

ÇOCUK NÖROLOJİ HASTALARINDA KEMİK İLİĞİ NAKLİ VE İLERİ HEMATOLOJİK TEDAVİ SEÇENEKLERİ

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GİRİŞ

Kemik iliği nakli, benign ve malign hematolojik hastalıklar, immün yetersizlik, doğuştan metabolik bozukluklar gibi çocukluk çağında rastlanan pek çok hastalığın tedavisinde tedavi protokollerinin bir parçası ve/veya tek iyileştirici tedavi seçeneği olarak yer almaktadır. Kök hücre kaynağı olarak kemik iliği dışında periferik kan kök hücre, kordon kanı gibi diğer kök hücre kaynaklarının da kullanıma girmesi ile ‘kemik iliği nakli’ yerine ‘hematopoetik kök hücre nakli’ (HKHN) terimi kullanılmaya başlanmıştır.¹

Otolog ve allojenik HKHN bazı nörolojik bozuklukların tedavisinde yer almaktadır. Multipl Skleroz gibi (MS) immün aracılı hastalıklarda otolog HKHN ve metabolik yollarda yer alan enzimlerdeki konjenital eksikliklerle karakterize durumlarda ise allojenik HKHN tercih edilmektedir.²

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Pediatric beyin tümörlerinin tedavisinde kontrol noktası blokajının kullanımı da aktif bir araştırma alanı olmuştur. Programlanmış hücre ölüm proteini 1 (PD1) ve sitotoksik T lenfosit ilişkili protein 4 (CTLA4) gibi kontrol noktası molekülleri, T hücrelerinin yüzeyinde bulunan ve bağışıklık tepkisini düzenlemeye yardımcı olan proteinlerdir. Kendi kendine toleransın geliştirilmesinde yer alırlar, ancak kanserler bu yolu tümöre özgü bağışıklık tepkisini azaltmak veya kaçmak için kullanabilir.²⁶ Tekrarlayan pediatric beyin tümörleri için bir anti-PD1 molekülü olan nivolumab ve anti-CTLA4 olan ipilimumab ile ilgili açık bir çalışma mevcuttur (NCT03130959).

KAYNAKLAR

1. Yesilipek M.A. Çocuklarda hematopoetik kök hücre nakli. *Türk Ped Arş* 2014; 49: 91-8.
2. de Vasconcelos P, Lacerda JF. Hematopoietic Stem Cell Transplantation for Neurological Disorders: A Focus on Inborn Errors of Metabolism. *Front Cell Neurosci*. 2022 May 26;16:895511.
3. Hübel K (2019). Mobilization and Collection of HSC. In: Carreras, E., Dufour, C., Mohty, M., and Kröger, N (eds). *The EBMT Handbook: Hematopoietic Stem Cell Transplantation and Cellular Therapies*, 7th edition. Berlin: Springer. <http://dx.doi.org/10.1007/978-3-030-02278-5>.
4. Cencioni MT, Genchi A, Brittain G, et al. Immune Reconstitution Following Autologous Hematopoietic Stem Cell Transplantation for Multiple Sclerosis: A Review on Behalf of the EBMT Autoimmune Diseases Working Party. *Front Immunol*. 2022 Feb 1;12:813957.
5. Sharrack B, Saccardi R, Alexander T, et al. European Society for Blood and Marrow Transplantation (EBMT) Autoimmune Diseases Working Party (ADWP) and the Joint Accreditation Committee of the International Society for Cellular Therapy (ISCT) and EBMT (JACIE). Autologous haematopoietic stem cell transplantation and other cellular therapy in multiple sclerosis and immune-mediated neurological diseases: updated guidelines and recommendations from the EBMT Autoimmune Diseases Working Party (ADWP) and the Joint Accreditation Committee of EBMT and ISCT (JACIE). *Bone Marrow Transplant*. 2020 Feb;55(2):283-306.
6. Snowden, J. A., Styczynski, J., Snarski, E., and Greco, R. Hematopoietic stem cell transplantation in autoimmune diseases: update from the EBMT Autoimmune Diseases Working Party with special reference to Poland. *Acta Haematologica Polonica* 2021; 52, 4: 217-224.
7. Van Wijmeersch B, Sprangers B, Rutgeerts O, et al. Allogeneic bone mar-

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- row transplantation in models of experimental autoimmune encephalomyelitis: evidence for a graft-versus-autoimmunity effect. *Biol Blood Marrow Transplant.* 2007 Jun;13(6):627-37.
8. Tan EY, Boelens JJ, Jones SA, Wynn RF. Hematopoietic Stem Cell Transplantation in Inborn Errors of Metabolism. *Front Pediatr.* 2019 Oct 25;7:433.
 9. Sailor KA, Agoranos G, López-Manzaneda S, et al. Hematopoietic stem cell transplantation chemotherapy causes microglia senescence and peripheral macrophage engraftment in the brain. *Nat Med.* 2022 Mar;28(3):517-527.
 10. Harrison F, Yeagy BA, Rocca CJ, Kohn DB, Salomon DR, Cherqui S. Hematopoietic stem cell gene therapy for the multisystemic lysosomal storage disorder cystinosis. *Mol Ther.* 2013 Feb;21(2):433-44.
 11. Biffi A. Hematopoietic Stem Cell Gene Therapy for Storage Disease: Current and New Indications. *Mol Ther.* 2017 May 3;25(5):1155-1162.
 12. Tokic V, Barisic I, Huzjak N, Petkovic G, Fumic K, Paschke E. Enzyme replacement therapy in two patients with an advanced severe (Hurler) phenotype of mucopolysaccharidosis I. *Eur J Pediatr.* 2007 Jul;166(7):727-32.
 13. Staal FJT, Aiuti A, Cavazzana M. Autologous Stem-Cell-Based Gene Therapy for Inherited Disorders: State of the Art and Perspectives. *Front Pediatr.* 2019 Oct 31;7:443.
 14. Fumagalli F, Calbi V, Natali Sora MG, et al. Lentiviral haematopoietic stem-cell gene therapy for early-onset metachromatic leukodystrophy: long-term results from a non-randomised, open-label, phase 1/2 trial and expanded access. *Lancet.* 2022 Jan 22;399(10322):372-383.
 15. Sharma A, Sane H., Gokulchandran N., et al (2017). Stem Cell Therapy in Pediatric Neurological Disabilities. In: Uner Tan (eds). *Physical Disabilities - Therapeutic Implications.* SPİ Global, Croatia. <http://dx.doi.org/10.5772/67656>.
 16. Verma RS. Breaking dogma for future therapy using stem cell – Where we have reached? *The Indian Journal of Medical Research.* 2016;143(2):129–131.
 17. Karussis D, Kassis I, Kurkalli BG, Slavin S. Immunomodulation and neuroprotection with mesenchymal bone marrow stem cells (MSCs): A proposed treatment for multiple sclerosis and other neuroimmunological/neurodegenerative diseases. *Journal of Neurological Science.* 2008;265(1-2):131–135.
 18. Hung C-W, Liou Y-J, Lu S-W, et al. Stem cell-based neuroprotective and neurorestorative strategies. *International Journal of Molecular Sciences.* 2010;11(5):2039–2055
 19. Crisostomo PR, Wang M, Herring CM, et al. Gender differences in injury induced mesenchymal stem cell apoptosis and VEGF, TNF, IL-6 expression: role of the 55 kDa TNF receptor (TNFR1). *Journal of Molecular and Cellular Cardiology.* 2007;42(1):142–149
 20. Markel TA, Crisostomo PR, Wang M, Herring CM, Meldrum DR. Activation of individual tumor necrosis factor receptors differentially affects

- stem cell growth factor and cytokine production. *Am J Physiol Gastrointest Liver Physiol.* 2007 Oct;293(4):G657-62.
21. Goetzl L, Darbinian N, Goetzl EJ. Novel window on early human neurodevelopment via fetal exosomes in maternal blood. *Annals of Clinical and Translational Neurology.* 2016;3(5):381-385.
 22. Kuşkonmaz B, Uçkan D, Yalnizoğlu D, et al. Mesenchymal stem cell application in children with subacute sclerosing panencephalitis. *Dev Med Child Neurol.* 2015 Sep;57(9):880-3.
 23. Wang X, Zhang M, Feng R, et al. Physical exercise training and neurovascular unit in ischemic stroke. *Neuroscience.* 2014;271:99-107.
 24. Wahl P, Brixius K, Bloch W. Exercise-induced stem cell activation and its implication for cardiovascular and skeletal muscle regeneration. *Minimally Invasive Therapy & Allied Technologies.* 2008;17(2):91-99
 25. Tuğcu D, Tanyıldız G, Kebudi R (2022). Çocuk beyin tümörlerinin epidemiyolojisi, kliniği ve yatkınlık yaratan durumlar. In: Kebudi R (eds). Çocuk ve Ergenlerde Beyin Tümörleri: Güncel Yaklaşım. 1. Baskı. Türkiye Klinikleri, Ankara.
 26. Plant-Fox AS, O'Halloran K, Goldman S. Pediatric brain tumors: the era of molecular diagnostics, targeted and immune-based therapeutics, and a focus on long term neurologic sequelae. *Curr Probl Cancer.* 2021 Aug;45(4):100777.
 27. Chi SN, Bourdeaut F, Laetsch TW, et al. Phase I study of tazemetostat, an enhancer of zeste homolog-2 inhibitor, in pediatric pts with relapsed/refractory integrase interactor-1 negative tumors. *J Clin Oncol.* 2020;38 no. 15_suppl 10525.
 28. Zhang A, Plunl A, Ozark P, et al. Therapeutic targeting of EZH2 and BET BRD4 in AT/RT. *Neuro Oncol.* 2019;21(Suppl 2) ii63.
 29. Fangusaro J, Onar-Thomas A, Young Poussaint T, et al. Selumetinib in pediatric patients with BRAF-aberrant or neurofibromatosis type-1 associated recurrent, refractory, or progressive low-grade glioma: a multicentre, phase 2 trial. *Lancet Oncol.* 2019;20:1011-1022.
 30. Packer RJ, Kilburn L. Molecular-Targeted Therapy for Childhood Brain Tumors: A Moving Target. *J Child Neurol.* 2020 Oct;35(12):791-798.