Neuronal Migration Disorders

Neuronal migration disorders (NMD's) are a group of disorders. They are caused by the abnormal migration of nerve cells (neurons). This happens early in the development of the fetal nervous system. Neuronal migration is the process in which neurons move from their place of origin to their permanent location. This process can be disrupted. Then the result is a structurally abnormal brain. This involves:

- Cerebral hemispheres.
- Cerebellum.
- Brainstem.
- Hippocampus.

NMD's may include:

- Schizencephaly.
- Porencephaly.
- Lissencephaly.
- Agyria.
- Macrogyria.
- Pachygyria.
- Microgyria.
- Micropolygyria.
- Neuronal heterotopias (including band heterotopia).
- Agenesis of the corpus callosum.
- Agenesis of the cranial nerves.

These disorders may be linked to other abnormalities, including other NMD's.

CAUSES

NMD's may be caused by genetic or biochemical abnormalities (e.g., Zellweger syndrome). Several genetic abnormalities have been found. This includes a deletion of a gene on chromosome 17p13.3. That causes lissencephaly, and a mutation of a gene on chromosome Xq22.3. This causes lissencephaly in males and band heterotopia in females. The Reelin gene on chromosome 7q22 causes:

- Microcephaly.
- Lissencephaly.
- Cerebellar.
- Small cerebellum (*hypoplasia*).
- Lymphedema.

Abnormalities on a number of other genes have been identified as the cause. But their roles are not well-understood.

SYMPTOMS

Symptoms vary. They may include:

- Reduced muscle tone (*hypotonia*).
- Seizures.
- Developmental delay.
- Mental retardation.
- Growth failure.
- Feeding difficulties.
- Puffiness of the extremities. It is due to poor fluid drainage. (*lymphedema*).
- Microcephaly.
- Motor dysfunction.

NMD's may be associated with early death. Most individuals with NMD's have a normal physical appearance. But there may be variations in facial appearance. These can be noticed by trained professionals.

TREATMENT

Treatment is symptomatic. It may include:

- Anti-seizure medication.
- Special or supplemental education consisting of:
  - Physical, occupational, and speech therapies.

The outcome for individuals with NMD's varies. It depends on:

- The specific disorder.
- The degree of neurological deficit and brain malformation.

RESEARCH BEING DONE

The NINDS conducts and supports a wide range of studies. These explore the complex systems of normal brain development, including neuronal migration. The knowledge gained from these studies provides the foundation for understanding how this process can go awry. It offers hope for new means to treat and prevent NMD's.

Research is continually being done to learn more about this problem.

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