

Review



Current Evidence for Post Stroke Aphasia Treatment

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Highlights

- Speech and language therapy is a treatment with sufficient evidence on post stroke aphasia.
- We can considered pharmacotherapy and Brain stimulation technique on post stroke aphasia in conjunction with speech and language therapy.

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ORCID iDs

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Conflict of Interest

The authors have no potential conflicts of interest to disclose.

ABSTRACT

Aphasia is a major devastating symptom in stroke survivors that deteriorates patient quality of life. Various treatment methods are applied for aphasia patients after stroke. Evidence is required to assess the effectiveness of variable therapy for aphasia. Results of a meta-analysis have concluded that speech and language treatment is effective post stroke. Better outcomes are expected with high dose and high intensity speech and language therapy within tolerable ranges. Computerized and group treatments can supplement classic one to one speech and language therapy. Pharmacotherapy and non-invasive brain stimulation combined with speech and language therapy have been well-studied and better outcomes are expected, however testing in a large number of subjects is required to validate the efficacy of these combined modalities.

Keywords: Aphasia; Speech Therapy; Drug Therapy; Transcranial Magnetic Stimulation; Transcranial Direct Current Stimulation

INTRODUCTION

Aphasia is an acquired impairment following brain damage that affects language ability such as expression and understanding of speech, reading, and writing. The symptoms of aphasia are various and individualized and involve many aspects of language ability. Prevalence of post-stroke aphasia is variable and it is reported in 15% to 35% of individuals of acute stroke [1]. Lack of functional communication of patients with aphasia results in functional deterioration, poor functional recovery, depression, and increased social isolation. It is major source of deterioration in patients with stroke that affects private and public health status after stroke. Aphasia severity is a predictor of health-related of quality of life.

There is evidence to support the efficacy of variable aphasia therapies. The most common and classic treatment of aphasia is speech and language therapy delivered by speech and language pathologist. The objective of speech and language therapy of aphasia is to recover patient communication function and educate patients and the people in their environment. Variable intensity and treatment methods were used for this treatment. A variety of different treatment have been developed including pharmacotherapy and brain stimulation techniques, including repetitive transcranial magnetic stimulation and transcranial direct current

stimulation. Observation and standardized test or non-standardized test can be used to train many communication abilities such as speech, language, pragmatics, reading, and writing. Following assessment of communication ability, especially language function, several interventions of aphasia should be planned immediately.

The objective of this review was to verify current evidence of post stroke aphasia treatment that are commonly done, including speech and language therapy, pharmacotherapy, and non-invasive brain treatment.

SPEECH LANGUAGE THERAPY

Speech language therapy is the most common and classic treatment method of post stroke aphasia. Several randomized controlled trials have investigated the efficiency of speech and language therapy for aphasia after stroke. A recent Cochrane review of speech and language therapy for aphasia reported that speech and language therapy had statistically significant benefits for aphasia patients in functional communication, reading, writing, and expressive language compared to no speech and language therapy [2]. However, these benefits were not evident in follow up.

As for intensity of speech and language therapy, high intensity and high dose speech and language therapy group showed favorable outcome in functional communication compared to low intensity low dose group. However, across the trials, significantly more participants dropped out of high intensity speech language therapy compared to those in the low intensity speech language intervention [2,3]. Until now, there has been no consensus on the optimum dose and intensity or duration of speech and language therapy.

When to begin speech and language therapy and effective period of treatment were investigated in one pilot randomized controlled study that showed improved communication outcomes in people with aphasia treated in early stage of stroke compared to delayed treatment. In this trial, patients received individualized, impairment-based daily aphasia treatment at the beginning of early stage of stroke (median 3 days) [4]. However, meta-analysis of early vs. delayed speech language therapy there was no statistically significant difference in functional communication between early vs delayed speech and language therapy. Also, the effects of speech and language therapy continued up to six months after stroke onset (chronic stage). A systematic review of interventions for patients with chronic aphasia greater than 6 months after stroke onset showed computer based treatment, constraint induced aphasia treatment, high intensity speech and language therapy, and group speech and language training showed effective for increasing functional communication capacity [5]. Based on several studies and systematic review, we cannot conclude when treatment should be started or how long it should be continued for people with aphasia after stroke, now.

There are randomized controlled study comparing computer-based therapy to no treatment, speech and language therapy, or nonlinguistic computer training. In these studies, beneficial effect is expected on computerized treatment [6-11].

Several trials compared a group-based speech and language therapy to one-on-one speech and language therapy. In group based speech and language therapy, 2 to 10 people

received group-based speech and language therapy. Several studies used constraint induced aphasia therapy, group discussion, recreational activities with therapist. There was no significant benefit in functional communication, receptive and expressive language for people treated with group-based treatment compared to conventional one-on-one speech language therapy [2,12]. However, there was no statistically significant effectiveness in one-on-one speech and language therapy group compared to group-based treatment group. Group-based treatment have benefit on social network and community access and is not inferior compared to one-on-one speech and language treatment.

A systematic review of communication partner training was published in 2010 and updated at 2016. All 25 of current review articles reported positive changes after partner training in updated review of 2016 [13,14]. However, there are limitations due to lack of high quality efficacy research and the studies have been focused on chronic phase aphasia patients. Communication partner training focused on communication skills is recommended for partners of people with chronic aphasia. However, there is insufficient research evidence to generate recommendations; additional high quality research is needed to increase the strength of existing recommendations.

PHARMACOLOGIC INTERVENTIONS

Pharmacologic interventions modulating stroke-induced disruption of diverse neurotransmitters has been used to improve language and communication deficits in aphasic patients. However benefits are not always evident for drug monotherapy or drugs combined with speech and language therapy. One class of pharmacologic compounds that act on dopaminergic and related monoaminergic transmitters have been the most widely investigated agents. Bromocriptine and levodopa are representative drugs in this category. Bromocriptine has been used for non-fluent aphasia such as transcortical motor and Broca's aphasia. It was reported to have beneficial effects in single case and case series studies. However, there was no significant difference compared to placebo in a randomized controlled trial that was published in 2006 [15]. A single dose of levodopa (100 mg) administered before every session of language training improved verbal fluency and repetition better than placebo group in post-stroke patients with frontal lobe damage.

Piracetam is a γ -aminobutyric acid derivatives that acts on acetylcholine and glutamate, and is commonly used nootropic agent to promises various benefits to brain function, including language improvement on post stroke patients. Recent published systematic review and meta-analysis of randomized controlled trials for Piracetam for post stroke aphasia showed that Piracetam did not significantly improve overall severity of aphasia, but only affected written language capacity [16]. Improvement in written language only after Piracetam treatment implies short term advantage but non long-term effects.

In recent years, two relatively new agents (donepezil and memantine) have been widely used for cognitive dysfunction induced by various diseases. These new agents have been investigated as potential drug adjuvants to speech and language therapy for post-stroke aphasia. Donepezil is a dose-dependent acetylcholinesterase inhibitor with a selective central action. In a randomized placebo controlled study published in 2006, the donepezil group showed significant improvement in aphasia severity at the endpoint (week 16) relative to placebo in post-stroke aphasia patients one year after stroke onset [17].

Acetylcholine acts as a cortical modulator and plays a role in cholinergic pathways that are vulnerable to vascular damage. Memantine, an N-methyl-D-aspartate receptor antagonist, is another drug used to treat cognitive dysfunction after stroke. N-methyl-D aspartate-type glutamate receptor activation can result in excessive calcium influx into cells which leads to excitotoxic neuronal death. Expected effects of memantine include modulation of glutamatergic activity leading to potential neuroprotective effects and augmentation of synaptic plasticity and potentiation. A randomized, placebo controlled study of both memantine and constraint-induced aphasia therapy for chronic post-stroke aphasia showed both memantine and constraint-induced aphasia therapy alone improved aphasia severity, but combining memantine with constraint-induced aphasia therapy achieved superior results. [18].

BRAIN STIMULATION

In recent years, non-invasive brain stimulation techniques, namely transcranial magnetic stimulation and transcranial direct current stimulation, have been applied to enhance language recovery in post-stroke aphasia patients. Recent studies have indicated that recovery of language abilities in patients with aphasia depends on reorganization of brain function. Patients with post-stroke aphasia showed maladaptive cortical changes in both hemispheres. When the left language-dominant area suffers massive injury, activity in the right homologous area may increase; this may hinder rather than aid language recovery [19-21]. After injury, interhemispheric inhibitory connections cannot effectively suppress right hemispheric activity and increasing activity in the right hemisphere may exert an inhibitory influence on left perilesional language areas. Alterations in activation of perilesional areas could predict treatment response in patients with chronic aphasia.

Repetitive transcranial magnetic stimulation (rTMS) induce weak electrical currents that depolarize or hyperpolarize neuronal membranes, therefore this may facilitate or inhibit activity of current cortex [22]. Most studies have described adjusted low frequency (1Hz) inhibitory repetitive transcranial magnetic stimulation with a 90% resting motor threshold in the triangular part of the right inferior frontal gyrus [23-28]. A meta-analysis of randomized, controlled trials concluded low frequency rTMS has a positive effect on language recovery in patients with aphasia after stroke [29]. Additional evidence showed naming, repetition, and writing skills showed improvement after rTMS relative to a control group. However, this evidence was only for immediately after stimulation. A small number of studies reported follow-up results; these follow-up times differed in each trial with respect to the long-term effects of repetitive transcranial magnetic stimulation.

Transcranial direct current stimulation (tDCS) is another neuromodulation technique that influence cortical brain activity. Weak electrical current is delivered to the brain through two electrodes. Under cathodal tDCS, targeted brain areas show decreased excitability. Anodal tDCS increases brain activity and neuron membrane hyperpolarization [30]. Several studies showed tDCS in combination with speech and language therapy was associated with better outcomes compared to a control group. Cochrane reviews assessed the effects of tDCS on improving aphasia after stroke [31]. Several studies applied anodal tDCS to the left Broca's or Wernicke's areas and another study applied cathodal tDCS to the right homologous Broca's area [32-36]. Another study used dual tDCS with an anodal electrode over the left Broca's area and a cathodal electrode over the right Broca's homologue area [37]. In this systematic

review, none of the studies used any formal outcome measures of functional communication [31]. A meta-analysis of six trials using picture naming as the outcome variable demonstrated that tDCS was not associated with significant enhancement of speech and language therapy outcomes in tDCS group vs. controls [31]. Thus, at this time there is no clear evidence of tDCS effectiveness in improving functional communication, language impairment. Further studies are needed.

CONCLUSION

In this review, speech language therapy was an effective treatment for post stroke aphasia. Though there is no known optimal treatment dose and intensity, high dose and high intensity therapy is recommended within a patient-tolerable range. Group and computerized therapies may be considered supplemental treatments. Pharmacotherapy and non-invasive brain stimulation including repetitive transcranial magnetic stimulation and transcranial direct current stimulation have recently been studied and may be efficacious treatments.

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