International Journal of Allied Medical Sciences and Clinical Research (IJAMSCR)

IJAMSCR |Volume 1 | Issue 1 | Oct - 2013
www.ijamscr.com

Review article

Pachygyria: A neurological migration disorder

Rajesh Kumar.D[1]*, Ramu.V.V[2], Ram Sarath Kumar.B[3], Sumalatha.N[3] Murali.G[4], Prathap Reddy.P[5]

[1*]Department of Pharmacology, Siddhartha Institute of Pharmaceutical Sciences, Narsaraopet. Guntur (Dt).

[2]Nova College of Pharmacy, Vijayawada, A.P.

[3]Sims College of Pharmacy, Guntur, A.P.

[4]Sai Aditya Institute of pharmaceutical Sciences, Vijayawada, A.P.

[5]Siddhartha Institute of Pharmaceutical Sciences Vijayawada, A.P.

ABSTRACT

Pachygyria is a neuronal migration disorder characterized by thick convulsions on cerebral cortex and brain has few gyri. It leads to mental retardation. It is also known as Macrogyria. It is considered as a rare disease. The disease involves mutations in a number of genes. Mainly the symptoms are seizures and delayed development. MRI and CT scan are used for diagnosis. It can be treated by anti epileptic medication and various therapies like speech therapy and occupational therapy. G therapy is effective for the treatment. So far, there is no specific drug treatment.

KEY WORDS: Pachygyria, Macrogyria, Mutations, Seizures and G therapy.

INTRODUCTION

Isolated Pachygyria means that only one part of the brain is affected, extensive Pachygyria signifies that most of the brain is absent of gyri. The condition is closely related to lissencephaly, a term used to describe the condition of a brain that is completely smooth. Though in most cases it is genetic, sometimes pachygyria can be caused by infection early in a pregnancy. During fetal development, neurons must migrate from their place of origin deep inside the brain to their proper neural circuits near the brain's surface. Neuronal migration, which can occur as early as the second month of gestation, is controlled by chemical signals. Neurons that settle outside of their designated locations cause the brain to develop structural abnormalities. "A neuronal migration disorder is a disorder where the neurons do not migrate as they should", Paciorkowski said. "Because the neurons are not showing up on the surface of the brain, the surface of the brain is not as developed as it should be and has fewer gyri. This is a shared finding of all neuronal migration disorders."The extent to which a person with Pachygyria is affected depends on how absent the brain is from convulsions. Paciorkowski said that in most cases, people with pachygyria have moderate to severe developmental delay and epilepsy. Proper brain function depends on the correct positioning of neurons as a result of directed migration during development. Humans with lissencephaly/ Pachygyria are mentally retarded and frequently suffer from epilepsy. The disease involves mutations in a number of genes.

*** Corresponding author: Rajesh Kumar.D.**
E-mail address: rajeshpharma89@gmail.com

Rajesh Kumar.D, et al / Int. J. of Allied Med. Sci. and Clin. Research Vol-1(1) 2013 [31-33]

Definition

According to Seattle Children's pediatric neurologist Alexander Paciorkowski, Pachygyria is a neuronal migration disorder that results in too few gyri, or folds in the brain. It is a Condition in which the convolutions of the cerebral cortex are abnormally large, there are fewer sulci than normal and in some cases the amount of brain substance is somewhat increased.

Synonym: Macrogyria, Incomplete lissencephaly.

History

Pachygyria is a Greek word; (from the Greek "pachy" meaning "thick" or "fat" gyri) is a congenital malformation of the cerebral hemisphere. It results in unusually thick convolutions of the cerebral cortex. It is a less variant of lissencephaly (smooth brain) characterized by short, broad gyri with lack of sulcation. Pachygyria is a condition identified by a type of cortical genetic malformation.

Symptoms

- Seizures
- Developmental delay
- Mental problems
- Poor muscle tone (hypotonia)
- Poor muscle control
- Feeding/swallowing difficulties
- Small head size (microcephaly)
- Swelling in the extremities.

Pathophysiology

Pachygyria is due to neuronal migration defects, usually genetic or toxic in origin. Mainly R264C alpha-tubulin mutation causes pachygyria, a neuronal migration disease.

Another mechanism involves the architectonic features of abnormal cerebral cortex in a brain with lissencephaly and pachygyria suggest than neuronal migration was interrupted by cortical and subcortical laminar necrosis in the fourth fetal month. The severest cortical abnormality lies in the distal perfusion fields of the major cerebral arteries, while the normal areas are located in the proximal perfusion fields. These architectonic and topographic features suggest that intra-uterine hypoxia or perfusion failure may be a pathogenetic mechanism leading to lissencephaly and pachygyria. Pachygyria, lissencephaly (smooth brain), and polymicrogyria (multiple small gyri) are all the results of abnormal cell migration. The abnormal migration is typically associated with a disorganized cellular architecture, failure to form six layers of cortical neurons (a four-layer cortex is common), and functional problems.

Causes

There may be various possible causes of Pachygyria, includes

- Viral infections,
- Insufficient blood flow to the brain during fetal development or
- Certain genetic factors.

Epedimiology

Pachygyria is classified as a rare condition .Neurologists and geneticists consider rare conditions to arise in less than 1 in 2,000 people.

Diagnosis

Mostly the application of MRI and CT scan is applied to understand the condition of the patients and accordingly the treatment schedule is planned in correlation of the symptoms and major obstruction. Magnetic Resonance Imaging (MRI) is commonly used for diagnosis. It provides a high contrast image for better delineation of white and gray matter. Pachygyria shows on an MRI as thickened cerebral cortices with few and large gyri and incomplete development of Sylvian fissures. While computed tomography (CT) provides higher spatial resolution imaging of the brain, cerebral cortex malformations are more easily visualized.

Treatment

The treatment of Pachygyria mainly depends upon assistive technology speech therapy, behavioral therapy, occupational therapy, counseling, symptomatic drug therapy for convulsions, involuntary movements etc. and surgery for corrective measures. However these therapies and cognitive interventions may vary from one patient to another depending on level of complications and age. So far there is no drug therapy available to improve motor functions and higher cortical functions of the brain.

Pachygyria is basically a structural defect; therefore specific treatment of this pachygyria is still not available especially of associated seizure problem. Treatment of pachygyria may include the treatment of gastronomy, the process involves the insertion of a feeding tube in order to reduce possible malnutrition and repeated spell of aspiration pneumonia in the affected child. However, gastronomical intervention may not be the treatment of the prime disease but it is a kind of

Rajesh Kumar.D, , et al / Int. J. of Allied Med. Sci. and Clin. Research Vol-1(1) 2013 [31-33]

back- up for the immunity of the concerned child in order to make the health system comparatively robust and scale of immunity can be improved.

G Therapy has shown positive effects in a few cases in the treatment of pachygyria. Changes in patients after G Therapy treatment for Pachygyria include improvements in muscle tone, understanding, speech and other global improvements. It is a pioneering homeopathic medical combination treatment for variety of neurological conditions. The complete name of this form of treatment is **"**Homeo-Biochemic Formulation Therapy**"**, it was formulated by Dr Gunvant Oswal from the University of Pune in India. G-Therapy is part of the Ayurvedic medicine, it is essentially based on a remedy whose substance is extracted from plants. The remedy is diluted according to the homeopathic process which states that the higher a substance is diluted the greater its effects will be and added to biochemical salts or body salts. The final product is available in form of tablets and like homeopathic remedies; the tablets have to be taken sublingually (under the tongue). The mechanism of action of G Therapy can be explained according to the principles of homeopathy, where in biochemical remedies reactivate the chemical changes for neurotransmission, while the homeopathic remedies act as catalyst to speed up the improvement.

REFERENCES

[1] Francis F., Meyer G., Fallet-Bianco C., Moreno S., Kappeler C., Socorro A. C., Tuy F. P., Beldjord C., Chelly J. Human disorders of cortical development: from past to present. Eur. J. Neurosci. 2006;23:877–893. [PubMed]

[2] Gao Y., Thomas J. O., Chow R. L., Lee G. H., Cowan N. J. A cytoplasmic chaperonin that catalyzes beta-actin folding. Cell. 1992;69:1043–1050.[PubMed]

[3] Gdalyahu A., Ghosh I., Levy T., Sapir T., Sapoznik S., Fishler Y., Azoulai D., Reiner O. DCX, a new mediator of the JNK pathway. EMBO J.2004;23:823–832. [PMC free article] [PubMed]

[4] Gleeson J. G., et al. Doublecortin, a brain-specific gene mutated in human X-linked lissencephaly and double cortex syndrome, encodes a putative signaling protein. Cell. 1998; 92:63–72. [PubMed]

[5] Grishchuk E. L., McIntosh J. R. Sto1p, a fission yeast protein similar to tubulin folding cofactor E, plays an essential role in mitotic microtubule assembly. J. Cell Sci. 1999;112:1979–1988. [PubMed]

[6] Poirier, Gray, and Escourolle. Manual of Basic Neuropathology 1990. pp 200.

[7] Cotran, Kumar, and Robbins. Pathologic Basis of Disease 5th edition. pp 1302.

[8] Barkovich AJ, Kjos BO. Gray matter heterotopias: MR characteristics and correlation with developmental and neurologic manifestations. Radiology. 1992;182 (2): 493-Radiology (abstract) - Pubmed citation

[9] Abdel razek AA, Kandell AY, Elsorogy LG et-al. Disorders of cortical formation: MR imaging features. AJNR Am J Neuroradiol. 2009;30 (1): 4-11. doi:10.3174/ajnr.A1223 -Pubmed citation

[10] Grainger & Allison's Diagnostic Radiology: A Textbook of Medical Imaging, 4th ed. 2001.

[11] Rarediseases.info.nih.gov.

[12] www.diseaseinfosearch.org.

[13] en.wikipedia.org.

****