Research and Practice

Rehabilitation of Primary Progressive Aphasia (PPA) in Persons with Dementia

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Highlights:

- Distinct Variants and Neurobiological Associations – PPA is classified into three main variants: semantic (svPPA), non-fluent/agrammatic (nfvPPA), and logopenic (lvPPA), each characterized by different patterns of language impairment. Notably, logopenic PPA is strongly linked to Alzheimer's disease (AD), with biomarkers such as amyloid-beta (Aβ) deposition and elevated tau levels commonly observed in affected individuals. In contrast, semantic and nonfluent variants are more frequently associated with frontotemporal lobar degeneration (FTLD).

- Behavioral and Multimodal Communication Interventions – Non-pharmacologic treatments, including Semantic Feature Analysis (SFA), Augmentative and Alternative Communication (AAC) methods, and multimodal strategies, have shown promise in supporting communication abilities in PPA patients. Brain imaging studies suggest that targeted behavioral interventions may activate residual language networks, promoting compensatory plasticity and improving communicative effectiveness.

- Future Research Directions: Eye-Tracking and Neuroimaging – While brain imaging has provided insights into PPA, eye movement tracking remains an underexplored area. Given that recent AAC advancements incorporate eye-tracking technology, integrating these metrics with neuroimaging could enhance the understanding of language processing and compensatory mechanisms in PPA, paving the way for more effective interventions.

Introduction

Primary Progressive Aphasia (PPA) is recognized as a complex neurodegenerative disorder, characterized primarily by a progressive decline in language abilities while other cognitive functions, such as memory and executive functioning, are relatively preserved in the early stages (Schaffer & Henry, 2021). This disorder is typically classified into three main variants based on distinct patterns of language impairment: semantic PPA (svPPA), non-fluent/agrammatic PPA (nfvPPA), and logopenic PPA (lvPPA) (Wilson et al., 2010; de la Sablonnière et al., 2021). The nonfluent/agrammatic variant is noted for grammatical errors and slow, effortful speech; the semantic variant is characterized by impaired single-word comprehension and naming difficulties, with associated deficits in object knowledge; and the logopenic variant is distinguished by difficulties in word retrieval and sentence

repetition, while grammar and motor speech are relatively preserved (Gorno-Tempini et al., 2011). Among the three types, the logopenic variant is considered the most strongly linked to Alzheimer's disease, as AD pathology, specifically amyloid-beta (Aβ) deposition, is frequently observed in affected individuals. Biomarkers typically associated with AD, such as decreased Aβ42 and elevated tau levels in cerebrospinal fluid (CSF), along with amyloid positivity on PET imaging, are common findings in cases of logopenic PPA. In contrast, the nonfluent/agrammatic and semantic variants are more commonly associated with frontotemporal lobar degeneration (FTLD) (Gorno-Tempini et al., 2011).

Unlike other forms of dementia, individuals with PPA retain memory, personality, and other cognitive functions, especially in the early stages. Over time, however, language deficits become increasingly severe, significantly affecting daily communication. The disorder not only impacts individuals diagnosed with PPA but also places a substantial burden on their caregivers, who often face considerable health and psychosocial challenges associated with caregiving. Thus, a detailed understanding of the language network structure and its compensatory mechanisms is essential for the development of effective assessment and treatment approaches for PPA. This section will discuss several studies examining rehabilitation approaches for PPA.

Behavioral Treatment Approaches for PPA

Behavioral treatments for PPA have generally focused on specific language functions, such as word retrieval, sentence production, and overall communicative effectiveness. In a systematic review of 103 studies evaluating non-pharmacologic interventions for PPA, evidence suggested that behavioral treatments yielded positive outcomes across various dimensions (Wauters, 2024). Significant improvements were observed in trained language targets, which generalized to untrained skills in several cases, and were maintained over time in some individuals. Interventions have predominantly aimed at enhancing lexical retrieval, while others have targeted broader communicative competencies, such as functional communication and multimodal strategies.

Supporting evidence for some behavioral treatments comes from brain imaging studies. Beeson et al. (2011) introduced a semantically based intervention aimed at improving word retrieval for logopenic PPA patients, which resulted in notable gains in lexical retrieval for both trained and untrained items, with sustained improvement over a six-month follow-up period. fMRI results indicated increased activation in the left dorsolateral prefrontal cortex, an area commonly associated with generative naming in healthy individuals. This finding suggests that targeted behavioral interventions may engage residual language network functions and support compensatory plasticity in PPA patients as the disease progresses.

Furthermore, the integration of Augmentative and Alternative Communication (AAC) methods, multimodal communication techniques, and specific lexical retrieval tasks have shown promise in supporting communication abilities, particularly in the semantic and nonfluent variants of PPA. These interventions address communication challenges by providing compensatory strategies that utilize a variety of communication modes. Despite the progressive nature of PPA, such interventions offer crucial support, enhancing functional communication and facilitating daily interactions (Bier et al., 2015; Cress & King, 1999; Mooney et al., 2018; Murray et al., 2013; Pattee et al., 2006; Rebstock et al., 2020; Routhier et al., 2011).

Techniques such as Semantic Feature Analysis (SFA) combined with multimodal communication, as explored by Rebstock and Wallace (2020), allow individuals to improve word retrieval and communicative effectiveness, although gains in word retrieval may be modest (Rebstock et al., 2020). Other approaches, including AAC devices like text-to-speech technology and American Sign Language (ASL), as demonstrated by Pattee et al. (2006), provide alternative avenues for expression; patients have been shown to prefer ASL in naturalistic settings. Group treatment models further increase engagement by incorporating communication partner training and systematic instruction, fostering practical skills and providing social support (Mooney et al., 2018). Additionally, procedural memory strategies for AAC use have been shown to support the long-term retention of skills, allowing individuals with PPA to manage communication more independently (Bier et al., 2015). Together, these interventions offer a multifaceted approach to supporting communicative effectiveness and enhancing the quality of life for individuals with PPA.

Conclusion

PPA has been widely studied through brain imaging, yet evidence from other physiological approaches, such as eye movement tracking, remains limited. With recent advances in AAC devices incorporating eye-tracking technology, and findings indicating specific eye movement patterns in Alzheimer's patients (Barral et al., 2020; Biondi et al., 2018), future research on PPA could benefit from a multimodal approach that integrates eye-tracking metrics with neuroimaging. Such a methodology would allow researchers to more effectively map the temporal and spatial dynamics of language processing and compensatory activity.

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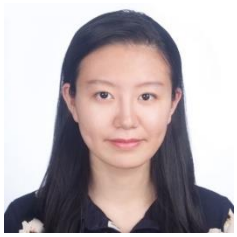

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