# Evaluation of some diagnostic features of covid-19 in patients with comorbidities

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## Abstract

The COVID-19 pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), lasted from March 2020 to May 2023, infecting more than 689 million people.

Metihods: 270 patients with chronic diseases admitted to the intensive care unit with Covid-19 were retrospectively examined.

Inclusion criteria: Al. Aladashvili Hospitalized patients with a confirmed diagnosis of Covid-19 in the clinic, who were placed in the intensive care unit (in the period 2020-2023)

Exclusion criteria: mild cases of covid-19, absence of concomitant diseases,

We evaluated the diagnostic accuracy according to the lower part of the curve

Result: the laboratory data differ reliably 10 days after treatment, the difference is reliable even. the predictive value of a positive result: very good - LDH, lactate; Good- Po2; Satisfactory - D dimer, leukocytes; bad - ferritin.

Prognostic value of a negative result: very good - D dimer, lactate, good - leukocytes, LDH, ferritin; Detractor - Po2.

diagnostic accuracy in the last stage of covid: LDH - very good, D dimer, leukocytes, lactate, $PO_2$ - good, ferritin - satisfactory.

The prognostic value of the result, as well as the diagnostic accuracy, is high.

A value of the area under the curve indicates good diagnostic value

pO2 has good sensitivity and very low specificity for predicting lethality in Covid-19 patients, so its use as an independent predictor is not appropriate.

Conclusions:

D-dimer, leukocyte count, lactate and LDH can be used as independent markers of lethality in patients with co-morbidities with covid-19.

Key wors: biochemical markers, covid-19

## Covid-19-ის ზოგიერთი დიაგნოსტიკური მახასიათებლის შეფასება თანმხლები დაავადებების მქონე პაციენტებში

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საქართველოს დავით აღმაშენებლის სახელობის უნივერსიტეტი

## ბსტრაქტი

COVID-19 პანდემია, გამოწვეული მძიმე მწვავე რესპირატორული სინდრომით, კორონავირუსი 2 (SARS-CoV-2), გაგრძელდა 2020 წლის მარტიდან 2023 წლის მაისამდე, დაინფიცირდა 689 მილიონზე მეტი ადამიანი.

მეთოდები: რეტროსპექტულად გამოკვლეული იქნა 270 პაციენტი ქრონიკული დაავადებებით, რომლებიც გადაიყვანეს კოვიდ-19-ით ინტენსიურ თერაპიის განყოფილებაში.

**ჩართვის კრიტერიუმი:** ალ. ალადაშვილის კლინიკაში მოთავსებული პაციენტები კოვიდ-19-ის დადასტურებული დიაგნოზით, რომლებიც მოთავსდნენ რეანიმაციულ განყოფილებაში (2020-2023 წლებში)

**გამორიცხვის კრიტერიუმები:**

კოვიდ-19-ის მსუბუქი შემთხვევები, თანმხლები დაავადებების არარსებობა,

ჩვენ შევაფასეთ დიაგნოსტიკური სიზუსტე ROC ანალიზის საშუალებით.

**შედეგები:** ლაბორატორიული მონაცემები სარწმუნოდ განსხვავდება მკურნალობიდან 10 დღის შემდეგ, დადებითი შედეგის პროგნოზირებადი მნიშვნელობა: ძალიან კარგი - LDH, ლაქტატი; კარგი- Po2; დამაკმაყოფილებელი - D დიმერი, ლეიკოციტები; ცუდი - ფერიტინი.

უარყოფითი შედეგის პროგნოზული ღირებულება: ძალიან კარგი - D დიმერი, ლაქტატი, კარგი - ლეიკოციტები, LDH, ფერიტინი; Detractor - Po2.დიაგნოსტიკური სიზუსტე კოვიდის ბოლო ეტაპზე: LDH - ძალიან კარგი, D დიმერი, ლეიკოციტები, ლაქტატი, PO2 - კარგი, ფერიტინი - დამაკმაყოფილებელი. შედეგის პროგნოზული ღირებულება, ისევე როგორც დიაგნოსტიკური სიზუსტე, მაღალია. მრუდის ქვეშ არსებული ფართობის მნიშვნელობა მიუთითებს კარგ დიაგნოსტიკურ მნიშვნელობაზე. pO2-ს აქვს კარგი მგრძნობელობა და ძალიან დაბალი სპეციფიკა Covid-19 პაციენტებში ლეტალობის პროგნოზირებისთვის, ამიტომ მისი გამოყენება, როგორც დამოუკიდებელი პროგნოზიტორი, არ არის მიზანშეწონილი.

დასკვნები:

D-დიმერი, ლეიკოციტების რაოდენობა, ლაქტატი და LDH შეიძლება გამოყენებულ იქნას როგორც ლეტალობის დამოუკიდებელი მარკერები პაციენტებში, რომლებსაც აქვთ covid-19 თანმხლები დაავადებები.

**საკვანძო სიტყვები:** ბიოქიმიური მარკერები, კოვიდ-19.

The COVID-19 pandemic, caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), lasted from March 2020 to May 2023, infecting more than 689 million people. The pandemic has killed 6.9 million people worldwide. According to WHO data, the number of confirmed cases of coronavirus in Georgia was 1,855,289, among them 17,132 patients died.

Studies have shown that an exacerbated inflammatory response (cytokine storm) can directly impair organ function in COVID-19 patients with moderate to severe disease, leading to decompensation, organ dysfunction, and death.

Given the potential for severe disease, rapid assessment of patients' progress is critical.

Continuous monitoring of biological markers is necessary to assess disease progression. They play an important role in clinical practice, can indicate the evolution of various pathological conditions and can be used as indicators for patient monitoring, influencing treatment decisions. Changes in biomarker levels can indicate disease progression, making them a valuable tool in clinical practice to guide treatment decisions and determine the need for intensive care unit (ICU) admission.

Numerous studies have highlighted changes in some biomarkers associated with the progression of COVID-19, especially in severe cases. These biomarkers include white blood cell count (WBC), D-dimer, interleukin-6 (IL-6), lactate dehydrogenase (LDH), urea, and creatinine, which are elevated. During the COVID-19 disease.

Although there is some similarity in prognostic features, there is a difference of opinion regarding the predictors of lethality. Studying the risk factors for the outcome is essential to increase pandemic preparedness in the future.

Unfavorable outcome of COVID-19 infection is especially often observed in patients with co-morbidities. However, according to the results of various studies, the risk of death from COVID-19 also significantly depends on the patient's age, which is why old age and co-morbidities have been considered risk factors for COVID-19.

Elderly patients and patients with chronic comorbidities such as cardiovascular disease, hypertension, diabetes, and lung disease are much more prone to developing severe, critical illness, and fatal outcomes of COVID-19. Determining these associations can help clarify the extent to which COVID-19 infection or pre-existing health conditions determine a patient's death. The correlation of the causality and development mechanism of death, as well as the role of the spectrum of co-morbidities in fatal cases, which would allow us to accurately assess the dangerous nature of the COVID-19 infection and to predict and avoid/prevent fatal outcomes, has not yet been definitively studied and clarified.

The purpose of the study: Determination of sensitivity, specificity and prognostic value of unfavorable outcome of inflammatory markers;

**Material and methods**

270 patients with chronic diseases admitted to the intensive care unit with Covid-19 were retrospectively examined.

The following were studied: demographic data, transmitted diseases, chronic diseases, laboratory characteristics. Inclusion criteria: Al. Aladashvili house Hospitalized patients with a confirmed diagnosis of Covid-19 in the clinic, who were placed in the intensive care unit (in the period 2020-2023)

Exclusion criteria:

Mild cases of covid-19, absence of concomitant diseases,

A structured questionnaire developed by us will be used, which includes information on patients:

Anamnesis, the results of ultrasound, cardiographic, computer-tomographic research, About the data of clinical-laboratory analyzes (on arrival, after 5 days, after 10 days);

**Statistical analysis**

When evaluating the quantitative indicators, we calculate the average, the mean square deviation, and for the qualitative indicators, the frequency and percentage were calculated;

The reliability of the difference between the groups in the case of quantitative indicators will be determined using the Student's t criterion, the equality of variances was evaluated according to Levene's Test, while the difference between the groups will be evaluated for the qualitative indicators - with the F (Fisher) criterion;

Correlations between qualitative factors were determined by means of Spearman's rank correlation, and in the case of quantitative factors - by Pearson's correlation analysis;

The diagnostic value of inflammatory markers was determined by means of ROC analysis;

We evaluated the diagnostic accuracy according to the lower part of the curve (Table 3.4.) 57 58 • The sensitivity is measured horizontally on the diagram, and the 1-specificity is measured vertically. The greater the area under the curve, the greater the diagnostic value of the test. Indicator of diagnostic accuracy of the test: Area diagnostic accuracy

0.9 – 1.0 excellent, 0.8-0.9 very good, 0.7-0.8 good, 0.6-0.7 satisfactory, 0.5-0.6 poor, < 0.5 test not reliable.

**Results:**

The average value of hemoglobin, eosinophil, basophil, lymphocytes reliably decreases - at admission it is reliably higher than at II and III ETP.

Leukocyte, myelocyte, metamyelocyte, eosinophil, basophil, lymphocyte, TT, indirect, bilirubin The average value of lymphocytes, pO2 increases reliably - at admission it is reliably lower than on II and III ETP.

We compared blood biomarkers in the groups of lethality and survivors at admission, 5 days and 10 days after admission (Table 1).

Table 1. Evaluation of blood biomarkers in dynamics

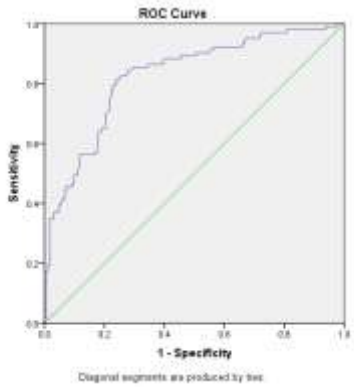
| factor | | N | Mean | StD | t | p |
|---|---|---|---|---|---|---|
| 10 days after the admission of CRP | Lethal | 100 | 119.69 | 81.17 | 11.73 | <0.0001 |
| | improved | 131 | 27.10 | 34.73 | | |
| D-dimer when admission | Lethal | 105 | 2731.52 | 4465.74 | 1.02 | 0.3077 |
| | improved | 162 | 2152.98 | 4594.50 | | |
| D-dimer – after 5 days | Lethal | 96 | 5457.65 | 14085.43 | 2.63 | 0.0090 |
| | improved | 158 | 2175.82 | 5364.72 | | |
| D-dimer after 10 days | Lethal | 103 | 3338.17 | 4151.24 | 6.88 | <0.0001 |
| | improved | 162 | 941.24 | 1245.92 | | |
| Leukocyte-at admission | Lethal | 107 | 8.59 | 6.25 | 1.91 | 0.0566 |
| | improved | 161 | 7.39 | 4.00 | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Leukocyte - after 5 days | Lethal | 97 | 11.18 | 5.61 | 3.62 | 0.0004 |
| | improved | 158 | 8.77 | 4.84 | | |
| Leukocyte - after 10 days | Lethal | 107 | 13.83 | 9.01 | 6.20 | <0.0001 |
| | improved | 162 | 8.88 | 3.81 | | |
| LDH-on admission | Lethal | 106 | 693.42 | 481.86 | 0.51 | 0.6104 |
| | improved | 163 | 666.62 | 303.71 | | |
| LDH-5 days later | Lethal | 96 | 856.56 | 357.49 | 5.91 | <0.0001 |
| | improved | 158 | 629.41 | 253.05 | | |
| LDH-10 days later | Lethal | 106 | 1044.99 | 682.72 | 8.88 | <0.0001 |
| | improved | 162 | 520.33 | 255.62 | | |
| Ferritin- on admission | Lethal | 104 | 355.07 | 319.96 | 0.58 | 0.5658 |
| | improved | 162 | 331.36 | 340.26 | | |
| Ferritin-5 days later | Lethal | 95 | 629.46 | 675.99 | 3.69 | 0.0003 |
| | improved | 156 | 397.60 | 313.04 | | |
| Ferritin-10 days later | Lethal | 101 | 676.67 | 692.77 | 5.34 | <0.0001 |
| | improved | 161 | 353.73 | 261.74 | | |
| pO2-on admission | Lethal | 107 | 71.01 | 31.03 | -0.87 | 0.3875 |
| | improved | 163 | 74.18 | 26.75 | | |
| pO2 -5 days later | Lethal | 97 | 76.12 | 35.44 | -2.00 | 0.0467 |
| | improved | 158 | 88.23 | 61.32 | | |
| pO2 -10 days later | Lethal | 107 | 73.24 | 32.02 | -3.34 | 0.0010 |
| | improved | 162 | 86.08 | 28.92 | | |

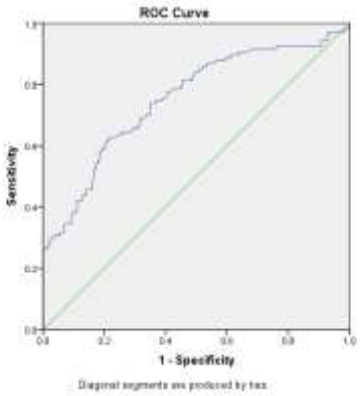
As we can see, according to the final result, the laboratory data differ reliably 5 and 10 days after treatment, and in the case of CRP, the difference is reliable even at entry, which allows us to assume that these data may represent one of the prognostic factors of lethality.

The sensitivity and specificity of laboratory data at 10 days post-entry are plotted as rock curves, and the area under the curve is shown in Table 1.

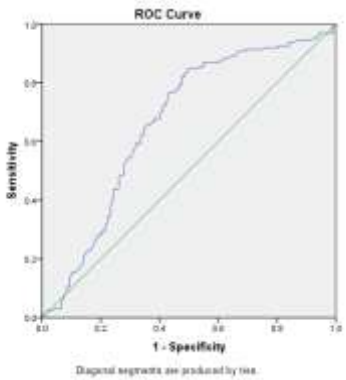
On the diagram, affinity is measured horizontally, and 1-specificity is measured vertically. The greater the area under the curve, the greater the diagnostic value of the test.



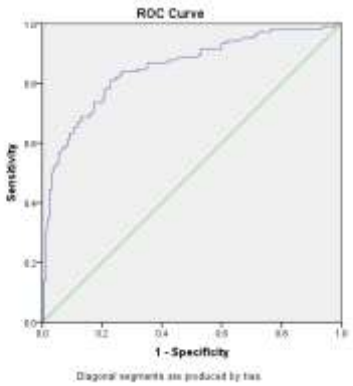

D dimer



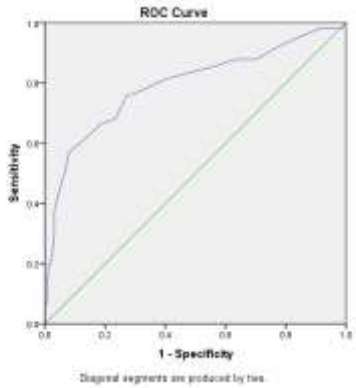

WBC



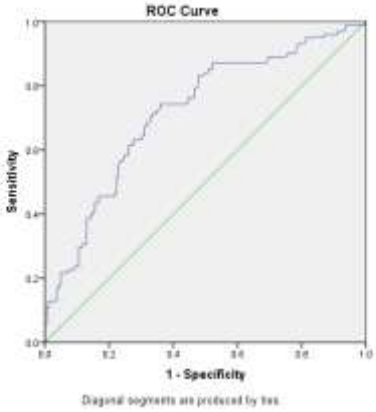

po2




LDH




Lactat




Ferritin

**The operating parameters of the test are given in Table 2**

**Table 2 Evaluation of operational indicators of the test**

| | | True Positive | False Positive | False Negative | True Negative | Area Under the Curve | Cut of |
|---|---|---|---|---|---|---|---|
| D dimmer | n | 84 | 39 | 19 | 123 | 0.794+0.029 | 951.5 |
| | % | 36.36 | 16.88 | 8.23 | 53.25 | | |
| WBC | n | 66 | 34 | 41 | 128 | 0.752±0.031 | 10.8 |
| | % | 28.57 | 14.72 | 17.75 | 55.41 | | |
| Po2 | n | 138 | 53 | 25 | 54 | 0.665+0.036 | 65.4 |
| | % | 51.11 | 19.63 | 9.26 | 20.00 | | |
| LDH | n | 131 | 24 | 31 | 82 | 0.851+0.025 | 601 |
| | % | 48.88 | 8.96 | 11.57 | 30.60 | | |
| Lactate | n | 61 | 13 | 46 | 149 | 0.794±0.030 | 2.05 |
| | % | 22.68 | 4.83 | 17.10 | 55.39 | | |
| Ferritin | n | 75 | 58 | 26 | 103 | 0.718±0.033 | 357 |
| | % | 32.47 | 25.11 | 11.26 | 44.59 | | |

On the 10th day after admission, it is characterized by very good inflammation: D dimer, LDH and Po2, good - ferritin, leukocytes, lactate.

Table 3. shows the diagnostic characteristics of the tests

Table 3. Diagnostic features

| | | Sensitivity | specificity | positive predictive value | negative predictive value | diagnostic accuracy |
|---|---|---|---|---|---|---|
| CRP | Mean | **0.685** | **0.902** | **0.860** | **0.766** | **0.801** |
| | 95%CI | **0.598** | **0.850** | **0.787** | **0.697** | **0.749** |
| | | **0.773** | **0.955** | **0.934** | **0.834** | **0.852** |
| D-dimer | Mean | **0.816** | **0.759** | **0.683** | 0.866 | **0.781** |
| | 95%CI | **0.741** | **0.693** | **0.601** | **0.810** | **0.731** |
| | | **0.890** | **0.825** | **0.765** | **0.922** | **0.831** |
| WBC | Mean | **0.617** | **0.790** | **0.660** | 0.757 | **0.721** |
| | 95%CI | **0.525** | **0.727** | **0.567** | **0.693** | **0.668** |
| | | **0.709** | **0.853** | **0.753** | **0.822** | **0.775** |

| | | | | | | |
|---|---|---|---|---|---|---|
| Po2 | Mean | **0.847** | **0.505** | **0.723** | 0.684 | **0.711** |
| | 95%CI | **0.791** | **0.410** | **0.659** | **0.581** | **0.657** |
| | | **0.902** | **0.599** | **0.786** | **0.786** | **0.765** |
| LDH | Mean | **0.809** | **0.774** | **0.845** | 0.726 | **0.795** |
| | 95%CI | **0.748** | **0.694** | **0.788** | **0.643** | **0.746** |
| | | **0.869** | **0.853** | **0.902** | **0.808** | **0.843** |
| Lactat | Mean | **0.570** | **0.920** | **0.824** | 0.764 | **0.781** |
| | 95%CI | **0.476** | **0.878** | **0.738** | **0.705** | **0.731** |
| | | **0.664** | **0.962** | **0.911** | **0.824** | **0.830** |
| Ferritin | Mean | **0.743** | **0.640** | **0.564** | 0.798 | **0.679** |
| | 95%CI | **0.657** | **0.566** | **0.480** | **0.729** | **0.623** |
| | | **0.828** | **0.714** | **0.648** | **0.868** | **0.736** |

The best specificity has lactate, good - D dimer, leukocytes, LDH, satisfactory - ferritin, poor - Po2, Accordingly, the predictive value of a positive result: very good LDH, lactate; Good- Po2; Satisfactory - D dimer, leukocytes; bad - ferritin.

Prognostic value of a negative result: very good - D dimer, lactate, good - leukocytes, LDH, ferritin; Detractor - Po2.

As we can see, diagnostic accuracy in the last stage of covid: LDH - very good, D dimer, leukocytes, lactate, Po2 - good, ferritin - satisfactory.

The prognostic value of the result, as well as the diagnostic accuracy, is high.

The sensitivity and specificity of D-dimer 10 days after admission are plotted as rock curves, and the area under the curve by stage is shown in Table 2

A value of the area under the curve indicates good diagnostic value

pO2 has good sensitivity and very low specificity for predicting lethality in Covid-19 patients, so its use as an independent predictor is not appropriate.

Discussion

WBC count at admission is significantly corelated with death in COVID-19 patients. Higher level of WBC count should be given more attention in the treatment of COVID-19. According to our research, the Area Under the Curve for WBC is 0.752+0.031.

Conclusions:

D-dimer, leukocyte count, lactate and LDH can be used as independent markers of lethality in patients with co-morbidities with covid-19.

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