



## COVID-19 HASTALARINDA EKSTRAKORPOREAL MEMBRAN OKSİJENİZASYONU (ECMO) UYGULAMALARI

Enise ARMAĞAN KOZA<sup>1</sup>

### EKSTRAKORPOREAL MEMBRAN OKSİJENASYONU

Ekstrakorporeal membran oksijenasyonu (ECMO) konvansiyonel tedaviye dirençli pulmoner ve /veya kalp yetmezliğinde geçici destek sağlayan ekstrakorporeal yaşam desteği yöntemidir. ECMO, açık kalp cerrahisinde kullanılan kalp akciğer makinesinin bir türevidir. ECMO işleminde hastadan gelen sistemik kan vücut dışına alınarak yapay bir akciğer olan oksijenatör (membran) vasıtası ile oksijenlenir, karbondioksit uzaklaştırılır ve yine yapay bir kalp görevi gören pompa yolu ile de kan vücuda geri gönderilir. Ekstrakorporeal yaşam desteğinin temel amacı; kalbin ve akciğerlerin iyileşene kadar dinlendirilmesi veya hastayı başka bir mekanik destek veya transplantasyon yöntemi için hazırlayana kadar sistemik dolaşım ve solunum desteği sağlamasıdır (1). Ekstrakorporeal membran oksijenasyonu ilk tanımlandığından günümüze kadar cihazda ve hasta yönetimindeki gelişmelere bağlı olarak ECMO kullanılan kritik hastaların sonuçlarında gelişmeler meydana gelmektedir (2). Konvansiyonel klinik desteğe dirençli akut solunum sıkıntısı sendromu olanlarda (3,4) hastane içi kardiyak arrestte 5 ve kardiyojenik refrakter şokta (6) ECMO kullanımı ile ilgili son yıllarda önemli çalışmalar yayınlanmaktadır.

İlk başarılı ekstrakorporeal dolaşım kullanımına ait kayıt 1954'de kardiyak cerrahi sırasında olmuştur.(7) ECMO'nun ilk solunum yetmezliğinde kullanımına ilişkin rapor ise 1972'de yayınlanmıştır.(8) ECMO' nun solunum yetmezli-

<sup>1</sup> Uzm. Dr., Erzurum Bölge Eğitim ve Araştırma Hastanesi, Anesteziyoloji ve Reanimasyon Kliniği  
enisekoza@hotmail.com

**KAYNAKLAR**

1. Pavlushkov E, Berman M, Valchanov K. Cannulation techniques for extracorporeal life support. *Annals of Translational Medicine*. 2017;5:70. doi: 10.21037/atm.2016.11.47.
2. Sauer CM, Yuh DD, Bonde P. Extracorporeal membrane oxygenation use has increased by 433% in adults in the United States from 2006 to 2011. *Asaio j*. 2015;61(1):31-36. doi: 10.1097/MAT.0000000000000160.
3. Combes A, Hajage D, Capellier G, et al. Extracorporeal Membrane Oxygenation for Severe Acute Respiratory Distress Syndrome. *New England Journal of Medicine*. 2018;378(21):1965-1975. doi: 10.1056/NEJMoa1800385
4. Peek GJ, Mugford M, Tiruvoipati R, et al. Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial. *The Lancet*. 2009;374 (9698):1351-1363. doi: 10.1016/S0140-6736(09)61069-2.
5. Chen YS, Lin JW, Yu HY, et al. Cardiopulmonary resuscitation with assisted extracorporeal life-support versus conventional cardiopulmonary resuscitation in adults with in-hospital cardiac arrest: an observational study and propensity analysis. *Lancet*. 2008;372(9638):554-561. doi: 10.1016/S0140-6736(08)60958-7
6. Combes A, Leprince P, Luyt CE, et al. Outcomes and long-term quality-of-life of patients supported by extracorporeal membrane oxygenation for refractory cardiogenic shock. *Crit Care Med*. 2008;36(5):1404-1411. doi: 10.1097/CCM.0b013e31816f7cf7
7. Gibbon JH, Jr. Application of a mechanical heart and lung apparatus to cardiac surgery. *Minn Med*. 1954;37(3):171-185; passim.
8. Hill JD, O'Brien TG, Murray JJ, et al. Prolonged extracorporeal oxygenation for acute post-traumatic respiratory failure (shock-lung syndrome). Use of the Bramson membranelung. *N Engl J Med*. 1972;286(12):629-634. doi: 10.1056/NEJM197203232861204.
9. Zapol WM, Snider MT, Hill JD, et al. Extracorporeal membrane oxygenation in severe acute respiratory failure. A randomized prospective study. *Jama*. 1979;242(20):2193-2196. doi: 10.1001/jama.242.20.2193.
10. Squiers JJ, Lima B, DiMaio JM. Contemporary extracorporeal membrane oxygenation therapy in adults: Fundamental principles and systematic review of the evidence. *J Thorac Cardiovasc Surg*. 2016;152(1):20-32. doi: 10.1016/j.jtcvs.2016.02.067.
11. Schmidt GA. *Extracorporeal life support for adults*: Springer; 2016.
12. Wang D, Zhou X, Liu X, Sidor B, Lynch J, Zwischenberger JB. Wang-Zwische double lumen cannula-toward a percutaneous and ambulatory paracorporeal artificial lung. *Asaio j*. 2008;54(6):606-611. doi: 10.1097/MAT.0b013e3181818c69ab.
13. Madershahian N, Nagib R, Wippermann J, Strauch J, Wahlers T. A simple technique of distal limb perfusion during prolonged femoro-femoral cannulation. *J Card Surg*. 2006;21(2):168-169. doi: 10.1111/j.1540-8191.2006.00201.x.
14. Özsoy SD, Ak HY. Ekstrakorporal Membran Oksijenizasyonu. *Koşuyolu Heart Journal*. 2018;21(3):236-244.
15. Aydın A, Çilingir D. Ekstrakorporal Membran Oksijenasyon Sistemi ve Kullanım Alanları. *Türkiye Klinikleri Hemşirelik Bilimleri Dergisi*. 2016;8(2):153-161.
16. Haydin S, Undar A. [Updates on extracorporeal life support in the world and challenges in Turkey]. *Anadolu Kardiyol Derg*. 2013;13(6):580-588. doi: 10.5152/akd.2013.182.

17. Lequier L, Horton SB, McMullan DM, Bartlett RH. Extracorporeal membrane oxygenation circuitry. *Pediatr Crit Care Med.* 2013;14(5 Suppl 1):S7-12. doi: 10.1097/PCC.0b013e318292dd10.
18. Tsai HC, Chang CH, Tsai FC, et al. Acute Respiratory Distress Syndrome With and Without Extracorporeal Membrane Oxygenation: A Score Matched Study. *Ann Thorac Surg.* 2015;100(2):458-464. doi: 10.1016/j.athoracsur.2015.03.092.
19. Organization ELS. General guidelines for all ECLS cases. Extracorporeal Life Support Organization Ann Arbor, MI; 2013.
20. Ferguson ND, Fan E, Camporota L, et al. The Berlin definition of ARDS: an expanded rationale, justification, and supplementary material. *Intensive Care Med.* 2012;38(10):1573-1582. doi: 10.1007/s00134-012-2682-1.
21. Braune S, Sieweke A, Brettner F, et al. The feasibility and safety of extracorporeal carbon dioxide removal to avoid intubation in patients with COPD unresponsive to non-invasive ventilation for acute hypercapnic respiratory failure (ECLAIR study): multi-centre case-control study. *Intensive Care Med.* 2016;42(9):1437-1444. doi: 10.1007/s00134-016-4452-y.
22. Ouweneel DM, Schotborgh JV, Limpens J, et al. Extracorporeal life support during cardiac arrest and cardiogenic shock: a systematic review and meta-analysis. *Intensive Care Med.* 2016;42(12):1922-1934. doi: 10.1007/s00134-016-4536-8.
23. Grant C, Jr., Richards JB, Frakes M, Cohen J, Wilcox SR. ECMO and Right Ventricular Failure: Review of the Literature. *J Intensive Care Med.* 2021;36(3):352-360. doi: 10.1177/0885066619900503.
24. Debaty G, Babaz V, Durand M, et al. Prognostic factors for extracorporeal cardiopulmonary resuscitation recipients following out-of-hospital refractory cardiac arrest. A systematic review and meta-analysis. *Resuscitation.* 2017;112:1-10. doi: 10.1016/j.resuscitation.2016.12.011.
25. Hakim AH, Ahmad U, McCurry KR, et al. Contemporary Outcomes of Extracorporeal Membrane Oxygenation Used as Bridge to Lung Transplantation. *Ann Thorac Surg.* 2018;106(1):192-198. doi: 10.1016/j.athoracsur.2018.02.036.
26. Zhang JJY, Ong JA, Syn NL, et al. Extracorporeal Membrane Oxygenation in Pregnant and Postpartum Women: A Systematic Review and Meta-Regression Analysis. *J Intensive Care Med.* 2021;36(2):220-228. doi: 10.1177/0885066619892826.
27. Sklar MC, Sy E, Lequier L, Fan E, Kanji HD. Anticoagulation Practices during Venovenous Extracorporeal Membrane Oxygenation for Respiratory Failure. A Systematic Review. *Ann Am Thorac Soc.* 2016;13(12):2242-2250. doi: 10.1513/AnnalsATS.201605-364SR
28. Mazzeffi M, Greenwood J, Tanaka K, et al. Bleeding, Transfusion, and Mortality on Extracorporeal Life Support: ECLS Working Group on Thrombosis and Hemostasis. *Ann Thorac Surg.* 2016;101(2):682-689. doi: 10.1016/j.athoracsur.2015.07.046
29. Parzy G, Daviet F, Persico N, et al. Prevalence and Risk Factors for Thrombotic Complications Following Venovenous Extracorporeal Membrane Oxygenation: A CT Scan Study. *Crit Care Med.* 2020;48(2):192-199. doi: 10.1097/CCM.0000000000004129
30. Hartley EL, Singh N, Barrett N, Wyncoll D, Retter A. Screening pulmonary angiogram and the effect on anticoagulation strategies in severe respiratory failure patients on venovenous extracorporeal membrane oxygenation. *J Thromb Haemost.* 2020;18(1):217-221. doi: 10.1111/jth.14640.

31. Chapman JT, Breeding J, Kerr SJ, Bajic M, Nair P, Buscher H. CNS Complications in Adult Patients Treated With Extracorporeal Membrane Oxygenation. *Crit Care Med.* 2021;49(2):282-291. doi: 10.1097/CCM.0000000000004789
32. Brogan TV, Thiagarajan RR, Rycus PT, Bartlett RH, Bratton SL. Extracorporeal membrane oxygenation in adults with severe respiratory failure: a multi-center database. *Intensive Care Med.* 2009;35(12):2105-2114. doi: 10.1007/s00134-009-1661-7
33. Mateen FJ, Muralidharan R, Shinohara RT, Parisi JE, Schears GJ, Wijdicks EF. Neurological injury in adults treated with extracorporeal membrane oxygenation. *Arch Neurol.* 2011;68(12):1543-1549. doi: 10.1001/archneurol.2011.209
34. Barbaro RP, MacLaren G, Boonstra PS, et al. Extracorporeal membrane oxygenation support in COVID-19: an international cohort study of the Extracorporeal Life Support Organization registry. *Lancet.* 2020;396(10257):1071-1078. doi: 10.1016/S0140-6736(20)32008-0.
35. Lorusso R, Combes A, Coco VL, De Piero ME, Belohlavek J. ECMO for COVID-19 patients in Europe and Israel. *Intensive Care Med.* 2021;47(3):344-348. doi: 10.1007/s00134-020-06272-3.
36. Schmidt M, Hajage D, Lebreton G, et al. Extracorporeal membrane oxygenation for severe acute respiratory distress syndrome associated with COVID-19: a retrospective cohort study. *Lancet Respir Med.* 2020;8(11):1121-1131. doi: 10.1016/S2213-2600(20)30328-3
37. Shekar K, Badulak J, Peek G, et al. Extracorporeal Life Support Organization Coronavirus Disease 2019 Interim Guidelines: A Consensus Document from an International Group of Interdisciplinary Extracorporeal Membrane Oxygenation Providers. *Asaio j.* 2020;66(7):707-721. doi: 10.1097/MAT.0000000000001193
38. Abrams D, Lorusso R, Vincent JL, Brodie D. ECMO during the COVID-19 pandemic: when is it unjustified? *Crit Care.* 2020;24(1):507. doi: 10.1186/s13054-020-03230-9
39. Badulak J, Antonini MV, Stead CM, et al. Extracorporeal Membrane Oxygenation for COVID-19: Updated 2021 Guidelines from the Extracorporeal Life Support Organization. *Asaio Journal.* 2021;67(5):485. doi: 10.1097/MAT.0000000000001422
40. Bartlett RH, Ogino MT, Brodie D, et al. Initial ELSO Guidance Document: ECMO for COVID-19 Patients with Severe Cardiopulmonary Failure. *Asaio j.* 2020;66(5):472-474. doi: 10.1097/MAT.0000000000001173.
41. Augoustides JG. Extracorporeal Membrane Oxygenation Crucial Considerations during the Coronavirus Crisis. *J Cardiothorac Vasc Anesth.* 2020;34(7):1720-1722. doi: 10.1053/j.jvca.2020.03.060.
42. Fitzsimons MG, Crowley J, Mark JB, Finlay G. COVID-19: Extracorporeal membrane oxygenation (ECMO). Wolters Kluwer Health; 2021.
43. Usman AA, Han J, Acker A, et al. A Case Series of Devastating Intracranial Hemorrhage During Venovenous Extracorporeal Membrane Oxygenation for COVID-19. *J Cardiothorac Vasc Anesth.* 2020;34(11):3006-3012. doi: 10.1053/j.jvca.2020.07.063.