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Review

Treatment and Prognosis of Aphasia after Stroke

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Abstract

Stroke is the second prominent cause of death in the world and the first in China with 1/3 of the survivors presenting with post-stroke aphasia (PSA). Herein PSA has been reviewed concerning novel studies in the frame of reference to epidemiological facts, advances in treatment and prognostic factors. Speech and language therapy (SLT) are the backbone of the management of aphasia. Likewise, in the acute context, reperfusion therapy has recently emerged as an influential option for better progression. In combination with SLT, pharmacotherapy specifically Donepezil and Memantine appear to work better though further research is warranted on its effectiveness on global language function. Testimonial of the usefulness of non-invasive brain stimulation techniques for PSA is preliminary but assuring and transcranial direct current stimulation trials are encouraging. A rarely discussed treatment option, acupuncture has been evidenced to result in impressing outcomes for motor PSA, functional communication, and linguistic abilities. Moreover, SPEAK-6 and aNIHSS tools have been recently developed and proved to predict prognosis at 6 months and 24 hours, respectively. Studies revealed several prognostic factors for PSA including the age at onset, location of the lesion, infarct size, baseline language ability, education level of the patient, white matter preservation and mechanism of neuroplasticity. Therefore, further research for treatment and prognosis of PSA are indicated with many participants, including varieties of aphasia types, explaining the pathophysiology of these recoveries of the novel approaches and details on the optimal daily dosage, intensity, and duration of these therapies.

Key words: Aphasia, Stroke, Memantine, Donepezil, Prognosis, Linguistics.

1. Introduction

Stroke is defined as a neurological deficit that occurs abruptly due to a focal vascular cause (1). It is the second leading cause of death and a major etiology of disability worldwide (2). It is more common among elder females than males despite the incidence being lower among females than

among males (3). In China, stroke is currently the first leading cause of death and its impact on China population is higher compared to the average global level and more prevalent in males than in females (4,5).

Aphasia is known to be an impairment of the production of the formal aspects of language, including the ability to find and choose words, comprehension, spelling, or grammar due to an acquired brain lesion. Most aphasias occur because of stroke, traumatic brain injury, brain tumor, or neurodegenerative diseases (6,7).

Approximately 100,000 stroke patients are diagnosed with aphasia annually, resulting in sudden impairment of daily activities, occupation, and communication. Moreover, it is mostly observed in older stroke patients, younger post-stroke aphasic patients are most likely to present with Broca's aphasia (8,9). The likelihood that post-stroke patients will experience aphasia is 20% -38%, which is estimated to be about 1/3 of patients with acute stroke. And the rate is higher in females compared to males (1.1-1.14 ratio) (10,11-15).
Aphasia syndromic classification includes global aphasia, Broca's aphasia, Wernicke's aphasia, anomic aphasia, conduction aphasia and the transcortical aphasia (16). Broca's aphasia occurs most frequently, anomic, and global aphasia follows (17).

Post-stroke aphasia (PSA) is associated with poor prognosis in both acute and chronic settings (18). There are several treatment approaches for aphasia which can be summarized into three major therapies, Speech, and language therapy (SLT), pharmacotherapy and brain stimulation techniques but the evidence on when to start treatment or how long it should continue is minimal (19,20). This review thus aimed to outline the current aphasia treatment approaches and its prognosis evidenced by recent studies and clinical trials in a summarized way.

2. Treatment of Aphasia

2.1 Speech and Language Therapy

Treatment of post-stroke aphasia should be started immediately following the cerebrovascular accident; moreover, the progression of linguistic functions may also occur in the chronic phase (21).

SLT is the most regularly used treatment method for PSA. The most recent Cochrane review and randomized controlled trials (RCTs) have proved the existence of strong evidence that SLT is beneficial in management of subacute and chronic stages of aphasia for both older and younger post-stroke aphasic patients when offered in high-intensity with marked improvements in aspects of communication, reading, writing, and language expression (22, 23, 24). Furthermore, in a subacute stroke, 16 SLT sessions, for half to one hour in 8 weeks consecutively, have been determined to be more efficient in the treatment of PSA as opposed to highly intense SLT management which results in many patients drop-out (25). On the other side, there is still existing controversy on the optimal daily dosage, intensity, and duration of SLT for chronic post-stroke aphasia (19, 23, 26). Most novel studies evidenced the role of multiple doses of high-intensity SLT compared to a single treatment period (27). Likewise, social support plays an obligatory role as an addition to routine SLT (28).

There are several contemporary randomized controlled studies on innovative training-based therapies, so far computer-based aphasia therapy has been capable to result in the improvements of both language skills and operative communication (24,29). In a small sample study, the software Power-Afa have been validated its usefulness as a tool in improving the linguistic and cognition for recovering post-stroke aphasic patients in the chronic phase (21).

However, compared to face to face, remotely delivered word-finding computer-based therapy via mainstream internet video conferencing can enhance picture naming in post-stroke aphasic patients and this is advantageous as it can be practiced even without computer experience or

supervision at home (30,31). Nevertheless, dysgraphia patients improved remarkably on practical writing measure following the assistive technology therapy (32).

2.2 Pharmacological treatment of aphasia

Current guidelines recommend pharmacotherapy approach for aphasia to be case-dependent and applied in combination with SLT, furthermore, there is no specific regimen recommended for routine use presently (20).

In the acute setting, reperfusion therapy like intravenous tPA, mechanical thrombectomy, carotid endarterectomy, and stenting appears to influence the sequel of aphasic patients (20,33). Thrombolysis has been strongly indicated as safe and effective even in aphasic patients with low NIHSS score resulting in greater linguistic improvement as early as 7 days after thrombolysis (34,35,36).

The latest studies suggested that two new agents (Donepezil and Memantine) which had been broadly used for cognitive impairment could intensify the PSA outcome. Donepezil is a dose-dependent, selective acetylcholinesterase inhibitor prescribed for stabilization of cognitive disorders, has shown promising outcomes in augmenting auditory comprehension, ability to name, repeat and express orally in aphasic patients. On the other hand, Memantine, as an antagonist for the NMDA receptor, with similar usage, recently proved to result in marked outcome in intensifying speech, naming, and repetition abilities post stroke (19,29,37). A recent meta-analysis from 7 RCTs had shown proof that Piracetam has a confined role in general linguistic impairment treatment and with short-lived impact on writing abilities (38). Likewise, the significance of bromocriptine for the management of PSA cannot be established, additionally, levodopa, galantamine, and amphetamine lacks absolute evidence to support effectiveness on PSA (37).

Acupuncture has been proved to have a significant contribution to stroke rehabilitation (39). It has been practiced among Chinese populations for hundreds of years in stroke management and is progressively adapted in some Western nations, therapeutically, fine needles or pressure must be administered at a specific position in the body (40). Acupuncture was approved by WHO since 1980 as a complementary therapy for several disorders, neurological diseases inclusively (41). A most contemporary meta-analysis involving 1747 patients indicated that acupuncture resulted in a marked improvement in PSA in terms of functional communication and linguistics (42). Furthermore, acupuncture is efficient in the treatment of motor aphasia in post-stroke (43).

2.2 Brain stimulation techniques

Recently there had been a wave of applications of new technologies in treatment of aphasia, studies have brought attention to the application of non-invasive brain stimulation techniques (NIBS) techniques such as transcranial electrical stimulation (tES) mostly transcranial direct current stimulation (tDCS), repetitive transcranial magnetic stimulation (rTMS), theta-burst stimulation (TBS) to treat PSA (19). New findings indicated the first-hand linkage between neural motor-limb systems and speech-language networks (44).

tDCS is a prominent NIBS technique which are used to regulate cortical excitability and producing excitation or inhibition effects by delivering a steady current across the scalp (45,46).

It fascinated high attention in the neurorehabilitation discipline because it is simple to operate as no serious adverse events and minimal cost, which warrants the usage at the patient's home [46,47,48]. In one human trial for 1,000 participants with repeated sessions by applying ≤4 mA, ≤7.2 Coulombs for ≤40 min, no marked adverse effect was reported (49). Additionally, amidst the correlative motor cortex sites, cerebellar neuromodulation appeared to improve verbal fluency (49,50). To achieve a positive outcome for tDCS intervention repeated sessions one day apart,

stimulation amplitude intensity of 1-2 mA in adults and 1 mA in children for 20 min and monocephalic anodal tDCS should be considered (46,51). The major factor which determines tDCS prognostic outcome in chronic non-fluent aphasia patients is a baseline severity (52).

Therefore, tDCS trials are encouraged as a complement to traditional SLT intervention for PSA and PPA (53,54,55). The latest studies indicated that supplementing neurostimulation approaches with SLT might result in significant outcomes in chronic aphasics in the same way, combined SLT with stimulated anodal on the left hemisphere and/or cathodal the right hemisphere improves both naming precision and rapidity (56,57).

rTMS is extensively applied for multiple neurological diseases with conceivable treatment outcomes (58). TMS has created a convincing prospect in the field of neuroscience due to its capacity to evoke neuronal activity and shape the excitation of the cerebral cortex (59). Furthermore, it is efficient in prompting current and generate action potentials within neurons by electromagnetic coil (60).

On the other hand, novel studies have acknowledged the possibility of considering low frequency rTMS as a tool for the management of non-fluent aphasics post stroke (61). Likewise, it has been observed that long-lasting improvements inability to name the picture is associated with rTMS to the right hemispheric region Broca area homolog (62).

3. Prognosis of Aphasia

PSA is an influential risk factor for a prolonged length of post-acute admission also leads to extreme cost to the nations, which was estimated to be $2.16 billion per year spent in the United States (63). At 6 months post-stroke, Sequential Prognostic Evaluation of Aphasia after stroke (SPEAK-model), SPEAK-6 has reviled good results for anticipating the long-term prognosis of PSA and discrimination among patients for better versus poor prognosis (64). In the same manner, one-day post-ischemic stroke, the abbreviated 24-h NIHSS (aNIHSS) appears to have magnificent prognostic certainty, clinical applicability with superb reliability in comparison with the total 24-h NIHSS (65).

Aphasia progression varies depending on the age at onset, lesion location and baseline language ability as shown in Figure 1. Younger age at initial presentation is associated with a good aphasia prognosis therefore younger patients should be prioritized for rehabilitation therapies (66).

Meanwhile, Broca's, inferior prefrontal gyrus, and premotor cortex brain lesions are associated with slowness of PSA recovery of the left hemisphere (67). Furthermore, lesions of the left side posterior superior temporal gyrus and superior longitudinal fasciculus or arcuate fasciculus (SLF or AF), may be correlated to poor prognosis of PSA (66-69).

In the most recent study to prognosticate 3-month PSA aftereffect, poor baseline linguistic ability was found to be directly correlated to initial aphasia severity, extensive infarcts and severe left temporoparietal junction disturbance 3 months (66,70). Presentation with severe sensory-motor derangement worsens the mechanism of neuroplasticity in the same way. Lesion of the left cortical motor increases neuroplasticity activities of the right motor cortex (71,72). Nevertheless, failure to preserve cerebral white matter is correlated with more serious aphasia (73).

4. Conclusion

PSA is associated with poor prognosis in both acute and chronic settings. As 30 % of acute stroke survivors are estimated to present with PSA, management in acute, sub-acute and chronic settings should be well addressed. In the acute setting reperfusion therapy recently proved to influence the sequel of aphasic patients. Moreover, in the sub-acute and chronic stages of aphasia SLT has been proved to improve communication, reading, writing, and language expression in old

and young patients when offered in high intensity, with multiple doses and social support, though more research is warranted on the optimal daily dosage, intensity, and duration of SLT. The role of computer-based aphasia in the improvement of both language skills and operative communication should not be underestimated.

NIBS techniques through cerebellar neuromodulation appear to improve verbal fluency, trials are encouraging as complementary to the custom SLT intervention though in the view of the recent guidelines. It is still considered to be experimental and at present not promoted into routine practice.

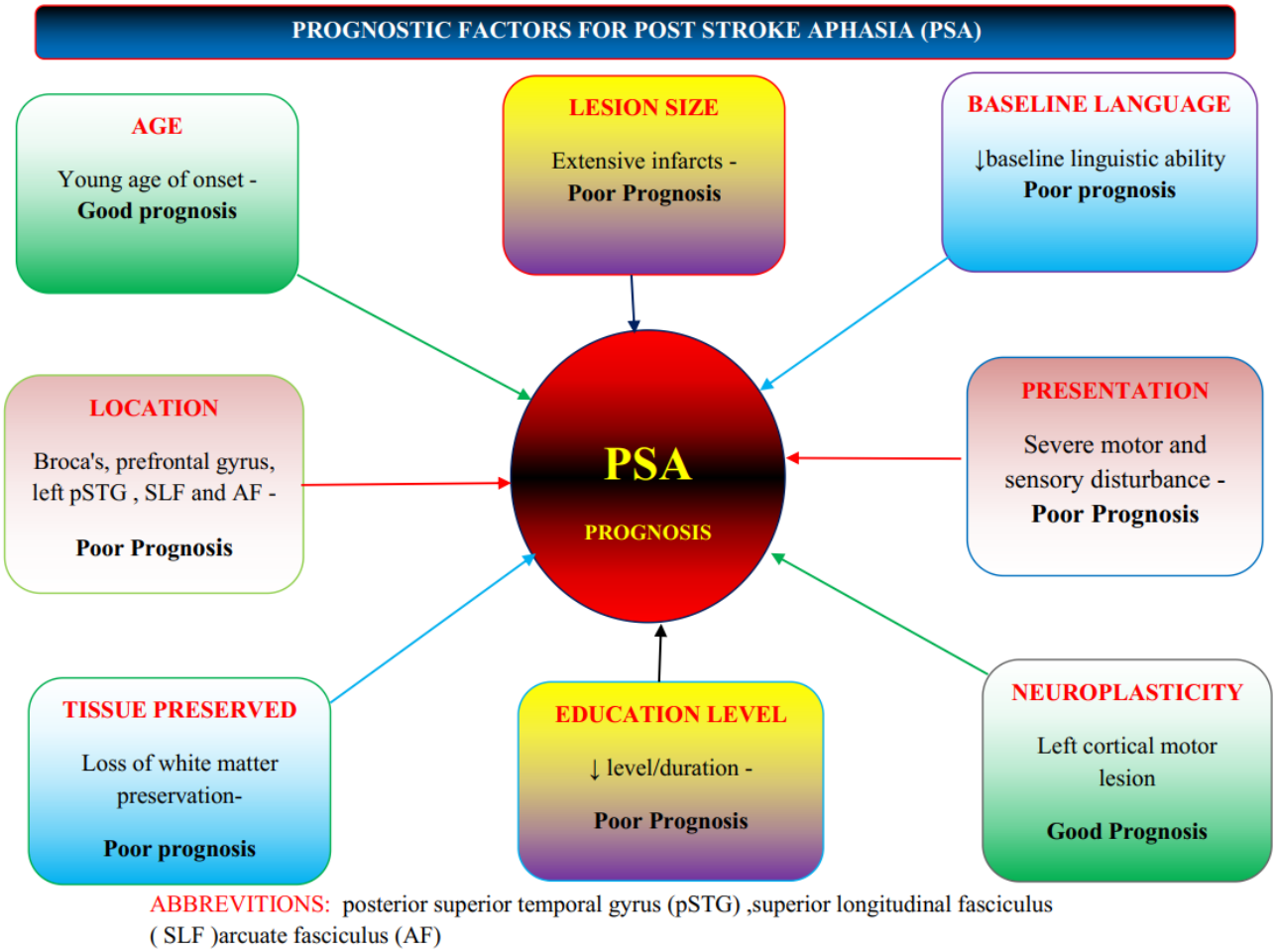

Figure 1. Prognostic factors for PSA. Showing various prognostic factors for Post Stroke Aphasia based on contemporary literature (PubMed search January 2016-July 2019). ↓ Indicates low level.

Declarations

1) ***Consent to publication***
We declare that all authors agreed to publish the manuscript at this journal based on the signed Copyright Transfer Agreement and followed publication ethics.

2) ***Ethical approval and consent to participants***
Not applicable.

3) ***Disclosure of conflict of interests***
We declare that no conflict of interest exists.

4) ***Funding***
None

5) ***Availability of data and material***
We declare that the data supporting the results reported in the article are available in the published article.

6) ***Authors' Contributions***

Authors contributed to this paper with the design (SSM), literature search (SSM), drafting (SSM), revision (YL,SSM and XC), editing (YL and XC) and final approval (SSM).

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None

8) Authors' biography

None

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