

## Bölüm 8

# KRONİK LENFOSİTİK LÖSEMİ'DE MİNİMAL REZİDÜEL HASTALIK

**Nazlı DEMİR<sup>1</sup>**

Kronik lenfositik lösemi(KLL) tedavisinde son yıllarda yaşanan gelişmeler ile tedavi yanıt oranlarında belirgin iyileşmeler meydana gelmiştir. Tek ajan tedi- vi protokollerinden kombinasyon tedavilerine geçilmiştir, ardından hedefe yönelik tedaviler ve yeni ajanlar ile yanıt oranları belirgin olarak artırılmıştır. Monoklo- nal antikorların kemoterapi ile kombinasyonu, progresyonsuz sağkalım(PFS) ve genel sağkalım(OS) sürelerini uzatmıştır(1-6). İbrutinib, İdelalisib ve Venetoclax gibi hedefe yönelik tedavilerin ilk sırada ve relaps refrakter hastalık hallerinde, monoterapi ve kombinasyonda kullanımı yaşam sürelerini uzatmıştır(7-14). KLL tedavisindeki nihai amaç rezidüel hastalığı saptanamayacak düzeye indirip kür elde etmek olmuştur.

Klinik çalışmalarda tedavinin faydasını göstermek için kullanılan altın stan- dard sonlanım noktası genel sağkalımdır(OS). Ancak yeni tedaviler ile yaşam sürelerinin uzaması, OS ölçümü için geçen takip sürelerini de giderek uzatmış- tir. Yeni ilaçların kullanımına girmesini hızlandırmak amacıyla çalışmalarda farklı sonlanım noktaları da kullanılmıştır. Progresyonsuz sağkalım(PFS) bunlar arasında en sık kullanıldır. Ancak etkin tedaviler ile PFS süreleri de uzamıştır. Bu nedenle klinik çalışma sürelerini kısaltmak ve yeni ajanlara ulaşımı kolaylaştırmak için yeni bir sonlanım noktası olarak minimal rezidüel hastalı- gin(MRD) kullanımı gündemdedir.

## **MİNİMAL REZİDÜEL HASTALIK NEDİR?**

Tedavi sonrası klinik, morfolojik ve radyolojik incelemeler ile saptanamayan an- cak daha spesifik yöntemler ile gösterilebilen kalıntı KLL hücreleri nüksün so- rumlusudur. Nüksün zamanı, kalıntı hastalığın miktarı ve lösemik hücrelerin ço- ğalma hızı ile ilişkilidir(15).

<sup>1</sup> Uzm Dr, Şişli Etfal Hamidiye Eğitim ve Araştırma Hastanesi, naztastemir@gmail.com

ghput sekanslama(HTS) yöntemi ile hasta plazmasındaki serbest tümör DNA'sı saptanarak rezidü hastalık taraması yapılabilir(15,55)

### **Sonuç**

MRD'nin KLL'de kullanımı, прогнозu tahmin etmek ve tedavi süreci ile stratejisine karar vermede yol göstericidir ve bireyselleştirilmiş tedavi yaklaşımının önünü açabileceğinin düşünülmektedir(15). Çalışmalarda elde edilen olumlu veriler nedeniyle MRD'nin bir sonlanım noktası olarak kullanılması gündemdedir. Çalışmalar, tedavi sonunda periferik kanda MRD negatifliğinin, tam yanıt varlığından bağımsız olarak tedavi etkinliğinin bir belirteci olduğunu göstermektedir.

MRD negatifliğini elde etmek ve idame tedavisi almaksızın uzun süreli remisyonda kalmak hastaları idame ve ardisık tedavilerden kaynaklanan toksisiteden koruyacak, hastalar ve toplum üzerindeki tedavi maliyetini azaltacak ve pahalı tedavilerin kullanımını geciktirecektir(15).

Erken dönemde MRD negatifliği elde edilen hastalarda toksisiteden kaçınmak amaçlı tedavinin azaltılması veya kesilmesi, MRD negatifliği sağlanamayan hastalarda ise çapraz direnç olmayan ajanlarla erken dönemde farklı tedaviler gündemdedir(38).

Standart bir yöntem belirlenmemiş olması ve her yöntemin farklı avantaj ve dezavantajlarının olması sorunların başında gelmektedir.

Klinik çalışmalarda elde edilen olumlu veriler nedeniyle MRD'nin bir sonlanım noktası olarak kullanılması gündemdedir ancak bu konuda literatür verilerinin artması gerekmektedir.

**Anahtar Kelimeler:** Minimal rezidüel hastalık, kronik lenfositik lösemi, akım sitometrisi, polimeraz zincir reaksiyonu

### **KAYNAKÇA**

1. Hallek M, Fischer K, Fingerle-Rowson G, et al; International Group of Investigators; German Chronic Lymphocytic Leukaemia Study Group. Addition of rituximab to fludarabine and cyclophosphamide in patients with chronic lymphocytic leukaemia: a randomised, open-label, phase 3 trial. Lancet. 2010;376(9747):1164-1174. Doi: 10.1016/S0140-6736(10)61381-5.
2. Böttcher S, Ritgen M, Fischer K, et al. Minimal residual disease quantification is an independent predictor of progression-free and overall survival in chronic lymphocytic leukemia: a multivariate analysis from the randomized GCLLSG CLL8 trial. J Clin Oncol. 2012;30(9):980-988. Doi:10.1200/JCO.2011.36.9348.
3. Eichhorst B, Fink AM, Bahlo J, et al; International group of investigators; German CLL Study Group (GCLLSG). First-line chemoimmunotherapy with bendamustine and rituximab versus fludarabine, cyclophosphamide, and rituximab in patients with advanced chronic lymphocytic leukaemia (CLL10): an international, open-label, randomised, phase 3, non-inferiority trial. Lancet Oncol. 2016;17(7):928-942. Doi: 10.1016/S1470-2045(16)30051-1.
4. Woyach JA, Ruppert AS, Heerema NA, et al: Chemoimmunotherapy with fludarabine and rituximab produces extended overall survival and progression-free survival in chronic lympho-

- cytic leukemia: Long-term follow-up of CALGB study 9712. *J Clin Oncol.* 2011;29:1349-1355. Doi:10.1200/JCO.2010.31.1811.
- 5. Fischer K, Bahlo J, Fink AM, et al: Long-term remissions after FCR chemoimmunotherapy in previously untreated patients with CLL: Updated results of the CLL8 trial. *Blood.* 2016;127:208-215. Doi: 10.1182/blood-2015-06-651125.
  - 6. Böttcher S, Hallek M, Ritgen M, et al: The role of minimal residual disease measurements in the therapy for CLL: Is it ready for prime time? *Hematol Oncol Clin North Am.* 2013; 27:267-288. Doi: 10.1016/j.hoc.2013.01.005.
  - 7. Davids M, Kim H, Brander D, et al. Initial results of a multicenter, phase II study of ibrutinib plus FCR (iFCR) as frontline therapy for younger CLL patients. *Blood.* 2016;128(22):3243.
  - 8. O'Brien S, Furman R, Coutre S, et al. Five-year experience with single-agent ibrutinib in patients with previously untreated and relapsed/refractory chronic lymphocytic leukemia/small lymphocytic leukemia. *Blood.* 2016;128(233).
  - 9. Ryan CE, Sahaf B, Logan AC, et al. Ibrutinib efficacy and tolerability in patients with relapsed chronic lymphocytic leukemia following allogeneic HCT. *Blood.* 2016;128(25):2899-2908. Doi: 10.1182/blood-2016-06-715284.
  - 10. Stilgenbauer S, Eichhorst B, Schetelig J, et al. Venetoclax in relapsed or refractory chronic lymphocytic leukaemia with 17p deletion: a multicentre, open-label, phase 2 study. *Lancet Oncol.* 2016;17(6):768-778. Doi: 10.1016/S1470-2045(16)30019-5.
  - 11. Ma S, Brander D, Seymour J, et al. Deep and durable responses following venetoclax(ABT-199/GDC-0199) combined with rituximab in patients with relapsed/refractory chronic lymphocytic leukemia: results from a phase 1b study. *Blood.* 2015;126(23):830.
  - 12. Roberts A, Seymour J, Eichhorst B, et al. Pooled multitrial analysis of venetoclax efficacy in patients with relapsed or refractory chronic lymphocytic leukemia. *Blood.* 2016;128(22):3230.
  - 13. Roberts A, Ma S, Brander D, et al. Impact of adding rituximab to venetoclax on the rate, quality and duration of response in patients with relapsed/refractory chronic lymphocytic leukaemia: a cross-study multivariable analysis. *European Hematology Association Abstracts;2016.*
  - 14. Furman RR, Sharman JP, Coutre SE, et al: Idelalisib and rituximab in relapsed chronic lymphocytic leukemia. *N Engl J Med.* 2014;370:997-1007. Doi: 10.1056/NEJMoa1315226.
  - 15. Thompson PA, Wierda WG. Eliminating minimal residual disease as a therapeutic end point: working toward cure for patients with CLL. *Blood.* 2016;127(3):279-86. Doi: 10.1182/blood-2015-08-634816.
  - 16. European Medicines Agency. Guideline on the use of minimal residue disease as an endpoint in chronic lymphocytic leukaemia studies [Internet]. 2014. London, UK: European Medicines Agency. Available from: [http://www.ema.europa.eu/docs/en\\_GB/document\\_library/Scientific\\_guideline/2014/12/WC500179047.pdf](http://www.ema.europa.eu/docs/en_GB/document_library/Scientific_guideline/2014/12/WC500179047.pdf).
  - 17. Robertson LE, Huh YO, Butler JJ, et al. Response assessment in chronic lymphocytic leukemia after fludarabine plus prednisone: clinical, pathologic, immunophenotypic, and molecular analysis. *Blood.* 1992;80(1):29-36.
  - 18. Hallek M, Cheson BD, Catovsky D, et al: Guidelines for the diagnosis and treatment of chronic lymphocytic leukemia: A report from the International Workshop on Chronic Lymphocytic Leukemia updating the National Cancer Institute-Working Group 1996 guidelines. *Blood.* 2008;111:5446-5456. Doi: 10.1182/blood-2007-06-093906.
  - 19. Kwok M, Rawstron AC, Varghese A, et al. Minimal residual disease is an independent predictor for 10-year survival in CLL. *Blood.* 2016;128(24):2770-2773.
  - 20. Kovacs G, Robrecht S, Fink AM, et al. Minimal residual disease assessment improves prediction of outcome in patients with chronic lymphocytic leukemia (CLL) who achieve partial response: comprehensive analysis of two phase III studies of the German CLL Study Group. *J Clin Oncol.* 2016;34 (31):3658-3765. Doi: 10.1200/JCO.2016.67.1305.
  - 21. Hallek M, Cheson BD, Catovsky D, et al: iwCLL guidelines for diagnosis, indications for treatment, response assessment, and supportive management of CLL. *Blood.* 2018;131(25):2745-2760. Doi: 10.1182/blood-2017-09-806398.

22. National Comprehensive Cancer Network. NCCN Clinical Practice Guidelines in Oncology: Chronic Lymphocytic Leukemia/Small Lymphocytic Leukemia. 2019. Version 5; 2019. [https://www.nccn.org/professionals/physician\\_gls/pdf/cll.pdf](https://www.nccn.org/professionals/physician_gls/pdf/cll.pdf). Accessed July 18, 2019.
23. Eichhorst B, Hallek M. Revision of the guidelines for diagnosis and therapy of chronic lymphocytic leukemia (CLL). *Best Pract Res Clin Haematol*. 2007;20(3):469-477.
24. Rawstron AC, Böttcher S, Letestu R, et al. Improving efficiency and sensitivity: European Research Initiative in CLL (ERIC) update on the international harmonised approach for flow cytometric residual disease monitoring in CLL. *Leukemia*. 2007;21(5):956-964. Doi: 10.1038/leu.2012.216.
25. Cabezudo E, Matutes E, Ramrattan M, et al. Analysis of residual disease in chronic lymphocytic leukemia by flow cytometry. *Leukemia*. 1997;11(11):1909-1914.
26. Lenormand B, Bizet M, Fruchart C, et al. Residual disease in B-cell chronic lymphocytic leukemia patients and prognostic value. *Leukemia*. 1994;8(6):1019-1026.
27. Varghese AM, Rawstron AC, Hillmen P. Eradicating minimal residual disease in chronic lymphocytic leukemia: should this be the goal of treatment? *Curr Hematol Malig Rep*. 2010;5(1):35-44. Doi: 10.1007/s11899-009-0041-2.
28. Rawstron AC, Villamor N, Ritgen M, et al. International standardized approach for flow cytometric residual disease monitoring in chronic lymphocytic leukaemia. *Leukemia*. 2007; 21(5):956-964.
29. Böttcher S, Stilgenbauer S, Busch R, et al. Standardized MRD flow and ASO IGH RQ-PCR for MRD quantification in CLL patients after rituximab-containing immunochemotherapy: a comparative analysis. *Leukemia*. 2009;23(11): 2007-2017. Doi: 10.1038/leu.2009.140.
30. Moreno C, Villamor N, Colomer D, et al. Clinical significance of minimal residual disease, as assessed by different techniques, after stem cell transplantation for chronic lymphocytic leukemia. *Blood*. 2006;107(11):4563-4569.
31. Böttcher S, Ritgen M, Pott C, et al. Comparative analysis of minimal residual disease detection using four-color flow cytometry, consensus IgH-PCR and quantitative IgH PCR in CLL after allogeneic and autologous stem cell transplantation. *Leukemia*. 2004;18(10):1637-1645.
32. Stehlikova O, Chovancova J, Tichy B, et al. Detecting minimal residual disease in patients with chronic lymphocytic leukemia using 8-color flow cytometry protocol in routine hematological practice. *Int J Lab Hematol*. 2014;36:165-171. Doi: 10.1111/ijlh.12149.
33. Rawstron AC, de Tute R, Jack AS, et al. Flow cytometric protein expression profiling as a systematic approach for developing disease-specific assays: identification of a chronic lymphocytic leukaemia- specific assay for use in rituximab-containing regimens. *Leukemia*. 2006;20:2102-2110.
34. Böttcher S, Ritgen M, Dreger P. Allogeneic stem cell transplantation for chronic lymphocytic leukemia: lessons to be learned from minimal residual disease studies. *Blood Rev*. 2011;25(2):91-96. Doi: 10.1016/j.blre.2011.01.001.
35. Van Dongen JJ, Langerak AW, Brüggemann M, et al. Design and standardization of PCR primers and protocols for detection of clonal immunoglobulin and T-cell receptor gene recombinations in suspect lymphoproliferations: report of the BIOMED-2 Concerted Action BMH4-CT98-3936. *Leukemia*. 2003;17(12):2257-317.
36. Vuillier F, Claisse JF, Vandenvelde C, et al. Evaluation of residual disease in B-cell chronic lymphocytic leukemia patients in clinical and bone-marrow remission using CD5-CD19 markers and PCR study of gene rearrangements. *Leuk Lymphoma*. 1992;7(3):195-204.
37. Rawstron AC, Kennedy B, Evans PA, et al: Quantitation of minimal disease levels in chronic lymphocytic leukemia using a sensitive flow cytometric assay improves the prediction of outcome and can be used to optimize therapy. *Blood*. 2001;98(1):29-35.
38. Ghia P. A look into the future: can minimal residual disease guide therapy and predict prognosis in chronic lymphocytic leukemia? *Hematology Am Soc Hematol Educ Program*. 2012;2012:97-104. Doi: 10.1182/asheducation-2012.1.97.
39. Serrati S, De Summa S, Pilato B, et al. Next-generation sequencing: advances and applications in cancer diagnosis. *Onco Targets Ther*. 2016;9:7355-7365.

40. Avet-Loiseau H. Minimal residual disease by next-generation sequencing: pros and cons. Am Soc Clin Oncol Educ Book. 2016;35:e425–e430. Doi:10.14694/EDBK\_159088.
41. Tomuleasa C, Selicean C, Cismas S, et al. Minimal residual disease in chronic lymphocytic leukemia: A consensus paper that presents the clinical impact of the presently available laboratory approaches. Crit Rev ClinLab Sci. 2018;55(5):329-345. Doi: 10.1080/10408363.2018.1463508.
42. Strati P, Keating MJ, O'Brien SM, et al. Eradication of bone marrow minimal residual disease may prompt early treatment discontinuation in CLL. Blood. 2014;123(24):3727-3732. Doi:10.1182/blood-2013-11-538116.
43. Bouvet E, Borel C, Obéric L, et al: Impact of dose intensity on outcome of fludarabine, cyclophosphamide, and rituximab regimen given in the first-line therapy for chronic lymphocytic leukemia. Haematologica. 2013;98(1):65-70. Doi: 10.3324/haematol.2012.070755.
44. Santacruz R, Villamor N, Aymerich M, et al: The prognostic impact of minimal residual disease in patients with chronic lymphocytic leukemia requiring first-line therapy. Haematologica. 2014;99:873-880. Doi: 10.3324/haematol.2013.099796.
45. Byrd JC, Furman RR, Coutre SE, et al. Targeting BTK with ibrutinib in relapsed chronic lymphocytic leukemia. N Engl J Med. 2013;369(1):32-42. Doi: 10.1056/NEJMoa1215637.
46. Furman RR, Sharman JP, Coutre SE, et al. Idelalisib and rituximab in relapsed chronic lymphocytic leukemia. N Engl J Med. 2014; 370(11):997-1007. Doi: 10.1056/NEJMoa1315226.
47. Byrd JC, Brown JR, O'Brien S, et al. Ibrutinib versus ofatumumab in previously treated chronic lymphoid leukemia. N Engl J Med. 2014;371(3):213-223. Doi: 10.1056/NEJMoa1400376.
48. O'Brien S, Furman RR, Coutre SE, et al. Ibrutinib as initial therapy for elderly patients with chronic lymphocytic leukaemia or small lymphocytic lymphoma: an open-label, multicentre, phase 1b/2 trial. Lancet Oncol. 2014;15(1):48-58. Doi: 10.1016/S1470-2045(13)70513-8.
49. Strati P, Keating MJ, O'Brien SM, et al. Outcomes of first-line treatment for chronic lymphocytic leukemia with 17p deletion. Haematologica. 2014;99(8):1350-5. Doi: 10.3324/haematol.2014.104661.
50. Thompson PA, Tam CS, O'Brien SM, et al. Fludarabine, cyclophosphamide, and rituximab treatment achieves long-term disease-free survival in IGHV-mutated chronic lymphocytic leukemia. Blood. 2016;127(3):303-309. Doi: 10.1182/blood-2015-09-667675.
51. Byrd JC, Furman RR, Coutre SE, et al. Three year follow-up of treatment naive and previously treated patients with CLL and SLL receiving single agent ibrutinib. Blood. 2015;125(16):2497-2506. Doi: 10.1182/blood-2014-10-606038.
52. Roberts AW, Davids MS, Pagel JM, et al. Targeting BCL2 with Venetoclax in Relapsed Chronic Lymphocytic Leukemia. NEnglJMed. 2016;374(4):311-322. Doi: 10.1056/NEJMoa1513257.
53. Algrin C, Golmard JL, Michallet M, et al: Flow cytometry minimal residual disease after allogeneic transplant for chronic lymphocytic leukemia. Eur J Haematol. 2017;98(4):363-370. Doi: 10.1111/ejh.12836.
54. Owen C, Christofides A, Johnson N, et al. Use of minimal residual disease assessment in the treatment of chronic lymphocytic leukemia. Leukemia Lymphoma. 2017;58(12):2777-2785. Do i: 10.1080/10428194.2017.1318439
55. Logan AC, Zhang B, Narasimhan B, et al. Minimal residual disease quantification using consensus primers and high-throughput IGH sequencing predicts post-transplant relapse in chronic lymphocytic leukemia. Leukemia. 2013;27(8):1659-1665. Doi: 10.1038/leu.2013.52.