Heterotopias cerebrales pdf

Neuronal deficits, not involving motor neurons, in mice lacking BDNF and/or NT4. Conover JC, Erickson JT, Katz DM, Bianchi LM, Poueymirou WT, McClain J, Pan L, Helgren M, Ip NY, Boland P, et al. Conover JC, et al. Nature. 1995 May 18;375(6528):235-8. doi: 10.1038/375235a0. Nature. 1995. PMID: 7746324 The grey matter heterotopias are a relatively common group of conditions characterized by interruption of normal neuronal migration from near the ventricle to the cortex, thus resulting in "normal neurons in abnormal locations" 2. They are a subset of disorders of cortical formation 3-4.Grey matter heterotopias can be divided macroscopically into:These are discussed in detail separately. The rest of this article concerns itself with a general overview.Although heterogeneous, some forms are X-linked as such there is an overall predilection.Patients most commonly present with focal seizures in the second decade of life. Additionally, and depending on the extent, children may demonstrate developmental delay or intellectual disability 3. Grey matter heterotopias are seen with greater frequency in patients with other congenital central nervous system anomalies, and these associated anomalies will also affect symptomatology. Associated anomalies include 3,10:Grey matter heterotopias are believed to be due to interruption of the normal migration of neurons from the periventricular telencephalic germinal matrix to the cortex and may be due to either genetic abnormalities or infection/trauma.Neuroblasts proliferate in the germinal matrix between 7 and 8 weeks of gestation. Migration takes place from 8 to 26 weeks gestation and is maximal between 8 and 16 weeks 10.As is the case with most imaging of the central nervous system, MRI is the modality of choice in assessing heterotopic grey matter due to its as yet unsurpassed contrast resolution.Antenatal and neonatal ultrasound has difficulty identifying heterotopic grey matter as the echogenicity of such grey matter is not sufficiently different from the surrounding white matter 6.Grey matter heterotopia has a slightly higher density than the surrounding white matter and can thus be seen if sufficiently large. Thin or small regions may not be apparent.On MRI the heterotopic tissue follows grey matter on all sequences. Their margins are often indistinct. Careful examination of the remainder of the brain is necessary to identify associated anomalies.In general MR spectroscopy demonstrates a decrease in NAA/Cr ratio in the heterotopic grey matter compared to normal control subjects. It is important to note that comparing the spectrographic trace to the 'normal-appearing contralateral side' is not necessarily valid as control as metabolic abnormalities in patients with malformations of cortical development may be widespread 7.fMRI (BOLD imaging) can demonstrate activation in heterotopic nodules and these can match epileptogenic EEG discharges 8.classification system for malformations of cortical development 1. Barkovich A & Kuzniecky R. Gray Matter Heterotopia. Neurology. 2000;55(11):1603-8. doi:10.1212/wnl.55.11.1603 - Pubmed2. Barkovich A & Kjos B. Gray Matter Heterotopias: MR Characteristics and Correlation with Developmental and Neurologic Manifestations. Radiology. 1992;182(2):493-9. doi:10.1148/radiology.182.2.1732969 - Pubmed3. Abdel Razek A, Kandell A, Elsorogy L, Elmongy A, Basett A. Disorders of Cortical Formation: MR Imaging Features. AJNR Am J Neuroradiol. 2009;30(1):4-11. doi:10.3174/ajnr.A1223 - Pubmed4. Barkovich A, Kuzniecky R, Jackson G, Guerrini R, Dobyns W. A Developmental and Genetic Classification for Malformations of Cortical Development. Neurology. 2005;65(12):1873-87. doi:10.1212/01.wnl.0000183747.05269.2d - Pubmed5. Barkovich A. Morphologic Characteristics of Subcortical Heterotopia: MR Imaging Study. AJNR Am J Neuroradiol. 2000;21(2):290-5. PMC7975345 - Pubmed6. G. M. Baxter, P. L. P. Allan, P. Morley. Clinical Diagnostic Ultrasound. (1999) ISBN: 9780632037445 - Google Books7. Leite C, Lucato L, Sato J, Valente K, Otaduy M. Multivoxel Proton MR Spectroscopy in Malformations of Cortical Development. AJNR Am J Neuroradiol. 2007;28(6):1071-5; discussion 1076. doi:10.3174/ajnr.A0511 - Pubmed8. Kobayashi E, Bagshaw A, Grova C, Gotman J, Dubeau F. Grey Matter Heterotopia: What EEG-FMRI Can Tell Us About Epileptogenicity of Neuronal Migration Disorders. Brain. 2006;129(Pt 2):366-74. doi:10.1093/brain/awh710 - Pubmed9. Mitchell L, Simon E, Filly R, Barkovich A. Antenatal Diagnosis of Subependymal Heterotopia. AJNR Am J Neuroradiol. 2000;21(2):296-300. PMC7975340 - Pubmed [1] Abdel Razek, A.A.K., Kandell, A.Y., Elsorogy, L.G., Elmongy, A. and Basett, A.A. (2009) Disorders of Cortical Formation: MR Imaging Features. American Journal of Neuroradiology 30(1):4-11 (PMID: 18687750) [2] Barkovich, J., Jackson Jr., D.E., and Boyer, R.S. (1989) Band Heterotopias: A Newly Recognized Neuronal Migration Anomaly. Radiology 171:455-458 (PMID: 2468173) [3] D'Agostino, M.D., Bernasconi, A., Das, S., Bastos, A., Valerio, R.M., Palmini, A., Costa da Costa, J., Scheffer, I.E., Berkovic S., Guerrini, R., Dravet C.,Ono, J., Gigli, G., Federico, A., Booth, F., Bernardi, B., Volpi, L., Tassinari and Guggenheim, C.A (2002) Subcortical Band Heterotopia (SBH) In Males: Clinical, Imaging And Genetic Findings In Comparison With Females. Brain (125)11: 2507–2522 (PMID: 12390976) [4] Donkol, R.H., Moghazy, K.M. and Abolenin, A. (2012) Assessment Of Gray Matter Heterotopia By Magnetic Resonance Imaging. World J Radiol 4(3):90-96 (PMID: 22468189) [5] Keraliya, A., Naphade P. and Murphy D. (2016) Band Heterotopia: An Unusual Cause of Seizures. Irish Medical Journal 109(5):411 (PMID: 27685882) [6] Pilz, D.T., Kuc, J., Matsumoto, N., Bodurtha, J., Bernadi, B., Tassinari, C.A., Dobyns, W.B. and Ledbetter, D.H. (1999) Subcortical Band Heterotopia in Rare Affected Males Can be Caused by Missense Mutations in DCX (XLIS) or LIS1. Human Molecular Genetics 8(9):1757-1760 (PMID: 10441340) The imaging findings of Heterotopia Within Cerebral White Matter are presented along with the relevant clinical history. Fig. 20.1Fig. 20.2Fig. 20.3Fig. 20.4Fig. 20.5Fig. 20.6Fig. 20.7Fig. 20.8Fig. 20.9Fig. 20.10 URL of this page: Periventricular heterotopia is a condition in which nerve cells (neurons) do not migrate properly during the early development of the fetal brain, from about the 6th week to the 24th week of pregnancy. Heterotopia means "out of place." In normal brain development, neurons form in the periventricular region, located around fluid-filled cavities (ventricles) near the center of the brain. The neurons then migrate outward to form the exterior of the brain (cerebral cortex) in six onion-like layers. In periventricular heterotopia, some neurons fail to migrate to their proper position and form clumps around the ventricles.Periventricular heterotopia usually becomes evident when seizures first appear, often during the teenage years. The nodules around the ventricles are then typically discovered when magnetic resonance imaging (MRI) studies are done. Affected individuals usually have normal intelligence, although some have mild intellectual disability. Difficulty with reading and spelling (dyslexia) and movement problems have been reported in some people with periventricular heterotopia.Less commonly, individuals with periventricular heterotopia may have other features including more severe brain malformations, small head size (microcephaly), developmental delays, recurrent infections, blood vessel abnormalities, stomach problems, or lung disease. Periventricular heterotopia may also occur in association with other conditions such as Ehlers-Danlos syndrome, which results in extremely flexible joints, skin that stretches easily, and fragile blood vessels. Periventricular heterotopia is a rare condition. Its incidence is unknown. In most cases, periventricular heterotopia is caused by mutations in the FLNA gene. This gene provides instructions for producing the protein filamin A, which helps build the network of protein filaments (cytoskeleton) that gives structure to cells and allows them to change shape and move. Certain mutations in the FLNA gene result in an impaired FLNA protein that cannot perform this function, disrupting the normal migration patterns of neurons during brain development.Periventricular heterotopia can also be caused by mutations in the ARFGEF2 gene. This gene provides instructions for making a protein that is involved in the movement (trafficking) of small sac-like structures (vesicles) within the cell. Vesicle trafficking is important in controlling the migration of neurons during the development of the brain. Mutations in the ARFGEF2 gene may disrupt this function, which could result in the abnormal neuronal migration seen in periventricular heterotopia.Researchers believe that mutations in the FLNA or ARFGEF2 genes may also result in weakening of the attachments (adhesion) between cells that form the lining of the ventricles. A weakened ventricular lining could allow some neurons to form clumps around the ventricles while others migrate normally to the exterior of the brain, as seen in periventricular heterotopia.In a few cases, periventricular heterotopia has been associated with abnormalities in chromosome 5. In each case, the affected individual had extra genetic material caused by an abnormal duplication of part of this chromosome. It is not known how this duplicated genetic material results in the signs and symptoms of periventricular heterotopia. Periventricular heterotopia can have different inheritance patterns. When this condition is caused by mutations in the FLNA gene, it is inherited in an X-linked dominant pattern.A condition is considered X-linked if the mutated gene that causes the disorder is located on the X chromosome, one of the two sex chromosomes. The inheritance is dominant if one copy of the altered gene in each cell is sufficient to cause the condition. A characteristic of X-linked inheritance is that fathers cannot pass X-linked traits to their sons.In X-linked periventricular heterotopia, males experience much more severe symptoms of the disorder than females, and in most cases die before birth.In about 50 percent of cases of X-linked periventricular heterotopia, an affected person inherits the mutation from a mother who is also affected. Other cases may result from new mutations in the gene. These cases occur in people with no history of the disorder in their family.Periventricular heterotopia caused by mutations in the ARFGEF2 gene is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. Individuals with periventricular heterotopia in whom ARFGEF2 gene mutations have been identified have a severe form of the disorder, including microcephaly, severe developmental delay, and seizures beginning in infancy. Most often, the parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but do not show signs and symptoms of the condition. Familial nodular heterotopia Periventricular nodular heterotopia Broix L, Jagline H, Ivanova E, Schmucker S, Drouot N, Clayton-Smith J, Pagnamenta AT, Metcalfe KA, Isidor B, Louvier UW, Poduri A, Taylor JC, Tilly P, Poirier K, Saillour Y, Lebrun N, Stemmelen T, Rudolf G, Muraca G, Saintpierre B, Elmorjani A; Deciphering Developmental Disorders study, Moïse M, Weirauch NB, Guerrini R, Boland A, Olaso R, Masson C, Tripathy R, Keays D, Beldjord C, Nguyen L, Godin J, Kini U, Nischké P, Deleuze JF, Bahi-Buisson N, Sumara I, Hinckelmann MV, Chelly J. Mutations in the HECT domain of NEDD4L lead to AKT-mTOR pathway deregulation and cause periventricular nodular heterotopia. Nat Genet. 2016 Nov;48(11):1349-1358. doi: 10.1038/ng.3676. Epub 2016 Oct 3. Citation on PubMed or Free article on PubMed Central Guerrini R, Parrini E. Neuronal migration disorders. Neurobiol Dis. 2010 May;38(2):154-66. doi: 10.1016/j.nbd.2009.02.008. Epub 2009 Feb 23. Review. Citation on PubMed Liu JS. Molecular genetics of neuronal migration disorders. Curr Neurol Neurosci Rep. 2011 Apr;11(2):171-8. doi: 10.1007/s11910-010-0176-5. Review. Citation on PubMed LoTurco JJ, Bai J. The multipolar stage and disruptions in neuronal migration. Trends Neurosci. 2006 Jul;29(7):407-413. doi: 10.1016/j.tins.2006.05.006. Epub 2006 May 19. Review. Citation on PubMed Lu J, Tiao G, Folkerth R, Hecht J, Walsh C, Sheen V. Overlapping expression of ARFGEF2 and Filamin A in the neuroependymal lining of the lateral ventricles: insights into the cause of periventricular heterotopia. J Comp Neurol. 2006 Jan 20;494(3):476-84. Citation on PubMed Parrini E, Ramazzotti A, Dobyns WB, Mei D, Moro F, Veggiotti P, Marini C, Brilstra EH, Dalla Bernardina B, Goodwin L, Bodell A, Jones MC, Nangeroni M, Palmeri S, Said E, Sander JW, Striano P, Takahashi Y, Van Maldergem L, Leonardi G, Wright M, Walsh CA, Guerrini R. Periventricular heterotopia: phenotypic heterogeneity and correlation with Filamin A mutations. Brain. 2006 Jul;129(Pt 7):1892-906. Epub 2006 May 9. Citation on PubMed Sheen VL. Periventricular Heterotopia: Shuttling of Proteins through Vesicles and Actin in Cortical Development and Disease. Scientifica (Cairo). 2012;2012:480129. doi: 10.6064/2012/480129. Epub 2012 Oct 22. Review. Citation on PubMed or Free article on PubMed Central Spalice A, Parisi P, Nicita F, Pizzardi G, Del Balzo F, Iannetti P. Neuronal migration disorders: clinical, neuroradiologic and genetics aspects. Acta Paediatr. 2009 Mar;98(3):421-33. doi: 10.1111/j.1651-2227.2008.01160.x. Epub 2008 Dec 16. Review. Citation on PubMed Verrotti A, Spalice A, Ursitti F, Papetti L, Mariani R, Castronovo A, Mastrangelo M, Iannetti P. New trends in neuronal migration disorders. Eur J Paediatr Neurol. 2010 Jan;14(1):1-12. doi: 10.1016/j.ejpn.2009.01.005. Epub 2009 Mar 4. Review. Citation on PubMed Learn how to cite this page