NEUROPSYCHOLOGY TODAY

Monthly Newsletter published by Dr. Danov Neuropsychologist, P.C.
July 2009 Issue – Child Neuropsychology: Seizure Disorders

Seizures: Definition and Types

Over 300,000 US school children through the age of 15 have seizure disorders. Seizures result from pathoanatomical abnormalities in the brain. Normally, nerve cells generate electrochemical impulses that act on other neurons, glands, and muscles to produce thoughts, feelings, and actions. During seizures, clusters of nerve cells signal abnormally, sometimes firing as many as 500 times a second, which is much faster than normal. This abnormal activity may cause strange sensations, emotions, and behaviors, including convulsions, muscle spasms, and loss of consciousness.[1,2]

After having two or more epileptic seizures, the person is considered to have epilepsy. Severe seizures may cause brain injury and/or disrupt the wiring in part(s) of the brain, when the wiring does not restore to the pre-seizure form. This may result in neurological and neurodevelopmental problems and the related impairments, which may or may not be associated with progressive worsening of symptoms and cognitive problems [1,2] (see "Neuropsychological

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Inside:

Neuropsychological Functioning in Children with Seizures

Due to the brain injury caused by seizures, children with seizure disorders may develop long-term cognitive deficits. Even though epileptic children usually have average intelligence (IQ) scores (albeit typically falling towards the lower end of the average range), some specific cognitive deficits may surface, depending on the type and location of the seizure.[2]

For instance, left temporal lobe seizures lead to verbal memory problems, while right temporal seizures do not. Seizures in the frontal lobes may result in executive dysfunction, which relates to poor planning, judgment, and allocation skills. Generalized seizures are related to deficits in sustained attention and concentration, while focal seizures are associated with poor selective attention.[2]

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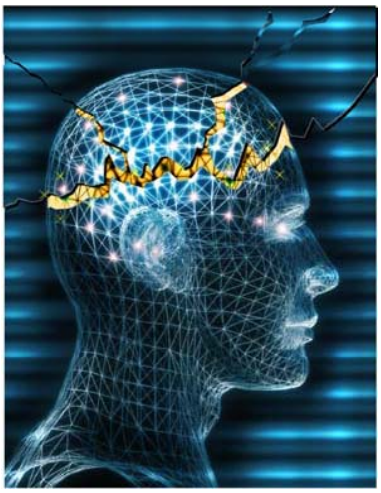

Causes of Epilepsy

Seizures develop due to an abnormal brain wiring or imbalance of neurotransmitters, or a combination of both. Epilepsy is frequently found in children with autism, cerebral palsy, and other disorders. Importantly, seizures may follow a head injury or another problem, when the brain attempts to repair itself causing abnormal nerve connections.[1,2]

Genetic abnormalities have been among the most important factors linked to epilepsy. Many types of epilepsy run in families, and some types have been traced to a specific gene. Seizures may also result from prenatal problems, including maternal infections, poor nutrition, and oxygen deficiencies; and exposure to toxins such as lead and carbon monoxide.[2]

Age at onset is another factor, as the brain's susceptibility to seizures, or seizure threshold, varies throughout lifespan. The seizure threshold is high at birth, dramatically decreasing by the age 2 years. Then, the seizure threshold increases through childhood, adolescence, and adulthood, indicating progressively lower susceptibility to seizures.[2]

Overall, the cumulative effects of the genetic and environmental factors, in addition to age at onset are believed to be at the root of seizure disorders. When the cause of seizures is unknown, the seizures are referred to as idiopathic epilepsy.[2]

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Functioning in Children with Seizures" for information on how seizures may impair neurocognitive functions).

There are different types of seizures that may occur in certain locations of the brain or throughout the brain. Focal seizures, also called partial seizures, occur in a specific part of the brain. Simple focal seizures are characterized by unusual sensations or feelings without loss of consciousness. Complex focal seizures are associated with loss of consciousness or alteration in consciousness, sometimes accompanied by automatisms (repetitious behaviors such as blinks, twitches, walking in circles, etc.). Complex focal seizures are sometimes precluded by unusual sensations referred to as auras.[1]

Generalized seizures are caused by abnormal neuronal activity in both hemispheres, and may result in loss of consciousness, falls, or massive muscle spasms. Notably, some people have seizures that begin as focal but then spread to the entire brain.There are many kinds of generalized seizures. Some examples are:

- Absence seizures (staring into space and/or having jerking or twitching muscles)
- Tonic seizures (stiffening of muscles in the back, legs, or arms)
- Clonic seizures (repeated jerking movements of muscles on both sides of the body)
- Tonic-clonic seizures (mixture of symptoms: muscle stiffening, jerks or twitches, loss of consciousness)
- Myoclonic seizures (jerks or twitches of the upper body, arms, or legs)
- Atonic seizures (loss of normal muscle tone: may cause falling down or dropping one's head) [1,2]

Benign epilepsy syndromes do not seem to impair cognitive functions or development, are easily treated, and stop spontaneously. Febrile seizures sometimes occur in children during an illness with high fever, but are not epileptic in nature. Some forms of epilepsy tend to go into remission or stop entirely during adolescence, while other forms persist into adulthood. Overall, younger age at onset and poor response to treatment have been linked to more aggressive disease course.[1,2]

Seizure Disorders and Neuropsychological Testing

Since, in some cases, seizures result in residual neurocognitive problems, neuropsychological (NP) evaluation may provide useful information regarding the cognitive functions that have been affected by seizure activity and the extent of neurocognitive impairment. Additionally, follow-up NP exams can help monitor the progression of seizures-related cognitive deficits.[5]

NP testing is also utilized for children who may benefit from surgical intervention. Not only NP exam allows comparing the patients' level of baseline vs. post-surgical cognitive functioning, but it may also help localize the seizures in specific parts of the brain.[5]

Finally, children may be referred for a NP exam in order to assess the side effects of antiepileptic drugs (AEDs) and help the child's parents and treating specialist with their choice of treatment(s). While AEDs are successful in alleviating some types of seizures, they may also lead to significant cognitive and behavioral problems. The NP functions typically affected by the AEDs are psychomotor speed, vigilance, memory, and mood. On the other hand, a reduction in seizures due to AEDs may improve the child's cognitive functioning, and NP exam can provide objective evidence of improvement.[6]

NP exam involves comprehensive non-intrusive testing of various NP functions by a licensed doctorate-level neuropsychologist. In addition to the aforementioned uses for children with seizure disorders, the results of NP exam shed light on how the identified neurocognitive deficits may affect the child's academic performance and behavior. The neuropsychologist makes recommendations with regard to what can be done to address the resulting problems.

About Dr. Rimma Danov

Dr. Rimma Danov received her PhD in clinical psychology from Adelphi University in NY. She completed her internship in clinical psychology and neuropsychology at Harvard Medical School and postdoctoral fellowship in pediatric and adult neuropsychology in a private clinic affiliated with NJ Medical School and the Robert Wood Johnson Medical Center. She is an assistant clinical professor at NYU School of Medicine, Dept. of Neurology, Penn State University, Dept. of Kinesiology, and Adelphi University, Derner Institute. In the past, she worked as a neuropsychologist for the NJ Devils Hockey Team and was engaged as a co-investigator of TBI in boxers at the NYS Athletic Commission.

Presently, Dr. Danov maintains a full-time private neuropsychology practice where she examines neurocognitive and neurobehavioral functioning of patients 2-90 years of age with various neurological and neuropsychiatric disorders, such as MS, TBI, CVA, Parkinson's, Alzheimer's, dementia, ADHD, PDD, Autism, learning disabilities, seizures, and many others, using state-of-the-art neuropsychological techniques. Dr.Danov also conducts and publishes research in these areas. She is available for medico-legal consultations and testimony.

("Neuropsychological Functioning in Children with Seizures," continued from page 1)

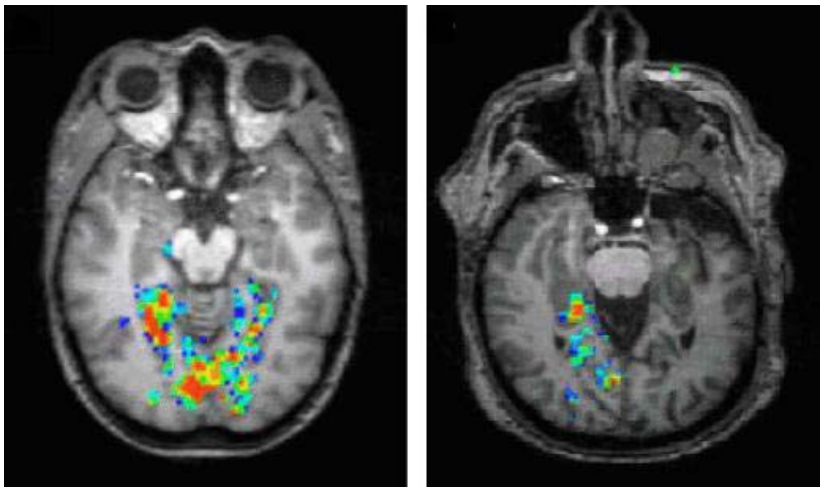
Additionally, seizures of left temporal lobe origin are associated with greater verbal deficits, while seizures occurring in the right temporal lobe may result in greater nonverbal deficits. Due to the proximity to the hippocampus, which is linked to consolidation of memories, focal temporal lobe seizures may lead to deficits in learning and memory. Even though the image below is based on adult participants, it provides a good example of the difference between brain activation in a healthy individual and a person with epilepsy.[2]

In the light of a wide range of residual neurocognitive deficits, it is not surprising that children with seizure disorders are at a greater risk of having learning difficulties and being diagnosed with a learning disorder. In fact, it has been estimated that over 50% of epileptic children suffer from learning disabilities, which impact their academic performance, even at the earliest disease stages.[3] Subsequently, children with epilepsy have been found to have high rates of not graduating from high school, unemployment, and low-prestige occupations later in life.[4]

Cognitive Rehabilitation and Seizure Disorders

Neurocognitive deficits in both adults and children with epilepsy are known to impact their daily functioning.[2,5] Since cognitive treatment has been effective in alleviating cognitive deficits in other neurological conditions, such as traumatic brain injury, stroke, and multiple sclerosis, research that incorporates cognitive rehabilitation (CR) for patients with epilepsy is emerging in the literature.

So far, to our knowledge, the studies investigating the effectiveness of CR for individuals with seizure disorders only focused on adults. For instance, among the reports that provided support for CR in epilepsy is a study by Engelberts and colleagues[7] who utilized the Retraining Method (retraining of impaired cognitive functions) for one group of epileptic patients and the Compensation Method (teaching compensatory strategies) for another group. The results revealed that both methods were effective in improving the patients' objective and subjective NP functioning and quality of life, as compared to the wait-list control group.[7] It is likely that once supported by additional research, the promising results from this and other studies on CR in epilepsy will instigate research on the efficacy of CR for children and adolescents with seizure disorders.



The image above includes brain MRI of a healthy individual (left) and a patient with right medial temporal lobe epilepsy (right) during a picture encoding task. The patient with epilepsy performed worse on the task, which is reflected in his/her lower level of hippocampal activation.

Works cited:

1. NIH, NINDS (2009). *Seizures and epilepsy: Hope through research.* http://www.ninds.nih.gov/disorders/epilepsy/detail_epilepsy.htm
2. Ho-Turner & Bennett (1999). Seizure disorders. [In Goldstein & Reynolds, *Handbook of Neurodevelopmental & Genetic Disorders in Children*, 499-524].
3. Camfield & Camfield (2007). Long-term social outcomes for children with epilepsy. *Epilepsia* 48, 3-5.
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Image credits:

1. Background image (pp.1,4): Jeff Johnson Biolog. & Medic. Visuals
2. Head image (p.1): from www.robarts.ca/epilepsy/
3. MRI (p.3): from Szaflarski et al. (2004). High resolution functional MRI at 3T in healthy…*Epilepsy & Behavior* 5, 244-252.

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Next Issues- Aug'09: Dementia; Sept'09: ADHD

We take the following insurance plans:

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Americhoice	Magnacare
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First Health	UHC/Oxford
HealthNet	Workers' Comp
Health Plus	1199

Case dependent:

Affinity	GHI HMO
Atlantis	Health First

Each insurance carrier determines the medical necessity of every requested neuropsychological exam differently. Our billing staff determines whether the exam will be covered by the insurance before the exam begins and works very hard to obtain an authorization, if needed. If you have questions about a plan that is not listed here, contact our office to find out whether we can obtain an authorization or have recently joined that plan.

Languages

We are very much open to diverse cultures in this practice and value the quality of a bilingual neuropsychological exam performed in the patient's native language. Dr. Danov is a native Russian speaker. Her current clinical staff include native ***Russian***, ***Spanish*** and ***Hebrew*** speakers.

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