

Laboratory abnormalities associated with COVID-19 infection

In addition to clinical symptoms and a positive COVID-19 test result, clinical laboratory tests provide important information about the condition of patients with COVID-19 infection. Clinical laboratory tests can help distinguish mild cases of COVID-19 from severe ones, define the prognosis, assess the need for hospitalization and monitor hospitalized patients.[1]

In patients with COVID-19 infection, relatively often the following laboratory abnormalities are detected: lymphopenia, increased levels of C-reactive protein and lactate dehydrogenase (LDH), decreased albumin and elevated ESR.[1-3]

Lymphopenia and increased C-reactive protein are among the laboratory abnormalities frequently seen in patients with COVID-19. These two tests can help assess prognosis and they might serve as indicators of disease severity and need for hospitalization.[4,5]

Other predictors of disease severity include increased values of the following tests: LDH, liver enzymes, creatinine, troponin, D-dimer, procalcitonin and prothrombin time.[1]

The main laboratory abnormalities seen in patients with COVID-19 are listed in Table #1.[6] Some of these abnormalities are mainly detected in severe cases of the disease.

Table #1 – Main laboratory abnormalities associated with COVID-19

Hematology	
Neutrophile count	Increased
Lymphocyte count	Decreased
Erythrocyte sedimentation rate (ESR)	Increased
Clinical Chemistry	
C-reactive protein (CRP)	Increased
Albumin	Decreased*
Liver enzymes (AST, ALT, GGT, ALP, Bilirubin)	Increased*
Lactate dehydrogenase (LDH)	Increased*
Kidney parameters (Creatinine, Urea/BUN)	Increased*
Lactate	Increased*
Cardiac markers	
CK-MB	Increased*
Myoglobin	Increased*
Troponin	Increased*

Coagulation	
D-dimer	Increased*
Prothrombin time	Increased*

*in severe cases, mainly

**Source of the table: <https://www.human.de/main-laboratory-abnormalities-associated-with-covid-19/> - Main laboratory abnormalities associated with COVID-19

From the laboratory tests listed in Table #1, increased D-dimer and prothrombin time may indicate activation of blood coagulation and/or disseminated coagulopathy.[1] In general, elevated D-dimer level in COVID-19 patients is associated with clinical worsening and poor prognosis.[7,8]

Thrombocytopenia is another indicator of disease severity and poor prognosis. Low platelet count can be a sign of consumption coagulopathy and it indicates worsening of illness in hospitalized patients.[9]

As for the other tests listed in Table #1, decreased albumin can be a sign of liver function impairment, while increased liver enzymes may indicate liver injury. Also, increased troponin and creatinine levels may be associated with cardiac and kidney injuries respectively. Elevated levels of LDH might be a sign of pulmonary injury.[1]

In addition to above-mentioned laboratory tests, increased procalcitonin may also predict severe cases of COVID-19.[10] In general, neutrophilia and elevated level of procalcitonin could be associated with bacterial co-infection and clinical worsening.[1]

Increased interleukin 6 (IL-6), among other cytokines, is one of the indicators of poor prognosis. [11,12]

Lastly, in patients with COVID-19, increased level of ferritin could be another potential marker of disease worsening.[12]

Written by: Tornike Batavani

Date: 30.04.2020

References:

1. Lippi G, Plebani M. The critical role of laboratory medicine during coronavirus disease 2019 (COVID-19) and other viral outbreaks. *Clinical Chemistry and Laboratory Medicine (CCLM)*. 2020 Mar 19;1(ahead-of-print). Available from: <https://www.degruyter.com/view/journals/cclm/ahead-of-print/article-10.1515-cclm-2020-0240/article-10.1515-cclm-2020-0240.xml> DOI: <https://doi.org/10.1515/cclm-2020-0240>
2. Lippi G, Plebani M. Laboratory abnormalities in patients with COVID-2019 infection. *Clinical Chemistry and Laboratory Medicine (CCLM)*. 2020 Mar 3;1(ahead-of-print). Available from: <https://www.degruyter.com/view/journals/cclm/ahead-of-print/article-10.1515-cclm-2020-0198/article-10.1515-cclm-2020-0198.xml> DOI: <https://doi.org/10.1515/cclm-2020-0198>
3. Rodriguez-Morales AJ, Cardona-Ospina JA, Gutiérrez-Ocampo E, Villamizar-Peña R, Holguin-Rivera Y, Escalera-Antezana JP, Alvarado-Arnez LE, Bonilla-Aldana DK, Franco-Paredes C, Henao-Martinez AF, Paniz-Mondolfi A. Clinical, laboratory and imaging features of COVID-19: A systematic review and meta-analysis. *Travel medicine and infectious disease*. 2020 Mar 13:101623. Available from: <https://www.sciencedirect.com/science/article/pii/S1477893920300910> DOI: <https://doi.org/10.1016/j.tmaid.2020.101623>
4. Tan L, Wang Q, Zhang D, Ding J, Huang Q, Tang YQ, Wang Q, Miao H. Lymphopenia predicts disease severity of COVID-19: a descriptive and predictive study. *Signal transduction and targeted therapy*. 2020 Mar 27;5(1):1-3. Available from: <https://doi.org/10.1038/s41392-020-0148-4>
5. Ling W. C-reactive protein levels in the early stage of COVID-19. *Medecine et Maladies Infectieuses*. 2020 Mar 31. Available from: <https://www.sciencedirect.com/science/article/pii/S0399077X2030086X> DOI: <https://doi.org/10.1016/j.medmal.2020.03.007>
6. Main laboratory abnormalities associated with COVID-19 – HUMAN Diagnostics Worldwide. [cited 2020 April 30]. Available from: <https://www.human.de/main-laboratory-abnormalities-associated-with-covid-19/>
7. Gao Y, Li T, Han M, Li X, Wu D, Xu Y, Zhu Y, Liu Y, Wang X, Wang L. Diagnostic utility of clinical laboratory data determinations for patients with the severe COVID-19. *Journal of Medical Virology*. 2020 Mar 17. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1002/jmv.25770> DOI: <https://doi.org/10.1002/jmv.25770>
8. Tang N, Li D, Wang X, Sun Z. Abnormal coagulation parameters are associated with poor prognosis in patients with novel coronavirus pneumonia. *Journal of Thrombosis and Haemostasis*. 2020 Apr 1. Available from: <https://onlinelibrary.wiley.com/doi/full/10.1111/jth.14768> DOI: <https://doi.org/10.1111/jth.14768>
9. Lippi G, Plebani M, Henry BM. Thrombocytopenia is associated with severe coronavirus disease 2019 (COVID-19) infections: A meta-analysis. *Clinica Chimica Acta*. 2020 Mar 13.

Available from: <https://www.sciencedirect.com/science/article/pii/S0009898120301248> DOI: <https://doi.org/10.1016/j.cca.2020.03.022>

10. Lippi G, Plebani M. Procalcitonin in patients with severe coronavirus disease 2019 (COVID-19): A meta-analysis. *Clinica Chimica Acta; International Journal of Clinical Chemistry*. 2020 Mar 4. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7094472/> DOI: 10.1016/j.cca.2020.03.004
11. Pedersen SF, Ho YC. SARS-CoV-2: a storm is raging. *The Journal of Clinical Investigation*. 2020 Apr 13;130(5). Available from: <https://www.jci.org/articles/view/137647> DOI: <https://doi.org/10.1172/JCI137647>
12. Henry BM, de Oliveira MH, Benoit S, Plebani M, Lippi G. Hematologic, biochemical and immune biomarker abnormalities associated with severe illness and mortality in coronavirus disease 2019 (COVID-19): a meta-analysis. *Clinical Chemistry and Laboratory Medicine (CCLM)*. 2020 Apr 10;1(ahead-of-print). Available from: <https://www.degruyter.com/view/journals/cclm/ahead-of-print/article-10.1515-cclm-2020-0369/article-10.1515-cclm-2020-0369.xml> DOI: <https://doi.org/10.1515/cclm-2020-0369>