X-Ray diffraction study of gallstones.

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Gallstone disease is very actual and important problem in medicine. The most widespread method of treatment is a radical laparoscopic cholecystectomy, but the perspective one is litholytic medical treatment. A study of phase and element composition, crystal structure, and physicomechanical properties of gallstones is necessary for a choice of the treatment and estimation of prognosis. Medical influence can reduce a dimensions or change a properties of gallstones and consequently facilitate stone disintegration process.

According to literature data cholesterol, bilirubin, bile and fatty acids and their calcium salts, and inorganic compounds (mainly calcium carbonates) are the general components of all gallstones. In accordance with the prevalence of cholesterol or bilirubin all stones divided into three groups: black pigment stones, brown pigment stones (rare in Europe) and yellow cholesterol stones. The ratio of cholesterol, phospholipids and bile acids determinates the process of lithogenesis in bile.

Of the 27 components of the gallstones, at least six types of cholesterol (cholesterol I, II, III, IV, V, VI) with various crystal structures, numerous variants of fatty and bile acids have been found and studied by scientists. However, there is not any reliable information about kinds of cholesterol and another compounds presented in gallstones.

The main purpose of our study was to systematize the data on the composition and the crystal structure of gall bladder stones and to study the composition of 20 gallstones removed operationally from residents of Moscow and its region. The phase composition and crystal structure of gallstones were examined by powder X-ray diffraction method (a single counter powder diffractometer HZG-4; CuK_{α} radiation; graphite monochromater). The element composition was determined by the standard chemical analysis. The study of gallstones was carried out from periphery to center ones.

First of all the interplanar spacings (*d*,A) together with the corresponding relative intensities (*I*,%) of all components of bile stones and their density were adopted from well-known experimental data or calculated. These results afford to identify of the composition of stones using X-ray diffraction method.

All examined bile stones are divided into the two groups: black bilirubin stones and many-coloured cholesterol stones. In turn, cholesterol stones are divided into two groups: monophase stones and multiphase ones. The first group of gallstones contained cholesterol I only. The second group of ones contained cholesterol I, an intermediate crystal form from cholesterol II to monohydrate cholesterol and possibly a small amount of deoxycholic acid II. It was found that the composition of the some analysed stones changes from periphery to center and besides, as a rule, the calcium concentration is higher in the center as compared with periphery. In all stones has been found the albumin.

For accuracy assay we analysed a commercial cholesterol test. The X-ray diffraction pattern of this sample revealed the presence of the main phase cholesterol I as well as three impurity phases: cholesterol II, VI, and a small amount of monohydrate cholesterol.