Bölüm
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SANTRAL SİNİR SİSTEMİNİN DİĞER İDİYOPATİK İNFLAMATUAR DEMİYELİZAN HASTALIKLARI VE MULTİPL SKLEROZ VARYANTLARI

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GİRİŞ

Santral sinir sisteminin idiyopatik demiyelinizan hastalıkları nedeni bilinmeyen geniş bir grup hastalığı içerir. En sık görülen multipl sklerozdur(MS). Diğerleri, hastalık başlangıcı, klinik görünümü, hastalık seyri, görüntülemede lezyonların lokalizasyonları ve yapısı, patolojik ve labratuvar özellikleriyle MS'den farklılıklar gösterirler. Ayrıca MS kullanılan tedavilere yanıt vermemeleride önemlidir. Bu özelliklerin tanımlanması ve bilinmesi, hastalıkların doğru tanı ve erken tedavisi açısından önemlidir. Bu yazıda bu grup içinde tanımlanmış SSS'inin diğer demiyelizan hastalıkları ve MS varyantları kısaca özetlenmiştir.

NÖROMİYELİTİS OPTİKA SPEKTRUM BOZUKLUKLARI

Daha önce Devic sendromu olarak bilinen nöromiyelitis optika (NMO), başlıca optik sinirler ve spinal kordu tutan inflamatuar lezyonlar ile karakterize santral sinir sisteminin (SSS) immun aracılı, ciddi inflamatuar ve demiyelinizan hastalığıdır. Son yıllarda, optik sinirlerin (OS) ve spinal kodun (SK) dışında SSS'in farklı bölgelerinin etkilendiği klinik fenotipleri tanımlanmıştır (1,2). Bu bozuklukların patogenezinin anlaşılması, hastalığa özgü aquaporin-4' e (AQP4) bağlayan antikor ile ilişkileri, nörogörüntüleme özelliklerinin belirlenmesi, önceki NMO sınıflandırmasının yeniden düzenlenmesi ile daha spesifik tanı kriterleri ve hastalık tedavi kılavuzu 2015 yılında yayınlandı ve bu grup NMO spektrum bozukluğu (NMOSD) olarak adlandırıldı (3). Tanı kriterleri, NMOSD'ları AQP4 antikor varlığına göre: seropozitif ve seronegatif veya AQP4 durumu bilinmeyenler olmak üzere ikiye ayırmıştır (4). Seronegatif grup NMOSD'ların yaklaşık %20-25'ini oluşturur. 2012 yılında seronegatif NMOSD'li hastaların bir kısmında miyelin oligodendrosit antikorlarının (MOG) olduğu bulundu. MOG antikoru bulunan grup AQP4 seronegatif olan NMOSD hastalarının yaklaşık % 30-40'ını oluşturur (5). Bu hastaların klinik fenotip olarak MS ve NMOSD'larda farklı olduğu görüldü ve yakın zamanda MOG antikor hastalığı(MOGAH) ayrı bir nozolojik antite olarak kabul edildi(6).

Epidemiyoloji

NMOSD genellikle sporadiktir, birkaç ailevi olgu tanımlanmıştır (3). Görülme sıklığı ve prevalansı 100.000'de sırasıyla 0.05-0.4 ve 0.52-4.4 arasındadır (7). Tüm ırkları ve etnik kökenleri etkilemesine rağmen beyaz olmayanlarda eğilim vardır. İnsidansı Martinique, Batı Hint Adaları, Asya ve Afro-Amerikan popülasyonlarında, Kafkas popülasyonlarına göre daha yüksektir. Afrikalılarda yüksek ölüm oranları bildirilmiştir (3,5,89).

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jiyle birlikte yürütülen çalışmalar, biyolojik alandaki ilerlemeler ile SSS'inin yeni idiyopatik demiyelinizan hastalıkları tanımlanmıştır. Gelecekte benzer çalışmalar mevcut hastalıkların daha iyi anlaşılması, tedavilerin belirlenmesi yanında yeni fenotiplerin tanımlanmasında yardımcı olacaktır.

Anahtar Kelimeler: İdiyopatik, demiyelinizan hastalık, multipl skleroz, varyant.

KAYNAKLAR

1. Ungureanu A, de Seze J, Ahle G, et al. Myelin oligodendrocyte glycoprotein anti bodies in neuromyelitis optica spectrum disorder. Rev Neurol (Paris). 2018;174 (10):675-679. doi: 10.1016/j.neurol.2018.01.378.
2. Shahmohammadi S, Doosti R, Shahmohammadi A, et al. Autoimmune diseases associated with Neuromyelitis Optica Spectrum Disorders: A literature review. Mult Scler Relat Disord. 2019;27:350-363. doi: 10.1016/j.msard.2018.11.008.
3. Bruscolini A, Sacchetti M, La Cava M, et al. Diagnosis and management of neuromyelitis optica spectrum disorders-An update. Autoimmun Rev. 2018;17(3):195-200. doi:10.1016/j. autrev.2018.01.001.
4. Wildner P, Stasiołek M, Matysiak M. Differential diagnosis of multiple sclerosis and other inflammatory CNS diseases. Mult Scler Relat Disord. 2019;15;37:1014 52. doi:10.1016/ j.msard.2019.101452.
5. Huda S, Whittam D, Bhojak M, et al. Neuromyelitis optica spectrum disorders. Clin Med (Lond). 2019;19(2):169-176. doi: 10.7861/clinmedicine.19-2-169.
6. Wynford-Thomas R, Jacob A, Tomassini V. Neurological update: MOG antibody disease.J Neurol. 2019;266(5):1280-1286. doi: 10.1007/s00415-018-9122-2.
7. Rosenthal JF, Hoffman BM, Tyor WR. CNS inflammatory demyelinating disorders: MS, NMOSD and MOG antibody associated disease. J Investig Med. 2019 Oct 3. pii:jim-2019-001126. doi:10.1136/jim-2019-001126.
8. Chang VTW, Chang HM. Review: Recent advances in the understanding of the pat hophysiology of neuromyelitis optica spectrum disorder. Neuropathol Appl Neuro boil. 2019; 28. doi:10.1111/nan.12574.
9. Weinshenker BG, Wingerchuk DM. Neuromyelitis Spectrum Disorders. Mayo Clin Proc. 2017;92(4):663-679. doi: 10.1016/j.mayocp.2016.12.014.
10. Alves Do Rego C, Collongues N. Neuromyelitis optica spectrum disorders: Features of aquaporin-4, myelin oligodendrocyte glycoprotein and double-seronegative-mediated subtypes. Rev Neurol (Paris). 2018;174(6):458-470. doi:10.1016/ j.neurol.2018.02.084.
11. Wu Y, Zhong L, Geng J. Neuromyelitis optica spectrum disorder: Pathogenesis, treatment, and experimental models. Mult Scler Relat Disord. 2019;27:412-418. doi:10.1016/ j.msard.2018.12.002.
12. Lana-Peixoto MA, Talim N. Neuromyelitis Optica Spectrum Disorder and Anti-MOG Syndromes. Biomedicines. 2019;12;7(2). pii:E42. doi:10.3390/biomedicines 7020042.
13. Sepúlveda M, Sola-Valls N, Escudero D, et al. Clinical profile of patients with parane oplastic neuromyelitis optica spectrum disorder and aquaporin-4 antibodies. Mult Scler. 2018 ;24(13):1753-1759. doi: 10.1177/1352458517731914.
14. Pittock SJ, Lennon VA. Aquaporin-4 autoantibodies in a paraneoplastic context. Arch Neurol. 2008;65(5):629-32. doi: 10.1001/archneur.65.5.629.
15. Jasiak-Zatonska M, Kalinowska-Lyszczarz A, Michalak S, et al. The Immunology of Neuromyelitis Optica-Current Knowledge, Clinical Implications, Controversies and Future Perspectives. Int J Mol Sci. 2016;2;17(3):273. doi:10.3390/ijms1703 0273.
16. Jarius S, Franciotta D, Paul F, et al. Cerebrospinal fluid antibodies to aquaporin-4 in neuromyelitis optica and related disorders: frequency, origin, and diagnostic rele vance J Neuroinflammation. 2010; 7: 52. doi: 10.1186/1742-2094-7-52.
17. Collongues N, Ayme-Dietrich E, Monassier L, et al. Pharmacotherapy for Neuromyelitis Optica Spectrum Disorders: Current Management and Future Options. Drugs. 2019 Feb;79 (2):125-142. doi: 10.1007/s40265-018-1039-7.
18. Dos Passos GR, Sato DK, Becker J, et al. Th17 Cells Pathways in Multiple Sclerosis and Neuromyelitis Optica Spectrum Disorders: Pathophysiological and Therapeutic Implications. Mediators Inflamm. 2016;2016:5314541. doi:10.1155/20 16/5314541.
19. Shosha E, Pittock SJ, Flanagan E. Neuromyelitis optica spectrum disorders and pregnancy: Interactions and management. Mult Scler. 2017;23(14):1808-1817. doi:10.1177/ 1352458517740215.
20. Wei Y, Chang H, Li X, et al. Cytokines and Tissue Damage Biomarkers in First-Onset Neuromyelitis Optica Spectrum Disorders: Significance of Interleukin-6. Neuroimmune modulation. 2018;25(4):215-224. doi: 10.1159/000494976.
21. He D, Zhang A, Li Y, et al. Autoimmune aquaporin-4 induced damage beyond the central nervous system. Mult Scler Relat Disord. 2017;18:41-46. doi:10.1016/j.msard.2017.09.013.
22. Zabad RK, Stewart R, Healey KM. Pattern Recognition of the Multiple Sclerosis Syndrome. Brain Sci. 2017;24:7(10). pii: E138. doi: 10.3390/brainsci7100138.
23. Bradl M, Reindl M, Lassmann H. Mechanisms for lesion localization in neuromyelitis optica spectrum disorders. Curr Opin Neurol. 2018;31(3):325-333. doi:10. 1097/WCO.0000 000000000551.
24. Höftberger R, Lassmann H. Inflammatory demyelinating diseases of the central nervous system. Handb Clin Neurol. 2017;145:263-283. doi: 10.1016/B978-0-12-802395-2.00019-5.
25. Wingerchuk DM, Banwell B, Bennett JL,et al. International consensus diagnostic criteria for neuromyelitis optica spectrum disorders. Neurology. 2015;14;85(2): 177-89. doi:10.1212/ WNL.0000000000001729.
26. Narayan R, Simpson A, Fritsche K,et al. MOG antibody disease: A review of MOG antibody seropositive neuromyelitis optica spectrum disorder. Mult Scler Relat Disord. 2018 ;25:66-72. doi: 10.1016/j.msard.2018.07.025.

27. Zarei S, Eggert J, Franqui-Dominguez L, Comprehensive review of neuromyelitis optica and clinical characteristics of neuromyelitis optica patients in Puerto Rico. Surg Neurol Int. 2018:3;9:242. doi:10.4103/sni.sni-224-18.
28. Baghbanian SM, Asgari N, Sahraian MA, et al. A comparison of pediatric and adult neuro myelitis optica spectrum disorders: A review of clinical manifestation, diagnosis, and treatment. J Neurol Sci. 2018:15;388:222-231. doi:10.1016/j. jns.2018. 02.028.
29. Rosales D, Kister I. Common and Rare Manifestations of Neuromyelitis Optica Spectrum Disorder. Curr Allergy Asthma Rep. 2016;16(6):42. doi:10.1007/s1188 2-016-0619-4.
30. Patterson SL, Goglin SE. Neuromyelitis Optica. Rheum Dis Clin North Am. 2017; 43(4) :579-591. doi: 10.1016/j. rdc.2017.06.007.
31. Flanagan EP. Neuromyelitis Optica Spectrum Disorder and Other Non-Multiple Sclerosis Central Nervous System Inflammatory Diseases. Continuum (Minneap Minn). 2019;25(3) :815-844. doi: 10.1212/ CON.0000000000000742.
32. Pittock SJ, Lucchinetti CF. Neuromyelitis optica and the evolving spectrum of autoimmune aquaporin-4 channelopathies: a decade later. Ann N Y Acad Sci. 2016;13:66 (1):20-39. doi: 10.1111/nyas.12794.
33. Akaishi T, Nakashima I, Sato DK, et al. Neuromyelitis Optica Spectrum Disorders. Neuroimaging Clin N Am. 2017 May;27(2):251-265. doi:10.1016/j.nic.2016. 12.010.
34. Wang Y, Zhang L, Zhang B, et al. Comparative clinical characteristics of neuromyelitis optica spectrum disorders with and without medulla oblongata lesions. J Neurol. 2014;261 (5): 954-62. doi: 10.1007/s00415-014-7298-7.
35. Netravathi, M, Maya, B, Hari-krishna, B, et al.(2019). Clinical, Neuroimaging and Therapeutic response in AQP4-positive NMO patients from India. Mult Scler Relat Disord. 2019; 30:85-93. doi:10.1016/ j.msard.2019.01.032.
36. Watanabe M, Nakamura Y, Michalak Z, et al. Serum GFAP and neurofilament light as biomarkers of disease activity and disability in NMOSD. Neurology. 2019;24;93(13):e1299-e1311. doi: 10.1212/ WNL.0000000000008160.
37. Peng A, Qiu X, Zhang L, et al. Evaluation of the retinal nerve fiber layer in neuromyelitis optica spectrum disorders: A systematic review and meta-analysis. J Neurol Sci. 2017 Dec 15;383:108-113. doi: 10.1016/j. jns.2017.10.028.
38. Bennett JL, de Seze J, Lana-Peixoto M, Neuromyelitis optica and multiple sclerosis: Seeing differences through optical coherence tomography. Mult Scler. 2015 May; 21(6):678-88. doi: 10.1177/1352458514567216.
39. Yonezu T1, Ito S, Mori M, et al. "Bright spotty lesions" on spinal magnetic resonance imaging differentiate neuromyelitis optica from multiple sclerosis. Mult Scler. 2014;20(3): 331-7. doi: 10.1177/1352458513495581.
40. Pekcevik Y, Mitchell CH, Mealy MA, et al. Differentiating neuromyelitis optica from other causes of longitudinally extensive transverse myelitis on spinal magnetic resonance imaging. Mult Scler. 2016;22(3):302-11. doi:10.1177/1352458515591069.
41. Chee CG, Park KS, Lee JW, et al. MRI Features of Aquaporin-4 Antibody-Positive Longi tudinally Extensive Transverse Myelitis: Insights into the Diagnosis of Neuromyelitis Optica Spectrum Disorders. Am J Neuroradiol. 2018;39(4):782-787. doi:10.3174/ajnr.A5551.
42. Dutra BG, da Rocha AJ, Nunes RH, et al. Neuromyelitis Optica Spectrum Disorders: Spectrum of MR Imaging Findings and Their Differential Diagnosis. Radiographics. 2018;38 (1):169-193. doi:10.1148/rg.2018170141.
43. Zalewski NL, Morris PP, Weinshenker BG, Neurol Neurosurg Psychiatry. Ring-enhancing Spinal Cord Lesions in Neuromyelitis Optica Spectrum Disorders. 2017;88(3): 218-225. doi:10.1136/jnnp-2016-314738.
44. Hu H, You X, Ye J. Short transverse myelitis in Chinese patients with neuromyelitis optica spectrum disorders. Mult Scler Relat Disord. 2018;21:78-83. doi:10.1016/j. msard.20 18.02.022.
46. Kim HJ, Paul F, Lana-Peixoto MA, et al; Guthy-Jackson Charitable Foundation NMO International Clinical Consortium & Biorepository. MRI characteristics of neuro myelitis optica spectrum disorder: an international update. Neurology. 2015;17; 84(11):1165-73. doi: 10.1212/WNL.0000000000001367.
47. Wang KY, Chetta J, Bains P, et al. Spectrum of MRI brain lesion patterns in neuro myelitis optica spectrum disorder: a pictorial review. Br J Radiol 2018;91:(1086):20 170690. doi: 10.1259/bjr.20170690.
48. Pekcevik Y, Orman G, Lee IH, et al. What do we know about brain contrast enhancement patterns in neuromyelitis optica? Clin Imaging. 2016; 40(3): 573–580. doi:10.1016/j.clini mag.2015.07.027.
49. Carnero Contentti E, Daccach Marques V, Soto de Castillo I, et al. Frequency of brain MRI abnormalities in neuromyelitis optica spectrum disorder at presentation: A cohort of Latin American patients. Mult Scler Relat Disord. 2018;19:73-78. doi:10.1016/j.msard.2017. 11.004.
50. Cai G, He D, Chu L, et al. Paraneoplastic neuromyelitis optica spectrum disorders: three new cases and a review of the literature. Int J Neurosci. 2016;126 (7): 660-8. doi:10.3109/ 00207454.2015.1054481.
51. Borisow N, Mori M, Kuwabara S, et al. Diagnosis and Treatment of NMO Spectrum Disorder and MOG-Encephalomyelitis. Front Neurol. 2018;23:9:888. doi:10.338 9/fneur. 2018.00888.
52. Kleiter I, Gold R. Present and Future Therapies in Neuromyelitis Optica Spectrum Disorders. Neurotherapeutics. 2016 ;13(1):70-83. doi:10.1007/s13311-015-0400-8.
53. de Sèze J, Kremer L, Collongues N. Neuromyelitis optica spectrum disorder (NMOSD): A new concept. Rev Neurol (Paris). 2016;172(4-5):256-62. doi:10.1016/ j. neurol.2016.03.003.
54. Elsone L, Panicker J, Mutch K, et al. Role of intravenous immunoglobulin in the treat ment of acute relapses of neuromyelitis optica: experience in 10 patients. Mult Scler. 2014;20 (4):501-4. doi:10.1177/1352458513495938.
55. Espiritu AI, Pasco PMD. Efficacy and tolerability of azathioprine for neuromyelitis optica spectrum disorder: A systematic review and meta-analysis. Mult Scler Relat Disord. 2019;33: 22-32. doi: 10.1016/j.msard.2019.05.011.

56. Yang Y, Wang CJ, Wang BJ, et al. Comparison of efficacy and tolerability of azathioprine, mycophenolate mofetil, and lower dosages of rituximab among patients with neuromyelitis optica spectrum disorder. J Neurol Sci. 2018;15;385:192-97. doi:10.1016/j.jns.2017.12.034
57. Ciron J, Audoin B, Bourre B, et al. Recommendations for the use of Rituximab in neuro myelitis optica spectrum disorders. Rev Neurol (Paris). 2018;174(4):255-264. doi:10.1016/j. neurol.2017.11.005.
58. Gombolay GY, Chitnis T. Pediatric Neuromyelitis Optica Spectrum Disorders. Curr Treat Options Neurol. 2018;2:20(6):19. doi: 10.1007/s11940-018-0502-9.
59. Shaygannejad V, Fayyazi E, Badihian S, et al. Long-term tolerability, safety and efficacy of rituximab in neuromyelitis optica spectrum disorder: a prospective study. J Neurol. 2019; 266(3):642-650. doi: 10.1007/s00415-019-09180-9.
60. Damato V, Evoli A, Iorio R. Efficacy and Safety of Rituximab Therapy in Neuromyelitis Optica Spectrum Disorders: A Systematic Review and Meta-analysis. JAMA Neurol. 2016; 1;73(11):1342-1348. doi: 10.1001/jamaneurol.2016.1637.
61. Enriquez CAG, Espiritu AI, Pasco PMD. Efficacy and tolerability of mitoxantrone for neuromyelitis optica spectrum disorder: A systematic review. J Neuroimmunol. 2019; 15;332:126-134. doi: 10.1016/j.jneuroim.2019.04.007.
62. Ramanathan RS, Malhotra K, Scott T. Treatment of neuromyelitis optica/neuromyelitis optica spectrum disorders with methotrexate. BMC Neurol. 2014;15;14:51. doi:10.1186/1471 -2377-14-51.
63. Kitley J, Elsone L, George J, et al. Methotrexate is an alternative to azathioprine in neuromyelitis optica spectrum disorders with aquaporin-4 antibodies. J Neurol Neurosurg Psyc hiatry. 2013;84(8):918-21. doi: 10.1136/jnnp-2012-304774.
64. Pittock SJ, Berthele A, Fujihara K, et al. Eculizumab in Aquaporin-4-Positive Neuromye litis Optica Spectrum Disorder. N Engl J Med. 2019;15;381(7):614-625. doi:10.1056/NEJM oa1900866.
65. Pardo S, Giovannoni G, Hawkes C, et al. Editorial on: Eculizumab in aquaporin-4-positive neuromyelitis optica spectrum disorder. Mult Scler Relat Disord. 2019;33:A1-A2. doi: 10.1016/j.msard.2019.07.001.
66. Carreón Guarnizo E, Hernández Clares R, Castillo Triviño T, et al. Experience with tocilizumab in patients with neuromyelitis optica spectrum disorders. Neurologia. 2019;27. pii:S0213-4853(19)30033-7. doi:10.1016/j.nrl.2018.12.013.
67. Yamamura T, Kleiter I, Fujihara K, et al. Trial of Satralizumab in Neuromyelitis Optica Spectrum Disorder. N Engl J Med. 2019;28;381(22):2114-24. doi:10.056/ NEJMoa1901747.
68. Cree BAC, Bennett JL, Kim HJ, et al.; N-MOmentum study investigators. Inebilizumab for the treatment of neuromyelitis optica spectrum disorder (N-MOmentum): a double-blind, randomised placebo-controlled phase 2/3 trial. Lancet. 2019;12;394(10206):1352-1363. doi: 10.1016/S0140-6736(19)31817-3.
69. Duan T, Tradtrantip L, Phuan PW. Affinity-matured 'aquaporumab' anti-aquaporin-4 antibody for therapy of seropositive neuromyelitis optica spectrum disorders. Neurophar macology. 2020;1;162:107827. doi:10.1016/j.neuropharm.2019.107827.
70. Zhou Y, Zhong X, Shu Y, et al. Pediatric-onset multiple sclerosis in Brazilian patients: Clinical features, treatment response and comparison to pediatric neuromyelitis optica spectrum disorders. Mult Scler Relat Disord. 2018;25:138-142. doi: 10.1016/j.msard.2018.07.036.
71. Fragomeni MO, Bichuetti DB, Oliveira EML. Pediatric-onset multiple sclerosis in Brazilian patients: Clinical features, treatment response and comparison to pediatric neuro myelitis optica spectrum disorders. Mult Scler Relat Disord. 2018;25:138-142. doi:10.1016/j.msard.2018.07.036.
72. Baghbanian SM, Sahraian MA, Naser Moghadasi A, et al. Disability and Therapeutic Res ponse in Paediatric Neuromyelitis Optica Spectrum Disorder: A Case Series from Iran. Iran J Child Neurol. 2019;13(3): 99-104.
73. Chitnis T. Pediatric Central Nervous System Demyelinating Diseases. Continuum (Minneap Minn). 2019;25(3):793-814. doi: 10.1212/CON.0000000000000730.
74. Nosadini M, Alper G, Riney CJ, et al. Rituximab monitoring and redosing in pediatric neuromyelitis optica spectrum disorder. Neurol Neuroimmunol Neuroinflamm. 2016 21;3(1): e188. doi: 10.1212/NXI.0000000000000188.
75. Borisow N, Hellwig, Paul F. Neuromyelitis optica spectrum disorders and pregnancy: relapse-preventive measures and personalized treatment strategies. EPMA J. 2018;10;9(3): 249-256. doi: 10.1007/s13167-018-0143-9.
76. Nour MM, Nakashima I, Coutinho E, et al Pregnancy outcomes in aquaporin-4-positive neuromyelitis optica spectrum disorder. Neurology. 2016;5;86(1):79-87. doi:10.1212/ WNL. 0000000000002208.
77. Klawiter EC, Bove R, Elsone L, et al. High risk of postpartum relapses in neuromyelitis optica spectrum disorder. Neurology. 2017;28;89(22):2238-2244. doi:10.1212/WNL.000000 0000004681.
78. Huang Y, Wang Y, Zhou Y, et al. Pregnancy in neuromyelitis optica spectrum disorder: A multicenter study from South China. J Neurol Sci. 2017;15;372:152-156. doi:10.1016/j.jns. 2016.11.054.
79. Salvador NRS, Brito MNG, Alvarenga MP, et al. Neuromyelitis optica and pregnancy-puerperal cycle. Mult Scler Relat Disord. 2019;34:59-62. doi:10.1016/j.msard.2019.05.007.
80. Shi B, Zhao M, Geng T, et al. Effectiveness and safety of immunosuppressive therapy in neuromyelitis optica spectrum disorder during pregnancy. J Neurol Sci. 2017;15;377:72-76. doi: 10.1016/j.jns.2017.03.051.
81. Hardy TA, Reddel SW, Barnett MH, et al. Atypical inflammatory demyelinating syndromes of the CNS. Lancet Neurol. 2016;15(9):967-981. doi:10.1016/S1474-4422(16)30 043-6.
82. Ramanathan S, Mohammad S, Tantsis E, et al. Clinical course, therapeutic responses and outcomes in relapsing MOG antibody-associated demyelination. J Neurol Neurosurg Psyc hiatry. 2018 ;89(2):127-137. doi: 10.1136/jnnp-2017-316880.8.
83. Zhou L, Huang Y, Li H, et al. MOG-antibody associated

demyelinating disease of the CNS: A clinical and pathological study in Chinese Han patients. J Neuroimmunol. 2017; 15;305:19-28. doi:10.1016/j.jneuroim.2017.01.007.
84. Cobo-Calvo A, Ruiz A, Maillart E, et al Clinical spectrum and prognostic value of CNS MOG autoimmunity in adults: The MOGADOR study. Neurology. 2018;22;90(21):e1858-e1869. doi: 10.1212/WNL.0000000000005560.
85. Reindl M, Waters P. Myelin oligodendrocyte glycoprotein antibodies in neurological disease. Nat Rev Neurol. 2019;15(2):89-102. doi: 10.1038/s41582-018-0112-x.
86. Dubey D, Pittock SJ, Krecke KN, et al. Clinical, Radiologic, and Prognostic Features of Myelitis Associated With Myelin Oligodendrocyte Glycoprotein Autoantibody. JAMA Neurol. 2019;1;76(3):301-309. doi: 10.1001/jamaneurol.2018.4053.
87. Jarius S, Ruprecht K, Kleiter I, et al. MOG-IgG in NMO and related disorders: a multi center study of 50 patients. Part 2: Epidemiology, clinical presentation, radiological and labo ratory features, treatment responses, and long-term outcome. J Neuroin flammation. 2016; 27;13(1):280. doi: 10.1186/s12974-016-0718-0.
88. Jarius S, Ruprecht K, Kleiter I, et al. MOG-IgG in NMO and related disorders: a multicenter study of 50 patients. Part 1: Frequency, syndrome specificity, influence of disease activity, long-term course, association with AQP4-IgG, and origin. J Neuro inflamm. 2016; 13:279. doi:10.1186/s12974-016-0717-1
89. Peschl P, Bradl M, Höftberger R, et al. Myelin Oligodendrocyte Glycoprotein: Deciphering a Target in Inflammatory Demyelinating Diseases. Front Immunol. 2017; 8;8:529. doi: 10.3389/fimmu.2017.00529.
90. Spadaro M, Winklmeier S, Beltrán E, et al. Pathogenicity of human antibodies against myelin oligodendrocyte glycoprotein. Ann Neurol.2018;84(2):315-328. doi:10.1002/ana.25291.
91. Di Pauli F, Berger T. Myelin Oligodendrocyte Glycoprotein Antibody-Associated Disorders: Toward a New Spectrum of Inflammatory Demyelinating CNS Disorders? Front Immu nol. 2018;29;9:2753. doi: 10.3389/fimmu.2018.02753.
92. Ikeda T, Yamada K, Ogawa R, et al. The pathological features of MOG antibody-positive cerebral cortical encephalitis as a new spectrum associated with MOG antibodies: A case report. J Neurol Sci. 2018;15;392:113-115. doi:10.1016/j.jns. 2018.06.028.
93. Chen L, Chen C, Zhong X, et al. Different features between pediatric-onset and adult-onset patients who are seropositive for MOG-IgG: A multicenter study in South China. J Neuroimmunol. 2018;15;321:83-91. doi:10.1016/j.jneuroim.2018.05.01 4.
94. Chen JJ, Flanagan EP, Jitprapaikulsan J, et al. Myelin Oligodendrocyte Glycoprotein Antibody–Positive Optic Neuritis: Clinical Characteristics, Radiologic Clues, and Outcome. Am J Ophthalmol. 2018; 195:8-15. doi:10.1016/j.ajo. 2018. 07.020.
95. Jurynczyk M, Messina S, Woodhall MR, et al. Clinical presentation and prognosis in MOG-antibody disease: a UK study. Brain. 2017;1;140(12):3128-3138. doi:10.1093/brain/ awx276.
96. Chen C, Liu C, Fang L, et al. Different magnetic resonance imaging features between MOG antibody- and AQP4 antibody-mediated disease: A Chinese cohort study. J Neurol Sci. 2019;15;405:116430. doi:10.1016/j.jns.2019.116430.
97. Kitley J, Waters P, Woodhall M, et al. Neuromyelitis optica spectrum disorders with aqua porin-4 and myelin-oligodendrocyte glycoprotein antibodies: a comparative study. JAMA Neurol. 2014;71:276–83. doi;10.1001/jamaneurol.2013.5857
98. Hamid SHM, Whittam D, Saviour M, et al. Seizures and Encephalitis in Myelin Oligo dendrocyte Glycoprotein IgG Disease vs Aquaporin 4 IgG Disease. JAMA Neurol. 2018; 1;75(1):65-71. doi: 10.1001/jamaneurol.2017.3196.
99. Budhram A, Mirian A, Le C, et al. Unilateral cortical FLAIR-hyperintense Lesions in Anti-MOG-associated Encephalitis with Seizures (FLAMES): characterization of a distinct clinico-radiographic syndrome. J Neurol. 2019;266(10):2481-2487. doi: 10.1007/s00415-019-09440-8.
100. Tao R, Qin C, Chen M, et al. Unilateral cerebral cortical encephalitis with epilepsy: a possible special phenotype of MOG antibody-associated disorders. Int J Neu rosci. 2020;23: 1-6. doi: 10.1080/00207454.2020.1720676.
101. Liu H, Zhou H, Wang J, et al. The prevalence and prognostic value of myelin oligodend rocyte glycoprotein antibody in adult optic neuritis. J Neurol Sci. 2019;15;396:225-231. doi:10.1016/j.jns.2018.11.029.
102. Salama S, Khan M, Levy M, et al. Radiological characteristics of myelin oligodend rocyte glycoprotein antibody disease. Mult Scler Relat Disord. 2019; 29:15-22. doi: 101016/ j.msard.2019.01.021.
103. Baumann M, Grams A, Djurdjevic T, et al. MRI of the first event in pediatric acquired demyelinating syndromes with antibodies to myelin oligodendrocyte glycolprotein. J Neurol. 2018;265(4):845-855. doi: 10.1007/s00415-018-8781-3.
104. Jarius S, Paul F, Aktas O, et al. MOG encephalomyelitis: international recommend dations on diagnosis and antibody testing. J Neuroinflammation. 2018;3;15(1): 134. doi:10. 1186/s12974-018-1144-2.
105. Anilkumar AC, Foris LA, Tadi P. Acute Disseminated Encephalomyelitis (ADEM). StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019 Jan-.2019 Sep 28.
106. Gray MP, Gorelick MH. Acute Disseminated Encephalomyelitis. Pediatr Emerg Care. 2016;32(6):395-400. doi: 10.1097/PEC.0000000000000825.
107. Carreira J, Casella MI, Ascenção BB, et al. Acute disseminated encephalomyelitis, a rare post-malaria neurological complication: Case report and review of the literature. Travel Med Infect Dis. 2019 Mar-Apr; 28:81-85. doi:10.1016/j. tmaid. 2018.03.005.
108. Cole J, Evans E, Mwangi M, et al. Acute Disseminated Encephalomyelitis in Children: An Updated Review Based on Current Diagnostic Criteria. Pediatr Neurol. 2019;100:26-34. doi: 10.1016/j.pediatrneurol.2019.06.017.
109. Berzero G, Cortese A, Ravaglia S, et al. Diagnosis and therapy of acute disseminated encephalomyelitis and its variants. Expert Rev Neurother. 2016;16(1):83-101. doi:10.1586/ 14737175.2015.1126510.

110. Pohl D, Alper G, Van Haren K, et al. Acute disseminated encephalomyelitis: Updates on an inflammatory CNS syndrome. Neurology. 2016;30;87(9 Suppl 2):S38-45. doi:10.1212/ WNL. 0000000000002825.
111. Esposito S, Di Pietro GM, Madini B, et al. A spectrum of inflammation and demyelination in acute disseminated encephalomyelitis (ADEM) of children. Auto immun Rev. 2015;14(10):923-9. doi: 10.1016/j.autrev.2015.06.002.
112. Losavio FA, Mirabella M, Tricoli L, et al. A unique case of multiphasic ADEM or what else? Mult Scler Relat Disord. 2019;35:73-75. doi:10.1016/j.msard.2019. 07.012.
113. Scolding N. Acute disseminated encephalomyelitis and other inflammatory demyelinating variants. Handb Clin Neurol.2014;122:601-11.doi:10.1016/B978-0-444-52001-2.00026-1
114. Taieb G, Allou T, Labauge P. Therapeutic Approaches in CLIPPERS. Curr Treat Options Neurol. 2017;19(5):17. doi: 10.1007/s11940-017-0455-4.
115. Pittock SJ, Debruyne J, Krecke KN, et al. Chronic lymphocytic inflammation with pontine perivascular enhancement responsive to steroids (CLIPPERS). Brain. 2010;133(9): 2626-34. doi: 10.1093/brain/awq164.
116. Taieb G, Mulero P, Psimaras D, et al. CLIPPERS and its mimics: evaluation of new criteria for the diagnosis of CLIPPERS. J Neurol Neurosurg Psychiatry. 2019;90 (9):1027-1038. doi: 10.1136/jnnp-2018-318957.
117. Tobin WO, Guo Y, Krecke KN, et al. Diagnostic criteria for chronic lymphocytic inflammation with pontine perivascular enhancement responsive to steroids (CLIPPERS). Brain. 2017;1;140(9):2415-2425.doi:10.1093/brain/awx 200.
118. Zalewski NL, Tobin WO. CLIPPERS. Neurol Neurosci Rep. 2017;17(9):65. doi:10. 1007/s11910-017-0773-7.
119. Rössling R, Pehl D, Lingnau M, Prüss H. A case of CLIPPERS challenging the new diagnostic criteria. Brain. 2018 ;1;141(2):e12. doi: 10.1093/brain/awx335.
120. Joshi K, Golden T, Ghazala S. CLIPPERS: An Increasingly Recognized Chronic Inflammatory Central Nervous System Disorder. Am J Med. 2019;132(2):e35-e36. doi:10.10 16/j.amjmed.2018.09.034.
121. Algahtani H, Shirah B, Alassiri A, et al. Tumefactive demyelinating lesions: A compre hendsive review. Mult Scler Relat Disord. 2017;14:72-79. doi:10.1016 /j.msard.2017.04.003.
122. Frederick MC, Cameron MH. Tumefactive Demyelinating Lesions in Multiple Sclerosis and Associated Disorders. Curr Neurol Neurosci Rep. 2016;16(3):26. doi:10.1007/s11910-016-0626-9.
123. Sánchez P, Meca-Lallana V, Barbosa A, et al. Tumefactive demyelinating lesions of 15 patients: Clinico-radiological features, management and review of the literature. J Neurol Sci. 20171;5;381:32-38. doi:10.1016/j.jns.2017.08.005.
124. Abdoli M, Freedman MS. Neuro-oncology dilemma: Tumour or tumefactive demyelinating lesion. Mult Scler Relat Disord. 2015;4(6):555-66. doi: 10.1016/ j.msard.2015.07.013.
125. Hardy TA. Pseudotumoral demyelinating lesions: diagnostic approach and long-term outcome. Curr Opin Neurol. 2019;32(3):467-474. doi: 10.1097/WCO.000 000000 0000683.
126. Bevan CJ, Cree BA. Fulminant Demyelinating Diseases of the Central Nervous System. Semin Neurol. 2015;35(6):656-66. doi: 10.1055/s-0035-1564682.
127. Hardy TA, Chataway J. Tumefactive demyelination: an approach to diagnosis and management. J Neurol Neurosurg Psychiatry. 2013;84(9):1047-53. doi:10.1136 /jnnp-2012-304498
128. Sánchez P, Meca-Lallana V, Vivancos J. Tumefactive multiple sclerosis lesions asso ciated with fingolimod treatment: Report of 5 cases. Mult Scler Relat Disord. 2018;25:95-98. doi: 10.1016/j.msard.2018.07.001.
129. Hu W, Lucchinetti CF. The pathological spectrum of CNS inflammatory demyelinating diseases. Semin Immunopathol. 2009;31(4):439-53. doi:10.1007/s00 281-009-0178-z.
130. Ayrignac X, Carra-Dallière C, Labauge P. Atypical inflammatory demyelinating lesions and atypical multiple sclerosis.Revue Neurol;174(6),408–418.doi:10.1016/j.neurol.201803.00
131. Rovira Á, Auger C, Rovira A. Other noninfectious inflammatory disorders. Handb Clin Neurol. 2016;135:425-446. doi:10.1016/B978-0-444-53485-9.00021-0.
132. Altintas A, Petek B, Isik N, et al. Clinical and radiological characteristics of tumefactive demyelinating lesions: follow-up study. Mult Scler. 2012;18(10): 1448–53.
133. Patriarca L, Torlone S, Ferrari F, et al. Is size an essential criterion to define tumefactive plaque? MR features and clinical correlation in multiple sclerosis. Neuro radiol J. 2016;29(5): 384-9. doi:10.1177/1971400916665385.
134. Hardy TA , Tobin WO , Lucchinetti CF. Exploring the Overlap Between Multiple Sclerosis, Tumefactive Demyelination and Baló's Concentric Sclerosis. Mult Scler. 2016;22 (8)986-92. doi: 10.1177/1352458516641776
135. Purohit B, Ganewatte E, Schreiner B, et al. Balo's Concentric Sclerosis with Acute Presentation and Co-Existing Multiple Sclerosis-Typical Lesions on MRI. Case Rep Neurol. 2015; 28;7(1):44-50. doi: 10.1159/000380813.
136. Amini Harandi A, Esfandani A, Pakdaman H, et al. Balo's concentric sclerosis: an update and comprehensive literature review. Rev Neurosci. 2018;27;29(8):873-882. doi:10.1515 /revneu ro-2017-0096.
137. Nader Kawachi JA, Andrade Magdaleno Mde L, Peñaherrera CA, et al. Early diagnosis of Balo's concentric sclerosis by diffusion tensor tractography: a case report and literature review. Medwave. 2016;14;16(2):e6402. doi:10.5867/medwave.2016. 02.6402.
138. Gobbin F, Marangi A, Orlandi R, et al. A case of acute fulminant multiple sclerosis treated with alemtuzumab. Mult Scler Relat Disord. 2017;17:9-11. doi:10.1016/j.msard.2017. 06.007.
139. Capello E, Mancardi GL. Marburg type and Balò's concentric sclerosis: rare and acute variants of multiple sclerosis. Neurol Sci. 2004;25 Suppl 4:S361-3 J
140. Jarius S, Haas J, Paul F, et al. Wildemann Myelinoclastic diffuse sclerosis (Schilder's disease) is immunologically distinct from multiple sclerosis: results from retrospective analysis of 92 lumbar punctures. Neuroinflammation. 2019;28;16(1):51.doi:10.1186/s12974-019-1425-4.