THE COMPARISON OF LANGUAGE ABILITIES OF THAI APHASIC PATIENTS AND THAI NORMAL SUBJECTS BY USING THAI ADAPTATION OF WESTERN APHASIA BATTERY

WORAWAN TEERAPONG

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Thai Adaptation of Western Aphasia Battery (WAB) was adapted from the Western Aphasia Battery which takes a short time to assess the language abilities of aphasic patients and can classify aphasic patients into eight aphasic syndromes. However, the WAB has not yet been used with Thai aphasic patients. The purposes of this study were to study the language abilities of Thai normal subjects and Thai aphasic subjects, and to compare the language abilities of aphasic patients and normal subjects by using the WAB. The reliability of the WAB was determined by the test-retest procedure with thirty Thai normal subjects and computed to be 0.990 and was significant at the 0.01 level. This result confirmed that the WAB had high test-retest reliability. Content validity of the WAB was evaluated by five experience speech pathologists. Their conclusions were that all subtests of the WAB could assess language abilities of aphasic patients. The subjects in this study were 30 Thai aphasic patients and 30 Thai normal subjects who were matched relative to age, gender and educational level. There were 20 male and 10 female in each group of aphasic and normal subjects, ranging in age from 24 to 76 years. Their educational levels ranged from prathom 4 to master's degree. Both normal and aphasic patients were administered the WAB. The responses were scored following the recommended WAB scoring system and analyzed by using descriptive statistics and a two-independent sample t-test.

The results of this study revealed that Thai normal subjects had very high scores on all subtests of the WAB. The Aphasia Quotient (AQ) mean score was 98.8 and ranged from 94.7 to 100. Thai aphasic patients received an AQ mean score of 48.57 which ranged from 9.3 to 87.0. The results indicated that the normal subjects demonstrated significantly higher mean scores on all subtests and AQ mean score than did the aphasic patients ($p < 0.01$). The results indicated that the AQ score of 94.7, which was the lowest AQ score of normal subjects, could be considered as a cut point score to differentiate normal persons from aphasic patients. The results also showed that the Thai Adaptation of the WAB could classify aphasic patients into eight aphasic syndromes that agreed with their clinical and neuro-radiological diagnoses. The study results agreed with many studies, such as, Kertesz and Poole (1974) and Kertesz (1979). Therefore, the Thai Adaptation of the WAB appears to be sensitive enough to differentiate normal people from aphasic patients and to classify aphasic patients into eight aphasic syndromes.

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แบบทดสอบ Thai Adaptation of Western Aphasia Battery (WAB) ประยุกต์มาจาก Western Aphasia Battery เป็นแบบทดสอบที่ประเมินความสามารถทางภาษาและแบ่งประเภทของผู้ป่วยอะเฟเซียโดยใช้ในการประเมินไม่นานนัก แต่แบบทดสอบ WAB ยังไม่มีการนำมาใช้ศึกษาวิจัย ดังนั้นการศึกษาครั้งนี้มีวัตถุประสงค์เพื่อศึกษาความสามารถทางภาษาของคนไทยปกติและผู้ป่วยไทยอะเฟเซียแต่ละประเภท และเปรียบเทียบความสามารถทางภาษาของผู้ป่วยไทยอะเฟเซียกับคนไทยปกติโดยใช้แบบทดสอบ WAB ค่าความเชื่อมั่นของแบบทดสอบประเมินโดย test-retest ในคนไทยปกติจำนวน 30 คน พบว่าแบบทดสอบ WAB มีค่าความเชื่อมั่น 0.990 ($p<0.01$) และค่าความเที่ยงตรงตามเนื้อหาซึ่งประเมินโดยนักแก้ไขการพูดผู้เชี่ยวชาญจำนวน 5 คน ทั้ง 5 คนสรุปว่าทุกแบบทดสอบย่อยของ WAB สามารถประเมินความสามารถทางภาษาของผู้ป่วยอะเฟเซียได้ กลุ่มตัวอย่างที่ใช้ในการวิจัยคือ ผู้ป่วยไทยอะเฟเซียจำนวน 30 คน และ คนไทยปกติจำนวน 30 คน ใช้วิธีจับคู่เหมือนทาง อายุ เพศ และ ระดับการศึกษา ประกอบด้วย เพศชาย 20 คน เพศหญิง 10 คน อายุระหว่าง 24 ถึง 76 ปี ระดับการศึกษาตั้งแต่ชั้นประถมศึกษาปีที่ 4 ถึง ระดับปริญญาโท กลุ่มตัวอย่างทั้ง 2 กลุ่มทำแบบทดสอบ WAB และคิดคะแนนตามระบบการคิดคะแนนของ WAB สถิติที่ใช้ในการศึกษาคือ ค่าเฉลี่ย ส่วนเบี่ยงเบนมาตราฐาน ช่วงกว้างของคะแนน และค่า t-test

ผลการศึกษาพบว่าคนไทยปกติได้คะแนน Aphasia Quotient (AQ) เฉลี่ย 98.8 โดยมีช่วงคะแนนตั้งแต่ 94.7 ถึง 100 ซึ่งสูงกว่าผู้ป่วยไทยอะเฟเซียที่ได้คะแนน AQ เฉลี่ย 48.57 โดยมีช่วงคะแนนตั้งแต่ 9.3 ถึง 87.0 และพบว่าคนไทยปกติได้คะแนนเฉลี่ยของแบบทดสอบย่อยทั้งหมดสูงกว่าผู้ป่วยอะเฟเซียอย่างมีนัยสำคัญทางสถิติที่ระดับความเชื่อมั่น 0.01 ($p<0.01$) คะแนน AQ 94.7 ซึ่งเป็นคะแนนต่ำที่สุดของกลุ่มคนไทยปกติอาจพิจารณาให้เป็นคะแนนที่สามารถแยกคนไทยปกติออกจากผู้ป่วยไทยอะเฟเซีย นอกจากนี้ยังพบว่าแบบทดสอบ WAB สามารถแบ่งประเภทของผู้ป่วยอะเฟเซียออกเป็น 8 ประเภท ซึ่งสอดคล้องกับผลการวินิจฉัยทางคลินิกของแพทย์ ผลการศึกษาดังกล่าวสอดคล้องกับผลการศึกษาอื่น ๆ เช่น Kertesz และ Poole ในปี 1974 และ Kertesz ในปี 1979 ดังนั้น แบบทดสอบ WAB น่าจะเป็นแบบทดสอบที่สามารถนำมาใช้ในการวินิจฉัยแยกผู้ป่วยอะเฟเซียจากคนปกติและแยกประเภทของผู้ป่วยอะเฟเซียได้อย่างน่าเชื่อถือ

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CHAPTER I

INTRODUCTION

Statement of the problems

Aphasia is a disturbance of the complex process of comprehension and formulating verbal messages that results from cerebral damage. It is characterized by a reduction or dysfunction of one or all modalities of communication abilities such as auditory comprehension, spontaneous speech, naming, reading, and writing (1,2,3,4,5,6,7,8,9,10,23,27). These communication disabilities directly affect aphasic patients, for example, in their occupation, social status, and family (11,12,13,14,22). Therefore, they live with various degrees of residual illness and handicap. As a result of aphasia, a speech pathologist may play a central role in the rehabilitation plan of the aphasic patients. The speech pathologist assesses all language modalities of the aphasic patients to evaluate the nature of their disabilities, degrees of severity, and areas of involvement in order that the aphasic patient will be given an appropriate rehabilitation program.

Since 1962, aphasiologists have developed many tests to evaluate the aphasic patient's speech and language abilities. Although, the early test batteries were adapted from psychological and educational tests, they were judge to be simple and crude (12). The first psycholinguistic methods for assessing an aphasic patient's performance was developed by Wepman and Jones in 1961. Later on, many standardized tests were developed. They are the Token test (DeRenzi and Vignolo 1962), the Minnesota Test of Differential Diagnosis of Aphasia or MTDDA (Schuel,1963), the Functional Communication Profile or FCP (Taylor, 1964), the Porch Index of Communicative

Abilities or PICA (Porch, 1970), the Boston Diagnostic Aphasia Examination or BDAE (Goodglass and Kaplan, 1971), the Aphasia Language Performance Scales or ALPS (Keenan and Brasell, 1974), the Neurosensory Center Comprehensive Examination for Aphasia or NCCEA (Spreen and Benton, 1972), and the Western Aphasia Battery or WAB (Kertesz, 1979) (1,4,5,12,15,23). All of these tests are different in some aspects; for example, the purpose of test, the selected language areas, and the analysis of results. The Token test is an example. This test measures only auditory language capacity and requires a short period of time administer (12,16). The PICA provides a sensitive and reliable measurement of degree of deficit and amount of recovery. However, clinicians have to be trained for some time to adjust themselves to the unique features of this test (11,12,16). Both the NCCEA and the MTDDA assess the patients' strengths and weaknesses in all language modalities but do not differentiate aphasic patients from other chronic brain syndrome patients (4,11,12). The MTDDA is the most comprehensive test for aphasia but it takes 2-6 hours to assess an aphasic patient (11,12). The BDAE is primarily a test to identify aphasia types concerning the location of brain damage and detects the severity of language disturbances. It provides many samples of language behavior and has effective, systematic scoring, and takes one to four hours to administer (1,11,12,17,18). The WAB is a modification of BDAE and is similar in purpose. The basic WAB can be administered in an hour to most aphasic patients (56). Furthermore, the standard scoring system serves as a classification system for aphasic patients into eight aphasic syndromes. Therefore, the WAB is rapidly becoming the instrument of choice among aphasiologists around the world (11,19,20,21,22,23,24).

The Western Aphasia Battery was constructured by Kertesz Andrew in 1972. It represents a substantial modification of the BDAE. Kertesz and Poole (1974) performed the first standardization on a population of 150 aphasic patients and, a control group of 59. The criteria for classification of aphasia were derived from scoring, and the criteria for differentiating aphasics from the control group were validated. High construct validity, test-retest reliability, and intrajudge and interjudge reliability were available on a large representative sample of aphasics that were tested by Kertesz and Shewan in 1980. The WAB includes an assessment of many clinical aspects of language. It consists of eight subtests: spontaneous speech, auditory verbal comprehension, repetition, naming, reading, writing, praxis, and construction. The first four subtests using the oral portion of language assessment are scored as the Aphasia Quotient (AQ). The AQ is a functional measure of the severity of a spoken language deficit in aphasia and also serves as a classification system for types of aphasia. The remaining four subtests, reading, writing, praxis, and construction, are scored as the Performance Quotient (PQ) which assesse a higher cortical function. The AQ and PQ are summed to form the Cortical Quotient (CQ) (9,11,12,19).

The Western Aphasia Battery is a standardized test. It requires only one hour to administer but can classify patients into eight aphasic syndromes and measure all degrees of severity exhibited by aphasic patients. In 1994, Gandour J., Dardarananda R., Potisuk S., and Holasuit S. developed a Thai Adaptation of the Western Aphasia Battery (WAB) maintaining the original purposes of the test. All subtests are included except subtest 8, construction, because it deals with other aspects of higher cortical functioning instead of language functioning (24). However, the Thai Adaptation of the Western Aphasia Battery (WAB) has not yet been used with Thai aphasic patients. The purpose of this study is to compare the language abilities of Thai aphasic patients and

normal subjects by using the Thai Adaptation of the Western Aphasia Battery (WAB).

Research Purposes

The purposes of this research are the following;

1. To study the language abilities of normal subjects.
2. To study the language abilities of each aphasic syndrome.
3. To compare language abilities of aphasic patients and normal subjects.

Research questions

The research questions are the following;

1. What are the language abilities of normal subjects ?
2. What are the language abilities of each aphasic syndrome ?
3. Are there any differences in the language abilities of aphasic patients and normal subjects ?

The Advantages of this Research

The advantages of this research are the following;

1. To use the Thai Adaptation of the Western Aphasia Battery test (WAB) as a clinical tool to differentiate aphasic patients from normal subjects.
2. To identify strengths and weaknesses of the Thai Adaptation of the Western Aphasia Battery test (WAB).
3. To plan appropriate therapeutic interventions, progressive evaluations, predict treatment prognosis, and provide guidance for patients' families.

4. To encourage further research on the Thai Adaptation of the Western Aphasia Battery (WAB) in aphasic patients.

Delimitations:

1. This study used 6 language subtests of the Thai Adaptation of the WAB; spontaneous speech, auditory comprehension, repetition, naming, reading, and writing subtests, and Aphasia Quotients (AQ). The praxis and construction subtests, and Cortical Quotient (CQ) were excluded because these two subtests measure higher cortical function.
2. The normal Thai subjects sampled for this research study resided in the greater Bangkok Metropolitan area.
3. The aphasic Thai subjects were selected from current Ramathibodi Hospital, Mahidol University, Bangkok.

Limitations:

1. The sample sizes of Thai normal subjects and Thai aphasics were 30 each, which correspond to minimum levels for statistical sampling.
2. The reliability and validity computed for the Thai Adaptation of the WAB used in this study have not been determined to a sufficient degree. Thus, the degree of this test's reliability and validity cannot be stated without reservation.
3. The effects of other mediating variables, e.g. educational levels, have not been formally addressed and analyzed in this study.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter focused on the topics concerning the anatomy of language, language deficits in aphasia, and the Thai Adaptation of the Western Aphasia Battery (WAB).

1. Anatomy of language

Language processing is a transformation of language received into meaningful content and a conversion of meaningful internal content into language output. It contains three processes: input transmission, integration, and output transmission. The first process refers to the input transmission of sensory complexes which are auditory, visual and tactile mechanisms. Each sensory complex encodes incoming stimulation into patterns of neural impulses in primary sensory areas. The second process is the integration of the pattern into meaningful symbolic formulation in a cortical complex which results in the understanding of spoken or written language. The third is the output transmission by means of the end organs of hand, mouth, and body that produce the language output, such as, speaking, writing, naming, and repetition which are needed for communication abilities (1,25,26,27,29,30). Language processing is controlled by the left hemisphere which is the dominant hemisphere for speech and language. All language output needs the integration of more than one cortical area (26,28). In addition, some language areas have highly complex activities which respond to more than one language function. For instance, Wernicke's area not only has a major role in comprehension of spoken language, but also has a role in naming,

reading, and writing. Also, the angular gyrus has a role in naming, reading, and writing. The anatomy of language was reviewed and focused on the study of language abilities in aphasic patients and normal subjects.

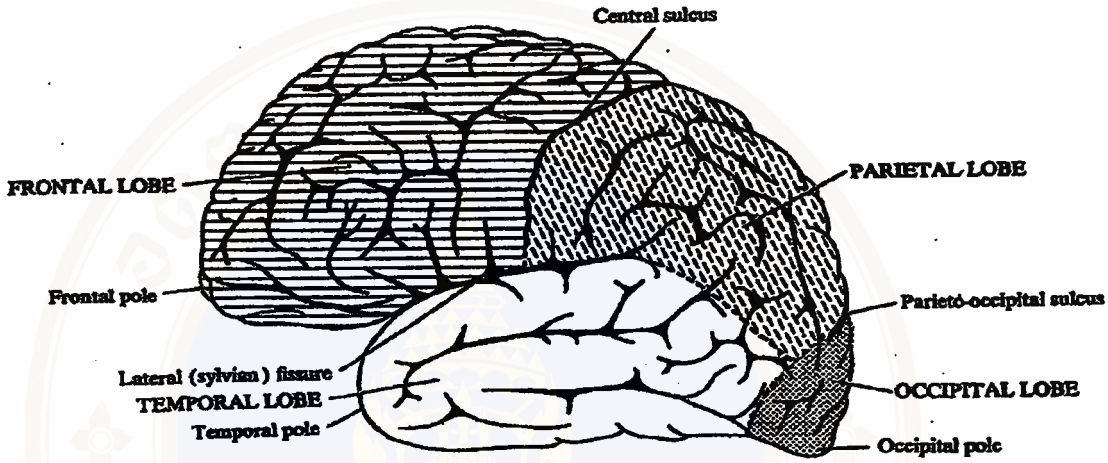

Figure 1. Lateral view of the left cortical areas showing the sylvian fissure which separates the frontal from the temporal lobes, the central sulcus which separates the frontal from the parietal lobes, and the parieto-occipital sulcus which separates the parietal lobe from the occipital lobes (33).

1.1 Anatomy of motor articulation

The anatomy of motor articulation is associated with Broca's area, primary motor area, premotor area, and supplementary motor area. Broca's area (Brodmann's area 44), located in the inferior frontal gyrus, has a role in motor programming of speech articulation movements. It evokes a detailed program for articulation to the primary motor area where the muscles of larynx, tongue, vocal cords, soft palate, and the respiratory muscles are appropriately stimulated (1). The primary motor area (Brodmann's area 4) controls the coordination and precise movements of the muscles

of articulators. It is connected by numerous afferent fibers from Broca's area, premotor area sensory cortex, thalamus, cerebellum, and basal ganglia (28,60,69).

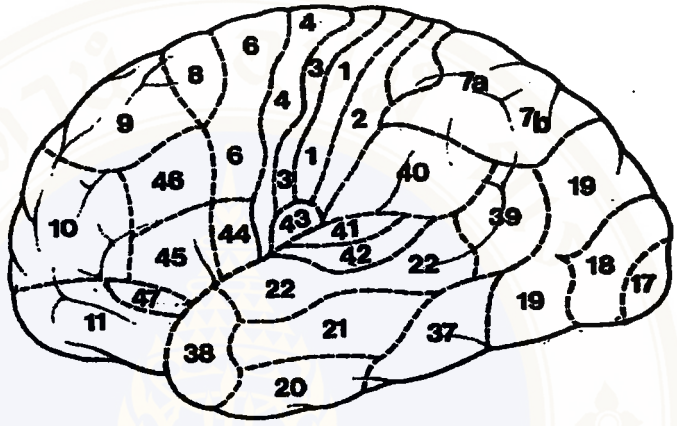

Figure 2. The lateral view of the left cortical areas showing the Brodmann's areas. The Brodmann's area 44 is also called Broca's area, Brodmann's area 22 also called Wernicke's area, and Brodmann's areas 39 and 40 are also called angular and supramarginal gyrus, respectively (34).

Adjacent to the primary motor area, the premotor area (Brodmann's area 6) plays a role in motor learning. It stores programs of motor activities assembled as the result of past experience. In addition, it is actively involved in planning motor programming and controlling sequence speech, rhythm, phonation, and articulation (31,32,48). The supplementary motor area (Brodmann's area8) is also involved in the preparation of internally remembered motor sequences and retrieval of self- initiated speech (68).

There are some subcortical units that involve motor speech processing. They are regional networks within larger neural networks that are connected together in loops. For example, basal ganglia located at the top of the brainstem are the largest of the subcortical motor centers in the extrapyramidal system. They receive information

primarily from motor and premotor areas connected back to the motor cortex by way of the thalamus. The role of the basal ganglia in motor control is their contributing to the activation, retrieval, or initiation of movement plans. The basal ganglia are thought to be important in generating motor programs. Thalamus also plays a role in motor speech processing. It provides for the integration of respiratory and oral motor activities in controlling voice loudness, accuracy of oral facial movement production, and speaking rate. Moreover, the thalamus is a relay station between the cortex and the limbic system, basal ganglia, and cerebellum. It thus plays a major role in arousal, attention, and short-term memory that is necessary for speech production. Therefore, the thalamus is the key structure in the integration of the propositional and emotional components of speech (33,34,35,59,78).

1.2 Anatomy of auditory comprehension

Both linguistic and nonlinguistic auditory signals depend on bilateral organization from the cochlea of the inner ear to brain stem nuclei, medial geniculate bodies of thalamus, and to Heschl's gyri. Heschl's gyri, a primary auditory cortex, detects and passes the signals to an auditory association area, Wernicke's area, (Brodmann's area 22) (1,36). Wernicke's area is devoted to the reception of spoken language. It is assumed that neural structures in Wernicke's area not only allow for comprehension of oral language, but also underline the formulation of internal linguistic concepts (37,38,39,40,41). The neural structure in Wernicke's aphasia codes auditory data, restructures it into complex auditory patterns, and compares it with previously established patterns. In addition, there are subcortical connections that affect the input to Wernicke's area and affect auditory comprehension. The subcortical areas have both

afferent and efferent pathways; thus they influence auditory comprehension. For example, the insula located medially to the temporal lobe contains fibers sensitive to auditory input. At the base of the posterior limb of the internal capsule, there is an area where large numbers of auditory fibers pass. Those fibers connect to various auditory regions of the cortex and corpus callosum. Therefore, the subcortical regions can markedly influence auditory comprehension processes (42).

1.3 Anatomy of naming

Naming is classified into many types such as confrontation naming, writing naming, category naming, and tactile naming (9,24,56). Confrontation naming requires visual perception and recognition, phonological encoding, and motor speech programming and execution (43). When an object or picture is to be named, visual form recognition is mediated in the occipital lobe and transferred to the region of the left angular gyrus, where the concept is generated. The conceptual information is then transmitted to Wernicke's area. The phonological form is activated in Wernicke's area and transmitted via the arcuate fasciculus to Broca's area, where it is converted to a motor plan and then implemented via the motor cortex (1). Writing naming initially requires a primary area and associated visual areas. The visual information is passed to the angular gyrus for interpreting, and the conceptual information is then transmitted to Wernicke's area for encoding. This information is passed to Exner's center, a posterior part of the second frontal gyrus, for controlling motor output for writing (44). Category naming requires the category to be stored in semantic memory. The anatomy of semantic memory involves the superior temporal gyri for encoding, the thalamus for retrieving and the left anterior cingulate cortex for encoding and retrieving (45).

Tactile naming depends on the perception of primary somaesthetic areas (Brodmann's areas 3,1, and 2) (46). Sensory perceptual information is transferred to the angular gyrus for interpreting the information, and passed to Wernicke's area for decoding with inner auditory experience. The information is then relayed to the angular gyrus and also passed to the frontal lobe for speech output. Both confrontation and writing naming tasks are used clinically more than category and tactile naming tasks because tactile naming is used for assessment in some rare aphasic syndromes such as astereognosis or tactile agnosia. Category naming is used mostly for mild aphasic patients (23).

1.4 Anatomy of repetition

The anatomical structure involved in the control of speech repetition is the arcuate fasciculus. It is a bundle of fibers originating in the upper temporal lobe and following an arching path subcortically around the posterior part of the Sylvian fissure, passing deep to the supramarginal gyrus and then forward to the anterior speech zone. It serves as a transmission pathway between the auditory association cortex (Wernicke's area) and the motor speech center (Broca's area). In word repetition, the heard word is detected by the primary auditory cortex and passed to Wernicke's area for decoding the auditory information with inner auditory experience. This process also requires an immediately accessible memory of phonemes and sequences of words or sentences in the temporal lobe. Then, the auditory information is relayed via the arcuate fasciculus to Broca's area where responses for motor programming of speech output are executed (38,47).

1.5 Anatomy of reading

The anatomy of reading requires a network organization of visual processing in the occipital lobe, the angular gyrus in parietal lobe, and Wernicke's area in the temporal lobe (49). When a written word is read, visual input from each side of the visual field is separated along the entire path: hemiretina, optic nerve, thalamus and optic radiation that is transmitted to the visual cortex of the opposite hemisphere. The graphic code is first registered by the primary visual area (Brodmann's area 17). This graphic code is received and interpreted in terms of sensation and spatial relationship (50). Then it is integrated and related to past visual experiences in the visual association area (Brodmann's area 18), thus enabling the reader to recognize the written language. Subsequently, visual information is transferred to the angular gyrus and passed to Wernicke's area to be decoded with inner auditory experience (38,49,51). The information is then returned to the angular gyrus again for interpreting the meaning. Thus, the angular gyrus takes a role in mediating the association between the graphic code from the visual association area and the auditory association area (1,30). If the written word is to be spoken, the information is transmitted to Broca's area where a detailed program for articulation is evoked (38).

1.6 Anatomy of writing

Writing is the language skill with the most complex network of relationships to other input and output channels (1). This complex function combines linguistic, acoustic, praxic, kinesthetic, visual, and motor components (52). Writing requires language abilities and motor integration to express ideas and to produce written words, sentences and, paragraphs (67). It can be delineated into two groups; a writing

mechanism associated with language, and a writing mechanism associated with the motor output necessary for writing (1,53). Writing mechanisms associated with language involve spelling which consists of two common strategies; a phonic strategy and a lexical strategy. The phonic strategy requires the identification of phonemes which are contained in a word, and then converts phonemes to graphemes using phoneme- grapheme mapping procedures and spelling rules such as syllable stress, or position in a word. The supramarginal gyrus and deep part of the insula appear to be important anatomical substrates for this production (54). Conversely, lexical strategy requires that the speller already be familiar with the word. Upon recognizing a spoken word, the speller apparently retrieves a sequence of corresponding letters from long term memory storage. The junction of the angular gyrus with the parietal-occipital lobule appears to be an important anatomical substrate for the production of lexical spelling (53). A writing mechanism associated with motor output is another mechanism. After the phonic or lexical spelling information is processed in both the supramarginal and angular gyrus, this information is relayed to the frontal lobe and Exner's center which controls motor output for writing (55). Moreover, coordination of eye, arm, hand, fingers muscles are necessary for this mechanism. The simplest skill in writing is copy writing which involves the representation of the letter as a visual form (1). Visual information is perceived in the occipital lobe and then transferred to supramarginal gyrus converting letters to graphemes (53). The grapheme information is finally passed to the frontal lobe, Exner's center, and a posterior part of the second frontal gyrus which controls motor output for writing (55). Spontaneous writing directly involves spelling. The ability to spell appears to be related to visual sequential

memory. To spell a word correctly, the individual must not only have to store the word in memory, but also be able to retrieve it completely. The angular gyrus responds in retrieval of a word and its meaning, and then the supramarginal gyrus converts phonemes to graphemes. This information is then passed to the Exner's center for writing. Visual feedback also attaches to the phonology of individual sounds, syllables, and the whole word (1,53). The process of writing dictation is similar to spontaneous writing except it involves the auditory process. Writing dictation shows a strongly automatized phonetic association between auditory input and spelled output. The linguistic auditory signal is interpreted by Wernicke's area where it compares the signal with previous established patterns. This signal is then transmitted to both angular gyrus and supramarginal gyrus (44).

2. Language Deficits

In order to understand the language abilities of aphasic patients, language deficits should be described. This section describes the disorders of speaking, auditory comprehension, naming, repetition, reading, and writing.

2.1 Disorders of speaking

Aphasic patients have several problems in speech production. Their overall speech patterns result from both language and motor speech implementation deficits (1). Aphasic speech patterns can be divided into fluent and nonfluent speech.

Fluent aphasic speech is essentially normal in rate, phrase length, melodic, and articulation. Having language disorders, fluent aphasic patients always substitute inappropriate words such as paraphasia and jargon. However, they do so smoothly and

effortlessly without interruption of the flow or melody of speech (43). Thus, despite near normal prosody and speech rate, there is often a considerable decrease in the amount of information. Their speech is disorganized or rambling in style (23,43).

Paraphasia is one of the speech characteristics in fluent aphasia (43,56). Paraphasia is the production of an incorrect syllable or word substituted for an intended one (67). It is the result of defective auditory monitoring of the speech output and of word retrieval deficits. These patients lack awareness of errors and do not explain where the inappropriate speech comes from in the first place (24). Moreover, the patients use paraphasia to tell something about the meaning of a word that they cannot retrieve (1). Paraphasia could be classified into three categories; phonemic, verbal, and neologistic paraphasias (1,67). Phonemic paraphasia is the substitution of sound structure which is identical with the intended sound or word. In spite of easy articulation of individual sounds, these patients produce syllables in the wrong order or distort their words with unintended sounds. Phonemic paraphasia also implies that, at a cognitive level of planning verbal production, the phonological rules of speech sound selection and combination are misrepresented. Verbal paraphasia is usage of an nonidentical word to substitute for the targeted one whether the semantic relation between both of them is changed or not. Neologistic paraphasia is the production of a nonsense word. Most instances of neologistic paraphasia occur in the context of severely disorganized speech (1,67). Many of a patient's neologisms contain stereotypic phonemic sequences, sometimes uttered singly, and sometimes in combination with other elements in meaningless strings.

Jargon is also another characteristic of fluent aphasic speech. Jargon are lengthy, fluently articulated utterances which makes little or no sense to the listener. The overall patterns are excessive speech initiated quickly and spoken smoothly. Jargon may include fluently produced phonemic paraphasia. Thus, jargon has been characterized broadly as incomprehensible, incoherent, and meaningless. Jargon is classified into two types. The first, neologistic jargon, is a heavy concentration of neologisms. The second, semantic jargon, is characterized by a higher proportion of semantic and unrelated verbal paraphasias (67).

The fluent aphasia include Wernicke's aphasia, transcortical sensory, conduction, and anomic aphasias. Speech output in Wernicke's aphasia is facile in articulation, tending to be filled with incorrectly chosen words and poorly formed sentences. In severe cases, speech output consists only neologistic jargon. Patients' rate of speech is sometimes excessively rapid and they may be unaware of their many speech output errors. Patients who exhibit this pattern may incorporate words and phrases that are far afield from the presumed topic of conversation. Fluent but paraphasic speech is another hallmark of Wernicke's aphasia. In anomic aphasia, their spontaneous speech is clear, fluent and in full sentences, but reduced in rate and showing obvious word-finding difficulty. Transcortical sensory aphasic speech is normal in rate, rhythm, and length of phrase, but with an emptiness of relevant substantives and runs of irrelevant jargon and neologistic words (24,81).

In contrast to fluent aphasic speech, nonfluent aphasic speech is characterized by decreased speech rate, increased effort, reduced phrase length, agrammatism, articulation disorder, apraxic speech, and dysprosody (1,5,23,24,59). In addition,

nonfluent aphasic individuals have difficulty initiating speech production and their overall quantity of speech also tends to be reduced. Broca's, global, isolation, and transcortical motor aphasias are classified as nonfluent aphasias. Nonfluent speech depends on both language and motor speech implementation deficits.

Nonfluent aphasic speech which results from language deficits causes a reduction in language production. Patients usually speak only using very simple syntactic structure (64). Content words such as nouns and main verbs are produced, but the function words such as articles, verb auxiliaries, and prepositions are omitted. Utterances sound like a telegram, a manner of speaking called telegraphic speech or agrammatism (24,56,64,71,72). According to several investigations, nonfluent aphasics had pervasive syntactic deficits and a greater impairment was found in function words (5,61,64,66,71).

The production patterns of motor speech implementation disorders are reduced, hesitant, effortful, poorly articulated and dysprosodic. Patients always take a long time and use much effort to produce each word (67). Great frustration seems to accompany all volitional speech efforts. Consonant blend may be reduced by omitting and thus contributing to awkward sounds. Words of more than one syllable tend to be slurred and short (55,57).

These patients also have an articulation disorder which can occur both in consonants and vowels (58,60,67). Patients with the most severe articulatory disorders are unable voluntarily to produce simple sounds even by imitation. In somewhat milder form, these patients may be considerably helped by imitation, but may articulate

laboriously distorted versions of the more difficult sounds, particularly consonant blends (24).

Apraxic speech is one of the articulatory disorders. It is an impaired ability to execute voluntarily the appropiate movement for articulation of speech in the absence of paralysis, weakness, or incoordination of the speech musculature. The patient with apraxia of speech gropes for accurate articulatory positions, trying to place the tongue, jaws, lips, and soft palate, and occasionally the vocal folds in the correct position for the production of a given sound or sequence of sounds. The major features of articulatory errors are unpredictable and inconsistent. As the articulatory task becomes longer and more complex, the patient may exhibit more production error (1,57).

Dysprosody is characterized by a slow speech rate, inappropriate stress patterns, pause between syllables, a marked interruption of the inflectional contour, and reduced loudness (42,69,70). Dysprosody also interrupts speech rhythm caused by articulatory and speech formulation blocks. It naturally occurs in free conversational speech than in oral reading. In free speech, these are many more sentence fragments, false starts, and backtracking all of which contribute to the interruption of speech rhythm (1,61,64).

2.2 Disorders of auditory comprehension

Disturbances of auditory comprehension in aphasic patients are common. These disturbances may take various form with varying degrees of severity (24). They range from severe deficits, including difficulty in the understanding of common single words, to mild deficits, reflecting only the impaired processing of more extensive discourse. The topics of auditory word recognition, auditory sentences comprehension, and auditory retention span deficits are discussed next.

Auditory word recognition is an ability to derive acoustic meaning from a spoken word. According to some investigators, Wernicke's aphasia patients had the most auditory word recognition impairment (24,73). Auditory impairment in Wernicke's aphasia is an evident event at the one word level. Transcortical sensory aphasia also has moderate auditory word recognition impairment (24). In some investigations, anomic aphasia patients had significantly poorer comprehension of isolated nouns and verbs with respect to their overall comprehension level (80). In contrast to Broca's, conduction, and transcortical motor aphasia, these patients had fair to excellent auditory word recognition (24).

Sentence comprehension refers to the interpretation of a fleeting, sequenced, and complex auditory stimulus into linguistic elements (10). Sentence comprehension normally involves immediate interpretation of semantic and syntactic elements as the sentence is being processed. Various explanations have been given for the pattern of comprehension impairment described. Some have focused on an inability to extract sentence word order, and others have attributed the problem to a deficit in the interpretation of all relational information such as that carried by prepositions and some verbs (10,76,77).

Generally, aphasic patients have significant impairment in sentence comprehension compared with non-aphasic brain damaged subjects and normal subjects (64,94). Broca's and conduction aphasia patients have difficulty in sentence-picture matching tasks when presented with center-embedded relation clause sentences (92). Some studies suggested that the sentences comprehension deficits of Broca's aphasia were the result of agrammatism (10,75,76). Some researchers found that anomic aphasia

patients possessed the best sentence comprehension and Wernicke' aphasia was the worst among the syndromes (1). However, at the milder levels, Wernicke's aphasia patients misunderstood complex statements (82). Sentence comprehension relative to transcortical sensory aphasia did not differ from Wernicke's aphasia (24).

Auditory retention span is an ability to retain a series of words that are heard (67). An exploration of the patient's auditory retention span generally involves the use of digit memory tasks, word memory tasks, sentence recall tasks, and a series of directions or commands of systematically varying complexity and length (9,23). Many researchers found that most aphasic patients had impaired auditory retention span (1,9,24,74,79). Wernicke's and global aphasia patients had difficulty following a simple auditory retention task (24). Broca's, conduction, and transcortical motor aphasia patients, who did very well on the auditory word recognition tasks, had difficulty with sequentially presented item (9).

2.3 Disorders of repetition

Repetition is the ability to repeat from a spoken model which appears unrelated to normal communicative activity. It is an important diagnostic indicator in the typology of conduction and transcortical aphasia. Repetition in aphasia may be disturbed at three points in the process. First, the patient may fail at the level of articulation in spite of his ability to demonstrate that he knows the meaning of the test words or sentence. Second, the patient may fail at the level of recognition. He may fail to grasp the sounds as words and, consequently, refuse to attempt to repeat them, or he may capture only certain fragments of a spoken model. Finally, he may fail because of a selective dissociation between auditory input and the speech-output system. The latter group of

patients may demonstrate fairly fluent speech and near perfect comprehension, yet have extraordinary difficulty in repeating what they have heard. This difficulty is increased by the length and unfamiliarity with the material to be repeated, and it depends as well on the grammatical composition of the sentences (1,24). The clinical symptomatology of repetition disorder in aphasic patients is reviewed next.

Nonfluent aphasic patients experience an almost break down in attempting to repeat words. In global aphasia, some patients may be total unable to produce speech sounds. Both Broca's and global aphasia may fail at the level of articulation. At the one word level, these patients can repeat words that they have not been able to retrieve spontaneously. Given phrases and sentences to repeat, their limitation in speech planing span, in articulation, in syntax, and in short term memory quickly come into evidence. Although the limitations of agrammatism are particularly noticeable in their abilities to repeat the grammatical functors of sentences, their repetitions are far beyond their spontaneous speech capacity. Sometimes, they repeat long words and use grammatical functors (24,43).

Feature repetition of fluent aphasics is the propensity for paraphasic intrusions of well articulated, but extraneous syllables, words, or phrases. Repetition of single words by these patients is usually much superior to their attempts at multiword utterances. Appending an extra syllable or two to a word is their characteristic error. Repetition in Wernicke's aphasia usually results in paraphasic distortion of the examiner's words, with the appearance of neologisms and irrelevant insertions. These patients often add a word or phrase or use a more complex form than that given. Another frequent

concomitant of this disorder is pressured of speech, often at a rate greater than normal, while the patient is unaware of anything wrong with his speech (24).

Having an interruption in the pathway between the auditory speech center and the motor output center, conduction aphasic patients directly experience a failure of repetition. In repetition of words, conduction aphasics show difficulties in the selecting and sequencing of phonemes for production. Some investigators found that when an identical phonological string was spoken as a single word, it was more difficult to repeat than when it represented two words (10). Unlike Wernicke's aphasic patients, patients with conduction aphasia are usually acutely aware of the inaccuracy of their production and make repeated attempts at self-correction. Repetition of phrases or sentences is usually much more difficult and may produce failures in patients who have little difficulty with single words. In milder cases of conduction aphasia, the repetition of short sentences is feasible, but usually includes errors. A characteristic type of error involves paraphrasing while retaining the meaning of the model sentence. Paraphrasing is much more likely to involve changes in grammatical functors than in significant lexical items. One study reported that conduction aphasics have extraordinary difficulty in repeating sentences that consist largely of grammatical functors, pronouns, prepositions, and low-information verbs (1).

2.4 Disorders of Naming

Anomia is characteristic of a difficulty in reminding or selecting a word which is used to call or to identify common objects, action words, colors, adjectives, and other categories of words (24,67). The major feature of anomic patients is the prominance of word finding difficulty in the context of fluent speech (24). The word-finding difficulty

is expressed through a variety of errors such as circumlocutions, semantic paraphasias, phonemic paraphasias, neologism, negations, and perseverations (1,10,56,86). This variety of error types suggests that, in aphasia, the naming process can break down for numerous reasons. Circumlocutions and semantic paraphasias indicate the phonological information for target words is not accessed while phonemic paraphasias indicate partial retrieval or impaired articulatory programming that of phonological information. Neologism indicates the combinations of errors in phoneme selecting and sequencing and the failure to retrieve of target entry (43,86). Anomia has been associated with a wide range of lesions patterns, thus anomia is widespread in aphasia.

Topics of the clinical symptomatology of anomia in aphasic patients follows. Many studies compared aphasic patients and normal subjects with several divergent tasks such as object naming, category naming, sentence completion. On all tasks measures, aphasics produced fewer relevant answers and a smaller variety of answers than the control groups of normal subjects (62,83,84,85). The difficulty appears to be restricted to certain features in nonfluent anterior aphasia, and appears to be more devastating in posterior aphasia (62,84,85).

Anomia in Broca's aphasic patients who have motor articulatory difficulties suggests that word retrieval proceeds up to the point of articulatory realization, but is blocked at the final stage. Broca's aphasic patients are often characterized as giving appropriate responses in confrontation naming and in appropriate naming for a target in spite of an effortful search. Their difficulty does not appear to involve a disturbance at the level at which lexical knowledge is represented (88). These patients recognize a functional base relation i.e., relation between the target object and the spoken names of

situations and actions normally associated with them. Furthermore, Broca's internal lexicon is more richly elaborated and better structured in terms of practical or functional information than the internal lexicon of the patient suffering from posterior damage (1,24,56,57,87). Among Broca's aphasic patients with agrammatism, there is sometimes a remarkable disparity between good success in picture naming and extremely disabling anomia during free conversation, and their word retrieval difficulties are more apparent when they try to produce sentences. However, Broca's aphasic patients have been more accurate in naming pictures than posterior patients, including Wernicke's and anomic aphasia (56,73,87).

Anomia in Wernicke's aphasic patients disrupts semantic category boundaries and lexical knowledge. They cannot retrieve the information of target words i.e., nouns, verbs, and adjectives and often use indeterminate nouns or nouns that are out of focus from the intended target in both their spontaneous speech and in their confrontation naming. In naming tasks, Wernicke's aphasic patients always use substitutions of vague or indefinite words such as thing, something, substitutions of erroneous words or neologisms, and sometimes use exclamations of frustration. Wernicke's aphasic patients, who are essentially hyperfluent, produce a significantly lower proportion of retrieved words than normal people and Broca's aphasic patients, who are essentially dysfluent. Perhaps the long and often communicatively empty speech of Wernicke's aphasia lends itself to circumlocutary form rather than lexical target words (1).

The speech of anomic aphasia is not a loss of access to all vocabulary because the words that have a primarily grammatical function in free conversation are unaffected. Pronouns, prepositions, copulas, auxiliary and modal verbs are readily available to the

fluent anomic patient, as are many high frequency nouns and verbs that enter into expressions of time and expressions of basic activities. Anomic patients are most prone to use circumlocutions and indefinite words, rarely producing neologisms or other paraphasias (1). In free conversation, some anomic patients are extremely facile in producing circumlocutions for their missing words. These circumlocutions may sound bizarre because of their vagueness. These anomic patients use many more specific circumlocution terms e.g., thing, them, there. They cannot organize the concepts in terms of functional and perceptual information (87,89,90).

Naming in conduction and transcortical motor aphasic patients are commonly well preserved. When these patients fail to retrieve a name, they respond remarkably well to prompting with the first sound (24,43). Some researchers reported that conduction aphasic subjects did quite well in the naming subtest of the WAB. But, some investigators found that conduction aphasia subjects had difficulty retrieving, resulting in phonemically distorted efforts (43).

2.5 Disorders of reading

Reading disorders refers to a loss of association of written words to sounds or meaning and a loss of recognizing letters by name or matching letters across forms of script or print (1). The disorders are known as both alexia and dyslexia. A reading deficit appears to be secondary to loss of oral language. It is found in many aphasic types and relates to the overall severity of language disabilities (28,91). Reading problems associated with aphasia are traditionally classified by their association with other symptoms of language disorder and by the location of damage. The traditional classifications are discussed as follows.

Alexia without agraphia or pure alexia means an inability to recognize words or letters while other language abilities such as speaking, auditory comprehension, and writing remain intact (1,9). The patient with alexia without agraphia is often noted to read in a letter by letter fashion. Each letter of the word is named, often aloud, before the word is identified. Comprehension of words spelled aloud is usually good (1,5).

Alexia with agraphia, the second traditional classification, refers to a disturbance of both reading and writing (9). The two most frequently cited in reading disturbances accompany Wernicke's aphasia and accompany Broca's aphasia. In Wernicke's aphasia, the part of speech is not an important predictor, although the patient may read function words somewhat better than contentives. Paralexic error are frequent, like the paraphasic errors in oral language. Paralexia is a reading difficulty due to a perceptual problem. There are visual and semantic paralexias. Visual paralexia consists of confusion of letters or words that are graphically similar and semantic paralexia consists of error of word meaning (1,5,9). The degree of reading disturbance usually parallels an auditory comprehension deficit. As in the speech of Broca's patient, word class frequency shows an important effect with concrete nouns being read more accurately than abstract nouns or function words. The Broca' s patient may comprehend more than would be expected because comprehension of the contentives may be good. Reading sentences may be very difficult. These patients tend to read with a whole-word or gestalt strong rather than a letter-by-letter or syllable approach. Comprehension of words spelled aloud is impaired (5,92,93,94). Transcortical aphasia patients have been described with severe alexia and agraphia.

Aphasic alexia is implicated when reading and writing are impaired in the absence of other language abilities, such as speaking, auditory comprehension, and repetition. This has also been referred to as a parieo-temporal alexia. There is difficulty with identification of letters and words as well as a significant impairment of writing in all aspects of written tasks. These patients will show elements of the Gerstmann Syndrome, alexia with agraphia, acalculia, impairment of finger identification, and right-left disorientation (1).

2.6 Disorders of writing

Writing refers to an expressive output of communication through the use of graphemes. Writing ability requires a complex function in cortical areas. Disturbances in writing or agraphia can result from many sites of injury (5). Varying patterns of writing problems or agraphia have been described with a variety of classification systems. Some patients may have writing abnormalities because of motor problems related to hand paresis or paralysis. But some patients may have phonological agraphia because disruption of phoneme to grapheme conversion is disrupted. They may have difficulty in writing nonwords and spelling rules such as position in a word and syllable stress. Some patients have semantic-syntactic processing disorders. They often commit derivational and structural errors; e.g. historian/historical and sanity/sanitation. These symtoms increase difficulty in spelling abstract and functor words and produce unintelligible content or rambling style (1,5,9,24). The next clinical symptomatology of writing disorders in aphasic patients is focused on.

Relative to agraphia in severe mixed aphasia, letter shapes may be defective although the patient has adequate motor control for copying and may be able to

produce a few highly over learned motor-graphic sequences such as his or her name. Patients who are free of hemiplegia may attempt cursive writing, but produce little that is intelligible beyond their name. Block printing is the usual style for patients using their nonpreferred hand. For writing, they can commonly write the beginning of the alphabet. Whole word recall from dictation of other simple object names rarely reveals any useful control of phono-graphemic correspondence, for example by using the correct first letter in attempting to retrieve the written word. Patients at this level neither produce single letters that are requested by name nor produce grammatical functions (1).

In nonfluent aphasia, such as Broca's and transcortical motor aphasia, many researchers reported that nonfluent aphasia associated with dominant frontal lobe damage resulted a loss of automaticity or a change in writing style with difficulty in using letters, and spacing letters, words, and lines (95). These patients have poor motor control of their preferred hand. The nonpreferred hand lacks experience and practice in writing movement (95). Block printing is more common than cursive writing. Letters are oversized, letter reversals occur, and words are misspelled through omission and substitution of letters. Disturbances in writing may parallel those with speech (10). Moreover, agrammatic writing is to be found in these patients. They fail to use prepositions, articles, or noun and verb inflections. Broca's aphasics seem to have more difficulty spelling phonically than do posterior aphasics. Furthermore, some researchers found that in writing tasks for Broca's aphasics, vowels are easier than consonants (96).

In fluent aphasia, such as Wernicke's, anomia, conduction, and transcortical sensory aphasia, writing is likely to appear as unintelligible jargon, spelling errors, word order abnormalities or verbal paragraphia, and word omissions (1,43) even though letters may be well formed in cursive script. In addition, their writing is a rambling style, in which there is repetitious use of certain words or phrases, substantives, and concrete action words and paragrammatic sentence forms as in their speech. Their writing, however, is reduced both rate of writing and quantity from normal levels. The narrative writing of Wernicke's aphasics has shorter runs of grammatically coherent words than does their speech. At the same time, the use of low information verbs and vague nouns are reduced in their writing as compared with their speech (10). Relative to words, spelling problems are not different from those of nonfluent patients.

Agraphia in the parietal lobe due to lesions affects the most elementary associations between letter strings and semantic or phonological representations. That is, patients neither spell, recognize oral spelling, nor retrieve the graphic form of individual letters. Their ability to retrieve the visual or motor graphic form of individual letters may be disrupted. In most cases, the ability to copy print is retained (1).

3. Western Aphasia Battery test (WAB)

The Western Aphasia Battery test was constructed by Andrew Kertesz in 1972. It is a modification of the Boston Diagnostic Aphasia Examination and is similar for both research and clinical purposes. Reasons to modify the WAB as indicated by Kertesz include a short administration time, a simple quantifiable scoring system, and a standard

scoring system which serves as a classification of aphasic patients into eight aphasic syndromes.

Most aphasic tests and batteries are too long and take many sessions to assess fully. For example, the MTDDA (Schuell,1965) takes 2-6 hours to assess an aphasic patient. The BDAE (Goodglass and Kaplan, 1972) takes 1-4 hours, and the PICA (Porch,1967) takes 1-2 hours to finish the test (1,11,12,17,18). The WAB takes only one hour to administer, but can measure all language modalities and the degree of severity of aphasia in patients (9,10). Although the WAB takes a shorter time than other tests, the eight subtests (spontaneous speech, auditory comprehension, naming, reading, repetition, writing, praxis, and construction) are similar to the other tests. A simple scoring system also helps in spending a shorter time in test administration. Moreover, a standard classification criteria is one of the WAB's advantages in classifying aphasic syndromes easily (see table 1 p.39)

The scoring systems of many aphasic tests are difficult to implement. The BDAE's scoring system depends upon longhand notation and rating scales in all performances: the melodic line, phrase length, grammatical form, paraphasia, repetition, word finding and auditory comprehension. It is difficult for a clinician to assign ratings. The PICA also has a complex multidimension scale for scoring the test. The clinician must be trained how to use and interpret the scoring system for approximately 40 hours (4,9,11,12,16,24). On the other hand, the scoring system of the WAB is simple. All subtests can be easily scored. In the spontaneous speech subtest, there are only two rating scores on information content and fluency. The rating criteria for information content and fluency are both in numbered 0-10 scales. The examiner can rate these

performances by following the criteria. The rest of the subtests have a similar scoring system. The sums of subscores do not require further statistical methodology and are computed by adding and mutiplying by 2 (9).

The classification criteria in the WAB can be drawn from raw scores in four oral language subtests: spontaneous speech, auditory verbal comprehension, naming, and repetition (see table 1 p.39). The classification criteria can clearly differentiate aphasic patients as one of eight basic types; Broca, Wernicke, global, conduction, transcortical motor, transcortical sensory, transcortical mixed, and anomic aphasias (9,11). Although the BDAE is a standard test for classifying aphasics, it is sophisticated relative to differentiating aphasic syndromes. The clinician must classify all performances by comparing them with a standard graph in the test manual.

3.1 WAB Subtests

The WAB test consists of eight subtests; spontaneous speech, auditory verbal comprehension, repetition, naming, reading, writing, praxis, and constructional subtests. The eight subtests are described below.

Spontaneous speech is used for the purposes of diagnosis, classification, prognosis, as well as considerations of localization and psycholinguistic research. It includes questions to answer and a picture to describe. Spontaneous speech is rated on information content and fluency. In fluency assessment; phrase length, grammatical completeness, jargon usage, word finding difficulty, circumlocution, and intonation are rated on 10-point scales. In information content assessment, the amount of information actually communicated in everyday situations, conversational questions, and description

of a picture are also rated on 10-point scales. The overall subtest score depends on the correct response to questions and completeness of picture description (9,56).

An auditory verbal comprehension subtest is used to evaluate comprehension of spoken language. Moreover, it assesses the comprehension of grammatical and semantic relationships. The comprehension subtest includes yes-no questions, a pointing task of auditory recognition, and a series of sequential commands. This subtest is similar to the BDAE but contains more yes-no questions and more instructions to follow. The yes-no question task includes 20 questions, some of which are relevant to the patient's own person and environment. Some deal with abstract questions, requiring comprehension of various grammatical and linguistic forms. In the pointing task, the patient is asked to point to each item: six objects, six line drawing objects, six letters, six numbers, six geometric forms, six colors, six items of furniture in the room, six body parts of the patient, five items of finger recognition, and seven tests of right and left orientation. The sequential command task begins with simple and short commands and keeps measuring the length of sentence and the number of the components. Commands involve manipulation of one object to touch another, using prepositions; "with-to", "on-top", "other-side", "over". The sequential command task is given more weight than either the yes-no questions or the word recognition task because of its difficulty and specificity for comprehension disturbances. It is a powerful tool in detecting mild degrees of comprehension deficit (9).

The repetition subtest is used for verbal expression assessment, oral agility, and imitation. Furthermore, repetition is used for distinguishing conduction and transcortical aphasia from other syndromes with impaired comprehension and

expression. The repetition task includes single words, composite words, numbers, word-number combinations, high probability sentences, low probability sentences, and sentences of increasing length and grammatical and phonemic complexity. The patient is asked to repeat the words. If completely repeated, 2 points are scored for each recognizable word. Minor dysarthric errors or colloquial pronunciation are scored as correct. One point is taken off for errors in order of word sequence or for literal paraphasia.

Naming is used for the purpose of measuring word finding difficulty. It includes object naming, word fluency, sentence completion, and responsive speech. In object naming, twenty common real objects are presented visually. In case of no response or an incorrect response, the patient is allowed to touch the object and, if still wrong, a phonemic or semantic cue is given. About 20 seconds are allowed for each item. In word fluency, the patient is asked to describe a category of animals in one minute. This test of word fluency is very sensitive to word-finding disturbances. Responsive speech as well as sentence completion is tested by completion of the open-ended sentences.

The purpose of the reading subtest is to evaluate the reading ability of aphasic patients. The reading subtest starts with the most difficult items: reading comprehension of sentences and reading of commands. Reading comprehension of sentences consists of the first eight items and uses a technique of sentence completion with a four-way multiple choice response set. The sentences range in complexity from simple sentences to a small paragraph of two sentences and to complex sentences. If the patient reads well on these two tasks and the combined score is over 50, then the test is discontinued. If the combined score of these two subtests is below 50, the test is

continued at the word level of the following items: written word stimulus-object choice matching, picture stimulus-written word choice matching, written word stimulus-picture choice matching, phonetic association, letter discrimination, and spelled word recognition.

The purpose of the writing subtest is to assess the writing ability of aphasic patients. This task consists of writing on request, writing output, writing to dictation, writing of dictated or visually presented words, recalling of written symbols, writing of dictated letters and numbers, and copying of words in a test sentence. In the writing on request task, the patient is asked to write his/her name and address. In written output, the patient is asked to write as much as he/she can in sentences about the same picture that is shown for the spontaneous speech subtest. The writing to dictation task requires the patient to write a given sentence **"The quick brown fox jumps over the lazy dog"**. If a combined score of 40 is achieved on these three items, the rest of the writing tasks are omitted and prorated. If the total score is below 40, the rest of the subtest is continued. In writing dictated or visually presented words, the patient is asked to write the name of 5 objects. If the patient fails to write the name of one of the objects dictated, the actual object is shown. If he/she still fails, the word is spelled by the examiner and the patient is asked to write. The last task is to have the patient spell the word by using letters cards. The alphabet and serial numbers up to 20 are requested in the recall of written symbols. In writing dictated letters and numbers, six letters and six numbers are dictated. Copying of sentences uses the same sentence as in the writing to dictation task.

The purpose of the praxis subtest is to assess gestural expression, upper limb praxis, buccofacial praxis, and serial actions. The praxis subtest consists twenty commands of upper limb praxis, buccofacial praxis, instrumental, and complex performances. In upper limb praxis, the patient is asked to make a fist, wave goodbye, salute, scratch their head, and snap their fingers. In buccofacial praxis, the patient is asked to put out their tongue, close their eyes, whistle, sniff a flower, and blow out a match. The instrumental performances involve the use of comb, toothbrush, spoon, hammer, and key. In complex actions, the patient is asked to pretend to drive a car, knock at a door and open it, fold a paper, light a cigarette, and play the piano. The command is given and, if the patient does not understand, it will be repeated. The patient is again asked to perform the movement or to use a certain instrument. A proximate performance on verbal stimulation is accepted, but if the patient does not perform, the next step is asking the patient to imitate the examiner. If this task is not performed, the instrument or object is given to the patient for actual use.

The purpose of the construction subtest is to assess the intelligence of aphasic patients. The construction subtest consists of a computation, drawing, block design, and Raven's colored progressive matrices tasks. The computation task utilizes one or two digit numbers and three items for addition, subtraction, multiplication, and division. These tasks are presented visually on cards and the examiner states the numbers and the requested arithmetic operation. The patient may respond orally or point to the correct answer. In the drawing task, the patient is asked to draw freehand a circle, square, Christmas tree, cube, clock, house, and person, and also to bisect a line. The first three items and a demonstration item from the Wechsler Intelligence Scale Block Design Test

are used in a block design task. Four blocks are put together and the patient will be asked to make them like the picture. If the patient fails to do it in 90 seconds, mix up the blocks and have him or her try again. If the patient fails on the second attempt, go on and show the next picture. Sets A, Ab, and B in Raven's Colored Progressive Matrices are used to assess visuospatial perceptual function and nonverbal intelligence (9).

3.2 Scoring system

The completed WAB yields total scores in terms of the Aphasia Quotient (AQ) and the Cortical Quotient (CQ) (9). The AQ is a functional measure of the severity of spoken language deficit and recovery in aphasia and the CQ is a general assessment of cortical function (9,108).

The AQ is obtained from the summed scores of the four language subtests multiplied by 2. These four subtests are spontaneous speech, auditory comprehension, naming, and repetition. The scoring of fluency and information content is on a 0-10 scale. The other subtests consist of test items with maximum scores adding up to 200 for comprehension (divided by 20 for scaling for AQ) and 100 for repetition and naming (divided by 10 for scaling) The AQ needs no further statistical manipulation by the clinician (9).

The remaining four subtests of reading, writing, apraxia, and construction provide an index of cortical functioning or the Cortical Quotient (CQ). The CQ reflects more than language functioning since it also includes other aspects of higher cortical functioning such as constructional tasks. The total score of the CQ is expressed as a percentage of a maximum score of 100. It includes 20 points from spontaneous

speech, 20 points from auditory verbal comprehension, 10 points from repetition, 10 points from naming, 10 points from reading, 10 points from writing, 10 points from praxis, and 10 points from construction.

3.3 Reliability and validity of the WAB

WAB reliability and validity data were provided by Kertesz A. and Shewan C in 1980. The WAB showed good internal consistency, high inter-intra judge reliabilities, test-retest reliabilities, and construct validity.

Internal consistency measures the reliability of test items, or whether various parts of the test contribute in a consistent manner to the total score. One hundred and forty aphasic patients were assessed by all the WAB subtests. The scores of all aphasics were used to measure internal consistency, using a Cronbach's alpha coefficient. The coefficient of the WAB was 0.905 ($p<.001$), indicating high internal consistency. Nunnally (1967) reported that a correlation of 0.80 was acceptable for tests which had adequate internal consistency (15).

Intrajudge reliability measures the consistency of assessment by the same examiner relative to the same subject on two different occasions. Ten aphasic patients were administered the test and recorded on videotape. Three judges viewed and scored each of 10 videotaped administrations of the WAB two times with a maximum interval of fifteen days. The correlation between the two sets of scores for the 10 patients, a measure of intrajudge reliability, was very high. All correlations were significant at the .001 level (9).

Interjudge reliability is the degree of agreement among judges' evaluations of the same test. It was studied by having eight judges independently score videotaped WAB

tests given to the same 10 aphasic subjects. The results indicated that both AQ and CQ correlation coefficients were all above .983. All of these coefficients were statistically significant at the .001 level.

To consider a test as a valid measure of aphasic impairment, consistency from one administration to another establishes test-retest reliability. A sample of test results of 38 chronic aphasic subjects, stable at the time of initial testing, were evaluated for test-retest reliability. Time between tests varied considerably from 6 months to 6 years. Pearson product moment correlation coefficients were computed and tested. All correlations of the AQs were above .880 and were significant at the .001 level. The correlations of the CQs were all at .900 and were significant at the .01 level. These values were well beyond acceptable levels (.800), indicating that the WAB was highly reliable over time.

Construct validity refers to the degree to which a test measures the construct it proposes to measure. To exam this, 15 subjects were selected who had been administered the WAB and the NCCEA within a maximum two week interval. In many cases the tests were on the same day or one day apart. The samples had included all severity levels and included aphasic subjects of all types as classified taxonomically by the WAB. The corresponding subtests from the two batteries were matched, and Pearson product-moment correlation coefficients were computed and tested. The correlations were high, ranging from .817-.919. All were significant at the .01 level. The matched subtests for both NCCEA and the WAB were summed, and a correlation of .973 ($p<.01$) was obtained. This correlation indicated that the WAB, when matched

for content with another aphasia test, showed a high degree of construct validity (9,15).

3.4 The classification criteria

The classification criteria of the WAB serves to differentiate aphasic patients in eight aphasic syndromes; Broca's, Wernicke's, Global, Anomic, Transcortical motor, Transcortical sensory, Transcortical mixed, and Conduction aphasias. After reviewing the first 150 aphasic patients in 1974, the criteria to classify aphasia were derived from the AQ relative to the four oral language subtests (table 1).

Table 1: Criteria for classifying aphasics based on scores from the Western Aphasia Battery (9).

Type of aphasia	WAB subtests scores			
	Fluency	Comprehension	Repetition	Naming
Global	0-4	0-3.9	0-4.9	0-6
Broca's	0-4	4-10	0-7.9	0-8
Isolation	0-4	0-3.9	5-10	0-6
Transcortical motor	0-4	4-10	8-10	0-8
Wernick's	5-10	0-6.9	0-7.9	0-9
Transcortical sensory	5-10	0-6.9	8-10	0-9
Conduction	5-10	7-10	0-6.9	0-9
Anomic	5-10	7-10	7-10	0-9

Adapted from Kertesz and Poole (1974)

Table 1 represents ranges of scores which clearly classify all aphasic patients into eight syndromes (9). A fluency score of 4 or below differentiates the aphasic patients

with significant motor involvement: global, Broca's, isolation of speech area, and transcortical motor aphasia from the fluency aphasic patients. A comprehension score of 4 or better differentiates Broca's aphasia from global aphasia, and transcortical motor aphasia from isolation aphasia. Among the fluency aphasic patients, the anomic and conduction aphasic patients have a comprehension score of 7 or more in contrast to Wernicke's and transcortical sensory aphasia which have a comprehension score below 7. A score of 8 or better in repetition distinguishes transcortical motor from Broca's aphasia, a score of 5 or greater in repetition discriminates isolation from global aphasia, and a repetition score which is less than 7 also separates conduction from anomic aphasia (9).

3.5 The cut point score.

In 1974, Kertesz and Poole studied language abilities of 150 aphasic patients and three groups of control subjects: 21 non-brain damaged neurological patients, 17 nondominant hemisphere, and 21 diffuse brain-damaged. They found that an AQ cut point score of 93.8 could differentiate aphasic patients from nonaphasic individuals. Aphasic patients' scores fall below this cut point score while nonaphasic subjects were at or above the AQ mean score of 93.8 (97). In 1979, 10 normal subjects and 22 normal subjects in the second standardization had AQ mean scores of 98.4 and 99.6. The cut point score that has been proven as being valuable in differentiating aphasic from nonaphasic patients was 93.8 (56).

Prutting and Kirchner studied the pragmatic aspects of language in aphasic patients in 1987. They used the WAB to differentiate aphasic patients from nonaphasic patients. The AQ mean score in 11 aphasic patients was 74.9. In groups of with 10

right hemisphere damage, the mean score of the AQ was 98.5 (98).

In 1990, Bayles and Tomoeda used the WAB to assess 3 aphasic patients. The first patient scored an AQ of 76.6 and was classified as having anomic aphasia. The other patient scored an AQ of 79.9 and was classified as having conduction aphasia. The last scored an AQ of 76.3 and was classified as having transcortical motor aphasia (100).

Lomas et al. studied the functional communication ability of 11 patients recovering from recent onsets of aphasia and 11 stable aphasic patients in 1989. The AQ mean score of recovering aphasic groups in the first test was 28.1 and the second was 33.7. The AQ mean scores in the stable groups were 59 and 60 for the first and the second tests respectively (101).

Kertesz and McCabe used the WAB to study recovery patterns and prognoses in 93 aphasic patients. The AQ mean scores in the first test, three months later, three to six months, and six to twelve months of all aphasic patients were below 93.8 (102).

Shuren et al. (1995) used the WAB to assess a 65 year old aphasic patient diagnosed by MRI as having left superior temporal inferior parietal infarction. They retested the patient 3 to 5 months after his stroke, and the AQ scores were 44 and 48.6 respectively (99).

3.6 Study of the WAB on Aphasia

The WAB has become a popular protocol for clinical evaluation and research since there has been a growing tendency among clinicians to use the WAB for many purposes. The WAB has been used to differentiate aphasic patients from normal subjects and also aphasic patients from nonaphasic patients, e.g. bilaterally and right

hemisphere damaged patients, and to use as a classification research instrument. Many studies found that the WAB's subtests could detect language disabilities of aphasic patients (9,53, 97, 99, 103,104,105,106).

In 1974, Kertesz and Poole studied the first standardization of the Aphasia Quotients of the WAB to taxonomic groups of aphasic patients. The controls consisted of three subgroups of 21 non-brain damaged neurological patients, 17 nondominant hemisphere lesions patients, and 21 patients with diffuse or dominant hemisphere or subcortical brain damage, but clinically no aphasia. One hundred fifty aphasic patients were the subjects. Both aphasic and control groups had similar educational and language backgrounds. The mean age of the control group was 59.07 and the mean age of aphasic patients was 61.1 years. All control groups and aphasic patients were tested and grouped according to test score, following the principle numerical criteria (table 1 p.39). The number of patients in each subgroup, their mean age, scores by subtests and by aphasia quotient (AQ) were shown in Table 2.

These results indicated that the eight aphasic types could be determined by the mean scores of fluency, comprehension, repetition, and naming subtests. While the severity of language deficits was also determined by the mean score of the AQ, fluency was one of the most important factors in differentiating the eight aphasic syndromes. Fluency scores below 5 separated the aphasics with significant motor involvement such as global, Broca's, isolation, and transcortical motor aphasias from sensory aphasias such as Wernicke's, anomia, transcortical sensory, and conduction aphasias. The repetition subtest was used clinically to distinguish transcortical and conduction aphasics from other sensory and motor aphasics. Repetition scores over 5

Table 2: The number, mean ages, mean scores and standard deviations of subtests and AQ from WAB in 150 aphasic patients and 59 controls (97).

No.	Type of aphasia	Age	Fluency Max=10	Comprehension Max=10	Repetition Max=10	Naming Max=10	Information Max=10	AQ Max=100
26	Global	65.0	1.0(1.2)	2.2 (1.7)	0.9(1.5)	0.5(1.3)	0.6 (0.9)	10.5(9.2)
24	Broca's	57.3	2.5(1.7)	5.9 (1.5)	3.3(3.1)	2.4(2.4)	1.8 (1.8)	31.7(16.6)
5	Isolation	65.6	3.0(1.7)	2.5 (1.0)	7.8(1.7)	2.1(1.7)	1.8 (1.1)	34.3(11.9)
28	Wernicke's	60.3	6.9(1.1)	3.5 (1.9)	3.7(3.0)	2.1(1.8)	3.3 (2.3)	39.0(12.8)
4	Transcortical motor	67.0	3.5(1.0)	6.2 (1.3)	9.2(0.9)	4.3(2.4)	3.5 (1.0)	54.4(8.4)
8	Transcortical sensory	51.3	6.9(1.4)	4.9 (1.3)	9.3(0.5)	4.0(2.5)	4.6 (1.3)	59.6(5.5)
15	Conduction	62.2	6.1(1.2)	8.3 (0.9)	5.0(1.9)	5.2(2.6)	5.7 (2.2)	60.5(12.7)
40	Anomic	60.3	8.0(0.9)	9.0 (0.8)	9.1(0.9)	7.8(1.2)	7.7 (1.7)	83.3(7.8)
150	Total	61.1	5.2(3.0)	5.7 (2.9)	5.3(3.8)	3.9(3.3)	4.0 (3.2)	48.2(28.2)
	Controls							
21	Non-Brain Damaged	59.2	10.0(0.0)	9.9 (0.2)	9.8(0.3)	9.5(0.3)	10.0(0.0)	98.4(1.0)
17	Non-Dominant Hemisphere	59.4	10.0(0.0)	9.7 (0.4)	9.8(0.2)	9.1(0.4)	9.9(0.3)	97.1(1.9)
21	Mixed Group	58.6	9.7(0.7)	9.5 (0.6)	9.6(0.5)	8.9(0.5)	9.2(1.3)	93.87(4.7)

Adapted from Kertesz and Poole (1974)

separated isolation from global aphasia, and repetition scores below 7 clearly separate conduction from anomia. The comprehension subtest consisted of three tasks; yes-no question, auditory word recognition, and auditory sequential tasks to test comprehension language. Broca's, transcortical motor, conduction, and anomic aphasics exhibited good comprehension with their scores of comprehension over 4 in contrast to Wernicke's, and transcortical sensory aphasics whose comprehension were impaired. The score for comprehension better than 4 could separate Broca' s from global, and transcortical motor from isolation. Some motor or Broca's aphasics did

very well on the auditory recognition tasks, but almost all aphasics except some anomic, transcortical motor and conduction aphasics had difficulty with the auditory sequencing task. Kertesz and Poole also concluded that a naming score below 9.0 was chosen as a cut-point to separate anomic aphasia from non-brain damaged controls. However, the naming subtest, which consisted of object naming, word fluency, sentence completion and responsive speech, did not distinguish between subgroups of aphasic patients (97). In their study, they suggested that the word fluency task was very sensitive to aphasic disturbances of word finding. All aphasics exhibited impairment in the word fluency task, even mild aphasics. According to their observations, many controls also did poorly on the word fluency task. Kertesz and Poole also suggested that the word fluency task depended on intelligence, degrees of relaxation and concentration, and probably on educational levels (97).

In 1979, Kertesz also studied the second standardization of the Aphasia Quotient of the WAB test. The subjects were 215 aphasics and 63 controls. Regarding the purpose of this study, Kertesz was interested in functional recovery from stroke than other etiologies. The controls consisted of 10 normal subjects and 53 nonaphasic patients with right hemisphere damage. The results were quite similar to the first standardization by Kertesz and Poole in 1974. When the first and second standardizations were compared, the total comprehension and repetition mean scores in second standardization were higher than those from the first standardization. There was an increase in the number of transcortical aphasics, with a significant decrease in Wernicke's aphasics in the second standardization as well. These differences seemed to relate to the higher portion of transcortical aphasics in the acute stroke population, and

the higher numbers of Wernicke's aphasics of other etiologies (9). The means and standard deviations of subtest scores and the AQ of aphasic patients and the controls are contained in Table 3.

In 1979, Kertesz also studied alexia and agraphia in various aphasic patients. The subjects were 225 aphasic patients. The control groups consisted of 69 nondominant hemisphere lesion patients, 18 patients who recovered from aphasia and 22 normal subjects. The means and standard deviations of the scores achieved by various aphasics and control groups on the writing, reading, comprehension and aphasic quotient are contained in Table 4.

In the reading subtest, global aphasics achieved the lowest scores. Broca's aphasics had reading ability better than isolation, transcortical sensory, and Wernicke's aphasics. The best reading score was achieved by anomic aphasics. Nondominant hemisphere lesions and normal subjects achieved significantly better total reading scores than anomics, the best performance in aphasic group. These results showed that reading was impaired in all aphasic groups (9).

In the writing subtest, global aphasics had very low writing scores. The low comprehension groups, such as, Wernicke's, isolation, and transcortical sensory aphasics also had low writing scores. The writing mean score of Broca's aphasics was considerably higher than those of isolation, and Wernicke's aphasics, even though both isolation and Wernicke's had higher AQ mean scores. Anomic and conduction aphasics had relatively higher scores than other aphasics. However, their writing mean scores were lower than all the control groups. In summary, all aphasic types had agraphia.

Table 3: The number, mean age, mean scores and standard deviations of subtests and AQ from WAB in 215 aphasic patients and 63 controls (9).

No.	Type of aphasia	Age	Fluency Max=10	Comprehension Max=20	Repetition Max=10	Naming Max=10	Information Max=10	AQ Max=100
20	Global	64.3 (11.3)	0.7(1.1)	3.1(2.3)	0.2(0.6)	0.06(0.1)	0.2(0.4)	6.2 (5.3)
26	Broca's	59.3 (15.3)	2.2(1.7)	13.3(3.2)	3.5(2.8)	2.6(2.6)	2.5(2.3)	35.2 (20.4)
3	Isolation	81.0(6.2)	3.0(1.0)	4.8(2.5)	6.8(1.7)	2.0(2.3)	1.6(2.8)	31.8 (16.4)
7	Transcortical motor	67.5(6.9)	4.1(0.38)	13.7(2.4)	8.6(0.62)	5.6(1.6)	5.7(1.8)	62.0 (8.2)
13	Transcortical sensory	66.9(9.6)	7.7(0.93)	10.7(2.9)	9.1(0.7)	4.3(2.5)	5.3(2.0)	63.8 (9.5)
12	Conduction	64.8 (11.1)	6.2(1.4)	15.9(1.6)	4.9(1.6)	4.9(1.6)	5.9(2.2)	60.6 (12.1)
16	Wernicke's	69.6 (13.0)	7.0(0.99)	7.3(4.0)	3.6(3.0)	2.7(2.4)	3.5(2.8)	41.4 (16.2)
44	Anomic	66.1 (12.0)	8.2(1.3)	17.8(1.6)	9.1(1.6)	8.1(0.8)	8.5(1.1)	85.5 (7.0)
141	Total aphasics With infarcts	65.3 (12.5)	5.4(3.1)	12.4(5.8)	5.8(3.7)	4.5(3.3)	4.8(3.4)	53.5 (29.9)
74	Aphasics Other etiology	54.4 (17.0)	6.5(2.7)	12.4(5.6)	6.5(3.4)	4.6(3.0)	5.5(3.0)	59.0 (26.5)
	Controls							
10	Normals	61.0(63)	10.0(0)	20.0(0)	9.9(0.1)	9.8(0.1)	10.0(0)	99.6 (0.3)
53	Non-dominant	64.7 (10.8)	9.4(1.3)	18.7(2.1)	9.5(0.5)	8.8(1.4)	9.2(1.4)	92.3 (8.0)

Adapted from Kertesz (1979)

Table 4 Means and standard deviation scores of writing, reading, comprehension subtests, and the AQs from the WAB in aphasics, recovered, and controls (9).

No.	Types of Aphasia	Writing Max = 100	Reading Max = 100	Comprehension Max = 10	AQ Max = 100
29	Global	2.75 (9.54)	9.13 (13.80)	2.38 (1.07)	11.71 (8.95)
37	Broca's	20.18 (20.48)	41.21 (23.44)	6.58 (1.54)	30.97 (17.35)
4	Isolation	12.00 (23.33)	29.25 (30.33)	4.67 (2.94)	48.75 (15.90)
9	Transcortical motor	34.44 (27.71)	64.22 (29.17)	6.82 (1.75)	62.75 (8.49)
20	Transcortical sensory	27.50 (22.67)	30.90 (26.18)	5.63 (1.56)	64.67 (11.30)
23	Conduction	40.52 (26.76)	65.47 (20.50)	8.31 (0.92)	65.22 (12.30)
17	Wernicke's	16.58 (18.13)	28.11 (20.73)	4.20 (2.06)	44.52 (17.25)
86	Anomic	57.32 (23.36)	77.71 (17.04)	8.87 (1.17)	83.96 (10.44)
	Controls				
22	Normal	85.54 (14.75)	95.95 (8.26)	9.94 (0.13)	98.84 (1.38)
18	Recovered	82.39(17.01)	91.66(7.02)	9.82(0.26)	97.17(1.46)
69	Non-dominant	69.62 (22.16)	88.13 (13.23)	9.65 (0.45)	94.90 (5.34)

Adapted from Kertesz (1979)

Moreover, Kertesz studied praxis in 216 aphasic patients. The control groups of 125 subjects consisted of 32 recovered aphasics whose AQ scores reached 93.8, 72 nondominant hemisphere lesions, and 21 normal, age-matched subjects. The means and standard deviations of the scores achieved by various aphasics and control groups on praxis subtests, as well as comprehension and aphasia quotient are contained in Table 5.

From Table 5, global aphasics performed poorly on all praxis subtests, similar to their AQs. Broca's did much better than global and isolation aphasics, even though Broca's aphasics had lower AQ mean scores than isolation aphasics. However,

Table 5. Mean scores for subtests and total praxis, comprehension, and AQs from the WAB in 216 aphasic patients, 32 recovered aphasia, 22 nondominant hemisphere lesions, and 21 normal subjects (9).

No	Type	Upper limp Max = 15	BF Max = 15	Instrumental Max = 15	Complex Max = 15	Total Praxis Max = 60	AQ Max = 100	Compreh ension Max = 10
18	Global	4.7	5.8	3.5	2.5	16.6	12.3	2.9
48	Broca's	11.9	9.8	8.9	7.7	38.4	33.4	6.3
6	Isolatiom	8.6	8.5	4.8	3.8	25.8	41.7	3.3
7	Transcortical Motor	13.7	12.8	11.8	10.0	48.4	66.7	7.8
17	Transcortical Sensory	12.8	13.5	11.1	10.2	47.2	62.5	5.3
24	Conduction	13.3	12.7	12.7	11.5	50.4	60.9	7.9
21	Wernicke's	11.8	12.0	9.3	8.3	41.6	48.1	4.8
75	Anomic	14.6	14.3	13.9	13.0	56.0	84.9	8.9
216	Total aphasic							
	Controls							
21	Normal	14.2	14.1	14.1	14.2	56.8	94.1	9.4
32	Recovered	14.9	14.8	14.7	14.3	58.9	97.3	9.8
72	Non-dominant	14.8	14.7	14.4	14.0	58.9	94.5	9.5
125	Total controls							

BF = bacco-facial , AQ = Aphasia Quotient Adapted from Kertesz (1979)

Broca's comprehension scores was better than those of isolation aphasics. Transcortical motor, transcortical sensory, and conduction aphasics had similar praxis scores and better AQs, indicating a milder form of aphasia. Wernicke's aphasics, on the other hand, had relatively poor scores on praxis, along with lower AQs and lower comprehension scores. Anomic aphasics approached normal subjects in their performance on the praxis tests, but there was a significant difference between anomics

and the control patients, especially in complex movements, where anomics had more difficulty than either normal controls and nondominant or recovered subjects (9).

In 1977, Kertesz and McCabe studied spontaneous recovery patterns and compared the course of treated and untreated aphasic patients. Ninety three aphasic patients were the subjects; 74 had cerebral infarcts and intracerebral hemorrages, 12 aquired subarachnoid hemorrage, and 7 were caused by head trauma. Their mean age was 57.4 years and mean educational level was 9.6 years. Some aphasic patients were divided into two groups; treated and untreated. Recovery rates were determined by measuring language performance on the WAB. The initial AQs, 0-6 week post-onset, were compared to the serial AQs at three, six months, and yearly after. The mean initial AQs of global, Broca's, conduction, Wernicke's, and anomic were 24.1, 35.6, 60.5, 34.0, and 76.9, respectively. The results indicated that recovery rate appeared to relate clearly to the time of examination after onset. Moreover, recovery rates were higher in post-traumatic than in cerebrovascular cases. Although some cases recovered well while under therapy, there was no significant difference between the treated and untreated groups. In addition, this study found the differences in recovery rate between various types of aphasia. The highest rates of recovery were shown by Broca's and conduction aphasics, and the lowest recovery rates by untreated global and anomic aphasics.

An AQ score of 93.8, which could separate aphasic from non-aphasic patients from a previous study (97), was used as a cut point criterion for complete recovery in this study. The study found that 12 anomic, 5 conduction, 2 transcortical sensory and one transcortical motor aphasic patients reached this criterion of recovery (102).

In 1977, Kertesz, Lesk, and McCabe studied the correlation between the lesions subjects on the basis of radionucleide brain scans and the severity of language deficits which were measured by the WAB. The 65 aphasic patients with cerebral infarcts were the subjects whose mean age was 63.05 years. The subjects had a positive scan within one month of being tested on the WAB, and the WAB test was given within one month after the stroke. The result indicated that the lesion size and severity of aphasia showed significant correlation (Pearson r=-0.67 at 55 df). The AQ mean scores of the subjects are contained in Table 6 (103).

Table 6: The mean ages, and the AQ mean scores and SDs in 5 different aphasia types (103).

Type of aphasia (number)	Mean age (SD)	AQ (SD)
Global (12)	64.6 (11.2)	5.9 (5.8)
Broca's (14)	55.1 (14.9)	31.9 (18.4)
Wernicke's (13)	65.5 (14.6)	34.0 (11.2)
Conduction (11)	64.5 (7.7)	57.0 (13.7)
Anomics (7)	65.7 (16.5)	88.8 (6.5)

Adapted from Kertwsz, Lesk, andMaCabe (1977)

In 1984, Roeltgen and Heilman studied lexical and phonological agraphia in eight aphasic patients. The subjects were 4 male and 4 female aphasic patients whose ages ranged from 26 to 86 years with a mean of 60.13 years. All these aphasic patients were tested for language deficits and classified aphasic types by using the WAB.

Six aphasic subjects were classified as mild anomia with mean scores of information content, fluency, comprehension, repetition, and naming of 9.33 (SD=0.51), 8.50 (SD=1.76), 8.68 (SD=0.73), 9.21 (SD=0.67), and 8.21 (SD=1.21),

respectively. All the language subtests scores were high except in naming subtest. The AQ mean score was 88.12 (SD=5.98). One aphasic was diagnosed with a mild conduction aphasia. The information content, fluency, comprehension, repetition, and naming scores were 8, 6, 7.8, 6.1, and 6.8, respectively. The AQ mean score was 69.4. Another one had a very mild aphasia that could not be classified. The information content, fluency, comprehension, repetition, and naming scores were 10, 8, 9.7, 9.5, and 9.1, respectively. The AQ mean score was 92.6.

The results from the writing tests were then compared with the results of CT brain scan. These results indicated that four patients fulfilled the criteria for lexical agraphia and, on CT scan, had lesions of the posterior angular gyrus that spared the supramaginal gyrus. The other 4 fulfilled the criteria for phonological agraphia. Their lesions involved the supramarginal gyrus of insula deep and spared the angular gyrus (53).

In 1987, Coslett et al. investigated spontaneous speech, reading, and the tendency to recognize and spontaneously correct syntactic errors in two groups of patients with transcortical sensory aphasia (TSA), TSA with lexical repetition (group 1; patients1 and 2), and TSA with nonlexical repetition (group 2; patients 3 and 4). The WAB was used to evaluate language deficits and classify aphasic types of these four subjects and also used for the purpose of this study.

The results from the WAB were consistent with the clinical diagnosis of transcortical sensory aphasia. Their mean scores of information content, fluency, comprehension, repetition, and naming were 4.5 (SD=2.08), 7.5 (SD=1), 4.5 (SD=1.15), 8.62 (SD=0.765), 2.72 (SD=1.22), respectively. Their AQ mean score was

55.7 (SD=9.02). The four TSA were characterized by impaired auditory comprehension and naming. They had fluent speech with semantically empty speech but had preserved repetition. Many of them could repeat long, complex sentences that they did not comprehend.

The results of the study found that, from describing the picture and answering simple questions in spontaneous subtest of the WAB, these two groups differed in the production of literal paraphasias. Patients in group 2 produced more literal paraphasias than did patients in group 1. As well as in the naming subtest of the WAB, Boston Naming Test and Peabody Picture Vocabulary test and repetition of single word, nonwords, and phrases, the incidence of literal paraphasias presented in group 2 was greater than in group 1.

In the reading test, the patients in group 1 could read both regular words (10 phonetically spelled words) and irregular words (10 phonologically unfamiliar nonwords), but the patients in group 2 could read only regular words. This performance strongly suggested that patients in group 2 could not use the lexical reading mechanism.

In spontaneous correct syntactic errors, all 40 sentences contained from three to five words and were presented in a random sequence. Patients were asked to repeat the sentences and then to indicate whether the presented sentence was correct or incorrect. The results found that patients in group 1 could spontaneously correct syntactic error. In contrast, the patients in group 2 could not correct syntactic errors spontaneously.

In conclusion, the results found that patients in group 1 (both lexical and direct repetition) were preserved, but in patients group 2, the lexical mechanism was disrupted and repetition was mediated by the non-lexical mechanism (104).

In 1993, Karbe et al. studied profiles of language impairment in three groups; 10 patients with primary progressive aphasia (PPA), 10 patients with probable Alzheimer's disease (AD) and 10 patients with aphasia. The WAB was used to evaluate the degree of language impairment and follow up studies were done 1 to 5 years after the initial testing. The initial WAB results of the 10 PPA patients were compared with those of the 10 AD and 10 stroke aphasic patients. The initial WAB data and its subtests are contained in Table 7.

The results of a statistical comparison found that the initial AQ of PPA patients was significantly lower than in those with AD, whereas the difference between the PPA and stroke aphasic groups were nonsignificant. A comparison of the four subtests of the WAB showed that their spontaneous speech performances were significantly lower in the PPA group than in both the AD and stroke aphasic group. Comparison the other three subtests revealed no significant differences. The result of this study found that the typical features in early stages of PPA were their expressive language disabilities. Their spontaneous speech was typically slow, hesitant, and sometimes agrammatic (105).

In 1995, Shuren et al. studied the course of unawareness of language errors in a jargon aphasic patient in the context of the six posited mechanisms. The subject was a 65 year old right-handed male with 8 years of education. A MRI brain scan performed 4 weeks after his stroke demonstrated left superior temporal, inferior parietal and a

Table 7: The mean scores (SD) of initial WAB AQ and its subtests from 10 Primary progressive aphasia (PPA),10 stroke aphasia, and 10 patients with Alzheimer's disease (AD) (105).

Subtests	Maximum score	PPA Mean score (SD)	Stroke Mean score (SD)	AD Mean score (SD)
Age, y	-	72.6(8.4)	73.0(8.0)	72.3(8.8)
Aphasia Quotient	100	79.6(7.9)	87.2(8.9)	91.0(5.4)
Spontaneous speech	20	14.6(2.4)	16.9(1.7)	18.5(1.6)
Information content	10	7.6(1.3)	8.3(0.9)	9.3(0.9)
Fluency	10	7.0(1.8)	8.6(1.1)	9.2(0.9)
Comprehension	10	8.4(0.8)	9.2(1.0)	9.4(0.7)
Yes/no questions	60	57.6(3.9)	58.8(2.1)	57.2(2.7)
Auditory word recognition	60	57.6(3.8)	57.9(3.1)	59.2(1.0)
Sequential commands	80	53.4(11.6)	67.9(17.4)	70.8(12.9)
Repetition	10	8.0(1.4)	8.7(1.1)	9.4(0.5)
Naming	10	7.3(1.6)	8.5(0.9)	8.6(0.5)
Object naming	60	49.2(10.3)	56.4(3.0)	57.8(2.1)
Word fluency	20	5.9(4.1)	10.2(5.1)	9.0(2.7)
Sentence completion	10	9.2(1.6)	8.9(1.9)	9.6(0.8)
Responsive speech	10	9.1(1.3)	9.4(1.3)	9.8(0.6)
Reading	100	83.2(14.3)	75.1(20.5)	86.8(7.6)
Writing	100	71.7(23.9)	52.9(27.3)	80.5(8.9)
Praxis	60	47.5(12.6)	56.8(4.1)	55.8(2.0)
Drawing	30	16.2(6.7)	15.3(4.1)	15.7(2.3)
Block design	9	5.7(2.1)	5.4(3.1)	3.5(2.3)
Calculation	24	20.8(3.9)	17.0(8.1)	19.6(4.8)
Raven's score	37	19.9(7.1)	22.5(4.5)	14.5(5.8)

Adapted from Coslett et al. (1987)

right putaminal lacunar infarcts. The WAB test was used to evaluate language abilities of the subject within 3 to 5 months after his stroke. The results of the WAB found that his fluency mean score was 7 but information content mean score was 0. Auditory comprehension was relatively good with a mean score of 9.55. His repetition and naming were poor with mean scores of 2.45 and 3.1, respectively. The AQ mean score was 46.3. His residual language was good in fluency of speech and auditory comprehension but poor in repetition.

The subject was then tested by the six tasks. There were tests of single word comprehension (Peabody Picture Vocabulary test), representation for speech production, the appropriate target word pronounced correctly, selective attention (speak and listen at the same time), delayed condition, and feed back loops between speech production and comprehension. Reduced attention capacity would result in unawareness of language errors when the aphasic was both speaking and listening but not w hen the aphasic was only listening (99).

In 1999, Ballard K. and Thompson C.K. studied (a) the acquisition and generalization of complex sentence production in agrammatism using linguistic specific treatment (LST) and (b) the utility of syntactic theory in guiding hypotheses of treatment effects. The subjects were 3 Caucasian men and 2 African women whose ages ranged from 38 to 69 years and educational levels ranged from 13 to 24 years. The WAB was used to evaluate language deficits and also used to classify aphasic type of the subjects. All participants were classified with moderate Broca's aphasia. The mean scores of fluency, repetition, and naming were 4, 5.48 (SD=7), and 6.26 (SD=1.38), respectively. Although auditory comprehension was impaired with the

mean score was 7.98, this was superior to expressive abilities. The AQ mean score was 62.9 (SD=7.27). Further, the CQ mean scores for reading, writing, praxis, and construction were 6.86 (SD=2.64), 5.62 (SD=1.61), 8.28 (SD=1.25) and 8.32 (SD=1.06), respectively.

The findings of this study presented evidence that the treatment improved sentence production with the greatest improvement observed in less severe Broca's aphasic patients (106).

In conclusion, the WAB has been used increasingly among aphasiologists. Some aphasiologists critiqued that the WAB has been one of the most useful instruments available. The taxonomic classification would allow the clinician to base therapy goals and activities on known characteristics of behavior and recovery associated with each classification. The Aphasia Quotient is useful in distinguishing between aphasic and normal and nonaphasic patients. The greatest advantage of the WAB is its shorter administration time of approximately one hour as compared to three hours or more for the BDAE. In addition, the WAB scoring system has more specific criteria than that of the BDAE. The scoring for information content and fluency have been specified clearly. Although some expertise in speech and language pathology is required, the test does not require additional extensive training to master the administration procedures (9,18).

CHAPTER III
MATERIALS AND METHODS

This study compared the language abilities of aphasic patients and normal subjects by using the Thai Adaptation of the Western Aphasia Battery (WAB). Information concerning the subjects, material, and the method of administration are illustrated as follows:

1. Subjects

1.1 Normal subjects

Thirty subjects were matched in pairs with aphasic patients relative to age, gender, and educational level using the following criteria:

1.1.1 No history of neurological disorders.

1.1.2 Age above 16 years.

1.1.3 Educational level of at least primary grade 4 with the ability to read and write in the Thai language.

1.1.4 Apparent normal hearing. Hearing was analyzed while the subject was conversing with the researcher in normal conversational loudness. If the researcher had to speak louder or repeat questions or information several times, these subject would not be selected.

1.2 Aphasic patients

Thirty aphasic patients from Ramathibodi hospital were chosen as the subjects for this study according to the following criteria:

1.2.1 A neurologist's diagnosis as having sustained some degree of brain damaged which affected the language abilities with an onset of illness of 6 months and beyond. This evidence was confirmed by computerized tomographic data (CT scan).

1.2.2 Age above 16 years.

1.2.3 Educational level of at least primary grade 4 with the ability to read and write in the Thai language.

1.2.4 Apparent normal hearing. Hearing was analyzed while the subject was conversing with the researcher in normal conversational loudness. If the researcher had to speak louder or repeat questions or information several times, the subject would not be selected.

2. Instrumentation

The instrument and instrumentation used in this research was study the following:

1. Thai Adaptation of the Western Aphasia Battery (WAB).
2. Audio tape recorder: SONY TCM 359v.
3. Video tape recorder: SONY 10X Handicam Video 8.
4. Stop watch.

3. Procedures

3.1 Pilot study of the Thai Adaptation of Western Aphasia Battery test.

Thirty normal subjects were tested in order to derive the reliability of the WAB test. A test-retest method was used in this study. The second administration of the test was one month after the first administration. The scores of both tests were computed and analyzed by using Pearson product moment correlation analysis.

All correlation coefficients computed were above 0.990 and were significant at the 0.001 level. Correlation coefficients between the test values were high and these results confirmed a high test-retest reliability.

3.2 Content Validity

Content validity of the Thai Adaptation of Western Aphasia Battery test was evaluated by five experienced speech pathologists. Their conclusion was that all subtests could assess the language performance of aphasic patients.

3.3 Procedures

Both normal and aphasic subjects were administered the Thai Adaptation of the Western Aphasia Battery. Subjects were informed about the purpose of the research and the testing procedure. The WAB was administered in a quiet room with a least distracting environment. The responses of normal subjects were recorded on audio tape and the responses of aphasic patients were recorded on audio tape and on video tape. While the test was being administered, the responses of the subjects were recorded and scored.

4. Measurement

After reviewing the audio tape and video tape recordings, the responses were scored following the WAB scoring system. The results were then computed and analyzed using statistical analysis methodology.

5. Data Analysis

The following statistical tests were performed to analyse the WAB test response data.

1. Percentages, means and standard deviations were used to describe the demographic characteristic of both groups.
2. A two-independent sample t-test was performed to compare the difference in means relative to language abilities of aphasic patients and normal subjects.
3. Pearson product moment correlation coefficients were computed to determine the test-retest reliability of the WAB.

CHAPTER IV

RESULTS

The Thai Adaptation of the Western Aphasia Battery (WAB) was administered to thirty normal subjects and thirty aphasic patients. There were 20 male and 10 female aphasics and normal subjects, ranging in age from 24 to 76 years. Their educational levels ranged from prathom 4 to master's degrees (Appendix A-1). The results of the data analysis are contained in three sections.

4.1 Language abilities of normal subjects.

4.2 Language abilities of each aphasic syndromes.

4.3 The comparison of language abilities of aphasic subjects and normal subjects.

4.1 Language abilities of normal subjects

The raw scores of each subtest of normal subjects are contained in Appendix A-2. The means scores and ranges from the WAB subtests are contained in Table 8.

The 29 normal subjects could perform full score on the fluency subtest. There was the only one subject who scored 9. The mean score of fluency subtest was 9.96. In information subtest, the 29 normal subjects could perform full score while the only one subject scored 8. The mean score of information content was 9.93. The mean scores and ranges of yes-no questions and word recognition were 57.8 (51-60) and 59.8 (58-60). All normal subjects had full scores on the sequential commands and praxis subtests. The mean score and range of the repetition subtest was 99.23 (94-100). In the naming subtest, the mean scores and ranges of object naming, responsive speech, sentence completion, and word fluency were 59.06 (53-60), 9.33 (6-10), 9.86

(8-10), and 17.73 (9-20), respectively. The mean scores and ranges of the reading and writing subtests were 96.25 (66.5-100) and 92.41 (43-100), respectively.

Table 8 Mean scores and ranges of the WAB subtests from 30 normal subjects.

Subtests	Max	Mean	Range
1.Spontaneous speech subtest			
1.1 Information content	10	9.93	8-10*
1.2 Fluency	10	9.96	9-10*
2.Auditory comprehension subtest	10	9.88	9.5-10
2.1 Yes-no questions	60	57.8	51-60
2.2 Auditory word recognition	60	59.8	58-60
2.3 Sequential commands	80	80	80
3. Repetition subtest	10	9.92	9.4-10
4.Naming subtest	10	9.60	8.2-10
4.1 Object naming	60	59.06	53-60
4.2 Word fluency	20	17.73	9-20
4.3 Responsive speech	10	9.33	6-10
4.4 Sentence completion	10	9.86	8-10
5. Reading subtest	100	96.25	66.5-100
6. Writing subtest	100	92.41	43-100
7. Praxis subtest	60	60	60
AQ scores	100	98.80	94.7-100

* see text

4.2 Language abilities of each aphasic syndrome.

The raw scores of each subtest of aphasic patients are contained in Appendix A-3. The means scores and range of the WAB subtests from 30 aphasic patients are contained in Table 9.

Table 9 Mean scores and ranges of the WAB subtests from 30 aphasic patients.

Subtests	Max	Mean	Range
1.Spontaneous speech subtest			
1.1 Information content	10	5.7	0-9
1.2 Fluency	10	3.83	0-9
2.Auditory comprehension subtest	10	5.63	1.65-9.9
2.1 Yes-no questions	60	47.27	30-60
2.2 Auditory word recognition	60	41.3	3-60
2.3 Sequential commands	80	24.3	0-80
3. Repetition subtest	10	4.75	0-10
4.Naming subtest	10	4.0	0-8.8
4.1 Object naming	60	28.58	0-57
4.2 Word fluency	20	3.72	0-13
4.3 Responsive speech	10	3.8	0-10
4.4 Sentence completion	10	3.9	0-10
5. Reading subtest	100	50.77	0-100
6. Writing subtest	100	38.42	0-100
7. Praxis subtest	60	47.83	18-60
AQ scores	100	47.82	9.3-87

Relative to the aphasic group in Table 9, the mean scores and ranges of information content and fluency in spontaneous subtests were 5.7 (0-9) and 3.83 (0-9). For the auditory comprehension subtest, the mean scores and ranges of yes-no questions, auditory words recognition and sequential commands were 47.27(30-60), 41.3(3-60) and 24.3 (0-80), respectively. The repetition mean score and range was 47.5(0-100). For the naming subtest, the mean scores and ranges of objects naming, word fluency, responsive speech and sentence completion were 28.58(0-57), 3.72(0-

13), 3.8(0-10) and 3.9(0-10), respectively. The mean scores and ranges for the reading and writing subtests were 50.77(0-100) and 38.42(0-100). The mean score and range of praxis subtest was 47.83(18-60). The mean score and range of AQ was 47.82(9.3-87).

Table 10 Mean scores and ranges from the WAB subtests and the AQ in eight different types of aphasias.

Clinical Diagnosis Of Aphasias	Average Age	N	Fluency (max=10)		Comprehension (max=10)		Repetition (max=10)		Naming (max=10)		AQ (max=10)	
			Range	Mean	Range	Mean	Range	Mean	Range	Mean	Range	Mean
Global	60.75	8	0-4	1.75	1.6-3.9	3.09	0-4.6	1.38	0-4.5	1.09	9.3-48.4	20.08
Broca	49.73	11	2-4	3.1	4.1-9.9	6.69	2-7.6	5.1	0-8.8	5.38	20-84.5	54.21
Transcortical motor	36.5	2	2-4	3.0	4.5-5.5	4.85	8.5-8.6	8.55	0.4-5.7	3.05	40.8-54.9	47.85
Isolation	41.0	1	-	4.0	-	3.8	-	7.6	-	1.2	-	37.3
Wernicke	57.0	2	6-8	7.0	5.6-6.4	5.95	1.5-3.3	2.4	0.4-5.3	2.85	38.5-63.3	50.9
Transcortical sensory	51.75	4	5-9	6.75	4.6-6.7	5.34	8.2-10	8.9	5.2-7.8	6.79	70.1-75.5	73.25
Conduction	55.0	1	-	8.0	-	9.0	-	5.0	-	4.8	-	69.6
Anomia	61.0	1	-	8.0	-	9.8	-	9	-	7.7	-	87.0

From Table 10, the mean scores and ranges of the fluency subtest for global, Broca's, transcortical motor, Wernicke's, transcortical sensory, isolation, conduction, and anomic aphasic patients were 1.75(0-4), 3.1(2-4), 3(2-4), 7(6-8), 6.75(5-9), 4, 8 and 8, respectively.

The mean scores and ranges of the comprehension subtest for global, Broca's, transcortical motor, Wernicke's, transcortical sensory, isolation, conduction, and anomic aphasic patients were 3.09(1.6-3.9), 6.69(4.1-9.9), 4.85(4.5-5.5), 5.95(5.6-6.4), 5.34(4.6-6.7), 3.8, 9 and 9.8, respectively.

The mean scores and ranges of the repetition subtest for global, Broca's, transcortical motor, Wernicke's, transcortical sensory, isolation, conduction, and anomic aphasic patients were 1.38(0-4.6), 5.1(2-7.6), 8.55(8.5-8.6), 2.4(1.5-3.3), 8.9 (8.2-10), 7.6, 5 and 9, respectively.

The mean scores and ranges of the naming subtest for global, Broca's, transcortical motor, Wernicke's, transcortical sensory, isolation, conduction, and anomic aphasic patients were 1.09(0-4.6), 5.38(0-8.8), 3.05(0.4-5.7), 2.85(0.4-5.3), 6.79(5.2-7.8), 1.2, 4.8 and 7.7, respectively.

The mean scores and ranges of the AQ for global, Broca's, transcortical motor, Wernicke's, transcortical sensory, conduction, and anomic aphasic patients were 20.08 (9.3-48.4), 54.21(20-84.5), 47.85(40.8-54.9), 50.90(38.5-63.3), 73.25(70.1-75.5), 37.3, 69.6 and 87, respectively.

Table 11 Mean scores and ranges of reading and writing subtests in eight different types of aphasias.

Clinical Diagnosis Of Aphasia	Average Age	N	Reading (max=100)		Writing (max=100)	
			Range	Mean	Range	Mean
Global	60.75	8	0-64.5	26.81	0-68.0	15.38
Broca	49.73	11	26-100	61.82	2-100	50.86
Transcortical motor	36.5	2	34-42	38.0	15-26	20.5
Wernicke	57.0	2	3.5-95	41.25	18-51	63.29
Transcortical sensory	51.75	4	27-80	53.75	2-85	41.62
Isolation	41.0	1	-	87	-	50.5
Conduction	55.0	1	-	62	-	44
Anomia	61.0	1	-	92	-	99

From Table 11, the mean scores and ranges of reading subtest for global, Broca's, transcortical motor, Wernicke's, transcortical sensory, isolation, conduction, and anomic aphasic patients were 26.81 (0-64.5), 61.82 (26-100), 38.0 (34-42), 41.25 (3.5-95), 53.75 (27-80), 87, 62 and 92, respectively.

The mean scores and ranges of writing subtest for global, Broca's, transcortical motor, Wernicke's, transcortical sensory, isolation, conduction, and anomic aphasic patients were 15.38 (0-68), 50.86 (2-100), 20.5 (15-26), 63.29 (18-51), 41.62 (2-85), 50.5, 44 and 99, respectively.

Table 12 Mean scores and ranges of fluency, comprehension, and repetition subtests in nonfluent vs fluent, anterior vs posterior, speech area vs border zone aphasic patients.

Aphasic groups (n)	Fluency (max=10)	Comprehension (max=10)	Repetition (max=10)
Non-fluent (n=22)	2.85 (0-4)		
Fluent (n=8)	7.44 (5-9)		
Control (n=30)	9.96(9-10)		
Anterior (n=15)		7.59 (4.1-9.9)	
Posterior (n=15)		4.56 (1.65-6.7)	
Control (n=30)		9.88 (9.5-10)	
Speech area (n=22)			3.42 (0-7.6)
Border zone (n=8)			8.39 (6.2-10)
Control (n=30)			9.92 (9.4-10)

From Table 12, the mean scores and ranges of fluency subtest for nonfluent aphasic group, Broca, global, transcortical motor and isolation, were 2.85(0-4) while

the mean score and range of fluency subtest of fluent aphasic group, Wernicke, transcortical sensory, conduction and anomia, was 7.44 (5-9). The fluency mean score and range for control subjects was 9.96 (9-10). The mean score and range of the comprehension subtest of anterior aphasic group, Broca, transcortical motor, conduction and anomic aphasics, was 7.59 (4.1-9.9) while the mean score and range of comprehension subtest of posterior aphasic group, Wernicke, transcortical sensory, global and isolation, was 4.56 (1.65-6.7). The comprehension mean score and range for control subjects was 9.88(9.5-100). The mean score and range of the repetition subtest of speech area aphasic group, global, Broca, Wernicke and conduction aphasias, was 3.42 (0-7.6) while the mean score and range of border zone aphasic group (transcortical sensory, transcortical motor, isolation and anomic aphasics) was 8.39 (6.2-10). The repetition mean score and range for control subjects was 9.92(9.4-10).

4.3 Comparison of language abilities between aphasic subjects and normal subjects.

A statistical comparison of all subtests scores between the WAB of 30 normal subjects and 30 aphasic patients were shown in Table 13.

From Table 13, the two sample t-test of independent means was used to examine the differences between the subtest means of normal subjects and the subtest means of aphasic patients. The results showed that normal subjects demonstrated significantly higher subtest means on all subtests and AQ mean scores than did the aphasic patients.

Table 13 Statistical comparison of language abilities subtest scores of the WAB of normal subjects and aphasic patients.

Subtests (Max score)	Normal (n=30)		Aphasia (n=30)		t
	Mean	S.D.	Mean	S.D.	
1.Spontaneous speech subtest (20)					
1.1 Information content (10)	9.93	0.182	5.7	2.93	-7.939*
1.2 Fluency (10)	9.96	0.36	3.83	2.45	-13.362*
2.Auditory comprehension subtest(200)					
2.1 Yes-no questions (60)	57.8	2.6	47.27	9.78	-5.698*
2.2 Auditory word recognition (60)	59.8	0.48	41.3	15.78	-6.415*
2.3 Sequential commands (80)	80	0.00	24.3	27.8	-10.966*
3. Repetition subtest (100)	9.92	1.69	4.75	3.33	-7.789*
4.Naming subtest (100)					
4.1 Object naming (60)	59.06	1.91	28.58	21.02	-7.909*
4.2 Word fluency (20)	17.73	3.39	3.72	8.12	-7.766*
4.3 Responsive speech (10)	9.33	1.32	3.80	3.73	-7.647*
4.4 Sentence completion (10)	9.86	0.50	3.90	3.88	-8.332*
5. Reading subtest (100)	96.25	8.06	50.77	32.33	-7.093*
6. Writing subtest (100)	92.41	16.49	38.42	33.84	-7.635*
7. Praxis subtest (60)	60	0.00	47.83	12.82	-5.669*
AQ scores	98.80	1.38	47.82	24.11	-7.854*

* all significant at p<.01

CHAPTER V

DISCUSSION AND CONCLUSIONS

The purpose of this study was to investigate the language performances of normal subjects and aphasic patients, compare the language performances of both groups, and identify language deficits in eight aphasic syndromes by using the Thai Adaptation of the Western Aphasia Battery test. The research questions which were developed for this study were answered as follows:

5.1 What are the language abilities of normal subjects measured by the Thai Adaptation of Western Aphasia Battery test?

By administration of the Thai Adaptation of Western Aphasia Battery test to 30 normal subjects, the results confirmed that all Thai normal subjects had very high language performance with an AQ mean score of 98.8 and scores ranging from 94.7 to 100. This result agreed with the studies of Kertesz in 1979 who reported that the AQ mean scores of 10, 22 and 21 normal subjects, were very high with the mean scores of 99.6, 98.8 and 94.1, respectively (Tables 3,4,5) (9). The AQ mean scores of 21 nonbrain damaged, 17 nondominant hemisphere, and 21 diffuse and subcortical brain damage of Kertesz and Poole'study were also high with the mean scores of 98.4, 97.1, and 93.8, respectively (Table 2). They suggested that the lowest AQ score of 93.8 could separate aphasics from nonaphasics. In the present study, the lowest AQ score of 30 Thai normal subjects whose age ranged from 24 to 76 years was 94.7. According to this study, the AQ score of the Thai Adaptation of the WAB, 94.7, might

be considered as a cut point separating the Thai aphasic patients from normal subjects having the same educational level.

There were 29 out of 30 normal subjects who obtained a full score (10 maximum)on the information content and fluency subtests in spontaneous speech. Only one subject scored 9 for information content subtest, and another scored 8 on the fluency subtest. (Appendix A-2) In the studies by Kertesz and Poole (1974) and Kertesz (1979), the mean scores for information content and fluency subtests obtained from the nonbrain damaged and normal subjects were relatively high (Tables 2,3) (9). From the result of this study, it was noted that all Thai normal subjects should score at the maximum of 10 or nearly maximum scores on both information content and fluency subtests.

On the auditory comprehension, repetition, naming, reading, writing and praxis subtests, the Thai normal subjects obtained relatively high scores with mean scores of 9.88, 9.92, 9.60, 96.2, 92.4 and 60.0, respectively (Table 8). In the results from Kertesz and Poole in 1974 and Kertesz in 1979, nonbrain damaged patients and normal subjects obtained high scores in auditory comprehension, repetition, naming, reading, writing and praxis subtests (Table 2,3,4,5) (9). However, by observation, the mean scores on the word fluency, reading and writing subtests for Thai normal subjects were 9.96, 96.25, and 92.41 which were lower than other subtests. The lower scores on these three subtests agreed with the result of Kertesz and Poole (1974). They suggested that scores on the word fluency subtest might depend on intelligence, degree of relaxation, concentration, and probably on educational level (97). In the word fluency subtest, the subjects were asked to describe a category of animals in one minute, so they had to concentrate and had to have enough knowledge to do so.

Kertesz and Poole (1974) also suggested that scores on the reading and writing subtests might depend on the educational levels of subjects (97). In the present study, all Thai normal subjects obtained reading and writing scores ranging from 66.5 to 100.0 and 43.0 to 100.0, respectively (Table 8). Subjects who received the lowest reading score (66.5) and writing score (43.0) graduated from prathom 4.

5.2 What are the language abilities of each type of aphasic patients?

By administration of the Thai Adaptation of Western Aphasia Battery to 30 aphasic patients, the results indicated that the aphasic patients received a wide range of AQ scores from 9.3 to 87, with a mean score of 48.57 (Table 9). Using the WAB classification criteria (Table 1), each type of aphasic patient exhibited a score which corresponded with their clinical diagnosis (Table 10). Therefore, the results suggested that the WAB classification criteria may be used as a clinical tool to classify Thai aphasic patients.

5.2.1. Fluency of speech

The fluency mean scores of global, Broca's, transcortical motor, and isolation aphasic patients were 1.75 (range = 0-4), 3.1 (range = 2-4), 3.0 (range = 2-4) and 4.0 respectively, while the fluency mean scores of Wernicke's, transcortical sensory, conduction and anomia aphasic patients were 7.0 (range = 6-8), 6.75 (range = 5-9), 8 and 8, respectively (table 10). All Thai nonfluent aphasics received the fluency scores 4 or below, while all Thai fluent aphasics obtained fluency scores of 5 or higher. These results agreed with the studies of Kertesz and Poole (1974) and Kertesz (1979) which reported that all fluent aphasics (Wernicke's, transcortical sensory, conduction and anomia aphasic patients), received fluency mean scores 5 or higher, while all

nonfluent aphasics (global, Broca's, transcortical motor, and isolation aphasic patients), scored 4 or below (Tables 2 and 3) (9,97). The study by Ballard and Thompson (1993) also showed that the fluency mean score of five Broca's aphasic patients was 4.0 (106).

From Computerized Tomographic studies (CT scan), Thai fluent aphasic patients, Wernicke's, trnscortical sensory, conduction and anomic patients had lesions in the postRolandic portion of the dominant hemisphere sparing the motor speech area in the preRolandic portion (see Appendix A-4). In contrast to fluent aphasics, Thai nonfluent aphasic patients (Broca's, isolation, transcortical motor and global aphasic patients) had lesions involving the motor speech areas in the preRolandic portion of the dominant hemisphere (see Appendix A-4). The motor speech areas in the preRolandic portion played a role in programming articulatory movement, controlling the coordination of articulatory muscle's movements, and planning sequential speech (1,28,31,32,60). The lesions involving the motor speech areas in the preRolndic portion of the dominant hemisphere usually caused the disturbances in speech fluency (1,24,28,32). Thus, nonfluent aphasic patients should have received lower scores on fluency subtest than fluent aphasic patients.

From video observations, Thai fluent aphasic speech was essentially normal in rate, phrase length, melodic, and well-articulated with normal syntactic patterns. Fluent aphasic patients used complete sentences which consisted of subjects, verbs, and/or objects. When their speech was analyzed in detail, it was found that fluent aphasics used many of indefinite words i.e., that, this, those. While they were describing a picture and answering questions, they had very fluent speech flow with full of nouns, verbs and conjunctions, but their speech was not about the picture or the

questions. They also substituted inappropriate words instead of target words by using verbal paraphasias and circumlocutions. These speech characteristics caused decreased information and the meanings were irrelevant but their speech flow was very fluent. These observations agreed with many studies which reported that fluent aphasic patients spoke in complete sentences, at a normal rate and phrase length (1,23,67), were melodic (43) and articulated but their speech lacked informational content and organization (1,23,43). Fluent aphasic patients also frequently substituted inappropriate words by using paraphasias and jargon (1,9,56,67).

In contrast to fluent aphasics, Thai nonfluent aphasic speech was characterized by a slow speech rate, effortful speech, reduced phrase length, articulation disorders, agrammatism and dysprosody. The degrees of severity of nonfluent speech ranged from producing only simple sounds to speaking only three word utterances. These nonfluent speech characteristics resulted from motor speech disorders and word finding difficulty. Resulting from motor speech programming disorders, nonfluent aphasic patients had difficulty initiating speech by grouping their lips, jaws, tongue, soft palate and vocal folds to place in the correct positions and sequences which made their speech quite slow, hesitant, and took much effort. They had articulation disorders with substitution and omission errors. These nonfluent aphasics also had agrammatism. Content words such as nouns and verbs were produced, but some grammatical words such as adjectives, adverbs and prepositions were omitted. Having had word finding difficulties, nonfluent aphasic patients experienced interruptions in speech and frequently used phonemic paraphasias which reduced speech fluency. These observations agreed with many studies which described nonfluent aphasic speech which was characterized by decreased speech rate (67), increased effort

(9,23,55,57,67), reduced phrase length (9,23), agrammatism (23,24,56,64), telegraphic speech (9,24,71,72), articulation disorders (58,60,67), apraxic speech (1,57) and disprosody (1,42,61,64,69,70).

5.2.2 Auditory comprehension

The comprehension mean scores of Thai nonfluent aphasics (global, Broca's, transcortical motor and isolation aphasic patients), were 3.09 (range = 1.6-3.9), 6.69 (range = 4.1-9.9), 4.85 (range = 4.5-5.5) and 3.80, respectively. From these results, it was noted that the comprehension mean scores of Thai global and isolation aphasics were lower than 4 while the comprehension mean scores of Thai Broca's and transcortical motor aphasics were higher than 4 (Table 10). These results demonstrated that a comprehension score 4 or better might separate Broca's and transcortical motor aphasics from global and isolation aphasics. It also agreed with the WAB classification criteria that a comprehension score of 4 or better separated Broca's and transcortical motor aphasics from global and isolaton aphasics (Table 1) (9). Kertesz and Poole (1974) and Kertesz (1979) also found that the comprehension mean scores of global and isolation aphasics were lower than 4 while the comprehension mean scores of Broca's and transcortical motor aphasics were higher than 4 (Table 2,4,5) (9,97). Moreover, a study by Ballard and Thompson (1999) showed that the comprehension mean score of five Broca's aphasics was 7.98 (106).

The comprehension mean scores of Thai fluent aphasics (Wernicke's, transcortical sensory, conduction and anomic aphasic patients), were 5.95 (range = 5.6-6.4), 5.34 (range = 4.6-6.7), 9.0 and 9.8, respectively (Table 10). These results indicated that Thai Wernicke's and transcortical sensory aphasics received comprehension scores lower than 7. This result agreed with the WAB classification

criteria that comprehension score of more than 7 separated conduction and anomic aphasia from Wernicke's and transcortical sensory aphasia (Table 1) (9). The results of the present study also agreed with those of other studies (9,53,97,104). Kertesz and Poole (1974) and Kertesz (1979) found that both Wernicke's and transcortical sensory aphasics received comprehension scores lower than 7 while conduction and anomic aphasics received comprehension scores higher than 7 (Tables 2,4,5) (9,97). The results from Coslett et al's (1987) study also showed that the comprehension mean score of transcortical sensory aphasics was 4.5 (104). Moreover, Roeltgen and Heilman (1984) found that the comprehension mean scores of anomic and conduction aphasics were 8.6 and 7.8, respectively (53).

From Computerized Tomographic studies (CT scan), Thai Broca's, transcortical motor, conduction and anomic aphasic patients had lesions sparing auditory comprehension areas, Wernicke's area, and/or subcortical connections in the postRolandic portion of the dominant hemisphere (see appendix A-4). In contrast, Thai Wernicke's, isolation, global and transcortical sensory aphasic patients had lesions involving auditory comprehension areas, Wernicke's area and/or subcortical connections in the postRolandic portion. Wernicke's area received the auditory signal from the primary auditory area, interpreted the meaning of spoken language, and compared these meanings to previous experiences in which a listener understood the spoken language (1,36,37,38,39,40,41). The lesions involving auditory comprehension areas, Wernicke's area and/or subcortical connections in the postRolandic portion usually caused disturbances of auditory comprehension (1,24,38,42). Thus, Thai Wernicke's, isolation, global and transcortical sensory

aphasic patients should receive a lower score on the auditory comprehension subtest than Thai Broca's, transcortical motor, conduction and anomic aphasic patients.

From the result of the present study, it was found that all aphasic patients had auditory impairments which had various degrees of severity. Those who had severe deficits exhibited impairment in understanding spoken words, and those with mild deficits had impairment only in understanding complex verbal commands. The auditory comprehension subtest consisted of three tasks which assessed the severity of auditory comprehension deficits (9). First, the auditory word recognition task required an ability to understand spoken words. The low comprehension group (global, isolation, transcortical sensory and Wernicke's aphasic patients) showed severe word recognition deficits that may be due to difficulty in the interpretation of word meanings. Those patients showed that they did not understand auditory stimuli even in one single word. These results of the present study agreed with those of Goodglass and Kaplan (1983) and Goodglass, Gleason and Hyde (1970) (24,80). Both studies found that global, isolation, transcortical sensory and Wernicke's aphasics had auditory word recognition impairment even though they used the Boston Diagnostic Aphasia test. The yes-no questions, the second task, required the ability to understand sentences, retain memory of whole sentences, and interpret semantic and syntactic elements (9). Almost all of the low comprehension patients could not answer the yes-no questions correctly because they were unable to grasp sentence word order, and unable to interpret the meaning of word and syntactic rules. The third task, sequential commands, consisted of long complex sentences with many vocabularies, complex syntactic structures and grammatical rules (9). This task required the ability to use digit memory, sentence recall, and the interpretation of semantic and syntactic

structures which required more than one cortical area (24). From observation, all aphasic patients had deficits in this sequential command task. The high comprehension aphasic group which had lesions sparing the postRolandic portion of the dominant hemisphere did very well on both the auditory word recognition and yes-no question tasks but, received low scores on the sequential commands task (see Appendix A-3). The results of this study agreed with those of Kertesz and Poole (1974), Ballard and Thompson (1999), and Roeltgen and Heilman (1984) (53,97,106). They found that Broca's, transcortical motor, conduction and anomic aphasics understood both auditory word recognition and yes-no questions tasks, but had difficulty in the sequential commands task.

5.2.3 Repetition

The repetition mean score of global aphasic patients was 1.38 (range = 0-4.6), while the repetition score of an isolation aphasic patient was 7.6. This result showed that a repetition score of 5 or below might separate global from isolation aphasia. This result agreed with the WAB classification criteria that a repetition score of 5 or below separated global from isolation aphasic (Table 1 p.39) (9). Kertesz and Poole (1974) and Kertesz (1979) also found that the repetition mean scores of global aphasic patients were 0.9 (SD = 1.5) and 0.2 (SD = 0.6) while the repetition mean scores of isolation aphasics were 7.8 (SD = 1.7) and 6.8 (SD = 1.7) (Tables 2,3) (9,97).

The repetition mean scores of Broca's, Wernicke's, transcortical motor and trsanscortical sensory aphasics were 5.1 (range = 2.0-7.6), 2.4 (range = 1.5-3.3), 8.5 (range = 8.5-8.6) and 8.9 (range = 8.2-10), respectively (Table 3). These results demonstrated that a repetition score of 8 could separate Thai Broca's and Wernicke's from transcortical motor and sensory aphasics. These results were similar to the WAB

classification criteria that a repetition score of 8 separated Broca's and Wernicke's from transcortical motor and sensory aphasics (Table 1 p.39) (9). Kertesz and Poole (1974) and Kertesz (1979) found that the repetition mean scores of transcortical motor and sensory aphasics were 8 or higher while the repetition mean score of Broca's and Wernicke's aphasics were all lower than 8 (Tables 2,3) (9,97). The results from the study of Coslett et al (1987) also showed that the repetition mean score of transcortical sensory aphasics was 8.6 (104).

In Thai fluent aphasics and high comprehension (conduction and anomic aphasic patients), the repetition mean scores were 5 and 9, respectively (Table 10). Since both types of aphasias sampled only one subject, the repetition scores of these two aphasics were very different. The results could not indicate the score which might separate them because the sample size of Thai conduction and anomic aphasics was too small. However, the results of this study agreed with Roltgen and Hoilman (1984). They found that the repetition score of conduction aphasic patients was 6.1 (53). Kertesz and Poole (1974) and Kertesz (1979) also found that the repetition mean scores of conduction aphasics were 5.0 (SD = 1.9) and 4.9 (SD = 1.6), while the repetition mean scores of anomic aphasics were 9.1 (SD = 0.9) and 9.1 (SD = 1.6) (Tables 2,3) (9,97).

From Computerized Tomographic studies (CT scan), Thai transcortical motor, transcortical sensory, anomic and isolation aphasic patients had lesions sparing the arcuate fasciculus and/or subcortical connections between Broca's and Wernicke's areas (see Appendix A-4). In contrast, Thai Broca's, Wernicke's, global and conduction aphasic patients had lesions involving the arcuate fasciculus and/or subcortical connections between Broca's and Wernicke's areas (see Appendix A-4). The arcuate fasciculus served as a transmission pathway between the auditory

association area, Wernicke's area, and Broca's area, the motor speech center. Lesions involving the arcuate fasciculus and/or subcortical connections between Broca's and Wernicke's areas usually caused disturbances in repetition (38,47). Thus, Thai Broca's, Wernicke's, global and conduction aphasic patients should receive lower scores on the repetition subtest than Thai transcortical motor, transcortical sensory, isolation and anomic aphasic patients.

From the results of this study, Thai Broca's, Wernicke's, global, and conduction aphasic patients had repetition deficits with various degrees. Global aphasic patients had the most severe repetition disorders. Some severe global aphasic patients failed to repeat even in one word but some repeated in one or two words with difficulty and frequently used neologisms. Their repetition deficits may be due to disorders in any or all of motor speech programming (1,24), short term memory (9,75), auditory comprehension (1,9,43). Broca's aphasics repeated only in one or two words and had phonemic paraphasias. In phrase and sentence level, Broca's aphasic patients repeated only the first or the last words of a phrase or sentence with difficulty. The repetition disturbances in these patients may be due to the motor speech programming disorders (1,24) and/or short term memory deficits (9,75). Wernicke's aphasic patients also had impairments in the repetition subtest even though they spoke fluently. These patients repeated only one or two words with phonemic paraphasias. Some Wernicke's aphasic patients repeated sentences with paraphasic distortions of the examiner's words, with the appearance of neologisms and irrelevant insertions. Their repetition deficits might be due to auditory comprehension disturbances (1,9,24) and/or short term memory deficits (9,75). The conduction aphasic patient had impaired repetition even though this patient had fluent speech and good auditory comprehension. This

disturbance of repetition was a feature of conduction aphasia (9,24). The conduction aphasic patient could repeat only one or two words but, in phrase and sentence levels, the patient repeated in wrong word order and repeated only the first or the last word of the sentences. The repetition deficits of this conduction aphasic patient may represent a selective dissociation between auditory input and the speech output system (9,24).

5.2.4 Naming

The naming mean scores of Thai global, isolation, Wernicke's, transcortical motor, conduction, Broca's, transcortical sensory and anomic aphasic patients were 1.09 (range = 0-4.5), 1.2, 2.85 (range = 0.4-5.3), 3.05 (range = 0.4-5.7), 4.80, 5.38 (range = 0-8.8), 6.79 (range = 5.2-7.8) and 7.7, respectively (Table 10). These results showed that all Thai aphasic syndromes had naming deficits with various degrees of severity. Among all the aphasic types, the anomic aphasic patient received the highest naming score on the naming subtest. When the scores of all subtests of Thai Adaptation of the Western Aphasia Battery were considered, the anomic aphasic patient did very well on fluency, auditory comprehension, repetition subtests but received the lowest score on the naming subtest. Rottgen and Hellman (1984) also found that the naming mean score of six anomic aphasic patients was 8.25 (SD = 1.21) while all other language subtests mean scores were higher (53). In differentiating the anomic aphasic patient from other aphasic syndromes, the naming subtest score should be relatively lower than the scores on the fluency, auditory comprehension, and repetition subtests.

From Computerized Tomographic studies (CT scan), most global aphasic patients had lesions involving the left preRolandic motor speech areas and/or subcortical connections, and the postRolandic auditory comprehension areas and/or subcortical

connections. Some global aphasic patients had more involved lesions in the parietal lobe and/or the occipital lobe. Most Broca's aphasic patients had lesions in the left preRolandic motor speech areas and/or subcortical connections, and some Broca's aphasic patients had more involved lesions in the parietal lobe and/or the temporal lobe. Wernicke's aphasic patients had lesions in the postRolandic auditory comprehension areas and subcortical connections, and one Wernicke's aphasic patient had more involved lesions in the parietal lobe. Most transcortical sensory aphasic patients had lesions involving the left border language zone in the postRolandic auditory comprehension areas and/or subcortical connections. Some transcortical sensory aphasic patients had more involved lesions in the parietal lobe. Transcortical motor aphasic patients had lesions in the left border language zone in the preRolandic motor speech areas and/or subcortical connections, and one transcortical motor aphasic patient had more involved lesions in the parieto-temporal lobes. The isolation aphasic patient had acute subdural hematoma with mild pressure effect on the left cerebral cortex. The conduction aphasic patient had a small lesion in the left temporo-parietal areas. The anomic aphasic patient had a small lesion in the left parietal white matter (see Appendix A-4). From the result of this study, global aphasic patients who had large and extensive lesions received the lowest mean score on the naming subtest (see Appendix A-4). In contrast to global aphasic patients, one Broca's aphasic patient who had a lesion only in the left frontal area received the highest score on the naming subtest (see Appendix A-4). The rest of the Broca's aphasic patients who had lesions not only in Broca's area but also in the parietal and/or subcortical connections areas received a lower score on the naming subtest (see Appendix A-4). The anomic aphasic who had a lesion only in the left parietal white matter also received a high score in the

naming subtest (see Appendix A-4). The lesions of anomia could not be localized because naming ability required complex functions of more than one cortical area including the occipital lobe, angular gyrus, Wernike's, and Broca's areas (1,43,45). The occipital lobe played a role in interpreting the visual form of object or picture, and the angular gyrus generated the conceptual information. Wernicke's area activated conceptual information to phonological form, and Broca's area converted it to a motor plan for naming. Thus, the degree of severity in naming might depend on the extension of lesions in the dominant hemisphere (1,45).

From the results of this study, all Thai aphasic patients had some degree of naming deficits. The naming subtest consisted of object naming, word fluency, sentence completion, and responsive speech (9). Object naming required the ability to use lexical knowledge (9). Among Thai aphasic groups, global aphasic patients performed the worst in this task. Their word finding difficulties were expressed through a variety of errors such as verbal paraphasias, phonemic paraphasias and neologisms which might indicate impairments in any or all of lexical knowledge, visual processing, motor articulatory programming, and inner auditory associating (43,86,88). Thai Wernicke's and transcortical sensory aphasic patients also had difficulty in retrieving the information relative to objects by using verbal paraphasia, circumlocutions, and substitutions of indefinite words. Their word finding difficulties might be due to disorders in lexical knowledge and inner auditory associating (1,87,89). These results agreed with Whitehouse, Caramazza, Zurif (1978) and Grober et al. (1980). Both studies postulated that anomia in Wernicke's aphasics resulted from the disruption of lexical knowledge (87,88). Thai Broca's and transcortical motor aphasic patients exhibited naming deficits by using phonemic paraphasias. The

phonemic paraphasias indicated the limitations in programming of motor articulatory movements (1,56). The result agreed with Grober et al. (1980) who suggested that the naming deficit in Broca's aphasics involved a disturbance of articulatory programming (88). The Thai conduction aphasic patient had difficulty in object naming, but this patient could promptly name the tested items with phonemic cues. His naming deficit might be due to phoneme selecting errors (43). The anomic aphasic patient had naming deficits and frequently using circumlocution. The patient might have difficulty organizing the concepts of target words (87,90). This finding agreed with those of Whitehouse, Caramazza, Zurif (1978) and Goodglass, Baken (1976). Both studies suggested that anomic aphasics used many circumlocution and indefinite words, and rarely produced neologisms or other paraphasias (87,90).

The second task, word fluency, required the ability to use lexical knowledge and semantic category memory (9,45). Most aphasic patients performed poorly in this task. The aphasic patients may have disorders in any or all of lexical knowledge, semantic category memory, and motor articulatory programming (9,43,45,86,88). The others two tasks, sentence completion and responsive speech, were easier than object naming and word fluency because the two tasks had stimulus contexts. Broca's, conduction, and anomic aphasic patients did well on these two tasks. However, both sentence completion and responsive speech tasks required auditory comprehension to understand the stimulus context. Wernicke's aphasic patients who had an impairment in auditory comprehension performed poorer than Broca's aphasic patients. Global aphasic patients did the worst in these tasks (Table 10). Their deficits may be due to disorders in any or all of auditory comprehension, lexical knowledge, and motor articulatory programming (9,86,88).

5.2.5 Reading

The reading mean scores of Thai global, transcortical motor, Wernicke's, transcortical sensory, Broca's, conduction, isolation and anomic aphasic patients were 26.81 (range = 0-64.5), 38.00 (range = 34.0-42.0), 41.25 (range = 3.5-95), 53.75 (range = 27-80), 61.82 (range = 26.0-100), 62, 87 and 92, respectively (Table 11). Based on the results of this study, all Thai aphasic types had reading deficits with various degrees of severity. Global aphasic patients received the lowest mean score on the reading subtest, while the anomic aphasic patient received the highest score on the reading subtest. It was also noted that the degree of reading deficits paralleled the auditory comprehension deficits (9,24,71). Thai Global, Wernicke's, transcortical sensory and transcortical motor aphasic patients who had low mean scores on the auditory comprehension subtest also received low scores on the reading subtest (Tables 10,11). Kertesz (1979) found that global, isolation, transcortical sensory and Wernicke's aphasic patients who had low mean scores on the auditory comprehension subtest received lower mean scores on the reading subtest than Broca's, conduction, and anomic aphasic patients (Table 4) (9). However, the reading scores of some types of Thai aphasic patients were different. One isolation aphasic patient had a low score on the auditory comprehension subtest (3.80) but received a high score on the reading subtest (87.0). One Broca's aphasic patient also received the maximum reading score of 100. These two subjects both graduated from higher education, earning bachelor degrees. These results might suggest that education background related to reading ability. Kertesz and Poole (1974) also indicated that educational levels would be more important in the reading tasks (97).

From Computerized Tomographic studies (CT scan), the cerebral lesions of aphasic patients were described in the previous section of this study (page 80-81). The results showed that Thai global aphasic patients who had large and extensive lesions received the lowest scores on the reading subtest (see Appendix A-4). One Broca's aphasic patient who received the maximum score on the reading subtest had a lesion only in the left frontal lobe. The anomic aphasic who had a lesion only in the left parietal white matter also had a high score on the reading subtest (see Appendix A-4). Reading ability required the network organization of more than one cortical area (1,30,38,49,50). Reading ability involved visual processing in the occipital lobe, inner auditory experience decoding in Wernicke's area, and information interpretation in the angular gyrus. If a written word was to be spoken, information was transmitted to Broca' s area (38,49). Thus, the degree of impairment in reading might depend on the extension of lesions in the dominant hemisphere (9,51).

From the results of this study, it was found that all aphasic syndromes had reading impairments of various degrees of severity. The reading subtest consisted of reading comprehension of sentences, oral reading of commands, and reading of written words, all of which assessed the severity of reading deficits (9). Reading comprehension of sentences required the ability to use visual processing, inner auditory experience decoding, and semantic and syntactic structures interpretation (9,24). Thai global aphasic patients performed the worst in this task. Wernicke's and transcortical sensory aphasic patients also performed poorly in reading comprehension of sentences. The reading deficits in global, Wernicke's, and transcortical sensory aphasic patients might have resulted from failure of any or all of visual association processing, auditory association, semantic, and syntactic interpreting (9,24,91).

Broca's aphasic patients had deficits in reading comprehension of sentences but their scores were higher than Wernicke's, global and transcortical sensory aphasic patients. They might have agrammatism relative to understanding some grammatical rules and/or some grammar difficulties regarding written words (9,92). The second task, the oral reading of commands, was scored for reading aloud and for performing the commands. This task required the ability to use motor articulatory movement, visual association processing, auditory association decoding and semantic interpreting (9). Global and isolation aphasic patients had deficits in both reading aloud and following the commands. Their deficits might be due to failure of any or all of motor speech programming, visual association processing, and semantic interpreting (9,24). Most Broca's and transcortical motor aphasic patients were able to perform the commands rather than reading aloud. They might have motor speech programming deficits which limited articulatory movement for reading aloud (5,93,94). These results agreed with Kertesz (1979) who suggested that Broca's and transcortical motor aphasic patients had an impairment in reading aloud because of their motor speech programming deficits (9). Some Broca's and transcortical motor aphasic patients had impairments both in reading aloud and performing commands which might be due to both semantic interpreting disorders and/or motor speech programming disorders (24,71). Most Wernicke's and transcortical sensory aphasic patients had difficulty in reading aloud and performing the commands. Their deficits might be due to disorders in any or all of auditory association, visual association processing, and semantic interpreting (24,92). Some transcortical sensory aphasic patients could read aloud without comprehending the commands. Their deficits might be the result of semantic interpretation disorders (24). The third task, the reading of written words, required an ability to understand and

recognize written words. This task was easy because there were pictures or objects as stimuli. Most aphasic patients could perform this task correctly except some severe global aphasic patients. These severe global aphasic patients might have deficits in any or all of interpretation of the written word, auditory association, and visual association processing (9,24,92,93).

5.2.6 Writing

The writing mean scores of Thai global, transcortical motor, conduction, transcortical sensory, isolation, Broca's, Wernicke's and anomic aphasic patients were 15.38 (range = 0-68.0), 20.5 (range = 15.0-26.0), 44.0, 41.62 (range = 2.0-85.0), 50.5, 50.86 (range = 2.0-100), 63.29 (range = 18.0-51.0) and 99.0, respectively. From the results, writing deficits were found in most Thai aphasic patients except one Broca's aphasic patient who received the maximum writing score of 100 (Table 11, Appendix A-3). It was noted that the degree of writing deficit paralleled with a speaking deficit (9,24). From the results, Broca's and global aphasic patients who had nonfluent speech received a lower writing mean score than Wernicke's aphasic patients who had fluent speech. Transcortical motor aphasic patients also received a lower writing mean score than transcortical sensory aphasic patients (table 11). Having lesions in the left frontal lobe and/or subcortical connections, the nonfluent aphasic patients also had an impairment in converting orthographic information into motor programming of handwriting movements (95).

Moreover, educational background would influence scores in the writing subtest. In the Thai Broca's aphasic group, 7 Broca's aphasic patients who had an educational level ranging from diploma to master degrees received a higher writing mean score (mean = 55.29) than 4 Broca's aphasic patients who had an educational level of

prathom 4 (mean = 43.13). In the Thai global aphasic group, 4 global aphasic patients who graduated with a diploma up to a Bachelor's degree received a higher writing mean score (mean = 23.6) than 4 global aphasic patients who graduated in prathom 4 to 6 (mean = 7.12) Kertesz and Poole (1974) and Roeltgen and Heilman (1984) also suggested that educational background would be important in the writing tasks (53,97).

The degree of severity in writing impairment might also depend on the extension of cerebral lesions in the dominant hemisphere. The results were similar to those of the reading subtest because the extensive lesions affected both reading and writing abilities (9,51). Thai global aphasic patients who had large and extensive lesions in the dominant hemisphere received the lowest writing mean score (see Appendix A-4). In contrast with global aphasic patients, one Broca's aphasic patient who had a lesion only in the frontal area obtained the maximum score on the writing subtest; one anomic aphasic patient who had a lesion only in the left parietal white matter received the near maximum score of 99.0 on the writing subtest (see Appendix A-4 and Table 11). These subjects are the same ones who got the lowest and highest scores in the reading subtest. Writing ability required complex functions in more than one cortical area (1,9,24). The complex functions combined linguistic, visual, kinesthetic and motor components (52). The supramaginal gyrus and deep part of insula converted phonemes to graphemes, and the angular gyrus responded in lexical spelling (53). The frontal lobe, or Exner's center, controlled motor input for writing (55), and the occipital lobe played a role in perceiving the visual information in written words. Thus, the degree of writing deficits might depend on the extension of lesions in the dominant hemisphere.

The writing subtest consisted of writing on request, dictation, copying, and the written output describing a picture, all of which assessed the severity of writing deficits (9). In writing on request, most Thai aphasic patients wrote their names and addresses correctly. It might be that one's name and address were very familiar words which were easy to write. However, some severe global aphasic patients had difficulty in writing their name or address. This might be due to disorders in any or all of lexical spelling, word recognition deficits, and motor programming relative to hand writing movement (24,44,95,107). In written output describing a picture, most global and transcortical motor aphasic patients had difficulty in performing this task. This deficit might be due to disorders in any or all of motor programming of handwriting movement, recognition of words, phoneme-grapheme conversions, lexical spelling, and visual association processing (24,44,95,107,108). Most Broca's aphasic patients also wrote only one or two words about the picture, and some wrote in simple sentences without using any prepositions or conjunctions. Their writings also showed spelling errors. These deficits might be due to any or all of problems in motor programming of handwriting movement, word recognition, phoneme-grapheme conversions, and agrammatism (9,95). Wernicke's and transcortical sensory aphasic patients had difficulty in sentence writing. Their writing showed that usage of low information verbs and nouns were reduced when compared with their speech. Both Wernicke's and transcortical sensory aphasic patients had spelling errors and wrong word order, but letters were well formed. They might have some disturbances in word recognition, lexical spelling, phoneme to grapheme conversion, and disconnection of auditory association (9,44,95,108). In dictation, most aphasic types had difficulty in writing dictation. Their deficits may be due to any or all of disturbances in auditory

perception, word recognition, lexical spelling, phoneme-grapheme conversions, and visual association processing (9,95). In the copying of words, most aphasic patients were able to copy words in a sentence, except some severe global aphasic patients could not perform this task. These severe global aphasic patients might have any or all of problems of motor programming of handwriting movement, word recognition, and visual association processing (9,95).

5.3 Are there any differences in the language abilities of aphasic patients and normal subjects?

The present study compared the language abilities of 30 aphasic patients and 30 normal subjects by using the Thai Adaptation of the Western Aphasia Battery test. The normal subjects were matched with the aphasic patients relative to age, gender, and educational level. The results showed that Thai normal subjects had significantly higher subtest mean scores on all subtests than did Thai aphasic patients ($p < .01$) (Table 13). These results agreed with Kertesz and Poole (1974) who studied the WAB using a normal group of 59 and 150 aphasic patients. Their control group was matched with aphasic patients relative to age, social and economic status, and intelligence. A comparison of language abilities on all subtests between the control group and aphasic patients group demonstrated that their differences were highly significant (97). Having lesions in the left dominant hemisphere caused disturbances in any or all language modalities, including speaking, auditory comprehension, repetition, naming, reading, and writing (9,24,36,37,39,40,47,48,51,55,58). Thus, Thai aphasic patients had lower scores on all subtests of Thai Adaptation of Western Aphasia Battery test than Thai normal subjects. From the results, Thai anomic aphasic patients, who had the mildest

aphasia, received the highest AQ scores (of the total group of aphasic patients) of 87.0 (Table 10), which were still lower scores than that the normal subjects who received the lowest AQ score of 94.7 (Table 8). It was noted that the lowest AQ score of 94.7 in the present study was higher than the cut score of 93.8 in Kertesz and Poole's study (Table 2). This might be because the AQ score of 93.8 from Kertesz and Poole's study was from patients with diffuse or subcortical brain damage but clinically no aphasia while the AQ score of 94.7 in the present study was obtained from normal subjects. The AQ score of 94.7 should be considered as a cut score for differentiation between Thai aphasic patients from Thai normal subjects.

The 29 Thai normal subjects received maximum scores on the fluency subtest. There was only one subject who scored 9. In contrast, none of the aphasic patients received a full score (10), and they had an overall fluency mean score of 3.83 (range = 0-9) (Table 9). Although the Thai fluent aphasic patients (Wernicke's, transcortical sensory, conduction and anomic aphasic patients) had fluent speech, their fluency mean score of 7.44 (range = 5-9) was lower than the fluency mean score of 9.96 (range = 9-10) of normal subjects (Tables 8,12). These aphasic patients spoke very fluently but they frequently used paraphasias and/or circumlocution. Their speech often contained complete sentences but the content might be irrelevant. From the results of this study, Thai aphasic patients received fluency scores lower than 10. These results agreed with those of Kertesz and Poole (1974) who found that all aphasic patients differed from a non-brain damaged control group in that their fluency scores were all below 10 (97).

In the auditory comprehension subtest, Thai aphasic patients received an auditory comprehension mean score of 5.63 (range = 1.65-9.9) (Table 9) while Thai normal

subjects received an auditory comprehension mean score of 9.88 (range = 9.5-10) (table 8). Although Thai anterior aphasic patients (Broca's, transcortical motor, conduction and anomic aphasic patients) had good auditory comprehension, their auditory comprehension mean score of 7.59 (range = 4.1-9.9) was lower than the auditory comprehension mean score (9.88) of normal subjects (range = 9.5-10) (Table 8,12). The sequential commands task consisted of long complex sentences and grammatical rules which required use of more than one cortical area to process and understand these sequential commands (9,24). Thus the anterior aphasic patients were relatively confused by complex sequential commands while all normal subjects received a full score on these sequential commands.

In the repetition subtest, Thai aphasic patients received a repetition mean score of 4.75 (range = 0-10) (Table 9), while Thai normal subjects received a repetition mean score of 9.92 (range = 9.4-10) (Table 8). Although the group of transcortical aphasics (transcortical sensory, transcortical motor, and isolation aphasic patients) had a higher repetition mean score than other aphasic types, these transcortical aphasic patients still received a repetition mean score of 8.39 (range = 6.2-10) which was lower than those of normal subjects (9.92, range = 9.4-10) (Table12). In the sentences repetition task, some sentences with increased length and grammatical complexity were complicated. The transcortical aphasic patients might have syntactic interpretation deficit and/or short term memory deficit and could not repeat long complex sentences (9,95). Instead, they omitted some words and used paraphasias in the sentence repetition.

In the naming subtest, the naming mean score of Thai normal subjects was 9.60 (range = 8.2-10), while Thai aphasic patients received a naming mean score of 4.00 (range = 0-8.8) (Tables 8,9). All of aphasic patients received a naming score below 9.

This result agreed with Kertesz and Poole (1974) who found that their group of aphasic patients differed from a non-brain damaged control group in that their naming mean score was below 9 (Table 2) (97). It might be that naming ability was a complex function which required more than one cortical area so all aphasic patients who had lesions in left cortical areas might have naming deficits.

Similarly to naming ability, reading and writing abilities were complex functions which required many cortical areas to process (24,30,38,123). Most aphasic patients who had lesions in more than one cortical area (see Appendix A-4) received lower reading and writing mean scores than Thai normal subjects. The reading and writing mean scores of Thai normal subjects were 96.25 (range = 66.5-100) and 92.41 (range = 43-100) respectively (Table 8) while those of Thai aphasic patients were 50.77 (range = 0-100) and 38.42 (range = 0-100), respectively (Table 9). These results agreed with Kertesz (1979) who studied reading and writing subtest results of the WAB on 22 non-dominant hemisphere lesions, 18 recovered patients, 69 normal subjects, and 225 aphasic patients. His results showed that the control group achieved significant higher total reading and writing mean scores than all 225 aphasic patients (Table 4) (9).

Conclusions

The present study compared the language abilities of 30 Thai aphasic patients and 30 normal subjects by using the Thai Adaptation of the Western Aphasia Battery. The normal subjects were matched with aphasic patients relative to age, gender and educational level. There were 20 male and 10 female aphasics and normal subjects, ranging in age from 24 to 76 years. Their educational level ranged from prathom 4 to master's degree.

The results in this study showed that the normal subjects had significantly higher subtest mean scores on all subtests and AQ mean scores than did the aphasic patients ($p < 0.01$) (Table13). The AQ score of 94.7, which was the lowest AQ score of normal subjects, was considered as a cut score which differentiated a normal person from an aphasic patient. The results also showed that the scores of aphasic patients obtained from the Thai Adaptation of the Western Aphasia Battery (WAB) agreed with their clinical diagnoses and WAB classification criteria. The Thai Adaptation of the WAB would classify aphasic patients into eight aphasic syndromes. A fluency score of 4 could separate nonfluent aphasic patients (global, Broca's, transcortical motor and isolation aphasic patients) from fluent aphasic patients (Wernicke's, transcortical sensory, conduction and anomic aphasic patients). A comprehension score of 4 or better could separate Broca's and transcortical motor aphasic patients from global and isolation aphasic patients, and a comprehension score of 7 or better could separate conduction and anomic aphasic patients from Wernicke's and transcortical sensory aphasic patients. A repetition score of 5 or better could separate isolation from global aphasic patients, and a repetition score of 8 or better could separate transcortical motor and sensory aphasic patients from Broca's and Wernicke's aphasic patients. Thus, the

Thai Adaptation of Western Aphasia Battery test appeared to be sensitive enough to differentiate normal persons from aphasic patients and to classify aphasic patients into eight aphasic syndromes. This differentiation and classification might be the basis for an appropriate plan of therapeutic procedures for the aphasic patient.

Recommendations

The recommendations from this study concerning further research and application are as follows:

1. The number of aphasic patients sampled in a future study should be increased in order to compare language abilities among each of the eight aphasic syndrome categories more accurately.
2. Neurological patients or brain-damaged patients without aphasia should be included in the subject group in order to find more accurately the cut point score separating aphasic patients from them.
3. High and low educational level subjects should be included in order to determine whether the results of the Thai Adaptation of Western Aphasia Battery test are dependent on educational level.
4. Intrajudge and interjudge reliabilities should be computed in order to further confirm that Thai Adaptation of Western Aphasia Battery is a reliable test.

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APPENDIX

Table A-1 Educational levels and gender of normal subjects and aphasic patients. Both groups were matched by age, sex, educational levels, and equal in number. (n=30 each)

Educational levels	Male	Female	Total
P.4 – P.6	7	5	12
M.1-M.3	2	-	2
M.4-M.6	-	-	-
Diploma	4	1	5
Bachelor degree	6	4	10
Master degree	1	-	1
Total	20	10	30

Table A-2 Raw data of each subtest of normal subjects

Normal Subjects	I.F. (10)	F. (10)	Y.N (60)	A.R (60)	S.C. (80)	R.P. (100)	O.N. (60)	W.F. (20)	R.S (10)	SC. (10)	R. (100)	W. (100)	AQ (100
1 (BA)	10	10	60	60	80	100	60	20	10	10	100	100	100
2 (BA)	10	10	60	60	80	100	60	20	10	10	100	100	100
3 (M7)	10	10	57	60	80	98	60	17	8	10	100	99	98.4
4 (DP)	10	10	60	60	80	100	60	20	10	10	100	100	99.6
5 (BA)	10	10	60	60	80	100	60	20	10	10	100	100	100
6 (P4)	10	10	57	60	80	95	60	16	6	8	97	88	96.6
7 (P4)	8	10	57	60	80	96	60	10	8	10	66.5	43	94.6
8 (P4)	10	10	54	60	80	96	60	9	10	10	100	100	96
9 (DP)	10	10	60	60	80	100	60	20	10	10	100	100	100
10 (P4)	10	10	57	58	80	100	60	16	6	10	100	88	97.8
11 (BA)	10	10	57	60	80	100	57	16	8	10	100	100	97.9
12 (P4)	10	10	57	59	80	100	57	20	10	10	100	95	99
13 (BA)	10	10	60	60	80	100	58	20	10	10	98	100	99.6
14 (BA)	10	10	60	60	80	100	60	20	10	10	100	100	100
15 (BA)	10	10	57	60	80	100	60	15	10	10	98	100	98.8
16 (BA)	10	10	60	60	80	100	60	20	10	10	100	100	100
17 (P4)	10	10	51	59	80	94	57	20	6	8	96	53	96
18 (BA)	10	10	60	60	80	100	60	17	10	10	100	100	99.4
19 (P4)	10	10	60	60	80	100	60	15	10	10	100	97	99
20 (DP)	10	10	51	60	80	100	60	15	10	10	96	98	98
21 (DP)	10	10	57	60	80	100	54	20	8	10	100	100	98.1
22 (DP)	10	10	54	60	80	100	60	20	10	10	100	100	99.4
23 (M3)	10	10	57	60	80	98	60	18	10	10	80	44.5	99.5
24 (P4)	10	10	60	60	80	98	60	18	10	10	80	98	99.2
25 (BA)	10	10	60	60	80	100	60	20	10	10	100	100	100
26 (P4)	10	10	57	59	80	100	53	9	10	10	80	98	96
27 (MA)	10	10	60	60	80	100	60	20	10	10	100	100	100
28 (P4)	10	10	57	60	80	100	56	20	10	10	93	96	98.9
29 (P4)	10	10	57	59	80	100	60	20	10	10	83	73	97.8
30 (P4)	10	9	60	60	80	100	60	20	10	10	100	100	96

I.F. = information content
F. = fluency
YN. = yes-no questions
AR. = auditory recognition
SC. = sequential commands
R.P. = repetition
ON. = objects naming
WF. = word fluency
RS. = responsive speech
SC. = sentence completion
R. = reading
W. = writing
P. = praxis

P. = prathom
M. = mathayom
DP. = diploma
BA. = bachelor degree
MA = master degree

Table A-3 Raw data of each subtest of aphasic patients.

Aphasic Patients	I.F. (10)	F. (10)	Y.N (60)	A.R (60)	S.C. (80)	R.P. (100)	O.N. (60)	W.F. (20)	R.S (10)	SC. (10)	R. (100)	W. (100)	AQ (100)
1 (BA)	9	4	57	60	80	76	57	11	10	10	100	100	84.4
2 (BA)	2	4	30	41	12	76	8	0	4	0	87	50.5	57.8
3 (M7)	3	4	42	37	12	85	4	0	0	0	42	26	40.9
4 (DP)	8	4	45	31	0	18	20	1	0	0	48	23.5	39.4
5 (BA)	8	4	58	45	29	63	39	7	6	6	36	56.5	64.4
6 (P4)	2	1	45	25	2	1	0	0	0	0	0	23.5	12.0
7 (P4)	8	4	58	59	80	52	48	12	10	10	92	61.5	70.1
8 (P4)	7	4	60	60	34	70	54	7	6	8	92	100	66.4
9 (DP)	9	5	54	56	14	82	51	10	6	8	70	85	71.8
10 (P4)	8	8	48	52	80	50	32	4	4	8	62	44	69.6
11 (BA)	9	9	54	53	8	82	56	4	10	8	38	25.5	75.4
12 (P4)	3	1	33	16	2	4	6	0	0	0	6	5	15.1
13 (BA)	8	4	57	55	8	60	44	7	6	7	53	53.5	60.8
14 (BA)	5	6	60	36	16	15	4	0	0	0	3.5	18	37.0
15 (BA)	0	1	36	29	6	1	4	0	0	0	34	3	10.0
16 (BA)	7	4	30	41	8	46	46	0.5	0	0	62	68	48.2
17 (P4)	4	2	48	44	6	46	22	0.5	4	3	36	3	36.9
18 (BA)	6	2	45	52	8	72	33	5	6	8	27	2	48.3
19 (P4)	8	8	48	37	8	92	33	5	6	8	27	2	78.3
20 (DP)	8	4	60	59	80	71	53	13	10	10	92	97	79.2
21 (DP)	8	2	54	56	40	14	36	3	3	5	86	54	47.2
22 (DP)	8	5	51	41	43	100	51	0.5	5	4	80	54	71.6
23 (M3)	1	2	33	21	4	2	10	0	0	0	64.5	0	14.2
24 (P4)	2	0	39	8	8	0	0	0	0	0	0	0	9.4
25 (BA)	9	8	57	59	80	90	46	13	10	8	92	99	87
26 (P4)	7	8	42	51	35	33	44	5	2	2	93	51	61
27 (MA)	5	2	51	26	6	18	7.5	3	0	2	40	24	28.7
28 (P4)	0	1	30	3	0	20	0	0	0	0	0	0	9.3
29 (P4)	6	2	42	47	14	86	49	0	6	2	34	15	54.8
30 (P4)	3	2	51	39	6	2	0	0	0	0	26	8	20

I.F. = information content
F = fluency
YN. = yes-no questions
AR. = auditory recognition
SC. = sequential commands
R.P. = repetition
ON. = objects naming
WF. = word fluency
RS. = responsive speech
SC. = sentence completion
S. = reading
X. = writing
P. = praxis

P. = prathom
M. = mathayom
DP. = diploma
BA. = bachelor degree
MA = master degree

Table A-4 Aphasic patients' demographic and medical data

No.	Sex	Age	Education	Time post onset (months)	Etiology	Computerized Tomography (CT scan)	Type of Aphasia	AQ
1.	M	25	BA.	12	Trauma	Left cerebral artery infarction in frontal lobe	Broca	84.4
2.	M	41	BA.	18	Trauma	Acute subdural hematoma	Isolation	57.8
3.	M	37	P.6	20	Trauma	Small intracerebral hematoma at left fronto-parieto-temporal lesions	Transcortical motor	40.9
4.	M	50	Diploma	49	Occlusion	Left middle cerebral occlusion at temporo-parietal region and anterior limb of the internal capsule	Global	39.4
5.	F	45	BA.	37	Hemorrhagic CVA	Left basal ganglia hemorrhage with intraventricular hemorrhage	Broca	64.4
6.	F	57	P.4	36	Occlusion	Large infarct at left temporo-parietal	Global	12.0
7.	F	39	P.4	9	Hemorrhagic CVA	Cerebral embolism left frontoparietal areas	Broca	70.1
8.	M	47	P.4	12	Hemorrhagic CVA	Subarachnoid hemorrhage	Broca	66.4
9.	M	24	Diploma	24	Trauma	Left parietal hematoma with mass effect causing midline shift	Transcortical sensory	71.8
10.	M	55	P.4	24	Trauma	Low density at left temporo-parietal lobe	Conduction	69.6
11.	M	59	Bsc.	59	Occlusion	Subacute cerebral infarction in left temporoparietal lobe due to occlusion of the insular brancles of the left middle cerebral artery	Transcortical sensory	75.4
12.	M	48	P.4	6	Brain abscess	Left basal ganglia and high parietal white matter with adjacent vasogenic brain edema	Global	15.1
13.	F	59	Bsc.	96	Hemorrhagic CVA	Atrophy of left parietal lobe, left pon and midbrain compatible with MCA territories	Broca	60.8

Table A-4 Aphasic patients' demographic and medical data

No.	Sex	Age	Education	Time post onset (months)	Eticlogy	Computerized Tomography (CT scan)	Type of Aphasia	AQ
14.	F	40	BA.	7	Trauma	Hemorrhagic transformation of the left temporoparietal areas	Wernicke	37.0
15.	M	76	BA.	6	Occlusion	Left basal ganglia-anterior and mid parietal lobe and left internal capsule lesions	Global	10.0
16.	M	64	BA.	40	Occlusion	Left temporo-frontal infarction	Global	48.2
17.	M	68	P.4	6	Occlusion	Hypodensity lesion at left corona radiata and left central semiovale	Broca	36.9
18.	F	61	BA.	7	Occlusion	Left basal ganglion and external capsule hematoma with surrounding brain edema	Broca	48.3
19.	F	69	P.4	6	Hemorrhagic CVA	Infarct of subcortical, basal ganglia, cord sign of both MCA	Transcortical sensory	78.3
20.	M	65	Diploma	6	Occlusion	Subacute infarct at the left temporal operculum, pareital operculum, left insular cortex with old hemorrage left external capsule without mass effect	Broca	79.2
21.	F	55	Diploma	6	Occlusion	Acute infarction involving left basal ganglia and left corona radiata	Transcortical sensory	71.6
22.	F	35	Diploma	6	Occlusion	Left basal ganglia hemorrhage	Broca	47.2
23.	M	67	M.3	6	Occlusion	Left fronto-temporal infarction	Global	14.2
24.	F	48	P.4	16	Occlusion	Left temporo-parietal region	Global	9.4

Table A-4 Aphasic patients' demographic and medical data

No.	Sex	Age	Education	Time post onset (months)	Etiology	Computerized Tomography (CT scan)	Type of Aphasia	AQ
25.	M	61	BA.	6	Hemorrhagic CVA	Left parietal white matter	Anomic	87.0
26.	M	74	P.4	36	Hemorrhagic CVA	Left cerebral atrophy temporal lobe and central peduncle	Wernicke	61.0
27.	M	51	MBA.	7	Hemorrhagic CVA	Left basal ganglia, thalamus, posterior limb of the internal capsule and fronto-temporal lobes	Broca	28.7
28.	M	75	P.4	9	Hemorrhagic CVA	Large subacute infarction of the whole left MCA distribution and smaller infarction of left occipital subcortical area	Global	9.3
29.	M	36	P.4	6	Hemorrhagic CVA	Left frontal with edema with pressure effect to left ventricle and subfalcine hernation	Transcortical motor	54.8
30.	F	53	P.4	24	Hemorrhagic CVA	Infarction at left temporoparietal area with eschemic foci or prominet perivascular space at both basal ganglia, hippocampus, periventicular white matter and centrum semiovale	Broca	20

Thai Adaptation of Western Aphasia Battery

1. พูดเอง

จดคำพูดของผู้ป่วยไว้ในกระดาษ บันทึกเทปหรือบันทึกภาพวิดีโอ ถ้าจำเป็นให้ดัดแปลงคำถามบางคำถามได้

วิธีการให้คะแนน พิจารณาจากเนื้อหาของข้อมูลและความคล่องในการพูด เช่น

1 วันนี้เป็นอย่างไรบ้าง

2 คุณเคยมาที่นี่ก่อนหรือเปล่า

3 คุณชื่ออะไร

4 บ้านของคุณอยู่ที่ไหน

5 คุณมีอาชีพอะไร

6 เล่าให้ฟังหน่อยว่าคุณมาที่นี่ทำไม หรือคุณมีปัญหาอะไร

7 บรรยายภาพ

วางภาพที่ 1 ไว้ตรงหน้าผู้ป่วยและพูดว่า "บอกซิว่าคุณเห็นอะไรบ้าง พยายามพูดให้เป็นประโยค" กระตุ้นให้ผู้ป่วยมองให้ทั่วภาพ เลื่อนภาพให้อยู่ตรงหน้าลานสายตาที่ปกติของผู้ป่วย เพื่อจะได้มองเห็นชัดเจน ถ้าผู้ป่วยพูดสั้นๆ เพียง 2-3 คำ ผู้ทดสอบควรกระตุ้นให้ผู้ป่วยพูดเป็นประโยคยาว ๆ ที่สมบูรณ์

คะแนนเต็ม 20

คะแนนที่ได้.....

การให้คะแนนข้อทดสอบ พูดเอง เช่น

1.1 เนื้อหา

(0) ไม่มีเนื้อหา (ไม่ตอบ)

(1) ตอบได้อย่างไม่สมบูรณ์ เช่น บอกชื่อหรือนามสกุลเพียงอย่างเดียว

(2) ตอบข้อใดข้อหนึ่งถูกเพียงข้อเดียว

(10) ตอบถูกหมดทั้ง 6 ข้อ รวมทั้งบรรยายภาพอย่างละเอียดถึงสิ่งต่างๆ และกิจกรรมต่างๆ โดยใช้ประโยคยาวๆ และซับซ้อน

1.2 การพูดคล่อง, ความสามารถในการใช้ไวยากรณ์อย่างถูกต้องแม่นยำและ Paraphasias เช่น

(0) พูดไม่เป็นคำและพูดสั้น ๆ ไม่มีความหมาย

(1) พูดถ้อยคำซ้ำๆ ซากๆ โดยมีการทำเสียงสูงต่ำคล้ายคำพูด มีความหมายบ้างไม่มีบ้าง

(2) พูดคำพยางค์เดียวอย่างตะกุกตะกักและเค้นเสียง และใช้ paraphasias บ่อยครั้ง

(10) พูดเป็นประโยคแบบปกติ ประโยคมีความซับซ้อนและมีความยาวเช่นคนทั่วไปพูด ไม่มีการพูดซ้ำๆ หยุดชะงักขาดเป็นช่วงๆ หรือพูดไม่ชัด ไม่มีparaphasias

2. การฟังเข้าใจคำพูด

2.1 คำถามใช่/ไม่ใช่

อธิบายให้ผู้ป่วยฟังว่าท่านกำลังจะถามคำถามที่ผู้ป่วยต้องตอบว่าใช่หรือไม่ใช่ ถ้าผู้ป่วยตอบไม่ได้ให้ใช้ท่าทางเช่น ถ้าต้องการตอบว่า "ใช่" ให้หลับตา ระหว่างกำลังทดสอบผู้ทดสอบถามคำถามซ้ำได้ แต่อย่าทำท่าบอกใบ้คำตอบ เช่น พยักหน้า พยายามพูดให้กำลังใจผู้ป่วยเมื่อผู้ป่วยพยายามตอบคำถามในกรณีที่ผู้ป่วยตอบแล้วเปลี่ยนใจตอบใหม่อีก ให้ถือคำตอบสุดท้ายเป็นคำตอบที่นำมาให้คะแนน ถ้าผู้ป่วยตอบแบบกำกวมหรือพูดเรื่อยเปื่อย ให้พูดทวนคำถามนั้นๆ ถ้าคำตอบยังกำกวมอยู่อีก ให้คะแนน 0 ข้อที่ตอบถูกต้อง ให้คะแนนข้อละ 3 คะแนน จดบันทึกคำตอบให้ตรงตามหัวข้อ คำพูด, ท่าทาง, กระพริบตา, พยักหน้า, ส่ายหน้า เช่น

คำพูด ท่าทาง กระพริบตา

1. คุณชื่อสมชายใช่หรือไม่ (คำตอบที่ถูกคือ ไม่ใช่)
2. คุณชื่อเปรมใช่หรือไม่ (คำตอบที่ถูกคือ ไม่ใช่)
3. คุณเป็นหมอใช่หรือไม่ (คำตอบที่ถูกคือ ไม่ใช่)
4. เดือนมีนาคมอยู่ก่อนเดือนมิถุนายนใช่หรือไม่
5. ม้าตัวใหญ่กว่าหมาใช่หรือไม่

คะแนนเต็ม 60
คะแนนที่ได้ .....

2.2 การฟังระลึกได้ระดับคำ

วางสิ่งของที่ใช้ทดสอบผู้ป่วยไว้ตรงหน้าผู้ป่วย ให้สิ่งของเหล่านั้นอยู่ในลานสายตาข้างที่ปกติของผู้ป่วย โดยเฉพาะผู้ป่วยที่มีปัญหาในการมองเห็นเพียงครึ่งเดียว ให้ผู้ป่วยดูภาพสิ่งของ รูปทรงต่างๆ ตัวหนังสือ ตัวเลข และสี สั่งให้ผู้ป่วยชี้ที่ของประดับบ้าน อวัยวะร่างกายและนิ้ว ดังรายการที่กำหนดให้ พูดสั่งซ้ำได้ 1 ครั้ง ถ้าผู้ป่วยชี้เกิน 1 อย่างในแต่ละครั้ง ให้ 0 คะแนน ผู้ป่วยจะได้คะแนนต่อเมื่อชี้อวัยวะได้ถูกต้องและถูกข้างด้วย ถ้าในห้องที่ทดสอบไม่มีของประดับบ้านดังที่กำหนดไว้ในรายการ ให้หาคำอื่นที่เหมาะสมแทน

คะแนนเต็ม 60
คะแนนที่ได้ .....

2.3 คำสั่งเป็นขั้นตอน

ให้คะแนนตามตัวเลขที่เขียนไว้เหนือคำสั่งแต่ละข้อ แม้ผู้ป่วยทำไม่ได้ถูกต้องครบบริบูรณ์ก็ได้คะแนนตามนั้น ในกรณีที่ผู้ป่วยขอให้พูดซ้ำหรือทำท่าสับสน ให้ผู้ทดสอบพูดซ้ำประโยคคำสั่งทั้งประโยค วางสิ่งของที่ทดสอบไว้ตรงหน้าผู้ป่วย เรียงลำดับดับนี้ ปากกา หวี และหนังสือ เรียกชื่อของแต่ละสิ่ง โดยพูดว่า "ดูนี่ปากกา หวี และหนังสือ" "คุณเห็นปากกา หวี และหนังสือไหม" "ฉันจะสั่งให้คุณชี้สิ่งของเหล่านี้และทำตามที่ฉันบอก" "พร้อมหรือยัง" ถ้าผู้ป่วยมีทีท่าว่าไม่เข้าใจคำสั่งให้สาธิตให้ดูด้วยการสั่ง "ใช้หวีชี้ปากกา" แล้วเริ่มทดสอบ เช่น

	คะแนน
ยกมือขึ้น	2
หลับตา	2

ชี้ปากกาแล้วชี้หนังสือ	4
ใช้หนังสือชี้หวี	8
วางหวีไว้ข้างๆ ปากกาและเปิดหนังสือ	20

คะแนนรวม 80
คะแนนที่ทำได้.....

3.พูดตาม

ให้ผู้ป่วยพูดตามรายการคำต่อไปนี้ จดจำคำพูดของผู้ป่วยไว้ด้วย ให้ผู้ทดสอบพูดซ้ำได้ 1 ครั้งถ้าผู้ป่วยขอร้องหรือทำท่าว่าไม่ได้ยิน ในกรณีที่ผู้ป่วยพูดตามได้ไม่ถูกต้องทั้งหมด ให้คะแนน 2 คะแนนสำหรับคำที่ฟังออก ถ้าผู้ป่วยพูดไม่ชัดเล็กน้อย (dysarthric errors) หรือพูดสำเนียงภาษาถิ่น ให้คะแนนเป็นถูก แต่ถ้าเรียงลำดับคำผิดให้หัก 1 คะแนน และถ้าใช้คำอื่นมาแทน (literal paraphasias) ให้หัก 1 คะแนน เช่นเดียวกัน เช่น

	คะแนน
2	
1. เตียง	2
2	
2.จมูก	2
2 2	
3. สี่สิบห้า	4
2 2 2	
4. เก้าสิบห้าเปอร์เซ็นต์	6
2 2 2 2 2 2	
5. เขาจะไม่กลับมาแล้ว	12
2 2 2 2 2	
6. กรมทหารมหาดเล็กรักษาพระองค์	10
2 2 2 2 2 2 2 2 2	
7. บรรจุไข่ห้าโหลลงในกระเป๋าของฉัน	18

คะแนนเต็ม 100
คะแนนที่ได้.....

4.การเรียกชื่อ

4.1 บอกชื่อสิ่งของ

ให้ผู้ป่วยดูสิ่งของที่ละอย่างเรียงตามลำดับดังใบรายชื่อตามบัญชี ถ้าผู้ป่วยดูสิ่งของนั้นแล้วไม่สามารถบอกชื่อหรือบอกผิด อนุญาตให้ผู้ป่วยจับต้องสิ่งของนั้น ถ้ายังบอกผิดอีก ให้แนะด้วยการบอกใบ้เสียงพยัญชนะ หรือส่วนของคำ หรือความหมายของคำนั้น เช่น พูดพยางค์แรกแต่ละข้อ ให้เวลาในการตอบไม่เกิน 20 วินาที ถ้าตอบถูกแต่พูดไม่ชัดเล็กน้อย ให้ 3 คะแนน ถ้าพูดไม่ชัดมาก (phonemic paraphasia) แต่พอฟังออกว่าเป็นคำใด ให้ 2 คะแนน แต่ถ้าต้องบอกใบให้ด้วยการแนะเสียงพยัญชนะหรือให้ใช้ความรู้สึกสัมผัส ให้ 1 คะแนน

สิ่งของ	คำตอบ	สัมผัสแตะต้อง	บอกใบ้เสียง	คะแนน
ปืน				
ลูกบอล				
แปรงสีฟัน				
ช้อน				

คะแนนเต็ม 60
คะแนนที่ได้ .....

4.2 การพูดคล่อง

ให้ผู้ป่วยบอกชื่อสัตว์ให้ได้มากที่สุดเท่าที่จะมากได้ในเวลา 1 นาที ถ้าผู้ป่วยทำท่าลังเล ให้ช่วยแนะว่า " นึกชื่อสัตว์เลี้ยง เช่น ม้า หรือพวกสัตว์ป่า เช่น เสือ" เตือนผู้ป่วยได้เมื่อเวลาผ่านไปแล้ว 30 วินาที ให้ 1 คะแนนสำหรับชื่อสัตว์แต่ละชื่อ (ยกเว้นเสือที่นำมาเป็นตัวอย่าง) ถ้าพูดไม่ชัดแบบ literal paraphasia ก็ให้คะแนน

คะแนนเต็ม 20
คะแนนที่ได้ .....

4.3 เติมประโยคให้สมบูรณ์

ให้ผู้ป่วยพูดเติมข้อความที่ผู้ทดสอบพูด เช่น "น้ำแข็ง....(เย็น)" ถ้าตอบถูกต้องให้ 2 คะแนน ถ้าออกเสียงอื่นแทน (phonemic paraphasia) ให้ 1 คะแนน ถ้าผู้ป่วยตอบแบบเป็นเหตุเป็นผลกันก็ให้คะแนน เช่น "น้ำตาล....(ทำให้อ้วน) แต่หญ้าไม่ใช่....(สีน้ำตาล)"

1) หญ้ามีสี....(เขียว)
2) น้ำตาลมีรส....หวาน

คะแนนเต็ม 10
คะแนนที่ได้.....

4.4 การพูดโต้ตอบ

ให้ 2 คะแนนถ้าพูดโต้ตอบถูกต้อง 1 คะแนนถ้าใช้ phonemic paraphasia

1) คุณใช้อะไรเขียน (ปากกา ดินสอ)

2) หมอกสีอะไร (ขาว)

คะแนนเต็ม 10

คะแนนที่ได้.....

5. การอ่าน

5.1 ความเข้าใจในการอ่านระดับประโยค

	คะแนน
1. ทหารถือ.....	2
ปืน	
ยิง	
ฟืน	
ของชำ	
2. คุณสมศักดิ์ซ่อมรถยนต์และรถบรรทุก เขาเป็น.....	4
ช่างตัดเสื้อ	
เครื่องยนต์	
ช่างเครื่องยนต์	
รถประจำทาง	
3. ปกติแล้วเรามีแหล่งพลังงานอย่างเหลือเฟือ แต่เนื่องจากน้ำมันขาดแคลน ชาติต่างๆ จึงพยายามค้นหาแหล่งพลังงานทดแทน เช่น.....	8
น้ำเดือด	
ธนาคาร	
ก๊าซธรรมชาติ	
เศรษฐกิจ	

คะแนนเต็ม 40

คะแนนที่ได้.....

5.2 อ่านแล้วทำตามคำสั่ง

ให้ผู้ป่วยดูบัตรแต่ละใบ และพูดว่า "ฉันต้องการให้คุณอ่านข้อความในบัตรดังๆ แล้วทำตามคำสั่งในบัตรนี้" ถ้าผู้ป่วยทำตามคำสั่งเพียงบางส่วน ให้พูดซ้ำได้ ถ้าผู้ป่วยอ่านหรืออ่านมี paraphasias หรือปฏิบัติได้เพียงบางส่วนของคำสั่ง ก็ให้ครึ่งคะแนน

	อ่านดังๆ	ทำตาม
1.ยกมือขึ้น	1	1
2.ชี้เก้าอี้แล้วชี้ประตู	2	2
3.หยิบดินสอ เคาะ 3 ที แล้ววางไว้ที่เดิม	3	3

ถ้าอ่านข้อทดสอบย่อย 5.1 และ 5.2 แล้วคะแนนรวมกันได้ 50 หรือมากกว่า ให้เลิกทำข้อทดสอบการอ่านนี้ แล้วให้คะแนนดังนี้ คะแนน = 100 – 2 (60 – คะแนนที่ผู้ป่วยทำได้) ถ้าคะแนนจากแบบทดสอบย่อยรวมกันแล้วไม่ถึง 50 ให้ทดสอบต่อไปจนเสร็จ

คะแนนปรับ.....

คะแนนเต็ม 20
คะแนนที่ได้.....

5.3 จับคู่คำอ่านกับของจริง

วางสิ่งของแบบสุ่มไว้ตรงหน้าผู้ป่วย สั่งให้ชี้สิ่งของ ซึ่งตรงกับคำในบัตรที่ 22 – 27 ถ้าทำถูกต้อง ให้คะแนนข้อละ 1 คะแนน

คะแนนเต็ม 6
คะแนนที่ได้.....

5.3 จับคู่คำกับภาพ

วางบัตรภาพที่ 2 ไว้ตรงหน้าผู้ป่วย บอกให้ผู้ป่วยชี้ที่ภาพซึ่งตรงกับคำในบัตรคำ ใช้คำในบัตรที่ 22 – 27 ให้ดูทีละบัตร ให้คะแนนถ้าตอบถูก

คะแนนเต็ม 6
คะแนนที่ได้.....

5.5 จับคู่ภาพกับคำ

วางบัตรที่ 34 ซึ่งมีรายการคำที่ต้องการทดสอบไว้ตรงหน้าผู้ป่วย บอกให้ผู้ป่วยชี้คำซึ่งตรงกับภาพในบัตร 28 – 33 ในการทดสอบวางบัตรภาพทีละภาพ ถ้าทำถูกต้องให้ข้อละ 1 คะแนน

คะแนนเต็ม 6
คะแนนที่ได้.....

5.6 จับคู่คำพูดกับคำเขียน

ใช้บัตรที่ 35 –38 สั่งให้ผู้ป่วยหาคำที่ตรงกับคำที่ผู้ทดสอบพูด โดยเลือกจากคำกลุ่มละ 5 คำ เช่น "ชี้กระดาษ" ให้ 1 คะแนนถ้าตอบถูก

คะแนนเต็ม 6
คะแนนที่ได้.....

5.7 การแยกความแตกต่างของตัวอักษร

ถ้าคะแนนที่ผู้ป่วยทำได้จากการชี้บอกตัวอักษรในแบบทดสอบการจำระลึกได้ระดับคำเป็น 3 คะแนนหรือน้อยกว่า ให้ใช้การจับคู่ตัวอักษรเดี่ยวๆ โดยใช้ตัวอักษรที่ตัดจากกระดาษ แล้วให้ผู้ป่วยจับคู่กับตัวอักษรบัตรที่ 4 ใช้ตัวอักษร ค ง น พ ร ส

คะแนนเต็ม 6
คะแนนที่ได้.....

5.8 การจำระลึกคำได้จากการสะกดให้

ผู้ทดสอบสะกดคำให้ผู้ป่วยฟัง เพื่อให้ผู้ป่วยพูดออกเสียงคำๆ นั้น ถ้าผู้ป่วยไม่เข้าใจวิธีการทดสอบให้ผู้ทดสอบทำตัวอย่างให้ดู โดยใช้คำที่ไม่อยู่ในรายการคำที่จะใช้ทดสอบจริง ให้ 1 คะแนนสำหรับคำที่ออกเสียงถูก

ก – า (กา)
คะแนนเต็ม 6
คะแนนที่ได้.....

5.9 การสะกดคำ

ให้ผู้ป่วยสะกดคำในรายการข้างล่างนี้ โดยผู้ทดสอบพูดออกเสียงคำแต่ละคำให้ฟัง ลองยกตัวอย่างเช่น "หมา" "ห – ม – า" ถ้าผู้ป่วยไม่เข้าใจวิธีทดสอบ ให้ 1 คะแนนสำหรับคำที่สะกดถูก

แมว
บ้าน

คะแนนเต็ม 6
คะแนนที่ได้.....

6. การเขียน

ใช้กระดาษไม่มีเส้น เขียนชื่อผู้ป่วยและวันที่ทำการทดสอบไว้ที่หัวกระดาษ

6.1 เขียนตามคำสั่ง

ให้ผู้ป่วยเขียนชื่อ ที่อยู่ ถ้าเขียนคำหรือตัวเลขถูก ให้ 1 คะแนน ถ้าสะกดผิดหรือเขียนผิดแบบ paraphasia ให้ครึ่งคะแนน

คะแนนเต็ม 6
คะแนนที่ได้.....

6.2 เขียนเอง

ให้ดูภาพในบัตรที่ 1 บอกให้ผู้ป่วย "เขียนเรื่องเกี่ยวกับสิ่งที่เกิดขึ้นในภาพ" ให้เวลา 3 นาที ถ้าผู้ป่วยเขียนเป็นคำๆ กระตุ้นให้เขียนเป็นประโยคยาวๆ ถ้าเขียนบรรยายภาพได้ครบถ้วนให้ 34 คะแนน ถ้าเขียนเป็นประโยคที่สมบูรณ์ประกอบด้วยคำตั้งแต่ 6 คำขึ้นไป ให้คะแนนประโยคละ 8 คะแนน ถ้าเขียนเป็นประโยคสั้นๆ หรือเป็นประโยคที่ไม่สมบูรณ์ แต่มีคำที่เกี่ยวข้องกับภาพให้คำละ 1 คะแนน ถ้าตัวสะกดผิดหรือมี paraphasias ให้หักทีละครึ่งคะแนน ให้คะแนนคำโดด ๆ คำละ 1 คะแนน แต่รวมกันแล้วไม่เกิน 10 คะแนน ไม่หักคะแนนเรื่องเครื่องหมายวรรคตอน

คะแนนเต็ม 34
คะแนนที่ได้.....

6.3 การเขียนตามคำบอก

ให้ผู้ป่วยเขียนประโยค "บรรจุไข่ห้าโหลลงในกระเป๋าของฉัน" ถ้าผู้ป่วยจำได้ไม่หมด ให้แบ่งวรรคสั้นๆ และพูดซ้ำได้ ถ้าเขียนได้ถูกต้องสมบูรณ์ ให้ 10 คะแนน หรือให้ 1 คะแนนสำหรับคำทุกคำที่เขียนได้ถูกต้อง หักครึ่งคะแนนสำหรับคำที่เขียนผิด หรือเขียนผิดแบบ paraphasic error

คะแนนเต็ม 10
คะแนนที่ได้.....

ให้เลิกทดสอบการเขียน ถ้าผู้ป่วยได้คะแนนรวม 40 ขึ้นไปจากข้อทดสอบย่อย 6.1, 6.2, 6.3 และให้ปรับคะแนนการเขียนดังนี้ คะแนนปรับ = 2 เท่าของคะแนนจริงที่ผู้ป่วยทำได้

คะแนนปรับ.....

6.4 เขียนตามคำบอกหรือดูบัตรคำแล้วเขียน

ให้ผู้ป่วยเขียนตามคำบอก ถ้าผู้ป่วยไม่เข้าใจให้ดูวัตถุของจริงหรือทำท่าทางบอกให้ผู้ป่วยเขียนคำนั้นๆ ถ้าผู้ป่วยยังทำไม่ได้ (จำไม่ได้หรือเขียนไม่ได้เลย) ให้ผู้ทดสอบสะกดคำปากเปล่า และถ้าผู้ป่วยยังทำไม่ได้อีก ให้ผู้ป่วยเรียงพยัญชนะที่จัดให้ ให้เป็นคำ โดยพยัญชนะอื่นนอกจากพยัญชนะที่ใช้ในการสะกดคำนั้นๆ เพิ่มอีก 2 ตัว หักครึ่งคะแนนถ้าเรียงพยัญชนะผิดหนึ่งตัว

คะแนนเต็ม 10
คะแนนที่ได้.....

6.5 ตัวอักษรและตัวเลข

บอกให้ผู้ป่วยเขียนตัวอักษรและตัวเลขจาก 0 ถึง 20 ให้คะแนนตัวละครึ่งคะแนน แม้ว่าจะไม่เรียงตามลำดับ

1 ตัวอักษรจาก ก – ฮ

2 ตัวเลขจาก 0 – 20

คะแนนเต็ม 12.5 (ตัวอักษร)
คะแนนที่ได้.....

คะแนนเต็ม 10 (ตัวเลข)
คะแนนที่ได้.....

6.6 เขียนตัวอักษรและตัวเลขตามคำบอก

ให้ผู้ป่วยเขียนตัวอักษรและตัวเลขตามคำบอก ให้คะแนนครึ่งคะแนนสำหรับตัวอักษรแต่ละตัวที่เขียนถูก และให้ 1 คะแนนสำหรับตัวเลขแต่ละตัวที่เขียนถูก

1 เขียนตัวอักษร ต ม จ บ ฟ

2 เขียนตัวเลข 5, 61, 32, 700, 1867

คะแนนเต็ม 2.5 (ตัวอักษร)
คะแนนที่ได้.....

คะแนนเต็ม 5 (ตัวเลข)

คะแนนที่ได้.....

6.7 ลอกคำในประโยค

ให้ดูบัตรที่ 39 ซึ่งมีประโยคเขียนไว้แล้ว บอกให้ผู้ป่วยลอกประโยคนั้น คำที่เขียนถูกให้คำละ 1 คะแนน ถ้าลอกตามถูกต้อง ให้ 10 คะแนน หักครึ่งคะแนนสำหรับตัวอักษรที่เขียนผิดแต่ละตัว

คะแนนเต็ม 10

คะแนนที่ได้.....

7. การทดสอบ Apraxia

พูดกับผู้ป่วยว่า "ฉันจะให้คุณทำอะไรอย่างหนึ่ง พยายามทำให้ดีที่สุด" สาธิตให้ดูถ้าผู้ป่วยไม่เข้าใจคำสั่ง ถ้ายังทำไม่ได้ให้เอาของจริงให้ดู (สำหรับที่มีเครื่องหมาย * กำกับ) ถ้าปฏิบัติได้ถูกต้องโดยไม่ต้องสาธิตหรือใช้สิ่งของ ให้ 3 คะแนน ถ้าทำได้เหมือนที่สาธิตให้ดู ให้ 2 คะแนน ถ้าทำได้ใกล้เคียงกับที่สาธิตหรือทำได้โดยใช้ของจริง ให้ 1 คะแนน ถ้าผู้ป่วยใช้อวัยวะของร่างกายแทนของจริง ให้ 2 คะแนน (ตัวอย่าง เช่น ใช้นิ้วแทนหวีในการหวีผม)

	คำสั่ง	เลียนแบบ	พร้อมสิ่งของ
ร่างกายส่วนบน 1. กำหมัด 2. ดีดนิ้ว			
ใบหน้า 3. แลบลิ้น 4. เป่าเทียนให้ดับ*			
เครื่องมือ 5. ใช้หวี* 6. ใช้ฆ้อน*			
ประสมประสาน 7. ทำท่าขับรถ 8. ทำท่ารีดผ้า			

คะแนนเต็ม 60

คะแนนที่ได้.....

บันทึกคะแนน

	สูงสุด	คะแนนที่ทำได้	คะแนนรวม AQ
พูดเอง			
เนื้อหา	10		
การพูดคล่อง	10		
รวม	20		
ความเข้าใจ			
คำถามใช่ – ไม่ใช่	60		
การฟังระลึกได้ระดับคำ	60		
คำสั่งเป็นขั้นตอน	80		
รวม			
(หารด้วย 20) เมื่อทำเป็น AQ	10		
พูดตาม	100		
รวม			
(หารด้วย 10)	10		
การเรียกชื่อ			
บอกชื่อสิ่งของ	60		
การพูดคล่อง	20		
เติมประโยคให้สมบูรณ์	10		
การพูดโต้ตอบ	10		
รวม			
(หารด้วย 10)	10		
Aphasia Quotient			
(บวกคะแนนรวมและคูณด้วย 2 เมื่อทำเป็น AQ			
การอ่านและการเขียน			
การอ่าน	100		
การเขียน	100		
รวม			
(หารด้วย 10)	20		
Praxis	60		
รวม			
(หารด้วย 6)	10		

BIOGRAPHY

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