

BÖLÜM 15

FASİYAL PARALİZİ VE AKUT KRANİYAL SİNİR HASTALIKLARINA YAKLAŞIM

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GİRİŞ

Kraniyal sinir disfonksiyonu; sinirin beyin sapındaki çıkış yerinden başlayarak tüm seyri boyunca gelişen herhangi bir hasara bağlı olarak ortaya çıkabilir.¹ Konjenital nedenler dışında; travma, kanama, iskemi, enfeksiyon, demiyelinizasyon, malignite etiyolojide rol oynar ya da idiyopatik olarak gözlenir.¹⁻³ Kranial nöropatiler izole olarak görülebileceği gibi, daha az sıklıkta multipl kraniyal nöropati şeklinde de karşımıza çıkabilir.² Bu bölümde başta fasiyal paralizi olmak üzere, akut kraniyal sinir tutulumları ve ayırıcı tanıları ele alınacaktır.

FASİYAL (VII. KRANİYAL SİNİR) PARALİZİ

Sir Charles Bell ilk olarak 1829 yılında, fasiyal sinir disfonksiyonuna bağlı unilateral fasiyal güçsüzlüğü tanımlamıştır.^{4,5} Fasiyal sinir, lezyonun konumuna bağlı olarak onu birden çok nörolojik bozukluğa duyarlı hale getiren karmaşık bir anatomiye ve işleve sahiptir.^{1,3} Başlıca motor görevi olan bir sinirdir, az sayıda duysal sinir lifi taşır. Motor ve duysal çekirdekleri ponsta yer alır. Sinir beyin sapını terk ettikten sonra petroz kemiğin içindeki fallop

kanalına girer. Kanalı geçip foramen stylomastoideum'dan çıkarak yüz kaslarını innerve eder. Dış kulak yolunda ufak bir alanın duyusunu ve dilin 2/3 ön bölümünün tat duyusunu sağlar. Submandibuler ve sublingual tükrük bezlerine parasempatik lifler taşır. Kornea refleksinin de efferent yolunu oluşturur.¹⁻³

Santral tip paralizide lezyonun karşı tarafındaki alt yüz kaslarında güçsüzlük gözlenir. Alın kaslarının korunması santral lezyonu düşündürür. Periferik tipte ise hasta lezyon tarafındaki gözünü kapatamaz, alnını kırıştırıramaz, kaşını kaldıramaz, nazolabiyal kıvrım kaybolur ve ağız sağlam tarafa doğru kayar. Stapedius sinirinden önceki fasiyal sinir lezyonları hiperakuziye neden olurken; lezyon bölgesine bağlı olarak, gözyaşında azalma ve dilin ön üçte ikilik bölümünde tat duyusu kaybı görülebilir.^{2,5,6}

Epidemiyoloji: Periferik fasiyal paralizinin yıllık görülme insidansı 10 yaş altında 2.7/100000 iken, 10-20 yaş arasında 10.1/100000 olarak bildirilmiştir.⁷ Çocuklarda erişkinlere göre 2-4 kat daha az sıklıkta görülmektedir.⁸ Diyabetik bireylerde de risk dört kat artmıştır.⁹ Eş zamanlı bilateral fasiyal paralizi görülme prevalansı ise %0.3-2'dir.¹⁰

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gözlenebilir. Trigeminal nevraltide olduğu gibi, glossofaringeal nevraltinin idiyopatik ve ikincil formları vardır. İkincil nedenler arasında demiyelinizan lezyonlar, serebellopontin köşe tümörü, peritonsiller apse, nörovasküler bası ve Eagle's sendromu (stiloid sürecin uzaması ve stilo-hiyoid ligamanın kalsifikasyonuna bağlı sinirin sıkışması) yer alır. Çocuklarda oldukça nadir görülür.¹⁷⁰

XI. KRANIYAL SİNİR (AKSESUAR SİNİR):

Sternokleidomastoideus ve trapezius kaslarını innerve eden, saf motor özelliği olan bir sinirdir. Bir kısım lifleri bulbustan, bir kısmı da servikal medulla spinalisin üst segmentlerindeki önboynuz hücrelerinden çıkar. Kranial kaviteyi foramen jugulare'den geçerek terk eder. Aksesuar sinirin felcinde omuzda düşme, ipsilateral kolun kaldırılmasında ve başın karşı tarafa çevrilmesinde güçsüzlük, skapulada kanatlaşma ortaya çıkar.^{1,2}

Tek taraflı akut/subakut tutulumunda özellikle aynı taraf foramen jugulare bölgesindeki tümöral nedenler akla gelmelidir. Burada IX. ve X. kranial sinirlerle yakın komşuluğu olması nedeni ile; sıklıkla bu üç sinire ait klinik belirtiler görülür. Bazen yakın komşuluğu olan XII. kranial sinirin felci de eklenebilir.^{1,168} Etiyoloji benzerdir.^{3,166,167} Bu sinirin akut hasarı özellikle lenf nodu biyopsisi/boyun diseksiyonu sırasında iatrojenik olarak veya künt/penetran boyun travmalarına bağlı olarak gelişir. Ek olarak; büyümüş lenf nodları, tümör basısı (spinal kord lezyonları, arka fossa tümörleri) ve radyoterapi sonucunda da bulgular ortaya çıkabilir. Motor nöron hastalığı, siringomyeli ve poliomiyelit de daha nadiren aksesuar sinir çekirdeklerini etkileyebilir.^{3,167,168}

XII. KRANIYAL SİNİR (HİPOGLOSSAL SİNİR)

Çekirdeği bulbusta olan, dilin motor siniridir. Kafatasından oksipital kemiğin kondili hizasında *canalis nervi hypoglossi*'den geçerek çıkar. Tek taraflı XII. kranial sinir felcinde dil

paralitik tarafa doğru sapar. Dilin aynı yarısında atrofi görülür İki taraflı lezyonlarında dilin dışarı çıkarılmadığı, hatta ağız tabanında hiç hareket etmediği dikkati çeker.^{1,2}

Hipoglossal sinirin tek taraflı felci seyrek görülür. Bulbusun siringomiyeli gibi hastalıklarında rastlanır.^{3,167} Hipoglossal sinirin izole veya komşu sinirlerle beraber tutulumu; travma, enflamasyon, karotis anevrizması, karotis arter diseksiyonu, lokal enfeksiyon, radyoterapi, cerrahi/dental girişim veya malignitelere bağlı olarak ortaya çıkabilir.^{2,3,171,172}

Travma öyküsü olan olgularda açıklanamayan boyun ağrısı, spazmodik tortikollis ve alt seviye kranial sinir tutulumu varlığında; oksipital kondil kırığını dışlamak için BT çekilmesi gerekebilir. Hipoglossal sinir hasarında kırık parçalarının yer değiştirmesine, ödeme ve hematoma bağlı olarak klinik bulgular gecikebilir, klinisyen bu açıdan uyanık olmalıdır.¹⁷³

KAYNAKLAR

1. Wilson-Pauwels L, J. Akesson E, Stewart PA, D. Spacey S. Cranial Nerves in Health and Disease. Wilson-Pauwels L, J. Akesson E, Stewart PA, D. Spacey S, eds. 2nd Edition. BC Decker Inc; 2002. p.1-225
2. Netter F. Netter's Cranial Nerve Collection . Netter F, ed. E-book. Elsevier; 2015. e.7-50
3. Tsementzis SA. Differential Diagnosis in Neurology and Neurosurgery: A Clinician's Pocket Guide. Tsementzis SA, ed. 2nd Edition. Thieme Publishers; 2019. p:160-196.
4. Roob G, Fazekas F, Hartung HP. Peripheral facial palsy: Etiology, diagnosis and treatment. Eur Neurol. 1999;41(1):3-9.
5. Shargorodsky J, Lin HW, Gopen Q. Facial nerve palsy in the pediatric population. Clin Pediatr (Phila). 2010;49(5):411-417.
6. Finsterer J. Management of peripheral facial nerve palsy. Eur Arch Oto-Rhino-Laryngology. 2008;265(7):743-752.
7. Katusic SK, Beard CM, Wiederholt WC, Bergstralh EJ, Kurland LT. Incidence, clinical features, and prognosis in Bell's palsy, Rochester, Minnesota, 1968-1982. Ann Neurol. 1986;20(5):622-627.
8. El-Hawrani AS, Eng CY, Ahmed SK, Clarke J, Dhiwakar M. General practitioners' referral pattern for children with acute facial paralysis. J Laryngol Otol. 2005;119(7):540-542.
9. Evans AK, Licameli G, Brietzke S, Whittemore K, Kenna M. Pediatric facial nerve paralysis: Patients, management and outcomes. Int J Pediatr Otorhino-

- laryngol. 2005;69(11):1521-1528.
10. Grundfast KM, Guarisco JL, Thomsen JR, Koch B. Diverse etiologies of facial paralysis in children. *Int J Pediatr Otorhinolaryngol.* 1990;19(3):223-239.
 11. Jackson CG, Von Doersten PG. The facial nerve: Current trends in diagnosis, treatment, and rehabilitation. *Med Clin North Am.* 1999;83(1):179-195.
 12. Stahl N, Ferit T. Recurrent bilateral peripheral facial palsy. *J Laryngol Otol.* 1989;103(1):117-119.
 13. Pavlou E, Gkampeta A, Arampatzi M. Facial nerve palsy in childhood. *Brain Dev.* 2011;33(8):644-650.
 14. Falco NA, Eriksson E. Facial nerve palsy in the newborn: Incidence and outcome. *Plast Reconstr Surg.* 1990;85(1):1-4.
 15. Picciolini O, Porro M, Cattaneo E, et al. Moebius syndrome: Clinical features, diagnosis, management and early intervention. *Ital J Pediatr.* 2016;42(1).
 16. Khine H, Mayers M, Avner JR, Fox A, Herold B, Goldman DL. Association between herpes simplex virus-1 infection and idiopathic unilateral facial paralysis in children and adolescents. *Pediatr Infect Dis J.* 2008;27(5):468-469.
 17. Furuta Y, Ohtani F, Aizawa H, Fukuda S, Kawabata H, Bergström T. Varicella-zoster virus reactivation is an important cause of acute peripheral facial paralysis in children. *Pediatr Infect Dis J.* 2005;24(2):97-101.
 18. Kansu L, Yilmaz I. Herpes zoster oticus (Ramsay Hunt syndrome) in children: Case report and literature review. *Int J Pediatr Otorhinolaryngol.* 2012;76(6):772-776.
 19. Christen HJ, Bartlau H, Hanefeld F, Eiffert H, Thomsen R. Peripheral facial palsy in childhood - Lyme borreliosis to be suspected unless proven otherwise. *Acta Paediatr Scand.* 1990;79(12):1219-1224.
 20. Markby DP. Lyme disease facial palsy: Differentiation from Bell's palsy. *Br Med J.* 1989;299(6699):605-606.
 21. Morgan M, Nathwani D. Facial Palsy and Infection: The Unfolding Story. *Clin Infect Dis.* 1992;14(1):263-271.
 22. Jenke AC, Stoek LM, Zillbauer M, Wirth S, Borusiak P. Facial palsy: Etiology, outcome and management in children. *Eur J Paediatr Neurol.* 2011;15(3):209-213.
 23. Papan C, Kremp L, Weiß C, Petzold A, Schrotten H, Tenenbaum T. Infectious causes of peripheral facial nerve palsy in children—a retrospective cohort study with long-term follow-up. *Eur J Clin Microbiol Infect Dis.* 2019;38(11):2177-2184.
 24. Jörg R, Milani GP, Simonetti GD, Bianchetti MG, Simonetti BG. Peripheral facial nerve palsy in severe systemic hypertension: A systematic review. *Am J Hypertens.* 2013;26(3):351-356.
 25. Krishnamurthy SN, Weinstock AL, Smith SH, Duffner PK. Facial palsy, an unusual presenting feature of childhood leukemia. *Pediatr Neurol.* 2002;27(1):68-70.
 26. Cornelius JF, Sauvaget E, Ba Huy PT, George B. Surgical treatment of facial nerve schwannomas. *Prog Neurol Surg.* 2008;21:119-130.
 27. Pawate S, Moses H, Sriram S. Presentations and outcomes of neurosarcoidosis: A study of 54 cases. *QJM.* 2009;102(7):449-460.
 28. Terada K, Niizuma T, Kosaka Y, Inoue M, Ogita S, Kataoka N. Bilateral facial nerve palsy associated with Epstein-Barr virus infection with a review of the literature. *Scand J Infect Dis.* 2004;36(1):75-77.
 29. Price T, Fife DG. Bilateral simultaneous facial nerve palsy. *J Laryngol Otol.* 2002;116(1):46-48.
 30. Willison HJ, Jacobs BC, van Doorn PA. Guillain-Barré syndrome. *Lancet.* 2016;388(10045):717-727.
 31. Dhawan SR, Saini AG, Singhi PD. Management strategies of Melkersson-Rosenthal syndrome: A review. *Int J Gen Med.* 2020;13:61-65.
 32. House JW, Brackmann DE. Facial nerve grading system. *Otolaryngol - Head Neck Surg.* 1985;93(2):146-147.
 33. Halperin JJ. Nervous System Lyme Disease. *Infect Dis Clin North Am.* 2015;29(2):241-253.
 34. Centers for Disease Control and Prevention (CDC). Lyme disease--United States, 2003-2005 - PubMed. *MMWR Morb Mortal Wkly Rep.* 2007;56(23):573-576. Accessed May 15, 2021. <https://pubmed.ncbi.nlm.nih.gov/17568368/>
 35. Halperin JJ. Lyme disease and the peripheral nervous system. *Muscle and Nerve.* 2003;28(2):133-143.
 36. Centers for Disease Control and Prevention (CDC). Recommendations for test performance and interpretation from the Second National Conference on Serologic Diagnosis of Lyme Disease - PubMed. *MMWR Morb Mortal Wkly Rep.* 1995;44(31):590-591. Accessed May 15, 2021. <https://pubmed.ncbi.nlm.nih.gov/7623762/>
 37. Wilske B. Epidemiology and diagnosis of Lyme borreliosis. *Ann Med.* 2005;37(8):568-579.
 38. Swartz JD, Harnsberger HR, Mukherji SK. The temporal bone: Contemporary diagnostic dilemmas. *Radiol Clin North Am.* 1998;36(5):819-853.
 39. Valls-Solé J. Electrodiagnostic studies of the facial nerve in peripheral facial palsy and hemifacial spasm. *Muscle and Nerve.* 2007;36(1):14-20.
 40. Wormser GP, Dattwyler RJ, Shapiro ED, et al. The clinical assessments treatment, and prevention of Lyme disease, human granulocytic anaplasmosis, and babesiosis: Clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis.* 2006;43(9):1089-1134.
 41. Halperin JJ, Shapiro ED, Logigian E, et al. Practice parameter: Treatment of nervous system Lyme disease (an evidence-based review): Report of the Quality Standards Subcommittee of the American Academy of Neurology. *Neurology.* 2007;69(1):91-102.
 42. Albisetti M, Schaer G, Good M, Boltshauser E, Nadal D. Diagnostic value of cerebrospinal fluid examination in children with peripheral facial palsy and suspected Lyme borreliosis. *Neurology.* 1997;49(3):817-824.
 43. Garro A, Nigrovic LE. Managing Peripheral Facial

- Palsy. *Ann Emerg Med.* 2018;71(5):618-624.
44. Gronseth GS, Paduga R. Evidence-based guideline update: Steroids and antivirals for Bell palsy: Report of the guideline development subcommittee of the American academy of neurology. *Neurology.* 2012;79(22):2209-2213.
 45. Salinas RA, Alvarez G, Daly F, Ferreira J. Corticosteroids for Bell's palsy (idiopathic facial paralysis). In: *Cochrane Database of Systematic Reviews.* John Wiley & Sons, Ltd; 2010.
 46. Arican P, Dunder NO, Gencpinar P, Cavusoglu D. Efficacy of Low-Dose Corticosteroid Therapy Versus High-Dose Corticosteroid Therapy in Bell's Palsy in Children. *J Child Neurol.* 2017;32(1):72-75.
 47. Karatoprak E, Yilmaz S. Prognostic Factors Associated With Recovery in Children With Bell's Palsy. *J Child Neurol.* 2019;34(14):891-896.
 48. Yoo HW, Yoon L, Kim HY, et al. Comparison of conservative therapy and steroid therapy for bell's palsy in children. *Korean J Pediatr.* 2018;61(10):332-337.
 49. Pitaro J, Waissbluth S, Daniel SJ. Do children with Bell's palsy benefit from steroid treatment? A systematic review. *Int J Pediatr Otorhinolaryngol.* 2012;76(7):921-926.
 50. Gagyor I, Madhok VB, Daly F, Sullivan F. Antiviral treatment for bell's palsy (Idiopathic facial paralysis). *Cochrane Database Syst Rev.* 2019;2019(9).
 51. Mehta RP. Surgical treatment of facial paralysis. *Clin Exp Otorhinolaryngol.* 2009;2(1):1-5.
 52. Peitersen E. Bell's palsy: the spontaneous course of 2,500 peripheral facial nerve palsies of different etiologies. *Otolaryngol Suppl.* 2002;549:4-30.
 53. Hanci F, Türay S, Bayraktar Z, Kabakuş N. Childhood Facial Palsy: Etiologic Factors and Clinical Findings, an Observational Retrospective Study. *J Child Neurol.* 2019;34(14):907-912.
 54. Slavkin HC. The significance of a human smile: Observations on Bell's palsy. *J Am Dent Assoc.* 1999;130(2):269-272.
 55. Psillas G, Antoniadis E, Ieridou F, Constantinidis J. Facial nerve palsy in children: A retrospective study of 124 cases. *J Paediatr Child Health.* 2019;55(3):299-304.
 56. Hamilos DL. Chronic rhinosinusitis patterns of illness. *Clin Allergy Immunol.* 2007;20:1-13.
 57. Konstantinidis I, Muelle A, Frasnelli J, et al. Post-infectious olfactory dysfunction exhibits a seasonal pattern. *Rhinology.* 2006;44(2):135-139.
 58. Yao L, Yi X, Pinto JM, et al. Olfactory cortex and Olfactory bulb volume alterations in patients with post-infectious Olfactory loss. *Brain Imaging Behav.* 2018;12(5):1355-1362. doi:10.1007/s11682-017-9807-7
 59. Tong JY, Wong A, Zhu D, Fastenberg JH, Tham T. The Prevalence of Olfactory and Gustatory Dysfunction in COVID-19 Patients: A Systematic Review and Meta-analysis. *Otolaryngol - Head Neck Surg (United States).* 2020;163(1):3-11.
 60. Agyeman AA, Chin KL, Landersdorfer CB, Liew D, Ofori-Asenso R. Smell and Taste Dysfunction in Patients With COVID-19: A Systematic Review and Meta-analysis. *Mayo Clin Proc.* 2020;95(8):1621-1631.
 61. Qiu C, Cui C, Hautefort C, et al. Olfactory and Gustatory Dysfunction as an Early Identifier of COVID-19 in Adults and Children: An International Multicenter Study. *Otolaryngol - Head Neck Surg (United States).* 2020;163(4):714-721.
 62. Mak PQ, Chung KS, Wong JSC, Shek CC, Kwan MYW. Anosmia and ageusia: Not an uncommon presentation of COVID-19 infection in children and adolescents. *Pediatr Infect Dis J.* 2020;39(8):E199-E200.
 63. Drareni K, Hummel T, Bensafi M, et al. Olfactory and Gustatory Function in Patients With Different Types of Maxillofacial Trauma. *Laryngoscope.* 2021;131(2):E331-E337.
 64. Genter MB, Doty RL. Toxic exposures and the senses of taste and smell. In: *Handbook of Clinical Neurology.* Vol 164. Elsevier B.V.; 2019:389-408.
 65. Nguyen-Khoa BA, Goehring EL, Vendiola RM, Pezzullo JC, Jones JK. Epidemiologic study of smell disturbance in 2 medical insurance claims populations. *Arch Otolaryngol - Head Neck Surg.* 2007;133(8):748-757.
 66. Stamou MI, Georgopoulos NA. Kallmann syndrome: phenotype and genotype of hypogonadotropic hypogonadism. *Metabolism.* 2018;86:124-134.
 67. Balcer LJ. Optic Neuritis. *N Engl J Med.* 2006;354(12):1273-1280. doi:10.1056/NEJMcp053247
 68. De La Cruz J, Kupersmith MJ. Clinical profile of simultaneous bilateral optic neuritis in adults. *Br J Ophthalmol.* 2006;90(5):551-554. doi:10.1136/bjo.2005.085399
 69. Bonhomme GR, Mitchell EB. Treatment of pediatric optic neuritis. *Curr Treat Options Neurol.* 2012;14(1):93-102.
 70. Tomsak RL. Vision loss. Bradley WG, Daroff RB, Fenichel GM, Marsden DC, eds: *Neurology in Clinical Practice.* 2nd Edition. Boston: Butterworth - Heinemann, 2000. p.187-192
 71. Beck RW, Sellers BJ, Cleary PA, et al. The Clinical Profile of Optic Neuritis: Experience of the Optic Neuritis Treatment Trial. *Arch Ophthalmol.* 1991;109(12):1673-1678.
 72. Collinge JE, Sprunger DT. Update in pediatric optic neuritis. *Curr Opin Ophthalmol.* 2013;24(5):448-452.
 73. Frohman EM, Frohman TC, Zee DS, McColl R, Galletta S. The neuro-ophthalmology of multiple sclerosis. *Lancet Neurol.* 2005;4(2):111-121.
 74. Rocca MA, Hickman SJ, Bö L, et al. Imaging the optic nerve in multiple sclerosis. *Mult Scler.* 2005;11(5):537-541.
 75. Martinez-Hernandez E, Sepulveda M, Rostásy K, et al. Antibodies to aquaporin 4, myelin-oligodendrocyte glycoprotein, and the glycine receptor $\alpha 1$ subunit in patients with isolated optic neuritis. *JAMA Neurol.* 2015;72(2):187-193.
 76. Golnik KC. Infectious optic neuropathy. *Semin Op-*

- hthalmol. 2002;17(1):11-17.
77. Theodoridou A, Settas L. Demyelination in rheumatic diseases. *Postgrad Med J*. 2008;84(989):127-132.
 78. Matsunaga M, Kodama Y, Maruyama S, et al. Guillain-Barré syndrome and optic neuritis after *Mycoplasma pneumoniae* infection. *Brain Dev*. 2018;40(5):439-442.
 79. Petzold A, Plant GT. Chronic relapsing inflammatory optic neuropathy: A systematic review of 122 cases reported. *J Neurol*. 2014;261(1):17-26.
 80. Arnold AC, Costa RMS, Dumitrascu OM. The spectrum of optic disc ischemia in patients younger than 50 years (an American Ophthalmological Society thesis) - *Trans Am Ophthalmol Soc* . 2013;(111):93-118.
 81. Fenichel G. *Clinical Pediatric Neurology - 5th Edition*. In: *Clinical Pediatric Neurology*. Elsevier Saunders; 2005:317-330.
 82. Baig MN, Lubow M, Immesoete P, Bergese SD, Hamdy EA, Mendel E. Vision loss after spine surgery: review of the literature and recommendations. *Neurosurg Focus*. 2007;23(5).
 83. Ramamoorthy J, Jain R, Trehan A, Saxena AK, Ahluwalia J. Orbital Mass in a Child with Acute Lymphoblastic Leukemia: A Case Report and Review of the Literature. *J Pediatr Hematol Oncol*. 2016;38(8):646-648.
 84. Chen TH, Farooq A V., Shah HA. Pediatric patient with T-cell lymphoblastic lymphoma and acute vision loss. *JAMA Ophthalmol*. 2018;136(2):213-214.
 85. Howell N. LHON and other optic nerve atrophies: the mitochondrial connection. *Dev Ophthalmol*. 2003;37:94-108.
 86. Kerrison JB. Optic neuropathies caused by toxins and adverse drug reactions. *Ophthalmol Clin North Am*. 2004;17(3):481-488.
 87. Simsek T, Simsek E, Ilhan B, Ozalp S, Sekercioglu B, Zilelioglu O. Traumatic optic nerve avulsion. *J Pediatr Ophthalmol Strabismus*. 2006;43(6):367-369.
 88. Yu-Wai-Man P, Griffiths PG. Steroids for traumatic optic neuropathy. *Cochrane Database Syst Rev*. 2013;2013(6).
 89. Jiang GL, Tucker SL, Guttenberger R, et al. Radiation-induced injury to the visual pathway. *Radiother Oncol*. 1994;30(1):17-25.
 90. Brecht S, Boda-Heggemann J, Budjan J, et al. Radiation-induced optic neuropathy after stereotactic and image guided intensity-modulated radiation therapy (IMRT). *Radiother Oncol*. 2019;134:166-177.
 91. Patt BS, Manning SC. Blindness Resulting from Orbital Complications of Sinusitis. *Otolaryngol Neck Surg*. 1991;104(6):789-795.
 92. Goytia VK, Giannoni CM, Edwards MS. Intraorbital and intracranial extension of sinusitis: Comparative morbidity. *J Pediatr*. 2011;158(3):486-491.
 93. Cannon ML, Antonio BL, McCloskey JJ, Hines MH, Tobin JR, Shetty AK. Cavernous sinus thrombosis complicating sinusitis. *Pediatr Crit Care Med*. 2004;5(1):86-88.
 94. Sivakumar S, Poulik J, Sivaswamy L. Monocular Blindness as Presentation Manifestation of Neuroblastoma. *The Neurohospitalist*. 2016;6(1):41.
 95. Friedman DI, Liu GT, Digre KB. Revised diagnostic criteria for the pseudotumor cerebri syndrome in adults and children. *Neurology*. 2013;81(13):1159-1165.
 96. Wall M, Kupersmith MJ, Kiebertz KD, et al. The idiopathic intracranial hypertension treatment trial clinical profile at baseline. *JAMA Neurol*. 2014;71(6):693-701.
 97. Quattrone A, Bono F, Fera F, Lavano A. Isolated unilateral abducens palsy in idiopathic intracranial hypertension without papilledema. *Eur J Neurol*. 2006;13(6):670-671.
 98. Kunte H, Schmidt F, Kronenberg G, et al. Olfactory dysfunction in patients with idiopathic intracranial hypertension. *Neurology*. 2013;81(4):379-382.
 99. Capobianco DJ, Brazis PW, Cheshire WP. Idiopathic intracranial hypertension and seventh nerve palsy. *Headache*. 1997;37(5):286-288.
 100. Arsava EM, Uluc K, Nurlu G, Kansu T. Electrophysiological evidence of trigeminal neuropathy in pseudotumor cerebri [5]. *J Neurol*. 2002;249(11):1601-1602.
 101. Malomo AO, Idowu OE, Shokunbi MT, Nwaorgu OGB, Oluleye TS. Non-operative management of benign intracranial hypertension presenting with complete visual loss and deafness. *Pediatr Neurosurg*. 2005;42(1):62-64.
 102. Schumacher-Feero LA, Yoo KW, Mendiola Solari F, Biglan AW. Third cranial nerve palsy in children. *Am J Ophthalmol*. 1999;128(2):216-221.
 103. Lyons CJ, Godoy F, Alqahtani E. Cranial nerve palsies in childhood. In: *Eye (Basingstoke)*. Vol 29. Nature Publishing Group; 2015:246-251.
 104. Raza HK, Chen H, Chansysouphanthong T, Cui G. The aetiologies of the unilateral oculomotor nerve palsy: a review of the literature. *Somatosens Mot Res*. 2018;35(3-4):229-239.
 105. Vaphiades MS, Roberson GH. Imaging of Oculomotor (Third) Cranial Nerve Palsy. *Neurol Clin*. 2017;35(1):101-113.
 106. Lee AG, Onan H, Brazis PW, Prager TC. An imaging guide to the evaluation of third cranial nerve palsies. *Strabismus*. 1999;7(3):153-168.
 107. White PM, Wardlaw JM, Easton V. Can noninvasive imaging accurately depict intracranial aneurysms? A systematic review. *Radiology*. 2000;217(2):361-370.
 108. Olesen J. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018;38(1):1-211.
 109. Kim JH, Hwang JM, Hwang YS, Kim KJ, Chae J. Childhood ocular myasthenia gravis. *Ophthalmology*. 2003;110(7):1458-1462.
 110. Spindle J, Tang SX, Davies B, et al. Pediatric Idiopathic Orbital Inflammation: Clinical Features of 30

- Cases. *Ophthalmol Plast Reconstr Surg*. 2016;32(4):270-274.
111. Olesen J, Bes A, Kunkel R, et al. The International Classification of Headache Disorders, 3rd edition (beta version). *Cephalalgia*. 2013;33(9):629-808.
 112. Tsirigotaki M, Ntoulis G, Lioumpas M, Voutoufianakis S, Vorgia P. Tolosa-Hunt Syndrome: Clinical Manifestations in Children. *Pediatr Neurol*. 2019;99:60-63.
 113. Al Othman B, Raabe J, Kini A, Lee AG. Update: The Miller Fisher variants of Guillain-Barré syndrome. *Curr Opin Ophthalmol*. 2019;30(6):462-466.
 114. Güneş AS, Genç HM, Yalçın EU, Yılmaz V, Direskeneli GS, Kara B. Acute ophthalmoparesis and persistent mydriasis: Expanding the clinical spectrum of anti-GQ1b positive cranial neuropathy in a 5.5-year-old girl. *Turk J Pediatr*. 2019;61(5):794-797.
 115. Banati M, Vachalova I, Vynogradova I, Heckmann JG. Isolierte Hirnnerven-Läsionen: Gangliosid-Autoantikörper als Hinweis auf Immunneuropathie. *Dtsch Medizinische Wochenschrift*. 2015;140(15):1154-1158.
 116. Morillon P, Bremner F. Trochlear nerve palsy. *Br J Hosp Med*. 2017;78(3):C38-C40.
 117. Dosunmu EO, Hatt SR, Leske DA, Hodge DO, Holmes JM. Incidence and Etiology of Presumed Fourth Cranial Nerve Palsy: A Population-based Study. *Am J Ophthalmol*. 2018;185:110-114.
 118. Hata M, Miyamoto K, Nakagawa S, Horii T, Yoshimura N. Horizontal deviation as diagnostic and prognostic values in isolated fourth nerve palsy. *Br J Ophthalmol*. 2013;97(2):180-183.
 119. Holmes JM, Mutyala S, Maus TL, Grill R, Hodge DO, Gray DT. Pediatric third, fourth, and sixth nerve palsies: A population-based study. *Am J Ophthalmol*. 1999;127(4):388-392.
 120. Botelho PJ, Giangiacomo JG. Autosomal-dominant inheritance of congenital superior oblique palsy. *Ophthalmology*. 1996;103(9):1508-1511.
 121. Dhaliwal A, West AL, Trobe JD, Musch DC. Third, fourth, and sixth cranial nerve palsies following closed head injury. *J Neuro-Ophthalmology*. 2006;26(1):4-10.
 122. Lee SH, Park SW, Kim BC, Kim MK, Cho KH, Kim JS. Isolated trochlear palsy due to midbrain stroke. *Clin Neurol Neurosurg*. 2010;112(1):68-71.
 123. Mantopoulos D, Hunter DG, Cestari DM. Isolated Bilateral Fourth Cranial Nerve Palsies as the Presenting Sign of Hydrocephalus. *Case Rep Ophthalmol*. 2011;2(2):211-214.
 124. Bathla G, Hegde AN. The trigeminal nerve: An illustrated review of its imaging anatomy and pathology. *Clin Radiol*. 2013;68(2):203-213.
 125. Truini A, Prosperini L, Calistri V, et al. A dual concurrent mechanism explains trigeminal neuralgia in patients with multiple sclerosis. *Neurology*. 2016;86(22):2094-2099.
 126. Kedar S, Jayagopal LN, Berger JR. Neurological and Ophthalmological Manifestations of Varicella Zoster Virus. *J Neuro-Ophthalmology*. 2019;39(2):220-231.
 127. Klazen Y, Van der Cruyssen F, Vranckx M, et al. Iatrogenic trigeminal post-traumatic neuropathy: a retrospective two-year cohort study. *Int J Oral Maxillofac Surg*. 2018;47(6):789-793.
 128. Goh BT, Poon CY, Peck RHL. The importance of routine magnetic resonance imaging in trigeminal neuralgia diagnosis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod*. 2001;92(4):424-429.
 129. Olesen J. Headache Classification Committee of the International Headache Society (IHS) The International Classification of Headache Disorders, 3rd edition. *Cephalalgia*. 2018;38(1):1-211.
 130. Brameli A, Kachko L, Eidlitz-Markus T. Trigeminal neuralgia in children and adolescents: Experience of a tertiary pediatric headache clinic. *Headache*. 2021;61(1):137-142.
 131. Elder C, Hainline C, Galetta SL, Balcer LJ, Rucker JC. Isolated Abducens Nerve Palsy: Update on Evaluation and Diagnosis. *Curr Neurol Neurosci Rep*. 2016;16(8).
 132. Chapman PR, Shah R, Cure JK, Bag AK. Petrous apex lesions: Pictorial review. *Am J Roentgenol*. 2011;196(3 SUPPL.).
 133. Robertson DM, Hines JD, Rucker CW. Acquired Sixth-Nerve Paresis in Children. *Arch Ophthalmol*. 1970;83(5):574-579.
 134. Lee MS, Galetta SL, Volpe NJ, Liu GT. Sixth nerve palsies in children. *Pediatr Neurol*. 1999;20(1):49-52.
 135. Alexandrakis G, Saunders RA. Duane retraction syndrome. *Ophthalmol Clin North Am*. 2001;14(3):407-417.
 136. Mahoney NR, Liu GT. Benign recurrent sixth abducens nerve palsies in children. *Arch Dis Child*. 2009;94(5):394-396.
 137. McLaren J, Cohen MS, El Saleeby CM. How well do we know Gradenigo? A comprehensive literature review and proposal for novel diagnostic categories of Gradenigo's syndrome. *Int J Pediatr Otorhinolaryngol*. 2020;132.
 138. Nair AG, Ambika S, Noronha VO, Gandhi RA. The diagnostic yield of neuroimaging in sixth nerve palsy - Sankara Nethralaya Abducens Palsy Study (SNAPS): Report 1. *Indian J Ophthalmol*. 2014;62(10):1008-1012.
 139. Park UC, Kim SJ, Hwang JM, Yu YS. Clinical features and natural history of acquired third, fourth, and sixth cranial nerve palsy. *Eye*. 2008;22(5):691-696.
 140. Landau ME, Barner KC. Vestibulocochlear nerve. *Semin Neurol*. 2009;29(1):66-73.
 141. Alford RL, Arnos KS, Fox M, et al. American college of medical genetics and genomics guideline for the clinical evaluation and etiologic diagnosis of hearing loss. *Genet Med*. 2014;16(4):347-355.
 142. Smith RJH, Bale JE, White KR. Sensorineural hearing loss in children. In: *Lancet*. Vol 365. Elsevier B.V.; 2005:879-890.
 143. Ohlms LA, Chen AY, Stewart MG, Franklin DJ. Es-

- establishing the etiology of childhood hearing loss. *Otolaryngol - Head Neck Surg.* 1999;120(2):159-163.
144. Carré F, Blanchard M, Achard S, Parodi M, Denoyelle F, Loundon N. Pediatric sudden sensorineural hearing loss: Experience in a pediatric ENT emergency care center. *Int J Pediatr Otorhinolaryngol.* 2020;135.
 145. Li FJ, Wang DY, Wang HY, et al. Clinical Study on 136 children with sudden sensorineural hearing loss. *Chin Med J (Engl).* 2016;129(8):946-952.
 146. Kuhn M, Heman-Ackah SE, Shaikh JA, Roehm PC. Sudden Sensorineural Hearing Loss: A Review of Diagnosis, Treatment, and Prognosis. *Trends Amplif.* 2011;15(3):91-105.
 147. Tarshish Y, Leschinski A, Kenna M. Pediatric sudden sensorineural hearing loss: Diagnosed causes and response to intervention. *Int J Pediatr Otorhinolaryngol.* 2013;77(4):553-559.
 148. Choung YH, Park K, Kim CH, Kim HJ, Kim K. Rare cases of Ménière's disease in children. *J Laryngol Otol.* 2006;120(4):343-352.
 149. Bosch AM, Abeling NGGM, Ijlst L, et al. Brown-Vialetto-Van Laere and Fazio Londe syndrome is associated with a riboflavin transporter defect mimicking mild MADD: A new inborn error of metabolism with potential treatment. *J Inherit Metab Dis.* 2011;34(1):159-164.
 150. Anand G, Hasan N, Jayapal S, et al. Early use of high-dose riboflavin in a case of Brown-Vialetto-Van Laere syndrome. *Dev Med Child Neurol.* 2012;54(2):187-189.
 151. Licameli G, Kenna MA. Is computed tomography (CT) or magnetic resonance imaging (MRI) more useful in the evaluation of pediatric sensorineural hearing loss? *Laryngoscope.* 2010;120(12):2358-2359.
 152. Na SY, Kim MG, Hong SM, Chung JH, Kang HM, Yeo SG. Comparison of sudden deafness in adults and children. *Clin Exp Otorhinolaryngol.* 2014;7(3):165-169.
 153. Chung JH, Cho SH, Jeong JH, Park CW, Lee SH. Multivariate analysis of prognostic factors for idiopathic sudden sensorineural hearing loss in children. *Laryngoscope.* 2015;125(9):2209-2215.
 154. Jahn K, Langhagen T, Heinen F. Vertigo and dizziness in children. *Curr Opin Neurol.* 2015;28(1):78-82.
 155. Joseph M, Furman L, Casselbrant M. Joseph M, Furman L, Casselbrant ML. Vertigo. In: Swainman KF, Ashwal S, Ferriero DM, Schor NF, editors. *Swaiman's Pediatric Neurology.* New York: Elsevier Saunders; 2012:118-126.
 156. Humphriss RL, Hall AJ. Dizziness in 10 year old children: An epidemiological study. *Int J Pediatr Otorhinolaryngol.* 2011;75(3):395-400.
 157. Gioacchini FM, Alicandri-Ciuffelli M, Kaleci S, Magliulo G, Re M. Prevalence and diagnosis of vestibular disorders in children: A review. *Int J Pediatr Otorhinolaryngol.* 2014;78(5):718-724.
 158. Çarman K, Yarar C. Çocuklarda vertigoya yaklaşımlar. *İKSST Derg.* 2016;8(1):10-14.
 159. Lee JD, Kim CH, Hong SM, et al. Prevalence of vestibular and balance disorders in children and adolescents according to age: A multi-center study. *Int J Pediatr Otorhinolaryngol.* 2017;94:36-39.
 160. McCaslin DL, Jacobson GP, Gruenwald JM. The predominant forms of vertigo in children and their associated findings on balance function testing. *Otolaryngol Clin North Am.* 2011;44(2):291-307.
 161. Balatsouras DG, Kaberos A, Assimakopoulos D, Katotomichelakis M, Economou NC, Korres SG. Etiology of vertigo in children. *Int J Pediatr Otorhinolaryngol.* 2007;71(3):487-494.
 162. Taborelli G, Melagrana A, D'Agostino R, Tarantino V, Calevo MG. Vestibular neuronitis in children: Study of medium and long term follow-up. *Int J Pediatr Otorhinolaryngol.* 2000;54(2-3):117-121.
 163. Batu ED, Anlar B, Topçu M, Turanlı G, Aysun S. Vertigo in childhood: A retrospective series of 100 children. *Eur J Paediatr Neurol.* 2015;19(2):226-232.
 164. Baloh RW. Differentiating between peripheral and central causes of vertigo. In: *Otolaryngology - Head and Neck Surgery.* Vol 119. SAGE Publications Inc.; 1998:55-59.
 165. Ferreira J, Franco A, Teodoro T, Coelho M, Albuquerque L. Vernet syndrome resulting from varicella zoster virus infection—a very rare clinical presentation of a common viral infection. *J Neurovirol.* 2018;24(3):379-381.
 166. Ong CK, Chong VFH. The glossopharyngeal, vagus and spinal accessory nerves. *Eur J Radiol.* 2010;74(2):359-367.
 167. M Das J, Al Khalili Y. Jugular Foramen Syndrome (Vernet). StatPearls Publishing; 2020. Accessed May 22, 2021. <http://www.ncbi.nlm.nih.gov/pubmed/31751061>
 168. Larson TC, Aulino JM, Laine FJ. Imaging of the glossopharyngeal, vagus, and accessory nerves. *Semin Ultrasound CT MRI.* 2002;23(3):238-255.
 169. Ray S, Jain P. Acute bulbar palsy plus syndrome: A rare variant of Guillain-Barre syndrome. *J Pediatr Neurosci.* 2016;11(4):322-323.
 170. Shereen R, Gardner B, Altafulla J, et al. Pediatric glossopharyngeal neuralgia: a comprehensive review. *Child's Nerv Syst.* 2019;35(3):395-402.
 171. Stino AM, Smith BE, Temkit M, Reddy SN. Hypoglossal nerve palsy: 245 cases. *Muscle and Nerve.* 2016;54(6):1050-1054.
 172. Guarnizo A, Glikstein R, Torres C. Imaging Features of isolated hypoglossal nerve palsy. *J Neuroradiol.* 2020;47(2):136-150.
 173. Sitaram CD, Nishanth A, Bhat SN, Kundanagar RS. Delayed hypoglossal nerve palsy following occipital condyle fracture. *BMJ Case Rep.* 2019;12(12):e232645.