

431

CNS System
central Nervous

Block

Physiology Team

Female Side

Male side

Done By :


Rawan Al-Misned

Ahmad Al-Marzoqi

Revised By:

Sara Al-Anazy

Mohammed Asiri



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Slide No.(1)

Speech and Language

Team Notes :

Definition: Speech may be defined as the means of communication between the two individual or group of individuals

Means of communications: Sensory or Motor

Sensory Communication

Auditory communication

Visual communication

Motor Communications:

Power of taking

writing

Steps of communication:1-Sensory input(Vision or Auditory) 2-Integration

3-Motor execution

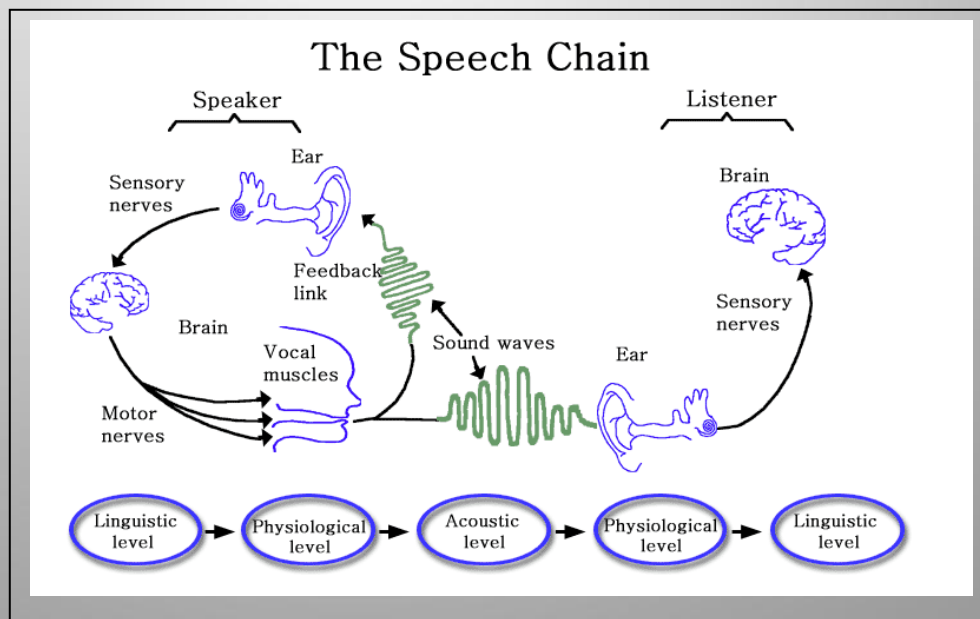
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Slide No.(2)

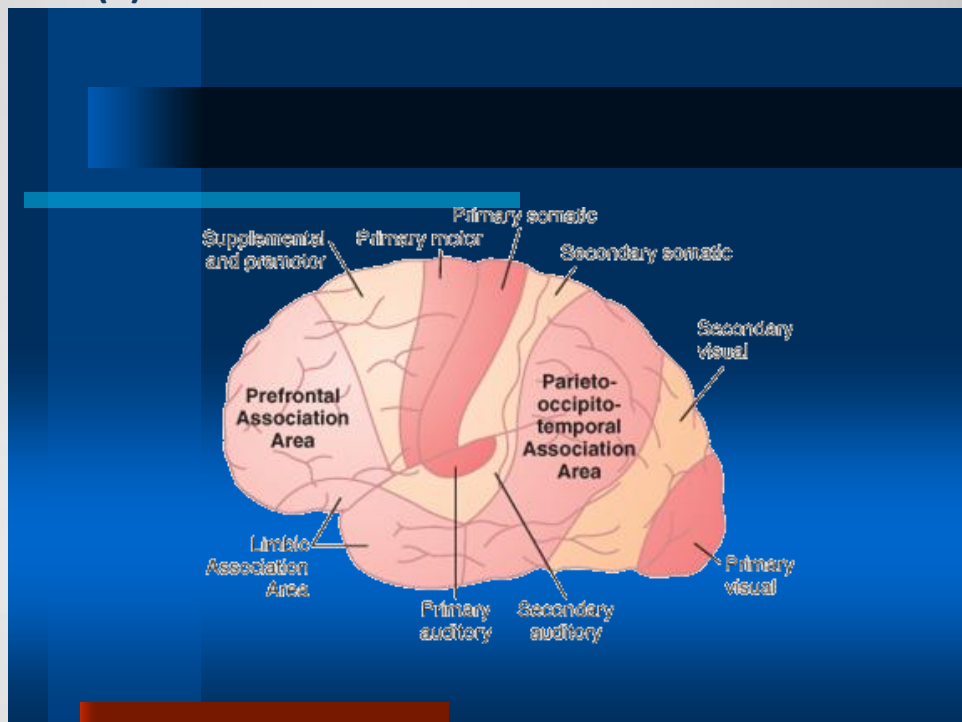
- It is the highest function of the nervous system
- Involves understanding of spoken & printed words
- It is the ability to express ideas in speech & writing

Team Notes :



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Team Notes :

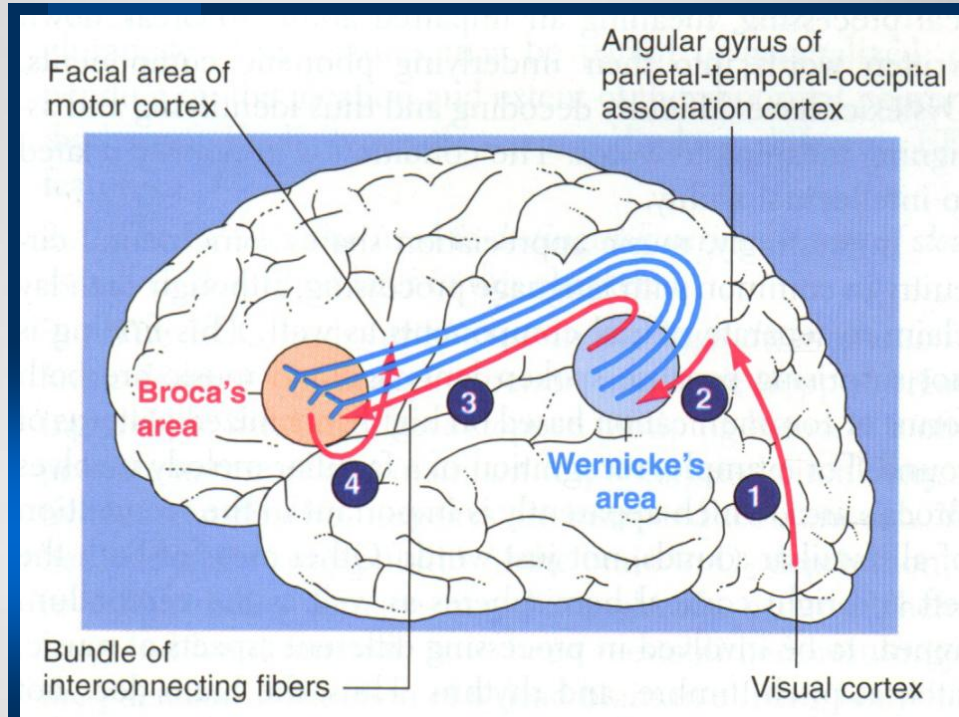
The areas responsible for speech & language are four:

- Wernicke's area (comprehension & choice of word)
- Broca's area (initiate the appropriate movement to produce speech)
- Arcuate fasciculus (connection between the Wernicke's area & Broca's area)
- Angular Gyrus (responsible for visual experience)
- **Speech Articulation Area: articulation describes how the tongue, lips, jaw, and other speech organs are involved in making a sound.**
- **Audiology Association Areas.**

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Team Notes :

The physiology of speech & language “ in respond to auditory stimulation”

When you hear sounds the auditory signals move to Primary Auditory Cortex area 41,42 >> signals will move to Wernick's area where the words will be understood >> the processed information move through Arcuate fasciculus >> Broca's area- receive processed information- >> motor & premotor areas to initiate speech respond-talking- or action respond- making a move-.

The physiology of speech & language “ in respond to visual stimulation”

When you read a book or read exam questions the visual signals move to Occipital area >> Angular gyrus where the visual stimulation will be processed not understood yet >> Wernick's area where will be an understanding of the visual stimulation >> Arcuate fasciculus >> Broca's area >> motor & premotor areas to initiate a respond.

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Areas involved

- 1- Wernicke`s area:
- At the posterior end of the superior temporal gyrus
- Closely associated with 1 & 2 auditory areas
- Responsible about comprehension of auditory & visual information, then project it to Broca`s area via arcuat fasciculus

Team Notes :

ASSOCIATION AREAS: These areas receive and analyze signals simultaneously from multiple regions of both the motor and sensory cortices as well as from sub-cortical structures.

The most important association areas are

1-Parieto-occipitotemporal association area

Area for Naming Objects.

Analysis of the Spatial Coordinates of the

Area for Language Comprehension.

2-Prefrontal association area

. Area for Initial Processing of Visual Language (Reading).

3-Limbic association area.

1- Wernicke`s area (cont.)

- Interpretations of sensory experience
- Formation of thought in response to sensory experience
- Choice of words to express thoughts

Team Notes :

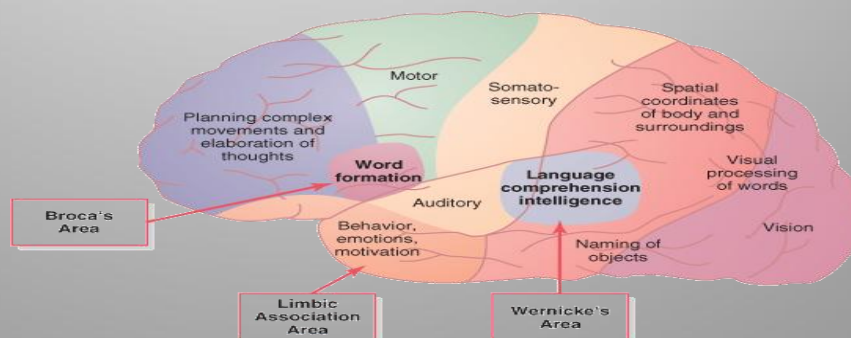
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- 2- Broca's area:
- At the lower end of premotor area
- Process information received from W. area into detailed & co-ordinated pattern for vocalization
- Then project it to motor cortex to initiate the appropriate movement of the lips & larynx to produces speech

Team Notes :

Broca's Area. A special region in the frontal cortex, called *Broca's area*, provides the neural circuitry for word formation. This area, is located partly in the posterior lateral prefrontal cortex and partly in the premotor area. It is here that plans and motor patterns for expressing individual words or even short phrases are initiated and executed. This area also works in close association with Wernicke's language comprehension center in the temporal association cortex,



2- Broca`s area (cont.):


- In adult who learn second language during adulthood. The MRI shows portion of Broca`s area concerned with it is adjacent to but separate from area concerned with the native language
- But in children who learn second language early in life there is only single area involved for both languages

Team Notes :

3- Arcuate fasciculus

Team Notes :

Arcuate Fasciculus: net of fibers to connect between the Wernicke's area & Broca's area.



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- 4- Angular Gyrus
- Lies behind Wernikes area fused posteriorly into the visual cortex
- Function: interpretation of information obtained from reading from visual cortex

Team Notes :

- W. area receive information from both auditory & visual areas
- Project it to B. areas via arcuat fasciculus
- Broca's area process information received into co-ordinated pattern of vocalization & then project that pattern to the motor area

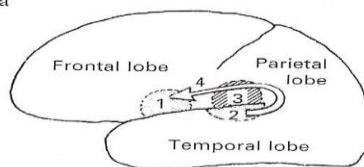
Team Notes :

Hand preference is associated with 'hemisphere dominance' for language. In right-handed people the left hemisphere is dominant; in left-handed people the left hemisphere is dominant in most, though 25% have a dominant right hemisphere.

The cortical centres for language reside in the dominant hemisphere.

1. Broca's area

Executive or motor area for the production of language – lies in the inferior part of the frontal lobe on the lateral surface of the cerebral hemisphere abutting the mouth of the Sylvian fissure.



2 and 3. Receptive areas

Here the spoken word is understood and the appropriate reply or action initiated. These areas lie at the posterior end of the Sylvian fissure on the lateral surface of the hemisphere.

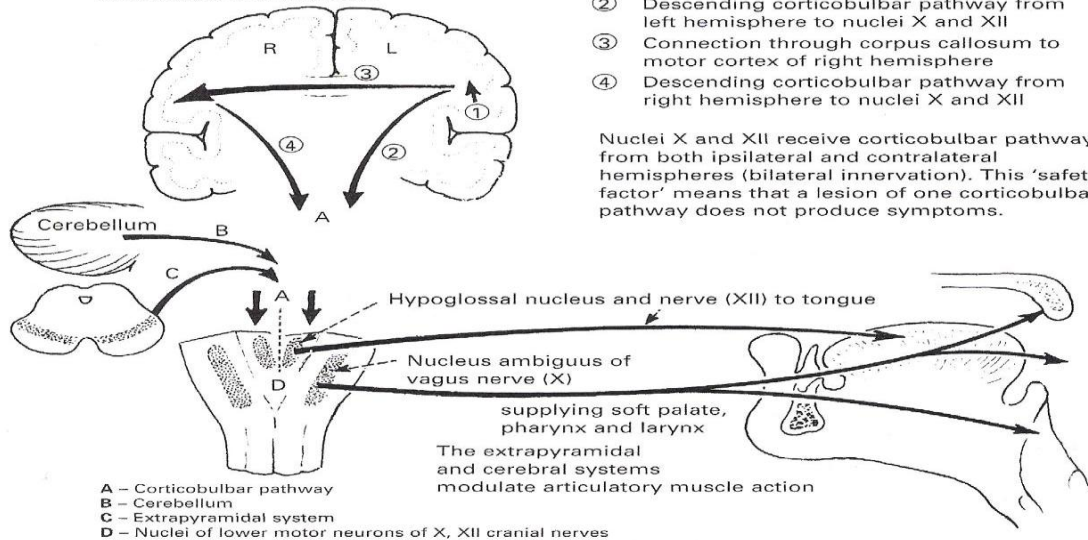
The temporal lobe receptive area (2) lies close to the auditory cortex of the transverse gyrus of the temporal lobe. The parietal lobe receptive area (3) lies within the angular gyrus.

Receptive and expressive areas must be linked in order to integrate function. The link is provided by (4), the **arcuate fasciculus**, a fibre tract which runs forward in the subcortical white matter.

- Initiation of movement of muscle of speech in tongue, larynx & lips.

The Mechanism of Articulation

Mechanism of articulation



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Muscles of expression, innervated by the facial nerve, play an additional role in articulation and weakness also results in dysarthria.

- Means the muscular movements of the mouth, tongue, larynx, vocal cords
- Responsible for the intonations, timing, and rapid changes in intensities of the sequential sounds.



- If writing is concerned, then information received from W. area is processed in the area of hand skills
- »»»»»» co-ordinated pattern of muscle movement projected to the arms & hand region of the motor cortex
- »»»»»» initiation of necessary muscle movement in the hand & arms required for writing a particular word

Team Notes :

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Aphasia

- **Abnormality of language function due to injury of language centres in cerebral cortex. Comprehension or expression of words will be affected**
- **Due to thrombus or embolism of cerebral vessels, trauma**

Team Notes :

APHASIA IS LOSS OF OR DEFECTIVE LANGUAGE FROM DAMAGE TO THE SPEECH CENTRES WITHIN THE LEFT HEMISPHERE.(categorical Hemisphere)

IN APHASIA THERE IS NO DAMAGE TO VISION, HEARING OR MOTOR PARALYSIS.THE DAMAGE IS IN SPEECH CENTERS IN CATEGORICAL HEMISPHERES.

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Types of Aphasia

Team Notes :

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1- Motor or Broca`s aphasia (non fluent):

- Lesion of Broca`s area
- Patient will understand spoken & written words but find it difficult to speech or to write
- Poorly articulated speech, slow with great effort & abnormal rhythm
- In some cases speech may be limited to 2-3 words

Team Notes :

This aphasia is frustrating cause the patient can understand the spoken and written information but can't express.



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2- Sensory or Wernikes aphasia (fluent):

- Lesion of wernikes area +/- arcuate fasucul
- Impaired comprehension
- Loss of intellectual function
- Failure to interprets meaning of written or spoken words
- Meaningless & excessive talk (in sever cases)

Team Notes :

Broca's area will receive not processed information, so the patient can't respond to others orders.



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3- Conductive aphasia (fluent):


- Lesion of nerve fibres of arcuate fasciculus
- Patient understand speech of others but can not repeat it
- Meaningless speech

Team Notes :

-Signals will move from Wernick's area to Broca's area abnormally.

-How to differentiate between the Conductive aphasia and Wernike's aphasia??

Give the patient an order to move if he responds that mean he has Conductive aphasia.



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4- Anomic aphasia:

- Lesion of angular gyrus, thus B. & W. are intact
- Speech & auditory comprehension is normal but visual comprehension is abnormal, due to visual information is not processed & not transmitted to W. area
- Dyslexia (word blindness) interruption in the flow of visual experience into W. area from visual area

Team Notes :

In this aphasia some patient can't see one or more letter, or he will see one or more number upside down.

Right Hemisphere

(the representational hemisphere)

- The right hemisphere controls the left side of the body
- Temporal and spatial relationships
- Analyzing nonverbal information
- Communicating emotion

- Left Hemisphere
- (the categorical hemisphere)
- The left hemisphere controls the right side of the body
- Produce and understand language

Team Notes :

There are also other types of aphasia:

1-Global(central) Aphasia: This means the combination of the expressive problems of Broca's aphasia and the loss of comprehension of Wernicke's.

The patient can neither speak nor understand language. It is due to widespread damage to speech areas and is the commonest aphasia after a severe left hemisphere infarct. Writing and reading are also affected.

2- Damage to auditory association area = Word Deafness

3-Damage to visual association area = Word Blindness (dyslexia)

Other Speech Disorders:

*****DYSARTHRIA: MEANS DISORDER IN ARTICULATION e.g., SLURRED SPEECH**

Dysarthria disturbances of the articulation in which contents of speech (Language) is unaffected

In some individuals who has no abnormality in the speech centre or in its pathways results in stuttering speech.

Examples

- gravelly' speech of upper motor neuronal lesions of lower cranial nerves,
- jerky, ataxic speech of cerebellar lesions (Scanning Speech),
- the monotone of Parkinson's disease (Slurred),
- speech in myasthenia that fatigues and dies away. Many aphasic patients are also somewhat dysarthric.

*****STUTTERING:**

- Have right cerebral dominance and widespread overactivity in the cerebral cortex and cerebellum. This includes increased activity of the supplementary motor area.

involuntary repetitions and prolongations of sounds, syllables, words or phrases as well as involuntary silent pauses or blocks in which the stutterer is unable to produce sounds. Why? Due to overactivity of right hemisphere over the left, It is also related to genetic abnormality.

*****What is Phonation??**

- **Sound production by passage of air over the vocal cord.**
- **Dysphonia: Abnormal sound production due to problem in vocal cord e.g., paralysis, CVA, other causes**
- **Causes: Paralysis of both vocal cord e.g whispering sound and inspiratory strider**
- **Paralysis of left vocal cord: The voice becomes weak and cough bovine. Mainly due to recurrent laryngeal palsy**