Original Article

A Screening Tool to Detect Stroke Aphasia: Adaptation of Frenchay Aphasia Screening Test (FAST) to the Indian Context

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Abstract

Background: Aphasia is a common consequence of stroke. To optimize recovery, it becomes critical as there are early identification and treatment of language deficits. The rising burden of stroke aphasia and lack of screening tools in the Indian context necessitates the need for a screening tool. **Objective:** We aimed to adapt and validate the Frenchay Aphasia Screening Test (FAST) to the Indian context in two widely spoken Indian languages, Telugu and Kannada, for the literate and illiterate population. **Methods:** A systematic process of adaptation and culturally appropriate modifications of the original FAST were done in 116 healthy controls and 115 patients. The validity of the adapted test was established. **Results:** The optimum cut-off values for detecting aphasia in our sample ranged from 25 to 25.5 (literate) and 13.5 to 15.5 (illiterate) with high sensitivity and specificity. There was also a significant correlation between aphasia scores for adapted FAST and the Western Aphasia Battery (WAB), establishing good convergent validity. **Discussion:** Results of the adaptation and validation of two Indian versions of FAST, suggest that it is an easy-to-use screening measure for detecting stroke-related language disabilities. The psychometric properties of the Indian version of FAST met the standardised requirements for adaptation and validation. **Conclusions:** The Indian version of FAST was found to be a reliable and valid bedside screening tool for aphasia in stroke patients. We aim that this study will facilitate the use of the test across other Indian languages and a large clinical population in the future.

Keywords: Adaptation and validation, aphasia testing, language, screening, stroke

Guest editor's notes: The Frenchay Aphasia Screening Test is popular and well established all over the world. Adaptations are not easy. It is not mere translation. Rigorous attention must be paid to cultural and linguistic parameters. This work was part of an ICMR project. It is expected that busy clinicians will carry the FAST in their smartphones and use it at bedside and in OPD.

Introduction

The global rise in stroke and stroke-related disabilities has led to an increase in numbers of persons with aphasia.[1] Post-stroke aphasia persists as a major disability in 20%-40% of stroke survivors across the globe[2] and ranges from 11% to 40% in the Indian context.[3,4] Early and accurate diagnosis of aphasia and intervention through appropriate, intensive therapy is critical for recovery,[5] and consequently facilitates the process of rehabilitation.[6]

Standard diagnostic aphasia tests like the Boston Diagnostic Aphasia Evaluation[7] and the Western Aphasia Battery,[8] require provision of specialized speech and language services, are time consuming and may be a challenge for wider use in low-resource countries like India. Screening tests are, therefore, required to detect aphasia in the acute stroke setting and busy clinical practice. In such situations, there is a need for easy to use, bedside aphasia screening tools that have greater efficacy in early diagnosis of aphasia. Commonly used screening tests for aphasia include Frenchay Aphasia Screening Test (FAST),[9] Mississippi Aphasia Screening Test (MAST)[10]

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and Acute Aphasia Screening Protocol.[11] These tests have however typically been developed for English speaking educated populations. There are fewer screening tests available in non-English languages such as Language Screening Test in French (LAST)[12] and Mississippi Aphasia Screening Test in Spanish (MASTsp),[13] established predominantly for the developed countries. Very few screening tools are available from low- and middle-income countries (LMICs) (e.g., Chinese version of Language Screening Test).[14] Therefore, given the increased burden of aphasia in LMICs and the paucity of appropriate screening tools, there is a critical need to develop simple, easy-to-use measures that are culturally and linguistically relevant, to screen for aphasia.

India is socio-demographically diverse, with a significant portion of the population that is illiterate. Development of a culturally, linguistically, and educationally appropriate tool to evaluate stroke aphasia is, therefore, a challenge.

In meeting this challenge, we adapted and validated the FAST[9] for the Indian context. FAST is one of the best-known screening instruments that comprehensively evaluates language skills, has high sensitivity and specificity in diagnosing aphasia in stroke patients and is easy to use, especially, in low-resource settings like India. This was a part of a larger project, supported by the Indian Council of Medical Research (ICMR), which involved the standardization of a wide range of cognitive, behavioural and functional tests as a part of the ICMR Neuro Cognitive Tool Box (ICMR-NCTB), across several languages and educational levels.[15] The adaptation of FAST was done in five Indian languages (Hindi, Bengali, Telugu, Kannada, and Malayalam). In this paper, we report the adaptation of FAST in two widely spoken Indian languages, Telugu and Kannada, for both literate and illiterate patients. We also report the validity of the adapted FAST.

Methods

Participants

A total of 116 healthy controls (47 Telugu and 69 Kannada speakers) and 115 patients with post-stroke aphasia (58 Telugu and 57 Kannada speakers) were recruited for the study using consecutive sampling. Healthy controls were recruited randomly from the local community and from attendants of patients visiting hospitals. The inclusion criteria for healthy controls included: No history of cognitive or behavioural complaints, no history of psychiatric and neurological illness, head injury, drug abuse and severe alcoholism. Post-stroke aphasia patients were prospectively recruited from the out-patient departments of Nizam's Institute of Medical Sciences, Hyderabad for Telugu and, NIMHANS, Bengaluru and Apollo Hospitals, Mysuru for Kannada. All patients were subjected to a systematic demographic, medical, neurological, and radiological evaluation for stroke characteristics, including the time after stroke and history of prior stroke by an experienced neurologist. Inclusion criteria included patients with ischemic or haemorrhagic stroke, older than 18 years, evaluated at least 1 month after stroke. Standard protocols for evaluation were conducted by neurologists certified in stroke diagnosis and care. Exclusion criteria for patients included: History of dementia, other major neurological or psychiatric disorders, sensory and motor disability in no more than one upper extremity, and hearing impairment.

A broad range of participants were included with varying levels of education, a number of languages spoken, social and economic backgrounds and ages to be more representative of the population, and to explore the impact of these variables on test performance. All participants were tested in their native language, which was the predominant language of use. Language history was obtained by interviewing a reliable family member. The native language of each participant, the number of languages spoken, language choice and the proficiency levels in these different languages were also noted using language use questionnaires.[16]

Patients were grouped into either literates or illiterates. The operational definition used in this study was based on Census operations of India report,[17] which defines illiterates as those who have had no formal education and were unable to read and write in any language.

Test description

The original FAST was developed for use by non-specialist staff working in a busy ward not requiring training in speech and language therapy, to detect the presence of language impairments in patients with acute and post-acute stroke evaluating major aspects of language.[9] The aim was to have a short, simple, standardized measure to diagnose and screen for aphasia and accompanying language deficits.

The test consists of four parts (1) *comprehension*: Instructions are given to point to various objects on cards portraying a scene and geometric shapes; (2) *expression*: Participants are asked to describe the picture and are also tested on verbal fluency; (3) *reading*: Participants are provided with five written instructions with graded difficulty; and (4) *writing*: Participants are asked for a written description of the picture and the scoring depends on spelling and grammatical construction. The test takes about 5-10 minutes to administer. The maximum score is 30 and the cut-off values for detecting aphasia in stroke patients up to 60 years and >61 years are 27 and 25, respectively.

Adaptation

There was a series of steps that were followed:

- Acquiring permissions from the test publisher (STASS publications) and the test developer (Dr. Pamela Enderby).
- Constituting a multidisciplinary panel of experts comprising stroke specialists, cognitive neurologists, speech-language pathologists, neuropsychologists and linguists who made the following suggestions: (1) the modified sketch should be culturally appropriate while remaining faithful to the original concept, (2) ensure the familiarity and nameability of the geometric figures in the Indian languages, and (3) ensure that the test is applicable for literate and illiterate populations.

Culturally appropriate modifications were made by the expert panel following cross-cultural adaptation guidelines by Guillemin, Bombardier and Beaton (1993).[18] The English

version was initially developed and piloted on a sample of 10 controls (5 literates and 5 illiterates). Two raters administered and scored the test on pilots independently. Inter-rater reliability was determined by Cohen's kappa. It was found that there was 91% agreement between the two raters and inter-rater reliability coefficient was 0.84. Based on the pilot group performance, ambiguities in the adapted items were resolved. Every item in the four sub-sections of the test was critically evaluated for cultural relevance and appropriateness while ensuring we tapped into the same domains as in the original test. The section given below lists out the specific changes that were made in the Indian version of FAST:

Picture Stimuli (the river scene): We retained the essence of the river scene from the original FAST while modifying some of the elements of the scene to make the setting more culturally appropriate and representative, including modifying the images of people, animals and types of boats that were used in the original sketch. Care was taken to retain all the elements of the original picture and the original placements of as many elements as possible. However, some of the placement of items had to be changed to ensure that picture balance and perspective were maintained [Figure 1]. The following changes were made to the specific elements in the picture:

a. The "dog" was replaced with "goat", as the man with a goat was deemed more representative of a pastoral, rural scene from India, than a man walking a dog.
b. In the original version, the "canoe" was tied to the shore near the bridge, which was replaced with a "ship" sailing behind the bridge, as "canoe" was not a familiar concept and not easily recognizable across India.
c. All three men were redrawn to look more "Indian" in facial features, skin tone and clothing.

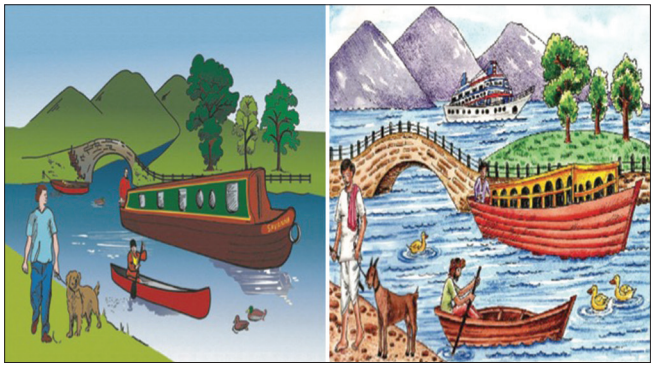

Figure 1: Picture stimuli (river scene) of original FAST (left) and the Indian version of FAST (right)

Comprehension: In this section, some of the shapes were modified to be more culturally appropriate and familiar, that is, "oblong" was replaced with "arrow", "pyramid" with "hill" and "segment of orange" with "half-moon".

The expression, reading, and writing sub-sections of the original test were retained in the Indian version of FAST.

The illiterate version of this test was developed by omitting or modifying the literacy dependent reading and writing sections of the test. The black and white line drawings were replaced with coloured pictures as line diagrams are difficult to name for illiterates. Following this, a literal word-to-word translation and back-translation of the adapted English version of FAST were done in two Indian languages: Telugu and Kannada.

Language evaluation

Patients and controls were administered the Indian version of FAST and Western Aphasia Battery[19,20] adapted for Telugu and Kannada. WAB was used as a gold standard test to diagnose aphasia. It is widely used to evaluate language functions to determine the presence, type, and severity of aphasia.[21] The examiners were either speech-language pathologists or psychologists. The study was approved by the Research Ethics Committee of Nizam's Institute of Medical Sciences, Hyderabad, and National Institute of Mental Health and Neurosciences, Bengaluru. Informed consent was obtained from all the participants and their family caregivers.

Statistical analysis

The demographic profile of the study cohort was analysed using independent t-test or Mann Whitney U test for continuous data and Chi-square or Fisher's exact test for categorical data. Internal validity was assessed using the intra-class correlation coefficient (ICC) or Cohen's kappa statistics. External validity and area under curve (AUC) was determined using Receiver Operating Characteristic (ROC) curve analysis. Optimum sensitivity and specificity of the Indian version of FAST in diagnosing stroke aphasia patients were established along with the corresponding cut-off values.

Results

Overall the study consisted of a total sample of 231 participants: 116 controls and 115 patients with aphasia. In 42.2% (49) of

Table 1: Demographic profile of Telugu- and Kannada-speaking healthy controls and patients with aphasia

	Telugu			Kannada		
	Controls (n=47)	Aphasia (n=58)	p	Controls (n=69)	Aphasia (n=57)	p
Age (years)	52.4 (15.0) [25-87]	56.7 (16.4) [22-93]	0.169	60.8 (9.5) [43-88]	56.7 (16.9) [25-90]	0.085
Education	8.8 (9.01) [0-22]	6.5 (5.8) [0-18]	0.126	6.2 (7.2) [0-16]	7.1 (6.2) [0-17]	0.445
Male	23 (48.9%)	44 (75.9%)	0.008	41 (59.4%)	43 (75.4%)	0.088
Literates	21 (44.7%)	34 (58.6%)	0.155	28 (40.6%)	33 (57.9%)	0.079
Bilinguals	32 (68.1%)	28 (48.3%)	0.066	52 (75.4%)	38 (66.7%)	0.373

Note: Data represented as Mean (SD) [Range] or Number (percentage) wherever applicable

Table 2: The FAST scores and WAB AQ of Telugu- and Kannada-speaking healthy controls and patients with aphasia

Literates	*n*	FAST (Total=30)	*p*	WAB AQ (Total=100)	*p*
Telugu Literates			< 0.001		< 0.001
Controls	21	27.8 (1.5)		96.3 (2.4)	
Aphasia	34	8.7 (7.3)		33.6 (25.4)	
Kannada Literates			< 0.001		< 0.001
Controls	28	28.7 (1.5)		98.7 (1.2)	
Aphasia	33	9.8 (6.2)		40.2 (24.8)	
Illiterates	***n***	**FAST (Total=20)**	***p***	**WAB AQ (Total=100)**	***p***
Telugu Illiterates			< 0.001		< 0.001
Controls	26	16.5 (1.1)		93.9 (1.6)	
Aphasia	24	5.7 (3.4)		38.7 (21.4)	
Kannada Illiterates Controls	40	17.3 (1.8)	< 0.001	94.9 (2.1)	< 0.001
Aphasia	24	7.4 (2.3)		47.3 (17.8)	

Note: Data represented as Mean (SD) wherever applicable. FAST: Frenchay Aphasia Screening Test; WAB AQ: Western Aphasia Battery Aphasia Quotient; AUC: Area under curve

Table 3: Sensitivity and specificity of the Indian version of FAST in Telugu and Kannada literate and illiterate speakers in detecting aphasia at optimum cut-off values

Language	AUC	Cut-off Values	Sensitivity	Specificity
Telugu Literates	1	25.5	1	0.91
Telugu Illiterates	1	13.5	1	1
Kannada Literates	1	25	1	0.96
Kannada Illiterates	1	15.5	1	0.98

Note: FAST: Frenchay Aphasia Screening Test; AUC: Area under curve

Table 4: Common Indian version of FAST cut-off values with sensitivity and specificity levels in detecting aphasia for literates and illiterates

Language	AUC	Cut-off Values	Sensitivity	Specificity
Literates	1	25.5	1	0.94
Illiterates	1	14	1	1

Note: FAST: Frenchay Aphasia Screening Test; AUC: Area under curve

Table 5: Number of patients correctly identified as having aphasia on the Indian version of FAST

115 TP	3 FP
116 TN	0 FN

Note: FAST: Frenchay Aphasia Screening Test; TP: True Positive; FP: False Positive; TN: True Negative; FN: False Negative

controls and 58.3% (67) of patients were literates. Telugu and Kannada speaking controls and patients were matched across the different socio-demographic variables [Table 1]. Both Telugu- and Kannada-speaking literate and illiterate healthy controls performed significantly better than patients with aphasia on the FAST and WAB. Patients with varying severity of aphasia (from mild to very severe) were included in the study, as measured using the aphasia quotient of the WAB.

The language scores of Telugu- and Kannada-speaking literate and illiterate healthy controls and patients with aphasia are presented in Table 2. The ICC for the control group is 0.730 and 0.729 for the patient group.

The optimum cut-off values for detecting aphasia in literates was 25.5 in Telugu (sensitivity = 1 and specificity = 0.91) and 25 in Kannada (sensitivity = 1, specificity = 0.96) and for illiterates was 13.5 in Telugu (sensitivity and specificity = 1) and 15.5 in Kannada (sensitivity = 1, specificity = 0.98). The area under curve was 1 ($p < 0.001$) for both Telugu and Kannada literate and illiterate groups. The AUC, cut-off values, sensitivity and specificity of Indian version of FAST in Telugu and Kannada literates and illiterates are presented in Table 3.

When we combined the participants across two languages the AUC for both literates and illiterates was 1 ($p < 0.001$) and the cut-off values for detecting aphasia in literate and illiterates was 25.5 (sensitivity = 1 and specificity = 0.94) and 14 (sensitivity and specificity = 1) respectively [Table 4]. The Pearson's correlation coefficient between Indian version of FAST scores and WAB Aphasia Quotient in Telugu literates and illiterates was 0.893 ($p < 0.001$) and 0.972 ($p < 0.001$) respectively, and 0.982 ($p < 0.001$) and 0.900 ($p < 0.001$) respectively in Kannada literates and illiterates. Table 5 shows the ability of the Indian version of FAST to identify patients diagnosed clinically as having aphasia using cut-off values of WAB.

Discussion

Screening and diagnosis of language impairment in the Indian context, given the cultural, linguistic and educational diversity necessitates the availability of tools that are adapted to these populations. In this study, we report results of the adaptation and validation of FAST, as an easy to use screening measure for detecting stroke-related language disabilities, in two Indian languages, Telugu and Kannada, for both literates and illiterates. The psychometric properties of the two Indian versions of FAST met the standardised requirements for adaptation. Our results

confirm the high validity of FAST as a screening tool in the literate and illiterate population in both Telugu and Kannada.

Culturally and linguistically appropriate adaptation of FAST for the Indian context was achieved while retaining the elements of the original test considering the socio-linguistic heterogeneous communities in India. The adaptation process was achieved based on standard recommendations[18] and inputs from a multidisciplinary panel of experts, translations, back-translations, and piloting of the test.

Both Telugu and Kannada versions of the adapted FAST showed high internal consistency. The sensitivity and specificity of the Indian version of FAST were calculated to establish its accuracy to detect aphasia. The optimum cut-off values for detecting aphasia in Telugu literates is 25.5 (sensitivity = 1 and specificity = 0.91) and Kannada literates is 25 (sensitivity = 1 and specificity = 0.96). The cut-off scores of the Indian version of FAST are comparable to the originally published FAST[9] that detected language deficits at an optimum cut-off point of 27 for individuals up to 60 years and 25 for individuals >61 years with high sensitivity (0.87) and specificity (0.80). Zero false-negative subjects indicate high specificity of the Indian version of FAST. The high sensitivity and specificity of the Indian version of the tool are also consistent with other aphasia screening tests such as MAST (sp)[13] (0.96 and 0.90) and French LAST[12] (0.98 and 1). The cut-off values for detecting aphasia in the illiterate group are 13.5 for Telugu (sensitivity and specificity = 1) and 15.5 (sensitivity = 1, specificity = 0.98) for Kannada. Overall, the tool showed high sensitivity and specificity at the optimum cut-off points for literates (25.5) and illiterates (14). Higher AUCs in both literate (1) and illiterate (1) versions of the tool further suggest the accuracy in diagnosis of the patients with aphasia.

In addition, we report a high correlation coefficient between the Indian version of FAST total scores and the Aphasia Quotient of a validated and more extensively used diagnostic tool, the Western Aphasia Battery. These findings indicate that the components of the Indian version of FAST seem to be sufficient to screen for language disorders and severity levels. It is, however, important to note that identification of specific language skills impaired requires more extensive language tests batteries that must be administered by trained speech and language specialists, for appropriate rehabilitation.

The strengths of the study are the relatively large numbers of aphasia patients included, the use of a standardised test of aphasia such as the WAB as a reference diagnostic test, and the adaptation of FAST in languages spoken in a developing country with educationally and linguistically diverse populations.

There were some limitations to the study. Firstly, we are reporting the validation results of only two languages. Secondly, the cut-off scores of Indian adapted FAST have not been applied to a new sample of individuals with post-stroke aphasia, to further validate our results. We aim that this study will facilitate the validation of the test across other Indian languages and in new aphasia cohorts in the future.

In conclusion, the Indian version of FAST - Telugu and Kannada is a reliable and valid screening test for aphasia in both literate and illiterate populations. Given the rising burden of stroke aphasia, the Indian version of FAST is useful in identifying aphasia in acute and sub-acute stroke settings and can be used in busy ward settings by non-specialist staff and is especially valuable in low-resource settings like India, where there is a dearth of specialized speech and language services.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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