



Role of Wada test and neuropsychological assessment in the management of patients with medically intractable epilepsy

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Objective

Medically intractable epilepsy is a debilitating condition impairing patients' quality of life in terms of suboptimal seizure control, higher risk of injury, and psychosocial impairment. Epilepsy surgery provides an option with curative intent for these patients. Temporal lobe resection and amygdalohippocampectomy have shown to provide satisfactory results when the epileptogenic foci were identified via imaging studies. The Wada test, along side with neuropsychological assessment, provides information on the lateralization of memory and language functions in patients with medically intractable epilepsy. Such information allows neurosurgeon to predict the postoperative outcomes by assessing the hemispheric memory and language functional reserve contralateral to the epileptogenic foci of patients. This gives both neurosurgeons and patients a clearer picture on risks and benefits of epilepsy surgeries. This is a retrospective case series analysis of patients undergoing epilepsy surgeries to illustrate the use of the Wada test and neuropsychological assessments in guiding the management in medically intractable epilepsy patients.

Method

The data of 4 patients (A-D) who underwent epilepsy surgeries from 2010 to 2015 were collected and retrospectively analysed. Collected data include results from the Wada test and neuropsychological assessments performed before and after surgeries. The data were compared to the surgeries performed in each patient.

Patient	Age on the date of Wada	Language Lateralization Index (L)	Surgery
A	33	0.93	Subdural grid implantation + Awake craniotomy cortical mapping + Excision of left posterior temporal lobe lesion
B	32	-0.17	Left anterior temporal lobectomy and amygdalohippocampectomy
C	46	1	Right anterior temporal lobectomy and amygdalohippocampectomy
D	37	1	Right anterior temporal lobectomy and amygdalohippocampectomy

Table 1

Results and Discussion

In the Wada test, amobarbital was injected at the site of the internal carotid artery of either hemispheres, thereby suppressing the function of the specific hemisphere. The effect of amobarbital will be monitored by EEG and status of hemiparesis during the procedure. Serial speech is assessed by asking the patient to start counting down from 100 before amobarbital is administered, and to continue counting after administration. Receptive speech functions are assessed by asking the patient to point to images of different named objects (e.g. "point to the rabbit"), and asking the patient to perform tasks according to commands (e.g. "point to your chin"). Patient is then asked to name objects shown on pictures, repeat proverbs, and read 2 sentences. Spontaneous speech is also observed. The performance after each task will be scored with a full mark of 14. Based on the scores of individual hemispheres, language lateralization is computed as an index (L) ranging from 1 to -1 (Eq.1). 1 is defined as complete left-side dominance while -1 is defined as complete right-side dominance. 3 out of the 4 patients were shown to be left-dominant in terms of language functions, while the remaining one has bilateral dominance. Their respective language lateralization and corresponding surgeries are listed in the Table 1. There were no post-procedural complications for all 4 patients.

$$L = \frac{(Rt\ Score - Lt\ Score)}{(Rt\ Score + Lt\ Score)} \times \frac{(Score\ with\ better\ language\ performance)}{(Highest\ possible\ score.\ i.e.\ 14)}$$

Eq.1

Neuropsychological assessment of these patients focus on the verbal and visual memory function in terms of immediate, short-term, and delayed recall. Pre-surgical and 1-year post-surgical assessments allow monitoring of any cognitive changes in terms of memory functions. No significant decline in memory function has been observed from all 4 patients, including patient A whose language dominance is ipsilateral to the lesion. Mild improvements in memory function have been found. A follow-up neuropsychological assessment may help further understand any changes in memory function post-operatively.

This study is limited mainly by the small sample size of 4 patients. Such a small sample size could be due to a low prevalence of medically intractable epilepsy, patients' unwillingness to participate in epilepsy surgery, and a tight patient selection for surgery. It would be ideal to include more cases with a more frequent neuropsychological assessment to assess any longitudinal changes in memory function following epilepsy surgery.

Conclusion

The Wada test and neuropsychological assessment provide crucial information on the lateralization of patients' memory and language functions. The Wada test identify potential cases where the lesion is ipsilateral to the side of functional dominance. This finding may call for further patient counselling and modification of the surgical plan. The combination of Wada test and neuropsychological assessment is hence essential in the preoperative planning and post-operative monitoring for epilepsy surgery candidates.