El-Tallawy et al. The Egyptian Journal of Neurology, Psychiatry and Neurosurgery (2019) 55:41
https://doi.org/10.1186/s41983-019-0086-7

The Egyptian Journal of Neurology, Psychiatry and Neurosurgery

RESEARCH Open Access

Relative frequency and prognosis of vascular aphasia (follow-up at 3 months) in the Neurology Department of Assiut University Hospital

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Abstract

Background: Post-stroke aphasia (PSA) is a disabling complication after stroke leading to impairment of quality of life. It was reported to develop in one third of patients with stroke and in two thirds of patients with right hemiplegia due to stroke.

Objectives: The aim of this study is to determine the relative frequency, clinical types, and prognosis of vascular aphasia in patients with acute cerebrovascular stroke.

Methods: The study was conducted on 1508 patients who were admitted with acute cerebrovascular stroke to the Neurology Department of Assiut University Hospital during the 6-month period. Among them, there were 107 patients presented with aphasia who were subjected to clinical assessment, Kasr El-Eini Arabic Aphasia test (KAAT), computerized tomography, and/or magnetic resonance imaging of the brain. Follow-up study of aphasic patients was done after 1 and 3 months with KAAT.

Results: Relative frequency of vascular aphasia in the Neurology Department of Assiut University Hospital was 7.1% and more common among male patients (57.9%), with the most frequent type was global aphasia (66.4%). Better improvement in follow-up was for aphasia without repetitive disorder ($p = 0.000$) mainly for subcortical aphasia ($p = 0.000$), and better recovery was reported among younger age groups ($p = 0.041$), patients with cerebral hemorrhage ($p = 0.019$), and patients with small-sized lesions ($p = 0.031$).

Conclusion: There were many prognostic factors which can predict rate of aphasia recovery like age of the patient, aphasia type, size, site, and pathology of the lesion.

Keywords: Aphasia, Stroke, Prognosis, Recovery

Introduction

Aphasia is an impairment of language, affecting the production or comprehension of speech and the ability to read or write. Aphasia is always due to injury to the brain areas involved in language most commonly from vascular disorders [1].

Post-stroke aphasia (PSA) is a common serious consequence that results from injury to an extended network of cortical and subcortical structures perfused by the middle cerebral artery in the left hemisphere [2], leading to increased long-term morbidity and mortality with residual disability [3, 4]. It also severely affects the ability to communicate and participation in social activities [5].

The incidence of PSA had been reported to be 40–60 per 100,000 individuals per annum [6, 7]. PSA is more common for older patients [8]. Fifteen percent of individuals under the age of 65 experience aphasia after their first ischemic stroke; this percentage increases to 43% for individuals 85 years of age and older [9].

The aim of the work is to determine the relative frequency, clinical types, and prognosis of vascular aphasia in patients with acute cerebrovascular stroke in the Neurology Department of Assiut University Hospital.

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Subjects and methods

The study is a cohort prospective study conducted in Assiut University Hospital. One thousand five hundred eight patients (1508), 779 males and 729 females, were admitted with acute cerebrovascular stroke (within 2 weeks from onset) to the Neurology Department of Assiut University Hospital, Assiut, Egypt, during the 6-month period (June 1, 2015 to November 30, 2015).

Among them, there were 107 (7.1%) patients presented with PSA, 62 (57.9%) males and 45 (42.1%) females, with 33 patients who could not complete the follow-up study (30 patients died and 3 patients could not be accessed).

The study included patients presented with disturbance of language, which was acquired in patients with acute cerebrovascular stroke who were admitted within 2 weeks from onset; also consciousness was clear that it could be judged from patients' behavior, attention to environment, and reaction to sensory stimulation; and the study excluded the thematic context of language [10] and patients with history of mental deterioration, psychiatric disorder, or severe hearing and/or visual impairment.

All selected patients were evaluated within 2 weeks after stroke onset and followed up at periodic intervals (1 month and 3 months later).

Each patient was subjected to history case taking, general medical and neurological examination according to the neurological special questionnaire of the Neurology Department of Assiut University Hospital and neurolinguistic tests: Kasr El-Eini Arabic Aphasia test (KAAT), applied by Hassanein as a simple, rapid, standardized, valid, and reliable bedside test for Egyptian patients, literate and illiterate, for evaluating aphasia [11].

The KAAT consists of six parts: repetition, comprehension (including auditory comprehension, written words, token test, and pantomime), spontaneous speech (including communication, articulation and prosody, automatized language, semantic structure, syntactic structure, verbal output, initiation and effort, and phrase length), naming, reading, and writing (including composition, dictation, copying and spelling). With a total score of 90 for educated and 70 for illiterate patients (after removing comprehension of written words, reading, and writing subtests).

The aphasic patients were classified according to Benson and Geshwind [12] into two groups: aphasia with repetitive disorder (including global, Broca's, Wernicke, conduction aphasia, pure ward deafness, and aphemia) and aphasia without repetitive disorder (including striatal, thalamic, mixed transcortical, transcortical motor, transcortical sensory aphasia, and anomia).

Neuroimaging studies also were done in the form of a computerized tomography (CT) and/or magnetic resonance imaging (M R I) of the brain. CT scan was done using Toshiba Multislice 16 computed tomography, Japan. MRI scan was obtained by using 1.5 Tesla Siemens Era machine 24 channels, Germany. T2, FLAIR, T1, and diffusion weighted images in the sagittal and axial planes were obtained. The size of cerebral infarction was classified according to Brott and colleagues [13] to small-sized lesion (lesion < half lobe), medium-sized (lesion involving between half lobe and one lobe), and large-sized (lesion > one lobe).

Follow-up study was done by clinical assessment of patients and KAAT test after 1 and 3 months.

An informed consent was obtained from all the patients before participating in the study. The Assiut Faculty of Medicine Ethical committee approved this study in May 24, 2015. The confidentiality of patient's information was maintained during all steps of the study.

Statistical analysis

Data entry and analysis were done using IBM SPSS statistics (Statistical Package for Social Science, version 22, 2013; IBM Corp., Armonk, NY, USA). Qualitative data were presented as numbers and percentages, and quantitative data were presented as means ± standard deviation (SD). Chi-square and Fisher Exact tests were used to compare between qualitative variables. Mann-Whitney test was used to compare quantitative variables between two groups, and Kruskal Wallis Test for more than two groups. Wilcoxon signed rank test was done to compare quantitative variables between baseline and follow-up. Regarding statistical analysis for rate of aphasia recovery, the study take in consideration the total score percentage instead of the total score of KAAT test to eliminate the variation between educated and illiterate patients. P value was considered statistically significant when $P < 0.05$ and highly significant when $P < 0.01$.

Results

The study was conducted on 1508 patients, 779 (51.66%) males and 729 (48.34%) females, with acute stroke. Among them, there were 107 (7.1%) patients presented with aphasia, 62 (57.9%) males and 45 (42.1%) females. Their age ranged from 20 to 85 years with a mean 59.38 years ± 15.43 SD. Hypertension and age ≥ 55 years were the most frequent risk factors, and most of the patients had more than one risk factor.

The clinical types of aphasia were classified into two groups, aphasia with repetitive disorder (79.4%) and aphasia without repetitive disorder (20.6%) with the most frequent types were global, Broca's then subcortical aphasia (Table 1).

There were 21 patients who had cerebral hemorrhage (19.6%), 86 patients had cerebral infarction (80.4%) who were classified according to size of infarction to small-sized lesions in 9 patients, medium-sized in 6 patients, and large-sized in 71 patients (Table 2).

Table 1 Clinical types of aphasia

Clinical type	Total (*N* = 107)		Male (*N* = 62)		Female (*N* = 45)		*P* value*
	N	%	*N*	%	*N*	%	
Aphasia with repetitive disorder:	85	79.4	47	75.8	38	84.4	
Global	71	66.4	41	66.1	30	66.7	0.954
Broca's	9	8.4	3	4.8	6	13.3	0.162
Wernicke	3	2.8	2	3.2	1	2.2	0.756
Conduction	1	0.9	0	0.0	1	2.2	0.421
Aphemia	1	0.9	1	1.6	0	0.0	0.392
Aphasia without repetitive disorder:	22	20.6	15	24.2	7	15.6	
Striatal	12	11.2	8	12.9	4	8.9	0.516
Thalamic	5	4.7	2	3.2	3	6.7	0.648
Mixed transcortical	2	1.9	2	3.2	0	0.0	0.508
Transcortical motor	1	0.9	1	1.6	0	0.0	0.392
Transcortical sensory	1	0.9	1	1.6	0	0.0	0.392
Anomia	1	0.9	1	1.6	0	0.0	0.392

N number, % percentage
*Used tests chi-square and Fisher exact tests

The higher mean score for repetition at the onset was for aphasia without repetitive disorder more than aphasia with repetitive disorder, and better improvement after 1 and 3 months (regarding repetition, comprehension, spontaneous speech, naming, reading, and writing) was for aphasia without repetitive disorder (Table 3 and Fig. 1).

The scoring of KAAT test at the onset and follow-up study between the most three frequent types of aphasia among the patients (global, Broca's, and subcortical aphasia) showed that the highest mean score at the onset was for Broca's aphasia. And the best improvement after 1 and 3 months (regarding repetition, comprehension, spontaneous speech, naming, reading, and writing) was for subcortical aphasia then Broca's aphasia, and the least improvement was for global aphasia (Table 4 and Fig. 2).

On comparing demographic and neuroimaging data regarding mean score of KAAT at the onset and rate of recovery of aphasia in the follow-up study, no statistically significant difference was reported between patients regarding different age groups or sex or size or pathology of lesion at the onset. But in the follow-up study, better improvement was reported among younger age groups, patients with cerebral hemorrhage, patients with subcortical aphasia, and patients with small-sized lesions (Table 5).

Table 2 Neuroimaging

Neuroimaging	*N* (107)	%
Cerebral hemorrhage	21	19.6
Cerebral infarction	86	80.4
Size of infarction:		
1- Small	9	8.4
2- Medium	6	5.6
3- Large	71	66.4

N number, % percentage

Discussion

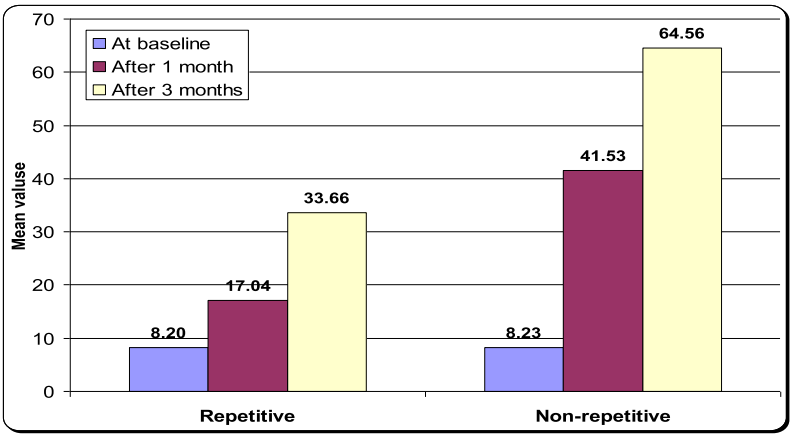
There is no sufficient data about aphasia epidemiology in Egypt, and few studies was conducted about that but in this study relative frequency of PSA in Assiut University Hospital was 7.1%, and this nearly agreed with El-Tallawy and colleagues, 2015, a previous study done at Assiut, which reported PSA among 6.7% of stroke patients [14].

In present study, aphasia was more common among male patients (57.9%) than among female patients (42.1%) and this was consistent with Gerges [15]. On the other hand, Engelter and colleagues [9], Kyrozis and

Table 3 Comparing KAAT score at onset between aphasia with repetitive disorder and without repetitive disorder

KAAT score	Types of aphasia		*P* value
	With repetitive disorder Mean ± SD	Without repetitive disorder Mean ± SD	
Repetition	0.28 ± 0.81	2.00 ± 3.69	0.040*
Comprehension	2.04 ± 4.64	1.23 ± 3.53	0.503
Spontaneous speech	5.69 ± 6.21	4.77 ± 9.22	0.579
Naming	0.08 ± 0.28	0.00 ± 0.00	0.166
Reading	0.00 ± 0.00	0.18 ± 0.66	0.061
Writing	0.09 ± 0.77	0.45 ± 1.74	0.133
Total score	8.20 ± 9.49	8.23 ± 17.15	0.992

KAAT Kasr El-Eini Arabic Aphasia test, *SD* standard deviation
*Significant *P* value at < 0.05, used test Mann-Whitney test



P-value: at onset 0.992 after1 month 0.000 after 3 months 0.000****

** Highly significant P value at < 0.01, used tests Wilcoxon Signed Rank Test, Mann-Whitney test, KAAT: Kasr El-Eini Arabic Aphasia test

Fig. 1 Comparing KAAT score at follow-up between aphasia with repetitive disorder and without repetitive disorder

colleagues [16], and Sinanović and colleagues [17] reported that aphasia was more frequent among females. However Kang and colleagues reported no sex difference in the incidence of aphasia [18]. In the present study, aphasia was more among males which can be explained that stroke patients who were admitted to Assiut University Hospital during the time of study were more males.

In present study, there was no significant difference between males and females regarding clinical types of aphasia. This was consistent with other studies that reported there was no association between gender and aphasia type specifically, Godefroy and colleagues [19] and Engelter and colleagues [9] who observed no gender differences on measures of auditory comprehension and expressive language.

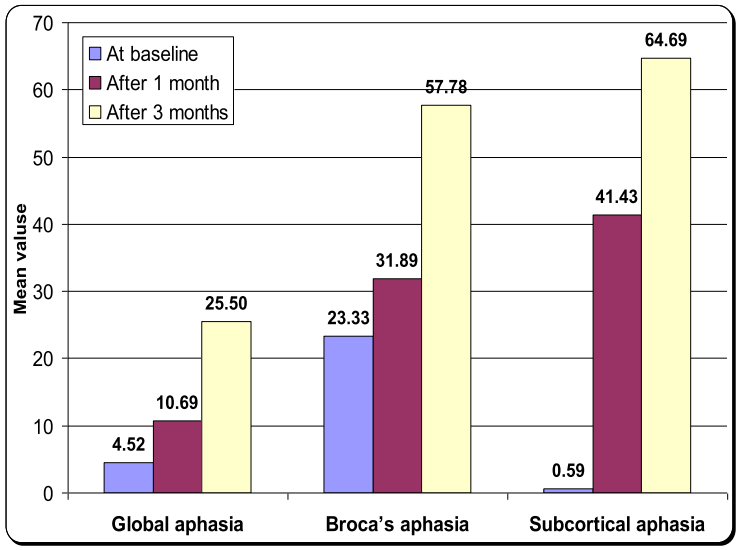
In present study, there was no significant difference between males and females regarding initial aphasia score or rate of recovery and that could be explained that both genders have the same mechanisms for aphasia recovery as regards the restoration of brain perfusion or neuroplasticity changes in the brain [20]. This was consistent with studies by Inatomi and colleagues [21], Seniow and colleagues [22], and Watila and colleague [23] that reported no gender difference in aphasia recovery.

The studied patients were classified into two groups, aphasia with repetitive disorder (79.4%) "Including global, Broca's, Wernicke, conduction aphasia and aphemia" and aphasia without repetitive disorder (20.6%) "Including striatal, thalamic, mixed transcortical, transcortical motor, transcortical sensory and anomia".

Table 4 Comparing KAAT score at onset between the most frequent aphasia subtypes (global, Broca's, and subcortical)

KAAT score	Types of aphasia			*P* value[1]	*P* value[2]	*P* value[3]
	Global	Broca's Mean ± SD	Subcortical			
Repetition	0.06 ± 0.33	1.44 ± 1.42	0.06 ± 0.24	0.000**	0.556	0.003**
Comprehension	0.23 ± 0.80	13.78 ± 1.64	0.00 ± 0.00	0.000**	0.217	0.000**
Spontaneous speech	4.20 ± 3.31	7.67 ± 1.22	1.06 ± 2.54	0.002**	0.000**	0.000**
Naming	0.03 ± 0.17	0.33 ± 0.50	0.00 ± 0.00	0.000**	0.486	0.013*
Reading	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	1.000	1.000	1.000
Writing	0.00 ± 0.00	0.11 ± 0.33	0.00 ± 0.00	0.005**	1.000	0.169
Total score	4.52 ± 3.78	23.33 ± 3.46	0.59 ± 1.80	0.000**	0.000**	0.000**

KAAT Kasr El-Eini Arabic Aphasia test, *SD* standard deviation
[1]Comparison between global and Broca's
[2]Comparison between global and subcortical
[3]Comparison between Broca's and subcortical aphasia
*Significant *P* value at < 0.05, **highly significant at < 0.01, used test Kruskal Wallis Test



** Highly significant P value at < 0.01, used tests Wilcoxon Signed Rank Test and Kruskal Wallis Test, KAAT: Kasr El-Eini Arabic Aphasia test

Fig. 2 Comparing KAAT score at follow-up for the most frequent aphasia subtypes (global, Broca's, and subcortical)

The most frequent type of aphasia was global aphasia (66.4%), followed by striatal (11.2%), Broca's (8.4%), thalamic (4.7%), Wernicke (2.8%), mixed transcortical (1.9%), conduction, transcortical motor, transcortical sensory, anomia, and aphemia (0.9% for each type of them). Many other studies had variable results regarding aphasia subtypes which could be attributed to variations in methodology.

The most frequent type of aphasia was global aphasia (66.4%) which could be explained that this study was carried out among the inpatients of Assiut University Hospital which is considered as a main center at Upper Egypt where most critical cases (as patients with global aphasia) are admitted because there is lack of neurology departments in Upper Egypt.

Higher score for repetition at the onset was reported for aphasia without repetitive disorder than aphasia with repetitive disorder, and there was better recovery during the follow-up in aphasia without repetitive disorder regarding repetition, comprehension, spontaneous speech, naming, reading, and writing. Then, comparative assessment was done between the most frequent three types of aphasia in the studied patients including global (66.4%), subcortical "Thalamic and striatal aphasia" (15.9%), and Broca's aphasia (8.4%).

These results revealed that the highest initial mean score at the onset was for Broca's aphasia while the best recovery during the follow-up (regarding repetition, comprehension, spontaneous speech, naming, reading, and writing) was for subcortical aphasia ($p = 0.000$) then Broca's aphasia, with the least recovery for global aphasia.

This was consistent with Pedersen and colleagues, and Jung and colleagues who observed that those with global aphasia had poorer recovery than those with other aphasia types, which may reflect higher stroke severity and extensive lesions that affect brain areas responsible for language process [24, 25] .Also Kang and colleagues reported better recovery in patients with subcortical aphasia which can be explained that patients with subcortical aphasia have preserved cortical structures with their ability for neuroplasticity changes that can help for aphasia recovery [18].

In comparing demographic, clinical, and neuroimaging data regarding the rate of recovery of aphasia in the follow-up study, it was reported that there were many prognostic factors that can predict rate of aphasia recovery.

There was no significant difference between different age groups regarding initial aphasia score at the onset. This was consistent with Kang and colleagues who found no difference between age and initial aphasia severity [18], but better recovery during follow-up was reported among younger age groups ($p = 0.041$) which can be explained that older patients had structural changes through aging process that impair mechanisms of aphasia recovery. This was consistent with Laska and colleagues and Watila and colleague who reported that there is a tendency for older patients to have a poorer recovery [23, 26],

Table 5 Comparing demographic, clinical, and neuroimaging data regarding rate of aphasia recovery

Percentage of improvement of total KAAT score				
	Age groups			*P* value[1]
	20–< 40	40–< 60	≥ 60	
	Mean ± SD			
At onset	13.84 ± 13.14	14.16 ± 19.92	10.16 ± 13.23	0.369
After (1)month	25.88 ± 28.59	15.71 ± 9.36	13.78 ± 18.37	0.116
After (3) months	50.75 ± 31.60	40.88 ± 16.57	25.55 ± 15.73	0.041*
	Pathology of stroke			*P* value[2]
	hemorrhagic	Ischemic		
	Mean ± SD	Mean ± SD		
At onset	8.95 ± 7.34	10.94 ± 11.73		0.467
After (1)month	38.34 ± 30.56	11.35 ± 12.95		0.010**
After (3) months	64.08 ± 36.83	35.19 ± 20.27		0.019*
	Size of infarction			*P* value[1]
	Small	Medium	Large	
	Mean ± SD			
At onset	12.32 ± 14.54	10.32 ± 9.32	8.44 ± 8.18	0.446
After (1)month	23.81 ± 26.59	11.84 ± 10.51	9.08 ± 7.82	0.338
After (3) months	52.00 ± 29.63	36.79 ± 17.19	32.02 ± 17.43	0.031*
	Site of lesion			*P* value[2]
	Cortical	Subcortical		
	Mean ± SD	Mean ± SD		
At onset	5.53 ± 4.36	0.59 ± 1.80		0.000**
After (1)month	8.59 ± 7.61	41.43 ± 15.08		0.000**
After (3) months	31.48 ± 16.83	64.69 ± 14.67		0.000**
	Sex			*P* value[2]
	Males	Females		
	Mean ± SD	Mean ± SD		
At onset	11.03 ± 14.99	11.37 ± 14.68		0.975
After (1)month	16.24 ± 21.07	19.66 ± 22.36		0.170
After (3) months	38.39 ± 28.15	44.74 ± 25.26		0.062

KAAT Kasr El-Eini Arabic Aphasia test, *SD* standard deviation
[1]Used Kruskal Wallis test
[2]Used Mann-Whitney test
*Significant *P* value at < 0.05
**Highly significant at < 0.01

while other studies such as Inatomi and colleagues [21] reported age as a not significant prognostic indicator for aphasia recovery which could be explained by short follow-up period in their study.

Better recovery was reported with hemorrhagic stroke more than ischemic stroke ($p = 0.010$ after one month and $p = 0.019$ after three months). This was consistent with Jung and colleagues who found that hemorrhagic stroke survivors had a better prognosis than ischemic stroke patients. The better prognosis may be due to fiber bundles being displaced without damage in hemorrhagic strokes [25].

In the present study, there was a negative correlation between the size of cerebral infarction and recovery rate as better recovery was for small-sized infarction ($p = 0.031$). This was consistent with Maas and colleagues [27] and Henseler and colleagues [28] who reported the negative influence of larger lesion on PSA recovery.

The limitation of this study is that a larger sample size with longer duration follow-up can be included with further assessment with functional neuroimaging to study the role of cerebral hemispheres in language recovery.

Conclusion

Relative frequency of PSA in Assiut University Hospital during the 6-month period was 7.1% with the most frequent type of aphasia being global subtype, and there were many prognostic factors which can predict rate of recovery in PSA like age of the patient, aphasia type, size, site, and pathology of the lesion. So, further assessment of PSA with a larger sample size and longer duration are recommended.

Abbreviations

CT: Computed tomography; KAAT: Kasr El-Eini Arabic Aphasia test; MRI: Magnetic resonance imaging,; *N*: Number; PSA: Post-stroke aphasia; SD: Standard deviation

Acknowledgements

Not applicable.

Funding

Not applicable.

Availability of data and materials

The paper is a part of a thesis conducted in Faculty of Medicine, Assiut University, and approved by its ethical committee. The data can be publicly available at the Faculty of Medicine, Assiut University.

Authors' contributions

HN and AH participated in the design of the study, guidance, follow-up, and final revision. AM helped in the practical works, participated in the design of the study, and participated in the statistical analysis. MN contributed to the acquisition, analysis, and interpretation of the data; performed the statistical analysis; prepared the paper; participated in the sequence alignment; and drafted the final revision of the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

An informed consent was obtained from all the patients before participating in the study. Assiut Faculty of Medicine Ethical committee approved this study in May 24, 2015. The confidentiality of the patients' information was maintained during all the steps of the study.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Received: 28 December 2018 Accepted: 22 May 2019
Published online: 07 June 2019

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