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Epilepsy in the Developing Brain: Neurobiology and Consequences

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Editorial

Epilepsy is a condition in which the balance of excitability and inhibition in the brain is skewed toward uncontrolled excitability. There is now considerable evidence that the pathophysiology and consequences of seizures varies significantly between the immature and mature brain. The sequential development and expression of important signalling pathways are linked to both the greater excitability of the immature brain compared to the mature brain and the distinct pathologic implications of seizures. Although the growing brain is less sensitive to seizure-induced cell loss than the mature brain, convulsions in the developing brain can cause irreversible changes in neuronal connections. Understanding the particular processes of seizure genesis and propagation in the juvenile brain will be necessary for developing novel techniques to treat and prevent the effects of seizures in children. Seizures are more common in children than in adults, with the highest rates occurring during the first year of life. Although there are many similarities in the illness across age groups, it has become obvious that there are substantial changes in the pathophysiology and effects of epilepsy between young children and adults. This article will go over partial seizures, which are the most common seizure type in both children and adults. Recurrent short seizures and status epilepticus will be discussed in terms of their causes and implications. Generalized seizures, such as absences, have various mechanisms that will not be discussed here. Snead's review piece is recommended to interested readers. Hyper-excitability of CNS neurons is a key physiologic hallmark of epileptic seizures. A seizure starts when a large number of neurons depolarize and generate action potentials at the same time. The behavioural changes that ensue are determined by the location of the initial event as well as the propagation pattern of the discharge. Because of a developmental mismatch between the delicate balance of excitement and inhibition, the immature brain is more prone to seizures than the mature brain. Early depolarizing effects of GABA paired with a delay in postsynaptic inhibitory systems result in a scenario where seizures are easily triggered. It is now known that prolonged or recurrent seizure activity can permanently affect the way the juvenile brain develops and produces connections through activity-dependent pathways. These changes in normal neural connectivity can have long-term effects on seizure susceptibility, learning and memory, and the likelihood of seizure-induced damage in the future.

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