



THE EFFECTS OF SPEECH THERAPY INTERVENTIONS IN APHASIA DUE TO ISCHEMIC STROKE AND THEIR CORRELATION WITH NEUROIMAGING PROFILE.

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ABSTRACT **Objective:** To study the effects of speech therapy interventions in aphasia due to ischemic stroke and their correlation with neuro imaging profile. **Setting:** This prospective analytical study was done in all ischemic stroke patients with language disturbance attending the neurology department between April 2025 and January 2026. **Participants:** 39 cases admitted to neurology department with the evidence of aphasia of fluent as well as non fluent types due to acute ischemic stroke, who were submitted to speech therapy thereafter. **Results:** This study investigates the effect of speech therapy interventions specifically comprehension, expression and repetition in 39 patients (35 males, 4 females) with varying literacy levels. There are no significant difference in age and speech therapy outcomes in the study. There is statistically significant improvement in both comprehension and expression across all literacy level with highest gain in graduates across comprehension. Of the speech therapy parameters repetition showed significant improvement where as from stroke area perspective M1/M2, M1/M4, M3/M4 and M5/M6 demonstrate recovery in all tested dimensions and other stroke area combination not.

KEYWORDS : Fluent Aphasia, Non-Fluent Aphasia, Melodic Intonation Therapy (MIT)

INTRODUCTION

Rehabilitation of aphasics due to ischemic stroke is multidimensional and speech therapy interventions form the core of it. Even though there are eight classical cortical aphasia types, for speech therapy rehabilitation they can be grouped as either fluent or non-fluent. In fluent type of aphasia, which is also known as sensory aphasia, the ischemic lesion is in the posterior part of the dominant hemisphere resulting in lack of comprehension of language. In non-fluent type of aphasia, which is also known as motor aphasia, anterior lesion in the dominant hemisphere results in inability to execute speech production. With speech therapy interventions, minimum of one hour a day for five to six months, one can repair comprehension, verbal expression and repetition difficulties among aphasics, and so the communication and ultimately the cognition. The ischemic location and extension in neuroimaging are associated with diverse functional outcomes. So, in this study we set out to investigate the correlation between neuroimaging and short-term outcome of speech therapy interventions with neuroimaging apart from sex, age and literacy.

METHODOLOGY

The speech therapy intervention in this analytical research is conducted in 39 patients with acute ischemic stroke with aphasia after medical stabilization. The initial speech therapy technique is non-specific or general for all types of aphasia. In this stimulation facilitation approach, auditory stimulation is delivered with live voice, binaural presentation, free-field, meaningful to day-to-day life and use of cues and prompts. The caregivers of the aphasic patients are the co-therapists for these speech therapy interventions who are further taught with specific techniques for non-fluent and fluent aphasia.

Melodic Intonation Therapy(1) is the key speech therapy technique for non-fluent aphasia which is carried out in four levels. It starts with tapping out rhythm by patients while listening to clinician's hummed and intoned utterances and at the end it makes the patient to

independently imitate the clinician's model of spoken utterance. Other strategies to improve expression include thematic language stimulation, vocabulary control of involuntary utterance, and language-oriented treatment which also includes graphic expression.

Treatment for Wernicke's (fluent) aphasia begins by specific auditory comprehension techniques like auditory bombardment, deblocking, addressing reading comprehension and treatment of aphasic perseveration. All these techniques are applied as context-based intervention with caregivers as important resource persons.

Early intensive speech therapy interventions are carried out on a daily basis, at least one hour for five to six weeks and outcomes have been scored according to three major variables: comprehension, expression and repetition. Reception is graded from 0 to 5, with 0 showing no understanding and 5 near-normal understanding.

Halfway scores gauge the patient's capacity to identify pointed objects around them (1), answer yes-no questions (2), complete a two-step command (3), and understand a three-step command (4).

Expression is also rated on a 0 to 5 scale, 0 indicating zero-word output and 5 reflecting near-normal expression. The ratings encompass patients producing less than 10 words (1), using 10-30 words or jargon phrases (2), constructing two-word sentences (3), and persons able to utter three-word sentences (4).

Repetition is graded on four levels: R-0 for no repetition, R-1 for less than 50% repetition, R-2 for 50-80% repetition, and R-3 for 80-100% repetition. These are again correlated with CT brain aspects score, M1-M3 as frontal lobe strokes whereas M4-M6 as temporo parietal strokes, results of which are as follows

OBSERVATION AND RESULTS:-

S.NO	AGE & SEX	LITERARY STATUS	STROKE AREA	END OF FIRST WEEK(20th WEEK)		
				COMPREHENSION	EXPRESSION	REPETITION
1	58/M	V Std	M5/M6	1(2)	1(4)	0(1)
2	51/F	IX Std	M1/M2	4(5)	3(5)	1(3)
3	36/M	VI Std	M5/M6	0(2)	1(4)	0(1)
4	60/M	VIII Std	M3/M6	2(4)	2(3)	1(2)
5	63/M	VIII Std	M3/M6	0(3)	1(2)	1(2)
6	61/M	VIII Std	M1/M4	2(4)	1(3)	0(1)
7	71/M	VII Std	M1	4(5)	2(3)	1(2)
8	80/M	V Std	M5/M6	0(1)	1(2)	0(1)
9	61/M	VIII Std	M5/M6	1(3)	2(4)	0(1)
10	70/M	IX Std	M5/M6	2(4)	3(5)	1(2)
11	58/M	IV Std	M3/M6	1(2)	1(2)	0(1)

12	60/F	Illeterate	M1/M2	3(4)	0(3)	0(1)
13	45/F	VIII Std	M5/M6	1(4)	3(4)	1(2)
14	70/M	IV Std	M1/M2	3(4)	1(3)	0(1)
15	55/M	Illeterate	M1/M4	1(3)	1(2)	0(1)
16	37/M	III Std	M5/M6	1(3)	2(4)	0(2)
17	55/M	III Std	M1/M2	3(5)	2(3)	1(2)
18	70/M	VIII Std	M3/M4	2(4)	1(4)	1(2)
19	48/M	VII Std	M5/M6	1(3)	2(4)	1(2)
20	57/M	Illeterate	M1/M2/M5/M6	0(1)	1(2)	0(1)
21	56/M	V Std	M5/M6	4(5)	2(4)	1(3)
22	47/M	X Std	M1/M2	4(5)	3(5)	2(3)
23	55/M	Illeterate	M1/M5	0(1)	0(0)	0(0)
24	57/M	X Std	M1/M5	0(2)	0(1)	0(1)
25	58/M	Illeterate	M5/M6	0(2)	1(3)	1(2)
26	40/M	Graduate	M5/M6	2(5)	3(4)	1(3)
27	52/M	Graduate	M1/M2	4(5)	3(5)	1(3)
28	51/M	X Std	M5/M6	3(4)	2(4)	1(2)
29	55/M	III Std	M1/M2	3(4)	1(3)	1(2)
30	63/M	Illeterate	M1/M2	3(4)	1(2)	1(2)
31	55/F	IXStd	M1/M2	4(5)	3(5)	2(3)
32	48/M	III Std	M5/M6	3(4)	4(5)	0(2)
33	42/M	IV Std	M1/M2	4(5)	2(3)	1(2)
34	50/M	Illeterate	M5/M6	2(3)	3(4)	1(2)
35	58/M	III Std	M5/M6	2(3)	3(4)	1(2)
36	44/M	V Std	M1/M2	3(5)	2(4)	1(2)
37	48/M	Illeterate	M5/M6	2(4)	3(4)	1(2)
38	48/M	Illeterate	M1/M2	3(4)	2(4)	1(2)
39	70/M	XI Std	M5/M6	2(4)	3(4)	1(2)

All analyses were conducted using IBM SPSS Statistics. Data were expressed as mean standard error (SE), and statistical significance was set at $p < 0.05$. Repeated Measures Analysis of Variance (ANOVA) was used to evaluate the differences between literacy groups and stroke groups. A two-tailed p -value < 0.05 was

considered statistically significant.

STROKE AREAS Vs COMPREHENSION

Result: At M1 and M1/M2/M5/M6--- There is no significant difference\

Pairwise Comparisons							
Measure: MEASURE_1							
Stroke	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
M1	1	2	-1.000	.614	.114	-2.253	.253
	2	1	1.000	.614	.114	-.253	2.253
M1/M2	1	2	-1.167*	.177	.000	-1.528	-.805
	2	1	1.167*	.177	.000	.805	1.528
M1/M4	1	2	-2.000*	.434	.000	-2.886	-1.114
	2	1	2.000*	.434	.000	1.114	2.886
M1/M5	1	2	-1.500*	.434	.002	-2.386	-.614
	2	1	1.500*	.434	.002	.614	2.386
M1/M2/M5/M6	1	2	-1.000	.614	.114	-2.253	.253
	2	1	1.000	.614	.114	-.253	2.253
M3/M4	1	2	-2.000*	.614	.003	-3.253	-.747
	2	1	2.000*	.614	.003	.747	3.253
M3/M6	1	2	-2.000*	.355	.000	-2.723	-1.277
	2	1	2.000*	.355	.000	1.277	2.723
M5/M6	1	2	-1.706*	.149	.000	-2.010	-1.402
	2	1	1.706*	.149	.000	1.402	2.010
Based on estimated marginal means							
*. The mean difference is significant at the .05 level.							
b. Adjustment for multiple comparisons: Bonferroni.							

Result:

Significant increases in comprehension scores from Time 1 (before) to Time 2 (after) were observed in the stroke groups:

1. M1/M2 ($p < 0.001$); M1/M4 ($p < 0.001$); M1/M5 ($p = 0.002$); M3/M4 ($p = 0.003$); M3/M6 ($p < 0.001$); M5/M6 ($p < 0.001$). The mean differences ranged from 1.167 to 2.000, indicating moderate

to strong improvement.

2. No significant change M1 ($p = 0.114$); M1/M2/M5/M6 ($p = 0.114$)

STROKE AREAS Vs EXPRESSION:-

Result: At M1, M1/M5 and M1/M2/M5/M6--- There is no significant difference

Pairwise Comparisons							
Measure: MEASURE_1							
Stroke	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
M1	1	2	-1.000	.636	.126	-2.298	.298
	2	1	1.000	.636	.126	-.298	2.298
M1/M2	1	2	-1.833*	.184	.000	-2.208	-1.459
	2	1	1.833*	.184	.000	1.459	2.208
M1/M4	1	2	-1.500*	.450	.002	-2.418	-.582
	2	1	1.500*	.450	.002	.582	2.418

M1/M5	1	2	-.500	.450	.275	-1.418	.418
	2	1	.500	.450	.275	-.418	1.418
M1/M2/M5/M6	1	2	-1.000	.636	.126	-2.298	.298
	2	1	1.000	.636	.126	-.298	2.298
M3/M4	1	2	-3.000*	.636	.000	-4.298	-1.702
	2	1	3.000*	.636	.000	1.702	4.298
M3/M6	1	2	-1.000*	.367	.011	-1.749	-.251
	2	1	1.000*	.367	.011	.251	1.749
M5/M6	1	2	-1.647*	.154	.000	-1.962	-1.332
	2	1	1.647*	.154	.000	1.332	1.962

Based on estimated marginal means

*. The mean difference is significant at the .05 level.

b. Adjustment for multiple comparisons: Bonferroni.

Result: Significant increases in expression scores were observed in: M1/M2 ($p < 0.001$); M1/M4 ($p = 0.002$); M3/M4 ($p < 0.001$); M3/M6 ($p = 0.011$); M5/M6 ($p < 0.001$).

M1/M2/M5/M6 ($p = 0.126$)

STROKE AREAS Vs REPETITION:-

Result:

At M1/M5 --- There is no significant difference.

No significant change occurs: M1 ($p = 0.126$); M1/M5 ($p = 0.275$);

Pairwise Comparisons

Measure: MEASURE_1

Stroke	(I) time	(J) time	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval for Difference	
						Lower Bound	Upper Bound
M1	1	2	-1.000*	.411	.021	-1.837	-.163
	2	1	1.000*	.411	.021	.163	1.837
M1/M2	1	2	-1.167*	.119	.000	-1.408	-.925
	2	1	1.167*	.119	.000	.925	1.408
M1/M4	1	2	-1.000*	.290	.002	-1.592	-.408
	2	1	1.000*	.290	.002	.408	1.592
M1/M5	1	2	-.500	.290	.095	-1.092	.092
	2	1	.500	.290	.095	-.092	1.092
M1/M2/M5/M6	1	2	-1.000*	.411	.021	-1.837	-.163
	2	1	1.000*	.411	.021	.163	1.837
M3/M4	1	2	-1.000*	.411	.021	-1.837	-.163
	2	1	1.000*	.411	.021	.163	1.837
M3/M6	1	2	-1.000*	.237	.000	-1.483	-.517
	2	1	1.000*	.237	.000	.517	1.483
M5/M6	1	2	-1.235*	.100	.000	-1.438	-1.032
	2	1	1.235*	.100	.000	1.032	1.438

Based on estimated marginal means

*. The mean difference is significant at the .05 level. b. Adjustment for multiple comparisons: Bonferroni.

Significant increases in expression scores were observed in: M1 ($p = 0.021$); M1/M2 ($p < 0.001$); M1/M4 ($p = 0.002$); M1/M2/M5/M6 ($p = 0.021$); M3/M4 ($p = 0.021$); M3/M6 ($p < 0.001$); M5/M6 ($p < 0.001$)
No significant change: M1/M5 ($p = 0.095$).

Comparative Domain Efficacy

The most consistent recovery was seen in **Repetition**, where seven out of eight tracked categories showed significant p-values. This suggests that the mechanical or phonological aspects of speech may be more responsive to the specific therapy provided than the complex cognitive-linguistic demands of **Expression** or **Comprehension**.

Group-Specific Observations

Certain stroke profiles appeared more resistant to change:

- The M1 Profile: This group showed no significant improvement in Comprehension or Expression, yet did improve in Repetition. This may indicate a specific type of deficit where internal language processing remains stalled despite improvements in motor-speech imitation.
- The M1/M5 Profile: Interestingly, while this group improved significantly in Comprehension ($S_p = 0.002$), they showed no significant change in Expression or Repetition. This suggests a "receptive-only" recovery pattern for this cohort.

Summary Table of Significance (Time 1 vs. Time 2)

Group	Comprehension	Expression	Repetition
M1	No	No	Yes
M1/M2	Yes	Yes	Yes
M1/M4	Yes	Yes	Yes
M1/M5	Yes	No	No
M1/M2/M5/M6	No	No	No
M3/M4	Yes	Yes	Yes

M3/M6	Yes	Yes	Yes
M5/M6	Yes	Yes	Yes

Pair wise comparison of age and speech therapy intervention doesn't show any significant difference. Speech therapy resulted in statistically significant improvements in both comprehension expression across all literacy levels ($P < 0.05$) with gains observed in illiterate, primary (1-5 Std), Secondary (6-12Std) & graduate groups. Mean improvements in comprehension ranged from 1.25 to 2.00, while expression improved from 1.33 to 1.75 across groups. Graduate denominated the highest gain in comprehension. Overall, groups M1/M2, M1/M4, M3/M4, M3/M6, and M5/M6 demonstrated the most robust recovery across all tested linguistic dimensions. Future research could investigate why the M1 and M1/M5 groups showed more selective recovery patterns.

REFERENCES

- Indian Speech and Hearing Association monograph. Adult Aphasia : Language Intervention. Editors S.P.Goswami & Annamma George
- Meinzer M, Harnish S, Conway T, Crosson B. Recent developments in functional and structural imaging of aphasia recovery after stroke. *Aphasiology*. 2011;25(3):271-290. doi: 10.1080/02687038.2010.530672. PMID: 21532927; PMCID: PMC3083028.
- Abutalebi J, Rosa PA, Tettamanti M, Green DW, Cappa SF. Bilingual aphasia and language control: a follow-up fMRI and intrinsic connectivity study. *Brain and Language*. 2009;109(2-3):141-156. doi: 10.1016/j.bandl.2009.03.003. [DOI] [PubMed] [Google Scholar]
- Adkins DL, Campos P, Quach D, Borromeo M, Schallert K, Jones TA. Epidural cortical stimulation enhances motor function after sensorimotor cortical infarcts in rats. *Experimental Neurology*. 2006;200(2):356-370. doi: 10.1016/j.expneurol.2006.02.131. [DOI] [PubMed] [Google Scholar]
- Neuro behavioral and imaging profile of vascular aphasic Syndromes with their short-term outcome. *INDIAN JOURNAL OF APPLIED RESEARCH*. Volume - 15 | Issue - 04 | April - 2025 | PRINT ISSN No. 2249 - 555X | DOI: 10.36106/ijar.