



## New Predictors of Destructive Cholecystitis

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### Abstract

One of the most frequent and dangerous complications of cholelithiasis is acute cholecystitis, which occurs in 10-15% of patients with GI [1-3]. It is with this complication that a significant number of tactical errors occur, which can lead to adverse consequences [1,4,5]. One of the important messages is to determine the indications for surgery and the timing of surgery. Despite a significant number of works devoted to this pathology, there is no single point of view on this range of problems. Special difficulties arise in the treatment of the elderly contingent, as well as in severe concomitant pathology.

According to the report of the Chief Surgeon of the Russian Ministry of Health, the number of confirmed cases of patients with acute cholecystitis in Russia has been steadily increasing over the past 17 years. So, in 2004, 114,400 cases were detected, and in 2019, 160,634 or almost 1.5 times more [6].

At the same time, one of the main problems determining the outcomes of the disease is the course of acute cholecystitis in elderly patients and in patients with severe concomitant pathology [7-9]. It should be noted that according to E. Galperin, one in four patients of the older age group (60-70 years old) is diagnosed with gallstone disease [10]. At the same time, about 60% of patients admitted to the hospital with acute calculous cholecystitis are elderly and senile. Considering the fact that in this age group the degree of anesthetic risk is IV (high: 5-6.5 points) or V (extremely high: 7-9.5 points), which is associated with severe concomitant pathology of vital organs and systems, therapeutic tactics continues to be the subject of discussion [11].

**Keywords:** Acute Cholecystitis; Chronic Calculous Cholecystitis (CCC)

### The Purpose of the Study

To study changes in the concentration of CK, GGTP, alkaline phosphatase, LDH in acute catarrhal and destructive cholecystitis.

### Materials and Methods

A single-stage study of 105 patients with the main clinical and morphological forms of acute calculous cholecystitis (acute catarrhal cholecystitis (ACC n = 35); acute phlegmonous cholecystitis (APC n = 35); acute gangrenous cholecystitis (AGC n = 35)) was performed on the basis of the Clinical Hospital N

1 in Chita. The study included patients with acute cholecystitis operated by laparoscopic cholecystectomy or traditional open cholecystectomy over the age of 18 years. The exclusion criteria were patients suffering from cholelithiasis complicated by mechanical jaundice, aged <18 years. The clinical comparison group included 35 patients with chronic calculous cholecystitis (CCC) over the age of 18, whose examination did not reveal pathology of the stomach, duodenum, operated with the standard laparoscopic cholecystectomy technique. The main criteria for exclusion from the clinical comparison group were: patients with

chronic calculous cholecystitis, acute calculous cholecystitis, under the age of 18 years, whose examination revealed pathology of the stomach, duodenum.

The activity of lactate dehydrogenase (LDH) and creatine kinase (CK) was studied in patients with acute cholecystitis in the first 2 hours after treatment. The letter was determined by kinetic colorimetric method with reagents of the company-Vital: lactate dehydrogenase - VITAL, Creatine kinase-Vital.

In order to determine the reliability, statistical processing of the obtained data was performed using the SPSS Statistics 11.0 program in compliance with the fundamental principles of statistical analysis used for research in biology and medicine. The results are given in an average value with an average quadratic error ( $M \pm m$ ). The statistical significance of the differences

between qualitative (categorical) features was performed using the conjugacy table with the evaluation of differences using the criterion  $\chi^2$ . The normality of the distribution of features was assessed using the Shapiro-Wilk criterion. The strength of the relationship between the concentration of the studied enzymes and the degree of destruction in the gallbladder wall was determined using the Pearson correlation coefficient. The Student's Criterion with Bonferroni correction was used to compare the studied groups with the clinical comparison group.

**The Results of the Study**

In the study of biochemical blood analysis for creatine phosphokinase (CKF), the following concentrations of this enzyme were obtained (Table 1).

Concentration changes KFC (UNITS/l)	Study groups (number of people)			
	Subgroup №1 (ACC) n = 35	Subgroup № 2 (APC) n = 35	Subgroup № 3 (AGC) n = 35	Clinical comparison group (CCC) n = 35
The average concentration value is <sup>1</sup>	168,7* 2* 3*	280,6 <sup>4*5*</sup>	323,8 <sup>6*</sup>	73
Standard deviation	18,3	25,8	39,5	29,7

**Table 1:** Average creatine phosphokinase concentration in the studied subgroups.

- \* p < 0.001 in subgroup No. 1 and subgroup No. 2;
- 2\*p < 0.001 in subgroup No. 1 and subgroup No. 3;
- 3\*p < 0.001 in subgroup No. 1 and clinical comparison group;
- 4\*p < 0.001 in subgroup No. 2 and clinical comparison group;
- 5\*p < 0.001 in subgroup No. 2 and subgroup No. 3;
- 6\*p < 0.001 in subgroup No. 3 and clinical comparison group.<sup>1</sup>

The correlation coefficient (p) is 0.986. The relationship between the studied signs is direct, the closeness (strength) of the connection is strong, the dependence of the signs is statistically significant (p = 0.014).

Based on the data obtained, it was found that the higher the degree of destruction in the wall of the gallbladder, the more

significant concentrations of CK are observed. Thus, in patients with OCD, an average concentration of 168.7 U / l is observed, which does not exceed the norm. But at the same time, the concentration of CK in group No. 1 is 2.3 times higher (p < 0.001) than the values obtained in the comparison group. In patients with OFC, there is an increase in the concentration of CK (280.6 U/l) by 1.5 times (p < 0.001) relative to the reference values, by 3.8 times (p < 0.001)

relative to the comparison group, by 1.7 times compared with group No. 1 ( $p < 0.001$ ). Along with this, the highest concentration (323.8 U/l) is observed in the group of patients with OHC, which exceeds the norm indicator by 1.7 times ( $p < 0.001$ ), 4.4 times the indicator of the comparison group, 1.9 times the values obtained in the OKH group ( $p < 0.001$ ) and 1.2 times the indicators in patients with OFC ( $p < 0.001$ ) (Figure 1).

It was found that the highest sensitivity and specificity in the diagnosis of acute catarrhal cholecystitis has a CK index from 0-190 U/l (sensitivity 71.4% [CI 65.8-77]; specificity 2.9% [0-11,1]); acute phlegmonous cholecystitis -  $>300$  U/l (sensitivity 40% [CI 25.9-51.4]; specificity 97.1% [94.3-99.9]); acute gangrenous cholecystitis -  $>300$  units/l (sensitivity 65.7% [CI 94.3-99.9]; specificity 97.1% [94.3-99.9]).

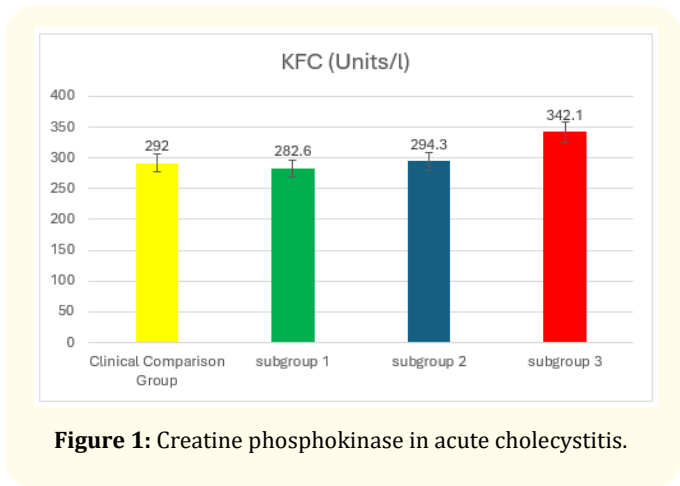


Figure 1: Creatine phosphokinase in acute cholecystitis.

An increase in the activity of CKF in destructive forms of acute cholecystitis is most likely associated with the destruction of the muscular membrane of the gallbladder. Based on the above, the content of this enzyme can serve as a predictor of destructive cholecystitis.

In the study of biochemical blood analysis for lactate dehydrogenase (LDH), the following concentrations of this enzyme were obtained (Table 2).

As a result of the study, we obtained data that show that with an increase in destructive processes in the gallbladder wall, a directly

Concentration changes LDG (UNITS/l)	Study groups (number of people)			
	Subgroup № 2 (APC) n = 35	Subgroup № 2 (APC) n = 35	Subgroup № 2 (APC) n = 35	Subgroup № 2 (APC) n = 35
The average concentration value is <sup>1</sup>	282,6*	294,3 <sup>2*</sup>	342,1 <sup>3*</sup>	292
Standard deviation	14,8	15,4	21,	21,6

Table 2: Average lactate dehydrogenase concentration in the study groups.

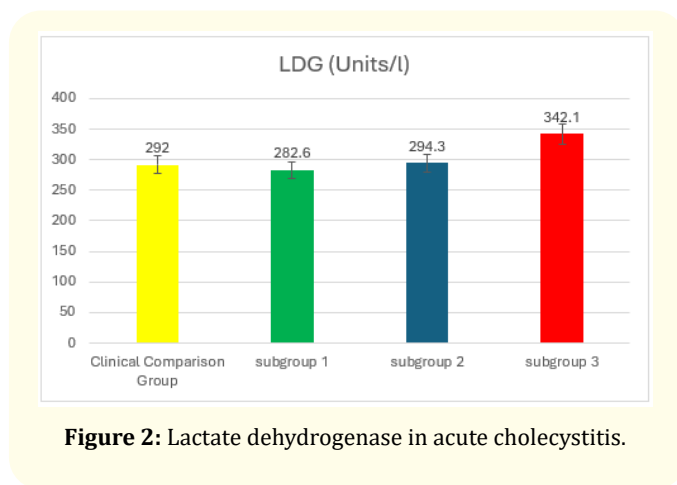
1\*p < 0.001 in subgroup No. 1 and subgroup No. 3;

2\*p < 0.001 in subgroup No. 2 and subgroup No. 3;

3\*p < 0.001 in subgroup No. 3 and the clinical comparison group.

<sup>1</sup> The correlation coefficient (p) is 0.782. The relationship between the studied signs is direct, the closeness (strength) of the connection is strong, the dependence of the signs is statistically significant (p = 0.002).

proportional increase in LDH concentration occurs. It was found that patients with OCD have an average concentration of 282.6 U/l, which does not exceed the reference values. At the same time, in patients with phlegmonous cholecystitis, the LDH value begins to increase and reaches 294.3 units/l, which does not exceed the norm. Along with this, in patients with acute gangrenous cholecystitis, the LDH concentration reaches 342.1 U/l, which is 1.1 times higher ( $p < 0.001$ ) than the reference values, 1.2 times higher ( $p < 0.001$ ) than the concentration of this enzyme in the clinical comparison group and in the subgroups of acute catarrhal and phlegmonous cholecystitis (Figure 2).



**Figure 2:** Lactate dehydrogenase in acute cholecystitis.

It was found that the highest sensitivity and specificity in the diagnosis of acute catarrhal cholecystitis has an LDH index from 0-290 U/l (sensitivity 68.6% [CI 56.0-81.2]; specificity 57.1% [CI 43.8-70.6]); acute phlegmonous cholecystitis - 290-350 U/l (sensitivity 62.9% [49.8-76.0]; specificity 42.8% [29.3-56.3]); acute gangrenous cholecystitis - 290-350 units/l (sensitivity 82.9% [CI 72.7-93.1]; specificity 42.8% [29.3-56.3]).

The main depot of LDH is muscle tissue. When the latter is destroyed, this enzyme increases in blood plasma. Acute destructive cholecystitis is characterized by the involvement of the muscular membrane of the gallbladder wall in the process. This enzyme can be used as a predictor of acute destructive cholecystitis

## Conclusion

Further study of the above enzymes will undoubtedly allow us to develop an effective method for the timely diagnosis of

destructive forms of acute cholecystitis. The use of the new method in combination with traditional diagnostic methods makes it possible to diagnose the severity of inflammatory changes in the gallbladder wall as early as possible and, accordingly, to timely select the most rational treatment method for a particular patient.

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