ANALYSIS OF PROGNOSTIC VALUE OF LEUKOCYTE AND HEMATOLOGICAL INDEXES OF INTOXICATION IN THE DIAGNOSIS OF SURGICAL SEPSIS

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Abstract: The mortality from surgical sepsis remains high and ranges from 17 to 83.7 %. The cause of high lethality is endogenous intoxication and multiple organ failure. The most common laboratory markers for determining the syndrome of endogenous intoxication in surgical sepsis are leukocyte and hematological intoxication indices, such as LII, HII, NII.
Aim of the work: to study the predictive value of laboratory and hematological indicators of intoxication in the diagnosis of surgical sepsis.
Materials and methods. A retrospective analysis of disease history and prospective follow-up of 41 patients treated for surgical sepsis in the Ivano-Frankivsk (Ukraine) Surgical Department of the CCCH in period between August 2015 and August 2018 was conducted. In the first day after the operation, all the patients been calculated the leukocyte index of intoxication, the hematological index of intoxication and the nuclear index of intoxication to assess their predictive and diagnostic significance. Methods of nonparametric statistics were used in the study: ROC-analysis, Mann-Whitney U-test, Spierman's criterion (Rs).
Results. The results of the diagnostic and prognostic significance of LII, HII, NII for 1 day postoperative period, with regard to the prediction of lethality by means of ROC analysis, Mann-Whitney U-test, Spirman criteria (Rs) showed low sensitivity and specificity in patients with surgical sepsis.
Common laboratory leukocyte and hematological non-specific indicators of endogenous intoxication determination have low prognostic and diagnostic significance in assessing the degree of endotoxicosis in surgical sepsis and can not serve as prognostic criteria for lethality.
Conclusions. The problem of diagnosing endotoxicosis in surgical sepsis requires the further study and introduction into clinical practice of new specific and integrated clinical and laboratory methods for the quantitative determination of endotoxicosis, which could serve as a reliable diagnostic criterion in assessing the severity of the condition and the prediction of hospital mortality.
Keywords: endogenous intoxication, leukocyte index of intoxication, hematological index of intoxication, nuclear toxicity index, surgical sepsis.

1. Introduction

Surgical sepsis remains an urgent and complex problem of surgery [1]. Forecasting of the course of septic patients requires further study [2, 3]. Endogenous intoxication determines the severity of sepsis and its consequences [4, 5].

The mortality from surgical sepsis remains high and varies depending on the severity of manifestations from 17 to 83.7 % [6, 7]. The cause of high lethality is endogenous intoxication and multiple organ failure [8].

Widely used laboratory markers to determine the syndrome of endogenous intoxication in surgical sepsis, such as the leukocyte index of intoxication, proposed by J. J. Calf-Calif. The more pronounced the inflammatory process, the more so in the leukogram of immature forms, calculated in the numerator of the formula. The better the body cope with intoxication, the more in the leukogram presence of lymphocytic-macrophage cells and eosinophils, which are calculated in the denominator of the formula. In the norm, LII is 0.5–1.5 c. u. Simplified version of LII, proposed by V. K. Ostrovsky, but LII in the modification by B. A. Reis did not lose the popularity too. Widely used in clinical practice for the diagnosis of endotoxicosis, the nuclear index of intoxication (NII) proposed by G. A. Dashtyantsom. A valuable non-specific laboratory criterion for the diagnosis of endogenous intoxication is the hematologic indicator of intoxication (HII), proposed by V. S. Vasiliev and V. I. Komar, in which two correction factors are introduced into the LII formula (Cl – coefficient of correction for the number of leukocytes, Kc – coefficient amendments to ESR). Since GPI includes three indicators of blood analysis, it is more informative in assessing the severity of the pathological process [9, 10].

Aim of the work – to study the predictive value of laboratory and hematological parameters of intoxication in the diagnosis of surgical sepsis.

2. Materials and methods

A retrospective analysis of 41 stories of the disease and prospective observation of patients treated for surgical sepsis in the Ivano-Frankivsk (Ukraine) surgical section of the Clinical Hospital for the period from August 2015 to August 2018 was conducted. All patients had symptoms that met the criteria for endogenous intoxication. Among 41 patients, 22 men and 19 women aged 22 to 79 years (55.60±2.84). The exclusion criteria were the presence of concomitant pathology in patients, which affects the severity of the patient's condition. The causes of surgical sepsis are presented in **Table 1**.

In the first day after the surgery, all patients been calculated the leukocyte index of intoxication according to the formula by Y. Y. Kalf-Kalifa, the hematological index of intoxication by V. S. Vasil'ev and V. I. Komar and the nuclear index of intoxication (HII) proposed by G.A. Dastastyans .

The consequence of purulent peritonitis was estimated by hospital mortality. Of the 41 patients examined, 33 patients were discharged with recovery, and 8 patients died.

Table 1
The causes of surgical sepsis

Nosological form	Number of patients	%
Perforated diseases of the abdominal cavity	11	26.82
Abscesses of the abdominal cavity	6	14.63
Distributed peritonitis due to acute surgical pathology (destructive appendicitis, cholecystitis, pancreatitis)	9	21.95
Acute intestinal obstruction with necrosis of the bowel loop	8	19.51
Traumatic damage to the abdominal cavity with the development of widespread peritonitis.	7	17.07
Total:	41	

Determination of the sensitivity and specificity of the initial level of LII, HII, NII in the assessment of the risk of hospital mortality was carried out using ROC analysis (Receiver Operating Characteristic analysis). Comparison of the average indices of LII, HII, NII between groups, patients was conducted using non-parametric U-test Mann-Whitney. Correlation analysis between the studied indicators was determined by the Spirman criterion (R_s).

3. Results

The results of the diagnostic significance of LII for 1 day of the postoperative period, concerning the prediction of lethality with the help of ROC analysis showed low values of its sensitivity and specificity in patients with surgical sepsis. The area under the ROC curves is 0.66 (p=0.2455).

Comparisons of the median LII values in patients who recovered and who died one day after the post-operative period according to the Mann-Whitney U-test did not show a statistically significant difference in mean values between these groups (p=0.1882).

The coefficients of Spirmen's rank correlation (r) between LII indices and the outcome of the disease (those who recovered – 0, deceased – 1) indicate a weak correlation between these indices (r=0.20; p=0.1916) by 1 day of postoperative period.

The results of the diagnostic significance of HII in patients 1 day postoperative period, in terms of mortality prediction using ROC-analysis showed low values of its sensitivity and specificity for the prediction of mortality in patients with surgical sepsis. The area under the ROC curves was 0.62 (p=0.4089). Comparison of mean values of HII in patients who recovered and who died at 1 day postoperatively according to the Mann-Whitney U-test did not show a statistically significant difference in mean values between these groups (p=0.3157).

The Spirmen rank correlation coefficient (r) between the HII data and the outcome of the disease (those who recovered – 0, the deceased – 1) pointed to a weak correlation between these indices (r=0.15; p=0.3214) by 1 day of postoperative period.

The results of the diagnostic significance of NII for 1 day of the postoperative period, concerning the prediction of lethality with the help of ROC analysis showed low values of its sensitivity and specificity in patients with surgical sepsis. The area under ROC curves is 0.70 (p=0.0953).

A comparison of the mean indicators of NII in patients who recovered and who died one day after the post-operative period according to the Mann-Whitney U-test did not show a statistically significant difference in mean values between these groups (p=0.0832).

Correlation coefficients of the Spirmen rang correlation (r) between the NII indices and the outcome of the disease (those who recovered – 0, the deceased – 1) indicate weak correlation between these indices (r=0.291; p=0.0857) for 1 day postoperative period.

4. Discussion

ROC analysis is used as the most accurate statistical method for assessing the effectiveness and predictability of the diagnostic test. The model is characterized by a curve placed above the positive diagonal, therefore talking about changes from 0.5 (non-informative test) to 1.0 ("ideal model"). For each cut-off threshold value, which varies from 0 to 1, the sensitivity value Se and the specificity of Sp are calculated. Thus a plot of the dependence of the sensitivity of Se and the specificity of 100 % – Sp. As a result, an ROC curve is formed. The higher the meaning of area under the curve (AUC), so the model has the best predictive power. The area under the ROC curve of less than 0.75 indicates that the diagnostic test has a low predictive value and can not be used for diagnosis [5].

The results of the performed statistical studies indicate that the most common laboratory leukocyte and hematological non-specific indicators of endogenous intoxication determination have low prognostic and diagnostic significance in the evaluation of the degree of endotoxicosis in surgical sepsis and can not serve as prognostic criteria for lethality. This is also evidenced by the fact that there was no statistically significant difference between the average indicators of LII, HII, NII between the groups of patients who recovered and who died. Significant correlation between the studied parameters and the outcome of the disease was also not detected.

Summing up the results of the study it can be argued that the data of the baseline level of laboratory leukocyte or hematological endotoxin indices in surgical sepsis are not sufficiently informative, have low prognostic significance and can not serve independently for assessing the severity of the patient's condition and the risk of hospital mortality.

Perspective of further researches. Thus, today the problem of diagnosis of endotoxicosis in surgical sepsis requires the further study and introduction into clinical practice of new specific and integrated clinical and laboratory methods for the quantitative determination of endotoxicosis, which could serve as a reliable diagnostic criterion in assessing the severity of the condition and the prediction of hospital mortality.

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