

## **Diagnostic value of paraclinical markers in the early diagnosis of various forms of acute pancreatitis**

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### **Abstract**

The comparative analysis of the diagnostic value of laboratory and instrumental methods of diagnosis in patients with acute pancreatitis (AP) was made for early diagnosis and prediction of infected acute necrotizing pancreatitis (ANP). The results were compared with other laboratory parameters, sonography and computer tomography (CT) of the abdomen with mild and severe pancreatitis. Laboratory examination methods were carried out in dynamics during the first week of illness, as well as instrumental.

**Objective:** to increase the effectiveness of treatment of patients with infected ANP by improving methods of early diagnosis.

**Materials and methods.** The study was conducted at the Ternopil University Hospital in a period from 2014 year to 2015 and based on the assessment of the severity of AP in 37 patients.

**The results of investigation.** Among examined with a moderate AP were-17(45.94%), severe-14 (37.84%), critical- 6 (16.22%) patients. Medium age of patients was  $43,4 \pm 1,44$  in the first study group and  $48,60 \pm 1,57$  - in the second group. Of all the 35 analyzed biochemical laboratory parameters allocated 7 (amylase, diastase, ALT, AST, bilirubin, protein, glucose), with a probable difference ( $P < 0.05$ ). In the analysis of blood procalcitonin was found that in 14 patients (70%) of II group (severe and critical AP) the levels of marker were increased ( $> 2,0$  ng / ml). II group had subgroup of 5 patients (25%- operated early) who had the level of marker:  $7,32 \pm 3,0$  ng/ml,  $p < 0,05$  and septic inflammation was evidenced in operating room. Ultrasonography at admission to hospital

in patients of I group found changes in the pancreas that were characteristics of AP in 15 patients (88%). High diagnostic value of CT in patients with critical AP was in 83,33% (3patients), with severe - in 88.88%(8 patients). Among amylase and diastase on the first day of illness correlations were:  $r=0,75$  in I group and  $r=0,73$  in II. On the third day:  $r=0,76$  and  $r=0,78$  in I and II groups.

Conclusions. After analyzing the data, we found that in determining the level of procalcitonin, amylase, blood glucose, and urine diastase in comparison with clinical parameters at admission AP diagnosis was confirmed in 17 (85.0%) and 15 (88.23%) cases in I and II groups.

**Key words:** acute pancreatitis, infected pancreatic necrosis, procalcitonin, diagnosis.

**Introduction.** The problem of pancreatitis remains one of great importance that require timely solution in each individual patient. In such circumstances, the role of early diagnosis methods, information content of laboratory and instrumental methods of examination are significant. The incidence of pancreatitis is from 8 to 13 per 100,000 population, representing 12-20% of surgical patients [6]. In 15-20% of cases pancreatitis is complicated by subtotal-total pancreatic necrosis with a total mortality from 24% to 80% [13]. Treatment of AP more often occurs before surgical specialists because the disease ranks third place among the diseases of the abdominal cavity after acute appendicitis and acute cholecystitis ranging from 4 to 16% [1,2]. Incidence of the AP over the last twenty years doubled and is increasing in many developed countries, affecting different segments of the population, reducing efficiency of working people from 21 to 60 years, more often 30-50 years, that causes social and economic importance of the problem [2,4,5,6]. Under 40 years dominate men (69%) [2,3]. Despite the use of modern diagnostic and treatment capacity, the overall mortality of ANP and lesion of retroperitoneal fat until now is still very high and averages 15-25% and 30-70% in sterile and infected ANP; severe forms have mortality to 85.7% [5,7,10,12]. Nowadays, both in Ukraine and abroad, there is no single doctrine of conservative and surgical treatment of ANP. Literature presents often contradictory messages. The subject of discussion is forecasting, a choice of indications and timing of surgery, techniques of operating procedures, as well as a number of issues regarding conservative treatment [9]. Although instrumental imaging of the pancreas has reached a very high level, the problem of non-invasive diagnosis of infected ANP is not fully solved [7,8]. Fast, accurate and timely determination of the nature and extent of the destruction of the pancreas and retroperitoneal fat and searching of "tools" for prognosis of the ANP is one of the possible solutions to the problem of treatment of this disease

[5,9]. In particular, the diagnostic value in determining the level of procalcitonin in blood - biochemical marker of early diagnosis of sepsis in surgical pancreatology has not been studied enough, so the scientific research in this area is more than appropriate.

**Objective:** to increase the effectiveness of treatment of patients with infected ANP by improving methods of early diagnosis.

**Materials and methods.** The study was conducted at the Ternopil University Hospital in a period from 2014 year to 2015 and based on the assessment of the severity of AP in 37 patients, who were divided into two groups according to the International consultation (2012), which is the addition of Atlanta (1992): patients with moderate AP (presence of sterile (pery) pancreatic necrosis and/or intermittent organ failure) constituted the I study group (n=17); patients with severe AP (presence or infected (pery)pancreatic necrosis, or sustained organ failure) and critical AP (availability of infected (peri) pancreatic necrosis and sustained organ failure) were the second group study (n = 20). It means that the severity was determined based on the availability of local determinants to which the pancreatic necrosis and/or necrosis perypancreatic tissues, which is represented by the term "(pery)pancreatic necrosis," and system determinants- a presence of organ dysfunction due to AP. A survey of 37 patients with AP cover required laboratory and instrumental methods, and some special, particularly the procalcitonin levels in the blood. The next step to determine prognostic parameters was significant correlation analysis of all these criteria. The attention was paid to statistically significant factors that correlate with parameters of the resulting ratio not lower than 0.7 (strong correlation).

**The results of investigation.** Among examined with a moderate AP were-17(45.94%), severe-14 (37.84%), critical- 6 (16.22%) patients. Medium age of patients was  $43,4 \pm 1,44$  in the first study group and  $48,60 \pm 1,57$  - in the second group.

To determine the diagnostic and prognostic value of some laboratory parameters in patients of I and II groups were analyzed 35 indicators that reflect the status of individual body functional systems on the 1st, 2nd, 3rd, 7th day of the disease.

In the statistical analysis of the received material using the Student's test was evaluated the probability of the differences in these parameters and in patients of both groups. Of all the 35 analyzed biochemical laboratory parameters allocated 7 (amylase, diastase, ALT, AST, bilirubin, protein, glucose), with a probable difference ( $P < 0.05$ ).

In the analysis of blood procalcitonin was found that in 14 patients (70%) of II group (severe and critical AP) the levels of marker were increased ( $> 2,0$  ng / ml). However, among patients of I group raising of procalcitonin found only in 3 patients (15%), in 14 (85%) patients did not exceed the norm values, indicating that inflammation was aseptical in this group . II group had subgroup

of 5 patients (25%- operated early) who had the level of marker:  $7,32 \pm 3,0 \text{ ng/ml}$ ,  $p < 0,05$  and septic inflammation was evidenced in operating room. Ultrasonography at admission to hospital in patients of I group found changes in the pancreas that were characteristics of AP in 15 patients (88%), these were patients with moderate severity AP (the presence of sterile (peri ) pancreatic necrosis), in 2 patients this study was not informative. Ultrasonography in II group had false results in 7 patients (18,91%). The main difficulties were associated with symptoms of bloating, especially hyperpneumatosis of transverse colon and because of overweight patients. It follows that at the first day in onset patients with AP medium, heavy and critical diagnostic value of sonographic diagnosis is reduced compared with AP light, which can lead to errors in diagnosis of AP. CT was performed in 15 patients with severe AP in group II ( $n = 9$ ) and critical ( $n = 6$ ). High diagnostic value of CT in patients with critical AP was in 83,33% (3 patients), with severe - in 88,88% (8 patients).

At the same time, thorough analysis traditionally were studied clinical and biochemical parameters (Table 1). In the second group of patients at the time of admission was observed a significant leukocytosis in the blood, increasing anemia combined with hypoproteinemia ( $p < 0,05$ ). In patients with severe and critical AP was diagnosed a significant level of cytolysis (the contents of AST, ALT) and violation of exocrine function of pancreas, which reflects significantly high amylase in blood and urine diastase (Table 1), showing substantial violations of amylase function. The average level of blood amylase and urine diastase in both groups was the highest on the first day of the disease and reduced to three days (in the second group even below normal) due to exocrine gland failure due to necrosis of the parenchyma of pancreas. To claim the abuse of exocrine function is possible when the three major functions of gland are determined (lipolytic, amylase, hydrolytic). However, in terms of the urgency of the situation and the existing limited laboratory complex in the clinic, this option is not always the case.

In both groups of observation is tendency to hyperglycemia, which is alarming due to violation of the endocrine function of pancreas because of inflammatory or inflammatory-destructive process. Average rates of blood glucose were higher than normal in both groups during the first seven days of observation, which is also due to symptoms of pancreatic necrosis.

Table 1. Some laboratory parameters in groups of research

Analyzes	I Group (n=17)	II Group (n=20)
Amylase, U/L	132,50+-23,48	290,71+-46,67**
Diastase, U/L	837,52+-185,82	1680,47+-380,33**
Glucose, mmol/l	7,52+-0,33	7,25+-0,33
Bilirubin, $\mu\text{m/l}$	15,77+-1,10	21,55+-2,55
ALT, U/L	32,36+-2,62	78,60+-14,6**
AST, U/L	33,03+-2,16	69,73+-12,9**
Leukocytes, $\times 10^9$	7,46+-0,32	12,09+-0,70*
Hemoglobin, g/l	116,34+-2,33	114,4+-3,18
Total protein, g/l	62,66+-0,92	52,64+-1,35*

Note: \*  $p < 0,05$ - reliability data between the first and second groups

\*\*  $P < 0,01$ - reliability data between the first and second groups.

It should be noted that only the blood levels of amylase, diastase urine and procalcitonin at admission correlated with the severity of pancreatitis. The next step to determine prognostic parameters was significant correlation analysis of all these criteria.

Correlation matrix of connections for each patient group consisted of 192 correlation coefficients. Patients in the first, second, third day of hospitalization beginning strong correlation probable totaled 33 ties. The vast majority of relationships formed such factors as the number of white blood cells, urine levels of diastase, amylase in blood, glucose levels that correlated with each other and with other parameters of the system. Among amylase and diastase on the first day of illness correlations were:  $r=0,75$  in I group and  $r=0,73$  in II. On the third day:  $r=0,76$  and  $r=0,78$  in I and II groups. It should be noted that parameters such as content of total protein, ALT, AST, hemoglobin, urea and creatinine in serum in the correlation matrix, likely did not form relationships with other indicators.

Received one of the methods of system analysis data confirm the key assumptions concerning the importance of these parameters in predicting the course of AP.

After analyzing the data, we found that in determining the level of procalcitonin, amylase, blood glucose, and urine diastase in comparison with clinical parameters at admission AP diagnosis was confirmed in 17 (85.0%) and 15 (88.23%) cases in I and II groups.

To clarify the diagnosis on the second day reevaluated laboratory data. Such indicators as the number of white blood cells, urine diastase level, performance level of procalcitonin, blood glucose, correlated with each other, indicating high diagnostic value in determining those levels of laboratory parameters for early diagnosis of ANP.

It should be noted that the results of determination of procalcitonin stated that patients in I group on the first, second, third day the marker was elevated in 3 patients (17,64%). In patients in the II group on first, second, third day - in 14 (70%) observations.

### **Discussion of results:**

Nevertheless, the received results based on a small number of researches (n = 37) it is opportunity to make some generalizations. The blood levels of amylase, diastase urine and procalcitonin at admission correlated with the severity of pancreatitis concerning the importance of these parameters in predicting the course of AP and diagnosis was confirmed in 17 (85.0%) and 15 (88.23%) cases in I and II groups. Ultrasonography at admission to hospital in patients of I group found changes in the pancreas that were characteristics of AP in 15 patients (88%), these were patients with moderate severity AP. High diagnostic value of CT in patients with critical AP was in 83,33% (3patients), with severe - in 88.88%(8 patients). Ultrasonography in II group had false results in 7 patients (18,91%) mostly because of overweight patients. It means that in onset patients with AP medium, heavy and critical diagnostic value of sonographic diagnosis is reduced compared with AP light, which can lead to errors in diagnosis of AP. Our instrumental data are indicated in the results of other researchers [4, 7]. Strong correlations among amylase and diastase on the first day of illness:  $r=0,75$  in I group and  $r=0,73$  in II, on the third day:  $r=0,76$  and  $r=0,78$  in I and II groups are also mentioned in other researching [6,8]. But our findings are based on the comparative analysis of the diagnostic value of laboratory and instrumental methods of diagnosis in patients with AP. Due to our results and facts of other studies there is still a wide area of researching the prediction of ANP and times of surgical treatment, so researching in this theme must developed.

### **Conclusions**

1. Diagnosis of acute pancreatitis is based on a comparison of clinical symptoms and results of instrumental and laboratory tests.

2. Diagnostic value of ultrasonography research method of pancreatic gland has screening value, requiring further use of purposeful examination.
3. In order to clarify the severity and specificity of lesions of the pancreas should be used computer tomography method.
4. Differentiation of inflammatory and inflammatory-necrotic lesions of the pancreas, complicated by infection, can be provided by traditional complex laboratory markers and also by procalcitonin certain level in the blood.

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