# 4. Bölüm

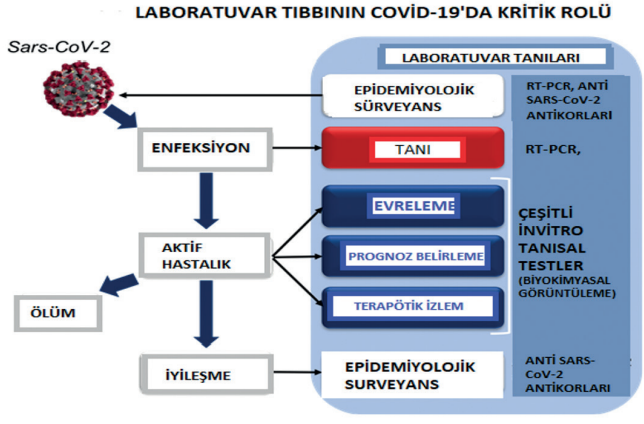
# BİYOKİMYASAL TANI

*Ebru ULAŞ*[1]

1. Kan tahlili ile COVID-19 anlaşılabilir mi?
2. Hangi tetkikler daha anlamlıdır?
3. Kan tahlilinin zamanı önemli midir?
4. Kan değerlerinde kalıcı bir etki var mıdır?

## GİRİŞ

COVID-19 pandemisinde Biyokimya Laboratuvarları hastalığın ve terapötik müdahalenin takibinde önemlidir. Laboratuvarda kullanılan testlerin iyileşme hızına katkıda bulunacağı açıktır (Şekil 1) (1).




**Şekil 1.**

[1] Uzm. Dr. Ebru ULAŞ, Sağlık Bilimleri Üniversitesi Samsun Eğitim ve Araştırma Hastanesi, Tıbbi Biyokimya Bölümü drebruu@yahoo.com

Virüs, birçok organ ve dokuda yüksek oranda bulunan ACE-2 reseptörü ile etkileşim yoluyla hücreleri enfekte etmektedir. Bu nedenle artan biyobelirteçlerin pek çoğu kötü sonuçlarla ilişkilendirilmiştir. Biyobelirteçler içinde lenfopeni, trombositopeni, lökositoz, CRP, PCT, AST, ALT, D-dimer, cTn şiddetli COVID-19'un en prediktif parametreleridir.

Hematolojik (lenfosit sayısı, nötrofil sayısı ve NLO), inflamatuvar (CRP, ESR, IL-6) ve özellikle biyokimyasal (D-dimer, Troponin, CK) parametrelerin şiddetli prognoz veya ölüm ile ilişkili olduğu, pıhtılaşma ve karaciğer parametrelerinin ise ciddi COVID 19 vakalarını belirlemede çok önemli bir rol oynadığı görülmektedir. Hematolojik, inflamatuvar, biyokimyasal ve immünolojik parametrelerin dikkate alınması COVID-19 pozitif hastaları risk kategorilerine ayırmaya yardımcı olacaktır. RT-PCR testleri enfeksiyonun varlığı doğrulamak için hayati önem taşırken diğer laboratuvar testleri hastalık şiddetinin değerlendirilmesine yardımcı olmaktadır.

Sonuç olarak biyokimya laboratuvarları inflamasyon ve multi organ yetmezliklerini biyobelirteçlerle izleyerek hastalığın ciddiyetinin değerlendirilmesine, risk sınıflandırmasına, prognozuna ve tedavinin izlenmesine büyük ölçüde katkı sağlamaktadır.

## KAYNAKLAR


1. https://www.ifcc.org/resources-downloads/ifcc-information-guide-on-COVID-19-introduction/
2. Ciaccio M, Agnello L. Biochemical biomarkers alterations in Corona Virus Disease 2019 (COVID-19) Diagnosis (Berl) 2020; 7(4): 365–372 doi: 10.1515/dx-2020-0057
3. Siddiqi, HK. Mehra, MR. COVID-19 illness in native and immunosuppressed states: a clinical-therapeutic staging proposal. J Heart Lung Transplant 2020. https://doi.org/10.1016/j.healun.2020.03.012
4. Yang, W, Cao Q, Qin, L, et al. Clinical characteristics and imaging manifestations of the 2019 novel corona virüs disease (COVID-19): a multi-centerstudy in Wenzhoucity, Zhejiang, China. J Infect. 2020;80:388–93. https://doi.org/10.1016/j.jinf.2020.02.016.
5. Ponti G, Maccaferri M, Ruini C. et al, Biomarkers associated with COVID-19 disease progression. Crit Rev Clin Lab Sci. 2020 Sep;57(6):389-39 doi:10.1080/10408363.2020.1770685
6. Bourgonje AR, Abdulle AE, Timens W, et al. Angiotensin converting enzyme 2 (ACE2), SARS-CoV-2 and the pathophysiology of corona virus disease 2019 (COVID-19). J Pathol. 2020 Jul;251(3):228-248. doi: 10.1002/path.5471.
7. Donoghue M, Hsieh F, Baronas E, et al. A novel angiotensin-converting enzyme-related carboxypeptidase (ACE2) converts angiotensin I to angiotensin 1- 9. CircRes. 2000;87(5):E1–E9.https://doi.org/10.1161/01.RES.87.5.e1
8. Anguiano L, Riera M, Pascual J, et al. Circulating ACE2 in Cardiovascular and KidneyDiseasesCurrMedChem. 2017;24(30):32313241. doi:10.2174/0929867324666170414162841.
9. Touyz RM, Li H, Delles C. et al. ACE-2 the Janus-faced protein – from cardio vascular protection to severe acute respiratory syndrome-corona virus and COVID-19. ClinSci. 2020;134(7):747–750.doi: 10.1042/CS20200363.

10. Tai W, He L, Zhang X. et al. Characterization of the receptor-binding domain (RBD) of 2019 novel corona virus: implication for development of RBD protein as a viral attachment inhibitör and vaccine. Cell MolImmunol. 2020. DOI:10.1038/s41423-020-0400-4
11. Li S, Tang Z, Li Z, et al. Searching therapeutic strategy of new corona virüs pneumonia from angiotensin-converting enzyme 2: thetarget of COVID-19 and SARSCoV. Eur J Clin Micro biol Infect Dis. 2020;39(6):1–6.https://doi.org/10.1007/s10096-020-03883-y
12. Shi Y, Wang G, Cai XP, et al.An overview of COVID-19. Zhejiang Univ Sci B. 2020 May;21(5):343-360. doi: 10.1631/jzus.B2000083.
13. Tay MZ, Poh CM, Rénia L, et al. Thetrinity of COVID-19: immunity, inflammation and intervention. Nat Rev Immunol. 2020 Jun;20(6):363-374. doi: 10.1038/s41577-020-0311-8.
14. Ji P, Zhu J, Zhong Z, et al. Association of elevated inflammatory markers and severe COVID-19: A meta-analysis. Medicine (Baltimore). 2020 Nov 20;99(47):e23315. doi: 10.1097/MD.0000000000023315
15. Tan C, Huang Y, Shi F, C-reactive protein correlates with CT findings and predicts severe COVID-19 early. J Med Virol. 2020 Jul;92(7):856-862.doi: 10.1002/jmv.25871
16. Perricone C, Bartoloni E, Bursi R, et al. COVID-19 as part of the hyperferritinemic syndromes: the role of iron depletion therapy. ImmunolRes. 2020; 68(4): 213–224. Published online 2020 Jul 17. doi: 10.1007/s12026-020-09145-5
17. ClelandDA,Eranki AP. Procalcitonin. StatPearls; [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 [cited 2020 Apr 22]. Availablefrom: http:// www.ncbi.nlm.nih.gov/books/NBK539794/
18. Bohn MK, Lippi G, Horvath A, et al. Molecular, serological, andbiochemicaldiagnosisandmonitoring of COVID-19: IFCC taskforceevaluation of thelatestevidence.ClinChemLabMed. 2020 Jun 25;58(7):1037-1052. doi: 10.1515/cclm-2020-0722.
19. Liu F, Xu A, Zhang Y, et al. Patients of COVID-19 maybenefitfromsustainedlopinavir-combinedregimenandtheincrease of eosinophilmaypredicttheoutcome of COVID-19 progression. Int J InfectDis. 2020; 95:183–191. doi: 10.1016/j.ijid.2020.03.013.
20. Lippi G, Henry BM. Eosinophilcount in severe coronavirusdisease 2019 (COVID-19). QJM Mon J AssocPhys. 2020.doi: 10.1093/qjmed/hcaa137
21. Yan Q, Li P, Ye X, et al. Longitudinalperipheralbloodtranscriptionalanalysis of COVID-19 patientscapturesdiseaseprogressionandrevealspotentialbiomarkers. MedRxiv. 2020.DOI: 10.1101/2020.05.05.20091355
22. Henry BM, Oliveira MHS, de Benoit S, et al. Hematologic, biochemicalandimmunebiomarkerabnormalitiesassociatedwith severe illnessandmortality in coronavirusdisease 2019 (COVID-19): a meta-analysis. ClinChemLabMed. 2020 Jun 25;58(7):1021-1028.doi: 10.1515/cclm-2020-0369.
23. Chen T, Wu D, Chen H, et al. Clinicalcharacteristics of 113 deceasedpatientswithcoronavirusdisease 2019: retrospectivestudy. BMJ. 2020;368:m1091.doi: 10.1136/bmj.m1091
24. Chai X, Hu L, Zhang Y, et al. Specific ACE2 expression in cholangiocytesmaycauseliverdamageafter 2019- nCoVinfection. BioRxiv 2020. https://doi.org/10.1101/2020.02. 03.931766.
25. Feng G, Zheng KI, Yan QQ, et al. COVID-19 andliverdysfunction: currentinsightsandemergenttherapeuticstrategies. J ClinTranslHepatol2020;8:18–24.doi: 10.14218/JCTH.2020.00018.
26. Lei F, Liu Y-M, Zhou F, et al. Longitudinalassociationbetweenmarkers of liverinjuryandmortality in COVID-19 in China. Hepatology. 2020. doi: 10.1002/hep.31301.
27. Akhmerov A, Marban E. COVID-19 andtheheart. CircRes 2020; 126:1443–55. https://doi.org/10.1161/CIRCRESAHA.120.317055
28. Qin JJ, Cheng X, Zhou F, et al.RedefiningCardiacBiomarkers in PredictingMortality of InpatientsWith COVID-19.Hypertension. 2020 Oct;76(4):1104-1112. doi: 10.1161/HYPERTENSIONAHA.120.15528
29. JanuzziJr JL. AmericanCollege of Cardiology. Troponinand BNP use in COVID-19. https://www.acc.org/latest-in-cardiology/ articles/2020/03/18/15/25/troponin-and-bnp-use-in-COVID19. Accessed: 4 May 2020

30. Chapman AR, Bularga A, Mills NL. et alHigh-sensitivitycardiactroponin can be an ally in thefightagainst COVID-19. Circulation 2020. doi: 10.1161/CIRCULATIONAHA.120.047008.
31. Angel-Korman A, Brosh T, Glick K, et al. [COVID-19, THE KIDNEY AND HYPERTENSION].LeibaA.Harefuah. 2020 Apr;159(4):231-234
32. Cheng Y, Luo R, Wang K, Zhang M, Wang Z, Dong L, et al. Kidneydisease is associatedwith in-hospitaldeath of patientswith COVID-19. KidneyInt 2020;97:829–38.doi: 10.1016/j.kint.2020.03.005.
33. Ronco C, Reis T, Husain-Syed F.et al. Management of acute kidney injury in patientswith COVID-19.LancetRespirMed. 2020 Jul;8(7):738-742. doi: 10.1016/S2213-2600(20)30229-0.
34. Zaim S, Chong JH, Sankaranarayanan V, et al.COVID-19 andmulti-organ response. CurrProblCardiol 2020:100618. doi: 10.1016/j.cpcardiol.2020.100618
35. Ronco C, Reis T. Kidneyinvolvement in COVID-19 andrationaleforextracorporealtherapies. NatRevNephrol 2020;1–3.
36. Lippi G, South AM, Henry BM.et alElectrolyteimbalances in patientswith severe coronavirusdisease 2019 (COVID-19). AnnClinBiochem. 2020 May;57(3):262-265. doi: 10.1177/0004563220922255.
37. Yin S, Huang M, Li D, et al.Difference of coagulationfeaturesbetween severe pneumoniainducedby SARS-CoV2 and nonSARS-CoV2. J ThrombThrombolysis 2020. https://doi.org/10.1007/s11239-020-02105-8
38. Bikdeli B, Madhavan MV, Jimenez D, et al. COVID-19 andthromboticorthromboembolicdisease: implicationsforprevention, antithrombotictherapy, andfollowup. J AmCollCardiol 2020. https://doi.org/10.1016/j.jacc.2020. 04.031
39. Tang N, Bai H, Chen X, et al.Anticoagulanttreatment is associatedwithdecreasedmortality in severe coronavirusdisease 2019 patientswithcoagulopathy. J ThrombHaemost 2020. https://doi.org/10.1111/jth.14817
40. Iba T, Levy JH, Connors JM, et al.Theuniquecharacteristics of COVID-19 coagulopathy,CritCare. 2020 Jun 18;24(1):360. doi: 10.1186/s13054-020-03077-0.
41. Helms J, Tacquard C, Severac F. High risk of thrombosis in patientswith severe SARS-CoV-2 infection: a multicenterprospectivecohortstudy. intensiveCareMed. 2020 Jun;46(6):1089-1098. doi: 10.1007/s00134-020-06062-x.
42. Lin HA, Lin SF, Chang HW. et al. Clinicalimpact of monocytedistributionwidthandneutrophil-to-lymphocyteratiofordistinguishing COVID-19 andinfluenzafromotherupperrespiratorytractinfections: A pilot study.HouSK.PLoSOne. 2020 Nov 2;15(11):e0241262. doi: 10.1371/journal.pone.0241262.
43. Crouser ED, Parrillo JE, Seymour C, et al Improved Early Detection of Sepsis in the ED With a NovelMonocyte Distribution WidthBiomarker.Chest. 2017 Sep;152(3):518-526. doi: 10.1016/j.chest.2017.05.039.
44. Balint B, Jepchumba VK, Guéant JL, et al.Mechanisms of homocysteine-induceddamagetotheendothelial, medialandadventitiallayers of thearterialwall.Biochimie. 2020 Jun;173:100-106. doi: 10.1016/j.biochi.2020.02.012.
45. Ponti G, Ruini C, TomasiA.et al.Homocysteine as a potentialpredictor of cardiovascular risk in patientswith COVID-19. MedHypotheses. 2020 Oct;143:109859. doi: 10.1016/j.mehy.2020.109859.
46. Abu-Farha M, Al-Sabah S, Hammad MM, et al. PrognosticGeneticMarkersforThrombosis in COVID-19 Patients: A Focused Analysis on D-Dimer, HomocysteineandThromboembolism Front Pharmacol. 2020 Dec9;11:587451. doi: 10.3389/fphar.2020.587451.
47. Zou Z, Yan Y, Shu Y, et al. Angiotensin-convertingenzyme 2 protectsfromlethalavianinfluenza A H5N1 infections. NatCommun. 2014;5:3594.
48. Ni W, Yang X, Yang D,et al.Role of angiotensin-converting enzyme 2 (ACE2) in COVID-19. CritCare. 2020 Jul 13;24(1):422. doi: 10.1186/s13054-020-03120-0.
49. Liu Y, Yang Y, Zhang C. Clinicalandbiochemicalindexesfrom 2019-nCoV infectedpatientslinkedtoviralloadsandlunginjury. SciChinaLife Sci. 2020;63(3):364–374.

50. Vakili S, Savardashtaki A, Jamalnia S. et al.LaboratoryFindings of COVID-19 Infectionare-Conflicting in Different Age GroupsandPregnantWomen: A LiteratureReview.ArchMedRes. 2020 Oct;51(7):603-607. doi: 10.1016/j.arcmed.2020.06.007.
51. Patel AN. Pediatric COVID-19: Systematicreview of theliteratureAmJ.OtolaryngolSep-Oct 2020;41(5):102573.doi: 10.1016/j.amjoto.2020.102573.
52. Henry BM, Lippi G, Plebani M.et al.Laboratoryabnormalities in childrenwithnovelcoronavirusdisease 2019. ClinChemLabMed2020;58:1135–8. 102. doi: 10.1111/apa.15270."
53. Hedrich CM. COVID-19 – considerationsforthepaediatricheumatologist. ClinImmunol2020;214:108420.DOI: 10.1016/j.clim.2020.108420.