Landau-Kleffner: treatment offers hope (continued)

The most difficult aspect of the symptoms is that they may rapidly develop or [develop] insidiously over a number of years or may fluctuate minute to minute, day to day."

Other autistic-like symptoms seen in LKS include attention deficit, insensitivity to pain, and resistance to change. Children with LKS also may respond to sounds such as doorbells, while appearing deaf to human speech. They often have problems with gross or fine motor skills, and may drool or develop problems with handwriting or an unusual walking gait. Visuospatial skills are unimpaired and on IQ tests they often have above-normal non-verbal scores.

Like autistic children, children with LKS may lose speech entirely, or use echolalic or "telegraphic" speech consisting mostly of nouns and a few verbs. Their voices may be nasal and uninflected, resembling the voices of deaf children. Some respond when people speak in front of them, but not when people speak behind them. They often delete the final consonants of words and interchange letters.

Children with LKS are frequently misdiagnosed as deaf, and some spend many years in classes for deaf students. Claire Penn et al. note in the *South African Medical Journal* that children with Landau-Kleffner respond inconsistently to hearing tests based on behavioral responses, and cannot be tested by means requiring speech. "Cortical testing . . . can often be confounded by neurological variables," they add, "including abnormal EEG patterns and medication."

Penn et al. say BSER (brainstem evoked response) testing seems to be the diagnostic procedure of choice for evaluating the hearing of children who may have Landau-Kleffner syndrome. It is important, they say, to be cautious when diagnosing deafness in children with a history of convulsions and aphasia, "even if audiometric findings are strongly suggestive of hearing loss."

Landau-Kleffner syndrome affects twice as many boys as girls, and has been reported in children ranging from 18 months to 13 years old. Generally there is no family history of developmental disorders, and the child has experienced no previous unusual physical problems. While less than 200 cases have been documented world-wide, some experts suspect that this low number reflects the difficulty of detecting the often subtle or confusing symptoms of LKS. Rudick agrees, saying, "I have come to realize that Landau-Kleffner syndrome is not as rare a disorder as once believed, but getting the correct diagnosis for this disorder is extremely rare."

What causes LKS?

Also called "acquired epileptic aphasia," Landau-Kleffner differs significantly from other forms of aphasia. (Aphasia is a term meaning loss of, or defect in, the ability to communicate). Penn et al. note that other aphasias typically have obvious causes such as encephalitis or head trauma; generally affect either receptive or expressive language (usually expressive) but not both; and often have a prognosis of rapid recovery, particularly in preschool children. None of these are true of LKS.

PROFILE OF A TYPICAL CHILD WITH LKS

- Normal development and age-appropriate language first 3-7 years
- Loss of receptive language while retaining some expressive language
- "Telegraphic" speech—few verbs
- Suspicion of deafness
- Child frustrated, puzzled by change in himself
- Autistic-like behaviors
- Normal or above normal non-verbal IQ score
- Abnormal EEG, with or without seizures

Most cases of Landau-Kleffner syndrome appear to be caused by defects in the temporal lobes in both hemispheres of the brain. This, Penn and colleagues say, accounts for the inability of one brain hemisphere of an individual with LKS to take over the functions of the opposite hemisphere—as often happens in other forms of aphasia, in which only one hemisphere of the brain is affected.

Suspected culprits in Landau-Kleffner syndrome include low-grade degenerative brain disease caused by slow viruses such as herpes simplex; an auto-immune disorder; or damage to brain areas caused by repetitive epileptic discharges. Another theory advanced by Tally Lerman-Sagie and colleagues in the *Journal of Child Neurology* is that abnormal metabolism of zinc may be a factor in Landau-Kleffner. Tests they performed on a six-year-old boy with LKS showed that while zinc absorption and excretion were normal, "zinc content [in red blood cells] was markedly reduced and did not rise following zinc supplementation."

Lerman-Sagie et al. note that an association between zinc metabolism and epilepsy has been shown in many studies since the 1970s, and that changes in zinc concentration lead to changes in the activity of the enzyme carbonic anhydrase, which "plays an important role in the regulation of brain excitation level."

Auditory pathways appear intact in LKS, indicating that hearing is normal.; but A. J. Cole et al. report in *Neurology* that brainwave measurements of one of their patients showed that cortical responses to tones were absent. This, they say, "supports the hypothesis that this patient suffered from bilateral posterior temporal cortical dysfunction...experimental evidence suggests that these waveforms are generated bilaterally, and thus a unilateral lesion may result in reduced amplitude but not in disappearance of these potentials, as seen in our case."

Surgery: early results promising

Until recently, the only treatments for Landau-Kleffner syndrome were anti-convulsive drugs and special education. Around 20% of children with LKS recovered from the disorder, usually within the first few months of the illness. A small minority improved but still had mild to moderate residual effects, and the remainder remained profoundly aphasic.

Now, however, a new surgical technique (currently performed only at Rush-Presbyterian-St. Luke's Medical Center in Chicago) offers hope of a cure for children affected by Landau-Kleffner. The procedure, described by neurologists Frank Morrell and Thomas Bleck and neurosurgeon Walter Whisler in the *Journal of Neurosurgery*, allows surgeons to operate in delicate and formerly "untouchable" areas of the brain without disturbing important neural connections in areas involved in speech, memory, and motor and sensory function.

Called "multiple subpial transection," the technique is based on experimental evidence that abnormal discharges occur only when there are substantial *horizontal* connections between neurons, while normal functioning of the brain depends primarily on the *vertical* connections between neurons. If vertical connections are not disturbed, Morrell says, substantial numbers of horizontal connections can be severed without significantly impairing the function of the brain. Whisler has compared the new technique to "digging fire lanes" to stop a forest fire.

Morrell and colleagues pinpoint the areas of the brain in which EEG abnormalities occur. Neurosurgeons then insert a hooked wire tool into these areas and make dozens of tiny horizontal cuts, severing the pathways of abnormal discharges.

At the time of this article, four children with Landau-Kleffner syndrome (one of them Rudick's son) had undergone the surgery. Three of the four are speaking, hearing and behaving normally again, and the fourth has begun comprehending sounds. (In all, the new surgical procedure has been performed on at least 32 individuals with different types of intractable epilepsy, and appears to be safe and effective.)

Morrell emphasizes that the only patients eligible for the surgical procedure are those who still have EEG abnormalities. He believes that patients who have LKS but no longer show abnormal EEG readings may have reached an irreversible stage of the disorder. Further, he notes, the abnormal EEG pattern identifies the area of the brain in which the surgery is to be performed; "without an EEG abnormality," he says, "the surgery cannot be done."

Morrell believes LKS may be caused by an epileptogenic lesion occurring in the speech cortex when the essential circuitry for speech is developing, interfering with the establishment of the normal circuit components during a critical period. It is possible, he says, that "if therapeutic intervention is delayed until beyond the critical period (approximately eight years of age), then there is essentially no possibility of reversing the process."

For further information, contact Jane Rudick, C.A.N.D.L.E., 4414 McCampbell, Montgomery, Alabama 36106.