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ORIGINAL ARTICLE

Neuropsychological Assessment In Epilepsy Surgery – Preliminary Experience In A Rural Tertiary Care Hospital In North East Malaysia

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Abstract

We present our preliminary experience in neuropsychological testing in epilepsy surgery patients to demonstrate how these tests contributed to decide the laterality of epileptic focus, and to assess the effect of surgery on patient's cognitive function and quality of life. Preoperative neuropsychological tests consisting of Wechsler Adult Intelligence Scale-III (WAIS) for IQ, Wechsler Memory Scale-III (WMS) for memory and patients' quality of life (QOLIE 31) were administered to refractory epilepsy patients under evaluation for surgical treatment. These tests were repeated one year after surgery and we studied any changes in trends. A total of seven patients were recruited in this study between July 2004 and July 2006. The aetiologies of refractory epilepsy were pure mesial temporal sclerosis (MTS) in five patients, dysembryogenic neuroepithelial tumour (DNET) in one and dual lesion of cavernous angioma with ipsilateral MTS in one. The preoperative neuropsychological tests were all in concordance to MRI finding, and showed good contralateral function; five lateralises to the right and two to the left. The post-operative Engel seizure count (median 8.00, IQR 7.00–8.75), general IQ (88 vs. 79), performance IQ (94 vs. 79), verbal memory (89 vs. 71), non-verbal memory (88 vs. 75) and QOLIE (53.14 vs. 44.71) were better compared to preoperative values. The verbal IQ (84 vs. 84) was unchanged. Neuropsychological tests are useful as ancillary investigations to determine the laterality of seizure focus and integrity of function in the contralateral temporal lobe. Following successful surgical treatment, there is a trend towards improvement in memory, IQ and quality of life scores in this small group of patients.

***Keywords*:** *Neuropsychological tests, epilepsy surgery, Wechsler Adult Intelligence Scale-III (WAIS), Wechsler Memory Scale-III (WMS), Quality of Life in Epilepsy-31 (QOLIE 31), neurosciences*

Introduction

The concept of epilepsy surgery is based on the principle that there is a localized abnormality in a part of the cerebral cortex that acts as epileptogenic foci. The success of the procedure would therefore depend heavily on accurate multimodal preoperative evaluation (1,2,3,4,5,6) and on confirmation by identification of a structural lesion of the cortex (7,8). Neuropsychological tests are standard pre and postoperative assessment for Epilepsy Surgery (9) to assess the temporal lobe function of both the affected and sides (10,11). It helped to predict the functional outcome postoperatively (12,13), and the preoperative test result were used for baseline value to compare to that of the post-operative.

The aim of this study is to evaluate the role of neuropsychological tests in the screening of refractory epilepsy patients, to determine the laterality of seizure onset and degree of functional loss of the contralateral temporal lobe, to look for changes of neuropsychological tests postoperatively and lastly, to observe the impact of surgery on patient's cognitive function and their quality of life.

Materials and Methods

This is a prospective, observational pilot study conducted from July 2004 to July 2007 in Hospital University Sains Malaysia (HUSM). All refractory epilepsy patients were evaluated for their suitability for surgical management by performing the following screening tests: scalp electroencephalogram (EEG), video EEG, brain MRI and neuropsychological evaluation using the WAIS-III, WMS-III, and Quality of Life in Epilepsy (QOLIE 31) scale. Surgery was offered to patients with precise electroclinico-radiological concordance, and with good contralateral lobe memory functions.

Patients with dual pathological lesions were only offered surgery if they were ipsilateral lesions. The surgery that was offered to patients includes lesionectomy, anterior temporal lobectomy (ATL) and amygdalahippocampectomy (AH) or combination of them. All patients were followedup at three monthly interval and seizure frequency and any complications were recorded. Neuropsychological tests were repeated at one year following surgery and any differences in the scores compared to preoperative values were investigated. No statistical tests for significance were done due to a very small sample size.

Results

There were seven patients that completed one year follow up, four males and three females. All except one were right-handed. The patients' age at surgery ranged between twelve years to forty-seven years (29.00 ± 12.2). Age of seizure onset ranged from four to twenty five years old (16.33 ± 12.5) and the duration of seizure between 3 and 43 years (12.67 ± 5.8).

The aetiologies of refractory were pure mesial temporal sclerosis (MTS) in five patients, dysembronic neuroepithelial tumour (DNET) in one and dual lesion of cavernous angioma with ipsilateral MTS in one. Total of three hippocampal volumetry studies were in agreement with the diagnosis of right MTS (right 1780.67 ± 344.18 vs. left 2516.33 ± 104.46) and showed same lateralization by scalp, video EEG and neuropsychological test results. At the same time, the MRI brain showed no atrophy on the contralateral side nor any additional lesion.

Preoperative neuropsychological assessments results are tabulated in Table 1. It compares the neuropsychological assessment results with reference to the site of lesion detected on the MRI. The verbal IQ (84.4 ± 7.23) was better than the performance IQ (81.2 ± 10.21) in patients with pathological lesion on the non-dominant (rightsided) hemisphere. Similarly, their verbal memory (82.2 ± 19.82) was better than non-verbal memory (43.2 ± 4.15). Their verbal memory (43.0

Table 1 : Comparison between preoperative verbal IQ and performed IQ based on side of lesion

Side of Lesion	IQ (Verbal)		IQ (Perform)		Memory (Verbal)		Memory (NonVerbal)	
	Right	Left	Right	Left	Right	Left	Right	Left
1		89		87		46		62
2	77		79		43		71	
3	78		73		45		62	
4		78		79		40		77
5	84		77		49		71	
6	94		78		38		102	
7	89		99		41		105	
Mean	84.40	83.50	81.20	83.00	43.20	43.00	82.20	69.50
Std. Deviation	7.232	7.778	10.208	5.657	4.147	4.243	19.817	10.607
Minimum	77	78	73	87	38	40	62	62
Maximum	94	81	99	87	49	46	105	

± 4.24) was worse than nonverbal memory (69.5 ± 10.60) in patients with pathological lesion on the dominant (left-sided) hemisphere. Poor verbal scores indicate lesion in left temporal lobe and poor nonverbal scores indicate lesion on the right side. In all the cases, there was good concordance with both MRI and neuropsychological lateralization.

The follow-up neuropsychological testing for our series was done at one year postoperatively as outlined in Table 2. The postoperative general IQ (median 88.00, IQR 78.00–97.00) is higher compared to preoperative general IQ (median 79.00, IQR 76.00 –88.00). The postoperative verbal IQ (median 84.00, IQR 82.00–97.00) is equal to preoperative verbal IQ (median 84.00, IQR 78.00–89.00). The postoperative non-verbal memory (median 88.00, IQR 81.00–91.00) is higher compared to preoperative non-verbal memory (median 75.00, IQR 57.00–80.00). Lastly, the patients' survey on quality of life postoperative QOLIE (median 53.0, ± IQR 46.0–62.0) values showed modest improvements when compared to the preoperative values (43.0 ± IQR 40.0–49.0).

In this study, the patients' seizure scores drastically improved postoperatively, five (71.42%) of the patients became seizure free (ILAE outcome seizure score of 1) while the other two had only occasional simple partial seizure (ILAE outcome seizure score of 3). Similarly the postoperative seizure count when translated into "Engel Seizure Count" showed marked improvement of the patients' seizure counts. The postoperative Engel counts (median 2.50, IQR 2.00–3.00) is lower compared to preoperative Engel counts (median 8.00, IQR 7.00–8.75).

Discussion

Neuropsychological testing plays a significant role in preoperative investigations for localizing and lateralizing the epileptogenic region. One important contribution is its predictability to determine the pathological side. Patients with left-sided lesions have been known to exhibit poorer verbal memory compared to the non-verbal component. This is the basis where neuropsychological testing can help further in lateralizing the lesion (12,13). The preliminary results in this investigation clearly indicate a trend demonstrating this. Patients with left-sided lesions had lower scores in verbal memory than non-verbal memory (43.0 vs. 82.2). Similarly, those with lesions situated on the right-side performed poorer in non-verbal tasks than in verbal tasks. Memory testing also contributes to the assessment of the functional integrity of the contralateral lobe. Should testing suggest severe memory and language deficiencies in the contralateral hemisphere, the risk of developing postoperative memory and language impairment are high.

Table 2 : The results for all the neuropsychological testing of pre- and postoperative result. The highlighted are result for patient whom undergone left sided surgery. Med= Median, IQR=Interval Quotient Ratio, Min=Minimum, Max=Maximum.

			IQ (Verbal)		**IQ (Perform)**		**Memory (Verbal)**		**Memory (NonVerbal)**		**QOLIE 31**	
	Pre Op	Post Op	Pre Op	Post Op	Pre Op	Post Op	Pre Op	Post Op	Pre Op	Post Op	Pre Op	Post Op
1	88	78	89	73	87	87	62	50	88	91	46	62
2	76	88	77	84	79	94	71	94	75	97	43	57
3	74	78	78	72	73	89	62	77	57	88	45	53
4	77	78	78	82	79	75	77	80	57	81	40	53
5	79	86	84	83	77	91	71	86	53	81	49	64
6	87	96	94	97	78	94	102	89	75	84	38	37
7	94	97	89	97	99	100	105	99	80	88	41	46
Med	79.0	88.0	84.0	84.0	79.0	94.0	71.0	89.0	75.0	88.0	43.0	53.0
IQR	76.0 - 88.0	78.0 - 97.0	78.0 - 89.0	82.0 - 97.0	77.0 - 87.0	89.0 - 100	62.0 - 102	80.0 - 97.0	57.0 - 80.0	81.0 - 91.0	40.0 - 49.0	46.0 - 62.0
Min	61	77	77	72	73	75	62	77	53	81	38	37
Max	102	97	94	97	99	102	105	99	88	91	57	64

The general IQ of these 7 patients assessed postoperatively (median 88.00, IQR 78.00–97.00) were better than the preoperative results (median 79.00, IQR 76.00–88.00). Three of the five patients rendered seizure-free following surgery had remarkable increase in IQ points on the side contralateral to the surgery. In a retrospective study by Engman et al. (14), 25 patients with epilepsy who underwent ATL resection demonstrated significant increments in IQ scores after medium-term followup. However, at long-term follow-up, these scores declined, returning toward baseline figures. Longterm follow-up on the patients in our study as well as increasing the sample size would allow the observation on whether these improvements in general IQ will revert to baseline values as shown by Engman et al. (14). Uncontrolled refractory epilepsy patients have been shown to have progressive intellectual decline. Though it is well known that following surgery, the neuropsychological test results of the resected side is slightly poorer compared to the preoperative value, the exact opposite occurs to the non-resected side so that the overall memory and IQ performance show improvement (1,9,15,16). Our results are in agreement with those from other studies (14).

It is well-documented that medicallyrefractory patients who underwent epilepsy surgery reported improved quality of life. In this study, slight improvements were observed (43.00 vs. 53.00) in overall quality of life with patients indicating improved confidence in both cognitive and social functioning and decreased anxiety.

In conclusion, our initial results suggest that neuropsychological tests are helpful in lateralizing the lesion with very high concordance to MRI finding. Following successful surgery, general IQ, performance IQ, verbal and non-verbal memory as well as the QOLIE are all showing a trend towards improvement.

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