Central nervous system embryology

Brain and the spinal cord develop from the embryonic ectoderm alongside other structures like the skin. Their development begins as early as the 3rd and 4th weeks of embryonic life, starting with the process of neurulation, which is the development of the neural tube. The neural tube closes spontaneously rostrally and caudally. In the fifth to sixth week, the first appearance of the brain, the prosencephalic development ensues. The primitive brain is comprised of the prosencephalon, mesencephalon, and rhombencephalon. The prosencephalon divides further into telencephalon and diencephalon through a series of developmental stages, namely: formation, cleavage, and development of the midline.

Any form of developmental alteration in these leads to the malformation of the developing brain.

Developmental malformation of the brain and spinal cord leads to a variety of diseases for microcephaly to spinal bifida. The stages of development of the cerebral cortex encompass three main steps. Defects in one or a combination of these steps form the basis of classification of abnormality of the cortical development as: The proliferation of neural cells: an abnormally high proliferation of the neural cells can lead to megalencephaly, and decreased proliferation leads to microcephaly. Neuronal migration: the outcome of partial neuronal migration is heterotopia and lissencephaly, excessive neuronal migration causes as cobblestone malformation. Postmigrational cortical organization and connectivity: irregular events in the post-migrational cortical organization causes focal cortical dysplasias and polymicrogyria.

The defects of neural tube fusion consist of encephalocele, meningocele, myelomeningocele, and spina bifida occulta.

Specifically, alterations in the closure of the rostral neural tube result in conditions like anencephaly or encephalocele. Myelomeningocele occurs from the incomplete causal fusion of the neural tube. Anencephaly typically occurs before the 24th day of life, while encephalocele and myelomeningocele occur about the 26th day of life [1)].

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Rewane A, Munakomi S. Embryology, Central Nervous System, Malformations. 2020 Jan 6. StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from http://www.ncbi.nlm.nih.gov/books/NBK553171/ PubMed PMID: 31985964.