Original Research Article

Effect of Formal Education on Initial Severity of Aphasia - A Retrospective Analysis

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ABSTRACT

Literature supports the education levels of an individual is important for language performance. Cognitive reserve within individuals can be explained on the basis of years of education, occupational achievements, reading habits and lifestyle of an individual. This retrospective study is a preliminary attempt to determine relationship between premorbid educational level and initial aphasia severity. For this purpose, thirty-two Malayalam speaking individuals with aphasia with a maximum post stroke period of three months having three levels of educational qualifications, below and above tenth grade and under graduates were selected. Detailed speech and language assessment were carried out using formal assessment tool. The severity of language impairment was determined by calculating Aphasia quotient. One way ANOVA was used to determine statistical significance. Although, subjects had similarities in pattern of Cerebrovascular accidents severity of aphasia varies. The subjects with lower Aphasia Quotient are present in all groups, illustrating that there is less corelation between the subjects' educational attainment and the severity of their communication problems.

Keywords: Aphasia, Formal education, Aphasia Quotient

INTRODUCTION

The term Aphasia refers a loss or impairment of language caused by brain damage. It is always due to injury to the brain most commonly from a stroke, particularly in older individuals. Aphasia is defined as a "disturbance of one or more aspects" of language comprehension, formulation, or expression. The disturbance is caused by a newly acquired disease of the central nervous system. Depending on an individual's unique set of symptoms, impairments may result in loss of ability to use communication as a tool for life participation. A person's symptoms may not fit precisely into a single aphasia type, and classification may change over time as communication improves with recovery. The outcome of aphasia varies significantly from person to person. The most predictive indicator of long-term recovery is initial aphasia severity, along with lesion site and size (Plowman E, Hentz

B, Ellis C, 2012). Formal education, occupational achievements, economic status are proposed indicators of cognitive reserve in an individual (Glymour et al., 2008). The relationship between Brain reserve and neurodegenerative disorders has been widely studied. The relationship between education and cognitive enhancement has long been researched. Lifelong learning can result in enhanced cognitive functioning as well as greater physical and mental health. Studies done in Alzheimer's disease suggest that educational level and cognitive reserve are highly corelated (Carret et al., 2005 & Roe et al., 2007).

Cognitive reserve in aphasia after stroke is rarely studied. A retrospective study including 39 persons with aphasia showed increased aphasia severity was associated with lower educational attainment and lower employment status 4 and 103 months after onset (Connor et al., 2001). Influence of age, gender and socio-economic status on type and severity of aphasia were widely studied in literature. Previous literature database suggested that neurological lesion determining aphasia does not vary in accordance with type, severity and socioeconomic status of literate and illiterate aphasics (Miceli et al., 1981; Castro-Caldas, 1995). Conversely, quantitative difference in aphasic syndromes between highly educated and less educated aphasic subjects in language performance task like reading and writing (Smith, 1971). In addition, a cross sectional study was done on 173 aphasics with and without twelve years of formal education. The study showed that performance of less educated individuals had a greater number of errors in oral written and spelling tasks, reading and comprehension tasks. Thus, authors concluded the importance of premorbid education in language performance skills and its vulnerability to stroke (González-Fernández et al., 2011).

Our objective in this study was to ascertain the potential impact of premorbid education level on the severity of aphasia following a stroke. Our hypothesis was based on earlier research on cognitive reserve and predicted that those with higher levels of education would experience less severe language impairment following a stroke.

Need of The Study
The recovery and prognosis of aphasic patients is chiefly depending upon the severity of communication impairments. There are various factors like age, size and site of lesion which can affect the severity of aphasic individuals. Also, evidences reported for the role of education in initial aphasia severity. So, this study is important to understand whether educational level of the affected individual has any effect on initial language impairments exhibited by aphasia patients.

Aim of the Study
Aim of this study is to understand the influence of premorbid educational level in severity of aphasia.

Objectives of the study
1. To investigate whether premorbid educational level influences communication impairment in Malayalam Speaking adults with Aphasia
2. To investigate the prognosis and recovery pattern of adults with aphasia depending on their educational status
3. To investigate and compare relationship between educational level and severity of Aphasia

MATERIALS AND METHOD
The retrospective study evaluated 32 Malayalam speaking persons with Aphasia (20 males and 12 females) followed by cerebrovascular accident in middle cerebral artery or with an infarct in Perisilvian region. All participants or whose known caretakers provided informed consent to participate in a series of language test. Inclusion criteria included subjects with premorbid Malayalam proficiency, no past history of symptomatic stroke, no history of Alzheimer's or dementia, hearing loss and untreated visual

impairment. Participants who underwent speech language intervention followed by CVA was excluded from study.

Speech Language assessment

Following a detailed case history each participant in the study was subjected to speech language evaluation. Western Aphasia Battery (Malayalam version) was administered with following experimental task (1) spontaneous speech, (2) auditory comprehension, (3) naming, (4) repetition of single word to complex sentences. In spontaneous speech each subject was instructed to answer questions given by investigator and the verbal fluency was assessed. Followingly, auditory comprehension was assessed where each participant had to respond yes/no questions, recognise words and perform sequential commands. The naming task comprised object naming, word fluency, sentence completion and responsive speech. Repetition tasks include reiteration of words to sentences. Aphasia quotient was calculated based on the tasks performed for each participant. Additionally, cortical quotient was also quantified. The severity of language impairment was determined by considering severity rating of Aphasia quotient.

Furthermore, the subjects were grouped into three categories based on their formal educational level. Groups are as follows, below tenth grade (BT), tenth passed and above (TP) and under graduates and above (UG). Each subject was screened for involvement of Dysarthria using Frenchy Dysarthria Assessment. Each participant had

undergone magnetic resonance imaging study to pinpoint lesion site.

STATISTICAL ANALYSIS

A normal distribution is a type of continuous probability distribution in which most data points cluster toward the middle of the range, while the rest taper off symmetrically toward either extreme. The middle of the range is also known as the mean of the distribution. The data should be checked for normal distribution before proceeding with further statistical tools. Shapiro-Wilk test is a statistical method to assess the distribution the data. The present data was found to be in normal distribution in the Shapiro-Wilk test. As the data was distributed normally, the one-way, or one-factor, ANOVA test for independent measures is used to compare the means and standard deviations of the three groups simultaneously. The result was statistically found to be statistically not significant (The f-ratio value is 0.82288; the degrees of freedom 2 and the p-value is .449159). The result is not significant at $p < .05$).

RESULTS

The group one includes the subjects with an educational qualification below tenth standard as shown in table 1. The sample size of this group is fifteen. The severity rating was based on Aphasia Quotient. The results revealed eight participants are coming under very severe type, five were under severe and two participants are in moderate level of dysfunction. The mean Aphasia Quotient of this group is 26.63 with a highest score of 72 and a lowest of 1.5.

Table 1: individuals with aphasia having educational level below tenth standard

Sl No.	Subject	Education	Age/Sex	Neuroimaging	Impression	AQ
	BT 1	7th	54/M	MRI Left MCA infarct	Global Aphasia	4.2
	BT 2	5th	62/F	MRI Multifocal acute infarct involving left MCA, ACA and watershed territories	Transcortical Motor Aphasia	41.4
	BT 3	5th	62/M	MRI Patchy areas of restricted diffusion involving left fronto-parieto-temporal lobes, absent flow signal involving left ICA and MCA	Broca's Aphasia	25.5
	BT 4	5th	53/M	CT Large recent onset infarct in left MCA	Broca's Aphasia	34.3
	BT 5	Nil	56/F	CT	Global Aphasia	7.5

Sl No.	Subject	Education	Age/Sex	Neuroimaging	Impression	AQ
				MCA infarct		
	BT 6	4th	48/F	CT Infarct in both basal ganglia both parietal periventricular white matter deep frontal lobe and both high parietal regions	Broca's Aphasia	42.6
	BT 7	Nil	59/F	CT Left MCA infarct	Global Aphasia	6.10
	BT 8	7th	68/F	MRI Large left frontotemporal insular cortex and basal ganglia diffusion Large MCA territory acute infarct	Global Aphasia	1.5
	BT 9	8th	36/M	CT Left MCA malignant infarct with midline shift	Global Aphasia	15.6
	BT 10	7th	53/F	MRI Acute left MCA infarct	Transcortical Motor Aphasia	72
	BT 11	2nd	81/F	MRI Left frontal and parietal cortical infarct	Global Aphasia	30.2
	BT 12	Nil	56/M	CT Left MCA infarct	Broca's Aphasia	12.2
	BT 13	Nil	70/F	MRI Acute infarct in left MCA	Global Aphasia	22.7
	BT 14	4th	53/M	CT Left MCA territory infarct	Broca's Aphasia	20.8
	BT 15	5th	74/M	CT Left MCA stroke	Transcortical Motor Aphasia	62.94

Table 2 delineates nine subjects with an educational qualification of high school level. The lowest Aphasia Quotient of this group was 4 and highest was 45.9 with a mean of 24.20. Among the nine participants, five were coming under very severe category and four were severe.

Table 2: individuals with aphasia having educational level having high school education

Sl No.	Subject	Education	Age/Sex	Neuroimaging	Impression	AQ
	TP 1	10th	45/M	MRI Diffused narrowing of LVA, bilateral ICA, MCA and ACA Both MCA poorly visualized CT Cerebral edema and acute infarcts in left MCA	Broca's Aphasia	41.4
	TP 2	10th	43/M	CT Left MCA block with mild midline shift towards right side	Broca's Aphasia	37.7
	TP 3	10th	54/M	CT Haemorrhagic stroke in left MCA	Broca's Aphasia	41.1
	TP 4	10th	62/M	CT Left MCA occlusion	Global Aphasia	4.50
	TP 5	10th	45/M	MRI Large left MCA infarct	Global Aphasia	4
	TP 6	10th	43/F	CT Left MCA infarct	Global Aphasia	4.73
	TP 7	10th	63/M	MRI Acute infarct in left frontoparietal region	Wernicke's Aphasia	45.9
	TP 8	10th	65/M	MRI Acute infarct in left MCA Chronic lacunar infarct in right half of lower midbrain, bilateral corona radiata and right thalamus, chronic infarct in left anterior gangliocapsular region	Broca's Aphasia	23.8
	TP 9	+2	56/F	MRI Acute lacunar infarct capsuloganglia region Left MCA infarct	Global Aphasia	14.7

Third group comprises eight subjects with an educational qualification of under graduation as shown in table 3. Mean Aphasia Quotient of this group was 36.83 with a highest Aphasia Quotient of 80.4 and lowest of 9.4

Table 3: individuals with aphasia having undergraduate levels

Sl No.	Subject	Education	Age/Sex	Neuroimaging	Impression	AQ
	UG 1	UG	54/M	CT Multiple hypodense area in left frontal, frontoparietal, left capsule-ganglionic regions as described- likely acute infarct	Broca's Aphasia	50.2

UG 2	UG	24/M	MRI Restricted diffusion in left fronto-parietal lobes, caudate nucleus and left external capsule Occlusion of left M1 & M2 segment	Broca's Aphasia	58.7
UG 3	UG	42/F	CT Large hypodense area involving left fronto-tempero-parietal region extending to basal ganglia Midline shift of 4.5mm to right and mucosal thickening seen in right sphenoid sinus Left haemorrhagic infarct	Broca's Aphasia	21.7
UG 4	PG	61/M	MRI Acute left MCA infarct	Wernicke's Aphasia	49.9
UG 5	UG	27/F	CT Acute infarct in left parietal frontal lobes and posterior insular region, Left MCA territory	Broca's Aphasia	12.4
UG 6	UG	69/M	MRI Acute infarct in frontoparietal lobe and anterior capsuloganglionic region	Transcortical Sensory Aphasia	80.4
UG 7	UG	66/M	MRI Large left MCA infarct	Global Aphasia	12
UG 8	UG	72/M	CT Acute Left MCA infarct	Broca's Aphasia	9.4

DISCUSSION

The aim of the study was to determine the influence of education in aphasic severity. The results revealed that formal education doesn't have any significands in the initial severity of Aphasia. Even though the subjects have similarities in their pattern of cerebrovascular accident, the severity of aphasia was in varying degrees. While making an analogy between the educational level of the subjects and severity of communication impairments, the subjects with lower Aphasia Quotient (less than 25) is present in all groups.

CONCLUSION

The study concludes that, formal educational level doesn't have any influence on the severity of language impairments in aphasia population and the factors such as age, aetiology, site of lesion and size of lesion have much more influence on severity of aphasias. The role of education in recovery patterns and performance task may be a focus of future studies.

REFERENCES

1. Carret NL, Auriacombe S, Letenneur L, Bergua V, Dartigues JF, Fabrigoule C. Influence of education on the pattern of cognitive deterioration in AD patients: The cognitive reserve hypothesis. Brain and Cognition. 2005 Mar 1;57(2):120–6.
2. Castro-Caldas A, Ferro JM, Guerreiro M, Mariano G, Farrajota L. Influence of Literacy (vs Illiteracy) on the Characteristics of Acquired Aphasia in Adults. In: Leong CK, Joshi RM, editors. Developmental and Acquired Dyslexia: Neuropsychological and Neurolinguistic Perspectives [Internet]. Dordrecht: Springer Netherlands; 1995. p. 79–91. Available from: https://doi.org/10.1007/978-94-017-1241-5_6
3. Connor LT, Obler LK, Tocco M, Fitzpatrick PM, Albert ML. Effect of socioeconomic status on aphasia severity and recovery. Brain Lang. 2001 Aug;78(2):254–7.
4. Glymour MM, Weuve J, Fay ME, Glass T, Berkman LF. Social Ties and Cognitive Recovery after Stroke: Does Social Integration Promote Cognitive Resilience? Neuroepidemiology. 2008;31(1):10–20.
5. González-Fernández M, Davis C, Molitoris JJ, Newhart M, Leigh R, Hillis AE. Formal education, socioeconomic status, and the severity of aphasia after stroke. Arch Phys Med Rehabil. 2011 Nov;92(11):1809–13.
6. Miceli G, Caltagirone C, Gainotti G, Masullo C, Silveri MC, Villa G. Influence of age, sex, literacy and pathologic lesion on incidence, severity and type of aphasia. Acta

Neurological Scandinavica. 2009 Jan 29;64(5):370–82.

7. Plowman E, Hentz B, Ellis C. Post-stroke aphasia prognosis: a review of patient-related and stroke-related factors. J Eval Clin Pract. 2012 Jun;18(3):689–94.

8. Roe CM, Xiong C, Miller JP, Morris JC. Education and Alzheimer disease without dementia. Neurology. 2007 Jan 16;68(3):223–8.

9. Smith A. Objective indices of severity of chronic aphasia in stroke patients. J Speech Hear Disorder. 1971 May;36(2):167–207.

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