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Barannik Konstantin
candidate of мedical sciences,
Assistant of the Department of Surgery №1
Dnipro State Medical University, Dnipro, Ukraine

Molchanov Robert
doctor of medical sciences, professor,
Professor of the Department of Surgery №1
Dnipro State Medical University, Dnipro, Ukraine

Barannik Serhiy
doctor of medical sciences, professor,
Professor of the Department of General Surgery
Dnipro State Medical University, Dnipro, Ukraine

PRACTICAL SIGNIFICANCE OF THE FEATURES OF LITHOGENESIS OF UREATIC STONES IN RESIDENTS OF THE DEVELOPED INDUSTRIAL REGION, PATIENTS WITH URIAL STONE DISEASE

Introduction. Urolithiasis is one of the oldest diseases known to medicine; however, the mechanisms of stone formation and development remain largely unclear. Physico-chemical, biological and biochemical processes that occur during the formation of urinary stones, determine the peculiarities of their composition and structure, as evidenced by modern methods of analysis: spectral, X-ray, polarization, optical, immersion, infrared spectrometry and others [1,2]. But it was determined that knowledge of the chemical composition and structure of urinary stones does not improve their destruction [3]. Urolithiasis, a complex multifactorial disease, results from an interaction between environmental and genetic factors. Epidemiological studies have shown that urolithiasis is associated with a number of lifestyle-related diseases, including cardiovascular disease, hypertension, chronic kidney disease, diabetes, and metabolic disorders. Syndrome [4, 5, 6]. Elucidation of the mechanisms underlying the formation of urinary stones will allow the development of new prophylactic agents. For the development of new modern methods of mechanical destruction of urinary stones, data on the structure of urinary stones, which primarily determines their physical properties, are of particular importance. An example is the fact that graphite and diamond have the same mineral composition (carbon), but the strength of each of them can’t be compared: one - fragile, the other - the hardest [7, 8].

Purpose of the study — to reveal the specific features of the ontogenesis of uroliths from the nirks of the Meshkants in the Dnipropetrovsk region, which are related to the structure and morphology of these dentures.

Follow-up methods. For the purpose of the work, a sequential analysis of the morphology of more than 246 urologists from the inhabitants of the Dnipropetrovsk region was carried out, and a detailed analysis of their petrographic studies was carried out. Rozmiri dolzhenyh kameniv vid 5 mm to 67 mm dozhiny, vid 4 mm to 54 mm lintels, vid 3 mm to 31 mm tovshchina. Okremi kameni bilshi roziru. The shape of the stones was varied. The morphology of uroliths was studied with the help of a stereoscopic binocular microscope MBS-9. Microscopic examination of sections of uroliths in Vikonan with the help of an optical polarizing microscope MIN-8.

Discussion of results. It seems that the solids of the body are blown one by one, not only behind the mineral warehouse, but behind the structure and texture. Pobudov's solid body, like a cut stone, is characterized by structural and textural features, which are inspired by yoga and future transformations (genesis). The structure and texture define the language of speech on different levels. The texture is the folding of the siege breed, the oriental orientation, the mutual expansion of warehouse parts, and also the way of filling the space. Texture is an important macroscopic sign, which should be carried out on rocks (on stone rosettes, on the surface of the polished sections). Structure - budova breed, which is characterized by rozmir, form, orienting chastice and the degree of conservation of organic surplus (microscopic sign). The structure of the pores of chemical treatment, including sich stones, is characterized by the degree of crystallinity and the size (dimensions) of grains.

The structure is important for the strength of urinary stones. The most strong and resistant to destruction stones that have a full-crystal equivalent to medium-grained or fine-grained structure. Large-grained, coarse-grained, giant-grained formations are more favorable for destruction, both under mechanical impact and under significant temperature changes, because large crystals with pronounced adhesion in large-grained formations are easily split and destroyed. Glassy stones break quickly under conditions of sharp temperature changes. Characteristic of stones is the presence of cavities, among which are identified such as cracks and cavities. The shape of the cavity is different - vesicular, canal-shaped, crack-like, branched, and others. The shape and degree of hollowness of the stone determine its properties such as density, strength, susceptibility to destruction.

In previous works, the structure and composition of urinary stones, including single kidney stones, are most fully focused on using petrography, infrared spectrography, laser and electron probe microanalysis. It is established that oxalate stones are characterized by fine-grained and fine-grained structure. The main types of texture of these stones were concentric, zonal and radial. A characteristic structural feature of urate stones is the microcrystalline structure, and the predominant textures are spherulitic, sectoral-spherulitic and chaotic. Amorphous minerals in the vast majority are given in the form of the cementing, connecting separate crystals of weight. In these stones, recrystallization processes with the formation of cavities were more often observed. Coral-like stones are characterized by a mixed composition. They were formed in the presence of amorphous minerals with the addition of salts of different compositions. The structural feature of coral-like stones was their chaotic construction.

Thus, the analysis of own data shows that urinary stones have different composition and, depending on the type, mainly consist of crystals of uric acid, sodium uric acid or ammonium, calcium oxalate or ammonia, calcium phosphate, magnesium phosphate or ammonia. All stones consist of organic and mineral parts. Many of them are mixed in composition. Mineral composition contains from 6 to 17 or more trace elements. As for the structure of stones, the studies devoted to this issue concern the study of microstructure as a consequence of stone formation. It is established that the microstructure of stones, as well as their composition, depends on the type of urinary stones. The study of the structure and composition of urinary stones in order to detail the mechanism of their destruction is an important task, because it is the principle of mechanical destruction is the basis of remote and contact methods of disintegration of stones.

According to external signs, the studied stones were divided into groups of known types: urate, oxalates, phosphates and mixed composition.

Urates had a firm consistency, color from yellow to dark brown. Their surface was often smooth. Individual stones were covered with small grains, which are tightly connected with the surface or (rarely) easily separated from the stone surface after a little pressure. Oxalates were solid formations from yellow to dark brown (more often). Their surface was also smooth, sometimes warty or rough, covered with dull sharp spikes. Phosphate stones were of different consistency: some of them were easily crushed, others had a solid consistency. They had a predominantly white or yellowish-white color, smooth or slightly rough surface. The stones of mixed composition had different colors and surfaces. Depending on the predominant ratio of components and internal connections, some of them were solid, others - easily crushed. Some of them were easily crushed only after the destruction of the solid surface layer. Others, on the contrary, were solid after the destruction of the surface layer.

Depending on the constituent substance, we divided the studied stones into three groups: 1) crystal, among which we additionally identified two groups: a) monomineral and b) polymineral; 2) amorphous; 3) mixed in composition - complex salts of various acids. Depending on the location of the crystals, radiant-radial, spherulitic, globular, and chaotic structures were distinguished.

It was found that urate is characterized by a concentric structure. 90% of stones have a well-formed core, the diameter of which (measured on samples) ranges from 0.1 to 0.5 mm. The nucleus is surrounded by dense layers with loose layers 0.1-0.5 mm wide. Often "punctures" are formed around the nucleus, which separates the layers and further destruction of the stone. The obtained data allow to determine the structure of urate as pelitomorphic-latent crystal, equivalently fine-grained (crystal size 0.01 mm).

The results of studies have shown that phosphates, like urate, have a concentric structure around the nucleus, often have 2 or more nuclei and a coral-like shape. Diameter of kernels from 0,1 to 0,5 mm. Phosphates have multi-step chips and loose layers. Layer width 0.1 mm or less. The structure of the stones is hidden crystal, equivalently fine-grained.

Oxalates, unlike urate and phosphate, do not have a clear concentric structure. These are monolithic stones (Figs. 1 and 2). Only 20% of the specimens have a well-formed core. Oxalates are composed of dense layers that do not have loose layers. When studying them under a microscope, it can be seen that the expressed crystals are not detected, but the microcracks have a very thin structure, which is filled with organic matter. That is, according to the degree of crystallization, the structure of oxalates is vitreous, fine-grained, stones do not have clearly defined crystals.

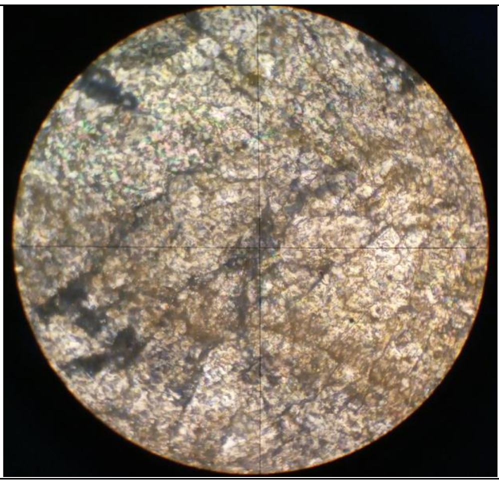

Fig.1. **Micrograph of the central part of an oxalate stone.** In the field of view, the main part of the thin section is composed of the mineral substance of inequigranular oxalate crystals (mainly wevellite (calcium oxalate monohydrate) and rarely - weddellite (calcium oxalate dihydrate). There is a boundary between 2 oxalate aggregates and numerous microcracks filled with organic matter. Polarized transmitted light. Magnification 110.

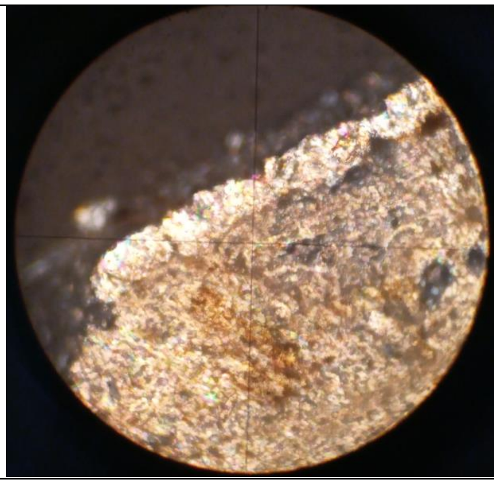

Fig.2. **Micrograph of the peripheral part of an oxalate stone.** In this section of the section, the microlayered (in the upper right part of the figure) and flaky structure of calcium oxalate aggregates (weddellite) are well manifested, and a thin layer of uric acid dihydrate is visible at the outer boundary of the sample. Polarized transmitted light. Magnification 110.

Stones of mixed composition (Figs. 3 and 4) are characterized by features of both phosphates and oxalates. They have a concentric structure, often 2 or more nuclei with a diameter of 0.01-0.1 mm. Mixed type stones combine elements of oxalates and phosphates, the structure is concentric in the form of a core, which is surrounded by layers varying in width (0.1-0.2 mm) and hardness. Layers of loose material 0.001 mm wide are often formed similarly to phosphates. The structure of stones is pelitomorphic-fine-grained.

Fig. 3. **Features of the structure of the central part of the stone of mixed structure.** In the field of view, the micrograph shows, along with a fragment of the "organic core" and the site of stone formation generation. The first generation is represented by a concentrically zoned kidney-shaped wewellite aggregate formed around a fragment of the “organic core”. The mineral substance of the second generation of stone formation in the form of kidney-shaped aggregates of vevellite with a concentrically zonal structure radially overgrows the aggregate of the first generation. Polarized transmitted light. Magnification 110.

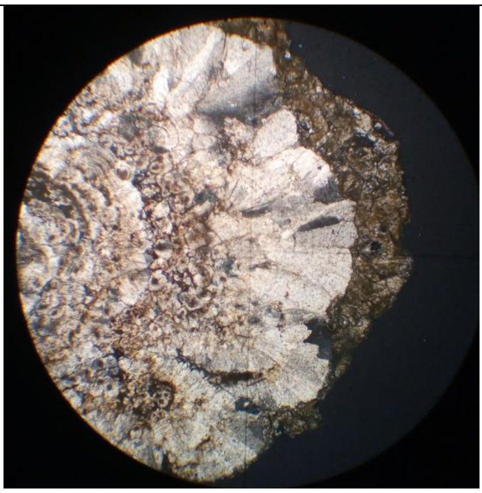

Fig. 4. **Features of the structure of the peripheral part of the stone of mixed structure.** The micrograph shows the boundaries between generations of stone formation. Structurally, the generation of stone formation is characterized by combinations of microspherical aggregates with layered and microkidney aggregates immersed in organic matter. In terms of minerals, there is a slight predominance of wevellite in relation to weddellite. Polarized transmitted light. Magnification 110.

From the above it can be seen that the three types of stones, in addition to oxalates, have the same structure. The texture is all layered or irregular. Chips are especially important in the construction of stone. Fracture fracture is the most fragile form of fracture that can occur in crystalline material when crystallographic surfaces are separated. Due to the fact that the neighboring crystal grains have different orientations, the brittle fracture at the boundary of the crystal grain changes its direction and continues to spread in the most favorable direction of the chip surface. It was noted that the chips have a step that is parallel to the direction of propagation of the crack and perpendicular to the plane of the crack. In all types of such stones, cavities, cracks and fissures were identified around the nuclei, which cause the separation of layers and subsequent destruction of the stone. But it should be noted that these formations are most pronounced and are often found in phosphates and urate. In phosphates chips are more often multistage. In oxalate stones chips are almost absent, cavities and cracks are rare.

Conclusions. Thus, urinary stones, as biological objects, in contrast to solids of mineral origin, have characteristic of each type of diagnostic features and stable types of structures and textures. It is known that the nature of the destruction is significantly affected by the structure of urinary stones. In turn, the structure reflects the peculiarities of the chemical composition and distribution of elements of zonal structures. However, in order to be able to improve the methods of their litholysis, destruction and, especially, metaphylaxis of recurrent stone formation, deep knowledge about the peculiarities of the physical and technical properties of urinary stones is required.

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