

Long-term recovery of post-stroke aphasia

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ABSTRACT

Aphasia is a debilitating condition that most commonly occurs after stroke. The greatest progress in aphasia recovery is believed to generally occur during the first year post stroke onset. Consequently, most studies have been designed to examine aphasia recovery during the first year and studies have generally not looked beyond that endpoint. To date a number of group studies, cases series and case reports of post-stroke aphasia recovery show significant and continuous improvements across multiple language modalities and beyond one year. This review is designed to explore the literature related to post-stroke aphasia recovery after one year. The collective evidence suggests long-term recovery of post-stroke aphasia can occur in some individuals and additional research is needed to identify the factors most predictive of longer-term recovery patterns.

KEYWORDS: aphasia, language, recovery, speech-language pathology.

ABBREVIATIONS

AQ	:	aphasia quotient
BNT	:	Boston Naming Test
PICA	:	Porch Index of Communicative Ability
PWA	:	persons with aphasia
SLTA	:	Standard Language Test of Aphasia

WAB	:	Western Aphasia Battery
BDAE	:	Boston Diagnostic Aphasia Examination
BASA	:	Boston Assessment of Severe Aphasia
NGA	:	Norwegian Basic Aphasia Assessment
VNT	:	Verb Naming Test
ANELT	:	Amsterdam-Nijmegen Everyday Language Test
PALPA	:	Psycholinguistic Assessments of Language Processing in Aphasia
CAT	:	Comprehensive Aphasia Test
ANT	:	Action Naming Test
MLE	:	Milan Language Examination

INTRODUCTION

Aphasia is a condition that occurs after stroke resulting in significant communication difficulties. Individuals with aphasia experience problems with listening comprehension, verbal expression, reading, and/or writing, thereby limiting their communication interactions [1]. Persons with aphasia (PWA) can experience significant disability, significant social isolation and reduced social participation even when aphasia is present in its mildest form [2-4]. Incidence rates have been reported from 28-45% of all stroke survivors depending on the reporting country [5-10]. In the United States (US) alone, 18% of all stroke survivors discharged from US hospitals experience aphasia [11] and there are believed to be over 2.5 million PWA living with the condition [12]. PWA frequently have longer hospital stays with

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associated higher costs than their stroke counterparts without aphasia [13, 14].

Traditionally, studies of aphasia are completed during the first year post stroke onset when the greatest recovery generally occurs [15]. Almost no studies have assessed outcomes beyond one year despite evidence that time post onset is not related to response to treatment after one year [16]. The traditional belief that early therapy is better has potentially impacted the study of longer-term recovery of aphasia particularly long after treatment has ceased. These beliefs are based on the perceived existence of a “window of plasticity” during the early recovery period [17]. However, Doogan and colleagues [17] continued to note that this early recovery period has been traditionally linked to motor recovery and consequently evidence to support equivalent language recovery is not as clear. Additionally, they note that such recovery patterns have been developed based on animal models and those models have yet to be definitively tested and explained in human rehabilitation. Consequently, it is possible that the general belief that early recovery is the most significant has resulted in very few studies examining long term recovery beyond the first year of aphasia onset [17]. This review was designed to examine and summarize the current evidence related to long-term aphasia recovery (beyond one year) and identify characteristics of recovery patterns.

Evidence from group studies

A number of studies of aphasia recovery show improvements over periods greater than one year. Naeser, Gaddie, Palumbo & Siassny-Eder examined the relationship between aphasia recovery one to two years post onset in 14 persons with global aphasia and found greater improvements in auditory comprehension particularly in the area of single word comprehension among those with global aphasia who did not have cortical lesions in Wernicke’s area with only subcortical temporal lobe lesions including the temporal isthmus compared to the group who had lesions in more than half of Wernicke’s area [18]. They observed no differences between the two groups in expressive tasks (spontaneous, speech, repetition, naming) which remained severely impaired in

both groups. In a second study, Naeser *et al.* also reported significant improvement in visual confrontational naming and number of words produced per phrase in 12 persons with Broca’s, global, transcortical motor, Wernicke’s, and conduction aphasia five years post stroke [19]. In contrast to their prior study, they found no significant improvements in comprehension skills. Nicholas *et al.* examined aphasia recovery among 24 individuals with severe aphasia (global, Wernicke’s, mixed transcortical aphasia, unclassified) and found improvements in communicative functions up to 18 months post onset, but the greatest improvement occurred with the first six months [20]. Interestingly, improvements in reading and auditory comprehension occurred most prominently in the second six months post onset. Aftonomos, Steele and Wertz examined responsiveness to therapy beyond six months post onset of aphasia in 23 persons with anomic, Broca’s conduction, Wernicke’s, transcortical sensory and global aphasia. They found improvements across a wide range of communicative abilities and aphasia severity levels following extensive aphasia treatment [21].

More recent studies of long-term recovery of aphasia offer similar positive outcomes. Becker and colleagues examined recovery in 38 persons with aphasia (PWA) to compare aphasia recovery at 3 points (4.3 months, 15 months & 66 months) and found an almost 18-point change between 15 and 66-month assessments [22]. Improvements were noted in naming, auditory comprehension and oral reading. Similarly, Holland and colleagues examined data from the AphasiaBank to explore recovery patterns among 26 PWA initially tested between six months and 5.8 years post onset of aphasia. They found that 16 exhibited positive improvements in their overall Western Aphasia Battery (WAB) aphasia quotient (AQ) [23]. Nakagawa *et al.* followed 121 PWA who received aphasia treatment (cognitive-based linguistic rehabilitation) for two years after aphasia onset and found that average aphasia severity scores on the Standard Language Test of Aphasia (SLTA) improved from 3.2 at baseline to 6.2 (out of maximum score of 10) at the conclusion of treatment [24]. Sachs, Rising and Beeson evaluated changes in anomia among 42 individuals with

Broca's, Wernicke's, conduction, anomic and global aphasia using data from the Mayo Clinic's Older Americans Normative Studies. They found significant improvement (average 7.67 points) on the Boston Naming Test (BNT) among those followed on average for two years [25]. These findings highlighted long term recovery of aphasia-related anomia. Collectively these group studies indicate that improvements in aphasia can occur beyond one year (See Table 1 for summary of studies).

Evidence from case series and case reports

Several case reports and case series have also reported aphasia recovery beyond one year. A very early study by Samples and Lane measured three-year recovery of an individual with global aphasia and found 38% overall improvement on the Porch Index of Communicative Ability (PICA) with total scores improving from 6.1 to 10.5 [26]. Specifically, continuous improvement in phrase productions, use of social language, self-cueing, positioning of articulators, and repetition were observed. It is notable that the client received extensive therapy over the three-year period unlike other reported cases. Pradat-Diehl, Tessier & Chounlamounry found improvements in spoken language, in tasks of oral naming, repetition, and reading, in an individual with severe non-fluent aphasia evaluated six years after the onset of aphasia [27]. Jungblut, Suchanek & Gerhard found improvements in spontaneous speech, comprehension, repetition and naming in an individual with global aphasia eight years after aphasia onset [28]. Jungblut and colleagues also published a case series of three individuals with severe Broca's and global aphasia examining recovery over a five-year period [29]. They found that each individual demonstrated significant improvements annually during reevaluations. The most significant improvements were exhibited in expressive linguistic abilities (repetition, naming) whereas the least improvements were observed in written language and comprehension. Anaki *et al.* found continued improvements in spontaneous speech, comprehension, repetition, naming, reading and writing over 14 years in an individual initially diagnosed with Wernickes aphasia [30]. It is notable that the client received intensive therapy

over a nine-year period. Stark examined aphasia recovery over a seven-year period in an individual with Broca's aphasia and found that their language performance and verbal communicative behavior (confrontational naming, oral sentence production, everyday language) demonstrated continued improvement [31]. Finally, the longest-term improvements found in the current literature was a report by Smania, Gandolfi, Angliotti, Girardi, Fiaschi & Girardi who found improvements 25 years after the onset of aphasia in a case initially diagnosed with global aphasia [32]. Improvements were observed over time in comprehension, repetition, naming, reading and event description (See Table 2 for summary of cases reports and case series).

REVIEW SUMMARY

The current review offers important information that supports the notion that language recovery in post-stroke aphasia can indeed occur beyond the first year of stroke. In fact, the results of some studies suggest that language recovery is continuous, even though in a slower rate. Improvements can occur in verbal communication skill which in turn also enhances the PWA's quality of life [31]. Interestingly, language improvements in PWA beyond the traditional one-year period has been observed across different modalities: comprehension and expression. However, studies demonstrate mixed results concerning which language modality seemed to be most advantageous. For example, Naeser, Gaddie, Palumbo & Siassny-Eder [18] suggest that greater recovery occurs in tasks of auditory comprehension while Jungblut, Mais, Huber, and Binkofski [29] observed the opposite pattern. All in all, however, significant language improvements have been consistently documented during the relatively stable and static chronic phase of aphasia, a finding contradictory to popular belief and traditional practice.

The collection of data also suggests that PWA, even those who share the same type of aphasia diagnosis, are not a homogenous group. Specifically, they show different patterns of recovery based on several factors, including the site of lesion (i.e. cortical vs. subcortical) [18]. Further, Nakagawa *et al.* found that the predictors that seem to drive long-term aphasia outcomes are mostly the age at

Table 1. Group studies reporting long-term aphasia recovery.

Author	Sample	Age	Recovery period measured	Treatment provided during recovery	Outcome measure	Outcome	Notes
Naeser <i>et al.</i> [18]	14 PWA (Global)	50 - 66 years	1-4 months post onset and 1-2 years post onset	No	Boston Diagnostic Aphasia Examination (BDAE)	Greater recovery in auditory comprehension for the group who did not have cortical lesions in Wernicke's area with only subcortical temporal lobe lesions including the temporal isthmus compared to the group who had lesions in more than half of Wernicke's area. Recovery of spontaneous speech, repetition, and naming was minimal (deficits remained severe in most cases) in both groups.	Significance level used ($p < 0.01$)
Nicholas <i>et al.</i> [20]	24 PWA (Severe aphasia)	44 - 75 years	1-2 months post onset till 2 years post onset	Yes, 22 PWA received speech-language therapy	Boston Assessment of Severe Aphasia (BASA)	Significant improvements were found for up to 18 months post onset, with the greatest improvement happening in the first 6 months post onset. Significant improvements in reading and auditory comprehension occurred only in the second 6 months post onset. Nineteen PWA had the same aphasia classification 2 years post-onset	Significance level used ($p < 0.01$)

Table 1 continued..

Author	Sample	Age	Recovery period measured	Treatment provided during recovery	Outcome measure	Outcome	Notes
Aftonomos <i>et al.</i> [21]	23 PWA (Chronic aphasia)	40 - 86 years	6 months till 15 years post onset	Yes, using a computer-based treatment system	Porch Index of Communicative Ability (PICA) Boston Naming Test (BNT) Western Aphasia Battery (WAB) BDAE	Significant pattern of improvement in language modalities in range of aphasia types and severities.	
Naeser <i>et al.</i> [19]	12 PWA	51 - 71 years	1 year post-onset and 5-12 years post onset	Yes, some PWA received therapy 2 years post onset	BDAE	Significant improvements in naming and speech as measured by phrase length were present in PWA 5 years post onset.	
Becker [22]	38 PWA	Average age of 55.7 years	4.3 months till 66 months post onset	N/A	Norwegian Basic Aphasia Assessment (NGA).	Significant improvements in overall language scores as well as across different language modalities with improved performance in tasks of naming, auditory comprehension, and reading aloud.	
Holland <i>et al.</i> [23]	26 PWA	36 - 90.7 years	6 months till 5.8 years post onset	Yes (before data collection)	Western Aphasia Battery-Revised (WAB-R) BNT Verb Naming Test (VNT)	Significant improvements in 16 of 26 PWA who were first tested an average of almost five years post-onset and retested an average of almost four years later in their overall language performance, picture naming, and verb naming, and several discourse measures.	

Table 1 continued..

Author	Sample	Age	Recovery period measured	Treatment provided during recovery	Outcome measure	Outcome	Notes
Nakagawa <i>et al.</i> [24]	121 PWA	Average age of 54.4 years	2 years	Yes (cognitive-based linguistic rehabilitation)	Personal narratives, picture descriptions, a procedural discourse task, and a Cinderella story retelling task	Seven PWA had an overall maintenance of language scores. Three PWA had an overall decrease in their language scores.	Significance level used ($p < 0.01$)
Sachs <i>et al.</i> [25]	42 PWA	Average age of 60.28 years	Average period of 2 years	Yes	Standard Language Test of Aphasia (SLTA) BNT	Notable improvement was observed among the 121 PWA in their overall language performance. Significant improvement in picture naming among PWA.	

Table 2. Case series and case reports examining long-term aphasia recovery.

Author	Case characteristics	Age	Recovery period measured	Treatment provided during recovery	Outcome measure	Outcome	Notes
Samples <i>et al.</i> [26]	Global Aphasia	58 years	3 years	Yes	Porch Index of Communicative Ability (PICA)	Continuous improvement throughout the 3-year recovery period with specific improvements in phrase productions, use of social language, self cueing, positioning articulators, and repetition.	Significance level used ($p < 0.01$)
Pradat-Diehl <i>et al.</i> [27]	Non-fluent Aphasia	27 years	9 years	Yes, started at 10 months post onset	Test pour l'examen de l'aphasie l'échelle de communication verbal de Bordeaux	Significant improvement 2 years after stroke on oral and written naming, repetition, and reading. Continuous progress in reading until the fourth year post onset. Maintenance in spontaneous written language skills starting the fourth year. Continuous progress in spontaneous speech even after the fourth year post onset. Slow but continuous progress in spontaneous oral language, with maintenance for several years, and then observable progress from the sixth until the ninth year post onset.	

Table 2 continued..

Author	Case characteristics	Age	Recovery period measured	Treatment provided during recovery	Outcome measure	Outcome	Notes
Jungblut <i>et al.</i> [28]	Global Aphasia; Alexia; Agraphia	57 years	20 months till 8 years post onset	Yes, a directed resource-orientated and music-supported training	Aachen Aphasia Test	Clinically significant improvements in spontaneous speech, repetition, and naming. Eight years post aphasia onset, further clinically significant improvements were observed in speech performances.	
Smania <i>et al.</i> [32]	Global Aphasia	37 years	25 years	Yes, for 2 years	Milan Language Examination (MLE) Token Test Raven Test Tests for oral, ideational, and ideomotor apraxia	Significant improvement in verbal comprehension and word repetition was most salient during the first year post aphasia onset. Significant improvement in naming and reading performance were most observed during the following 2 years. Progressive language and spontaneous speech improvements were found up to 25 years post aphasia onset.	
Stark [31]	Broca's Aphasia	47 years	7 years	Yes, throughout recovery period	Boston Naming Test (BNT) Action Naming Test (ANT)	Significant and continuous language and verbal communicative behavior improvements were observed.	

Table 2 continued..

Author	Case characteristics	Age	Recovery period measured	Treatment provided during recovery	Outcome measure	Outcome	Notes
Anaki <i>et al.</i> [30]	Wernicke's Aphasia; Conduction Aphasia	68 years	14 years	Yes	Amsterdam-Nijmegen Everyday Language Test (ANELT) Discourse production to different picture stimuli Psycholinguistic Assessments of Language Processing in Aphasia (PALPA) Comprehensive Aphasia Test (CAT)	There was an observation of carryover from oral to written sentence production as well as to verbal communication in everyday life.	
					BNT Cookie Theft Picture description task The Diagnostic Assessments of Reading Fuld Object Memory Evaluation Phonological Awareness Test Raven's Colored Progressive Matrices	Significant improvement in overall language abilities as evidenced by significant increase in language scores. Specifically, improvements were observed in conversation skills, repetition, word finding, discourse, reading and writing.	

Table 2 continued..

Author	Case characteristics	Age	Recovery period measured	Treatment provided during recovery	Outcome measure	Outcome	Notes
Jungblut <i>et al.</i> [29]	Three PWA with non-fluent aphasia with concomitant apraxia of speech	Mr. U: 53 years Mrs. A: 44 years Mr. H: 44 years	5 years	Yes, started 18 months post onset using a directed resource-orientated and music-supported training	Rey Auditory Visual Learning Test Rey-Osterrieth Complex Figure Test Wechsler Adult Intelligence Scale Western Aphasia Battery Wisconsin Card Sorting Test Aachener Aphasia Test	Significant language and motor speech improvements even in the very late chronic stage of severe nonfluent aphasia and apraxia of speech. Expressive linguistic abilities (repetition, naming) were most improved whereas written language and comprehension were least improved.	

aphasia onset, lesion in the left superior temporal gyrus (including Wernicke's area), and baseline language abilities, including aphasia severity [24]. Sachs, Rising, and Beeson further corroborate the latter finding, reporting the greatest recovery in PWA whose initial severity was moderate rather than severe [25]. Future studies are therefore urged to investigate language patterns and predictors in aphasia recovery beyond the traditional one-year period.

LIMITATIONS

Despite the interesting findings reported here, the review has limitations. First, the findings of case studies, case series and small studies do not always translate to the general population and they can be difficult to replicate. Overall, there have been very few studies examining aphasia recovery beyond one year. Second, studies of behavior and particularly those with a small number of subjects have the potential for measurement error and performance variability. For example, some aspects of aphasia tests are derived for subjective ratings of spontaneous speech performance. These subjective ratings have the potential to impact the overall test scores. Additionally, PWA can vary in the performances during aphasia assessments not truly reflecting improvements or declines in skills [33]. Finally, some studies examined natural recovery beyond one year whereas others included PWA who continued to receive treatment. Despite these limitations, this review offers preliminary evidence that improvements can be made decades post aphasia onset.

CONCLUSIONS

The current review offers critical information that can guide clinical practice. With the presented evidence herein, clinicians are encouraged to continue speech and language therapy for PWA beyond the first year post aphasia onset. Evidence suggests that while aphasia recovery is most observable during the first year, PWA continue to show improvements in both receptive and expressive modalities across different domains of language, which in turn significantly improves quality of life and everyday communication, an important outcome of aphasia therapy.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

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