IQ Difference before and after Temporal Lobe Epilepsy Surgery: First report from Indonesia

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Abstract

Epilepsy is a serious disorder of the brain, affects almost fifty million people in the world. About 40% of the patients finally became refractory to epileptic drugs, especially those with temporal lobe epilepsy (TLE). This refractory condition may cause psychosocial decline, including patient's intelligence. Surgical therapy has an important role in stopping further damage to brain cells caused by repeated seizures. The elimination of the seizure after surgery will hopefully results in better intelligence score. This study aims to find out the effect ofsurgical therapyin TLE patients after surgery. We were using a Quasi Experimental study with One Group Pre-test and Post-test design. The samples were taken with consecutive sampling method. Subjects were 15 TLE patients who underwent anterior temporal lobectomy and have passed at least one year postoperative period, and also had done an intelligence quotient (IQ) test before surgery. IQ before and after surgery were measured with WAIS and WISC-R method. The statistical tests used were paired t-test. We found the verbal IQ after surgery(98.8±9.88(76-119)) were significantly higher(p=0.01) comparedwithpreoperativeverbalIQ(92.7±9.60(77-113)). On the other hand, performance IQ after surgery (98.2±8.64(82-115)) were higher compared with preoperative performance IQ (96.0±9.39(75-116)) but it was not significant (p=0.5). Total IQ after surgery (97.8 ±7.69(81-107)) also higher compared with preoperative total IQ (93.9±9.28(75-115)) but also not significant (p=0.08). Postoperative verbal IQ improvement was found compared with preoperative verbal IQ.

Keywords: *IQ, epilepsy, epilepsy surgery*

Introduction

Epilepsy is the most frequent serious brain disorder that affects almost fifty million people all over the world. [1] Report from WHO shows the prevalence is 1% of total population in the world, equal value with breast cancer in woman and prostate cancer in man.[2] The incidence rate of epilepsy is still high, especially in developing country, reaching 114 cases in every 100.000 population each year.[3] With its known incidence rate, Indonesia with 220 million in total population has about 250.000 new epilepsy cases each year. Related to the age, the prevalence chart shows bimodal pattern, getting higher in pediatric then come down in early and middle adult, and then rising again in the elderly.[4,5]

Almost 30 to 40 percent of all epilepsy patients will become immune to anti-epilepsy drugs (AED) called refractory epilepsy.[6,7] Complex partial epilepsy is a bulk of this kind of refractory epilepsy.[8,9]In complex partial epilepsy, the epileptic focus mostly located in the side part of the brain. Precisely, it is located in hippocampus area and amygdala body which sometimes involving brain surface area of temporal lobe as well. [8,10]

In every single epileptic spell, brain cells injury or even death will occur. Therefore, when the spell frequently occurs, there will be weakening or death of brain cells, hence, will result in severe declining of intelligence ability.[10-12]

Intelligence has been defined by Wechsler as the aggregate or global capacity of the individual to act

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purposefully, to think rationally and to deal effectively with his environment.[13] In general, intelligence is divided into three categories, which are practical ability for problem solving, verbal ability and social competence. Whereas Intelligence Quotient (IQ) is an intelligence score derived from a comparison between mental age and chronology age then multiply by 100.[14]

Since 1999 epilepsy surgery has been performed in Indonesia with terrific post-operative results of seizure attack rate. However, there is no research to date have been conducted that review about the improvement of intelligence ability in post epilepsy surgery patients in Indonesia. This research is conducted to know the possible effect of epilepsy surgery on their intelligence ability, by comparing on their IQ before and after epilepsy surgery.

Material and Method

This research was conducted during March and June 2012 in dr. Kariadi General Public Hospital, Semarang, Central Java of Indonesia. It is Quasi-experimental study one group pre-test and post-test design. The independent variable in this research is epilepsy surgery, whereas dependent variable is IQ.

The target population is the epilepsy patients who had had an epilepsy surgery and already passed a year-time period after operation. Inclusion criteria consist of: a) be declared as temporal lobe epilepsy patient based on preceding clinical examination (EEG, MRI and semiology), b) The patient has the result of IQ examination before surgery. The exclusion criteria: a) Patient who does not have IQ examination before surgery, b) Patient or family refuses to take part in this research, and c) Based on the medical record, there was another abnormality diagnosed which could affect the cognitive function, such as mental disorder. All procedures performed in studies involving human participants were in accordance with the ethical standards of the Medical Faculty, Diponegoro University and Kariadi Hospital eticalresearch committee and with the 1964 Helsinki declaration standards.

Consecutive sampling was used as the sampling method and successfully obtained 15 patients who meet with the criteria. IQ before surgery was collected from medical report whereas IQ after surgery was obtained from the direct test. Paired t-test was used for statistical analysis.

IQ examination after surgery was supervised by the same psychologist who also supervised IQ examination before surgery. The examination was taken place in the installation of Medical Rehabilitation of dr. Kariadi General Public Hospital. IQ was measured by using WAIS method (Wechsler Adult Intelligence Scale) and WISC-R (Wechsler Intelligence Scale for Children) after informed consent was taken.

Result

Table 1: Data of demography characteristic and factors that associate with epilepsy

Characteristic	**Mean ± (min-max)**	**n (%)**
Sex - Male - Female	 - -	 10 (66.7%) 5 (33.3%)
Age of IQ examination (year)	24.3±7.17 (17-41)	-
Age of first seizure (year)	14.0±7.13 (2-30)	-
Duration of epilepsy (year)	7.7±4.70 (1-16)	-
Duration of IQ surgery-IQ examination	41.6±29.70 (12-93)	-

Surgery side - Dominant side - Non-dominant side	 - -	 5 (33.3%) 10 (66.7%)
Seizure state after surgery - Free seizure - Not seizure free	 - -	 13 (86.7%) 2 (13.3%)

Table 2. Result of IQ examination before and after epilepsy surgery

IQ	**Before surgery**	**After Surgery**	**p***
Verbal IQ	92.7±9.60 (77-113)	98.8±9.88 (76-119)	0.01
Performance IQ	96.0±9.39 (75-116)	98.2±8.64 (82-115)	0.5
Total IQ	93.9±9.28 (75-115)	97.8±7.69 (81-107)	0.08
*Pairet-test: before and after surgery			

From the table 1, more than half of sample is male (66.7%). The average age of IQ examination when was taken is 24.3±7.17 with the youngest age is 17 years old and the eldest one is 41 of age. Based on the age of the first experience of epilepsy seizure, the average is 14.0±7.13 years old with the youngest age is two years old and 30 years old is the eldest. Duration of having epilepsy is 7.7±4.70 years with the shortest period is one year and the longest one is 16 years. The time distance between surgery and post-surgery IQ examination is 41.6±29.7 months of average. The shortest is 12 months and 93 months for the longest one. Regarding the surgery side, mostly it is in the non-dominant side (66.7%). Almost in all samples became free of epilepsy seizure state (86.7%).IQ comparison between before and after epilepsy surgery shows in table 2.

From the table 2, verbal IQ after epilepsy surgery shows a better outcome than before surgery and it is statistically significant (p=0.01) (figure 1).The anothercomponent of IQ, the performance IQ also shows higher outcome after epilepsy surgery than performance IQ before surgery, however, it is not statistically significant (p=0.5) (figure 2). A Better outcome is also found in total IQ after surgery than before surgery although it is not worth statistically (p=0.08) (figure 3).

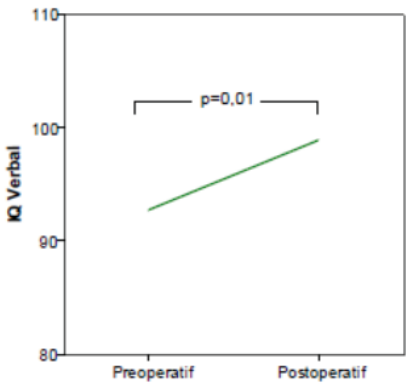


Figure 1: Verbal IQ of temporal lobe epilepsy Patients before and after surgery (n=15)

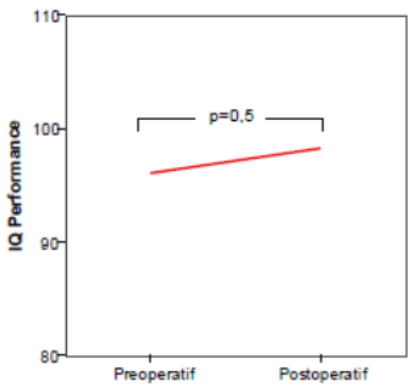
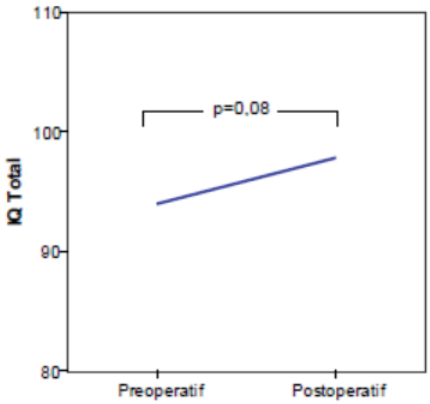


Figure 2: Performance IQ of temporal lobe epilepsy patients before and after surgery (n=15)



Time measurement
Figure 3: Total IQ of temporal lobe epilepsy patients before and after surgery (n=15)

Discussion

We found all of IQ components after epilepsy surgery were higher than before surgery. However, it wasmerely one of IQ component, the verbal IQ thatshowed an escalation andhadsignificant statistical value. This outcome can be related with part of the brain where the damages occurred. It is in the temporal lobe, part of the brain that has responsibility for language ability, therefore, any manipulation in this part willbe affecting on verbal IQ.[15] The performance IQ is slightly affected by the surgery even showing an increased outcome. Total IQ which was a merge result of both verbal and performance IQ showed an increased outcome although not statistically significant.

A research by Anderson, et al. studying the correlation between intelligentsia and brain structure concluded that there is a significant correlation between verbal IQ and total IQ with the volume of temporal lobe both in the right and left side, and also with hippocampus structure. However, no significant correlation found with performance IQ.[15] Their result definitively supports our research and possibly underlies the mechanism of how the verbal IQ increases after epilepsy surgery.

The weakness of this research was not to consider the anti-epileptic drugs. There are some samples who still consume AEDs routinely. In the other hand, several samples have already stopped the AEDs completely. This weakness possibly could affect the IQ examination outcome because AEDs also could influence the cognitive function.

Our research also found a limitation of the total of sample. Not only caused by the time limit but also, our research was conducted only in one center. When the research is conducted multicenter by using cohort method, the obtained sample will be greater in quantity.

Allegedly, one of the factors that possibly affect the increase of IQ in post-surgery epilepsy patient wasexternal stimulation, both by the family and closest friends even from medical practitioners. In the future, we expect the management of epilepsy patient not only stopped after the surgery but also involve proper stimulation therapy for helping stimulation of brain cells activity. Moreover, the doctor has to encourage their family members who have undergone surgery to frequently give stimulation to the patient for increasing the intelligentsia.

Conclusion

IQ of temporal lobe epilepsy patient is increased after epilepsy surgery. This outcome is pointed out from the escalation of verbal IQ after surgery that statistically significant, compared with verbal IQ before surgery. An increase of performance and total IQ are also found, however, they are not statistically significant.

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