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Comparison of Visual Field Defect Change Post Ischemic Stroke Patients

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ABSTRACT

Background: Evaluation of changes in visual field defects in post-stroke patients is very important given the large incidence rate. The aim of this study was to investigate the comparison of visual field defect post ischemic stroke patients.

Methods: The cross sectional is used in this study. In this study, field defects were assessed in patients who had passed the acute phase and the following 3 months. Furthermore, the change in the value of The Visual Field Index (VFI) and Mean Deviation (MD) that occurs in post-ischemic stroke patients is assessed. The number of samples was 18 subjects. Sampling technique with consecutive sampling. Hypothesis test used chi-square test. A two-tailed P-value of <0.05 was considered statistically significant.

Results: The results showed that both the right and left eye experienced improvement in MD after 3 months. In the right eye, the greatest changes were seen in mild degrees (first examination 11.1% to 22.2% at second examination) where moderate severity decreased in number. Whereas in the left eye the greatest change was in mild degrees from 38.9% to 27.75% and normal degrees increased from 22.2% to 38.9%. Comparison of VFI values in the field of view of post-acute ischemic stroke patients, it is known that the right eye (3.5%) has a greater mean increase in VFI values than the left eye (0.89%). There has been an increase in the visual field as assessed by the mean deviation and visual field index in ischemic stroke patients after the acute phase and after the next 3 months ($p<0.05$).

Conclusion: This analysis confirmed there has been an increase in the visual field as assessed by the mean deviation and visual field index in ischemic stroke patients after the acute phase and after the next 3 months.

Keywords: Visual Field Defects, Post Ischemic, Stroke

INTRODUCTION

Visual disturbances are one of the main complications in post-stroke patients. Approximately 65% of patients after acute stroke experience visual problems. Visual disturbances can be in the form of decreased central vision, visual field disturbances, eye movement disorders and visual perception disorders. One of the things that get attention is visual field defects that arise and have negative implications for the quality of life and daily activities of post-stroke patients.[1][2]

Impaired visual field in stroke occurs when the lesion occurs in the visual pathway, where clinical manifestations may include blindness of one eye, bitemporal hemianopia, binasal hemianopia, left or right homonymous hemianopia, superior or inferior homonym quadranopia, central scotoma or other forms. The ratio of this defect in the left eye and right eye is almost the same.[3][4]

Visual field examination is important in evaluating lesions involving the visual pathway. Automated perimetry has a better standard and provides statistical analysis that is based on normative data by age. This perimetry also provides data on reliability and patient response, which can only be estimated by the operator on the perimetric manual.[5][6]

The visual field index on perimetry consists of Mean Deviation (MD), Visual Field Index (VFI) and Pattern Standard Deviation (PSD). The MD is the average of the values presented in the mapping of total numerical deviations, with 0 indicating no deviation from normal and large negative values associated with further field loss. The VFI is an extension of MD which is designed for cataract sufferers and is more sensitive to changes near the center of the field of view, and is more related to the loss of ganglion cells. Normal vision in VFI was 100%, while perimetric blindness resulted in a VFI value close to 0%. The Pattern of PSD summarizes visual field losses localized to a single index, regardless of general depression. PSD gives low values in the normal field, in the uniform depression area and in the blind field, but the PSD value is highest when it loses the advanced field of view. VFI and MD are very helpful for staging and for monitoring patient progress over time. The level of statistical significance compared to normal is shown in addition to the MD and PSD values that fall outside the normal range. VFI does not show a limit of normative significance, because it was developed primarily as a staging and metric development.[7-9]

MATERIALS & METHODS

Study design

The cross sectional is used in this study. The study population was all post-ischemic stroke patients in the Department of Neurology, Dr. M. Djamil General Hospital Padang, Indonesia. The number of samples was 18 subjects. Sampling technique with consecutive sampling. In this study, field defects were assessed in patients who had passed the acute phase and the following 3 months. Furthermore, the change in the value of The VFI and MD that occurs in post-ischemic stroke patients is assessed. The study inclusion criteria were all patients who had been diagnosed after ischemic stroke and had passed the acute phase in the Neurology Department of Dr. M. Djamil General Hospital Padang, Indonesia with a history of stroke less than 3 months and more than 3 months, vision> 1/60 and cooperative.

Research procedures

The visual field examination is carried out as follows: 1) each eye tested will take about 10 minutes for the perimetric test; 2) it is important to see fixation targets during the test; 3) light stimuli will be projected at the center and periphery of the perimetric cup; 4) a response button is given to the patient and he is told to press the button whenever the stimulus is seen; 5) not all stimuli will be visible, as the brightness will vary from very bright to very dim; 6) all visible even dim stimuli are recorded; 7) if the patient is tired, the test can be stopped by pressing the trigger continuously or informing the examiner; 8) The eye which is not examined will be closed, but must be kept open.

The reliability of the field test was assessed. The test is considered reliable if fixation losses, false positives and false negatives are less than 25%. If more than 25% is deemed ineligible and repeated.

Statistical Analysis

Hypothesis test used chi-square test. A two-tailed P-value of <0.05 was considered statistically significant. Data is analyzed by using SPSS version 23.0.

RESULT

Characteristic post ischemic stroke patients (Table 1).

Table 1. Characteristic post ischemic stroke patients

Variables	Value
Age (years), mean±SD	56.5 ± 17.82
Sex, f(%)	
Male	10 (55.56)
Female	8 (44.44)

Table 1 found the mean age of the research subjects was 56.5 ± 17.82 years. Based on gender, it was found that more men (55.56%) suffered from ischemic stroke.

Value of MD in visual field examination of 1st and 2nd acute phase ischemic stroke patients (Table 2).

Table 2. Value of MD in visual field examination of 1st and 2nd acute phase ischemic stroke patients

	Mean ± SD	p-value
Right eye		<0.0001
1st examination	-8.46±10.24	
2nd examination	-6.72±7.27	
Left eye		<0.0001
1st examination	-6.89±10.73	
2nd examination	-5.87±11.50	

Table 2 showed that both the right eye and the left eye experienced a decrease in MD values at the first examination. The right eye experienced a decrease in the mean MD score that was greater than the left eye on first examination.The right eye also had a lower mean MD score than the left eye on the second examination after 3 months.

MD-grade visual field examination of the right eye, 1st and 2nd examination of post-acute phase ischemic stroke patients (Table 3).

Table 3. MD-grade visual field examination of the right eye, 1st and 2nd examination of post-acute phase ischemic stroke patients

MD-grade	1st examination		2nd examination	
	f	%	f	%
Normal	6	33.4	6	33.4
Low	2	11.1	4	22.2
Moderate	5	27.75	4	22.2
Heavy	5	27.75	4	22.2
Total	18	100.0	18	100.0

Table 3 showed the MD degree based on the Hoddapp classification, at the first examination the right eye of the study subjects had the most normal MD degrees (33.4%) and the least was the mild degree (11.1%). The results of the second MD examination of the right eye were also found that most had normal MD degrees (33.4%), while mild, moderate and severe degrees had the same number.

Table 4. MD-grade visual field examination of the left eye, 1st and 2nd examination of post-acute phase ischemic stroke patients

MD-grade	1st examination		2nd examination	
	f	%	f	%
Normal	4	22.2	7	38.9
Low	7	38.9	5	27.8
Moderate	3	16.7	2	11.1
Heavy	4	22.2	4	22.2
Total	18	100.0	18	100.0

Table 4 found that the MD grade in the left eye was found to be the most mild (38.9%). On the second examination, MD degrees were at most normal (38.9%).

Visual field examination of the 1st and 2nd post-acute phase ischemic stroke patients (Table 5).

Table 5. Visual field examination of the 1st and 2nd post-acute phase ischemic stroke patients

	Mean±SD	p-value
First examination of right eye VFI	79.44±32.00	<0.0001
Second examination of right eye VFI	82.94±21.50	
First examination of left eye VFI	84.33±28.50	<0.0001
Second examination of left eye VFI	85.22±30.00	

Table 5 showed that the VFI value in the study showed results that were in line with the MD value, where the right eye and the left eye also experienced a decrease in the VFI value which was in line with the decrease in the MD value at the first examination. The right eye also experienced a decrease in the mean VFI value that was greater than the left eye on examination 1. Similar to the MD score, the right eye also had a lower mean VFI value than the left eye on the second examination after 3 months.

Comparison of the degree of mean deviation of post-acute phase ischemic stroke patients at the first and second examinations (Table 6).

Table 6. Comparison of the degree of mean deviation of post-acute phase ischemic stroke patients at the first and second examinations

Eye	Examination	MD degree				p-value
		Normal	Low	Moderate	Heavy	
Right	First	6 (33.4%)	2 (11.1%)	5 (27.75%)	5 (27.75%)	<0.001
	Second	6 (33.4%)	4 (22.2%)	4 (22.2%)	4 (22.2%)	
	Total	12 (33.3%)	6 (16.7%)	9 (25.0%)	9 (25.0%)	
Left	First	4 (22.2%)	7 (38.9%)	3 (16.7%)	4 (22.2%)	
	Second	7 (38.9%)	5 (27.75%)	2 (11.1%)	4 (22.2%)	
	Total	11 (30.6%)	12 (33.3%)	5 (13.9%)	8 (22.2%)	

Tabel 6 showed that the comparison of changes in the degree of MD in post-acute phase stroke patients at the first and second examinations in this study which was tested with chi-square analysis showed a significant relationship, where no cell in the table had an expected value of less than five with a correlation test value. Pearson chi square of 25.833 fulfills the requirements for a value of p = 0.001.

The results showed that both the right and left eye experienced improvement in MD after 3 months. In the right eye, the greatest changes were seen in mild degrees (first examination 11.1% to 22.2% at second examination) where moderate severity decreased in number. Whereas in the left eye the greatest change was in mild degrees from 38.9% to 27.75% and normal degrees increased from 22.2% to 38.9%.

Comparison of VFI for post-acute ischemic stroke patients at the first and second examinations (Table 7).

Table 7. Comparison of VFI for post-acute ischemic stroke patients at the first and second examinations

	Mean (%)	Mean difference	95% Confidence interval	p-value
First examination of right eye VFI	79.44	3.50	3.33 - 3.68	<0.0001
Second examination of right eye VFI	82.944			
First examination of left eye VFI	84.33	0.89	0.85 - 0.93	<0.0001
Second examination of left eye VFI	85.22			

The 7 showed that the comparison of visual field VFI values of post-acute phase ischemic stroke patients was tested using the chi-square test. In the statistical test, it was seen that both eyes experienced an increase in the mean VFI value which was statistically significant (p<0.05), where the right eye (3.5%) had an increase in the mean VFI value that was greater than left eye (0.89%).

DISCUSSION

Many factors affect the improvement of vision and visual field function. Progressivity or control of the underlying disease, location of the lesion, stimulation and individual adaptation are important factors in determining the restoration process or improvement of visual and visual field functions. Gender is also one of the other factors that determine the clinical outcome of ischemic stroke patients.[10],[11]

Women with ischemic stroke have a worse clinical outcome than men. Ischemic stroke patients who are female tend to have more severe disabilities. This is because women have a higher risk of developing various complications such as thromboembolism with atrial fibrillation and cardioembolism. In addition, hormones are also thought to influence clinical outcome. There are differences in sex hormones between men and women, where men are dominated by the sex hormone testosterone, while in women by estrogen. The vasoprotective effect of testosterone makes clinical outcomes in men better. Women, especially those who have experienced menopause, have very low levels of estrogen, which will have an impact on clinical outcomes. Differences in microvascularization and neuron interactions in the brain in males and females are thought to cause different responses to brain damage, thus making clinical outcomes in women worse than in males. Other factors affecting improvement of visual field disorders is the underlying disease of stroke patients. [12-15] These 5 subjects are known to have multiple comorbidities, type II diabetes mellitus, dyslipidemia and hypertension. These three diseases are known to be risk factors for thromboembolism and atherosclerosis, the most common causes of stroke and the increase in recurrent strokes.

Based on this research, it can be concluded that the visual system and the brain have the potential for complex plasticity and are very good at repairing damage to visual field disorders and visual function that occur. Visual field improvement can occur if the appropriate stimulus, adaptation and therapy are given

to post-stroke patients so that they can improve the patient's quality of life.[16][17]

During the study several difficulties were encountered. One of them is the difficulty in examining Humphrey's field of view. The majority of post-stroke patients have limited mobility, so they sometimes cannot sit up straight during the examination and complete the examination. Other difficulties included decreased concentration and fatigue of the patient during Humphrey's visual field examination. Another difficulty was that subjects were excluded after the first examination, generally due to disease progression, stroke recurrence and death.

CONCLUSION

This analysis confirmed there has been an increase in the visual field as assessed by the mean deviation and visual field index in ischemic stroke patients after the acute phase and after the next 3 months.

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