VALIDITY OF CORTICAL LANGUAGE MAPPING IN YOUNG PEDIATRIC PATIENTS

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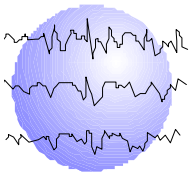

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ABSTRACT

RATIONALE: Previous studies have suggested that mapping of cortical language areas is often successful in children as young as seven years, but is most often successful in children ages 10 and older. However, little is known regarding the success of cortical language mapping in children age six and younger.

METHODS: Patients were six children, ages 3.6 to 6.9 years with a subdural electrode array (SEA) implanted in the dominant frontal (n=1), nondominant frontal (n=1), or dominant frontotemporal area (n=3). A SEA was positioned over the frontotemporal region of the presumed minor language hemisphere in a patient who evidenced possible bilateral language on intracarotid amobarbital procedure (IAP). Etiologies included idiopathic epilepsy (n=1), cortical dysplasia (n=1), tumor (n=3) and Rasmussen syndrome (n=1). IQ ranged from 76 to 114 (mean=96). Language testing included confrontation naming and repetition speech.

RESULTS: Frontal and/or temporal language areas were identified in the four patients whose SEAs resided in the language dominant hemisphere (based on the IAP). A frontal language area (FLA) was identified in both patients in whom this region was mapped; however, errors in naming or repetition were seen at only one or two pairs of electrodes, and were seen on an inconsistent basis. A temporal language area (TLA) was identified in all three patients in whom this region was mapped. With the exception of a patient who underwent hemispherectomy for Rasmussen syndrome (and in whom the expected postoperative aphasia was observed), language during the immediate postoperative period was intact. Cortical language areas were not identified in the two patients whose SEAs resided in either the nondominant or presumed minor language hemisphere. No decline in language was observed on bedside exam during the immediate postoperative period in these two patients.

CONCLUSION: It is possible to successfully map cortical language areas in children age 6 and younger when the IAP indicates the presence of language in the hemisphere to be operated. However, errors in naming and repetition speech are more reliable when stimulating the TLA than in the FLA. Repetition or naming errors produced by stimulation of the frontal language area may be circumscribed and inconsistent.

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Introduction

Previous studies suggest that cortical language areas may be less frequently identified (1) or involve smaller, more discrete regions (2) in pediatric patients than in adults during electrical stimulation mapping. Although cortical language areas can often be identified in young patients, little is known about the language performance of very young children during mapping procedures.

Methods

The sample consisted of four female and two male patients ages 3 years, 7 months to 6 years, 11 months. Etiologies included tumor (n=3), idiopathic epilepsy, Rasmussen syndrome, and cortical dysplasia. With the exception of patient 1, who demonstrated mildly impaired intellectual functioning preoperatively, all patients evidenced normal IQ. All patients underwent intracarotid amobarbital procedure (IAP) to clarify hemispheric dominance for language prior to placement of the subdural electrode array (SEA). Side of surgery involved the nondominant or minor language hemisphere in two patients. The decision was made to conduct language mapping in these cases following IAP results that were ambiguous for language lateralization. In the remaining four patients, surgery involved the primary language hemisphere. The SEA was positioned over the temporal (n=1), frontotemporal (n=3), or frontal region (n=2). Language testing consisted of naming and/or repetition of phrases, as a previous study suggested that errors are most commonly seen in these language modalities (3). The final language map was based on data from a minimum of two stimulation sessions.

Results

No language areas were identified in the two patients in whom surgery involved the nondominant or minor language hemisphere.

In the three patients who underwent mapping of temporal cortex in the dominant hemisphere, distinct disturbance of naming or repetition (speech arrest, hesitation, inability to perform naming/repetition specifically, or paraphasic error) was observed on a consistent basis during stimulation of at least two electrode pairs in the superior temporal gyrus.

In both patients (2 & 5) in whom a frontal language area was mapped in the language dominant hemisphere, only inconsistent language errors were observed at one or two electrode pairs. Errors were noted adjacent to motor tongue regions, and consisted of either unintelligible utterances, repetition errors (e.g. green, black and black" for green and black), or naming errors.

On bedside exam, no postoperative language impairment was noted except in patient 6 who underwent hemispherectomy involving the presumed dominant hemisphere.

Summary and Conclusions

- Results of this study are largely consistent with previous data on pediatric cortical mapping studies. Clear disruption of language performance was seen at relatively few SEA electrode pairs, but could be elicited on a consistent basis during stimulation of the temporal language area. Errors were seen at fewer stimulation sites in the frontal language area, and these errors were not seen during every stimulation trial.
- Language cortex can be successfully mapped in young children, but those performing these studies should expect to identify smaller areas of language cortex and less consistent responses to stimulation compared to adult patients, particularly in the frontal region.

References

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Table 1

Patient Characteristics

Patient #	Age (yrs-mos)	Handedness	Gender	Diagnosis/Etiology	VIQ	PIQ
1	6-7	Right	Female	Idiopathic Epilepsy	77	81
2	6-11	Right	Female	DNET	113	113
3	3-7	Right	Male	Cortical Dysplasia	89	105
4	4-6	Right	Male	Low Grade Tumor	90	96
5	4-7	Right	Female	High Grade Tumor	113	113
6	4-1	Right	Female	Rasmussen	97	96

VIQ ~ Verbal IQ
PIQ ~ Performance IQ

Table 2

Language Data

Patient #	Age (yrs-mos)	Side of Surgery	Intracarotid Amobarbital Procedure	Language Task	Temporal Language Area Identified	Frontal Language Area Identified
1	6-7	Right	Bilateral; Left> Right	Repetition	No	No
2	6-11	Left	Bilateral; Left > Right	Naming	*	Inconsistent errors at two electrode pairs
3	3-7	Left	Possibly Right	Naming Repetition	*	No
4	4-6	Left	Left	Naming	Yes	*
5	4-7	Left	Left	Repetition	Yes	Inconsistent errors at one electrode pair
6	4-1	Left	Left	Repetition	Yes	**

* Did not extend over this region
** Limited patient stamina precluded assessment of frontal language area
Language identified where expected