EPILEPSY

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"SEIZURE"

The very word seizure is enough to strike fear into the heart of almost any human being. In the eyes of the onlooker it is often associated with a mental or physical weakness and even demonic possession. Great names as Caesar, Napoleon, and Mohammed are people that have been victims of this convulsion disorder. Sometimes associated with death throes, convulsions, seizures, and epileptic fits are very misunderstood and scary to the uninformed.

The seizure mechanism

A seizure in its basic form is a lower level brain function reflex or mechanism. Every "normal" brain has this mechanism seated below the cortical functions of the brain. This reflex mechanism can be induced in a healthy brain by depriving it of oxygen or by "tuning down" cerebullar functions with drugs or even a fever can trigger a seizure. In the injured brain, seizures are sometimes a signal of low oxygen levels to the brain or the injured portion of the brain. The brain controls its own blood flow from higher levels of function that make thousands of minute adjustments to the blood vessel sizes every few seconds. For instance, while opening and closing your hand the brain will dilate the vessels to the portion of the brain involved with that process to allow more blood flow to that area. When the brain senses low oxygen it can reflexly send control of the brain and the circulation of the brain to lower levels of brain function that dilate all of the blood vessels thereby assisting the blood and oxygen flow to the brain. *A seizure could be considered a primary defense mode of self-preservation.*

Sometimes portions of the brain receive de-myelinating injuries that cause leakage and shorts of brain signals. These shorts are picked up by the cerebellum as unusual activity and the cerebellum then tunes these signals down to prevent the seizure from happening. When the cerebellum fails to bring these unusual and even threatening signals under control then the reticular system of the brain shuts down the cortical function and sends control of the body to lower levels of the brain that also contain the seizure mechanism.

Use of anticonvulsants

One of the reasons epilepsy is equated to mental retardation and deformities is from the side effects of anti-seizure medications prescribed to the seizure patient. (One of the very side effects of the most popular medications Dilantin, is that it can cause seizure disorders)! Anticonvulsants are toxic to the body and cause severe side effects like: dulling of the mind, staggering and falling, unusual hair growth, enlarged gums, interference with normal endocrine and metabolic functions, liver damage, brain damage, immune system damage, and even death to name a few. Often these side effects are unjustly attributed to the brain injury and seizure disorder of the individual when in actuality they are directly caused by the potent barbiturates prescribed for the medical purposes of controlling convulsions. An editorial titled "Epilepsia"(1) sums up the use of anticonvulsants by stating. "Some patients suffer more from chronic toxicity- due to anticonvulsants- than from their seizure disorder and the modern management of epilepsy requires constant vigilance to strike a balance between the burdens of the disease and the complications of the therapy."

Anticonvulsants like Phenobarbital are synthetic chemicals called barbiturates. They are used primarily to help induce sleep and are central nervous system depressants thereby causing the dullness associated with seizure disorders.

In the article titled "Epilepsia" (1) "emphasized that the widespread misconception that 70 to 80% of epileptics are controlled by drugs does not agree with the published facts. A persistent finding in the studies reviewed is that the longer the duration of the follow-up, the worse the prognosis in terms of seizure control. An overall picture that emerged from the literature is that complete seizure control is achieved for 2 years in 30 to 37% of patients; but that figure falls to approximately 20% at 5 years and 10% at 10 years." This review of epilepsy is a consistent one, which surprisingly has not altered throughout this century, despite the use of drugs and advances of medical science.

(1) Epilepsia (17:xiii-xv, 1976)

Epilepsy

What Is Epilepsy?

Epilepsy is not a single disorder, but covers a wide spectrum of problems characterized by unprovoked, recurring seizures that disrupt normal neurologic functions. Epileptic seizures occur when a group of nerve cells in the brain (neurons) become activated simultaneously, emitting sudden and excessive bursts of electrical energy. This hyperactivity of neurons can occur in various locations in the brain and, depending on the location, have a wide range of effects on the sufferer, from brief moments of confusion to minor spasms to loss of consciousness. The nerves themselves may be damaged or problems might occur in neurotransmitters (the chemicals that act as messengers between nerve cells). The neurotransmitter gamma aminobutyric acid (GABA), seems to be particularly important in suppressing seizures. Experiments also suggest that deficiencies in a receptor of the neurotransmitter serotonin may help promote epileptic seizures. Epilepsy falls into two main categories: partial or focal seizures and generalized seizures. Within these two categories are a number of subtypes, each of which requires different therapeutic approaches, so an accurate diagnosis is important. In addition, some cases of epilepsy can be a hybrid of subtypes, while others defy precise categorization.

Partial (Focal) Seizures

A partial or focal seizure is the more common type of epilepsy and is caused by a disorder of a neuron population in a specific site on one side of the brain.

Simple Partial Seizures. A person with a simple partial seizure (sometimes known as Jacksonian epilepsy) does not lose consciousness but may experience confusion, jerking movements, tingling, or odd mental and emotional events, such as deja vu, mild hallucinations, or extreme responses to smell and taste. After the seizure, the patient usually has temporary weakness in certain muscles.

Complex Partial Seizures. Slightly over half the seizures in adults are complex partial types, and about 80% of these seizures originate in the temporal lobe of the brain, which is located close to the ear. Disturbances there can result in loss of judgment, involuntary or uncontrolled behavior, or even loss of consciousness. About 20% of these patients have seizures that start in the frontal lobes of the brain. Prior to the actual seizure, people sometimes experience a warning sign, known as an aura, which can be an odd odor or a visual or auditory hallucination. People with a complex partial seizure may lose consciousness briefly and appear to others as motionless with a vacant stare. Emotions can be exaggerated, and some sufferers appear to be drunk. After a few seconds, some may begin to perform repetitive movements, such as chewing or smacking their lips. Episodes usually last no more than two minutes, and people can have them infrequently or as often as every day.

Secondarily Generalized Seizures. In some cases, simple or complex partial seizures evolve into generalized seizures, which are known as secondarily generalized seizures. [See Generalized Seizures, below.] The progress may be so rapid that the partial stage is not even noticed.

Generalized Seizures

Generalized seizures are caused by disturbances of nerve cells in more diffuse areas of the brain than with partial seizures and therefore have a more serious affect on the patient.

Tonic-Clonic (Grand Mal) Seizures. The first stage of a grand mal seizure is called the *tonic phase,*in which the muscles suddenly contract, causing the patient to fall and lie rigidly for about 10 to 30 seconds. Some people experience a premonition or aura before a grand mal or tonic-clonic seizure; most, however, lose consciousness without warning. If the throat or larynx is affected, there may be a high-pitched musical sound called stridor when the patient inhales. Spasms occur for about 30 seconds to a minute as the seizure enters the *clonic phase,*when the muscles begin to alternate between relaxation and rigidity. After this phase, the patient may lose bowel or urinary control. The seizure usually lasts a total of two to three minutes, after which the patient remains unconscious for a while and then awakens to confusion and extreme fatigue.

Absence (Petit Mal) Seizures. Petit mal or absence seizures are brief (3 to 30 seconds) and may consist of only a short cessation of physical movement and loss of attention. They may even pass unnoticed by others. Petit mal may be confused with simple or complex partial seizures; in petit mal, however, a person loses consciousness and may experience attacks as often as 50 to 100 times a day. About 25% of patients with petit mal develop grand mal seizures.

Specific Seizures in Children

West syndrome affects children within the first year, usually beginning between four and eight months. The infant experiences spasms and developmental delay. Lennox-Gastaut syndrome is a severe form of epilepsy in young children, which causes multiple seizures and some developmental retardation.

Other Seizures

Myoclonic epilepsy is a rare genetic seizure that can be mild and cause brief periods of jerkiness in limited parts of the body, such as the face or trunk, or it may be severe, with grand mal seizures, hearing loss, mental damage, and heart problems.
A person who has an atonic, or akinetic, seizure loses muscle tone. Sometimes it may affect only one part of the body, so that, for instance, the jaw slackens and the head drops. At other times, the whole body may lose muscle tone, and the person suddenly falls. A brief atonic episode is known as a drop attack.
Seizures can also be simply tonic or clonic. In tonic seizures, the muscles contract and consciousness is altered for about 10 seconds, but the seizures do not progress to the clonic or jerking phase. Clonic seizures, which are very rare, occur primarily in young children, who experience spasms of the muscles but not the tonic rigidity.

What Is the Cause of Epilepsy?

It is estimated that 50 million people worldwide and 2.5 million Americans have epilepsy. About 75% of epileptic seizures start in childhood. About 5% of the population will have at least one seizure, not counting the 5% of children who have seizures caused by fevers. The cause can be determined for about 28% of partial epilepsy patients, but in nearly three quarters of all cases, the cause is unknown. The age of onset can sometimes offer a clue.

Causes in Children

Febrile Seizures. Febrile seizures are caused by high fever and usually occur between the ages of three months and five years. They are quite common and occur in about 3% of all children under five years old. Nearly all febrile seizures are brief and have no long-lasting effect.

Vaccinations. Some controversy arose a few years ago over the possibility that the DTP (diphtheria -tetanus-pertussis) vaccine might trigger epilepsy or other neurologic diseases. In young children, high fever from a vaccination can, in rare instances, trigger seizures, which are almost always temporary and have no serious consequences. Some experts suggest that

children who have neurologic events following their DTP shot may already have a preexisting impairment, such as epilepsy or abnormal brain development, which is revealed but not caused by the vaccine. Children with epilepsy may be at risk for an outbreak of symptoms two or three days after the vaccination. Such a temporary worsening of their disease does not appear to pose a danger to the child. In general, for infants with suspected neurologic problems, a decision to vaccinate may be delayed until their neurologic situation is clarified (but no later than their first birthday).

Television-Induced Seizures. Certain patterns of rapidly flashing colors have triggered seizures in hundreds of television watchers, most recently in Japanese children who watched cartoons with rapid fluctuating colors. (It appears that the color variations, not the light, caused the seizures.)

Other Causes. Seizures in infants and children may also be due to birth defects, difficulties during delivery, infections, poisoning, or head injuries. Melatonin, an herbal remedy available over the counter for sleep disorders, has been found to cause seizures in children who have existing neurologic problems.

Causes in Adults

If epilepsy first appears in teenage or adult years, the known major causes tend to be drug or alcohol abuse, withdrawal from certain antianxiety or antidepressant drugs, cancer, disorders of blood vessels, infections, or diabetes. Occupational exposure to certain chemicals can also cause epilepsy. One study found an association between epileptic seizures and herpes simplex virus infections that occur in the central nervous system. More research is needed before any causative role can be proved. In the elderly, epilepsy is often due to degenerative diseases of the brain. Small strokes, called transient ischemic attacks, are often difficult to distinguish from mild epileptic seizures, and in fact, a first seizure in adults might be a precursor to stroke.

Causes Affecting All Ages

Head Injuries. Head injuries can cause seizures, with the risk highest in severe head trauma. In such cases, a first seizure related to the injury can occur even years later. People with mild head injuries, which involve loss of consciousness for less than 30 minutes, have only a slight risk that lasts up to five years after the injury.

Genetic Factors. Some forms of epilepsy are inherited. Researchers have recently identified genetic mutations that affect the channels in nerve cells that carry calcium, potassium, and sodium back and forth. Sodium, potassium, and calcium serve the brain as ions and produce electric charges that must fire regularly in order for a steady current to pass from one nerve cell to another. If the channels that carry them are genetically damaged, an imbalance occurs that can cause misfire and seizures. One gene, known as Cacng2 or stargazer, impairs ion channels that regulate sodium and calcium and may be responsible for an inherited form of absence epilepsy. Others known as KCNQ2 and KCNQ3 affect potassium channels and are found in families with a rare form of generalized seizures that occur in infancy called benign familial neonatal convulsions.

Brain Tumors. Both cancerous and noncancerous brain tumors can cause seizures in children and adults.

Pseudoepilepsy. In many cases, a seizure can be caused by psychologic stresses, which is known as pseudoepilepsy. It can usually be distinguished from true epilepsy using electroencephalogram (EEG), which measures brain waves.

Standard Medications

Certain standard anti-seizure medications are usually used first for epilepsy, depending on the seizure. If they fail or if the patient becomes tolerant to the primary medications, then newer so-called add-on drugs are tried, usually in combination with standard drugs.

Carbamazepine. Carbamazepine (Tegretol, Carbatrol) is effective when used alone or with other drugs against partial seizures (especially complex partial seizures), grand mal seizures, and combinations of these types. It is not useful for petit mal, myoclonic, or atonic seizures. Patients with partial seizures tend to tolerate this drug better than others, but individuals vary. Many

physicians prefer carbamazepine to phenobarbital for children because it has less adverse effects on thinking and behavior. Carbamazepine also has the added benefit of relieving depression and improving alertness. Initial side effects may include double vision, headache, sleepiness, dizziness, and stomach upset. These usually subside after a week and can be greatly reduced by starting with a small dose and building up gradually. People also may have visual disturbances, ringing in the ears, agitation, or odd movements when drug levels are at their peak. The extended-release form (Carbatrol) may help reduce these symptoms. In about 6% of patients, skin reactions are so severe that the drug has to be discontinued. In about 10% of those taking the drug, a decrease in white blood cells occurs. This is generally not serious unless infection accompanies it. Other blood conditions can arise that also are potentially serious. Patients should be sure to inform the doctor if they have any sign of irregular heartbeats, sore throat, fever, easy bruising, or any unusual bleeding. Water retention can be a problem in older people. Long-term therapy can cause osteoporosis in women, who should take calcium and vitamin D supplements. Some research indicates that citrus fruit, especially grapefruit, can increase the level of adverse effects of carbamazepine, and should be avoided by those taking this drug.

Phenytoin. Phenytoin (Dilantin) is effective for adults who have grand mal, complex partial, and simple partial seizures, but not for petit mal, myoclonic, or atonic seizures. Some physicians prescribe phenytoin for people with head injuries who are at high risk for seizures. Side effects are sometimes difficult to control. Some people may develop a toxic response to normal doses, while others, such as those with alcoholism, may require higher doses to achieve benefits. High doses can sometimes result in staggering, lethargy, nausea, gum recession, depression, eye-muscle problems, anemia, and an *increase* in seizures. (Toxic amounts taken for long periods can actually damage the part of the brain that affects muscular stability.) Troublesome side effects include excess body hair, eruptions and coarsening of the skin, and anorexia. In rare cases, liver damage may occur. Long-term therapy can cause osteoporosis in women, who should take calcium and vitamin D supplements.

Valproate. Valproate (Depakene) or a similar drug divalproex sodium (Depakote) is the primary choice for generalized seizures and is useful for nearly all major seizures, including, in some cases, seizure combinations. Valproate is not usually recommended for young children because of an unusual, but potentially fatal, toxic effect on the liver. (This is a very rare effect, however, that is most likely to affect children under two years of age who have birth defects and are taking more than one drug.) Some physicians recommend monitoring blood levels for liver function once before administering valproate, then monthly during the first six months, and periodically after that. In addition, patients and parents of patients are advised to be on the watch for symptoms of liver problems, including loss of appetite, lethargy, acute confusion, vomiting, abdominal pain, yellowish coloring of the skin, water retention, and easy bruising. Studies are reporting symptoms of Parkinson's disease preceded by hearing loss in people taking it for more than a year, but they were reversible when the drug was withdrawn. Fortunately, most side effects are minor, occurring early in therapy and then subsiding. In some studies, nearly half of those taking valproate initially experienced stomach and intestinal problems (nausea, vomiting, heartburn). These side effects can be controlled or avoided with the delayed-release form of the drug (Depakote). Increased appetite with significant weight gain is also a common problem. Hand tremors, irritability, and hyperactivity in children are fairly common. Temporary hair thinning and loss have occurred. In premenopausal women, valproate increases the risk for menstrual irregularities and polycystic ovaries. (These side effects also appear in women using other anti-epileptic drugs, but the risk from valproate appears to be higher.) Valproate is, however, the preferred drug for women taking oral contraceptives. Under investigation is a derivative of valproate called ABS-103, which may have fewer severe side effects and still be effective against seizures.

Phenobarbital. Phenobarbital (Luminal) is used for grand mal and simple partial seizures. It is not effective in complex partial seizures and the drug may even exacerbate petit mal seizures. It is often the initial drug used for seizures in newborns and young children. The most common and troublesome side effects are drowsiness and problems with memory and with tasks requiring sustained performance or motor skills. Patients sometimes describe their state as "zombie-like." Some controversy has arisen over studies indicating that children taking phenobarbital to prevent fever seizures score lower on intelligence tests, even for some months after going off the drug. Some people, particularly children and the elderly, develop hyperactivity. Adults can become depressed on the drug. A number of physicians prefer to prescribe drugs that have less sedating effects. On the other hand, phenobarbital has less toxic effects on other parts of the body than

most anti-epileptic drugs, and drug dependence is unusual given the low doses for epileptic patients.

Primidone. Primidone (Mysoline) is converted in the body to phenobarbital, and so has the same benefits and adverse effects. It appears to be less well tolerated than phenobarbital and some authorities believe that primidone has no advantage over the other drug.

Ethosuximide. Ethosuximide (Zarontin) is used for petit mal (absence) seizures when the patient has experienced no other type. It succeeds in abolishing petit mal seizures in 60% of these patients and controls them in up to 90%. Ethosuximide can cause stomach problems, dizziness, loss of coordination, and lethargy. In rare cases, it has caused severe and even fatal blood abnormalities. Periodic blood counts are recommended for patients taking this drug.

Clonazepam. Clonazepam (Klonopin) is recommended for myoclonic and atonic seizures that cannot be controlled by other drugs and may be useful in newborns in whom other drugs are ineffective. Although clonazepam can prevent generalized or partial seizures, patients generally develop tolerance to the drug , and seizures recur. About 50% of those who take clonazepam experience drowsiness; one-third develop imbalance and staggering; and about 25% have personality changes, including irritability, aggression, and in children, hyperactivity. Weight gain may occur. Among other side effects are eye muscle problems, slurred speech, tremor, and skin and stomach problems. People who have had liver disease or acute angle glaucoma should not take this drug, and people with lung problems should approach the drug with caution. The drug can be addictive, and abrupt withdrawal has been known to trigger status epilepticus. Clobazam is a drug similar to Clonazepam that is currently under investigation. It is inexpensive, and some overseas studies have reported that it controlled seizures in 10% to 30% of patients with epilepsy that were not controlled with other treatments. Side effects are similar to those of clonazepam, and patients develop tolerance to both drugs within a few months.

Add-On or Alternative Drugs

In recent years, a number of drugs have been developed to address the problem of seizures that have become refractory to standard treatments. Some are being designed to interrupt specific processes leading to epileptic seizures. Presently, they are generally used only in combination with other drugs, but many are being tested as sole therapy. All appear to offer some benefit but also have troublesome side effects. In general, these drugs reduce seizures by about 50% in about half of the patients tested, but it should be noted that early trials of drugs are usually performed with severely ill patients and they may be more effective in milder cases of epilepsy. Studies are underway to determine any advantage of one over the other; one comparing six drugs, gabapentin, lamotrigine, tiagabine, topiramate, vigabatrin, and zonisamide, found no significant difference. The leading drug in the study for reducing symptoms was gabapentin and the one that had fewest patients withdrawing from treatment was lamotrigine. Unfortunately, most studies report only on seizure reduction and few assess other factors, such as quality of life affected by the drug.

Gabapentin. Gabapentin (Neurontin) is particularly effective in combination for controlling complex partial seizures and secondarily generalized partial seizures but not at all effective for petit mal seizures. Its side effects include sleepiness, fatigue, and dizziness. It has low toxicity and no significant interactive effects when taken with other antiepileptic drugs. It may prove to be particularly useful in the elderly, who tend to take many other medications.

Lamotrigine. Lamotrigine (Lamictal) has been approved for add-in therapy, but studies also indicate it is safe and effective as single therapy for seizures not controlled by standard medications. It is effective in partial or generalized seizures and for Lennox-Gastaut syndrome. Studies overseas have found it to be as effective as carbamazepine and phenytoin, and patients tolerate it better. Lamotrigine may be an effective alternative for people who experience weight gain or other hormonal-related side effects from valproate. The drug appears to improve cholesterol levels. A rash occurs in 5% of patients; it may disappear in some patients who continue taking the drug but in rare cases it can become very severe. The risk of the rash appears to increase if the patient is also taking valproic acid. Other side effects may include nausea, dizziness, blurred vision, and sleepiness. A rare but serious side effect is anticonvulsant hypersensitivity syndrome, characterized by fever, skin eruptions, abnormal lymph nodes, and damage to internal organs, usually hepatitis.

Topiramate. Topiramate (Topamax) is similar to phenytoin and carbamazepine and is effective for a wide variety of epilepsy forms, including partial and generalized seizures. Studies are showing a 34% to 87% reduction in seizure frequency, with some patients becoming seizure free. The most common side effects of topiramate are related to brain and mental functioning, and include dizziness, fatigue, visual disturbances, mental slowing, mild depression, tremor, and impaired concentration. It can also cause weight loss, diarrhea, and increase the risk for kidney stones.

Vigabatrin. Vigabatrin (Sabril) was designed to increase the brain levels of gamma aminobutyric acid (GABA), the enzyme that inhibits seizure activity. It appears to be effective in children, including those with West syndrome, and also for the elderly. Its use as a single drug is being studied. In two trials comparing it to carbamazepine, vigabatrin did not do as well in one and was equal to the older drug in the other; in both studies, however, it appeared to be much safer than carbamazepine. It can cause weight gain, drowsiness, sleep disturbances, and possibly severe depression. If administered too quickly, psychosis can occur. A few cases of impaired vision have been reported after two to three years of vigabatrin treatment. Studies are needed to determine the extent and severity of this possible side effect.

Hormonal Treatments. When seizures are worsened by menstrual cycle changes, suppressing ovulation may be recommended using drugs called gonadotropin-releasing hormone agonists. Women who no longer wish to bear children may also consider hysterectomy or oophorectomy (removal of the ovaries). Each of these treatments must be accompanied by estrogen replacement therapy.

Other Add-On Drugs. Oxcarbazepine and tiagabine are similar to phenytoin and carbamazepine but have fewer side effects. Oxcarbazepine appears to have few interactions with other drugs and may prove to be useful for the elderly. Other promising add-on drugs include zonisamide (Zonegran), levetiracetam, flunarizin, remacemide, losigamone and levetiracetam. After reports of severe deaths from a serious blood condition known as aplastic anemia and from liver failure associated with felbamate (Felbatol), it is recommended only for severe epilepsy, such as Lennox-Gastaut syndrome, when other drugs fail.

Older Drugs

Some older but less effective drugs may still have a role against epilepsy. Acetazolamide (Diamox) is some times used against common types of seizures, but patients quickly develop tolerance for it. Clorazepate (Gen-Xene, Tranxene) has been useful in combination therapy, for certain types of complex partial seizures, and in those who have frequent seizures. Tolerance to this drug is also a problem. Trimethadione (Tridione) is effective for petit mal seizures, but has very serious side effects and its use is severely limited.

Vagus Nerve Stimulation

Electrical stimulation of the vagus nerve, the longest nerve in the body, is proving to be an effective treatment for epilepsy in many cases. Two vagus nerves run along each side of the neck, then down the esophagus to the gastrointestinal tract; they affect swallowing, speech, and many other bodily functions. They also appear to connect to parts of the brain that are involved with seizures. In vagus nerve stimulation, a battery-powered device similar to a pacemaker is implanted under the skin in the upper left of the chest and a lead is attached to the left vagus nerve in the lower part of the neck. The batteries wear out after three to five years and need to be removed and replaced. Many European neurologists now believe electrostimulation should be used routinely and that it can replace surgery in many cases. Its effectiveness is somewhat greater than that of several newer drugs. Studies report that within two or three months, seizures are reduced by about 20%, and seizure control may even improve over time. One study reported that after 18 months the procedure reduced seizure frequency by 42% in children with severe epilepsy that had not responded to other treatments. Another also suggested that vagus nerve stimulation reduces partial seizures that impair awareness, which tend to cause more harm than simple partial seizures. Vagal stimulation can cause shortness of breath, hoarseness, sore throat, coughing, ear and throat pain, or nausea and vomiting. These side effects can be reduced or eliminated by reducing the intensity of stimulation. An analysis of early cases found no serious adverse side effects, although the treatment may cause lung function deterioration in people with existing lung disease. In one study, a patient with no history of heart disease had a heart attack and in another a patient died of clotting disorders within a few months after treatment; it is not

clear, however, if vagus stimulation was responsible in either case. Other devices that stimulate the thalamus are being tested.

What Lifestyle Measures Can Help Prevent Epileptic Seizures?

Avoid Triggers

In most cases, there is no known trigger for the seizure. Inadequate sleep can trigger seizures in some people, although in others seizures occur during sleep. One study indicated that food allergies might provoke some seizures in children who also have migraine headaches, hyperactive behavior, and abdominal pains. Parents should consult an allergist if they suspect foods or additives might be playing such a role. Alcohol and smoking should be avoided, although light alcohol consumption does not appear to increase seizure activity in people who are not alcoholics or sensitive to alcohol. Patients should avoid exposure to flashing or strobe lights.

Relaxation Techniques

Some people with epilepsy have found that relaxation methods help reduce the severity of the attacks. Such methods include Yoga exercises, diaphragmatic rhythmic breathing, and meditation techniques. (There have been some reports, however, that deep breathing triggers seizures in certain people.) Adequate and restful sleep is extremely important in helping to prevent seizures.

Diet

Fasting has been used to prevent seizures since ancient times. In the 1920s, a high-fat, no-sugar, low protein diet, known as a ketogenic diet, was used to prevent seizures. The diet is based on the premise that burning fat instead of carbohydrates causes an increase in ketones, substances in the blood that may prevent irritation in the central nervous system. It had lost popularity after the introduction of antiepileptic drugs but has recently been reinvestigated for children with severe seizures from injury, birth defects, or disease, which do not respond to medications. It is a very difficult diet, particularly for children; after an initial two- or three-day fast, they eat almost nothing but fats, with very few proteins and no sugar. Typically, a meal consists of a large amount of heavy cream, several pads of butter on a sugarless cracker, and perhaps a small piece of meat. For vegetables, children can have as much lettuce, celery, or cucumbers as they wish. Even a slight deviation from the diet, however, can provoke a seizure. Children cannot take medications, such as Tylenol, that contain sugar. One center reported that the ketogenic diet prevented seizures completely in about one third of patients and reduced the severity or frequency of seizures in another third. The diet seems to be more helpful in children ages one to eight but is rarely effective in adults. The diet often causes nausea and diarrhea, and a physician must supervise this drastic diet, since high levels of ketones can be dangerous.

Support Groups and Therapy

It is very important for children with epilepsy to be treated as normally as possible by parents and siblings. Children should be assured they will not die from this problem, and often they can be given the hope that they will outgrow the disorder. Most children will not have seizures triggered by sports or by any other ordinary activities. As soon as they are old enough, children should be active participants in maintaining their drug regimens, which should be presented in as positive a light as possible. Because reducing emotional stress plays an important role in managing this disorder, psychologic therapy may be beneficial and even necessary for some people. Everyone who suffers from epilepsy or who has a child with epilepsy can benefit from support associations, which are free and available in most cities.