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# Diagnosis of Post-Stroke Aphasia: A Review of Language Tests in Korea

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## HIGHLIGHTS

- Aphasia is one of the most devastating cognitive impairments caused by stroke.
- Early and accurate diagnosis of aphasia is essential for treatment planning.
- Language evaluation tool should be standardized in the patient's native language.
- We reviewed comprehensive and brief screening tests for aphasia in Korea.

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**Conflict of Interest**

The authors have no potential conflicts of  
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## ABSTRACT

Aphasia is one of the most serious cognitive impairments in stroke patients. An accurate diagnosis of aphasia is important for early interventions that optimize patients' functional status. Therefore, we present a review of the aphasia assessment tools currently available in Korea. Aphasia is usually evaluated using a standardized comprehensive assessment battery to establish the diagnosis of aphasia, its severity, and the treatment plan. Before a comprehensive language test, a brief screening test for aphasia can be useful to identify whether any further assessment is necessary. Several standardized evaluation tools are readily available in Korea. The Paradise-Korean version of the Western Aphasia Battery (PK-WAB) is a commonly used comprehensive aphasia test for determining the presence, type, and severity of aphasia. The Korean version of the Boston Naming Test (K-BNT) is an in-depth test to evaluate naming ability. Several screening tests, such as the Korean version of the Frenchay Aphasia Screening Test (K-FAST), the Screening Test for Aphasia and Neurologic Communication Disorders (STAND), and Semantic Verbal Fluency (SVF), can be applied to identify patients at risk in terms of language performance. Depending on the outcome of these tests, patients can be referred for further evaluation.

**Keywords:** Aphasia; Language; Stroke; Rehabilitation; Review

## INTRODUCTION

Approximately 20%–36% of patients develop aphasia after stroke [1]. Although aphasia tends to improve within a year after stroke, only 40% of patients experience a complete or almost complete recovery at 1 year post-stroke [2]. Appropriate early language interventions are important for optimizing outcomes in patients with aphasia. In order to implement appropriate interventions to promote rehabilitation, an accurate evaluation of aphasia is crucial. Aphasia can be detected through medical history-taking, neurological examinations, and language function evaluations in an outpatient clinic or at the bedside. Aphasia is mainly diagnosed using standardized comprehensive language assessment tools. These standardized comprehensive tests are primarily administered by speech language pathologists, and they are time-consuming and may not always be available. Therefore, it may be useful to perform brief screening tests for aphasia before comprehensive language tests. Brief screening tests are designed for general use by non-specialist health professionals to identify patients at risk

in terms of language performance and prompt a referral for a further detailed evaluation. In this study, we review both comprehensive and brief screening tests for language performance in post-stroke patients that are clinically used in Korea.

## COMPREHENSIVE TESTS

The Paradise-Korean version of the Western Aphasia Battery (PK-WAB) is frequently used in Korea to assess language function in adult patients. It is a Korean version of the Western Aphasia Battery (WAB), developed by Kertesz, which is a standardized tool for evaluating aphasia in English-speaking countries. The WAB has high internal consistency, test-retest reliability, and validity [3-5]. The first version of PK-WAB was developed in 2001 and revised in 2012 by Kim and Na [6,7]. The PK-WAB is a comprehensive aphasia test used to determine the presence, type, and severity of aphasia [4]. As shown in **Table 1**, The PK-WAB consists of 2 parts: Part I and Part II. Part I consists of four oral language sub-tests; spontaneous speech, auditory comprehension, repetition, and naming. Part II is composed of 2 written language areas (reading and writing), and other cognitive abilities including praxis, construction, visuospatial ability, and calculation. It takes 30 minutes for Part I to be administered, and 45 minutes or more for Part II. By evaluating four oral language profiles including fluency, comprehension, repetition, and naming, aphasia can be classified into eight types: global, Broca's, mixed transcortical, transcortical motor, Wernicke's, transcortical sensory, conduction, and anomic. Furthermore, the PK-WAB provides an aphasia quotient (AQ), language quotient (LQ), and cortical quotient (CQ). The AQ denotes the severity of aphasia calculated from the oral language profile. The LQ is an indicator of overall language proficiency, calculated from the oral language profile and two written language areas. The CQ provides comprehensive information on overall cognitive function and it is calculated based on the oral and written language areas, as well as other cognitive abilities [8]. The measurement and diagnostic properties of PK-WAB are shown in **Table 2**.

The Korean version of the Boston Naming Test (K-BNT) is an in-depth test to evaluate the naming ability; this is a modified version of the Boston Naming Test (BNT) to apply to Korean language and culture [9,10]. The BNT is a routinely used confrontation naming test in the

**Table 1.** Characteristics of the aphasia evaluation tool in Korea

Test	Subtest	Score	Administration time	Cut off value for aphasia
PK-WAB [6]	Part I: Spontaneous speech; Auditory comprehension; Repetition; Naming	AQ: 0-100	30-45 min	
	Part II: Reading and writing; Cognitive abilities (praxis, construction, visuo-spatial ability, calculation)	LQ: 0-100 CQ: 0-100	45-60 min	
K-BNT [10]	Naming	0-60	15 min	
K-FAST [11]	Full form: Comprehension; Expression; Reading; Writing	0-30	10 min	Age ≥ 65: 20 Age < 65: 25
	Short form: Comprehension; Expression	0-20	3 min	Age ≥ 65: 14 Age < 65: 16
MAST [17]	Comprehension; Expression	0-20	3 min	Age ≥ 65: 14 Age < 65: 16
STAND [12]	Language category: Picture description; Naming; Listening; Understanding; Repetition; Reading; Writing	OLI: 0-20	3-4 min	OLI: 14
	Speech category: Speech/Motor programing; Speech performance	GLI: 0-30		GLI: 23
SVF [13]	Naming		1 min	60 sec: 7 30 sec: 6

PK-WAB, Paradise-Korean version of Western Aphasia Battery; K-BNT, Korean version of Boston Naming Test; K-FAST, Korean version of the Frenchay Aphasia Screening Test; MAST, Mobile Aphasia Screening Test; STAND, Screening Test for Aphasia & Neurologic Communication Disorders; SVT, Semantic Verbal Fluency; AQ, aphasia quotient; LQ, language quotient; CQ, cortical quotient; OLI, Oral Language Index; GLI, Global Language Index.

**Table 2.** Measurement and diagnostic property of the aphasia evaluation tool in Korea

Test	Reliability	Validity	Reference	Sensitivity	Specificity
PK-WAB [6]	Inter-rater reliability 1.000 ( $p < 0.001$ ) Intra-rater reliability 0.976	$r = 0.719$ ( $p = 0.001$ )	K-BNT	92.0-100.0%	90.0-100.0%
K-BNT [10]	Cronbach's $\alpha = 0.9325$				
K-FAST [16]	Full form Inter-rater reliability 0.920 Intra-rater reliability 0.979-0.990 ( $p < 0.01$ )	$r = 0.904$ ( $p = 0.000$ )	PK-WAB AQ	88.0%	28.6%
	Short form Inter-rater reliability 0.940 ( $p < 0.01$ ) Intra-rater reliability 0.979-0.998 ( $p < 0.01$ )	$r = 0.910$ ( $p = 0.000$ )		90.0%	31.0%
MAST [17]	Inter-rater reliability 0.997, ( $p < 0.001$ )	$r = 0.752$ ( $p < 0.001$ )	PK-WAB AQ	90.0%	73.3%
STAND [12]	Inter-rater reliability 0.81-1.00, ( $p < 0.001$ )	$r = 0.73$ ( $p < 0.001$ )	PK-WAB AQ	94.5%	92.9%
	Intra-rater reliability 0.67-1.00, ( $p < 0.001$ )				
SVF [13]			STAND	60 sec: 86.5%	82.7%
				30 sec: 84.6%	90.5%

PK-WAB, Paradise-Korean version of Western Aphasia Battery; K-BNT, Korean version of Boston Naming Test; K-FAST, Korean version of the Frenchay Aphasia Screening Test; MAST, Mobile Aphasia Screening Test; STAND, Screening Test for Aphasia & Neurologic Communication Disorders; SVT, Semantic Verbal Fluency; AQ, aphasia quotient.

United States and other Western countries. The K-BNT consists of 60 items, the same as in the original BNT. However, the content of the original BNT was altered because many items of the original BNT were considered inapplicable to the Korean population. The K-BNT items consist of pictures drawn in black-and-white lines for each word. As presented in **Table 1**, the total score of K-BNT is 60 points, with 1 point for each of the 60 questions. The examiner shows a picture to the patient, and the patient answers with the name of the picture. If the patient does not respond for 15 seconds after being presented with the figure, semantic hints and phonemic hints are presented sequentially, and the response is recorded separately after the hint. This test can sensitively identify patients' naming ability. It can also provide useful information for treatment planning based on the patient's response to the hints. It is particularly useful for the differential diagnosis of brain disease patients with mild language impairment. The internal consistency reliability of this test is shown in **Table 2**.

## BRIEF SCREENING TESTS

The standardized screening tests that can be used in Korea include the Korean version of the Frenchay Aphasia Screening Test (K-FAST), the Screening Test for Aphasia and Neurologic Communication Disorders (STAND), and the Semantic Verbal Fluency (SVF) tests. These tests take less than 10 minutes, making them easy and convenient to use at the bedside [11-13]. The characteristics of these tests are summarized in **Table 1**.

The K-FAST was translated and standardized in 2008 by Pyun [11]. The Frenchay Aphasia Screening (FAST) was developed to enable quickly and simply identify the presence of language deficits for experts working with patients at risk of aphasia [14]. The FAST has been used as a screening tool to identify patients with communication difficulties, who should be referred for further assessment. The FAST was first published in 1987, and the second version was published in 2006 by Enderby et al. [14,15]. The total score of the FAST is 30 points. The FAST consists of 4 subscales, including comprehension, verbal expression, reading, and writing. The comprehension portion accounts for 10 points, and it is rated by the patient looking at 2 pictures and pointing to what the examiner is explaining. Verbal expression comprises 10 points, and it is assessed in 2 steps. First, the examiner shows a river scene picture and asks the patient to describe the picture. The examiner then removes the picture

and instructs the patient to name as many animals as possible within 1 minute. The reading and writing portions are worth 5 points each. For patients who have difficulty reading and writing, only the comprehension and verbal expression parts can be evaluated as a brief test, with a total score of 20. As described in **Table 2**, the K-FAST showed high concurrent validity with the Korean version of the Western Aphasia Test (K-WAB), and was evaluated as having high inter-rater and intra-rater reliability [16].

In response to the growing demand for telerehabilitation, another study developed the Mobile Aphasia Screening Test (MAST) [17]. The MAST was developed as an iPad (Apple, Cupertino, CA, USA) application, adopting the K-FAST [11]. The MAST showed significant correlations with the K-FAST and K-WAB. In addition, the MAST showed excellent inter-rater reliability and intra-rater reliability. This test has high sensitivity (90.0%) and specificity (73.3%) with an accuracy of 0.930 (95% confidence interval, 0.853–1.000) (**Table 2**). The MAST can be used anywhere and anytime to identify aphasia in stroke patients.

The STAND is an aphasia screening test independently developed in Korea [12]. The STAND has several advantages, such as a short evaluation time of 3 to 5 minutes and consists of questions that are not affected by age or education level. This test comprises language and speech categories. For the language category, there are 6 sub-steps that measure language performance in picture descriptions, naming, listening and understanding, repetition, reading and writing. The speech category includes 4 sub-steps to assess speech/motor programming and speech performance. The STAND was designed to be easily applied to acute stroke patients by language and speech specialists as well as by other clinicians at the bedside. This tool can be used to determine whether a patient has aphasia and can classify the type of aphasia. Patients with brain damage can be diagnosed with aphasia based on Oral Language Index (OLI), which is a total score of picture description, naming, understanding and repetition, and the Global Language Index (GLI), which adds reading and writing performance scores to the OLI. Based on these results, aphasia can be classified into 8 types: Broca's, Wernicke's, transcortical motor, transcortical sensory, conduction, anomic, mixed, and global. The STAND showed high concurrent validity with the K-WAB, and it was evaluated as having high inter-rater and intra-rater reliability (**Table 2**).

The SVF test is simple and easily applicable for stroke patients with word retrieval difficulties, which are one of the most common language problems experienced by patients with aphasia [13]. Patients undergoing this test are asked to say as many words as possible in a selected semantic category (e.g., animals or grocery items) within a given amount of time, usually 30 or 60 seconds. During this test, subjects need to retrieve information from the lexicon and semantic memory, and generate responses. The cut-off scores between the aphasia and non-aphasia groups in post-stroke patients are 6.0 for the initial 30 seconds, and 7.0 for the total 60 seconds. In addition, the sensitivity value for distinguishing between the aphasia and non-aphasia groups was as high in the initial 30-second administration (0.846) as in the entire 60-second administration (0.865). However, the specificity for the naming response at the initial 30 seconds (0.905) was somewhat higher than that of the total 60-second administration (0.827) (**Table 2**).

## CONCLUSIONS

The most widely used English language comprehensive batteries are the WAB, the Boston Diagnostic Aphasia Exam, and the Comprehensive Aphasia Test [4,18,19]. These batteries are validated and provide substantial information about the patient's language performance in multiple language domains. Frequently used aphasia screening tests in English-speaking countries include the FAST, Acute Aphasia Screening Protocol, Mississippi Aphasia Screening Test, Reitan-Indiana Aphasia Screening Examination, ScreeLing, and the Ullevaal Aphasia Screening Test [20-25]. These tests are quick screening tools that take only a few minutes and are easy to apply clinically. However, some of them have not been properly validated, so further studies are needed.

Since a language performance evaluation should be performed in the patient's native language, evaluation tools should be standardized for each country and language. In this article, we review the standardized aphasia evaluation tools available in Korea. The language evaluation tools currently used in Korea have been translated and modified to fit Korean culture or independently produced and used. Proper use of these validated tools will enable early and accurate diagnosis and treatment planning, which will help optimize patients' language function.

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