques of liver morphology (contrast radiodiagnosis, computed and magnetic resonance tomography, ultrasound) enables accurately estimate the nature, depth and intensity of hepatic structural damage associated with the disease development. The intensity of immune response on parasite presence can be verified using latex-agglutination reaction and enzyme immunoassay with specific alveococcal diagnosticum. Moreover, alveococcus scolex in some cases can be found in sputum. Previously [16, 17] we showed that alveococcus significantly and directionally changes crystallogenic properties of biosubstrates, and this transformation results in similar shifts of salivary and urinary crystallostasis. At the same time, the characteristics of metabolic changes including the changes of physicochemical parameters of biological fluids in alveococcosis, its operative management and in postoperative period which can indicate the efficiency and radicality of alveococcosis surgical management have been poorly studied.

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Materials and Methods. Saliva and urine samples of 42 patients treated for alveococcosis were studied. The diagnosis was verified by instrumental (ultrasound, computed and/or magnetic resonance tomography) and laboratory (latex-agglutination, ELISA) tests. All the patients were operated: 30 of them underwent radical surgeries (from high-risk operations — hemihepatectomy, and mean-risk operations — lobectomy), the rest — palliative operations. All patients involved in the study successfully underwent the management.

The study complies with the declaration of Helsinki (adopted in June, 1964 (Helsinki, Finland) and revised in October, 2000 (Edinburg, Scotland)), and was performed following approval by the ethic committee of Kirov State Medical Academy. Written informed consent was obtained from all patients.

Biological fluid (saliva and urine) sampling was performed on admission and before discharge from hospital. The patients were followed up for a year and more, and biofluid sampling was repeated 2 weeks after the operation, as well as 1 and 3 months after the surgery.

All substrate samples were studied according to teziocrystalloscopy technique [17, 18]. Normal saline was used as a basic substance. The results of proper and initiated biofluid crystallization were assessed and described using semi-quantitative integral parameters according to own algorithms [18].

The findings were processed using Statistica 6.0.

Results and Discussion. The data on the changes of physicochemical properties of biological fluids in an early postoperative period suggest that when patients with alveococcosis are discharged from hospital, they have their metabolic status partially normalized.

The study of the characteristics of proper crystallization of saliva in alveococcosis patients in a long-term postoperative period after radical surgery (Fig. 1) enabled to state that by key parameters characterizing structure complexity and density of crystal elements (structuredness index — SI and crystallization capacity — CC) as early as 2 weeks after surgery there can be recorded the values which differ minimally from physiological ones ($p > 0.05$), and subsequently, the values change slightly achieving plateau.

We verified the integrity of dysmetabolic changes of saliva composition and properties based on the assessment of integrated index of crystallogenesis “correctness” — facies destruction degree (FDD) of dried biological media. Thus, being rather high when a patient is discharged, FDD significantly decreases 2 weeks after the surgery, and significantly exceeds the level in apparently healthy people ($p < 0.05$). A month after the surgery this parameter is no different from physiological values, and 3 months after the operation

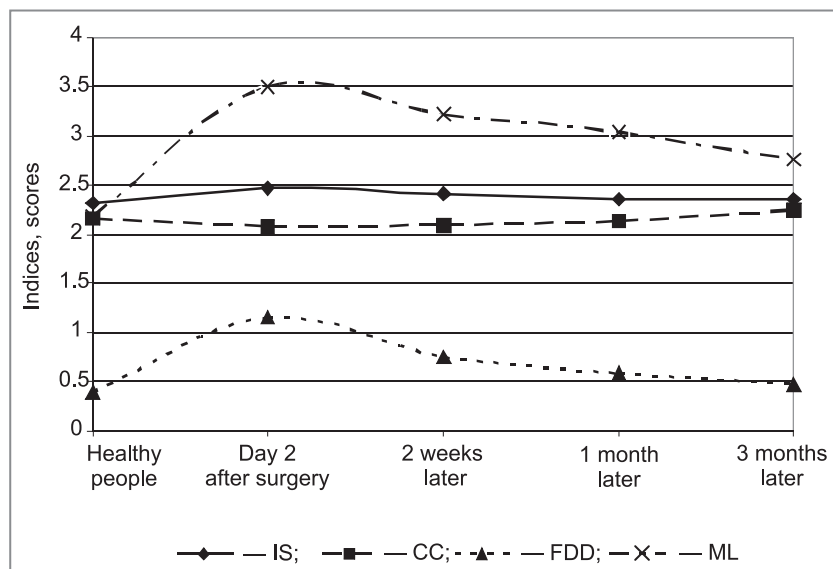


Fig. 1. Morphometric data of saliva crystallograms of patients with alveococcosis in a long-term postoperative period after radical surgery

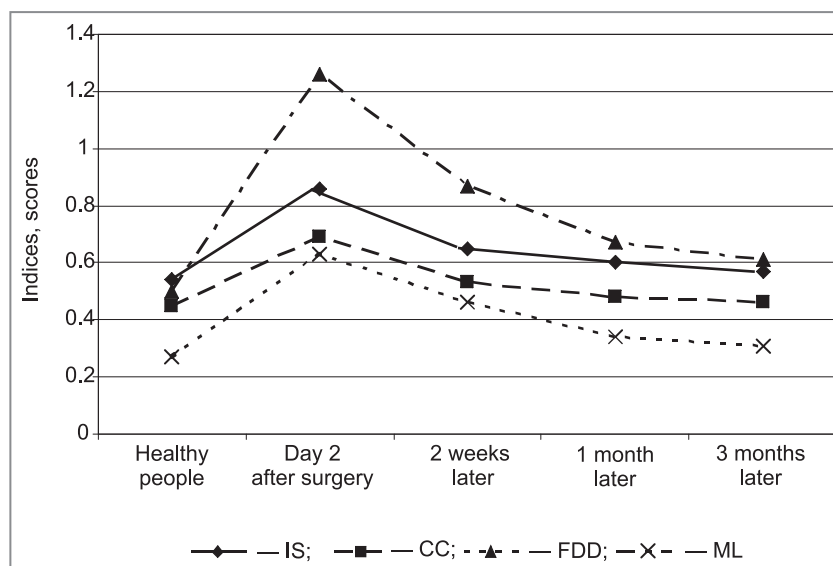


Fig. 2. Morphometric analysis of crystalloscopic urinary facies in a long-term period after radical surgery of alveococcosis

it keeps decreasing remaining within the range of the norm.

Similar changes were revealed for marginal level (ML) of a sample (See Fig. 1) though the values of the parameter remained higher than those of saliva samples in a control group (in healthy people) and the values 1 month after the surgery. In our opinion, it is due to a long-term presence of higher level of immunoglobulin in biological fluids of patients (blood, saliva, urine, etc.) and slower cease of immune response on the presence of alveococcus in the body. It was another 3 months after discharge before saliva micro-slides showed normalization of the parameter.

The assessment of changes of urinary crystallogenic

properties in a long-term postoperative period (Fig. 2) revealed the intensity of changes in crystallograms of this biological fluid to be more significant than in saliva. And 2 weeks after discharge from hospital only the quantitative parameter of biomaterial structuring — crystallization capacity — is normalized, subsequently the parameter achieving its plateau and being no different from physiological crystalloscopic “pattern” of urine ($p>0.05$). Two weeks after the surgery other indices decrease as well, however, they remain at the level which exceeds that established for apparently healthy people ($p<0.05$). Marginal level intensity of a micro-slide and its SI have the quickest rate of decrease reaching physiological values 1 month after surgery and continue moderate drop 3 months after surgery.

The most persistent changes were revealed in relation to integrated parameter of crystallogenesis — FDD. This parameter which reflexes the balance of physicochemical characteristics and component composition of biological substrate, though demonstrating a clear tendency for decrease, remains at a higher level in relation to control values even 1 month after surgery. According to the findings, it is normalized only 3 months later, when FDD is within the physiological range. Therefore, such patients have metabolic shifts till the third month after surgery.

The assessment of a radical surgery effect on physicochemical properties of biological fluids verifying the presence and intensity degree of metabolic disorders is of special interest, both

scientific and practical. Therefore, we compared the characteristics of saliva crystallogenic potential 3 months after surgery in patients with alveococcosis taking into account radical or palliative operations performed (Fig. 3).

Absolute majority of the main morphometric indices of saliva crystalloscopic facies in patients 3 months after a radical surgery was found to normalize (See Fig. 3). The exception is marginal level intensity, as in addition to physiological components there can be concentrated class G antibodies to alveococcus transported through a brain-salivary barrier. By contrast, a palliative operation performed in an early postoperative period and partially normalizing oral crystallogenic activity further levels

this positive effect on metabolism. This fact is embodied in the following phenomenon: in patients under consideration the values of estimated indices of saliva crystallograms pathologically transform again, nearly achieving their preoperative level ($p > 0.05$ compared to initial values). And only FDD significantly increasing still does not reach its initial value ($p < 0.05$).

These tendencies are also noticeable by the spectrometric analysis findings of saliva crystallograms of patients in the treatment and control groups (Fig. 4). So, total optical density of saliva crystalloscopic facies in patients 3 months after a radical operation is no different from that of apparently healthy people, except for wavelength $\lambda = 350$ nm, in which the level of the parameter exceeds physiological ($p < 0.05$). By contrast, spectroscopic "pattern" of saliva of patients with alveococcosis 3 months after palliative treatment has the same level as that in preoperative period.

Upon the whole, we can conclude that the complex of metabolic effects which have an effect on crystallogenesis of biological fluids in patients with alveococcosis has a directional character and can be completely reversible in case of radical treatment. Moreover, realization of the phenomenon of parasite-associated crystallization at organismic level provided codirectional transformation of crystallogenic and initiating properties of biological fluids in the presence of alveococcus [11]. Transformation intensity increases in progressive disease depending on both metabolic activity of helminth, and response of macro-organism including an immune response. Thus, crystallogenesis shifts play a key role in alveococcosis pathogenesis and can be determined and estimated using a complex of biocrystallome study of fluid media, and further acting as an informative integral diagnostic criterion, as well as the index of efficiency and radicality of the performed surgery and the course of an early and long-term postoperative period.

Conclusion. The performed studies enable to conclude that in a long-term

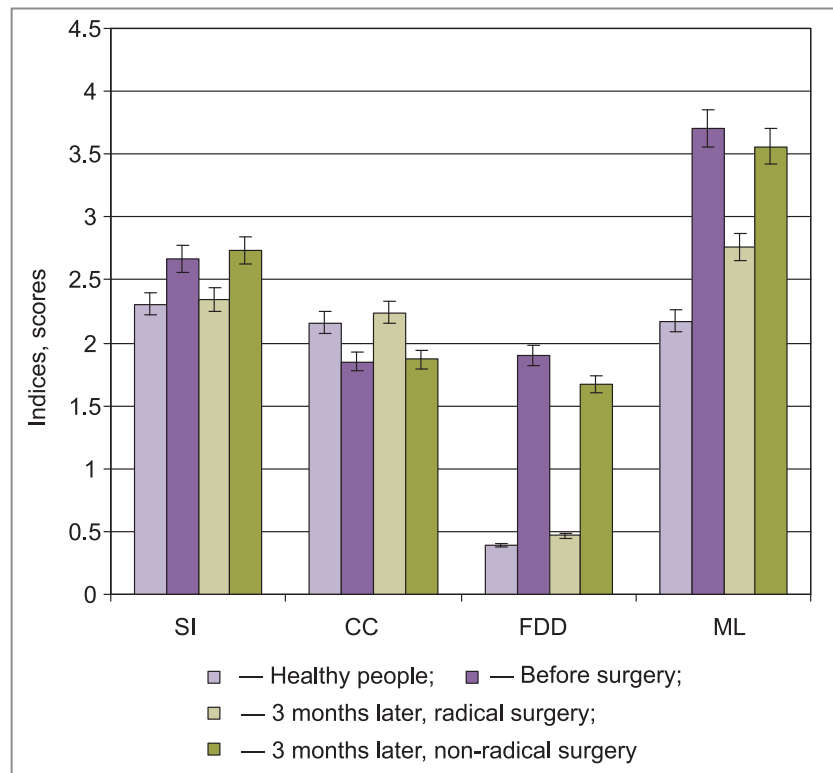


Fig. 3. Changes of crystallogenic properties of saliva in patients with alveococcosis depending on operation radicality

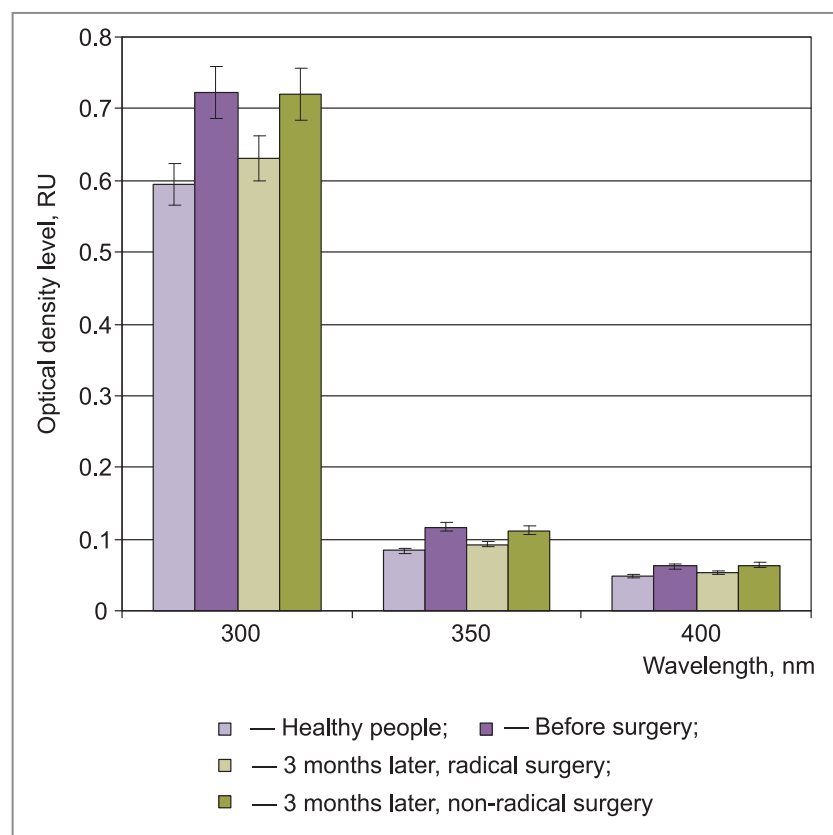


Fig. 4. Spectrometric findings of salivary facies in patients with alveococcosis depending on surgical radicality

postoperative period patients with alveococcosis who underwent a radical surgery appear to have gradual metabolism normalization (according to the parameters of crystallogenic and initiating properties of saliva and urine, and therefore, by their physicochemical characteristics and component composition), while palliative operations provide only temporal partial optimization, metabolic effect of which levels as early as 3 months after surgery. This fact has both pathogenetic and diagnostic value, as it can underlie the assessment techniques of effectiveness of the performed surgery and its radicality.

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