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Language after Hemispherectomy: Effects of Seizure Control

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Introduction and Rationale

There is no question that on-going seizure activity in children has a debilitating effect on all aspects of cognitive development, including language (Dulac et al., 1996; OLeary et al., 1983; Rossi et al., 1996). Comparing the effect of left- versus right-temporal lobe origin seizures, Cohen (1992) reported the expected correlation between side and auditory/verbal vs visual/spatial memory in children with complex partial epilepsy. Furthermore, specific aspects of linguistic performance were shown to be differentially affected in children with simple-partial left hemisphere epilepsy (Cohen & Le Normand, 1998). Linguistic comprehension tested in this study gradually improved to reach normal performance levels while production remained quite poor in comparison with controls. A general conclusion drawn from these and other studies is that cognitive development in children with epilepsy is severely compromised in comparison to neurologically intact children.

It is thus surprising to find that the effect of seizure control in post-surgical patients and its relevance to improved cognitive and linguistic functioning remains an area of great controversy. A few studies report that seizure-free patients perform no better cognitively than their counterparts who continue to have seizures after surgery (Grande et al., 1997; Seidel et al., 1997). However, post-surgical seizure control and linguistic outcome have not been specifically explored to our knowledge, though some reports indicate that this relation is far from linear (Vargha-Khadem & Mishkin, 1997). It seems that seizure control by itself does not guarantee improved linguistic functioning in hemispherectomy patients. However, patients who become seizure-free after surgery performed early in life are asserted to demonstrate a better linguistic prognosis.

This is a preliminary report of a pilot study examining the validity of the latter claim and adding to the quantitative investigation of the effects of seizure control on language outcome by evaluating spoken language outcome as a function of seizure control, age of seizure onset, and seizure duration

in a large population of pediatric hemispherectomies.

Methods

Subjects consisted of 42 patients who underwent hemispherectomy for intractable seizures at UCLA Medical Center. Age at onset of seizures: 0;0 – 11;0 years, age at surgery: 0;3 – 17;3 years, seizure duration: 0;3 – 14;1 years, post-surgical evaluation: no less than 5 years. Postoperative spoken language outcome was rated on the basis of free language samples from 0 – no language to 6 – fluent mature speaker.

Results and Discussion

Based on the analysis of the entire population the following results were obtained: 1) age at seizure onset positively correlated with language outcome ($p > 0.013$); 2) postsurgical seizure control positively or negatively correlated with language outcome in a statistically significant way ($p > 0.0082$). Seizure duration did not reach statistical significance.

Although it is clear from this preliminary analysis that clinical variables related to seizure activity are relevant in predicting post-surgical cognitive outcome in hemispherectomy patients our major concern and intuition was that for many children in our sample the respective prediction would not prove accurate. Indeed, we have found that some children go on to develop language despite on-going seizures while other patients *with* seizure control remain without any language. We thus hypothesized that 1) post-surgical seizure control is just one measure of the integrity of the remaining hemisphere and cannot be approached without accounting for specific etiologies. As a result of this prediction variables of language outcome and seizure control are currently analyzed separately for the three major etiologies (cortical dysplasia, Rasmussen's encephalitis and infarct). 2) Different language outcomes in the patients without seizure control can be explained by differentiating between those seizures that result from a structural lesion in the remaining, presumably "healthy" hemisphere and seizures that result from functional damage sustained as a result of pre-surgical seizures/abnormal functioning from the removed hemisphere. To date our hypotheses have been confirmed.