MECP2-Related Severe Neonatal Encephalopathy

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MECP2-related severe neonatal encephalopathy is a neurological disorder that primarily affects males and causes brain dysfunction (encephalopathy).

Keywords: genetic conditions

1. Introduction

Affected males have a small head size (microcephaly), poor muscle tone (hypotonia) in infancy, movement disorders, rigidity, and seizures. Infants with this condition appear normal at birth but then develop severe encephalopathy within the first week of life. These babies experience poor feeding, leading to a failure to gain weight and grow at the expected rate (failure to thrive). Individuals with *MECP2*-related severe neonatal encephalopathy have severe to profound intellectual disability. Affected males have breathing problems, with some having episodes in which breathing slows or stops for short periods (apnea). As the child ages, the apnea episodes tend to last longer, especially during sleep, and affected babies often require use of a machine to help regulate their breathing (mechanical ventilation). Most males with *MECP2*-related severe neonatal encephalopathy do not live past the age of 2 because of respiratory failure.

MECP2-related severe neonatal encephalopathy is the most severe condition in a spectrum of disorders with the same genetic cause. The mildest is PPM-X syndrome, followed by *MECP2* duplication syndrome, then Rett syndrome (which exclusively affects females), and finally *MECP2*-related severe neonatal encephalopathy.

2. Frequency

MECP2-related severe neonatal encephalopathy is likely a rare condition. Twenty to 30 affected males have been reported in the scientific literature.

3. Causes

Mutations in the *MECP2* gene cause *MECP2*-related severe neonatal encephalopathy. The *MECP2* gene provides instructions for making a protein called MeCP2 that is critical for normal brain function. Researchers believe that this protein has several functions, including regulating other genes in the brain by switching them on or off as they are needed. The MeCP2 protein likely plays a role in maintaining the normal function of nerve cells, which ensures that connections (synapses) between these cells form properly. The MeCP2 protein may also control the production of different versions of certain proteins in nerve cells. Although mutations in the *MECP2* gene disrupt the normal function of nerve cells, it is unclear how these mutations lead to the signs and symptoms of *MECP2*-related severe neonatal encephalopathy.

3.1. The gene associated with MECP2-related severe neonatal encephalopathy

- MECP2

4. Inheritance

MECP2-related severe neonatal encephalopathy has an X-linked pattern of inheritance. 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 in each cell. In males, who have only one X chromosome, a mutation in the only copy of the gene in each cell is sufficient to cause the condition. In females, who have two X chromosomes, a mutation in one of the two copies of the gene in each cell is usually sufficient to cause the condition. However, females with a mutation in the *MECP2* gene do not develop *MECP2*-related severe neonatal encephalopathy. Instead, they typically develop Rett syndrome, which has signs and symptoms that include intellectual disability, seizures, and movement problems.

In some cases, males with *MECP2*-related severe neonatal encephalopathy inherit the mutation from a mother with mild neurological problems or from a mother with no features related to the mutation. A characteristic of X-linked inheritance is that fathers cannot pass X-linked traits to their sons. Other cases result from new mutations in the gene and occur in people with no history of the disorder in their family.

5. Other Names for This Condition

- methyl-cytosine phosphate guanine binding protein 2 related severe neonatal encephalopathy
- severe congenital encephalopathy due to MECP2 mutation
- severe neonatal encephalopathy due to MECP2 mutations

References

1. Bianciardi L, Fichera M, Failla P, Di Marco C, Grozeva D, Mencarelli MA, SpigaO, Mari F, Meloni I, Raymond L, Renieri A, Romano C, Ariani F. MECP2 missensemutations outside the canonical MBD and TRD domains in males with intellectualdisability. J Hum Genet. 2016 Feb;61(2):95-101. doi: 10.1038/jhg.2015.118.
2. Francke U. Mechanisms of disease: neurogenetics of MeCP2 deficiency. Nat Clin Pract Neurol. 2006 Apr;2(4):212-21. Review.
3. Gonzales ML, LaSalle JM. The role of MeCP2 in brain development andneurodevelopmental disorders. Curr Psychiatry Rep. 2010 Apr;12(2):127-34. doi:10.1007/s11920-010-0097-7. Review.
4. Kankirawatana P, Leonard H, Ellaway C, Scurlock J, Mansour A, Makris CM, Dure LS 4th, Friez M, Lane J, Kiraly-Borri C, Fabian V, Davis M, Jackson J,Christodoulou J, Kaufmann WE, Ravine D, Percy AK. Early progressiveencephalopathy in boys and MECP2 mutations. Neurology. 2006 Jul 11;67(1):164-6.
5. Schüle B, Armstrong DD, Vogel H, Oviedo A, Francke U. Severe congenitalencephalopathy caused by MECP2 null mutations in males: central hypoxia andreduced neuronal dendritic structure. Clin Genet. 2008 Aug;74(2):116-26. doi:10.1111/j.1399-0004.2008.01005.x.
6. Villard L. MECP2 mutations in males. J Med Genet. 2007 Jul;44(7):417-23.