CHAPTER IV
RESULT

This study is a survey research. The objectives are 1) to study the prevalence of cognitive impairment in brain tumor patients, 2) to study the prevalence of neuropsychiatric symptoms in brain tumor patients, and 3) to find the relation between each individual's variables that influence the neuropsychiatric symptoms and the cognitive impairment of brain tumor patients. The result of the analysis shall be presented in two steps.

Step 1: Analysis of the sample's characteristics

Step 2: Analysis for the research questions, divided into three parts

1. Analysis of the prevalence of cognitive impairment in brain tumor patients

2. Analysis of the prevalence of neuropsychiatric symptoms in brain tumor patients

3. Analysis of the relation between each individual's variables that influence the neuropsychiatric symptoms and the cognitive impairment of brain tumor patients

Step 1 Analysis of the sample's characteristics

After examining the collected data from all 43 samples, 5 of them were inapplicable because four of them were not diagnosed to have brain tumors and one of them could not complete the whole five parts of the evaluations. Thus the remaining samples were 38 patients.

Table 4.1 Status of brain tumor patient sample

Demographic data		**N**	%
Sex	Male	5	13.2
	Female	33	86.8
	Total	**38**	**100**
Age	18-20	2	5.2
	21-30	5	13.2
	31-40	5	13.2
	41-50	11	28.9
	51-60	8	21.0
	61-70	6	15.8
	71-80	1	2.7
	Total	**38**	**100**
$\bar{X}$ = 45.92 SD = 14.78 Min = 18 Max = 75			
Education	No Education	3	7.9
	Primary School	20	52.6
	Hi - School	7	18.4
	Diploma	1	2.7
	Bachelor's Degree	7	18.4
	Total	**38**	**100**

Table 4.1 Status of brain tumor patient sample (Cont.)

Demographic data		**N**	%
Type of tumor	Single brain tumor	29	76.3
	Multiple brain tumor	9	23.7
	Total	**38**	**100**
Tumor area	Frontal	7	18.4
	Parietal	6	15.8
	Pituitary	7	18.4
	Temporal	1	2.6
	Cerebellum	3	8.1
	Occipital	4	10.5
	Thalamus	4	10.5
	Frontal+Parietal	4	10.5
	Temporal+Thalamus	1	2.6
	Frontal+Parietal+Temporal	1	2.6
	Total	**38**	**100**
Classification	Neuroepithelial tissue	9	25.7
	Cranial and paraspinal nerves	3	8.6
	Meninges	14	40.0
	Sellar region	5	14.3
	Metastatic tumor	4	11.4
	Total	**35**	**100**
Type	Primary tumor	33	94.3
	Secondary tumor	2	5.7
	Total	**38**	**100**

Table 4.1 Status of brain tumor patient sample (Cont.)

Demographic data		**N**	%
Comorbid	None	19	50
	Hypertention	12	31.8
	Allergy	2	5.3
	Seizure	3	7.6
	Cholesterol	2	5.3
	Total	**38**	**100**
Previous Medical History	Have	37	97.4
	None	1	2.6
	Total	**38**	**100**
Previous Psychiatric symptom	Have	38	100
	None	0	0
	Total	**38**	**100**
Medicine	Have	26	68.4
	None	12	31.6
	Total	**38**	**100**
Glasgow Coma Scale Score	13	2	5.3
	14	9	23.7
	15	27	71.0
	Total	**38**	**100**
$\bar{X}$ = 14.66 SD = 0.582 Min = 13 Max = 15			

According to table 4.1, among the sample group, there are 5 males (13.2%) and 33 females (86.8%). The ratio between male and female is 1:6.5. Considering age, the majority is 41-50 years old, which comprises 11 patients (28.9%); followed by 51-

60 years old, which is 8 patients (21%). Looking at education level, most of the sample, at 50%, graduated primary school.

To look at the characteristics of tumors of the sample, 76.3% of them all have one tumor. They are 7 frontals (18.4%), 6 parietals (15.8%), 7 pituitatries (18.4%), 1 temporal (2.6%), 3 cerebellums (8.1%), 4 occipital (10.5%), and 4 thalamus (10.5%). Considering the classification, 40% of the patients have meninges tumors, followed by neuroepithelial tissues at 25.7%, and 94.3% of all are primary brain tumors.

Most of the sample do not have any underlying diseases or psychiatric symptom records, and have never been treated for tumors. The level of consciousness is good (Glasgow Coma Scale = 13-15).

Step 2 Analysis for the research questions

Part 1 Analysis of the prevalence of cognitive impairment in brain tumor patients by using fundamental statistics

Table 4.2 Comparing cognitive impairment of brain tumor patients in doing the MMSE-Thai 2002 and MoCA Thai version

Demographic data		MMSE	MoCA
Cognitive Impairment	Abnormal	6(15.79%)	30(78.95%)
	Normal	32(84.21%)	8(21.05%)
	Total	**38**	**38**

Table 4.3 Result of evaluating cognitive impairment, compared individually

Demographic data		N	%
MMSE normal but MoCA abnormal		24	63.16
MMSE normal, MoCA normal		8	21.05
MMSE abnormal, MoCA abnormal		6	15.79
	Total	**38**	**100**

According to Table 4.2 and 4.3, in the MMSE test, there are only 6 patients who have cognitive impairment (15.79%), but in the MoCA test, there are 30 patients that have cognitive impairment (78.95%). In addition, when compared individually, 63.16% of the patients that are evaluated by the MMSE but show no cognitive impairment do have cognitive impairment when evaluated by the MoCA.

Part 2 Analysis of the prevalence of neuropsychiatric symptoms in brain tumor patients by using fundamental statistics

Table 4.4 Neuropsychiatric symptom problems of brain tumor patients

Demographic data		**N**	%
Neuropsychiatric symptom	Normal	32	84.2
	Abnormal	6	15.8
	Total	**38**	**100**

Table 4.5 Characteristics of neuropsychiatric symptom of brain tumor patients

	Neuropsychiatric symptom						
No.	**Hallucination**	**Aggression**	**Depress**	**Irritability**	**Aberrant motor**	**sleep**	**Appetite**
1.							/
2.			/		/		/
3.			/				
4.	/						
5.		/		/		/	
6.		/		/			

According to Table 4.4 and 4.5, most sample do not have neuropsychiatric symtoms. Only 6 people do, which can be categorized into 1 hallucination, 2 aggression, 1 Aberrant motor behavior, 1 sleep problem, and 1 appetite.

Part 3 Analysis of the relation between each individual's variables that influence the neuropsychiatric symptoms and the cognitive impairment of brain tumor patients

Table 4.6 Result of comparing cognitive impairment of brain tumor patients, categorized by gender

	Cognitive impairment			
sex	Abnormal	Normal	Total	χ^2
Male	4 (10.5%)	1 (2.7%)	5 (13.2%)	.004
Female	26 (68.4%)	7 (18.4%)	33 (86.8%)	
Total	30 (78.9%)	8 (21.1%)	38 (100%)	

* p < .05, Symmetric = .000, Cramer's V =0.10

According to Table 4.6, chi-square equals to .004, which indicates that gender and cognitive impairment have a statistically significant relation at .05. And Cramer's V = .10 indicates that both variables have a slight relation.

Table 4.7 Result of comparing neuropsychiatric symptoms of brain tumor patients, categorized by gender

	Neuropsychiatric symptom			
sex	Abnormal	Normal	Total	χ^2
Male	1 (2.6%)	4 (10.5%)	5 (13.1%)	.077
Female	5 (13.2%)	28 (73.7 %)	33 (86.9%)	
Total	6 (15.8%)	32 (84.2%)	38 (100%)	

According to Table 4.7, chi-square equals to .077, thus gender and neuropsychiatric symptoms do not have a significant relation at .05. Cramer's V = .045 indicates that both variables have a very small relation.

Table 4.8 Result of comparing cognitive impairment of brain tumor patients, categorized by locations of brain tumors

	Cognitive impairment			
Area	Abnormal	Normal	Total	χ^2
frontal	10 (26.3%)	2 (5.3%)	12 (31.6%)	10.853
parietal	6 (15.8%)	0 (0%)	6 (15.8%)	
pituitary	5 (13.1%)	2 (5.3%)	7 (18.4%)	
temporal	2 (5.3%)	0 (0%)	2 (5.3%)	
cerebellum	2 (5.3%)	1 (2.6%)	3 (7.9%)	
occipital	4 (10.5%)	0 (0%)	4 (10.5%)	
thalamus	1 (2.6%)	3 (7.9%)	4 (10.5%)	
Total	30 (78.9%)	8 (21.1%)	38 (100%)	

* $p < .05$, Symmetric = .088, Cramer's V =0.534

Table 4.9 Ratio of cognitive impairment occurrence, categorized by locations of tumors

Demographic data	Cognitive impairment	None
Frontal	10(83.3%)	2(16.7%)
Non-Frontal	20(76.9%)	6(23.1%)
Total	30	8

According to Table 4.8 and 4.9, chi-square is 10.853. Locations of tumors and cognitive impairment are not significant related to each other at .05. Cramer's V = .315 indicates that both variables have a small relation.

Table 4.10 Result of comparing neuropsychiatric symptoms of brain tumor patients, categorized by locations of brain tumors

	Neuropsychiatric symptom			
Area	Abnormal	Normal	Total	χ^2
frontal	3 (7.9%)	9 (23.8%)	12 (31.7%)	2.724
parietal	1 (2.6%)	5 (13.1%)	6 (15.7%)	
pituitary	1 (2.6%)	6 (15.8%)	7 (18.4%)	
temporal	0 (0%)	2 (5.3%)	2 (5.3%)	
cerebellum	0 (0%)	3 (7.9%)	3 (7.9%)	
occipital	0 (0%)	4 (10.5%)	4 (10.5%)	
thalamus	1 (2.6%)	3 (7.9%)	4 (10.5%)	
Total	6 (15.8%)	32 (84.2%)	38 (100%)	

* $p < .05$, Symmetric = .000, Cramer's V =0.264

Table 4.11 Ration of neuropsychiatric symptoms occurrence, categorized by locations of tumors

Demographic data	Neuropsychiatric symptom	None
Frontal	3(23.1%)	10(76.9%)
Non-Frontal	3(12%)	22(88%)
Total	6	32

According to Table 4.10 and 4.11, chi-square equals to 2.724. Locations of tumors and neuropsychiatric symptoms do not have significant relation at .05. Cramer's V = .264 indicates that both variables have a very small relation.

Table 4.12 Result of comparing cognitive impairment symptoms in brain tumor patients, categorized by underlying diseases

	Cognitive impairment			
Comorbid	Abnormal	Normal	Total	χ^2
Hypertention	11 (28.9%)	1 (2.6%)	12 (31.5%)	4.776
Allergy	1 (2.6%)	1 (2.6%)	2 (5.2%)	
Seizure	3 (7.9%)	0 (0%)	3 (7.9%)	
Cholesterol	2 (5.3%)	0 (0%)	2 (5.3%)	
None	13 (34.3%)	6 (15.8%)	19 (50.1%)	
Total	30 (78.9%)	8 (21.1%)	38 (100%)	

* p < .05, Symmetric = .000, Cramer's V =0.355

According to table 4.12, chi-square equals to 4.776. Underlying diseases and cognitive impairment do not have significant relation at .05. Cramer's V = .355 indicates that both variables have a very small relation.

Table 4.13 Result of neuropsychiatric symptoms of brain tumor patients, categorized by underlying diseases

	Neuropsychiatric symptom			
Comorbid	Abnormal	Normal	Total	χ^2
Hypertention	2 (5.3%)	10 (26.3%)	12 (31.6%)	2.705
Allergy	1 (2.6%)	1 (2.6%)	2 (5.2%)	
Seizure	0 (0%)	3 (7.9%)	3 (7.9%)	
Cholesterol	0 (0%)	2 (5.3%)	2 (5.3%)	
None	3 (7.9%)	16 (42.1%)	19 (50.0%)	
Total	6 (15.8%)	32 (84.2%)	38 (100%)	

* p < .05 ค่า Symmetric = .000, Cramer's V =0.267

According to Table 4.13, chi-square equals to 2.705. Underlying diseases and neuropsychiatric symptoms do not have significant relation at .05. Cramer's V = .267 indicates that both variables have a very small relation.

Table 4.14 Relation between age and cognitive impairment of brain tumor patients

Cognitive impairment		N	$\overline{X}$	**SD**	**p-value**
Age	Abnormal	30 (78.9%)	47.47	15.651	.092
	Normal	8 (21.1%)	40.12	9.568	
	Total	38 (100%)			

* p < .10

Table 4.15 Ratio of cognitive impairment occurence, categorized by age

Demographic data	Cognitive impairment	None
Age < 60	23(74.2%)	8(25.8%)
Age > 60	7(100%)	0(0%)
Total	30	8

According to Table 4.14, the average age of the group that has cognitive impairment is higher than the group with no cognitive impairment. After analyzing it, the average ages of both groups have statistical significant difference at .10. In addition, according to Table 4.15, the group of elders (aged higher than 60 years old) has the ratio of cognitive impairment less than those aged lower than 60 years old.

Table 4.16 The relation between age and neuropsychiatric symptoms of brain tumor patients

Neuropsychiatric symptom		N	$\overline{X}$	**SD**	**p-value**
Age	Abnormal	6 (15.8%)	41.17	19.385	.400
	Normal	32 (84.2%)	46.81	13.964	
	Total	38 (100%)			

* p < .05

Table 4.17 Ratio of neuropsychiatric symptom occurence, categorized by age

Demographic data	Neuropsychiatric symptom	None
Age < 60	5(16.1%)	26(83.9%)
Age > 60	1(14.3%)	6(85.7%)
Total	6	32

According to Table 4.16 and 4.17, it shows that the average age of those who have neuropsychiatric problems are lower than the average age of those who do not. After analyzing it, the average ages of both groups have a statistically significant difference at .05.

Table 4.18 The relation between education level (years) and cognitive impairment of brain tumor patients

Cognitive impairment		N	$\bar{\chi}$	**SD**	**p-value**
Education	Abnormal	30 (78.9%)	7.87	4.725	.039
	Normal	8 (21.1%)	11.75	3.919	
	Total	38 (100%)			

* p < .05

Accroding to Table 4.18, the average education level (years) of those who have cognitive problem is lower than those who do not. After analyzing it, it is found that the average education levels of both groups have a statistically significant difference at .05.

Table 4.19 The relation between education level (years) and neuropsychiatric symptoms of brain tumor patients

Neuropsychiatric symptom		N	$\overline{\chi}$	SD	p-value
Education	Abnormal	6	9.67	6.623	.571
	Normal	32	8.50	4.487	
	Total	38			

* $p < .05$

According to Table 4.19, the average education level (years) of those who have neuropsychiatric symptoms is not quite different from those who do not. After analyzing it, it is found that the average education levels (years) of both groups do not have a statistically significant difference at .05.

CHAPTER V
DISCUSSION, CONCLUSION AND RECOMMENDATION

This research is a survey research. The objectives are to study the prevalence of cognitive impairment and neuropsychiatric symptoms of brain tumor patients, and to find the relation between individual's variables that induce neuropsychiatric symptoms and cognitive impairment in brain tumor patients.

The populations of this research are brain tumor patients that are diagnosed by doctors at the Department of Surgery, Faculty of Medicine, Siriraj Hospital. The samples are 43 first-time diagnosed brain tumor patients in September 2013 through February 2014.

The tools for this research comprise five parts: general questionnaire, the Glasgow Coma Scale, the MMSE-Thai 2002, The Montreal Cognitive Assessment (MoCA), and the Neuropsychiatric Inventory (NPI).

Descriptive statistics is used for analysis in order to explain the characteristics of the sample and the variables that are used in the research. Quantitative data, i.e. age and education level, are analyzed by means and standard deviation. As for qualitative data; i.e. gender, locations of tumors, types of tumors, complication comorbidity, previous treatment, psychiatric symptom record, and previous medication; are analyzed by frequency and percentage.

To study the relation between individual's variables and cognitive impairment and neuropsychiatric symptoms are divided into two parts. First is the independent variables that are quantitative data; i.e. gender, locations of tumors, types of tumors, complicated comordity, previous treatment, psychiatric symptom record, and previous medication. These are analyzed by chi-square. Second is the qualitative data, i.e. age and education level. The statistics used to analyze is MannWhitney U-test.

Conclusion

The result can ve concluded as the following.

1. The results of primary analysis regarding the sample's status are found that the ration between male and female is 1:6.5. The reason why there is a big difference between two genders is that more female patients consented to participate. Most of the sample fall in the 41-50 year-old group. In addition due to the data collection was done at the Common Ward, the education level is not so high, hence most of them have a primary school education.

Most of the patients in the sample have only one tumor and it is meninges type. The following group is neuroepithelial tissue type. Nonetheless, almost all of them are primary brain tumor.

Most of the patients in the sample group do not have any underlying diseases or psychiatric symptom records. In addition, they have never been through any treatment. Their level of consciousness is good (Glasgow Coma Scale = 13-15) because the patients in this study were only chosen if they would be able to go through all the data collection process.

2. After analyzing the prevalence of cognitive impairment of brain tumor patients, it is found that 78.95% of the patients have cognitive impairment. And after analyzing the prevalence of neuropsychiatric symptoms, it is founded 15.8% of the patients have neuropsychiatric symptoms.

3. After analyzing the relation between individual's variables that induce cognitive impairment and neuropsychiatric symptoms, it is found that gender has a statistically significant relation to cognitive impairment at .05, and has a statistically significant relation to neuropsychiatric symptoms at .10. On the other hand, age and education level have statistically significant relations to cognitive impairment at .10 and .05, respectively.

Discussion

According to the result, it can be discussed according to the research objectives as followed.

1. According to the study, it is found that the patients in Siriraj Hospital mostly have one tumor at one location. All of the patients are divided to be 12 patients who have a tumor at frontal (31.5%), 6 at parietal (15.8%), 7 at pituitary 18.4%), 2 at temporal (5.2%), 3 at cerebellum (8.1%), 4 at occipital (10.5%), and 4 at thalamus (10.5%). This is different from the study of Trevor (2012) that found the characteristics of brain tumor occurence according to the location, that is posterior fossa (30%), frontal and temporal lobe (22%), parietal lobe (12%), pituitary (10%), and occipital lobe (4%).

Considering the classification, it is found that there are 14 patients with meninges tumors (40%), 9 with neuroepithelial tissue (25.7%), 5 with sellar region (14.3%), 4 metastic tumor (11.4%), and 3 with cranial and parasoinal (8.6%). This is also different from the prevalence of brain tumor occurence classified by type by World Health Orhanization, which is collected by Andrew H. Kaye (2005). There are 52% neuroepithelial, 15% metastatic, 15% meningioma, 8% pituitary, and 8% acustic neuroma, respectively.

After analyzing the prevalence of cognitive impairment, it is found that 78.95% of the patients in Siriraj Hospital have cognitive impairment, which is less than the result from the research of Tucha O (2000) that studies the cognitive impairment of brain tumor patients, both primary and secondary intracranial types, before undergoing the treatment. The study is done by psychological tools that have standard to evaluate memory, attention, language, and executive function. The result shows that more than 90% of the patients have cognitive impairment. The reason that the sample of this research has less cognitive impairment is because the data collection was done only in those who were willing to participate and had good consciousness level.

After analyzing the prevalence of neuropsychiatric symptoms of brain tumor patients in Siriraj Hospital, it is found that there are only 6 patients (15.8%) that have neuropsychiatric symptoms. It can be categorized into 1 person with hallucination, 2 with aggression, 2 with irritability, 1 with aberrant motor behavior, 1

with sleep problem, and 2 with appetite. These figures are fewer than previous studies, for example Sompop Reungtrakul (2011) and Trevor (2012) who state that 47-84% of brain tumor patients have psychiatric and behavioral symptoms; or the study of David A. Tomb (2008) that studied intracranial tumor patients and found that 50% of them have psychiatric problems. The reason that the sample of this research has less psychiatric problems than other studies is due to the data collection was done only with patients who had good condition and level of consciousness and were willing to take part. Moreover, the evaluation was done via asking the patients and their relatives, which could render inaccurate information about the symptoms.

2. After analyzing the relation between individual's variables that influence cognitive impairment and psychiatric symptoms, it is found that:

2.1 As for the qualitative variables; such as gender, tumor locations, and underlying diseases, gender; they have statistically significant relations to cognitive impairment and neuropsychiatric symptoms at .05 and .10, respectively.

2.2 After analyzing the relation between quantitative variables, such as age, education level (years of education), and cognitive impairment and neuropsychiatric symptoms, it is found that age and education level have statistically significant relations to cognitive impairment at .05 and .10, respectively. The samples who are older tend to have a chance to have cognitive impairment more than the younger ones, for elders have more apoptosis of brain cells due to increased age. And those who have higher education have less cognitive impairment becasue they have more development of brain cells but less apoptosis than those with less education.

Research Limitation

1. The research is done only at Siriraj Hospital, so the result cannot cover for other patients from other hospitals.

2. The data collection from the evaluation and the time for observation are deficient, so it cannot assure that patients do not have cognitive impairment or neuropsychiatric symptoms. The observation while the patients are being treated in the in-patient ward is necessary. For those patients who are doubted to be in that case, they ought to be evaluated by psychological measure in order to examine them again.

Recommendation

Recommendation for Applying This Resaerch's Result

1. Even though this research is based on only patients in Siriraj Hospital and cannot cover other hospitals, it still is a fundamental research for further similar research in Thailand.

2. According to the result, age and education level are related to cognitive impairment, thus this is applicable to observing cognitive impairment and taking care of brain tumor patients. It also helps in preparing relatives for taking care of old patients who have low education level.

Recommendation for Further Research

1. There should be more study about brain tumor locations whether they have a relation to cognitive impairment or neuropsychiatric symptoms by using a bigger sample size than in this research because research from other countries finds that locations of brain tumors have a relation to the stated problem.

2. After removing the tumor for 6 months, patients may have some changes in cognitive impairment and neuropsychiatric symptoms.