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DIAGNOSTIC VALUE OF PROCALCITONIN IN COVID-19 DISEASE

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Abstract. *After the onset of the COVID 19 pandemic, there was a need for reliable biomarkers that reflect the rapid progression of the disease to stratify high-risk patients. There is an increased demand for the use of biomarkers that reflect cell and organ damage in the disease of SOVID 19. Plasma biomarkers reflecting bacterial inflammation in the body, including C-reactive protein (CRO) and procalcitonin (PKT) in the diagnosis of bacterial pneumonia, have taken a firm place in the management algorithm of patients with bacterial infection [1,3]. However, since COVID 19 is an understudied disease, further research is needed to develop practical recommendations. It is known that the level of CRP is related to the severity of the course, the spread of inflammatory infiltration, and the prognosis of community-acquired bacterial pneumonia, with its concentration > 100 mg / l, the specificity of confirming bacterial pneumonia reaches 90%, with a concentration < 20 mg / l, the diagnosis is unlikely [1 ,2]. At the beginning of the COVID 19 pandemic, the high level of CRO in the blood of patients is often considered a marker of an infection that is considered to be bacterial, and can be the basis for prescribing antibacterial therapy. Also, high levels of procalcitonin, D-dimer, and ferritin in the blood of patients indicate that a systemic inflammatory reaction is starting in the body. An increase in the level of CRO in the body is related to the severity of the disease and is also one of the main criteria for prescribing anti-inflammatory therapy [2, 4,5]. In addition, it is important to analyze the practical possibilities and prospects of using PKT in bacterial infections - acute pneumonia and infection with the new coronavirus. Procalcitonin is a polypeptide that is normally produced in the cells of the thyroid gland and its concentration in healthy people should not exceed 0.01 ng/ml.*

Keywords: *infection, COVID 19 pandemic, plasma biomarkers, inflammatory reaction.*

Research Materials and Methods: A retrospective analysis of literature data was performed. The following methods were used during the research: analytical and descriptive evaluation.

Before the Covid-19 pandemic, PKT was considered as a marker of neoplastic process [10], later it attracted attention as a biomarker of inflammation [9]. Studying its role is important mainly in infectious diseases. In the diagnosis of systemic infections (bacterial, parasitic and fungal), the amount of PCT may increase. The amount of PCT increases to – 1000 ng/ml or more due to extrathyroid synthesis in liver, pancreas, kidneys, lungs, intestinal cells, and leukocytes. [6,7]. Within a few hours after the stimulation of endotoxins and/or cytokines (IL-1, IL-6, Tnf-DK, il-1B, etc.), the level of PKT begins to increase. It reaches its peak after about 12-24 hours, which lasts for several days [11,12]. In severe bacterial infections, the level of PKT not only increases significantly, but also increases very quickly, which means that a septic process has developed in the body. The half-life of PKT is 36-48 hours, which increases its diagnostic value compared to SRO (19 hours) and cytokines (about 24 hours) [7]. Cytokines released in the disease of COVID-19, especially interferon (INF)-g negatively affect the amount of PKT, which increases the significance of the diagnostic value [10]. Clinicians have extensively and urgently studied reliable biochemical markers of the severity of COVID 19 to stratify high-risk patients and

optimally allocate resources to patients with very rapid disease progression. Biomarkers studied in this context include procalcitonin (PKT), C-reactive protein (CRO), ferritin (Ferritin), D-dimer, interleukin-6 (IL-6), and others [1,7].

Procalcitonin (PKT) is a prohormone of the glycoprotein calcitonin produced by the parafollicular cells of the thyroid gland. In bacterial infections, the level of PKT increases significantly, because it is produced by parenchymal tissues under the influence of endotoxins and anti-inflammatory cytokines. [4,5]. Thus, in a physiological state, PKT is recorded at a level much lower than 0.05 ng/ml. In addition, when stratifying patients in the risk group, PKT also has a rapid course in terms of time, its level is determined 2-6 hours after the stimulus. [3,6,9]. Although PKT is considered a biomarker of bacterial infection, there are conflicting opinions about its effectiveness as a prognostic tool for COVID 19. [7,8,11]. In addition, cytokines produced by COVID 19, especially interferon, have a negative effect on PKT levels [10]. Early post-pandemic studies have shown higher levels of PKT in severe cases of COVID 19. Lippi et al. reported that in severe cases the level of PCT can increase fivefold [1,3]. Various other authors have also supported the idea that any significant increase in PKT levels over baseline reflects the onset of a critical phase of viral infection. Levels of procalcitonin and other markers of inflammation were examined in patients with moderate to severe pneumonia. Although the total number of patients with elevated procalcitonin appears to be limited, a retrospective analysis of patients' medical history suggests that measuring procalcitonin can predict the severity of the disease. Procalcitonin production from extrathyroidal sources is greatly enhanced in bacterial infections, actively supported by high concentrations of interleukin (IL)-1. PKT is a non-hormonal glycoprotein precursor of calcitonin. The level of PKT is undetectable under normal conditions, but increases to coordinate the "immune response-vasoactivity" response in response to bacterial invasion of the body [5,6]. Bacterial infections stimulate PKT production by stimulating macrophages to produce inflammatory cytokines such as tumor necrosis factor (TNF)-α, interleukin (IL)-1, and IL-6, which stimulate PKT synthesis by all cells within hours. Studies have shown that despite the fact that COVID 19 is a viral infection, an increase in the level of PKT is noted in the disease. In this case, an increase in PKT indicates a more severe course of the disease and a higher risk of death, especially in elderly patients. A meta-analysis showed that a high level of PKT is associated with the severity of the disease. This state indicates the severity of the disease and increasing systemic changes in the body [11,12]. Determining the amount of PKT allows to diagnose the development of bacterial infections in the body and determine the tactics of antimicrobial therapy in patients with COVID-19 [11]. Some researchers did not find an association between PKT and bacterial co-infection in patients with COVID 19 and showed that high PKT was mainly related to disease severity and concomitant inflammation rather than bacterial co-infection [12]. At the same time, the synthesis of this biomarker is inhibited by interferon and its concentration increases in viral infections. A significant increase in procalcitonin in patients with severe forms of xalosis reflects bacterial co-infection, which complicates the clinical presentation of the disease. Procalcitonin (PKT) is one of the modern biomarkers of systemic inflammation in infectious diseases and is important as one of the cytokines in the development of hyperimmune pathology [3]. In healthy people, the hormone calcitonin is secreted by the cells of the thyroid gland.

In addition to other clinical and laboratory parameters, the amount of PCT provides diagnostic, prognostic and theragnostic information, and is especially important in sepsis and respiratory tract infections. A high level of PCT is typical for sepsis and is recorded in the blood

in the early stages, after about 3 hours. Consequently, the diagnostic value of PKT concentration determination in bacterial inflammatory diseases is very high [5]. Procalcitonin is the most studied biomarker so far and allows determining the optimal choice in the selection of antibiotic doses [4,7]. PKT production is induced in response to exposure to microbial toxins. After stimulation of cytokines in the blood, the amount of PKT increases. In severe forms of the disease, if there is no tendency to decrease PKT even during antibacterial therapy, it is an important prognostic factor in the elderly and patients with severe chronic diseases. It is well known that alveolar damage in severe viral infections leads to interstitial edema, impaired perfusion due to inflammation, and hypoxemic respiratory failure. Therefore, in viral infections, appropriate treatment is prescribed, taking into account the damage to the respiratory tract (for example, influenza or the new coronavirus infection COVID 19), the use of antibiotics is carried out only when there is evidence of the addition of bacterial infection [2,6]. The concentration of PKT in the blood serum can also increase in the presence of concomitant diseases in the body. For example: chronic kidney disease and heart failure. Therefore, the procalcitonin level should be evaluated taking into account the following. A number of authors believe that routine markers such as CRO, erythrocyte sedimentation rate and leukocyte level should be taken into account in diagnostic and prognostic bacterial infections, including bacterial pneumonia [11]. P. Espada et al. It is noted that the threshold value of PKT difference between bacterial and viral etiology of lung damage is 0.1 ng/ml.. Randomized studies conducted in patients with respiratory tract infections revealed an important prognostic value of PKT. As a result, the inclusion of this indicator in treatment protocols leads to a reduction in the use of antibiotics in various clinical conditions. In a study by G. Zhang et al., high levels of PKT increased the risk of adverse disease outcomes in elderly patients with chronic comorbidities. In the group of patients with severe form of SOVID 19, 92.3% of patients had PKT level > 1 ng/ml. That is, a significantly higher value of PCT was observed in them - higher than 1.89 ng/ml (1.53-8.67). In mild forms of the disease, this value was found to be around 0.17 ng/ml (0.05-1.06). However, PKT levels, as a marker of bacterial infection, are not elevated in the majority of patients with COVID-19, suggesting virus-related lung damage. In severe forms of the disease, the level of PKT > 0.5 ng/ml has a sensitivity of 88% and a specificity of 68% [9]. Studies have shown that elevated PKT levels are associated with increased risk of death. Thus, it is necessary to monitor not only PCT, but also CRO levels in patients with COVID-19. An increase in the amount of CRO helps to analyze the activity of systemic processes in the body and to make a decision on anti-inflammatory therapy, an increase in the level of PKT indicates the presence of hospital-acquired bacterial infections and complications that require the appointment of antibiotics. In patients with COVID-19, the appointment of antibacterial therapy is carried out only when there are reliable signs of bacterial infection - the appearance of purulent sputum, an increase in the level of PCT in the blood of 0.25-0.50 ng / ml, an increase in the level of leukocytes in the blood more than 10 thousand / ml (mainly a 10% increase in the number of nucleated neutrophils).

Because leukocytosis can be caused by glucocorticosteroid therapy rather than bacterial infection [2,10]. During the pandemic, the data obtained by researchers from all over the world confirm that determining the amount of PCT in severe and severe forms of the disease in patients with COVID-19 helps to manage antibacterial therapy and shorten the duration of treatment.

Conclusion: Determination of PKT concentration in patients with COVID 19 is of important diagnostic value and requires additional studies using microbiological approaches to

detect bacterial infections in the relevant contingent of patients. It also helps to decide whether to carry out further diagnostic studies or the possibility of using other therapeutic approaches, the appropriateness of antibacterial therapy, and the two durations. Further studies in different settings are needed to evaluate the association of PCT with disease severity, mortality, and concomitant bacterial infections, as well as the effect of antibiotics.

REFERENCES

1. Караматуллаева З. Э., Орзикулов А. О., Ибрагимова Э. Ф. “Значение антикоагулянтов при лечение COVID-19”. Журнал гепатогастроэнтерологических исследований. Ежеквартальный научно-практический журнал №1 (Том 2) 2021 год. С. 107-110
2. Караматуллаева З. Э., Ибрагимова Э. Ф., Мустаева Г. Б. РОЛЬ МИКРОЭЛЕМЕНТОВ ПРИ ЗАБОЛЕВАНИИ COVID-19 //International Scientific and Practical conference «COVID-19 and other topical infections of Central Asia» June 23-24, 2022, Shymkent. – С. 116.
3. Орзикулов А. О. и др. COVID-19 ИНФЕКЦИЯСИНИ ДАВОЛАШДА АНТИКОАГУЛЯНТЛАР ЎРНИ ВА АҲАМИЯТИ //СБОРНИК. – С. 333.
4. Орзикулов А.О., Рустамова Ш.А., Караматуллаева З.Э., Ибрагимова Э.Ф. Covid-19 инфекциясини даволашда антикоагулянтлар ўрни ва аҳамияти. Материалы международной научно-практической конференции с участием международных партнерских вузов: Достижения современной медицины в изучении эпидемиологии инфекционных болезней. Самарканд, 10-июня 2021 год.- С.206-215
5. Орзикулов А.О., Рустамова Ш.А., Караматуллаева З.Э., Ибрагимова Э.Ф. COVID-19 касаллигида тромбоэмболик асоратлар ривожланишида D-димер аҳамияти //Биология ва тиббиёт муаммолари. - 2021. - №. 6 (132). - С. 240-246.
6. Самибаева У. Х., Осланов А. А., Караматуллаева З. Э., Очилов О., Ходжиева Севгиноз «Covid-19 касаллиги ташхисотида компьютер томографияси диагностик аҳамияти». журнал биомедицины и практики. 2022/8/30. Том№ 7. Номер№3.
7. Рустамова Ш. А., Мирзаева Д.А. «Ранняя клинико-эпидемиологическая диагностика коронавирусной инфекции у пожилых» Сборник материалов международной online научно-практической конференции» Актуальные проблемы охраны окружающей среды и здоровье населения в период пандемии коронавирусной инфекции (COVID-19)» 10 декабря 2020 года. С. 94-98.
8. Рустамова Ш. А., Мирзаева Д. А. Современные подходы к диагностике, профилактике, лечению и реабилитации COVID-19 // Сборник материалов III международного конгресса: Непрерывное медицинское образование в республике Казахстан. 26-27 ноября 2020 г
9. Эргашева Муниса Якубовна, & Субхонова Сарвиноз Комиловна «Анализ диагностической ценности прокальцитонина при оценки течения COVID-19» GOLDEN BRAIN, 1(8), 60–72. https://doi.org/10.5281/zenodo.7772422
10. Gupta N., Zhao Y.-Y., Evans C.E. The stimulation of thrombosis by hypoxia. Thromb Res 2019; 181: 77–83, https://doi.org/ 10.1016/j.thromres.2019.07.013.
11. Tang N., Bai H., Chen X., Gong J., Li D., Sun Z. Anticoagulant treatment is associated with decreased mortality in severe coronavirus disease 2019 patients with coagulopathy. J Thromb Haemost 2020; 18(5): 1094–1099, https://doi.org/10.1111/jth.14817.

12. Tang N., Li D., Wang X., Sun Z. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. J Thromb Haemost 2020; 18(4): 844–847, https://doi.org/10.1111/jth.14768
13. Эргашева М. Я. Особенности клинико-лабораторной диагностики энтеровирусной инфекции без поражения ЦНС //Достижения науки и образования. – 2020. – №. 1 (55). – С. 114-119.
14. Эргашева М. и др. РОЛЬ ПОЛИМЕРАЗНОЙ ЦЕПНОЙ РЕАКЦИИ В ДИАГНОСТИКЕ ЭНТЕРОВИРУСНОЙ ИНФЕКЦИИ У БОЛЬНЫХ С ПРОЯВЛЕНИЯМИ ОСТРОЙ КИШЕЧНОЙ ИНФЕКЦИИ //Журнал гепато-гастроэнтерологических исследований. – 2020. – Т. 1. – №. 1. – С. 91-93.
15. Ярмухамедова Н. А., Эргашева М. Я. Клинико-лабораторная характеристика при серозном менингите энтеровирусной этиологии //Вопросы науки и образования. – 2019. – №. 27 (76). – С. 134-144.
16. Yakubovna E. M. et al. Aspects of Clinical and Laboratory Diagnostics of Enteroviral Infection without CMS Damage //Central Asian Journal of Medical and Natural Science. – 2021. – Т. 2. – №. 6. – С. 1-5.
17. Munisa E. Polymerase chain reaction in diagnostics of an enteroviral infection at patients with implications of acute intestinal infection //European science review. – 2016. – №. 11-12. – С. 106-107.
18. Якубова М., Эргашева М., Долиева У. COVID 19 ПРОФИЛАКТИКА (НА ПРИМЕРЕ СУРХАНДАРЬИ) //Авиценна. – 2021. – №. 81. – С. 21-23.
19. Эргашева М. Я. Вклад энтеровирусной инфекции в развитие серозного менингита //International scientific review of the problems of natural sciences and medicine. – 2018. – С. 28-32.
20. Эргашева М. Я. Вклад энтеровирусной инфекции в развитие серозного менингита //International scientific review of the problems of natural sciences and medicine. – 2018. – С. 28-32.
21. Ergasheva M. Y. Sod activities in the liver, kidney, pzh, and tc homogenates of rats in the dynamics of extrahepatic cholestasis //Web of Scientist: International Scientific Research Journal. – 2022. – Т. 3. – №. 02. – С. 710-715.
22. Mirkhamzaevna A. M., Yakubovna E. M., Shakhobidinovna V. N. Safety Assessment of Highly Active Antiretroviral Therapy in Patients with HIV Infection //EUROPEAN JOURNAL OF INNOVATION IN NONFORMAL EDUCATION. – 2022. – Т. 2. – №. 1. – С. 289-292.
23. Anvarovna Y. N. et al. POLYORGAN INSUFFICIENCY DURING OBTURATION OF GALLERY IN THE EXPERIMENT //Entomologist's Gazette. – 2022. – Т. 73. – №. 1.
24. Mirkhamzaevna A. M., Yakubovna E. M., Shakhobidinovna V. N. Safety Assessment of Highly Active Antiretroviral Therapy in Patients with HIV Infection //EUROPEAN JOURNAL OF INNOVATION IN NONFORMAL EDUCATION. – 2022. – Т. 2. – №. 1. – С. 289-292.
25. Maryem E. S. et al. Pneumococcal meningitis: Clinical aspects, bacterial profile and clinical course //International Journal of Infectious Diseases. – 2016. – Т. 53. – С. 79.
26. Орипова П. О., Бобоқандова М. Ф., Шомуродова Г. Т. КЛИНИКО-ЭПИДЕМИОЛОГИЧЕСКИЕ АСПЕКТЫ ГНОЙНОГО ПНЕВМОКОККОВОГО

МЕНИНГИТА У ДЕТЕЙ В САМАРКАНДСКОЙ ОБЛАСТИ (САМАРКАНДСКИЙ МЕДИЦИНСКИЙ ИНСТИТУТ) //Экономика и социум. – 2021. – №. 5-2 (84). – С. 139-150.

27. Bobokandova M. F. et al. THE SIGNS OF STAPHYLOCOCCUS AURECUS INFECTION IN ADULTS ARE MANIFESTED IN THE CLINIC BASED ON THE MECHANISM OF ACTION ON THE ORGAN SYSTEMS AND ANTIBIOTIC RESISTANCE //AGROBIOTEXNOLOGIYA VA VETERINARIYA TIBBIYOTI ILMIY JURNALI. – 2022. – С. 464-469.