Understanding Aphasia in a Simplified Manner

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Abstract

Speech disorders including aphasia and dysarthria are common neurological disorders. Aphasias are commonly seen with stroke. This part of neurological examination frightens many physicians probably because of the great volume and complexity of literature on this topic. Therefore we present here a simplified and easy approach towards the understanding and examination of these disorders.

Key words: Aphasia, language, speech disorders.

Definitions

Speech is a highly evolved function of the cerebral cortex. Speech is the human faculty by which thought processes are symbolically expressed. Speech is the vocal form of human communication. It is based upon the syntactic combination of lexicals and names that are drawn from very large vocabularies (usually > 10,000 different words). Each spoken word is created out of the phonetic combination of a limited set of vowels and consonant speech sound units.

Components of speech

Speech is the mechanical function of one’s ability to communicate in oral language. It includes language production, phonation, and articulation.

Language

Language is the symbolisation of ideas. It is the ability to convert thoughts into comprehensive words. It consists of five parameters i.e., speaking, hearing, repeating, reading, and writing.

Speech and hemispherical dominance

Speech is the function of the cerebral hemisphere. It is undertaken by the dominant hemisphere. 9 out of 10 humans have right handedness. 90% of humans also have left hemispherical dominance. The other 10% have left handedness. 7% out of these 10% have left hemispherical dominance. 3% out of the 10% have right hemispherical dominance. Thus 97% of humans have left hemispherical dominance. Only 3% have right hemispherical dominance.

Pathological symptoms related to language functions:

<table>
<thead>
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<th>Pathological symptoms related to language functions:</th>
<th>Explanation</th>
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<td>Language related symptom</td>
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<td>Literal (phonematic) paraphasia</td>
<td>Words with false or left-out sounds</td>
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<td>Verbal (semantic) paraphasias</td>
<td>Wrong or inadequate words</td>
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<td>Neologisms</td>
<td>Non-existent words</td>
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<td>Anomia</td>
<td>Word retrieval difficulties</td>
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<td>Agrammatism</td>
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<td>Stereotypes</td>
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<td>Dysarthria</td>
<td>Disturbance of articulation</td>
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<tr>
<td>Dysprosody</td>
<td>Disturbance of speech melody or rhythm</td>
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<tr>
<td>Alexia</td>
<td>Disturbance of reading</td>
</tr>
<tr>
<td>Agraphia</td>
<td>Disturbance of writing</td>
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Wernicke’s area

The auditory comprehension of spoken speech takes place in the posterior end of the superior temporal gyrus. Karl Wernicke, a German neurologist, identified it and described the pathway connection to Broca’s area via the arcuate fasciculus. This area is neuroanatomically described as the Brodmann area 22.

Broca’s area

The motor area for spoken speech is situated in the posterior part of the left inferior frontal gyrus. Paul Broca, a French Surgeon, described it in 1865 in two patients who lost speech and showed a lesion in the lateral frontal lobe at autopsy. This area is neuroanatomically described as the Brodmann area 44 and 45.

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Conduction area
A deep, white matter tract, connecting the Wernicke's area to the Broca's area, also called arcuate fasciculus, derived from a Latin word meaning curved bundle neural tract, is important in dominant hemisphere lesions. Damage to the arcuate fasciculus leads to conduction aphasia: repetition deficits arise following damage to the arcuate fasciculus of the dominant hemisphere.

Exner's area
It is an area of the brain just above Broca's area and anterior to the primary motor control area. It is the area for writing, close to the area for hand movement. Damage to it results in agraphia. This area is neuroanatomically described as the Brodmann area 6.

Reading area
It is an area of the brain just medial to the left occipital lobe and in the splenium of the corpus callosum. It is the centre for reading. It receives impulses from the eye and transmits them to the association area for analysis by red matter, then passes it on to the arcuate fasciculus. A lesion here causes pure word blindness. This area is neuroanatomically described as Brodmann area 17.

Speech disorders are of 4 types
1. Aphasia/dysphasia
2. Anarthria/dysarthria
3. Aphonia/dysphonia
4. Mutism

Definitions
Aphasia: Loss of language due to dysfunction in the central mechanism of the brain is called aphasia. Minor disorders of the same is called dysphasia, e.g., right hemiplegia producing dysphasia.

Dysarthria: Dysfunction of the peripheral mechanism of speech leading to defective articulation is termed dysarthria, e.g., lower motor neuron type of facial palsy, pseudobulbar palsy.

Dysphonia: Loss of voice due to dysfunction of the voice producing mechanism is called dysphonia, e.g., vocal cord palsy, acute laryngitis.

Alexia: Loss of ability to read is alexia.
Agraphia: Loss of ability to write is agraphia.

Approach to diagnosing aphasia/dysphasia
What is Aphasia?
- disturbance of comprehension and formulation of language (i.e., higher neuropsychologic functions)
- affection of language related functions: reading and writing
- produced by damage of cortical regions related to language functions
- reasons of damage: stroke, head injury, or cerebral tumours
- different major aphasia syndromes

Analysis of aphasia
1. Sensory component: comprehension
2. Motor component: articulation, fluency, repetition, naming, writing

Testing spontaneous speech
Fluency: See whether speech is fluent without hesitations, uninterrupted by searching for a forgotten word
Effort taken for speech: See whether the patient has effortless/effortful speech
Vocabulary: See whether there is any word-finding difficulty. Whether patient stammers and stumbles. Look for ability to speak in full sentences, or whether the patient is able to talk only in phrases
Grammer: See whether the grammer is correct or not

Testing comprehension
Whether patient can hear and understand speech?
Tested by asking the patient to obey a command. Ask the patient to show the tongue, close the eyes, lift a limb.
Whether fluency is preserved or not? Speech whether fluent, i.e., without hesitations? Is it incessant, rapid, and uninterrupted?
Use of paraphasias, a descriptive phrase instead of a forgotten word. Use of neologisms, invented words and nonsense words. Jargon speech, an extreme example of the above speech, devoid of meanings.

**Testing repetition**

Patient is asked to repeat a simple sentence. It has to be clearly stated by the examiner, e.g., today is Wednesday, August the 17th, 2009. See whether the patient is able to repeat what you say. Remember never to shout at an aphasic patient, as hearing is usually normal in these patients. A patient with a left frontal lesion can repeat simple words and phrases. A patient with posterior lesions in the angular gyrus, cannot repeat what the examiner says. This is the characteristic feature of conduction aphasia. This function is preserved in transcortical aphasia.

**Testing for naming**

The patient is shown an object and asked to name it. A commonly used object should be shown, e.g., a pen or match box. See whether the patient is able to name the object. Patient may be handed over the object, or asked to demonstrate the use of the object. In anomic aphasia or nominal aphasia, the patient is unable to name it however but can use it. Auditory comprehension, repetition, reading and writing are usually preserved in such a patient. Memory testing otherwise will be normal.

Other tests to be done

Ask the patient to read from a command. See whether he answers a written question. See whether he obeys commands which are written down. Ask the patient to read aloud, to write name and address, to draw a picture or clock, or do small calculations, e.g., 4 + 4.

**Aphasia syndromes**

1. **Broca’s aphasia**

   **Non-fluent telegraphic speech**

   Reduced verbal content and phrase length – generally less then four-word agrammatical sentences (or with frequent errors). Mostly content words are used (nouns and verbs). There is absence of functional words (prepositions and conjunctions). The matter is conveyed anyway. Functional comprehension is present, but the patient has trouble following complex grammatical statements. Reading aloud is not possible.

   Cause: Middle cerebral artery (MCA) territory stroke involving the left frontal lobe

2. **Wernicke’s aphasia**

   **Jargon speech**

   Fluency increased, increased verbal content, para-grammatism – speech running, phrase length – generally greater than five words. Grammatical sentences (or close to normal). Paraphasic errors (literal or verbal). Literal – sound substitution with errors (winging, ringing), semantic – word substitution (sister for mother). Neologisms (made-up words). Logorrhoea – inability to stop speaking, severely impaired auditory comprehension. Cause: Middle cerebral artery territory stroke involving the left superior temporal lobe.

3. **Conduction aphasia**

   **Repetition defect**

   It is relatively uncommon. Spontaneous speech is fluent, and there is considerable word finding difficulty. Preserved auditory comprehension. Significant difficulty with repetition. Literal paraphasia, self correction, numerous pauses, filled pauses – Aaaaa Aaaaa, reading deficit – variable, writing deficit – variable.

   Lesion: left superior temporal area, supramarginal gyrus.

4. **Nominal aphasia**

   **Primary deficit – word finding and naming**

   Speech output is fluent with numerous pauses, pauses may be filled with circumlocutions, describing the function of an object; but the name cannot be retrieved. Auditory comprehension is intact. Reading and writing are also intact. There is focal damage to the left temporal and parietal area. Usually residual or good recovery as compared to other aphasias. Also indicates good prognosis if seen in the acute stage.
5. Global aphasia

*Severe impairment in all modalities*

Speaking, listening, reading, and writing severely impaired. Auditory comprehension – very limited. Speech output – only few understandable utterances. Some areas of spared speech function are utilised in communication.

Brain damage resulting in a massive fronto-temporo-parietal lesion, complete occlusion of MCA. Rarely, without hemiplegia.

6. Transcortical motor aphasia

*Similar to motor aphasia but with intact repetition*

Lesion in the border zone superior or anterior to Broca’s area. Non-fluent, limited speech output. Auditory comprehension is good. Reading comprehension is good. Syntax not as bad as in Broca’s aphasia. Lesion: occlusion of anterior cerebral artery.

7. Transcortical sensory aphasia

*Similar to sensory aphasia, but with intact repetition*

Deficits in all language modalities, fluent aphasia. Echolalia – they can repeat, but cannot understand. Much difficulty in communicating. Syntax not as bad as in Broca’s aphasia. Lesion in the border zone posterior and inferior to Wernicke’s area – occlusion of anterior cerebral artery.

**Aphasias - comparison**

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>N</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wernicke’s</td>
<td>47</td>
<td>17.74</td>
</tr>
<tr>
<td>Broca’s</td>
<td>42</td>
<td>15.85</td>
</tr>
<tr>
<td>Global</td>
<td>33</td>
<td>12.45</td>
</tr>
<tr>
<td>Anomic</td>
<td>24</td>
<td>9.06</td>
</tr>
<tr>
<td>Conduction</td>
<td>19</td>
<td>7.17</td>
</tr>
<tr>
<td>Undecided</td>
<td>51</td>
<td>19.25</td>
</tr>
<tr>
<td>Transcortical</td>
<td>6</td>
<td>2.26</td>
</tr>
<tr>
<td>Residual</td>
<td>24</td>
<td>9.06</td>
</tr>
<tr>
<td>No aphasia</td>
<td>19</td>
<td>7.17</td>
</tr>
<tr>
<td>Total</td>
<td>265</td>
<td>100</td>
</tr>
</tbody>
</table>

**Speech disorder: dysarthria**

*Definition*

Any combination of disorders of respiration, phonation, articulation, resonance, and prosody, that may result from a neuromuscular disorder.

**Types of dysarthria**

1. **Flaccid dysarthria (Bulbar)**
   
   Lesion: lower motor neuron level.
   
   Features: breathy phonation.
   
   Hypernasality: other features of bulbar palsy particularly, dysphagia to solids, and nasal regurgitation of liquids.

2. **Spastic dysarthria**
   
   Lesion: upper motor neuron level.
   
   Communication: individual syllables are slurred and precision of consonant pronunciation is lost. British constitution becomes Brizh conshishushon. Exaggerated jaw jerk. Dysphagia particularly to liquids. Emotional incontinence is seen.

3. **Ataxic dysarthria**
   
   Lesion: cerebellum level.
   
   Communication: scanning or staccato speech. Irregular articulatory breakdown. Rhinoceros becomes Rhi-noc-er-os.
4. **Dyskinetic dysarthria**

Lesion: basal ganglia level. Hypokinetic type (Parkinsonism): monotonous speech.

* Rapid rate
* Short rushes of speech with final decay.

5. **Myasthenic dysarthria**

Voice may be normal at the beginning of each sentence, but abnormalities develop as the sentence progresses. Testing by asking the patient to count up to 30.

6. **Mixed dysarthria**

May be the most common.

Examples:

* Motor neuron disease – Flaccid + spastic.
* Multiple sclerosis – Ataxic + spastic.
* Wilson's disease – Ataxic + spastic + hypokinetic.

**References**

39. Marièn P, Paghera B, De Deyn PP et al. Adult crossed aphasia in...


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3. Dr. G. B. Jain Oration
4. Founder-President Prof. M. C. Gupta Oration

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   i. The member should have a standing of minimum three years in the Association.
   ii. The member should have participated in the annual conferences, scientific programmes, contributed to the Journal and actively engaged in the organisation of the annual conference of IACM.
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